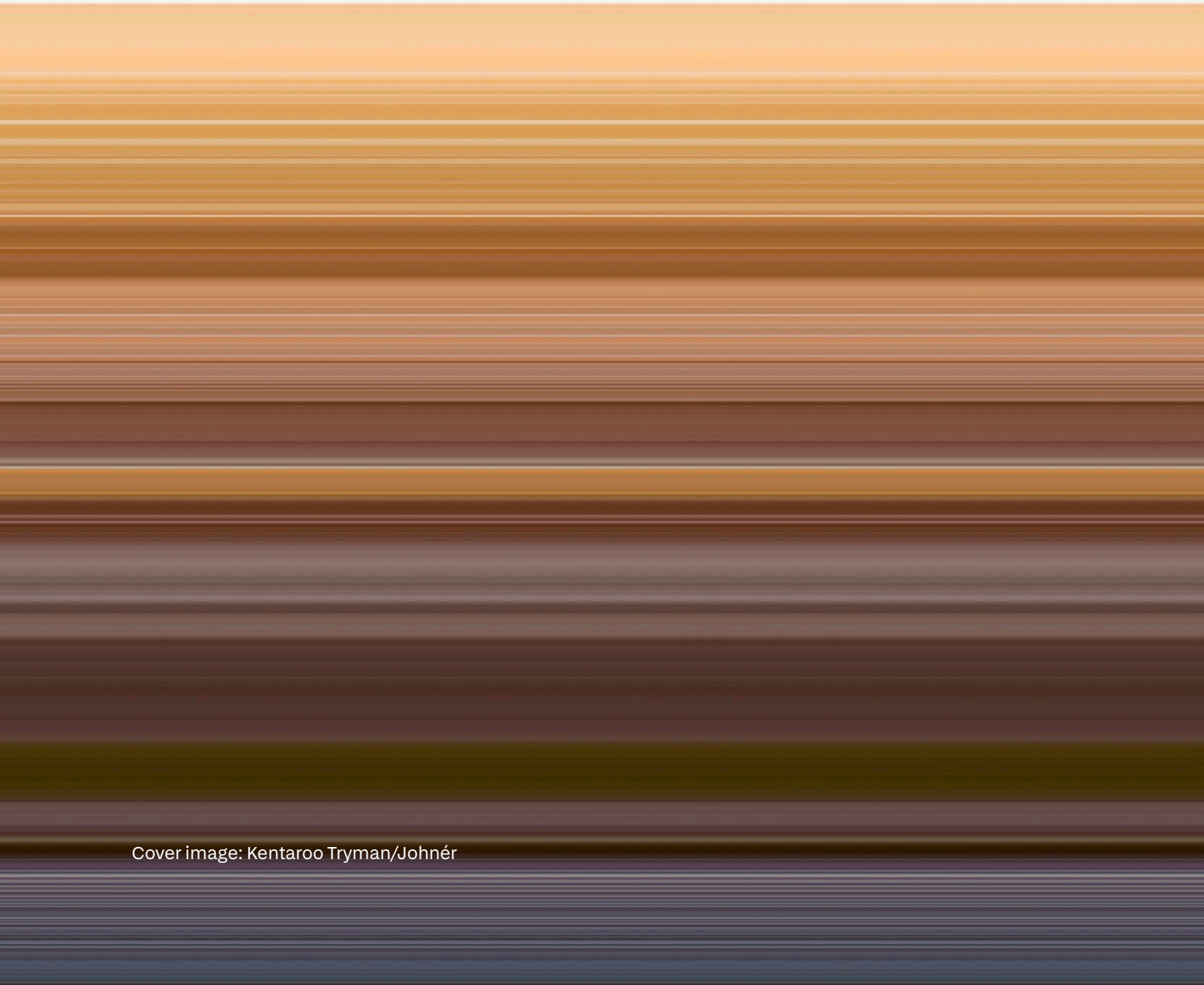
The AI Commission's

Roadmap *for* Sweden

Words from the translator

The Commission's Report has been translated using a combination of AI, machine translation technology, and fairly minimal human post-editing. The report is nearly 70,000 words long. Instead of taking several weeks to translate from scratch, it took only a few days. Although perhaps not 100-percent consistent, it nevertheless recreates the content of the Swedish report in English extremely accurately.



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To **Minister** Erik Slottner

On 7 December 2023, the government decided to appoint a committee with the task of identifying the need for and proposing measures that can help to strengthen the development and use of artificial intelligence (AI) in Sweden in a sustainable and safe way. The assignment was to be completed by 1 July 2025, but the committee has chosen to bring the report forward to November 2024. This reflects the committee's conviction that it is urgent to get important political decisions in place.

Chairperson Carl-Henric Svanberg was appointed as Chair as of 7 December 2023. Information security specialist Anne-Marie Eklund Löwinder, Professor Fredrik Heintz, Head of Digitalisation Olof Hernell, President Ulrika Lindstrand, Head of Public Policy Nicklas Berild Lundblad, IT Director Marcus Matteby, Executive Member Sara Mazur, Professor Sylvia Schwaag Serger, Editor-in-Chief Mathias Sundin and Director Martin Svensson were appointed as members on the same day.

On 26 January 2024, the committee itself appointed as high-level experts former Head of the European Commission in Sweden Katarina Areskoug, Executive Director Börje Ekholm, Board Chairman Mats Granryd, Executive Director Martin Lundstedt, Director-General Katrin Westling Palm, Board Chairman and former Head of European Operations Magnus Tyreman and Director-General Nils Öberg.

On 30 April 2024, Senior Adviser Sara Bringle and Chief of Staff Jörgen Eklund, Desk Officer Shannon Felländer Tsai, Head of Division Marie Haldorson, Deputy Director Emil Lidén, Desk Officer Maria Nordström, Coordinator Per Nydén, Analyst Katarina Näslund, Desk Officer Erik Oreland, Desk Officer Martin Persson, Director Jon Simonsson, Legal Adviser Jeanna Torslund and Deputy Director Jenny Wada were appointed as experts. Shannon Felländer Tsai was dismissed on 22 August 2024 and on the same day Deputy Director Harald Fredriksson was appointed as an expert.

On 22 January 2024, Dean Susanne Ackum was appointed Chief Secretary of the Committee. Analyst Jon Olofsson, on 1 February 2024, Advisor Aron Verständig, on 19 February 2024, and Mattias Hector, on 15 April, were appointed as Secretaries. On 29 January 2024, student Anton Eklöf was appointed Deputy Secretary.

During its work, the committee has held five full-day meetings and 23 digital meetings. The committee has also held over 200 meetings with more than 150 different stakeholders from virtually all parts of Swedish society.

The committee, which has adopted the name the AI Commission, is now submitting its report *The AI Commission's Roadmap for Sweden.*

Carl-Henric Svanberg
Stockholm, November 2024

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Magnus Tyreman
Nils Öberg

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Anton Eklöf
Mattias Hector
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Aron Verständig

Foreword from the Chair:
We've done it before

AI is a disruptive, emerging technology that, in human hands, creates the conditions for fundamental improvements to our societies, just as the railway, electricity and the telephone did.

The pace and the changes are such that it is not possible to stand aside and wait for total and complete knowledge, but it is necessary to orientate oneself along the way, establish principles and a direction of travel, and then act. This is why the AI Commission has asked for this report to be brought forward.

AI is already part of our reality in Sweden within companies, organisations and authorities. As is often the case with new technology, this is happening in a somewhat disorganised, scattered manner - not on the basis of any grand, overall plan, but depending on where the will, entrepreneurial drive and resources are in society. In previous technology shifts, Sweden has often been able to demonstrate technological leadership early on by establishing new, rapidly growing and later world-leading companies. We do not yet see anything like this when it comes to AI and Sweden.

AI is best understood when it is linked to existing activities and functions in a society: education, health and social care, research, product development, data analysis, anti-money laundering, infection control, road safety, tax collection, public transport systems, customer care or whatever.

This also makes it clear that a government, or an AI commission, cannot formulate a grand plan on 'how' to use a new technology. But what is urgently needed - and what this report also focuses on - are the principles, standards and efforts required to ensure that the spread and use of AI is as rapid, safe, comprehensive and positive as possible for Swedish society. Quite simply, there is a need for comprehensive traffic rules, fuel supply and targets for AI. AI requires particular vigilance and a special focus on the risks of manipulation, fragmentation and fake news that AI can pose.

Chair of the AI Commission, Carl-Henrik Svanberg. Photo: Volvo

Although Sweden does not yet have any leadership in AI, but is rather lagging behind, there are other aspects that speak in Sweden's favour: Sweden is a trust-based society, where cooperation and compromises between different social interests have created an almost unique ability to adapt society, often based on technological shifts. Sweden's goal that everyone should participate also signals the need for security during change. Companies will be founded and expand as a result of the first, second and third waves of AI - and so on.

That said, the state must of course ensure that the basic conditions are in place. Clear political leadership is needed in times of great and rapid change, but it also requires coordinated resources for our public sector, secure electricity supply, available computing power, fast digital infrastructure, good skills supply and stable entrepreneurial conditions.

AI becomes a threat if we stand on the sidelines and passively watch a technological and social change without acting and linking it to our overall endeavours in Sweden for a better life for all. AI will only become an opportunity when we use it with self-confidence, combine our resources wisely and create clear game rules for the benefit of welfare, growth and the building of a prosperous Sweden.

Carl-Henric Svanberg
Stockholm, November 2024

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1 Introduction and summary

The development of AI will affect our entire society. How this happens depends to a large extent on our own behaviour. By being proactive and involving all groups in society, we can benefit greatly from the increased use of AI, while managing risks and challenges.

Photo: Fredrik Ludvigsson/Johnér

Introduction
and summary

It has been said by many and may sound like a cliché, but it is nevertheless true - the use of artificial intelligence, or AI, will change and develop our society. Just as the steam engine, electricity, telephony and IT have done in the past. The process is already underway. We use AI every day, often without realising it. These range from simple services that make our lives easier, like controlling a robot vacuum cleaner, to functions that can literally save lives, like AI-assisted cancer diagnosis. These services are the result of computers being able to learn directly from data instead of following pre-programmed rules. However, the dramatic developments in AI in recent years have further pushed the boundaries of what can be achieved with AI. We can now control machines with our natural language and be helped to create new materials in the form of text, images, programme code, sound and much more. It combines our human intelligence with artificial intelligence. As a result, we can work faster and with higher quality, while becoming more creative and innovative. AI has thus become a tool for us all.

This year's Nobel Prizes in Physics and Chemistry are a telling illustration of the progress that has been made in AI, but more importantly how AI developments are leading to breakthroughs in different scientific disciplines. Physics laureates Hinton and Hopfield are being honoured for their work on artificial neural networks. These underpin many of the developments that have allowed Chemistry Laureates Baker, Hassabis and Jumper to develop AI models, which have revolutionised the understanding of proteins and their structures. This in turn has a major impact on the ability to predict diseases and find effective treatments.

While this development holds great potential, it also raises concerns for some people - concerns ranging from what will happen to their jobs, to whether AI could develop abilities and a will of its own that could ultimately threaten human existence. One simply wonders what kind of society this development will lead to.

It is not fated

Our answer to that question is a counter-question. What do we want the change to lead to? Because development is not fated, it is in our own hands. There is no single future, but many different ones. Where our path leads will be determined by how we act and relate to the use of AI. According to the AI Commission, a passive and reactive approach is the worst and most risky option. It would mean putting our future in the hands of others.

Instead, our vision of the future is a society that reflects a conscious effort to maximise the opportunities offered by the use of AI, while managing the challenges that arise. This does not mean that AI is used for everything. AI is a very powerful tool, but that doesn't mean that every problem is best solved using AI.

Our vision is a society where people's everyday lives are simplified with the help of AI services, and where there is a basic understanding of what AI is, and is not. A society where there is a lively discussion about opportunities and risks, based on science.

Knowledge is the first and perhaps most important line of defence against the malicious use and development of AI. At the same time, we are using AI to hamper organised crime and build resilience against cyber threats.

It is also a society where our unique access data is utilised much better than today, while maintaining respect for privacy and copyright. By increasing data sharing opportunities and deepening cooperation between the private and public sectors, we are not only enabling innovation and development in the public sector. We are also improving its ability to fulfil its growing commitment - a commitment that otherwise risks becoming overwhelming due to demographic developments.

With good access to data, computational capacity in the form of computing power and broad AI expertise, Swedish companies can become more innovative and successful in world markets, not least by applying

In our future society, AI is a tool at the service of citizens. Photo: Gorodenkoff/Shutterstock

AI in new areas. In combination with in-depth cooperation between academia and industry, this helps Swedish research and innovation to flourish and attract international expertise. Swedish actors are forces to be reckoned with in international cooperation to solve important societal problems.

People's jobs will certainly change, but usually for the better, with more interesting and rewarding content and less repetitive and monotonous elements. In some cases, tasks may disappear altogether. In both cases, support is available in the context of a well-functioning redeployment system, focusing on the protection and retraining of the individual. This helps to maintain and strengthen trust in society.

In our future society, AI is a tool at the service of citizens.

Sweden is well placed . . .

This positive picture of society is a vision. But it is not a utopia. Sweden has a long history of going through technological shifts stronger - we have invested for the future, often on an uncertain evidence base, but with a vision that the investments will bear fruit. In the mid-nineteenth century, major public investment in railways enabled us to begin the transformation from one of Europe's poorest countries to the prosperity of today. With openness to change and the ability to capitalise on the benefits of new technologies, we have strengthened our competitiveness and increased our prosperity. We have done this in consensus and cooperation between all parts of society.

. . . but we are lagging behind

However, the positive developments we have just described are not something we can take for granted - quite the contrary. Our vision requires strong political leadership and the realisation that we are at a crossroads where our future prosperity will largely depend on how well we manage to take advantage of AI's opportunities and address its challenges.

Mario Draghi's report The Future of European Competitiveness. Photo: Alexandros Michailidis/Shutterstock

Unfortunately, this realisation does not seem to have taken root in society. The AI Commission can instead conclude that Sweden is lagging behind in development. It is a picture that has been confirmed in our many meetings with representatives of different societal groups: we need to get better at utilising AI to address our societal challenges, and we need to do so quickly.

There are many ways to illustrate Sweden's lagging behind in the AI field. One is to look at international comparisons. The Global AI Index from Tortoise Media is a well-established index, suitable for comparing the development of AI in society as a whole between countries.[1] Unfortunately, this year's edition of the index shows that Sweden's relative position is weak and has deteriorated. In the overall index, Sweden has fallen from 17th place (in 2023) to 25th place (in 2024) out of 83 countries compared. Among EU countries, we rank as low as 10th place, with both Finland and Denmark ahead in the list. Our ranking is particularly weak in the government strategy dimension, where Sweden is ranked as low as 57th. We believe this is a crucial weakness, as political leadership is needed to get the necessary measures in place. This has also been one of the strongest messages we have received in our contacts with representatives of different groups in society.

While this type of cross-country ranking is never perfect in all aspects, our judgement is that the overall picture is credible - Sweden is falling behind. Sweden's low ranking not only globally, but also within the EU, is particularly worrying as the EU also tends to lag behind in AI, as emphasised in Mario Draghi's report The Future of European Competitiveness.[2] For example, American and Chinese dominance in the cloud computing market is almost total, with the ten largest AI platforms in the EU owned by companies from precisely these two countries. This situation is problematic from several points of view. First, it undermines European innovation, growth and regulatory policies, which need to become more innovation- and growth-friendly. Second, it clearly illustrates the vulnerability European actors.

However, the issue of vulnerability is complex and has two important aspects: in today's security environment, dependencies, especially in critical services and sectors, should be carefully considered. This suggests, among other things, that an indigenous capability should be built up in key areas. In the Roadmap, we make a number of proposals in this direction. But at the same time, it is crucial to ensure that Swedish and European actors continue to have access to the latest AI technology, which today is often offered through American AI platforms. In this perspective, it

[1] See Annex B for an in-depth presentation of The Global AI Index.
[2] See the box in the International Positions chapter for more information.

is problematic that the launch of several AI services has been delayed or cancelled due to EU regulations on AI and data. These two aspects must be constantly balanced against each other.

In the vision we just described, Sweden has succeeded in capitalising on the great potential gains that lie in increased AI use. But these opportunities for increased competitiveness and welfare also have a downside: if we do not succeed, the consequences will be serious. The problem is that in the short term, the consequences will not be very noticeable and clear to everyone. Instead, the impact will creep up on us, in terms of making it harder for our businesses to compete. This would lead both to pressures on the labour market and to lower income growth. Similarly the public sector would find it increasingly difficult to fulfil its social responsibilities, with negative effects on people's trust and willingness to pay taxes. We would also be less equipped to deal with the problems associated with the malicious use of AI.

Passivity is rarely a good strategy, especially when life is changing. It is the AI Commission's ambition that our Roadmap will serve as a wake-up call and inspire us to confidently embrace the common challenge and opportunity of AI development. Together, we can ensure that we utilise AI for the common good and for the benefit of society, just as we have done in previous technology shifts. There is nothing to say that we cannot do it again this time.

Einride's self-driving, electric lorry, T-pod on Swedish roads. The picture was taken in Jönköping in May 2019. Photo: Wiktor_swe/Shutterstock

The ecosystem

If we are to improve Swedish competitiveness through the development and use of AI, while minimising its risks, we cannot rely on individual efforts. Isolated initiatives often fall flat if they are not part of a broader effort. Instead, a palette of actions is needed that complement each other and create an ecosystem for AI in society. According to the AI Commission, the following elements are necessary for a well-functioning AI ecosystem.

Electricity

Developing and deploying AI models requires an abundant and reliable supply of electricity. With rising demand for electricity from elsewhere, there must be no concerns about electricity production. This could quickly lead to the relocation of AI companies.

Data

Sweden has both large amounts and long time series of data. To exploit these, data must be accessible and of high quality, well-structured and standardised, and findable by the user. Regulatory frameworks must also allow data to be shared effectively, while respecting privacy and copyright.

Computing power

Computing power is a prerequisite for private and public actors to develop and use AI. Today, it is possible to access computing power in two ways. Either through purchased cloud services, which means that you rent a data centre owned by external operators. The other approach is to acquire your own computing power by buying computers designed specifically for AI use.

Security and safety

Ethics and security are important when using AI. It concerns security in relation to the malicious use of AI and the use of cloud services. But it also concerns security issues related the further development of AI and concerns about existential risks and AI tools as an important component of security work.

Telecoms

Telecoms networks enable fast data transmission and real-time communication, which is crucial for AI services that require large amounts of data and fast response times. The next generation of AI services will further increase the speed and coverage requirements of telecoms networks.

Cutting-edge research

In AI development, the distance between basic research, application, innovation and product is short. Collaborative cutting-edge research environments between academia, the private and public sectors are therefore needed. As a small country, we need to attract expertise and ideas from outside, while allowing researchers to stay in Sweden.

Access to foreign AI resources

Most of the value generated by AI is created when using AI, through AI platforms and AI tools. These are usually American. For Swedish actors to continue to be able to use and develop AI, it is important that they have continued access to these.

AI skills for all

If AI is to have a broad impact on society, knowledge is needed. Knowledge about what AI is and what it is not, as well as the opportunities and challenges that come with the technology. In the short term, there is likely to be some imbalance in the labour market before new industries and companies have absorbed workers made redundant due to various AI services. The smooth functioning of the transition system is therefore crucial for the perception of AI and the willingness of people to embrace the new technology.

Innovation and venture capital

AI will lead to important innovations in all areas. The innovation climate is therefore important, not least access to risk capital, so that businesses can be created and grow. It involves both private and public funding - for example, from 'business angels', banks or investment funds, as well as from public organisations such as Vinnova or Almi.

Leadership

System-wide change requires leadership and governance. Decisions often have to be taken under time pressure and with little basis for decision-making. The political governance model must therefore allow for rapid and decisive action. This also applies in international contexts, where many AI-related issues are decided, for example regarding regulation and safety.

The need for complementary measures - an example

To show how widespread AI use in society requires action in different areas, we exemplify using one of the tasks in the AI Commission's terms of reference: "...to propose measures for the increased use of AI in public administration through data-driven innovation and data supply." Our main proposal for this is a so-called AI Workshop, where public actors can jointly develop solutions within the framework of a common AI infrastructure. This requires the ability to share data. At present, there are significant barriers to this. Computing power is also needed, in the form of dedicated computers for particularly sensitive information, and the utilisation of cloud services. The latter requires clarification of what is legally possible and what is not. This is also where the security aspect comes in.

To find the best solutions, the private and public sectors must also work together, with private companies solving public challenges. This in turn requires dynamic research environments, where academia collaborates with actors from both the private and public sectors. Training initiatives are also needed so that people are equipped to recognise and exploit the opportunities offered by the use of AI.

However, perhaps the most important prerequisite for putting an AI Workshop in place is clear political leadership. Normally, our decentralised governance model makes it difficult to find solutions to problems that span multiple sectors. However, there is currently a broad consensus among municipalities, regions and government agencies on the need for a common infrastructure to develop and deploy AI solutions. The government taking this opportunity to respond to this need will be crucial to achieving the increased use of AI in public administration that has been expressed in our terms of reference.

In periods of system-wide change, more centralised governance may be needed. Photo: Shutterstock

The Commission's proposals for action
In addition to this introduction, the report consists of three overarching parts: *A solid foundation to build on, AI for all and Leadership and governance.* Under each part, there are a number of chapters that address specific issues of importance for the use of AI in Sweden. These have been broken down into smaller sections. Each chapter also contains a number of proposals for initiatives that the AI Commission considers necessary for development to move in the right direction.

Below we summarise and justify the main proposals. We have chosen to group the proposals into five clusters: *Political leadership is needed, A knowledge boost for all, Future-proofing welfare, World-class research* and *Innovation for development.*

As we emphasise in the description of the ecosystem, our proposals should be considered holistically, with all proposals complementing each other. Implementing half of the proposals, for example, would not have half the impact - it is the whole that delivers.

Political leadership is needed

In its contacts with representatives of various groups in society, the AI Commission has been conveyed a picture of considerable frustration. Many are impatient to access the efficiency and welfare gains that AI can offer, and concerned that progress is too slow. They believe that while many initiatives are being taken, the lack of coordination and strategic planning means that the barriers are too high and progress often fails to materialise.

The root problem seems to be linked to weak central leadership and a lack of ability to manage system-wide technologies such as AI in an appropriate way. There is almost total agreement that the Swedish governance model, with its high degree of delegation, has its limitations when dealing with the kind of cross-sectoral challenges that AI represents. Under more normal circumstances, the model works well. But in times of rapid, disruptive and system-wide change, more centralised governance may be needed, in the same way that a hospital temporarily goes into temporary state of emergency in critical situations.

We therefore propose that a special task force be set up at the Prime Minister's Office in the Government Offices, with the aim of monitoring the implementation of the necessary measures regarding AI. Such a task force should act as a bridge between politics and the employees at the Government Offices who work with the individual issues and regularly consult with representatives of society in general (business, social partners, municipalities and regions). The group should be chaired by a state secretary with experience of working in the Government Offices and include both generalist and specialist expertise. After five years, it should be evaluated whether this task force should continue its work, or whether there can be a return to a more normal situation regarding the handling of AI-related issues within the administration.

An important task for the group should be to prepare a government decision on an AI strategy, based on

this Roadmap. Such a decision should be taken in spring 2025. The government, through this task force, should annually follow up on the actions taken to fulfil the objectives for Sweden's AI strategy. To facilitate the follow-up of the implementation, and to get an indication of whether the measures are having the intended effect, we propose Key Performance Indicators, based on the Tortoise Global AI index. No index is perfect, but our judgement is that this is the best for country comparisons to reflect the development of our AI competitiveness.

We also propose that the government encourages public authorities to use AI in their activities. For example, by introducing reporting requirements for public authorities on how they are working to implement AI responsibly, or through specific assignments to increase the use of AI.

For a small open economy like Sweden's, global markets and international cooperation have been very important in achieving the prosperity we enjoy today. In this case, EU cooperation occupies a special position, because we, as members, negotiate the same laws and rules that to a large extent govern what we can do nationally. A committed and proactive approach within the EU is therefore important. This applies not least to AI-related issues such as the use and sharing of data or joint investments in computing power and strong research environments. Our view is more can be done in this regard. We therefore propose efforts to increase Swedish representation in the EU institutions, not least to take a seat in the newly established AI agency in Brussels. We also propose measures to increase Swedish utilisation of joint EU initiatives in research and innovation, which often require some Swedish co-financing.

As Mario Draghi's report The Future of European Competitiveness shows, EU regulation tends to act as a barrier to entrepreneurship and innovation in many cases. We believe that the government must work to ensure that EU regulation makes it possible for AI solutions to emerge. An important part of this work is to do what we can to ensure that the implementation of EU rules, such as the GDPR and the AI Regulation, is more uniform between the member states. Today, many Swedish companies perceive that varying implementation and interpretation of EU regulations constitute a trade barrier. The latter is illustrated, among other things, by the fact that several US technology companies have delayed or completely refrained from launching their most advanced AI models for use in the EU. Given the speed of technological development, this poses a major risk for Swedish companies. This is one of the reasons why, in addition to the work within the EU, we must invest in bilateral cooperation with the best in the world in AI. We therefore propose an increased investment in technical attachés with deep knowledge of the Swedish AI ecosystem.

A knowledge boost for all

AI is a powerful tool, but the technology alone is not enough to create benefits for people and society. It requires use, that is, interaction between people and AI tools. This is not just about engineers and techies either - everyone can benefit in some way from using AI services.

Everyone should be able to participate in a conversation about AI, around the kitchen table, over lunch or in the boardroom. Photo: Scandinav

However, for the use of AI to take off across society, a basic level of AI knowledge is needed across the population. Everyone should be able to participate in a conversation about AI, around the kitchen table, over a working lunch or in the boardroom. Beyond the basic knowledge, everyone must also understand how AI can be used in their own employment. All education must therefore be AI-proofed by integrating AI knowledge across the board - whether in social sciences, law, engineering or biology. This also applies to employers' normal further training of their staff.

To achieve this, we propose a comprehensive investment in education throughout society - a skills boost for everyone. This includes investments in public education, including public libraries, and an opportunity for everyone to access quality-tested AI tools free of charge. In other words, an initiative similar to what was done in connection with the home PC reform in 1998. The initiative is intended to be made within the framework of a so-called AI hub, where you can get information on how you as an individual can benefit from AI. We also propose an investment the further training of teachers at universities and colleges, so that AI can become part of all higher education.

Increasing knowledge about AI is an important factor in increasing the protection of individuals and society against, for example, malicious uses of AI. It is also important to make people aware of other types of risks and challenges related to AI use. However, AI is also a very effective tool to counter risks to society. To further enhance the security of society, we therefore propose to invest in increased research on AI and cybersecurity, including technologies. In addition, we propose the creation of an AI Security Institute, tasked with conducting and promoting research on security risks associated with AI. In this way, the institute can contribute to highlighting and addressing actual security risks. We also highlight the need to develop ethical guidelines for the use of AI.

Future-proofing welfare

Demographic change poses a serious challenge to the public sector - there are fewer of us to look after more of them. As society in general develops, the demands on public services are also increasing. Within a few years, it is estimated that the sector will need to deliver 125 per cent of today's welfare, but with 75 per cent of today's staffing. Public services will also be available all the time and everywhere. This makes it very difficult for many actors, such as small municipalities, whose tasks are no different from those of large ones. The AI Commission believes that increased use of AI services are essential for the public sector to fulfil its responsibilities, which are an important part of our entire social contract. However, there are a number of obstacles in the way of such a development.

A key barrier is the current limited access to data, and the difficulties in sharing data between and within authorities. Sweden has a valuable asset in the form of data. However, it is currently very difficult to utilise it, both in the public and private sectors. The result will be that many potential solutions in areas such as health and social care, law enforcement and the interface between citizens and authorities will remain untapped. This is largely due to laws and regulations that were often designed when the value of sharing data was much lower than today. Looking at how data sharing can create value today, the regulatory framework needs to be recalibrated in some respects. There is also considerable uncertainty as to how the existing regulatory framework should be interpreted in terms of data sharing opportunities. This applies not least to the EU's General Data Protection Regulation (GDPR). Our view is that the uncertainty leads to decision-makers in both the public and private sectors tending to prioritise what is safe before what is unsafe. This means that they would rather not try a possible AI solution than take the risk of breaking the rules. This uncertainty must be reduced.

To make data more accessible for AI use and reduce legal uncertainty, we are putting forward a number of proposals. These include changing the logic of the Public Access to Information and Secrecy Act (OSL) so that the main rule is that there is no confidentiality to protect the individual between authorities. In other words, the starting point should instead be that authorities should be able to exchange information with each other. To counteract fragmentation and non-uniform application of data protection legislation, it should be investigated how a framework law for personal data processing can be designed. Furthermore, the application of the GDPR in Sweden should be reviewed. To make it easier for individuals to find public data, we also propose that a Data Steward function for guidance be established at Statistics Sweden (SCB). These measures would significantly increase the opportunities for actors from both the public and private sectors to utilise data for AI services. We also propose to clarify the possibilities for public actors to use cloud services offered by non-EU companies.

In addition to better legal and practical possibilities to share data, new conditions are also needed for cooperation if the public sector is to respond to its challenges. This is about cooperation between public actors, but also between the public and private sectors. The main reason why collaboration is difficult to achieve today is that we lack a common AI infrastructure that meets the requirements of the public sector. The systems in the public sector are fragmented and have major problems communicating with each other, which makes it very difficult to develop joint AI solutions.

We therefore propose to establish a common core infrastructure for the development and delivery of AI-driven services in the public sector - a so-called AI Workshop. In the workshop, public actors - state authorities, regions and municipalities - will be able to explore, develop and deploy new AI services and functions. They will also be able to share and use quality-assured data, models and components. The private sector has an important role in developing solutions.

By virtue of their experience and expertise in the field, we propose that the Swedish Social Insurance Agency and the Swedish Tax Agency become supplier authorities for the AI Workshop. However, all actors should be able to contribute to and use the workshop. This will be made possible by means of a differentiated fee model for use. In connection with the AI Workshop, there will also be joint support functions for public actors who lack their own expertise. For example, a small municipality may request help from the workshop. A 'task force' of experts and generalists would help identify needs and propose solutions. The AI Workshop could also serve as a one-stop shop for information on various AI-related issues.

World-class research

In order for Sweden to strengthen its competitiveness with the help of AI, it is crucial that we have world-class research environments. The high rate of development and the shrinking distance between basic research and finished commercialised products, means that these environments need to be highly dynamic and characterised by close cooperation between academia, industry and the public sector. In this endeavour, it is vital that Sweden succeeds in both attracting and retaining cutting-edge expertise. We therefore propose a broad initiative to strengthen our research environments and our international attractiveness. This includes create a number of centres of excellence in AI research and special initiatives for national postdoc positions and international visiting professors. We also propose an initiative for combined positions, where researchers combine their position at a university with work in the private or public sector.

We also propose the establishment of national graduate schools in AI. These would offer subject-specific postgraduate programmes that integrate AI expertise into the curriculum, which should cover broad societal issues. An appropriate target is to train 600 PhDs with AI expertise over a ten-year period.

For Sweden to be able to conduct world-class AI research, it also needs computing power in the form of access to supercomputers adapted for AI. Through the Knut and Alice Wallenberg Foundation (KAW), Swedish AI researchers have access to the Berzelius supercomputer at the University of Linköping. However, in line with rapid technological development, the need for additional computing power for research is growing rapidly. It is a matter of both the training of AI models, which can take several months, and the use (inference) of already trained models. The latter places different demands on computing power, as the computer must then be able to respond within fractions of a second to questions and data from a large number of users simultaneously. We therefore propose two separate initiatives for additional computing power for training and the use of AI models for research purposes respectively.

Jan-Ingvar Jönsson inaugurates the Berzelius supercomputer. Photo: Thor Balkhed/Linköpings University

Innovation for renewal

Sweden has long been a leading innovation country and in many ways still is. However, with AI, the perspective on innovation has changed. AI is not just an innovation in itself - it is above all a tool for further innovation. The opportunities for innovation and the pace of innovation have therefore increased dramatically. For Sweden to keep up with this development, we must ensure that we have a climate that creates the conditions for innovation; that allows creativity in companies, academia and the public sector to operate with as few and small obstacles as possible. This is where many of our proposals in other areas help, for example on data sharing. However, there is a need for further action.

As we mentioned earlier, the regulation of AI-related issues, in particular the GDPR and the AI Regulation, is seen as difficult to interpret and complex, not least by small and medium-sized enterprises (SMEs). It is often described as perhaps the biggest barrier to innovation. That is why we propose to increase the resources of the Swedish Authority for Privacy Protection (IMY) to provide regulatory sandboxes for businesses. We also propose that the increased resources will be used to guide companies on how different ideas work together with the GDPR.[3]

Another initiative to promote innovation among SMEs is the European Commission's new concept called AI Factory. It involves setting up facilities in different locations across the Union that offer computing power and services to SMEs in particular, with the aim of enabling them to experiment, train models and further educate themselves. Each AI Factory is co-funded by the host country and the EU. Sweden has expressed a wish to host one of these, which is possible because it was previously decided to build a new supercomputer, called Arrhenius. This will be part-funded by the EU and part of an EU network of supercomputers, which is a requirement for applying to host an AI Factory. We propose that the government allocate funds to co-finance the hosting of an AI Factory. Such an establishment would mean a lot, both technically and economically, for SMEs' opportunities to conduct advanced AI innovation.

Venture capital is needed for innovation companies to emerge and grow. Swedish venture capital markets generally function well. We therefore do not see any general need for public support. However, there is a need for some targeted measures towards companies and projects with high potential added value that have difficulty to obtain private funding. These include innovations with very high technological risk, so-called disruptive technologies. It is also about business ideas that are not sufficiently scalable to attract private capital, but where the social benefits can be significant. We therefore propose increased funding for Vinnova and Almi in order to support this type of innovation.

We also propose that Vinnova investigate the possibilities of promoting cross-sectoral projects, where the value of a solution benefits more than just the parties involved. The state must be prepared to significant funding when valuable projects of this type are identified.

Developing AI solutions often requires access to large language models. We make suggestions on how we should proceed with the development of such models in Swedish in a way that takes advantage of the experience that exists in Sweden and our unique access to public data, while respecting copyright.

Next steps

The important thing now is to quickly come to proactive decisions that strengthen Sweden's competitiveness in the AI field. This is also the reason why we in the AI Commission have chosen to bring forward our report from July 2025 to November 2024.[4] In order to strengthen competitiveness, several complementary measures are needed in a wide range of areas. In the Roadmap, we propose concrete measures that we believe can be decided and implemented relatively immediately, i.e. as early as in 2025. These are initiatives and assignments to authorities that the Government Offices have extensive experience of preparing and managing in the budget process. Other proposals must be investigated further to find their more precise form or to be presented as finalised legislative proposals. However, it is of the utmost importance that these processes are initiated promptly.

The government should therefore adopt an AI strategy based on this Roadmap as soon as possible. Funding for our proposals should be included in the spring amending budget for 2025, or in an extra amending budget submitted to Parliament in spring 2025. The implementation work should be driven and supervised by a task force placed at the Prime Minister's Office. An important task for the proposed task force will be to continue the work started by the AI Commission: to create consensus on how to achieve the society we have described above, with AI at the service of citizens. Consensus creates the conditions

[3] Who should be responsible for the regulatory sandbox under the AI Regulation is not a matter for the AI Commission to decide. This issue will be addressed in the inquiry on the safe and trustworthy use of AI launched by the government in September 2024.

[4] In order to comply with both the Committees Ordinance and the directives issued by the Government for our work, we will also have this Roadmap printed in the series of Government Official Reports (SOU).

for cooperation on the issues, which is necessary to achieve the desired effects.

Below are the estimated costs of our proposals, broken down by the chapter of the Roadmap in which they appear. The largest increases in resources are proposed for various initiatives in frontier research. Other significant initiatives are proposed for the public sector, in the form of the AI Workshop, a knowledge boost and computing power. These are proposals that should be decided quickly. In addition, we are also proposing a number of investigations into issues that are not yet ready for decision. We have included an indicative cost in the table for some of these inquiries, but not for all. It is therefore important for the Government to be prepared for additional costs when the proposals are made. In some areas, such as energy and telecoms, we are not proposing any investments at present. However, it is important that the Government monitors developments closely in these areas and is ready to take action if necessary.

It is also important to understand that the estimated costs of the proposed measures are gross costs. The AI Commission is convinced that the proposals as a whole will result in significant savings and revenue increases, through higher growth and productivity in society. We do not present aggregate estimates of these effects, as we do not believe that sufficiently clear and reliable estimates are currently available. Our view is based on the experience of previous technology shifts, as well as the examples of savings and efficiency gains that we present in various places in the Roadmap.

Table 1: Costs of our proposals by area (SEK million)

Area	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6-10	Year 1-5	Year 1-10
Computing power	845	165	165	165	165	250	1 505	1 755
Data	4	4	4	4	4	20	20	40
Security	130	80	80	80	80	400	450	850
Cutting-edge research	655	655	655	655	655	3 275	3 275	6 550
Skills	508	563	607	217	217	85	2 112	2 197
Innovation	108	108	108	108	108	40	540	580
Public sector	157	512	512	512	512	60	2 205	2 265
International positions	257	209	211	213	215	1 075	1 105	2 180
Leadership and governance	35	35	35	35	35	0	175	175
Standard cost for inquiries	60	60	0	0	0	0	120	120
TOTAL:	2 759	2 391	2 377	1 989	1 991	5 205	11 507	16 712

Another initiative to boost innovation among SMEs is the European Commission's new concept called AI Factory. Photo: Gorodenkoff/Shutterstock

2 A solid foundation to build on

In this part of the report, we review the areas that are important enablers for the development and use of AI in Sweden. These can be seen as the necessary foundation on which the other measures are built, which are developed in Part 3, AI for All, and Part 4, Leadership and Governance.

The foundation starts with more traditional infrastructure, in the form of energy and telecoms, without which there will be no digital business at all. Other important building blocks are access to computing power, in the form of computers, and data. These two can be said to be the engine and fuel for AI. For AI to develop in a fierce global competition, a world-class research environment is also required. This is followed by a discussion of the security and ethical issues, which are also central to the harmonious and balanced implementation of AI in society. Finally, the need for continued access to AI resources from the rest of the world is discussed. Sweden is a small country and we will always be dependent on the outside world, not least in the field of AI.

This section contains:

Photo: Feher Istvan/Shutterstock

A solid foundation
to build on

Energy

ChatGPT summarises:

AI's development depends on a stable and abundant supply of electricity, while we are in a time when demand for fossil-free energy is growing rapidly. How will AI's energy needs be met when the electrification of industry and the transport sector requires more and more?

In this chapter, we explore how AI can be both a challenge and a solution for the future energy system. In addition, we look at why Sweden's fossil-free electricity generation gives us a unique advantage in the global AI race. The issue of electricity adequacy will be crucial - both for AI technology progress and for society's green transition.

AI and electricity consumption

AI is an energy-intensive technology. This is due the large amount of data and computing power, in the form of access to powerful computers, required to train and use different AI tools. This is especially true for systems with broad applications - such as large language models and generative AI - that can analyse text, images and other media types. Less generalised algorithms, with narrower use areas, use less computing power and thus also less energy. An example of this is the algorithms used by the Swedish Tax Agency to detect discrepancies in tax returns.

The size of AI's future electricity demand is currently highly uncertain and cannot be predicted with any precision. The uncertainty depends on how the technology will be developed and used. As modelling becomes more advanced and more widely applied, electricity demand will increase. The fact is that the computing power required for AI has multiplied every year since generative AI was introduced, leading to a corresponding increase in energy use. If the current trend in energy use were to continue, the technology would require a lot of electricity in the future.[5] However, experience shows that digital technologies tend to evolve rapidly, and more energy-efficient computer processors and algorithms are being developed all the time.[6] Against this background, there is reason to expect a significantly smaller increase in electricity consumption linked to the development and use of AI. Overall, it is reasonable to assume that AI will account for one or a few per cent of total electricity consumption worldwide.w

While AI will increase demand for electricity, it does not mean that overall energy use in society will be affected in the same way. AI is a key tool for improving the efficiency of energy use in society, which makes it an important key to achieving the green transition. The fact box *Three examples of how AI can make energy use more efficient* provides examples of this.

[5] There are estimates from the US on future electricity consumption from AI and data centres in the US. For example, the Electric Power Research Institute (EPRI) estimates that data centres could consume up to 9 per cent of US electricity generation by 2030.

[6] According to a report by Google DeepMind, data centre energy consumption could be reduced by up to 40 per cent in the context of data centre cooling. The AI models optimised the performance of cooling systems in real time based on data on temperatures, energy consumption and pump speeds. See https://deepmind.google/discover/blog/deepmind-ai-reduces-google-data-centre-cooling-bill-by-40/.

Three examples of how AI can make energy use more efficient[7]

AI can be used to improve the matching between supply and demand for weather-dependent energy sources

To reduce the risk of incorrect forecasts of supply and demand for solar and wind power, Vattenfall has developed self-learning algorithms that combine historical weather data with real-time information on cloud movements. These algorithms enable highly accurate near-term forecasts. With these forecasts, Vattenfall reduces its risk and costs, while contributing to a more stable electricity system.

Data-driven minimisation of disturbances and outages with the help of AI

E.ON has developed an algorithm that predicts when a medium-voltage network needs to be replaced, which has reduced power outages by up to 30 per cent. Italy's Enel installed sensors on power lines in 2019 to detect vibration levels. Based on machine learning algorithms, Enel was able to Enel was able to identify and fix potential problems. This effort resulted in a 15 per cent reduction in the number of power outages.

Smart systems optimise energy use in buildings by predicting electricity prices

ABB has developed an AI model for forecasting energy use in commercial buildings, helping property owners to avoid high electricity prices and benefit from variable electricity contracts. If similar mechanisms are implemented widely in society, it could contribute to a better match between electricity supply and demand, which in turn leads to a more stable electricity system. AI also has the potential to achieve energy savings by optimising air conditioning and lighting systems in buildings. According to Schneider Electric, AI can reduce energy use in buildings by 15-25 per cent over the next four years.

[7] See Why AI and energy are the new power couple, International Energy Agency, 2023; Energy-Guzzling AI Is Also the Future of Energy Savings, The Wall Street Journal, 2024.

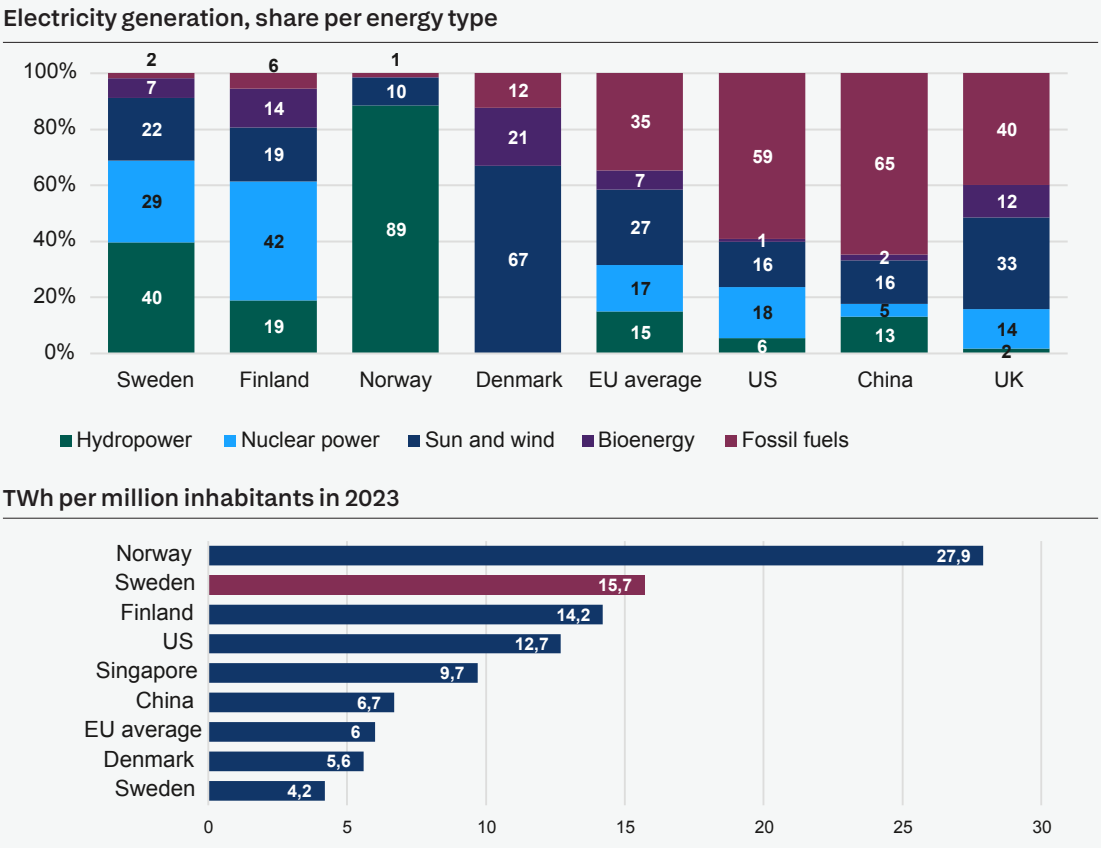
Fossil-free electricity as a competitive advantage

The development and use of AI requires data centres to train and deploy algorithms. In the digital sector, geographical location matters less, as operators can deliver services globally via the internet. This allows data centres to be concentrated in locations with favourable conditions from which they can serve a global clientele. Electricity consumption in a given country is thus affected not only by AI developments, but also by the location of data centres.

Sweden and our immediate neighbours have excellent conditions for hosting data centres. This is mainly because we have relative political stability, a cold climate, good access to water and, above all, cheap, stable and fossil-free electricity. Fossil-free electricity is becoming increasingly interesting as voices are raised in favour of making AI climate-friendly. This has made the Nordic region attractive for setting up data centres.

Figure 1 shows the difference in the electricity generation mix in the Nordic region compared to key countries in AI. The US, China and the UK have electricity generation that is significantly more dependent on fossil fuels than the Nordic countries. Sweden, Norway and Finland also have relatively high electricity generation per capita. In addition to Figure 1, the World Economic Forum's energy transition index also shows the attractiveness of the Nordic region terms of energy system potential. Here, Sweden is at the top, followed by its Nordic neighbours. The index captures how well countries are equipped to adapt their energy systems to the green transition. This includes not only electricity production, but also broader aspects of the energy system, such as sustainability, availability and security.[8]

Figure 1: Electricity generation in 2023



Note: Fossil fuels include natural gas, coal and oil.
Source: Ember (2024), Energy Institute - Statistical Review of World Energy via https://ourworldindata.org/grapher/shareelectricity-nuclear.

[8] The WEF Energy Transition Index is built around three pillars: Equitable, Secure and Sustainable. Together, they capture regulatory aspects as well as infrastructure, innovation, and human and financial capital. The WEF believes that these components are needed to create long-term sustainable electricity systems. Source: https://www.weforum.org/publications/fostering-effective-energy-transition-2023/.

Sweden's favourable conditions for housing large data centres have led several companies to choose to locate their servers in Swedish facilities, see the fact box *Establishment of data centres.* From a global emissions perspective, this is positive, as emissions from AI decrease when electricity-intensive computer use increasingly uses electricity that is fossil-free, rather than fossil-dependent. At the same time, this development could lead to large amounts of energy being allocated to data centres in Sweden. Given the increasing demand for electricity in other sectors of society, it is therefore important that electricity use in data centres creates social benefits. This applies in particular at larger establishments that require a lot of electricity.[9] For example, the relative social benefit of data centres increases if Swedish operators have access to the computing power in the centres.[10]

Proposal

- The AI Commission proposes that the government should initiate dialogue with actors who are the process of establishing large and energy-intensive data centres. The proposal aims to reach agreements that safeguard Sweden's interests.

Establishment of data centres

Company	Description
Meta	In 2013, Meta opened server halls in Luleå, which was the company's first establishment outside the US. The server halls are part of Meta's global infrastructure used to power Meta's platforms, including Facebook, Instagram and WhatsApp.
Amazon Web Service	Since 2018, the company has data centres in Västerås, Eskilstuna and Katrineholm, which are used to offer cloud services globally.
Microsoft	Microsoft announced a $33.7 billion investment in 2024 in data centres designed for cloud computing and AI.
Coreweave and EcoDataCentre	At EcoDataCenter's facility in Falun, the US company Coreweave will invest in a data centre to offer the service "GPU as a service". The total investment amounts to SEK 8 billion.
EcoDataCentre	EcoDataCenter has acquired parts of the Kvarnsveden paper mill in Borlänge to build AI infrastructure. The company has also initiated a project in Östersund together with, among others, Jämtkraft and the company WA3RM, with a total investment of approximately SEK 18 billion. At the time of writing, the project is environmental authorisation.

Is there enough electricity for AI?

AI technology has accelerated at the same time as several other energy-intensive social projects are being implemented. Sweden's electricity demand has remained almost constant for the last 30 years or so and is now starting to increase. According to Swedish authorities, annual electricity consumption is expected to increase from the current 140 TWh to 200-340 TWh by 2045. However, these figures do not take into account the potential increase in electricity demand that is expected to occur as the use of AI increases.[11] The figures also do not include the positive impact AI can have on energy systems.

Future demand for electricity is driven partly by the transition from the use of fossil fuels to electricity, for example in transport, and partly by new electricity consumption arising from increased processing of Swedish raw materials. One such example is increased steel production from Swedish iron ore. The emergence of new industries also affects electricity use, such as the production of electro-fuels, battery production and new mining activities. Many of these projects are still uncertain, which explains the wide range in estimates of future electricity demand. Depending on the assumptions made about, among other things, the electrification of industry, the authorities estimate that electricity demand could increase between 40 and 140 per cent by 2045.

The development and use of AI is part of this evolution. While it is not possible to estimate the net impact on future electricity demand, it is clear that AI will depend on a stable and abundant electricity supply. Properly managed, Sweden's electricity production can create favourable conditions for AI, for example by ensuring that data centres create societal benefits. However, this also means that periods of electricity shortages can have far-reaching consequences for the development of AI in Sweden.

[9] In Ireland, the rapidly growing data centre industry has led to increased demand for electricity, raising concerns about capacity shortages and security of supply. This has resulted in both an individual assessment of new data centres and a temporary halt to their development in Dublin until 2028.
[10] In a report from 2023, the Swedish Agency for Growth Policy Analysis analysed the welfare effects of the electricity tax rebate that data centres received until 2023. The agency concluded that the tax rebate was not economically viable and that it mainly benefited large foreign operators. See Assessing the welfare effects of electricity tax exemptions in general equilibrium: The case of Swedish data centres (WP 2023:04).
[11] The scenarios' assessment of the increase in electricity demand was made before generative AI had its breakthrough and became widely recognised. The assessment takes into account a possible increase in electricity consumption in data centres of up to 21 TWh, which is almost ten times the current estimated electricity consumption.

Photo: Sundinfoto/Shutterstock

To meet the increased demand for electricity, the government has set a target of doubling the current production capacity. In government bill 2023/24:105 *Long-term direction of energy policy,* the government emphasises that the energy system must be flexible meet new electricity needs as they arise. To achieve this, Sweden will plan and clarify electricity demand in different geographical areas for the years 2030, 2035, 2040 and 2045. As part of this work, regular checkpoints will be introduced, the first of which is planned for 2030.

In this planning, it is important that the government takes into account the electricity demand generated by the development and use of AI, which is complicated by the current lack of reliable data on the electricity consumption of data centres housing AI.[12]

Proposals

- In Bill 2023/24:105, the Government proposes that "the planning of the Swedish electricity system should provide the conditions for supplying the electricity needed for increased electrification and that enable the green transition". The Government therefore considers that Sweden should plan to meet an electricity demand of at least 300 TWh by 2045". The AI Commission shares this assessment, as a doubling of current production capacity is a prerequisite for the competitiveness of Swedish industry in general, and for AI in particular. If electricity shortages or the risk of electricity shortages arise, the consequences could be significant, both for AI development and for investments in Swedish industry. This risks affecting the country's long-term competitiveness.

- The AI Commission believes that the government needs to monitor developments closely and be prepared to adjust its policies and measures for electricity generation at short notice. This is due to the high level of uncertainty about the future use of electricity. The AI Commission therefore welcomes the in-depth follow-up of the quantitative assessments proposed by the government in Bill 2023/24:105, in the form of checkpoints starting in 2030. Here, the AI Commission believes that the in-depth monitoring should pay particular attention to the growing electricity needs of the AI sector. This is due to rapid technological developments that may require adjustments to current assessments. In its work on the checkpoints, the government should also consider how AI can be used to reduce energy use in different sectors of society.

- The AI Commission proposes that the government task the Swedish Energy Agency with monitoring and reporting on trends in AI and energy consumption. To make this possible, better statistics are needed on the energy consumption of data centres than are currently available.

[12] The Swedish Energy Agency stresses the need for new ways of documenting the energy use of digital systems and there will be reporting requirements for data centres at EU level through the EED and the Energy Statistics Regulation.

Telecoms

ChatGPT summarises:

The telecoms sector plays a central role in the digitalisation of society, and its importance is increasing with the emergence of AI.

In this chapter, we explore the opportunities and challenges that arise when telecoms and AI interact, particularly around real-time data and low latency. How fast and stable we can transmit information will be crucial for future digital solutions, from healthcare to industry. Despite this, Sweden has lagged behind in investments in mobile networks and 5G, which risks negatively affecting the country's competitiveness and innovation. The chapter provides an overview of the current role of telecoms and its growing importance in an AI-driven world.

What is telecoms?

Telecommunications, also known as telecoms, is the traditional term for the transmission of information over distance using technical means. It includes all types of voice, data and video transmissions. It includes various technologies and services such as telephony, fibre optics, satellites, radio, television and the internet. Legislation and regulation use the term *electronic communications.* Often, including at EU level, the term *connectivity*[13] is used to describe the overall policy area.

The role of telecoms in digitalisation and the development of AI

With the help of telecoms, it is possible to transport large amounts of information and data between people, machines, businesses and governments. Most often, it is information that the digital services we use every day. Thanks to telecoms, we can, for example, file taxes online, stream films and music, shop, socialise and access news and social information on our computers and mobiles.

As digitalisation increases, there has also been an explosion in the amount of data flows that need to be shared between us in various ways, often in real time. To meet these developments, fast and reliable connectivity is essential. In short, telecoms are a prerequisite for the digital society, and their importance is increasing due to AI.

For society, there are major benefits to be gained from being able to quickly implement real-time data transfers. This is especially true for the development of new smart systems that often rely on AI technology. One such example is remote patient monitoring. Using so-called 'wearable technology', such as smartwatches and medical sensors, it is possible to measure vital signs such as pulse and blood pressure, and then share this measurement data directly with a doctor via the mobile network. As a further example, ambulance staff can use the mobile network to transmit patient data during transport, allowing medical staff to prepare before the patient arrives at the hospital.

In the future, more digital solutions and smart systems will rely on real-time data flows, which will require low latency. This refers to the time it takes for information to reach its final destination in a digital network, such as the delay that can occur when a voice reaches the recipient during a phone call. Already today, there are examples of digital solutions that need very low latency, such as remote control of machines and robots, financial transactions and online games. As AI systems start to analyse and react to information from the environment in real time, the need for low latency in telecom networks will increase further.

A further link between AI and telecoms is that AI models are often too large to be computationally efficient. Instead, they require dedicated hardware, which in turn resides in dedicated data centres. AI services therefore require telecommunications, in particular fast and stable internet, to connect these data centres to our phones or computers.

Overall, we can conclude that the use of AI will accelerate the digitalisation of society and make fast and stable connectivity essential for managing everyday life and work tasks. For businesses, access to high-quality connectivity will become an increasingly important competitive advantage and will determine where they locate themselves. AI technology will thus increase the importance of internet connectivity for regional development. AI solutions are also likely to drive the digitalisation of welfare services.

[13] Connectivity means connection and encompasses digital networks, from mobile and fixed structures to the internet, including cables and satellites.

By extension, this means that the internet will be necessary to access public services.

In other words, a fast and stable connection in all parts of the country can help to equalise economic conditions and promote democratic participation. We therefore believe it is particularly positive that the government intends to commission the Swedish Post and Telecom Authority (PTS) to investigate how support can be designed for geographical areas where there are no conditions for commercial expansion of mobile coverage and capacity.[14]

Investment in the mobile network

The importance of a stable and fast internet connection, as discussed in the previous section, cannot be emphasised enough. But what is the technology we are referring to when we discuss this area?

Internet connectivity essentially relies on two key components: fibre networks and mobile networks. We often use the fibre network to connect to the internet, for example via WiFi at work or at home. When we are on the move, we can connect to the internet via the mobile network (today represented by different generations of mobile networks: 3G, 4G and 5G). In the future, however, we may not be dependent on local WiFi, as modern mobile networks offer higher security and reliability.[15] It will then be possible to fully integrate mobile networks and cloud services to provide businesses and individuals with constant and secure connectivity, regardless of location. Such developments would lead to a reassessment and simplification of the traditional IT infrastructure in workplaces and homes. This is particularly valuable given that working life is becoming less location-bound and more people are working fully or partly remotely.

For a century, Sweden has been at the forefront of telecoms deployment, both in terms of latest technology and coverage. One illustration of this is that Sweden has a relatively well-developed fibre network, especially in cities and urban areas, which provides a good basis for offering AI solutions. In contrast, Sweden's mobile network fares worse in an international comparison. The rollout of 5G, the latest generation of mobile networks, has happened earlier and faster in the US and Asia than in Sweden. According to the latest edition of the GSMA's 5G Connectivity Index, Sweden ranks twenty-first.[16] Our Nordic neighbours Norway, Finland and Denmark are all among the top seven in the world. Similarly, the major AI nations of China and the US rank ahead of Sweden. Furthermore, the index shows that of the twenty highest ranked countries on the list, only six are EU countries. This is of particular relevance for Sweden as our telecoms market is heavily influenced by EU legislation.

When the perspective is broadened to include the entire mobile network, and not just 5G, the situation appears slightly more positive. In a measurement of mobile network reliability carried out by Opensignal in 2024, Sweden ranks sixth globally, with similar scores to Norway. Countries such as Denmark, South Korea and Japan all rank ahead of Sweden. Opensignal also measures the average download speed in the mobile network, where Sweden's speed is lower than in our neighbouring countries Finland, Norway and Denmark.

The speed of the mobile network can be partly explained by Sweden's large area and sparse population structure, which has meant that operators have chosen to prioritise low frequency bands. Low frequency bands can cover larger areas, and fewer base stations and antennas are needed. The downside is that low frequency bands are less suitable for transporting large amounts of data.

Globally, the 3.5 GHz band is used as the main carrier for the new 5G technology, allowing large amounts of data to be transmitted. In Sweden, this frequency band is only used in major cities, which may pose a growing challenge as the economy digitises. Currently, Sweden's mobile operators are working to expand the 3.5 GHz band to more locations, but this requires demand from both public and private operators. It will take several years for small and medium-sized towns to get 3.5 GHz coverage. In the meantime, simpler 5G services are delivered over the lower frequency bands.

Better coverage with higher frequency bands is important for the development of AI, but even more important is the full roll-out of mobile core networks (the 5G intelligence itself). Core networks need to be upgraded to full 5G functionality, known as 5G SA see box *5G technology enables AI*. Only then will it be possible to introduce new functionalities and services, which will be needed for AI in the future.

Exactly what explains Sweden's low investment in mobile networks is not easy to determine. One explanation that is often put forward is that low profitability for operators negatively affects their willingness to invest. One sign of the operators' low profitability is that it is generally below the cost of capital. Profitability is affected by the fact that the Swedish

[14] Government Bill. 2024/25:1 p. 21.
[15] Mobile networks offer a higher level of reliability and security because they are designed to support critical services, with continuous monitoring by operators and scrutiny by authorities such as the PTS, which means that security is built into the system from the outset rather than added as an afterthought.
[16] The index is available at https://data.gsmaintelligence.com/5g-index.

operator market is fragmented, with many different actors and tough competition. This fragmentation is partly due to EU competition rules, which in some cases have not allowed mergers or required commitments. This problem is not specifically Swedish, but is largely common within the EU. The so-called Letta and Draghi reports also highlight the need to reform the European telecoms market. The

latter points to the need for consolidation and the relaxation of competition rules, as well as measures related frequency licences and spectrum allocation.

Proposals

- For over a century, Sweden has been a pioneer in the development and application of telecommunications. Unfortunately, we have now fallen behind, which risks reducing our innovation and competitiveness. It is therefore of the utmost importance to address the reasons for this.

- The issue is complex, however, and the AI Commission sees the government's decision to set up an inquiry to accelerate the rollout of 5G and fibre in Sweden as an important step in the right direction. The inquiry will propose additions and adaptations to meet the requirements of the EU's Regulation on gigabit infrastructure. This EU regulation aims to reduce the costs of deploying high-speed electronic communications networks.

- The AI Commission believes that the inquiry should also be tasked with analysing the relevant proposals in the recently published Draghi report that affect the telecoms market. Here, for example, we propose that the inquiry should specifically analyse the proposals concerning how competition law affects company consolidations and make proposals on the positions that Sweden should pursue in the EU in the AI domain. The inquiry should also consider how Sweden can push for increased investments in telecoms at EU level, such as investments in bandwidth and 5G SA. The costs of these measures should be weighed against the value they can create in terms of a competitive AI sector.

5G technology enables AI

5G technology enables AI through faster and more robust data transmission. The increased speed and capacity of 5G networks creates new opportunities for AI-based systems that rely on processing large amounts of data in real time. 5G SA (stand alone) allows operators to allocate specific network capacity based on individual customer needs. This flexibility allows customers with high stability and reliability requirements to get a customised connection, which was not possible with previous network generations where resources were shared equally between all users..

In practice, these technological developments have already started to make a difference. At the Kankberg mine in Västerbotten, Boliden is using a local 5G network to remotely control vehicles at a depth of 400 metres. This improves both the safety and efficiency of mining operations, as machines can be controlled from a safer location above ground. 5G technology allows the 'brain' that controls the machines to be located in a different place from the machine itself. It opens the door to the future implementation of smart AI-based systems, without need to install specific hardware in each vehicle.

These developments demonstrate the potential for future synergies between 5G technologies, AI and other advanced systems. By combining these technologies, we can expect new innovations that will change the way we use digital networks. 5G SA, in combination with AI, has the potential to play a key role in the coming digital transformation, although the technology is not yet available through Swedish operators.

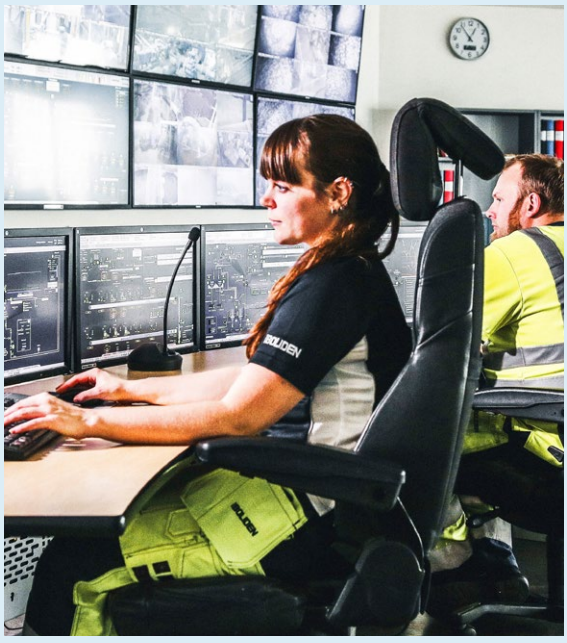


Photo: Boliden

Computing power

ChatGPT summarises:

Computing power forms the backbone of the digital society and is a crucial factor for the ongoing AI revolution.

In this chapter, we dive into the complex world of computing resources, where traditional data centres meet the specialised capabilities of graphical processing units (GPUs) that are driving AI innovations forward. We explore the strategic choices between cloud computing and in-house supercomputing, and how these decisions affect everything from research to commercial use. In addition, we discuss the varying needs of different sectors and the role governments can play in creating a sustainable and competitive infrastructure for computing power. By uncovering these aspects, we will understand how we can navigate a future where the possibilities of AI are limitless, but resources are limited.

What is computing power?

Computing power consists of individual or interconnected computers that perform the calculations underpinning all digitisation.[17] We use it every day, often without thinking about it. Computing power is necessary when we browse on our mobile phones, use social media or follow weather forecasts, for example.

There are many different types of computers. The most central part of a computer is the unit that performs calculations. Today's computers use two main types of computing devices, CPUs and GPUs[18]. CPUs are designed to be general-purpose computing devices, often performing many calculations in succession very quickly. GPUs (graphics processing units) were originally built to create images on a screen (hence the name), which is based on performing calculations in parallel with different data. GPUs have developed very quickly and have become more widely used. Their ability to compute in parallel on many different data sets makes them very suitable for data-intensive calculations such as training AI models. A supercomputer consists of a large number of devices, CPUs, GPUs or a mixture of these, connected by high-speed networks and working together (in parallel).

Today, the specialised computing power of AI is often based on many parallel graphics processing units (GPUs). It is largely thanks to the development of new, more powerful GPUs that recent advances in AI have been made possible. The hallmark of large-scale AI infrastructure is that, in the same way as traditionally powerful computers, it is expensive, very energy intensive and has high cooling requirements.

Purchased or own computing power

Access to computing power is a prerequisite for private and public actors to develop and use AI. Today, access to computing power is possible through two approaches.

Either through purchased cloud services, which means renting a data centre owned by external actors. There is a clear US dominance here. The other option is to acquire your own computing power by buying computers.

The main advantage of using cloud services is that they are easy to use and allow for a quick start-up. This allows you to scale up your AI operations without costly investments. This is particularly valuable if the need for computing power varies greatly over time, as an in-house computer would then be unutilised for periods of time. However, if you can utilise your own computing power well, the cost per GPU hour will be significantly higher for these cloud services than for your own computing power.

This means that cloud computing can quickly become very expensive if you use a large number of GPU hours.

A further disadvantage of cloud computing is that control over sensitive computations and data can be lost if data is sent outside the country's borders especially outside the EU. This can also apply when using the cloud services of foreign providers established in Sweden. This means that the use of cloud services is limited by laws and regulations.

[17] Here we define computing power as including not only computing power, but also data storage and internal networks between data and systems.
[18] CPU stands for Central Processing Unit and GPU for Graphical Processing Unit.

Computing power consists of individual or interconnected computers that perform the calculations underpinning all digitisation.
Photo: Thor Balkhed/Linköpings University

Instead of using cloud services, acquiring your own computing power, i.e. buying your own computers, is cheaper if the computing power is utilised. Another significant advantage of in-house computing power is that it promotes the development of skills in society. This makes it possible to compete and cooperate in the development of computing power on the global stage. Thus, although commercially provided computing power is often sufficient, there are reasons to develop our own expertise in this area. Having our own computing power would also guarantee us some computing power in a crisis situation. It would also make it possible to develop and analyse the technology from a national security perspective, and to cooperate with other countries that have done the same analysis. For example, Germany and France have taken a leading position in Europe in this field. Our Nordic neighbours have also invested in their own computing power for both research and commercial use.

The conclusion is that we need a good mix of cloud services and nationally coordinated, open computing power that demonstrates opportunities and paves the way for both research and large-scale commercial use of AI.

Different needs in different sectors

The availability and use of computing power differs between different actors in society. Below is a description of the situation in universities and colleges, private companies and the public sector, and proposals for actions to be taken.

Universities and colleges

The need for large-scale computational resources for AI at universities and colleges has increased dramatically over the past 15 years. Above all, it has concerned the need to be able to train AI models.

Today, universities and colleges have relatively good access to computing power for training *smaller* AI models. However, it is insufficient to train really large models or to be able to use the models on a larger scale. Training an AI model is very extensive computational endeavour that requires access to large-scale GPU-based computing power. For large-scale models, such as language models, months of computing time may be required. It's not just access to computing power in the form of GPUs and storage needed. Equally necessary is the need for large amounts of memory. This is to store data and be able to quickly feed training data into the computer.

The rapidly increasing future need for large-scale computing power for AI comes not only from leading researchers in the field of AI who need access to ever greater computing power to compete on the international research front. It also comes from researchers in advanced application areas where models are both trained and fine-tuned. Examples of such applications can be found in several key research areas in the life sciences and in AI research for autonomous systems and robotics.

However, there has already been some progress in this area. For example, the Knut and Alice Wallenberg Foundation acquired the Berzelius supercomputer, which is used for basic research initiatives. This is being done, for example, within the Wallenberg AI, Autonomous Systems and Software (WASP). For more information on WASP, see page 54.

Berzelius is based at the National Academic Infrastructure for Supercomputing in Sweden (NAISS) at Linköping University.[19] The focus of the activities is on basic research within academia, companies have some access to computing power through research collaborations.

In the summer of 2023, it also became clear that Sweden will be the principal of one of the supercomputers within the framework of the EU organisation EuroHPC JU. The aim of the EuroHPC JU is, among other things, to strengthen the EU's access to computing power by coordinating and bring together Europe's supercomputers. With a total budget of €2.1 billion (just under SEK 24 billion), the EuroHPC JU is based on co-funding, which means that the EU matches the funding contributed by the Member States themselves.[20]

Arrhenius, as the supercomputer is called, will be located at Linköping University and become operational in 2025.

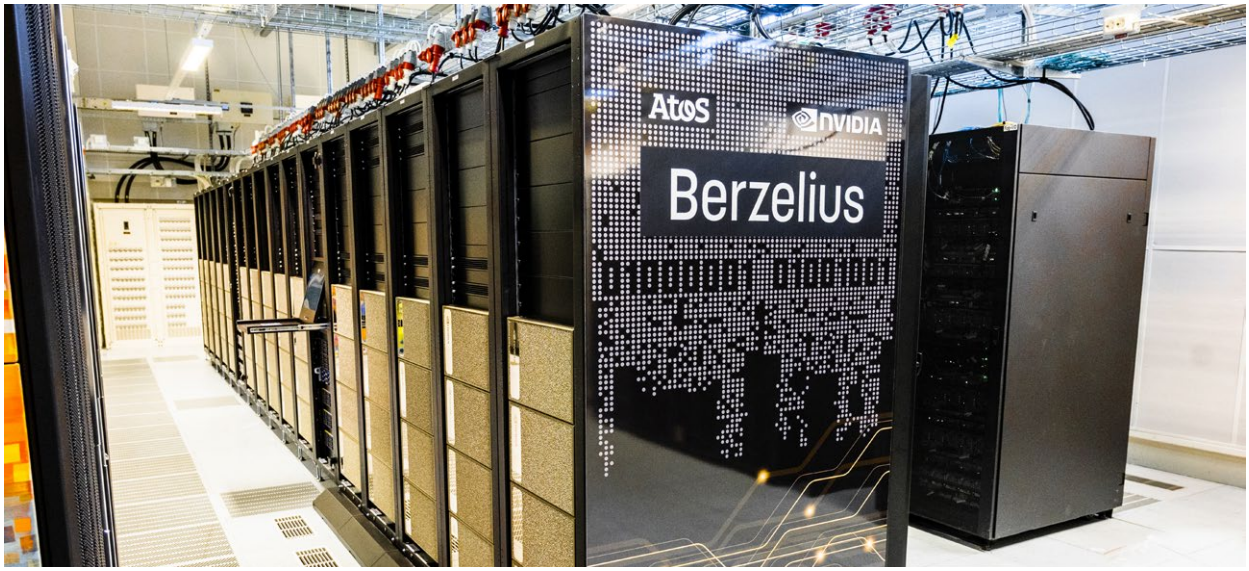
The EuroHPC JU currently covers 35 per cent of the operating and financing costs. The remaining costs are currently funded by the Swedish Research Council and other Swedish actors, who together contribute SEK 510 million.[21]

However, it is important to note that Arrhenius will replace the current computers used for traditional technical scientific calculations in Sweden. Although it will contain a smaller proportion of GPUs, it is not optimised for large-scale AI training. Instead, the initial phase of Arrhenius will be needed to fulfil traditional needs, for example in physics, chemistry, climate science, biology and medicine.

But Arrhenius is nevertheless an important prerequisite for the development of AI in Sweden. This is because, by virtue of being linked to the EuroHPC JU, it opens up the possibility for Sweden to apply for a so-called AI Factory (see box on page 34 for more information on AI Factory). A successful Swedish application will bring investments in computing power and expertise dedicated to AI.

Looking ahead, the AI Commission believes that continued investment in resources for the development and training of AI models for Swedish researchers is of the utmost importance. This is to ensure Swedish cutting-edge research in AI and advanced applications. Such an initiative should be seen as a complement to the Knut and Alice Wallenberg Foundation's investment in the Berzelius supercomputer, but should of course be coordinated to ensure the long-term national development of competitive resources and services.

[19] NAISS is an organisation for supercomputing and computing power that currently operates at eleven of Sweden's universities and colleges, and manages a number of the universities' supercomputers.
[20] For more details on the EU's efforts in AI, see the chapter International positions.
[21] The Swedish Research Council has allocated SEK 250 million for an investment in Arrhenius over five years (2025-2029).



The Berzelius supercomputer is located at the National Academic Infrastructure for Supercomputing in Sweden (NAISS) at Linköping University. Photo: Thor Balkhed/Linköpings University

Proposal

- The AI Commission estimates that the government needs to provide the Swedish Research Council with SEK 300 million as a one-off investment for the development and training of AI models. Thereafter, SEK 25 million is needed annually to keep the system competitive.

There is also a growing need to be able to apply trained AI models in the next step. The result of training an AI model is that they are provided with a set of so-called para-meters, which for large models can be hundreds of billions. The Swedish language model GPT-SW3, trained on the Berzelius supercomputer, has 40 billion parameters. However, the latest commercial models have significantly more parameters, and the size increases with each new version.

When training AI models, users often have to queue up to access computing power. At Berzelius, it can currently take several days of queuing to make calculations, as the computer is normally fully loaded around the clock.

When using trained AI models, the parameters are used to process information that is input. As an example, GPT-SW3 has been trained to predict the next word in a sequence, thus creating new texts. This requires computing power capable of responding very quickly to the questions posed by the user. For everyday interactive use, the computer needs to respond within a fraction of a second and to many users simultaneously.

Thus, the application of AI services requires a computer with sufficient power to handle the immediate interaction between computer and user. The interaction with, for example, the AI tool ChatGPT would significantly decrease in value if it took several minutes for the user to receive a response. In the future, it is likely that we will be in greater need of computing power for using AI models than for training them.

In Sweden, however, we currently lack a comprehensive computing power dedicated to the use of AI services, known as inference. It is the AI Commission's assessment that large-scale inference-adapted computing power should now be built up to create the possibility of providing Swedish AI-based user services. Such efforts should of course be weighed against cloud-based commercial services offered and focused on those uses that for various reasons are not relevant to cloud services. This computing power should be available to both the business sector and the public sector, which have a great need to deploy systems to offer business solutions and public services.

Proposal

- The AI Commission estimates that the government needs to provide the Swedish Research Council with SEK 200 million as a one-off investment to upgrade and expand existing computing power for the use of AI services. Thereafter, SEK 25 million is needed annually for upgrading and development. Such an investment will also help to cover the needs for application computing capacity in the private and public sector. In this context, it is important to closely monitor the development of cloud services, so that the mix of building our own computing power buying cloud services is always optimal.

Business sector

The private business sector largely meets its own computing power needs. Large Swedish enterprises are currently investing heavily in their own computing power, while small and medium-sized enterprises (SMEs) meet their needs mainly via cloud services and local servers. This works satisfactorily for simpler and less resource-intensive calculations. However, some SMEs, whose business relies on computation-heavy algorithms, may need the computing power of a supercomputer. From the perspective of these companies, it would be optimal to coordinate the individual investments in a common computing power or cloud service procurement. However, experience shows that this is difficult to realise in practice, as the number of companies needed to achieve critical mass is too large to coordinate the investment. Computing costs can thus create a barrier for some SMEs to utilise AI. This situation has led some countries to focus on SMEs in their public investment in computing power for AI.[22]

Recently, several companies have established data centres in Sweden, most

recently in Falun and Borlänge.[23] This is a development that could help facilitate access to computing power, not least for SMEs. Companies are setting up by renting space in Swedish data centres or by building their own. This reflects Sweden's attractiveness for such establishments - there is cheap, fossil-free electricity, a cool climate, plenty of cooling water and relatively stable rules. These

[22] Canada recently invested 2 billion Canadian dollars to strengthen its computing power, with small and medium-sized enterprises (SMEs) as an explicit target group. Finland's AI strategy also highlights SMEs as key players in the technology shift.
[23] The US company CoreWeave offers computing power to AI. Together with the Swedish company EcoDataCenter, the company has invested SEK 8 billion in a new data centre at Ingavarvet in Falun. EcoDataCenter will eventually also build a data centre in the Kvarnsveden paper mill area in Borlänge.

establishments can provide higher education institutions, private companies and public sector organisations with additional opportunities to access computing power. However, in order for these establishments to provide competitive advantages for Sweden, it is important to set requirements for the establishments.[24]

The Arrhenius supercomputer (discussed in more detail in connection with the section on universities and colleges) also offers a unique opportunity to strengthen business-related AI development in Sweden.

This is because it opens up the possibility for Sweden to host a so-called *AI Factory,* an initiative from the European Commission that aims, among other things, to support SMEs in their efforts to develop AI. This is mainly done by providing them with computing power at competitive prices and secure test environments for new AI services. Several stakeholders, including the Swedish Research Council, NAISS[25], RISE[26] and SciLifeLab, are behind the initiative. Approval would mean significant additional EU funding for Sweden for a computing power that could then serve SMEs, among others.

AI Factory

AI Factory is one of the European Commission's key initiatives to strengthen the Union's competitiveness and increase investment in digitalisation and AI. The initiative is partly funded by the EuroHPC organisation.

The aim of the initiative is to create a broad range of expertise in AI, both in business and research. To achieve this, AI Factory supports AI start-ups, large companies, government agencies and researchers with both infrastructure and resources to enable them to develop AI models and applications. This is done, among other things, by offering access to advanced training and further education, as well as access to resources necessary for calculations and data storage.

The purpose of AI Factory is not only to foster the development of AI services. It is also to ensure that talent and companies do not leave the region. An AI Factory will also take strategic responsibility in areas where it is a leader. For Sweden this could include, for example, automotive and engineering, forestry, renewable energy and electricity grids, cybersecurity, life sciences/pharmaceuticals and climate research.

The organisations that can apply for funding to provide an AI Factory are those that host one of the EuroHPC's various systems. One such organisation is the Swedish National Informatics Infrastructure Society (NAISS), which hosts the Arrhenius supercomputer. In June 2024, NAISS submitted a preliminary Swedish expression of interest to provide an AI Factory. Based on the expression of interest, EuroHPC has announced that it has reserved funds for Sweden to apply for funding for an AI Factory with up to €20 million in budget over three years.

EuroHPC has also announced the possibility to apply for funds both for computing power and for skills-boosting initiatives, or only for the latter. The NAISS management, in consultation with the Swedish Research Council has made the judgement that it is strategically wise for Sweden to apply for both.

NAISS thus intends to apply for €10 million each for computing power and skills enhancement activities for research and industry. The application also includes a co-financing requirement: €20 million for hardware and €10 million for capacity building activities. In other words, Sweden must ensure co-financing of €30 million.

Sweden has full control over the part that is financed nationally. However, the part funded by EuroHPC is made available to users throughout the Union. This creates a situation where countries at the forefront of AI development will attract users from the rest of the Union. By extension, this will strengthen the ability of these countries to attract key talent and expand their start-up scene. For this reason, it is strategically important for Sweden to be among those taking the lead in the initiative.

Computing power for AI is a very central part of infrastructure investments for Sweden, especially in terms of the ambition to increase our competitiveness. In light of this, the AI Commission believes that it is very important to take advantage of the possibility that EuroHPC can co-finance the investments.

[24] See the Energy chapter for a discussion on this.
[25] Abbreviation for The National Academic Infrastructure for Supercomputing in Sweden (NAISS).
[26] Abbreviation for Research Institutes of Sweden AB.

Proposal

- The AI Commission believes that it is very important that the government supports efforts to establish an AI Factory in Sweden, which would, among other things, increase the availability of computing power at a subsidised price for small and medium-sized enterprises. This would require counterpart funding from Sweden of at least 50 per cent of the costs. This would involve €30 million[27] as a one-off investment and then €10 million per year for four years for operation. Responsibility should be shared between the Swedish Research Council and Vinnova as the target group is SMEs.

Public sector

The public sector also needs computing power to train AI models, but the emphasis here is primarily on implementing AI services to provide public services. Offering public AI services places high demands on security and stable operation. The services must be available around the clock and to many users simultaneously. More often than not, these requirements make it difficult for public organisations to purchase computing power via cloud services, especially as there are currently legal obstacles for the public sector to procure them.[28]

Today, there is no unified computing power for the public sector, but AI services are mainly delivered through local computing power within different authorities. The situation for the public sector is not dissimilar to that of businesses in terms of the different conditions between large and small actors. Larger authorities, such as the Swedish Tax Agency and the Swedish Social Insurance Agency are at the forefront of AI use thanks to their extensive resources and expertise. Smaller authorities, small regions and municipalities have often not even started using AI, as they lack both computing power and expertise. As with SMEs, there are coordination gains to be made here, but these are prevented by the same coordination problems that businesses often face. The government therefore needs to create the conditions for the public sector to utilise shared computing power adapted to AI, both in-house and in the form of procured cloud services where appropriate. A proposal that meets the computational needs of the public sector is discussed in detail in the chapter *AI for a public sector at the forefront.*

Monitor the needs for future computing power

Universities and colleges, industry and the public sector will increasingly depend on AI-related computing power. The initiatives listed by the AI Commission in this chapter cover needs that we can foresee today. In order to provide long-term competitive resources, given the rapid pace of technological development, plans for upgrades and improvements must be integrated from the outset. It is therefore important that the government closely developments to ensure sufficient computing power for training AI models and using AI services.

Proposals

- The AI Commission believes that the Swedish Research Council, preferably in collaboration with the other Nordic science councils, should report annually to the government on whether the computing power for training and using AI models is sufficient. The Government should be prepared to increase the appropriation for this purpose if the Swedish Research Council's analysis shows such a need. It is important that the needs analysis takes account of the fact that the supply computing power can affect demand and innovations. Some oversupply of computing power is therefore preferable at this stage.

- Computing power for training AI models and using AI services is becoming an increasingly important part of modern society. The AI Commission therefore believes that it should have the same status as other critical infrastructures, such as railways and electricity grids.

What we have talked about so far concerns the computational needs of today's technologies, but we can already see tomorrow's technology shift around the corner. Quantum computers are an example of an area where developments are making great strides and could significantly change the way computing is performed in the future. However, despite the significant progress that has been made, further technological development and research are required to achieve practical applications of quantum computers. However, the potential of quantum systems is so great that Sweden should prioritise active participation in their development. This is already happening to some extent through initiatives from, for example, the Knut and Alice Wallenberg Foundation. The AI Commission welcomes the fact that the Government has commissioned the Swedish Research Council to produce a basis for a national quantum strategy.[29]

[27] Approximately SEK 345 million at a euro exchange rate of SEK 11.49 (2 Nov 2024).
[28] For a more in-depth discussion of the issue of cloud computing in the public sector, see the chapter AI for a public sector at the forefront.
[29] See Assignment to submit a basis for a national strategy in the quantum field (U2024/01451).

Data as a prerequisite for AI development

ChatGPT summarises:

Historically, data has played a central role in decision-making, but in an era of rapid technological development, its importance has become more pronounced than ever.

In this chapter, we explore how the availability of relevant and high-quality data is a crucial prerequisite for the development and application of artificial intelligence (AI). With concrete examples, such as cancer diagnosis algorithms, we show how the quality and variety of data affect not only the effectiveness of the technology but also its ethical implications. To enable the effective use of these technologies, it is crucial that legislation is designed in a digitisation-friendly way, which means considering at an early stage how new technologies can be used to create societal benefits. Join us as we dive deeper into the complex relationship between data, AI and the future of society.

The need for relevant data

The emergence of AI has fundamentally changed the meaning of data and statistics. Previously, data was primarily a means to ensure that decisions of various kinds were made on the right basis - an equally important purpose. With AI, data has become a tool that has the potential to transform society.

To illustrate the increasing importance of data, a developer has been commissioned to create an algorithm for diagnosing cancer from X-ray images, intended to support doctors. For the algorithm to work effectively, access to a large and varied data set is required - i.e. a large number of X-ray images that have been analysed by experienced radiologists, both those that show cancerous tumours and those that do not. The more X-ray images the developer has at his disposal, the better the algorithm will be at making the right diagnosis. In this simplified example, X-rays are the data necessary to train the algorithm. For other types of AI models, the data could be text, images or audio recordings.

While access to data is crucial for the use of AI, it is not only the quantity of data that matters, but also its quality. If the radiologists who created the training data in our example had done a sloppy job and failed to certain tumours, the model would have performed worse. It is also necessary that data is structured carefully in accordance with the specifications applicable in the area concerned.[30]

The model in the example would also perform less well if the X-ray images only represented a certain group of people, as different body types, ages or disease patterns may affect how cancerous tumours appear on the images. This would make the algorithm more efficient for the body types in the data set, but less reliable for other groups. For example, if we assume that we only have access to X-ray images for men, these would not be very relevant for predicting cancer in women.

The developer could have solved this by adding a more diverse database that includes X-ray images from people with different backgrounds. However, in such a case, other problems may arise. For example, the new images may be in a different format or include a broader definition of tumours, such as images of benign tumours or precancerous lesions. In other words, the training data still needs to reflect the specific problem that the AI is supposed to solve, which is facilitated by using standards and documentation in the data collection.

[30] See, for example, Bolagsverket, the Swedish Agency for Digital Government, Lantmäteriet, the Swedish Tax Agency, Assignment on secure and effective access to basic data Final report for government assignments Fi2018/02149/DF, Fi2018/03036/DF and I2019/01060/DF.

The study found that screening with AI resulted in 20 per cent more identified cancers, but only 3 per cent more false positives.
Photo: Gorodenkoff/Shutterstock

Clinical assessment of mammography images with AI

Breast cancer is the most common cancer among women. In 2020, 7,400 women were diagnosed with invasive breast cancer in Sweden. In the 1980s, screening was introduced, which uses mammography to detect breast cancer. Nearly one million women are invited to such a screening every year, and 60 per cent of all breast cancer cases are detected by mammography. The X-rays taken are reviewed by two breast radiologists, who are currently in short supply.

In a Swedish study from 2023 that included 80,000 women, half of the women were assessed by two radiologists, while the other half were assessed with AI-assisted screening. The study showed that AI screening resulted in 20 per cent more identified cancer cases, but only 3 per cent more false positives, i.e. where the suspicion of cancer disappeared after further investigation. At the same time, the workload for radiologists was reduced by 44 per cent. A radiologist reviews an average of 50 mammograms in one hour. This means that this AI application saved five months of work on the 40,000 screening examinations in the group reviewed with AI.[31]

[31] See Kristina Lång, Viktoria Josefsson, Anna-Maria Larsson, Stefan Larsson, Charlotte Högberg, Hanna Sartor, Solveig Hofvind, Ingvar Andersson, Aldana Rosso, Artificial intelligence-supported screen reading versus standard double reading in the Mammography Screening with Artificial Intelligence trial (MASAI): a clinical safety analysis of a randomised, controlled, non-inferiority, single-blinded, screening accuracy study, The Lancet Oncology, Volume 24, Issue 8, 2023. pp.936-944.

This example shows how access to high-quality, well-structured data is an absolute necessity for the development and use of AI. But it also shows the necessity to consider the risks that the data used reflect historical and existing inequalities, known as *bias*, which in turn reflect human decisions. In other words, if the results of an AI are uncritically accepted, it can lead to the re-creation of these inequalities, often with a historical basis. However, it is unlikely to assume that data will ever not be coloured by bias. Moreover, data being coloured by bias may be a prerequisite for an AI to learn what bias is.

To put it simply, access to data - information - is necessary when it comes to the application of AI for two different reasons. Firstly, it concerns so-called training data, which is the type of data described at the beginning of this section. Secondly, it is production data, which is used when the AI model is in operation. It is possible to develop advanced AI models, but without access to production data, the models become almost useless. If you don't have access to X-ray images to use the cancer-trained algorithm on, you won't benefit from it either. This may seem trivial, but it can be a real challenge as there are often various legal restrictions on data sharing, not least in the health sector.

Interoperability

A key concept when it comes to using data to enable AI is interoperability. The term refers to the ability of different systems, often computer systems, to work together and exchange information with each other.[32] Interoperability can be described in terms of four different layers: *legal*, *organisational*, *semantic* and *technical*. The legal layer refers to the legal prerequisites sharing data, while the organisational layer refers to how the organisational prerequisites - such as governance and objectives - are designed. Semantic interoperability means that data are structured in such a way that they can be made available, for example that there are uniform standards. Finally, technical interoperability that the technical systems are designed so that data can actually be shared. There are thus several different conditions that need to be met for data to be shared effectively.

Sweden is well supplied with data

In an international comparison, Sweden has unusually good public data, data that is also unusually well organised. There are several reasons for this. Sweden has been relatively spared from war, which means that the archives that have been built up are relatively intact. In addition, both the state and the church have documented various tasks and works over the centuries. The expansion of welfare services and taxation, among other things, has led to a high level of ambition when it comes to collecting and categorising these various tasks and works. The registers built up by public actors in Sweden also contain various unique identifiers, such as personal identity numbers, which provide good linking opportunities.

Our prospects on the data side are therefore good. If we can utilise the asset that our public data represents, it will lead to major benefits for society and strengthened competitiveness. There is also great potential for value creation in the private sector through increased data sharing.[33]

Initiatives to increase access to data

The European Commission has declared the 2020s the Digital Decade, with the ambition to make the EU the most attractive, secure, dynamic and agile data-driven economy in the world. This has resulted, among other things, in the Data Management Regulation[34] and the Data Regulation[35]. The EU Open Data Directive[36] and its implementing rules are also already in force. These initiatives improve the conditions for data sharing in the EU internal market while making more data available for use.

Another important element of the EU's data strategy is the creation of common European data spaces. The idea is to create a variety of digital infrastructures, within which it will be possible to share data easily while maintaining security and privacy requirements. At the time of writing, the development of such data spaces is ongoing in 14 different sectors.[37] The most advanced is the European Health Data Space (EHDS).[38]

In Sweden, the government adopted a national data strategy in October 2021 with the aim of promoting various forms of open and controlled data sharing. The aim is to increase access to data for AI and other purposes. The strategy is based on the EU's data strategy and the OECD's recommendation on increased access to and sharing of data, which Sweden has signed.[39]

Recently, a number of government reports have also been presented with proposals aimed at improving interoperability. In December 2023, the *Committee on Interoperability in Data Sharing* presented its final report.[40] The committee proposes, among other things, a new policy goal: that the most urgent data sharing in public administration should be fully interoperable by 2030. This will be achieved, among other things, through a new law on public administration interoperability.

In May 2024, *the Committee on Health Data Infrastructure as a National Interest* submitted its final report.[41] The committee makes a number of proposals that collectively aim to increase the interoperability of health data. Among the proposals is an obligation for healthcare providers to make certain information about a patient available to other healthcare providers. This is achieved through coherent care

[32] See SOU 2023:96 En reform för datadelning. p. 38 and p. 61 ff. See also SOU 2007:47 Den osynliga infrastruktur - om förbättrad samordning av offentlig IT-standardisering p. 71.
[33] See, for example, the example of AstraZeneca in the chapter Innovation, entrepreneurship and venture capital.
[34] Regulation (EU) 2022/868 of the European Parliament and of the Council 30 May 2022 on European Data Governance and amending Regulation (EU) 2018/1724.
[35] Regulation (EU) 2023/2854 of the European Parliament and of the Council of 13 December 2023 on harmonised rules on fair access to and use of data amending Regulation (EU) 2017/2394 and Directive (EU) 2020/1828 (Data Regulation).
[36] Directive (EU) 2019/1024 of the European Parliament and of the Council of 20 June 2019 on open data and the re-use of public sector information. The Open Data Directive has given rise to the Public Sector Data Access Act (2022:818).
[37] These are health, agriculture, manufacturing, energy, mobility, financial sector, public administration, skills, cultural heritage, research and innovation, the Green Deal, languages, media and tourism. See Annex I of the Commission Staff Working Document on Common European Data Spaces (SWD(2024) 21 final) published in January 2024.
[38] The European Health Data Space (EHDS) Regulation was adopted in March 2024 by the European Council. The regulation is planned to be adopted by the European Parliament later in 2024. The government has started work to create the conditions for effective implementation of the regulation. The EHDS will improve the possibilities to share health data digitally, which in turn is a prerequisite for the full utilisation of AI in healthcare.
[39] The European Commission's EU Data Strategy was published in February 2020. The OECD Recommendation of the Council on Enhancing Access to and Sharing of Data was adopted in 2021.
[40] SOU 2023:96 A reform for data sharing.
[41] SOU 2024:33 Shared health data - double benefit Rules for increased interoperability in health care.

and care documentation and by giving the Swedish eHealth Agency responsibility for developing interoperability solutions for the health sector.

In conclusion, it is clear that there is a political will to facilitate the sharing and use of data. However, despite the initiatives taken, there are still significant difficulties, both legal and more technical, for society as a whole to fully benefit from the strategic resource that our data represents. This reflects, among other things, that the current regulatory framework is not fully adapted to today's challenges and opportunities. All regulatory design requires that decision-makers

The regulator weighs up the different interests, pros and cons, to find a reasonable balance. The value of regulation must always be weighed against the value of not having regulation, or having less regulation. There is reason to strike a partly new balance here.

Before the use of AI took off, the significant benefits that would be possible today through a more sharing-friendly regulation. The cost of having a strict regulatory framework, in terms of blocked opportunities, was simply much lower in the past. It is the AI Commission's view that this has led to a need to rebalance the regulation affecting data sharing opportunities in general in order to make data more accessible.

Below we review various areas with a bearing on data sharing where we believe action is necessary. In addition to the proposals made in this chapter, the AI Commission supports the proposals made in the aforementioned *Committee on Interoperability in Data Sharing* and the *Committee on Health Data Infrastructure as a National Interest*.

Transparency and secrecy

The Public Access to Information and Secrecy Act (OSL) applies to public authorities and some private organisations. The Act specifies the circumstances in which a particular piece of information is covered by secrecy or is public. Secrecy may exist to protect various interests, both individual and public. For example, it may concern the protection of the personal integrity of a patient in health care or secrecy to protect Sweden's security.[42]

The main rule in the OSL is that information is subject to secrecy may not be disclosed to individuals or to other authorities. This principle applies not only between authorities, but also between different branches of activity within an authority when they are to be regarded as independent of each other.

Information that is subject to secrecy may only be exchanged if this is specifically stated in the OSL or other statute.

The current provisions of the OSL, on secrecy between and within authorities, make the exchange of data difficult. This has also been the intention, as the purpose of the rules is to protect the personal integrity of individuals and prevent abuse of access to information.

At the same time, the legislator has recognised that there are a large number of cases where it is justified for authorities to share information with each other. There are therefore a number of exceptions to the principle of secrecy, through various disclosure obligations and secrecy-breaking provisions. These have become so numerous and convoluted that they have created a complex and difficult-to-interpret body of legislation, with a patchwork of rules. In addition, the secrecy provisions often recognise that certain data may be shared on a case-by-case basis, i.e. in a case. However, many of the opportunities offered by AI rely on access to large amounts of data, including for analysis. That is, the routine exchange of large amounts of data and that the exchange does not only take place for individual cases but at a more comprehensive level and with a focus on phenomena.

To enable the kind of data sharing that many AI applications require, we believe that a paradigm shift in public access and privacy legislation is necessary. The starting point should be transparency between authorities instead of secrecy when it comes to protecting individuals' personal and economic circumstances. Secrecy remains appropriate in some cases, but it should be the exception, not the rule.

In September 2024, the *Committee on improved possibilities for information exchange between authorities* presented its proposal for a new general secrecy-breaking provision.[43] The Committee's proposal means that authorities should be given the opportunity, under certain conditions, to share confidential information with each other. This is provided that it is necessary for another authority to be able to prevent, detect or investigate fraud or regulatory offences, or to be able to handle cases in statutory activities. However, the proposed rule has a number of exceptions. Among other things, it does not cover information protected by healthcare confidentiality. In its report, the committee states that the proposed provision may enable authorities to develop and use AI models in their business to a greater extent than is possible today.[44]

[42] Anyone who unlawfully shares confidential information may be held liable for breach of professional secrecy (Chapter 20, Section 3 of the Criminal Code).
[43] SOU 2024:63 Increased information exchange between authorities - Needs and proposed changes.
[44] See in particular p. 443 et seq. of the report.

The Committee also concluded that the best thing would be to reverse the starting point in the OSL, and as a general rule allow information about individuals to be exchanged between authorities. However, the committee was not able to make such proposals within the framework of its mandate.[45]

Proposals

- The AI Commission therefore proposes that the government should investigate the possibility of changing the logic of the OSL provisions, so that the main rule is that there is no confidentiality for the protection of the individual between authorities and between independent branches of activity within an authority. The government should also clarify what kind of secrecy to protect individuals should remain.

- The AI Commission proposes that the government should consider whether the general secrecy-breaking provision proposed in SOU 2024:63 should be extended to include information protected by healthcare confidentiality. For example, it should be possible to break such secrecy if it is needed to improve the healthcare system's ability to make diagnoses.

Protection of privacy and possibilities to use data

The protection of privacy is fundamental and is enshrined in both the ECHR, EU Charter of Fundamental Rights, as well as the Instrument of Government. The EU's General Data Protection Regulation (GDPR) is also central to the protection of personal integrity.[46] The Regulation, which applies to both public and private activities, contains a number of basic provisions on how data containing personal data may be processed and shared.[47] When it comes to the processing of personal data by public authorities for the purpose of preventing, detecting or investigating criminal offences or executing criminal penalties, the EU Data Protection Directive applies instead, which has been implemented in Swedish law through the Crime Data Act (2018:1177).

The GDPR is complemented in several public activities by data protection regulations. There is a large number of such regulations. These regulations mainly concern the processing personal data by public authorities and are complementary to the general regulation and exist both in the form of law and regulation. The purpose of the register regulations is to adapt the regulation to the specific needs of the authorities in their respective activities, and to strike a balance between the need for efficiency in the activities and the need to protect the privacy of the individual.[48]

However, recent societal developments have led to the obsolescence of many data protection regulations. The AI Commission is therefore of the opinion that the register statutes should be modernised in order to make it easier for authorities to process personal data in their activities.

At present, it is not fully possible for the authorities to fulfil their constitutional tasks effectively. This is due to the fact that specific purpose clauses and detailed enumerations of the personal data that may be processed constitute a major obstacle. Given the current structure of regulatory statutes, where a large part of the provisions of the statutes are contained in law, parliamentary authorisation is sometimes required when new data needs to be processed in the authorities' activities. This makes it cumbersome to change the regulations. While some statutory provisions are required, there is a need for greater flexibility in regulation, as new needs can arise quickly, and more provisions should be suitable for regulation through ordinances.[49] Greater use of regulations for the register statutes will facilitate amendments where necessary.

For several authorities and activities, the register statutes have begun to be reviewed and there are proposals, or already implemented changes, that entail more or less modern and appropriate regulation. One example is the proposal for new register statutes for the Swedish Tax Agency, Swedish Customs and the Swedish Enforcement Authority (SOU 2023:100). However, we believe that similar changes, based on the proposals made, are needed for all Swedish authorities. This would be a first step towards giving the authorities better opportunities to utilise the potential of increased AI use. There are also advantages in using similar wording in different register statutes.

This first step can be implemented relatively quickly, but it is not enough to facilitate the use of AI in public activities. In a longer perspective, it is justified to change the Swedish data protection regulation at its core. We believe that the processing of personal data

[45] See page 17 of the report.
[46] A more detailed review of these regulations can be found in SOU 2023:100 Framtidens dataskydd vid Skatteverket, Tullverket och Kronofogden. p. 244 ff.
[47] Article 4(1) GDPR defines personal data as any information relating to an identified or identifiable natural person. In Chapter 2. 7 of the Freedom of the Press Act defines personal data as any information that can be directly or indirectly attributed to a natural person. Examples of personal data are name, personal identity number, home address and IP address.
[48] See Prop. 2015/16:65, Aliens Data Act, p. 21.
[49] Since the Instrument of Government contains a protection of personal integrity (Chapter 2, Section 6), it is required in certain cases that a restriction of it may only be effected by law and fulfil other requirements set out in Chapter 2, Sections 20 and 21 of the Instrument of Government.

There are also grounds for a review in relation to the GDPR. The regulation came into force in 2018, meaning that over six years have passed since then. Photo: Shutterstock

by public authorities should be regulated in a single law instead of separate register regulations, which have led to fragmented legislation and non-uniform application. With a single regulation, application could be more uniform.

There are also grounds for a review in relation to the GDPR. The regulation came into force in 2018, meaning that over six years have passed since then. Photo: Shutterstock

Proposal

- The AI Commission proposes that work on modernising existing data protection legislation should continue. At the same time, the Commission believes that the government should investigate how a framework law for personal data processing could be designed to replace the separate data protection laws.

There are also grounds for a review in relation to the GDPR. The regulation came into force in 2018, which means that over six years have passed since then. Since the GDPR is an EU legal framework, the review should cover the Swedish statutes that supplement the GDPR in the light of both Swedish and European legal practice, as well as national statutes in other Member States. The fact that the GDPR is applied differently in the EU's 27 Member States has been identified in the aforementioned Draghi report as an obstacle to AI development. The report recommends, among other things, that the rules should be simplified and that resources should be devoted ensuring that they are applied in a harmonised manner throughout the Union.[50] One message that has reached the AI Commission in a large number of meetings with various stakeholders is that the Swedish interpretation of the GDPR would be more restrictive than that of other EU countries.

Against this background, the AI Commission believes that a review should include an analysis of the practice of Swedish courts and administrative authorities in order to see whether, and if so how, Swedish courts and authorities interpret the Regulation in a more restrictive way than other Member States do. The review should also investigate whether it is possible to make it less complicated to share and use data containing personal data by amending Swedish national regulations. At the same time, it is important to ensure continued robust protection of personal integrity. A reasonable balance between the need to make data available and the protection of privacy is therefore necessary.

[50] The future of European competitiveness, Part B In-depth analysis and recommendations (September 2024), p. 79.

Proposal

- The AI Commission believes that the government should set up an inquiry to conduct a review of the implementation and application of the GDPR in Sweden.

Invest in research on privacy-enhancing technologies
The AI Commission believes that Sweden should take a leading role in *privacy enhancing technologies* (PET). PET is crucial to reconcile innovation and privacy. These technologies reduce the risk of personal data being exposed. One example is *differential privacy*, which de-identifies individuals' data in large datasets. Another interesting area of research is *synthetic data*, where artificially created data is used instead of real personal data. This minimises the risk of privacy breaches. In addition, technologies such as *federated machine learning*, where machines are trained on local devices without the need to transfer raw data, are of great interest. By supporting research in these areas, Sweden can not only strengthen its competitiveness in privacy-friendly AI, but also contribute to a safer digital environment in the EU and globally.

Proposal

- In the chapter *AI and societal security*, the AI Commission proposes an increase in funding for Cybercampus Sweden for research on AI and cybersecurity. Our assessment is that research on PET technologies should be included in this proposal.

Legislation to become more digitisation-friendly

As we mentioned earlier, a significant part of current legislation was drafted long before it became known how widely AI could be used in society.

This means that the current regulatory framework is often not designed in an appropriate way, taking into account how modern technology has made it possible to use data and thus create societal benefits in a different way than was previously possible. Against this background, it is important to design laws and other regulations in a digitalisation-friendly way. In this regard, the OECD, among others, has pointed to the need to embed digitalisation early in the process of designing new rules. This approach is called *digital by design*.[51]

The Swedish Agency for Digital Government (Digg) has compiled recommendations on how this can be done. For example, those drafting a regulation should consider from the outset how it should be designed enable data to be shared in the area.[52]

- The AI Commission proposes that an authority, committee or special investigator proposing new regulation should assess whether the proposal is designed in a digitalisation-friendly way.

The requirement shall be set out in the Ordinance (2024:183) on Impact Assessments.

Better governance and accessibility of public data (Data Governance and Data Steward)

We have previously noted that data needs to be of good quality in order to be used. This means, among other things, that data needs to be structured in a uniform way in accordance with established standards in each area. For a long time, there have been requirements for public administration to have good information management.[53] However, these requirements have been based on a document-centred view of information management, which has often led to data being locked up in documents or systems. In the process of digitising public administration, the legislator has also not done enough to ensure that information can be easily exchanged in digital form.

In order to further develop and clarify what is meant by good information management in the public sector, known as *data governance*, the AI Commission believes that a clear requirement should be introduced for all public actors. The requirement should be to maintain modern digital information management that enables interoperable data sharing in a secure and privacy-protective manner. This means that public sector actors must ensure that the data for which they are responsible and which exists within their respective organisations is well structured. This also means that data should be structured in a way that allows it to be processed independently of the technical infrastructure and to be shared in a secure, trust-based and interoperable way in accordance with applicable standards and norms.[54] For governmental authorities such a requirement be set out in the Government Agencies Ordinance (2007:515) and, for regions and municipalities, in the Local Government Act (2017:725). An alternative to this proposal could be to introduce a data management act covering activities at central, regional and municipal level.

In order to clarify standards for data management in different sectors, the government should consider

[51] The OECD Digital Government Policy Framework: Six dimensions of a Digital Government", OECD Public Governance Policy Papers, No. 2. 2020.
[52] The recommendations are available at https://www.digg.se/kunskap-och-stod/utforma-regelverk-digitaliseringsvanligt/diggs-rekommendationer-for-att-utforma-digitisation-usual-regulations.
[53] For example, public bodies are obliged to keep a register of public documents received and created (Chapter 5, Section 1 of the OSL).
[54] In this context, it is worth mentioning the National Basic Data Framework developed by Digg.

commissioning authorities to develop such standards.[55] Here, the respective areas of responsibility of the authorities, and the division of responsibilities set out in the annex to the Ordinance (2001:100) on Official Statistics, can provide guidance as to which authorities should be given this type of task. In addition, it may be appropriate to assign a *data steward* role to an authority to support other actors in achieving good data management and facilitating data sharing in the public sector. Expert knowledge on both data governance and data management issues is available at Statistics Sweden (SCB).[56]

As part of good data management, public actors should establish a data plan. Such a data plan should set out what data the actor holds and how the data is managed, including how it enables data sharing. The data plan should also indicate how the public sector body intends to evaluate the need for data in order to fulfil its mission in the best possible way. By establishing and continuously updating their data plan, public actors will need to regularly consider whether they are managing data appropriately and what data they should have access to given their mission.

We also believe that there are strong reasons it needs to be easier for private actors to gain knowledge of where relevant data is available. By establishing a Data Steward function, the AI Commission believes that it should be possible for an individual to turn to this function for advice on where specific public data is available. In addition to the above, it can be difficult, especially for researchers and smaller companies, to access public data due to high fees.

Proposals

- The AI Commission proposes that a requirement for modern data management for public actors should be set out in legislation, including a requirement to establish a data plan.
- The AI Commission suggests that the government consider tasking one or more authorities to develop sector-specific standards for modern data management.
- The AI Commission proposes that the government consider giving Statistics Sweden a coordinating task to promote modern data management in the public sector.
- The AI Commission proposes that the Government instruct Statistics Sweden to establish a Data Steward function as described in this section. We believe that Statistics Sweden should receive an increased annual allocation of SEK 4 million for this task.
- The AI Commission proposes that the government commissions Statistics Sweden to review fee models for access to public data. The aim is to make data more accessible, especially for researchers and small businesses.

Requirement to include data access and interoperability in impact assessments

As described in this chapter, access to data has become an increasingly important factor, not only for AI development, but for digitalisation in general. The AI Commission therefore proposes an addition to the Ordinance on Impact Assessments (2024:183), making it mandatory to investigate access to data (data impact assessments). When a government inquiry prepares a legislative proposal or when an administrative authority decides on regulations or general advice, such a study must therefore be prepared as part of the impact assessment.

A data impact assessment must, among other things, describe the types of data available in the area in question and the data necessary to measure the results of the proposal presented. A data impact assessment must also consist of an interoperability analysis that addresses the technical and legal possibilities of making the data in question available. Through such an addition, the AI Commission believes that the issue of access to data can be raised and become a natural part of the process of developing new laws, ordinances and regulations.

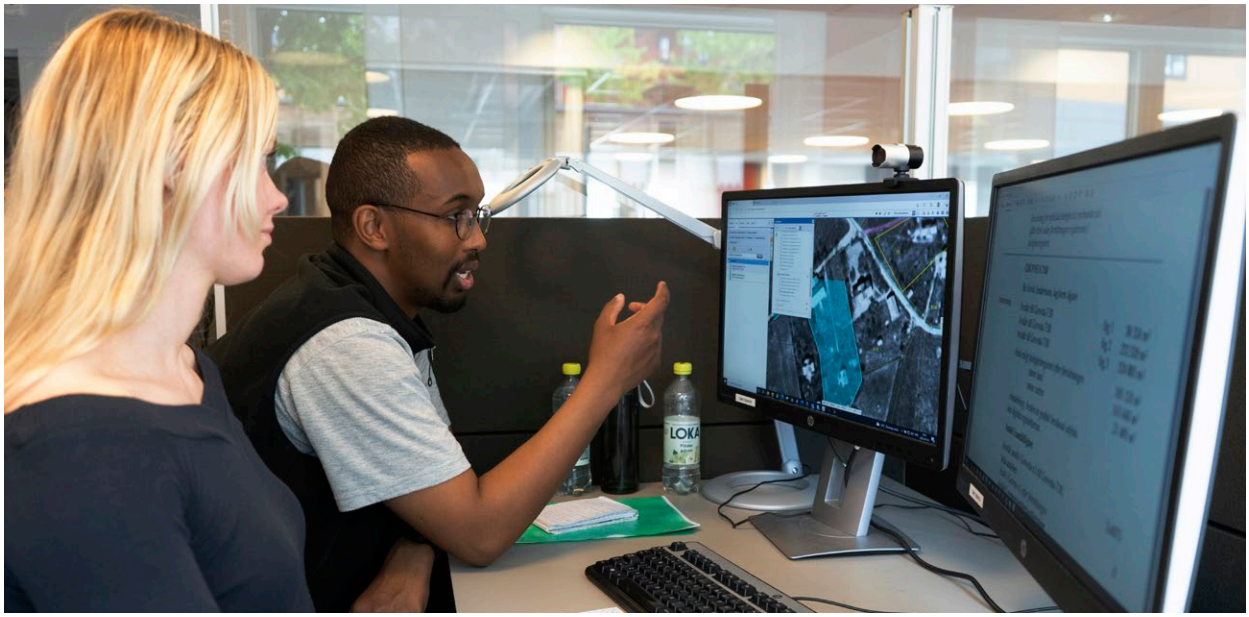
Proposal

- The AI Commission proposes that the Ordinance on Impact Assessments (2024:183) be amended so that a data impact assessment shall be mandatory when a government commission prepares a legislative amendment or when an administrative authority decides on regulations or general advice.

Clarify the possibilities for public actors to use cloud services

A particular issue in the use of AI concerns the availability of cloud services. For many businesses and public authorities, access to this service is a prerequisite for the success of their digitalisation and use of AI. Access to cloud services makes it possible to use AI tools, which are not possible to use without transferring data to the cloud. There are also other benefits

[55] As an example, the Swedish National Archives is working to develop common administrative specifications (FGSs) that establish common exchange formats. The FGSs are very useful, for example, when setting requirements for e-archives.
[56] As mentioned above, the Swedish Data Portal, provided by Digg, is an important hub for issues related to data management standards.



When a public sector organisation uses a cloud service, it may be necessary to disclose confidential information to the cloud service provider. Photo: Lantmäteriet, Natasja Kamenjasevic.

of using cloud-based solutions, such as shortening the lead times for developing new AI services, but also improving business continuity and preparedness.

However, for public actors, there are a variety of legal difficulties, and sometimes obstacles, to the use of this type of service. As cloud services are often provided by an actor outside Sweden, and even outside the EU, the GDPR may constitute an obstacle to using the service. Against this background, it has recently been suggested in the aforementioned Draghi report that the EU should make it easier for European operators to use cloud services in, for example, the United States, the country that dominates the market.[57]

The use of a cloud service by a public actor may require the disclosure of confidential information to the cloud service provider. If a piece of information is subject to confidentiality, its disclosure is not authorised unless a confidentiality-breaking is applicable. Since 2023, the OSL (Chapter 10, Section 2a) has contained a secrecy-breaking provision for mere technical processing or storage, if it is not inappropriate in the circumstances for the information to be disclosed. However, it is unclear whether this provision will allow public actors to transfer classified information to a cloud service when needed. This is because a cloud service may involve more than technical processing or storage, such as various types of analyses using AI.

However, for public actors, the use of cloud services is not only a question of legality, but also of appropriateness. Should Swedish authorities hand over control of data that we refer to as socially responsible to private companies or other countries? In addition, there are various security-related aspects. Examples include increased general vulnerability, increased risks of unauthorised access to data, and difficulties in vetting staff and establishing accurate risk and vulnerability analyses. The AI Commission considers this uncertainty to be unfortunate.[58]

- We propose that the application of the provision in Chapter 10, Section 2a of the OSL should be broadened and that it should clarify the circumstances under which public sector organisations can and should use cloud computing in their operations.[59]

[57] The future of European competitiveness, Part B In-depth analysis and recommendations (September 2024), p. 77 ff.
[58] See also a discussion in the chapter *AI and societal security*.
[59] The chapter *AI for a public sector at the forefront* also proposes a common digital core infrastructure (AI Workshop), which is also proposed to include cloud solutions.

Photo: R Photography/Shutterstock

Precision medicine can save lives[60]

Today, it is possible to analyse a patient's genes and thus diagnose and tailor treatment based on the genetic characteristics of the individual patient. This type of diagnosis and treatment is known as precision medicine. It is difficult to say what data is and will be relevant for precision medicine in the future. Today, it is common practice to analyse a patient's genes with the help of AI, for example, which requires AI to be trained on data from a large number of patients.

Current regulations, such as the Patient Data Act (2008:355), abbreviated PDL, which governs healthcare, were created at a time when precision medicine did not exist and are therefore not adapted to current conditions. According to the PDL, it is currently not expressly permitted to access a patient's personal data for the purpose of treating another patient. The legal support for healthcare professionals to process of personal data for health care purposes in an individual case is based on the assumption that the staff is involved in the care of the patient whose data is being processed. The implementation of precision medicine in Sweden would be facilitated by allowing healthcare professionals to access the personal data of patients other than those in whose care they are involved.

If personal data is to be shared between healthcare providers, for example between two regions, there are also confidentiality limits to be taken into account. Thus, the legal prerequisites for full-scale implementation of precision medicine in Sweden do not currently exist.

Precision medicine is, however, already used to some extent today. For example, it is possible to identify genes and other biological markers that the individual patient has. Such a process can provide a basic understanding of the patient's conditions and can be crucial to initiate a targeted treatment. The presence of this type of detailed mapping of different diseases, and the more personalised treatments that mapping allows, is increasing. However, there is no legal basis for healthcare professionals to compare this data between different patients.

This example clearly illustrates the need, in some cases, to find a new balance between the protection interest for the individual's personal integrity and the benefits of being able to share data within public organisations. It is a benefit with the potential to benefit both the individual and society. In the case of healthcare, it is clear in many cases that making data more accessible can save lives.

[60] The example is largely taken from SOU 2023:76 Re-use of health data for healthcare and clinical research. p. 352 f. In that report, there is an in-depth discussion the legal challenges of re-using health data.

AI and societal security

ChatGPT summarises:

AI's advances open up enormous opportunities for strengthening societal security, but they also bring new risks.

This chapter explores how AI can be used both as a powerful tool to protect our society and as a potential risk factor that can be exploited by malicious actors. With the right application, AI can help prevent crime, fight cyberattacks and strengthen our defences. At the same time, it increases our vulnerability to cyberattacks, disinformation and autonomous weapons, which requires proactive measures and robust security systems. Here is how Sweden can address these challenges by developing AI technologies in a way that strengthens societal resilience and security.

External threats – The security policy situation

Sweden and Europe are in the most serious security situation in many decades – probably since the end of the Second World War. Russia's invasion of Ukraine in 2022 and the sharp deterioration of the situation in the Middle East over the past year and a half are two major contributing factors. The current serious security situation is expected to persist, or worsen, for the foreseeable future.[61] The Swedish Defence Committee recently noted that the digitalisation of our society has made the cyber domain an arena for threats and attacks, for example against companies and financial systems that have functions critical to society.[62]Society's response needs to be both to counter these threats and to use AI itself to make society safer. For the authorities tasked with safeguarding Sweden's security, AI is already an important tool.

New technologies create new dependencies - on security of supply and digital sovereignty

The deteriorating security situation is a factor that has important implications for the new dependencies emerging in the development of AI. As mentioned in the chapters *Access to international AI resources* and *Computing power*, access to computing power in the form of specialised computers is required to take advantage of the opportunities offered by the latest technological developments. Computing power in the world today is mainly located in the US and China and in a few European countries. The manufacture of these computers is in turn dependent on the availability of semiconductors and rare earth elements that are only available in certain locations. We also see how firstly the US, and secondly China, dominate the global - and to a large extent also the European - tech market. For example, the ten largest online platforms in Europe are owned by US (six) or Chinese (four) companies. Moreover, three US players currently control two-thirds of the European cloud computing market, while European companies account for only two per cent.[63]

As Sweden's AI capabilities become increasingly important for our security, new dependencies are emerging. Access to computing power, as well as the technology, knowledge and raw materials necessary to build such infrastructure, is key. A situation where significant parts of the global computing power are under the control of states that are hostile to Sweden would be clearly negative for our security. The extent to which Sweden, alone or together with others, has access to or the possibility of building such capabilities is therefore of importance for Sweden's security policy situation.

These issues need to be integrated into the work establishing good security of supply in Sweden. Ensuring that our AI capability can be maintained even in troubled times is as important as industry continuing to be supplied with inputs or telecoms and data networks continuing to function. Unfortunately, the experience of the coronavirus pandemic shows that in times of need, solidarity between allied countries and within the EU risks breaking down. At the time, it was about things like vaccines and personal protective equipment, but in the future it could just as easily be about computing power or IT equipment.

[61] See, inter alia, National Security Strategy, Skr. 2023/24:163, p. 9 f.
[62] Security Policy Report of the Swedish Defence Committee 2023 (Allvarstid Ds 2023:19), p. 36.
[63] See The future of European competitiveness Part B | In-depth analysis and recommendations. p. 77 ff.

Admittedly, it is in practice impossible for a country the size of Sweden to be independent of others in this area - international cooperation, particularly within the EU, is in many respects an immediate necessity. Even so, we must take this perspective into account in contingency planning.

Access to computing power, electricity supply and electronic communications to maintain Sweden's AI capability is also an aspect of the broader issue of *digital sovereignty*. Since the late 2010s, the extent to which it is compatible with Swedish and European legislation to use foreign, usually American, cloud services in certain activities has been a live issue. This is particularly true when it comes to classified information or sensitive personal data.[64] Quite separately from what is

permitted, it is also highly relevant to ask what is *appropriate*. For example, it is necessary to consider to what extent important societal functions should depend on digital infrastructure located abroad, and on functioning connections with those countries.[65]

It is of key importance for Sweden to maintain adequate security protection in order to prevent unauthorised persons from gaining access to strategically important digital infrastructure. It is equally important to prevent sensitive Swedish technology from falling into the wrong hands. A discussion is currently underway in the EU on issues relating to economic security, where AI is one of the emerging technologies identified as particularly important to consider.[66] The research conducted in Sweden is in many cases sought after, not least by foreign powers, which in some cases engage in research espionage or unauthorised technology acquisition.[67]

One way of preventing foreign actors from gaining access to technology that is of key importance to Sweden's security is the new Foreign Direct Investment Review Act adopted by parliament in 2023.[68] The Act, which in turn is based on regulation at EU level, authorises the government to further define the technologies to be covered by the law. One such technology is AI algorithms, which use or generate data containing sensitive personal or location data.[69] This means that an investment in, for example, a company that develops AI algorithms must be notified to the Inspectorate for Strategic Products (ISP). ISP has the possibility to prohibit a foreign direct investment, for example if it is necessary to prevent harmful effects on Sweden's security. While this legislation is a welcome addition to the security protection toolbox, it is important that the audits are not designed in a way that unnecessarily discourages investors who might otherwise provide welcome capital injections to Swedish AI companies.

Proposal

- The AI Commission believes that those responsible for an essential service must take into account the impact on Sweden's digital sovereignty when deciding on the use of AI in the service.[70]

The direct external threats from AI use

Today, hostile state actors threaten Swedish security interests through cyberattacks, sabotage attempts, undue influence and unauthorised intelligence gathering.[71] These actors are already using AI, and this is expected to increase as the technology develops and the ability to use it in both old and new ways increases. One of the most obvious uses of AI for an actor who wants to harm or destabilise Sweden is disinformation. Disinformation is not a new phenomenon, but it is now possible to publish large amounts of individualised information much faster than before.

AI makes it possible to create large amounts of text, sound and moving images quickly, easily and with little effort as part of disinformation and advocacy campaigns. AI can also be used to effectively disseminate materials and messages on social media, for example. The dissemination of false or misleading information can be done with the aim of damaging trust in the media and social institutions, which in turn can lead to a weakening of the democratic state and the will to defend it (the will to defend).[72] This issue is particularly relevant in connection with general elections. There is a concern that AI tools will be used to manipulate the outcome of elections by spreading disinformation or misinformation. The latter term refers to false or misleading information that is spread without malicious intent due to ignorance or lack of source criticism. Beyond the type of threats we mention above, there are also risks in the future of military applications of AI.

[64] This issue has been the subject of inter-agency cooperation within the framework of eSam, see https://www.esamverka.se/vad-vi-gor/molnfragan.html. See also the chapter *Data as a prerequisite for AI development*.
[65] See also a discussion in the chapter *Data as a prerequisite for AI development*.
[66] See https://ec.europa.eu/commission/presscorner/detail/sv/IP_24_363.
[67] See the Security Service Annual Report 2023/2024. p. 32 ff.
[68] The Foreign Direct Investment Review Act (2023:560) entered force on 1 December 2023.
[69] See Annex 2 to the Ordinance (2023:624) on the review of foreign direct investment.
[70] This is also a contributing factor to the proposals made in the chapter *AI for a public sector at the forefront* for a joint public AI Workshop.
[71] National Security Strategy, Skr. 2023/24:163, p. 4 f.
[72] See, for example, the report of the Swedish Defence Committee (Ds 2023:34), p. 240.

This is particularly true of the possibility of using AI to develop autonomous weapons, which can act offensively without human control. The risks of systems with the capacity to kill without human decision-making are obvious, and it is problematic that clear international legal regulation of such weapons is still lacking. Both the UN and the International Committee of the Red Cross have called for urgent action to address the many difficult issues surrounding autonomous weapons.[73],[74]

Even non-military uses of AI expose us to new threats from hostile actors. For example, AI systems may be vulnerable to manipulation or attack, meaning that imperceptible changes in the data could cause the AI to make the wrong decision. This can be particularly serious in safety-critical systems, such as autonomous vehicles or military applications. There are also risks that AI-powered security systems may react too quickly or inappropriately to perceived threats, leading to the escalation of conflicts without human intervention or understanding.

Internal threats - crime and extremism challenge the open society

The security situation within the country has also deteriorated in recent years. As a result of organised crime, there has been a sharp increase in the number of explosions and deadly firearms violence. It has also become much more common for innocent bystanders to be targeted. Violent extremism has led to an increased risk of terrorist attacks and threats to the institutions of open society.[75] Furthermore, the criminal economy is extensive - the Police Authority estimates it to be worth around SEK 100-150 billion annually.[76] It causes direct harm to both the public and individuals, through both welfare crime and fraud. Criminals use AI tools to enhance their capabilities. Crime schemes, such as welfare offences and fraud, are facilitated, for example, when AI makes it easier to mislead authorities and individuals. AI can also be used to help make many forms of financial crime more difficult to detect.

As far as terrorism is concerned, the Security Service assesses that the threat of attack against Sweden comes primarily from lone wolf extremists, rather than resourceful organisations or state actors.[77] Here is another example of threats linked to technological development: with AI support, such a lone wolf actor can receive significant help in planning and preparing an attack.

AI strengthens Sweden's security and defence

AI is currently being used to strengthen Sweden's security and defence capabilities. Through AI solutions for data analysis, decision support and intelligence, it is possible to analyse large amounts of data in a very short time. This can be used for logistics planning, vulnerability analysis or combat, among others. Other defence and security applications include event and image recognition, for example to detect hostile movements or distinguish enemies from friendly forces. AI can also be used to realistically and dynamically simulate situations and enemies in games and exercises. The availability of, and ability to apply, AI technology is thus of importance for military power relations.[78]

AI also offers effective opportunities to combat and prevent crime. Not least, completely new opportunities for knowledge development are created when data from the judicial system can be combined with data from, for example, the Swedish Social Insurance Agency, the Swedish Tax Agency and social services. Such data can be used by law enforcement agencies, among others, for analysis with the help of AI in a way that has not previously been possible.[79] This can lead to new insights not only into how crimes can be detected and prosecuted, but also prevented and avoided. The possibilities for biometric identification[80] can also be expected to increase as AI technology develops, increased possibilities to identify both offenders and victims.[81] AI can also contribute positively to criminal investigations through digital forensics, which is an emerging field that is becoming increasingly important for effective law enforcement. Finally, it is worth mentioning that AI can also be used to quickly identify and address disinformation.

The role of AI in defence against cyberattacks

The benefits of AI in cybersecurity are significant. With the help of AI technology, protection can be strengthened against both antagonistic cyberattacks and accidental IT incidents. By analysing patterns in large amounts of data, AI can identify potential threats that are difficult for humans to detect, and alert cybersecurity professionals. AI is also being used to automate

[73] See United Nations General Assembly Resolution A/RES/78/241 on lethal autonomous weapons systems.
[74] See, for example, the Joint Statement of 5 October 2023 by the UN Secretary-General and the President of the International Committee of the Red Cross on the need to establish new prohibitions and restrictions on autonomous weapons systems.
[75] See, for example, National Security Strategy, Skr.2023/24:163, p. 4, Security Police Annual Report 2023/2024, p. 9 et seq. and Resilience and Action - a national strategy against organised crime, Skr. 2023/24:67, s. 3.
[76] See https://polisen.se/om-polisen/polisens-arbete/kriminell-ekonomi/.
[77] See the Security Service Annual Report 2023/2024, p. 9.
[78] See National Security Strategy, Skr. 2023/24:163. p. 10 f.
[79] See also the chapter *Data as a prerequisite for AI development* regarding the possibilities of sharing data between different actors.
[80] Biometric identification refers to the identification of a person through their physical or physiological characteristics, such as their face, fingerprints or retina.
[81] The ministry memorandum Improved possibilities for the police to use camera surveillance (Ds 2024:11) proposes that the Swedish Police Authority and the Swedish Security Service in certain cases should be authorised to use real-time biometric remote identification systems in public places for law enforcement purposes.

routine security tasks, thereby freeing up staff time for more complex tasks that technical systems cannot handle as well. This is particularly important as there is a shortage of expertise in both IT and cybersecurity. By increasing the speed and accuracy of threat detection and response, AI can also reduce the impact of cyberattacks[82] .

At the same time, these possibilities to prosecute crime of various kinds also raise legitimate questions about personal integrity and the right to privacy. Uncritical and broad use of AI of the kind described above should not be allowed in a constitutional state and liberal democracy of the kind we want Sweden to be. Nor will be, given the AI Regulation's ban on the use of AI systems with unacceptable risk, as well as the strict regulation of those with high risk. This is important for people's long-term trust in both AI technology itself and the public organisations that use it.[83]

Strengthening research on AI and cybersecurity

In the light of the above, there are reasons to invest in research on AI and cybersecurity. As is often the case with AI development, it is necessary to establish collaborations between the private, public and academic sectors. A good place for such research is Cybercampus Sweden, which was inaugurated in February 2024 and is located at the Royal Institute of Technology (KTH). Cybercampus is a Swedish national initiative where universities and colleges as well as the private and public sectors collaborate on research, innovation and education in cyber security and cyber defence. KTH is also home to the Centre for Cyber Defence and Information Security (CDIS), which focuses on research aimed strengthening Sweden's defence capability. Sweden's cyber soldiers are also trained at CDIS. CDIS was founded in 2020 as a collaboration between KTH and the Swedish Armed Forces. Today, the Swedish Defence Research Agency (FOI), the Swedish Civil Contingencies Agency (MSB), the Swedish Defence Radio Establishment (FRA) and the National Defence College also participate in its activities. There are also plans to integrate CDIS into Cybercampus Sweden.

In terms of specific areas for research, the AI Commission considers that more research on *how* AI can be used to strengthen cybersecurity is of great interest. This could include code reviews and other methods to detect software vulnerabilities or automated penetration testing and ethical hacking. AI can also help us confirm the security of larger systems in a better way than previously possible. In addition, it can strengthen our understanding of automated incident response, i.e. how we can train AI to defend computer networks against attacks. Large language models can, for example, be used to develop attack code and to exploit vulnerabilities in systems. It is therefore justified that we learn more about how a potential attacker can use the latest technology in order to adapt the cyber security of important systems. In this work, it is natural to establish and build on existing cooperation within the Nordic region, the EU and NATO.

Proposal

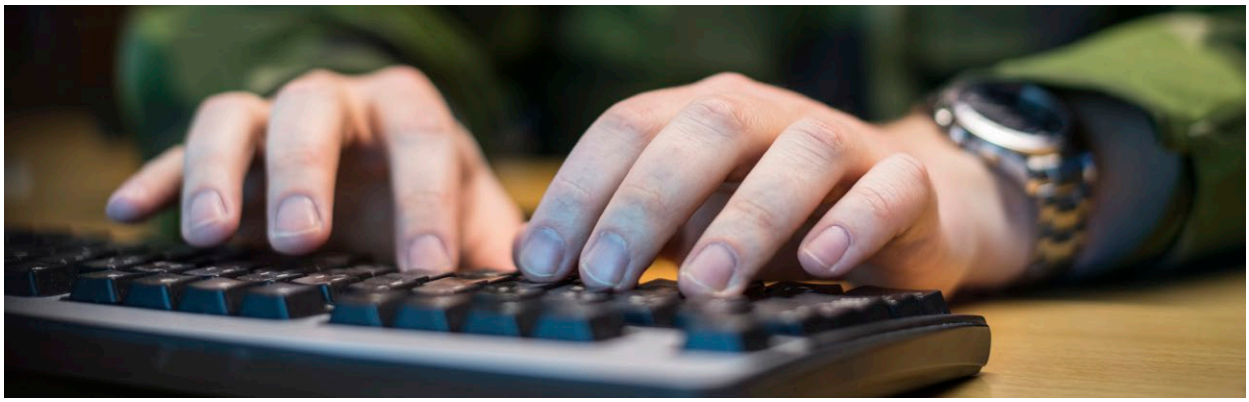
- The AI Commission believes that there is reason further strengthen research on AI and cybersecurity under one principal, KTH through Cybercampus Sweden. In order to strengthen research in AI and security, the AI Commission proposes that SEK 50 million be allocated annually to strengthen and develop the research currently being conducted. By allocating these funds, conditions are created to apply for additional funding from the EU, as well as from the private sector and other research funders. We consider such a grant to be sufficient to establish a dedicated AI and security research department composed of both senior and junior researchers.

Non-antagonistic threats accidents will happen

The threats we have discussed so far are all *antagonistic*. That is, threats that are based on a malicious actor deliberately directing an attack against Swedish society or Swedish interests. There are also *non-antagonistic threats,* i.e. threats that do not arise intentionally. These include pandemics, accidents and climate change, all of which pose serious challenges. A landslide can destroy a major motorway and a data centre can burn down. It also includes operational errors, lack of expertise and poor practices. Seven out of ten IT incidents reported to MSB in 2023 were due to reasons other than attacks, such as mistakes or system failures.[84] We therefore need to work actively to prevent preventable events. We also need to ensure preparedness for the serious threats that can never be completely eliminated, and the ability to manage the consequences they may bring.

In this area too, AI can be used to strengthen society in many ways. It can help us both to plan for serious events in peacetime and to manage them once they occur.

[82] See, for example, the report Foresight Cybersecurity Threats for 2030 - Update by ENISA, the European Union Agency for Cybersecurity. Available at https://www.enisa.europa.eu/publications/foresight-cybersecurity-threats-for-2030-update-2024-extended-report/@@download/fullReport.
[83] The need for strong trust in AI is also discussed in the chapter AI for a public sector at the forefront.
[84] MSB, Annual report on cyber incident reporting 2023. p. 21.



The AI Commission believes that the government needs to take initiatives to ensure good contingency planning in areas where loss digital capability otherwise risks disrupting important societal functions. Photo: Swedish Armed Forces

With the help of AI, we can, for example

- Optimise the maintenance and repair of critical infrastructures such as transport, electricity and communication systems. This is done by analysing data from sensors that detect signs of deterioration or malfunction before it goes as far as a breakdown or collapse.
- Study historical data and current trends to predict the occurrence and extent of natural disasters and enable authorities to implement countermeasures and evacuation plans in advance, or at least at an early stage.
- Track real-time data from sources such as social media, sensors and satellite imagery to get an idea of the level of damage, identify areas in need of immediate assistance and optimise resource allocation during different types of crises.

The AI Commission believes that the authorities, and other actors, that are part of Sweden's civil defence system must strengthen their ability to use AI in these and similar ways.[85] But even in these cases, increased use of AI presents not only opportunities, but also risks. In this context, however, the main concern is how greater reliance on advanced technologies increases our vulnerability to disruptions in technological systems. We will now address this issue in more detail.

Building resilience in a high-tech society

Increased use of technology in society, not least in essential activities, has led to enormous gains. Quality and service levels have increased, waiting times have been reduced, and major savings have been made. At the same time, a large number of societal functions are now completely dependent on the functioning of technology. There are many examples of cyberattacks as well as unintentional errors and accidents having led to serious disruptions in society, sometimes lasting for days. Airports all over the world have had to stop traffic, entire retail chains have had to close down because they were unable to collect payment, and municipal administrations have been paralysed because they lost control of their IT systems.

As the use of AI increases in society, the dependence of many organisations on the functioning of technical systems will also increase. This vulnerability will thus become even more apparent. It is therefore necessary for critical technical systems to be built in a way that makes them fundamentally resilient to the full spectrum of threats. Systems must be *robust*, i.e. able to withstand a high degree of stress without affecting their function, and *resilient*, i.e. able to adapt to and recover from disruptions. A measure of *redundancy* is also needed, or backup solutions that can take over when the regular systems fail. None of this is new or specifically linked to AI development. On the contrary, these needs are already very much present today, as a result of the digitalisation that has already taken place in society. However, any effort to increase the use of AI must, to be responsible, take this perspective into account.

No matter how resilient the technical solutions are made, we can never completely ignore the risk of their failure. Disruption-sensitive operations obviously need to have contingency and business continuity plans for such scenarios. For example, emergency hospitals are always ready to switch to manual record keeping if the digital systems stop working. Many organisations can also cope with a period of IT disruption. In these cases, more advanced contingency procedures do not need to be prepared.[86]

[85] For suggestions on how to improve the conditions for the development and use of AI in the public sector, see the chapter *AI for a public sector at the forefront*.
[86] For example, the activities of the Swedish Social Insurance Agency are vital to society, but an interruption in the ability to receive applications, process cases and make payments for one or a few days does not normally pose a serious threat to society or individuals.

If in the future we have made ourselves dependent on AI to maintain certain essential functions, we need to have a plan for scenarios where the necessary technology is knocked out for an unacceptably long time, for whatever reason. The problem is that in many cases, it will no longer be a realistic option to switch to manual - or even digital, but AI-less - management, as the workload will then be unmanageably high. Instead, activities will need to be conducted in a fundamentally different way. The focus must then be on meeting basic needs and interests to the best of one's ability, such as access to electricity, communications, food, provision of basic data or economic security for the population.[87] In these cases, it is important that the laws and regulations governing the activities have taken such scenarios into account, and allow for the temporary overriding of ordinary rules and procedures.

Proposals

- The AI Commission believes that the government needs to take initiatives to ensure good contingency planning in those areas where a loss of digital capability would otherwise risk disrupting key societal functions.

- The AI Commission also recognises the need to develop and maintain robust contingency plans and response strategies to rapidly address and mitigate the negative consequences of AI-related security incidents. AI-specific scenarios should be developed and included in national security exercises, and cooperation strengthened between authorities, companies and higher education institutions to respond effectively to threats.[88]It may also involve strengthening existing procedures and plans so that the risks discussed in this section are also addressed.

Finally, it is worth returning to the issue of digital sovereignty touched on earlier in this chapter. There are good reasons for Sweden to ensure full control over certain digital assets. Nonetheless, we cannot ignore the fact that, in certain situations, society's resilience may increase, rather than decrease, if key data and AI services are placed in commercial cloud services based abroad instead of - or in addition to - their own data centres. The same applies if the choice is between having access to a capability without full control over it, and being completely without it. This is something that the government and the responsible actor will need to analyse carefully and on a case-by-case basis.

Ethical and safe use of AI

As described in this Roadmap, AI is widely used in our society today. The use of AI in a particular sector may raise ethical considerations. It may therefore be relevant for each sector of society to develop ethical guidelines on how AI should be used in different professions, taking into account established standards and principles, such as the Code of Conduct for Lawyers, the Code of Conduct for Accountants or the Code of Medical Ethics. For example, the Defence Committee has recently called for ethical guidelines on AI in the field of defence. These are intended to address both the specific legal and ethical problems associated with AI in military applications.[89] When developing ethical guidelines, it is natural to work closely with industry organisations or equivalent, which usually have considerable expertise. It may also be relevant to consider

UN agency UNESCO's guidelines on ethics and AI.[90] In addition, we believe it is important that the ethical guidelines also consider how the use of AI may affect children's rights.[91]

A new institute for AI security

There is a great need for knowledge about the risks that the development and use of AI can bring to our society. To strengthen society's resilience, but also to address concerns about AI, we believe that an institute for AI security should be established. The institute's main task will be to conduct and promote research on security risks associated with AI. In this way, the institute can help to ensure that actual security risks associated with AI are highlighted and addressed. Where the institute's research shows that a particular security risk is imaginary or exaggerated, it should have a clear remit to point it out. This will ensure that the discussion around security and AI is based on evidence and facts, and that society's resources are focused on addressing real risks. To this end, the institute will publish an annual report on the most important AI safety issues and provide recommendations on how to address them. It will also develop guidelines and *best practices* for safe AI use and development.

The institute should be an independent authority and be able to apply for and receive external funds and/or grants to finance its research. The externally

[87] Economic security here means, among other things, that the economic security systems, such as the payment of social security, pensions, etc. should work.
[88] In this context, it is interesting to note that the study that proposed the current civil defence regime proposed a specific preparedness sector for cybersecurity in order to strengthen societal coordination on these issues. However, the proposal did not materialise. See SOU 2021:25 Structure for increased resilience, p. 258 ff.
[89] See Ds 2024:6, p. 43. In July 2024, the government tasked Digg and IMY with producing indicative guidelines for the use of generative artificial intelligence (AI) in public administration. The task is to be reported by 20 January 2025.
[90] UNESCO's Recommendation on the Ethics of Artificial Intelligence was adopted by its 193 Member States in 2021.
[91] See, for example, UNICEF's 2021 policy guidance on AI for children.

funded research should be independent of the funder in terms of methodology, results and publication methods. The institute should also set up an expert council with representatives from relevant authorities, such as the Swedish Defence Radio Establishment, the Swedish Armed Forces, the Swedish Civil Contingencies Agency, the Swedish Psychological Defence Agency, the Swedish Security Service, as well as from higher education institutions and the business community. The council's task will be to identify new opportunities and challenges in AI security and provide strategic advice to the institute and the government. In this regard, we consider it important that the council consists of people with different competences and experiences.

As regards the location of the institute, we propose that it be placed close to KTH and Cybercampus Sweden, where research on AI and cybersecurity is conducted (see the proposal above). Other Swedish universities, colleges and research institutes should also be encouraged to establish research collaborations with the new institute. To this end, we believe that a special research fund of SEK 50 million should be set aside. The research fund would also have the possibility to receive grants from private actors. The AI Commission also proposes that the institute should have the capacity to host a high-tech AI security testing laboratory, as part of our proposed investment in computing power.

In addition to the above, the institute will actively seek to establish collaborations with similar AI security institutes, both within and outside the EU. These collaborations will primarily aim to common competences in AI security. But we also envisage that they will include bilateral cooperation agreements with strategically important member states, initiatives for joint research projects and exchange of best practices in AI security. In addition, there are reasons for the institute to have partnerships with the major international companies developing AI. Through these measures, Sweden can take a leading role in ensuring safe and reliable AI development, while strengthening our international position as a leading nation in digital innovation and security.

An initiative of this nature could also strengthen Sweden's international position. Sweden would not be the first to have an institute like the one we propose. On the contrary, there are already institutes for AI security in countries such as Japan, Singapore, the United Kingdom and the United States.[92] In May 2024, a global meeting, the AI Seoul Summit 2024, was held to discuss international cooperation between national institutes working on AI security. Among other things, the summit agreed to establish an international network of institutes working on AI security. Ten countries and the EU agreed to cooperate on AI security standards, research and testing. Sweden has long been a pioneer in digitalisation and technological innovation. With the establishment of an institute for AI security, Sweden can take a leading role in the development of safe and reliable AI, not least within the EU. This is particularly urgent given the establishment of the EU AI Agency in Brussels.

Proposal

- The AI Commission proposes that a Swedish Institute for AI Security be established. We believe that an annual appropriation of SEK 30 million is necessary to run the institute. A research fund of SEK 50 million will be linked to the institute.

AI - an existential risk?

It is possible that the rapid development of technology will eventually - according to some perhaps already within the next few years, lead to us reaching *artificial general intelligence* (AGI). In practice, this means software that can perform a wide variety of tasks and solve a wide variety of problems, and that is significantly more capable than the AI systems we have today. Reaching AGI would open up enormous new possibilities, and that in itself is not necessarily dangerous. However, some argue that such a development could threaten the existence of humanity. This is because AI systems develop a will of their own that is different from ours, and see us as a threat to their own survival or goals. The risk in such a scenario is that systems simply become more capable than humans and that our capabilities are not enough to prevent uncontrolled development.

Those who have warned of such an existential risk have proposed, among other things, a pause in the development of AI.[93] However, it has been argued that a pause would only favour malicious actors, as they would be unlikely to respect such a decision. The AI Commission recognises that concerns about so-called existential risk need to be taken into account, but at the same time regrets that parts of the public discussion on security have tended to focus on speculative risks with very low probability. As we touch on in the previous section, it is important that society's efforts to manage AI-related security risks are evidence-based.

[92] The AI Office being established in Brussels by the European Commission will, among other things, fulfil the tasks of the AI Safety Institute.
[93] See, for example, Future of Life Institute, Pause Giant AI Experiments: An Open Letter.

Collaborative cutting-edge research

ChatGPT summarises:

AI research is developing at a rapid pace, linking fundamental science and practical application. Sweden has a strong tradition in both research and innovation, but global competition now requires national efforts to maintain and strengthen our leadership in AI.

This chapter explores how cutting-edge research, industry and education can work together to accelerate AI development in Sweden. By promoting centres of excellence, international collaborations and support for young researchers, it offers concrete suggestions on how we can build the skills needed. It is a plan to ensure that Sweden stands strong in the AI race of the future.

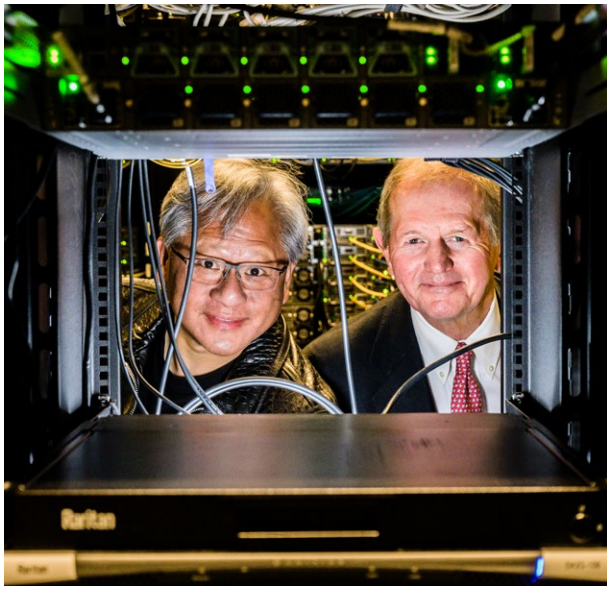
The starting point is relatively good, but there are challenges

In recent years, the development of AI has been extremely rapid, and new findings have led to AI-based applications in both expected and completely new areas. One phenomenon that permeates AI development is the short distance between basic research, application, innovation and product. In the context of innovation, we often talk about *Technology Readiness Levels* (TRL) to describe how far along the road to a product a discovery or innovation has come. What used to take many years on the TRL scale can now take just a few months in the AI field. This means that companies that want to be at the forefront of AI must be extremely close to research by either conducting their own basic research or linking up with leading research at universities and colleges. In light of this, it is clear that cutting-edge research in AI is crucial for Sweden to be able to maintain and strengthen its competitiveness in a number of important application areas for the country.

In an international comparison, Sweden has long held its own in both research and innovation. There is also currently a skills boost in AI research and education involving several key actors, of which the Wallenberg AI, Autonomous Systems and Software Programme (WASP) is the most significant.

The starting point for an investment in cutting-edge research in AI in Sweden is therefore relatively good. At the same time, research is conducted in an internationally accelerated competitive context, and in order not to fall behind and continue to participate in the development of AI, national focused large-scale investments must be made both in the short and long term.

One challenge in investing in cutting-edge research is that the skills base in AI in Sweden is limited in the short term. We must therefore recruit leading AI researchers from other countries, while retaining younger talent. In the long term, new PhDs, through initiatives such as WASP, can be an important addition to the overall excellence around AI in the country. According to the AI Commission, the goal should be to have excellent research at the global forefront in AI itself, while we invest in subject-specific AI skills in broad areas of science, such as natural and engineering sciences, medicine and health, and humanities and social sciences. This chapter outlines a series of actions to ensure that we achieve this goal.



Jen-Hsun "Jensen" Huang and Marcus Wallenberg in the centre of the Berzelius supercomputer at Linköping University. Photo: Thor Balkhed/Linköpings University

WASP

WASP, which stands for Wallenberg AI, Autonomous Systems and Software Programme, was initiated in 2015. It is Sweden's largest single research programme ever, and an important catalyst for collaboration between universities and companies in the fields of AI, autonomous systems and software.

WASP builds on the combined existing expertise of Sweden's five major information and communication technology (ICT) universities: Chalmers University of Technology, Royal Institute of Technology, Linköping University, Lund University and Umeå University, and leading research groups at Örebro University, Uppsala University and Luleå University of Technology.

A snapshot of WASP

- Budget: SEK 6.5 billion until 2031.
- Target: graduate 600 PhDs and recruit 80 world-leading researchers.
- Outcomes so far:
  - More than 580 PhD students have been admitted and more than 140 have graduated at the universities and universities that make up the network as described above.
  - 67 top international researchers have been recruited to the universities involved
  - 80 companies and public authorities have been involved in the programme.

Initiatives that can rapidly increase excellence in the country

For Sweden to compete in a world where the path from innovation to product is getting shorter all the time, basic research needs to be linked directly to businesses in new and innovative ways. Basic research and applied research must be interwoven by creating research environments with sufficient critical mass to achieve both excellence in research and synergy effects in society. The Canadian example is interesting to study. Among other things, they have invested in a model with centres of excellence, that has proven successful.[94] In addition, there is the so-called Mitacs programme, which brings companies and universities together, helping both sides to better understand each other's comparative advantages.[95] This has led to more professors, PhD students and graduates being employed in the private sector, bringing them closer to industrial innovation and development.

Several Swedish higher education institutions have also established centres that focus on both basic research and applied AI. These centres act as hubs where researchers, students and industry partners collaborate and address key challenges and opportunities across a range of fields. By creating dedicated AI initiatives and fostering interdisciplinary collaboration, these universities and colleges are positioning themselves in the national and international AI landscape. It is important that the initiatives proposed by the AI Commission take into account the ongoing activities in the field, as there needs to be a good reception capacity for new resources and initiatives. We also believe that higher education institutions should be considered early in the planning of these proposed initiatives, in particular to ensure the desired impact and that the initiatives are part of a wider context.

- The AI Commission proposes that the government establish a limited number of centres of excellence in the AI field at an approximate unit cost of SEK 100 million per year for 10 years, totalling SEK 300 million annually. The centres will collaborate with researchers and projects at various Swedish and international higher education institutions, as well as with both the business community and the public sector. These centres may be virtual and involve several higher education institutions, but must have one higher education institution as their principal. The Swedish Research Council, in consultation with other research funding bodies, should be the principal for a call and allocate resources in competition between universities and colleges.

[94] Canada's AI strategy is centred around three national AI institutes: Amii, Institut Vecteur and Mila. These institutes bring together expertise from the scientific community and conduct research in areas such as energy, health and security. Each institute also runs programmes to commercialise AI research and support the emergence of new start-ups. See: https://cifar.ca/wp-content/uploads/2023/11/aican-impact-2023-eng.pdf.
[95] See also the chapter *Innovation, entrepreneurship and venture capital*.

To ensure long-term access to expertise that stays in Sweden, it is important that higher education institutions offer attractive AI positions for newly qualified researchers. A national postdoc programme should therefore be established in AI. Researchers should be given annual funding, with no requirement for international placement, but with good opportunities for international exchanges. The aim of this is to give doctoral students and researchers, not least those with an international background, the opportunity to continue their careers in Sweden. This would make a positive contribution to national research and strengthen the country's innovation capacity.

- The AI Commission proposes that funds be set aside for 200 AI postdoc positions at a total cost of SEK 500 million over ten years. The Swedish Research Council, in consultation with other research funding bodies, should be the principal for a call for proposals and allocate the resources in competition between universities and colleges.

- To attract top international researchers, attractive packages for foreign visiting professors should also be created. Linking such packages to our unique access to data and the proposed centres of excellence and research schools can increase Sweden's attractiveness.

- The AI Commission proposes to allocate funds for the equivalent of 50 full-time visiting professors in AI at a cost of SEK 300 million in total over ten years. The Swedish Research Council, in consultation with other research funding bodies, should be the lead organisation for a call for proposals and allocate the resources in competition between universities and colleges.

Vision: Strengthen Sweden's profile as a research nation in AI

Visiting professors could be given the task of solving the ten most important societal problems in the AI field. The problems are formulated by the international research community and announced in connection with the Nobel celebrations. The visiting professors will build their own research teams within the proposed centres of excellence and graduate schools proposed in this chapter, to address the problems.

To increase the link between research and society in general, and at the same time ensure that as many PhDs as possible stay in Sweden, more *combined positions* should be established, where researchers share their employment between academia and the public sector or companies. To this end, there are, for example, regulations that make it possible to co-opt a professor or to combine employment as a senior lecturer or professor with employment at a healthcare unit. However, the regulations on combined employment are currently limited to employment that is combined between the university and healthcare units. The Government has therefore submitted a memorandum proposing amendments the Higher Education Act to enable joint employment between higher education and other sectors.[96] The AI Commission welcomes this.

If the proposal goes through, the AI Commission wants to encourage young researchers to combine work at a university with work in a municipality, authority or company. Assuming that the authority or company where the researcher works part-time pays half the cost, 500 such combined positions would cost the state budget SEK 350 million over a ten-year period.

- The AI Commission proposes that funds be allocated for the equivalent of 500 combined AI positions at a total cost of SEK 350 million over 10 years. The Swedish Research Council, in consultation with other research funding bodies, should be the lead organisation for a call for proposals and allocate the resources in competition between universities and colleges.

Global competition for AI skills is fierce and many countries are taking targeted measures to attract and retain people with high AI skills. Here we can see that Sweden stands out in a negative way. The main reason is that our current migration rules often lead to people from other countries who have completed their doctoral studies in Sweden being forced to leave the country, instead of staying and contributing to society with their expertise. These rules are now under review,[97] which the AI Commission welcomes. It is important that a change is made to facilitate more international talent to stay after completing their education. In addition to simplifying processes and offering better conditions, in line with our proposals in this section, Sweden should also focus on creating favourable conditions that promote opportunities for long-term settlement in the country. An assignment to this effect has been given to about ten authorities

[96] See Proposal for amendments to increase mobility early in academic careers (U2024/00229).
[97] See Improved conditions for foreign doctoral students and researchers to work in Sweden and more reliable assessments of residence permits for studies (HR2024/00827).

coordinated by the Swedish Agency for Economic and Regional Growth. The AI Commission looks forward to the results of this assignment[98].

Initiatives to strengthen long-term excellence

A good way to develop long-term excellence in Sweden is to establish graduate schools, where AI knowledge is integrated into subject-specific research programmes. Graduate schools should be organised by subject, as different areas will have different applications. They should include common course elements in basic AI technology but also other subjects such as ethics, law and security. In addition, each specialisation should have advanced courses adapted to the respective subject area.

Graduate schools should be national, with doctoral positions allocated in competition between universities and colleges. Inspiration can be drawn from existing concepts such as WASP, WASP-HS[99] and SciLifeLab, which organises a graduate school of 200 PhD students in data-driven life science with a focus on AI. The AI Commission considers that an appropriate target is to train 600 PhDs with AI expertise over a ten-year period. The proposed graduate schools could usefully include both PhD students employed by an HEI and PhD students in the private or public sector.

- The AI Commission proposes that graduate schools be established within the main areas of the Swedish Research Council and that SEK 2.4 billion be allocated for this purpose over a ten-year period, corresponding to 600 PhDs. The Swedish Research Council, in consultation with other research funding bodies, should be the principal for a call for proposals and allocate the resources in competition between universities and colleges.

AI4Science - AI as a new scientific tool

The use of AI in research has been labelled AI4Science, and has the potential to completely change the way knowledge is created. The development of new scientific methods based on AI and machine learning has the potential to accelerate scientific progress many times over. Major advances have already been made in biology, materials science, meteorology, but also in the humanities and social sciences. AI can accelerate discoveries and improve research processes by integrating, for example, reasoning AI systems, data-driven machine learning, large language models and data visualisation into subject-specific research.

AI is not only affecting theoretical and practical research in various fields, but is also changing the entire scientific process. AI is changing the way teaching is conducted, theses are written, literature is consumed and PhD students are supervised. Making the best use of AI's potential in science will be crucial for how national research development can both create new, and in already strong areas maintain, international competitiveness.

Realising the new opportunities offered by technology requires training efforts for researchers, PhD students and technical staff. This needs to be done at an interdisciplinary, generic level, spanning many, if not all, scientific disciplines. But it must also take place at more specialised levels, focusing on subject-specific tools that are central to the respective scientific field.[100]

It also requires us to systematically build the organisation and infrastructure to support the development, implementation and integration of AI in scientific contexts. Such infrastructure includes both hardware for training and utilisation (inference) of AI models, as well as clusters of expertise that can support the required interdisciplinary development and integration. In the fast-moving world of shorter. The gap between research and application also requires strong cooperation between academia, industry and the public .[101]

A number of different measures can accelerate the development of AI4Science and give Swedish research a competitive advantage. Possible issues : developing theory and practice around the role of AI systems in research and their ability to reason, based on data in combination with established scientific knowledge; improving methods for collecting, managing and synthesising high-quality scientific data - preferably internationally; developing guidelines around ethics, trust and responsibility issues in AI for science; and developing robust evaluation methods that responsibly clarify the performance, capabilities and limitations of the scientific use of AI.

[98] See Assignment to strengthen coordination linked to Sweden's ability to attract and retain highly qualified international skills and other foreign labour that is important for Sweden's competitiveness (KN2024/00521).
[99] WASP-HS stands for Wallenberg AI, Autonomous Systems and Software Program - Humanity and Society, which conducts research and builds expertise to better understand how AI affects people and society.
[100] See proposals in the chapter AI for a public sector at the forefront.
[101] See proposals in collaborative frontier research chapter.

Access to international AI resources

ChatGPT summarises:

In a world where artificial intelligence is shaping the future, Sweden faces both opportunities and challenges when it comes to accessing international AI resources. While nations like the US and China are leading development, the EU is struggling to keep up with this rapid technological transformation.

This chapter explores the critical importance of Swedish and European companies having continued access to the latest AI tools and platforms, despite complex global competition. We examine the value chain that underpins AI's value creation and how it is in the application of these tools that the real benefits can be realised. By examining both the opportunities and regulatory barriers, we highlight how important openness and access are for Sweden to assert itself in the global AI arena.

Transparency is important

Sweden is a small open economy, and as such highly dependent on the world around us. This applies not least in the field of AI. The fact that the production and development of AI-related goods and services is not evenly distributed around the world poses a particular challenge. The area is currently dominated by the United States and China. Also countries like Israel, Canada, Singapore, the UK and Taiwan are in the forefront. As highlighted in the Draghi report, the EU is lagging behind. This development is an important factor behind the increasing drive towards strategic autonomy, which is characterising EU policy in particular. A key part of this process is to build up European capabilities in strategic areas. This is a laudable ambition and an important reason behind the AI Commission's call to increase Swedish efforts in the AI field. However, it is important that this ambition does not mean alienation from the rest of the world. It would not be good in the long term, but in the short and medium term the consequences can be devastating, especially in the AI area.

Value creation in AI production and development - focus on application

Where the actual value creation takes place in the production and development of AI can be illustrated in a so-called value chain that extends from basic research to the practical use of ready-made AI tools and platforms (provided via cloud services). Such platforms can be described as digital environments where individuals, companies and public sector actors can access different types of AI services for a fee. The platforms are typically provided by large US tech companies. This value chain can be described in five main steps:

Step 1: Basic research and algorithm development

This is about theoretical research and innovation that form the basis for future technological advances. Examples of pioneering research include the 2017 paper *Attention Is All You Need*, which introduced the so-called Transformer architecture, which was the start for large language models.[102]

Step 2: Development and production of infrastructure and computing resources

These include specialised hardware and cloud services that provide the necessary computing power and storage space to develop, train and deploy AI models. Examples of this are the design and production of specialised semiconductors suitable for AI computing, known as Graphic Processing Units (GPUs) and Tensor Processing Units (TPUs), as well as cloud services provided by major US tech companies.

Step 3: Development of advanced and pre-trained AI models

The basic development in step 1 often forms a starting point for more specific customisations developed for different tasks. Examples of such models are the major language models released on a regular basis, such as the GPT series from Open AI.

Step 4: Development of AI platforms and tools

AI platforms and tools are often developed from large language models. These enable actors to integrate AI into their products and services. The range of such tools is vast and includes everything from machine learning and music and image creation tools, to optimising industrial processes.

[102] Vaswani et al. Attention is All you Need, Advances in Neural Information Processing Systems. 30. Curran Associates, Inc.

Step 5: Use of AI platforms and tools by actors in different industries and sectors of society

This step involves using existing platforms and tools based on AI technologies. It can involve buying pre-developed software that is installed in your own IT environment, or using cloud services to utilise the tools that large tech companies offer through their platforms. Regardless, the applications are numerous. For example, it can be used to optimise various processes in the manufacturing industry. But it can just as easily be used to design recommendation systems in e-commerce or to develop medical diagnostic tools in healthcare. In other words, the list of these types of applications is long and getting longer every day.

While all stages of the value chain are important, the greatest economic and societal value is created in the later stages - the development and utilisation of different AI platforms and AI tools.[103] The fact that value creation is concentrated in the latter stages is of great relevance to Sweden. This is not least because the first stages of the value chain are very capital-intensive and dominated by countries such as the United States and China - competing successfully in these areas is not impossible, but relatively difficult for a small country like Sweden. There is therefore much to suggest that it is in the application of AI that Swedish actors have their comparative advantage.

The fact that much value is created in the later stages of the value chain is mainly due to four factors:

- Scalability: A well-developed AI platform, which people can leverage to use AI services and tools, can be used in many different industries and applications.
- Network effects: the more people use a platform, the more valuable it becomes, as the use of the platform also leads to its training. Thus, through use, product development takes place that benefits all users.
- Problem solving: End-use is where real societal problems and challenges are encountered. It is by solving these that AI use creates concrete value for society.
- Availability: To use this type of off-the-shelf AI solution to create value, all you need is a computer, knowledge, data and good ideas. For example, it does not need its own access to computing power in the form of supercomputers or large amounts of electricity.

The high potential added value represented by the use of these tools and platforms makes the issue of accessibility very central. As mentioned earlier, the vast majority of platforms and tools available today come from outside the EU, mainly in the form of large US and Asian technology companies. By comparison, the EU accounts for less than 10 per cent of global investment in AI platforms. This presents a challenge in the development of value-creating AI applications in Sweden and the EU. As noted in the chapter *International positions*, the EU is now investing in catching up in the development of AI, which is very welcome. Despite this, it will be some time before we see a clear change. It is therefore likely that we will remain dependent US tools and platforms for a considerable time. It is therefore very problematic that there have recently been increasing signals that access to these tools and platforms is restricted for users within the EU, with a strong reference to the EU regulatory framework.

Regulatory framework and competitiveness

The regulatory framework for AI in Europe creates both opportunities and challenges for actors who want to apply AI in their business. On the one hand, rules and guidelines help build trust and ensure the ethical and responsible use of AI. On the other hand, overly strict or unclear regulatory frameworks risk stifling innovation and making it more difficult for European actors to compete in the global market.

The EU General Data Protection Regulation (GDPR) and the AI Regulation set high standards for how personal data can be collected, processed and shared, as well as how AI can be used. For many actors, this creates an uncertainty about what data can be used for AI development and how global AI platforms can be utilised without breaking the rules. This is particularly challenging when data needs to be transferred to countries outside the EU/EEA, for example when using cloud services from a US provider. This has led many European operators to hesitate to use AI platforms based on US cloud services, even these are often world-leading. This problem seems to be particularly pronounced for Swedish operators, as the message the AI Commission has received from various operators is that the implementation of regulation tends to be more rigid in Sweden than in many other EU countries. This further contributes to a reluctance to use these services.

[103] A platform can be described as a collection of tools and technologies that make it possible to develop, use and manage AI, without having to build everything from scratch.

The regulatory barriers and uncertainties surrounding AI regulations also mean that European operators risk having access to the latest and most advanced AI tools later than operators in other parts of the world. For example, in July 2024, Meta, formerly Facebook, announced that it will not to launch its latest multimodal model in Europe, arguing that the regulatory environment was too unpredictable.[104] Similarly, Google launched its Gemini AI in December 2023, with the exception of the EU.

At a time when AI is developing at a dizzying pace, such delays can have major consequences. Those who can apply the latest technology fastest will have a significant head start, while those who lag behind risk losing competitiveness. Even if the EU launch of a new model is only six months away, it can have a very negative impact on our companies' ability to compete globally. This applies not least to smaller companies and start-ups that are dependent on being able to scale up their operations quickly. In addition to making it more difficult for existing and future companies in Sweden and the EU, it increases the risk of companies choosing to establish themselves outside the EU. For Sweden and the EU as a whole, the limited availability of these platforms and tools means a risk of losing competitiveness and missing out on the potential welfare gains that increased use of AI solutions represents in society.

- The AI Commission emphasises how crucial it is that these platforms and tools are made available in Sweden and the EU at the same time as in the rest of the world. As suggested in the chapter *International positions*, it is therefore of great importance that Swedish representatives work to ensure that AI-related EU regulation does not contribute to a deterioration in the availability of these tools. The technical attachés proposed in the same chapter should also actively work to reduce these risks.

[104] A multimodal model is an AI model that can process and understand multiple types of data at the same time, such as audio, text and images.

The AI Regulation

In August 2024, the EU Regulation on harmonised rules for artificial intelligence systems, the AI Regulation, entered into force. It is the most comprehensive AI regulation in the world. The new framework sets out safety, ethical and human rights requirements based on four risk categories: AI systems with unacceptable risk, high risk, limited risk and minimal risk. AI systems with unacceptable risk are banned, while those with minimal risk are accepted and therefore do not need to be regulated.

The AI systems covered by the regulation must, among other things, comply with rules requiring transparency, rigorous testing, reporting of serious incidents and a certain level of cybersecurity. The Regulation also requires Member States to establish a so-called regulatory sandbox for AI. This refers to a controlled framework established by a competent authority that allows providers or potential providers of AI systems to develop, train, validate and test their systems according to a specific sandbox plan. This is done for a limited time and under regulatory supervision.

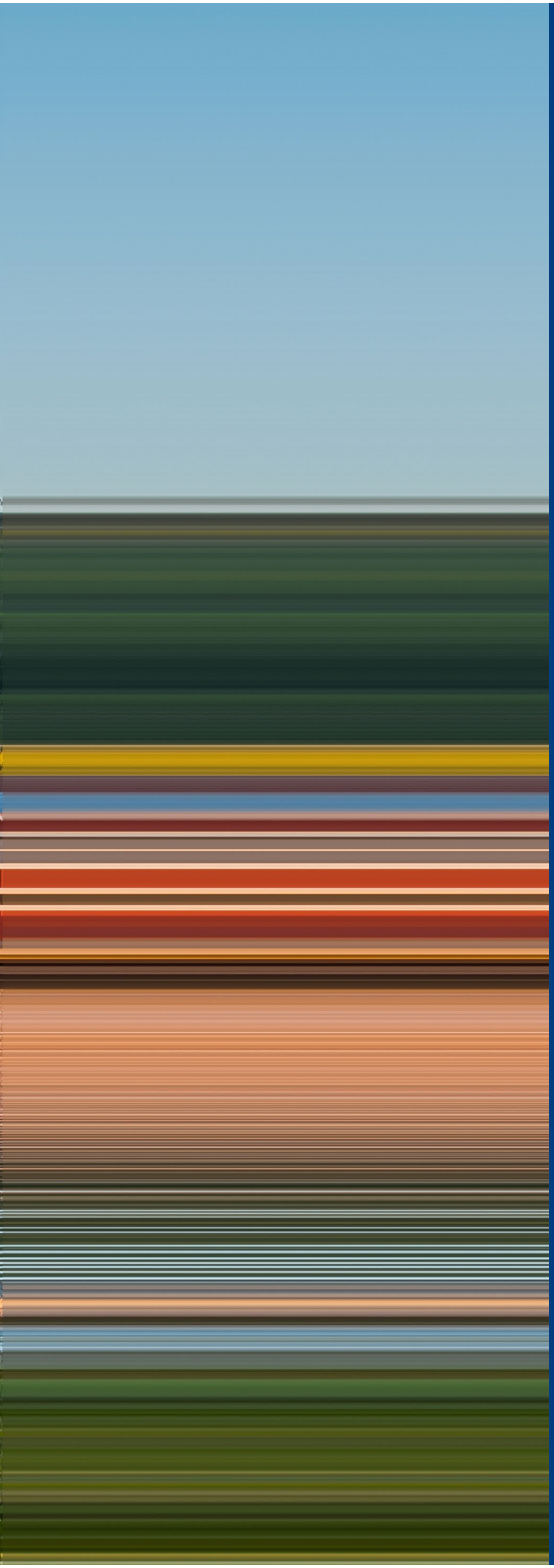
Although the Regulation entered into force on 1 August 2024, the majority of its rules will not apply until 2 August 2026. However, the bans on AI systems with unacceptable risk will apply after six months and the rules on AI models for general purpose after twelve months (from 1 August 2024).

Monitoring and implementation

Each Member State shall designate, by 2 August 2025, the national authorities responsible for the implementation of the AI Regulation and market surveillance, in particular as regards AI systems with high risk. At EU level, the European Commission will set up the AI to coordinate implementation in the Member States. The AI Office is also given a specific responsibility to draw up detailed rules for AI models developed for general purposes, and to monitor their application. In addition, three advisory bodies will be established at EU level:

5. a European AI Board, consisting of high-level representatives from the Member States.
6. an advisory forum with representatives from research, industry, civil society and SMEs to provide technical expertise.
7. a scientific panel of independent experts to support implementation.

In September 2024, the government commissioned a special investigator to, among other things, submit proposals on which Swedish authorities should receive information under the regulation and what legislative amendments will be necessary. The investigator must submit their proposals by 30 September 2025.



3 AI for all

In the following three chapters, *Skills boost for all*, *Innovation, entrepreneurship and venture capital*, and *AI for a public sector at the forefront*, we discuss and propose what is needed for society as a whole to embrace AI and capitalise on the opportunities it offers.

We start with the need to raise awareness of AI across the population and ensure that the structural transformation brought about by AI can be implemented in a way that preserves and strengthens our trust in each other and in society. We also look at the business environment in terms of innovation, entrepreneurship and access to risk capital. Sweden has a tradition of innovative technology companies and it is important that the conditions are in place for companies to be able to keep up with developments. Finally, we look at the challenges for the public sector and make suggestions on how AI can enable the sector to live up to people's expectations.

This section contains:

Photo: Adam Höglund/Shutterstock

AI for all

Skills boost for all

ChatGPT summarises:

AI will impact all of society, and for Sweden to maximise the benefits of this development, a major skills boost is needed. As AI technology becomes increasingly integrated into our everyday lives, from workplaces to schools and homes, we need to ensure that everyone has the ability to understand and use these tools. This is not just about training technicians and researchers, but also about providing the entire population, regardless of age or background, with basic AI skills. Without these efforts, society risks creating new divides, with some groups left out of the digital transformation.

This chapter will discuss how education, training and labour market actors can work together to ensure a broad and inclusive dissemination of knowledge. By investing in education and lifelong learning, we can not only strengthen Sweden's competitiveness, but also ensure sustainable and equitable AI development. Here the AI Commission presents its proposals to achieve these goals.

Popular education

Experience from previous major structural transformations shows that new technologies often benefit different social groups to different degrees. This can be problematic, as a country with a large share of the population that uses AI will achieve great competitive advantages. A country where people understand the fundamental opportunities and risks of AI is also a country that can safely and ethically use AI for the good of society. A country that offers security during transition is a country that can implement major technology shifts with broad legitimacy. It is thus crucial for society's development and cohesion that everyone wants, dares and can access new technologies.

For Sweden to fully benefit from the new technology, a high minimum level of basic AI skills is needed among the Swedish population. Unfortunately, there are groups today that are digitally excluded. According to the Swedish Internet Foundation's report[105] *Swedes and the Internet* from 2024, only four per cent of Swedes are considered to be digitally excluded, but this figure hides a skewed distribution in the population - among older people, the corresponding figure is 22 per cent. The rapid development of technology also risks creating new knowledge gaps.[106] For example, the same report shows that 30 per cent of the population used an AI tool in 2023, mainly for private purposes. It is much more common among younger Swedes. Between the ages of 18 and 34, 60 per cent say they have used AI tools. This can be compared with Swedes aged 65-84, where only five per cent say they have done so. Above all, it is the AI tool ChatGPT that is used. To fully reap the benefits of the new technology, but also to avoid abnormalities such as fraud, misrepresentation and inbuilt bias in automated decisions, we need to reduce today's knowledge gaps and counteract future ones. Sweden's long tradition of popular education can play an important role here.

Several organisations and authorities are currently working on these issues, partly within the framework of the Digital Day initiative run by the Swedish Post and Telecom Authority (PTS). Other examples are the Internet Foundation's website *internetkunskap.se*, which helps educate safe and aware internet users by gathering knowledge about the internet and digital services that we use in everyday life. Among other things, it has a section on AI, describing what it is and how it is used, as well as the opportunities and risks associated with the technology. The Swedish Psychological Defence Agency (MPF) has a special responsibility to ensure that the Swedish population is well prepared in terms of psychological defence, while the Swedish Agency for the Media is tasked with coordinating national work on media and information literacy. As part of this, the Swedish Media Authority has been tasked with implementing a national

[105] A similar picture is painted in Statistics Sweden's report *The population's use of IT* (2024).
[106] Swedes and the Internet, The Swedish Internet Foundation (2024).

initiative to strengthen media and information literacy in 2024 and 2025. The initiative will raise public awareness of how AI can be used in the information flow and thus contribute to strengthening the resilience of society against, inter alia, disinformation and undue influence of information.

Popular education is practised in different forms but rests on the same basic idea of promoting lifelong learning, active citizenship and democratic participation. Perhaps the best known are the various study associations, but other club activities and various private and public initiatives are also extensive; see the box below for examples of popular education initiatives around digitalisation and AI. Overall, more than 800,000 people participate in the activities of study associations and folk high schools alone every year.[107] The Swedish popular education system thus offers excellent opportunities to disseminate knowledge about AI to the general public - knowledge about the opportunities, but also about the risks. Particularly valuable is the opportunity to reach out to groups with higher levels of digital exclusion, such as people with disabilities and older people.

Popular education initiatives in the field of digitalisation and AI

SeniorNet (seniornet.se) is a non-profit organisation that helps seniors use digital technology and services.

Studiefrämjandet and the libraries have, within the framework of the Digidel network, created Medborgarveckan (digidel. se), which promotes collaboration and knowledge sharing. For one week each year, a series of activities focus on the public's encounter with digital public services.

The collaborative platform Digitalidag (PTS.se), which annually and nationally gathers forces to inspire all people to want and be able to be part of digital development. For example, Digitalidag (Digital Day) 2023 involved 375 stakeholders (private and public sector, universities and colleges, social partners and civil society) and together they organised over 1,000 activities in 216 municipalities. By building on existing structures, training activities can be organised in places where people feel safe and through actors that are relevant to the target group.

Digitalhjälpen (PTS.se) provides guidance and tips for digital beginners.

Swedish Science Centers (fssc.se) is a member association that represents, promotes and develops the industry with 20 science centres across the country - a unified national resource for lifelong learning. They work together to give children and young people, regardless of background, the opportunity to increase their scientific capital through knowledge in AI, science, technology, engineering and maths, as well as strengthened skills in entrepreneurship and innovation development.

Photo: Anna Gerdén/Tekniska Museet

[107] See Facts about popular education 2023, Folkbildningrådet (2023).

Proposals

- To increase knowledge about AI among all people living in Sweden, the AI Commission proposes an increase in funding for public education programmes to folk high schools, the Swedish Agency for the Media,[108] PTS and study associations for the years 2025-2029 with SEK 100 million per year. The purpose of the initiative is to reduce and prevent the gaps that can increase in society during major technological shifts and to increase knowledge of the opportunities and risks AI can bring. This can increase the legitimacy and acceptance of the transition that is taking place.

- The AI Commission also proposes an investment of SEK 100 million per year in public libraries between 2025 and 2029, strengthening their mission to promote the use of information technology for knowledge acquisition and learning. The initiative aims to help the public to try out and use AI tools free of charge.

- Like the home PC reform of the 1990s, the government should offer all citizens free access to a selection of quality-assured AI services: the 'AI for all' reform.[109] By democratising access to these tools, Sweden can position itself as a pioneer in AI use. Such a broad effort would not only stimulate innovation and productivity at the individual level, but also give Sweden a unique profile internationally - a country that prioritises making cutting-edge technology accessible to all citizens. The AI services could usefully be brought together in the AI Hub proposed by the AI Commission on page 70. Which AI services should be included in The AI Hub needs to be rapidly investigated. The task force we propose in the chapter *Leadership and Governance to implement the Roadmap* shall be tasked with rapidly investigating and negotiating with suppliers on the conditions for offering free AI services, capping the cost of the initiative and the duration the offer.

- The government should also consider providing pupils, students and teachers with free access to AI services for an extended period. Libraries and the Government Service Centre should AI services free of charge, as well as staff who can assist in how they can be used. This too needs to be urgently addressed by the task force we propose in the *Leadership and Governance chapter to implement the Roadmap*. Otherwise, it is up to employers to ensure that staff have the tools they need to fulfil their tasks and improve their work.

Mainstream education

AI in schools

The purpose of the AI Commission's mission is to ensure that Sweden, as a leading research, industrial and welfare nation, should better utilise the opportunities and manage the risks of AI. If Sweden is to maintain and strengthen this position in future generations, it is crucial that we also equip children and young people for the future.

However, the AI Commission does not make any proposals in the field of school education in this report, as our directive prevent us from doing so. At the same time, the Commission recognizes the opportunities and risks that AI can bring to the education system. AI will, and should, have a major impact on schools. This applies to both content and teaching methods. It's a matter of capitalising on the technology's opportunities, but also of clarifying its problems.

As in society at large, AI offers great opportunities for school staff to improve and rationalise administrative tasks. For example, teachers can use AI to produce lesson plans, timetables, reports and carry out documentation. This frees up time to focus on pedagogical development and the individual needs of students, to name a few examples.

AI also has great potential to be used as a pedagogical tool in school education, provided that scientific research shows favourable learning effects. In this regard, AI technology can offer new opportunities to personalise teaching and level out the differences in students' circumstances, for example due to their parents' different educational backgrounds. If schools do not introduce students to AI, there is a risk that the different socio-economic backgrounds of students will lead to growing gaps in this area. The home then becomes the place where knowledge about, and use of, AI takes place.

[108] The AI Commission welcomes the assignment to the Swedish Agency for the Media regarding a national initiative to strengthen media and information literacy. See Assignment to the Swedish Agency for the Media to implement a national initiative to strengthen media and information literacy in an era of artificial intelligence and disinformation and thus increase society's resilience (Ku2024/00419).

[109] It needs to be clarified how citizens can access the services of the AI Hub described below.

Schools also have an important role to play in making it clear that AI should not be seen as a miracle cure that can replace children's need for solid basic knowledge and training in analytical skills to understand and interpret their the world around us. There are also risks associated with AI, such as fabricated facts, deception, and influence on democracy, which schools must recognise and discuss to ensure that the new technology is used ethically and safely in the service of society.

Vision: AI tools in education

AI services have the potential to change perspectives on what teaching can achieve. For one thing, teaching can become much more personalised, on the other hand, teachers can be given more time to devote to those who need more support. Perhaps most strikingly, for the first time, AI enables each student to have a 'private teacher' who adapts their pedagogy to their circumstances - a teacher who also has unlimited time and is available around the clock. This customisation could help the physical teacher, together with the AI, to adjust the level of difficulty to challenge students who need it. Instruction could also be iterated, meaning that instruction is adapted based on the student's previous performance and reactions. AI could thus offer a flexible and incremental learning process, where each step builds on the previous one, providing a more dynamic learning environment.

AI in education could also provide a deeper insight into each student's learning process. Teachers can see what students are studying, how long they do it for, what sticks, what is difficult, and what is interesting or uninteresting. Of course, this should not jeopardise students' privacy. But used with judgement it allows for support where it is really needed and the possibility to monitor learning in real time in a way that is not possible today. An important effect of all this is that it could increase the school's ability to equalise life chances for students with different circumstances, backgrounds and motivations. For example, we know from research that parents' educational background has a significant impact on children's success in school, with children of university-educated parents having a clear advantage over others - an inequality that could be reduced with the availability of an AI teacher. Also, in the interaction with the AI teacher, the student does not have to feel stupid if they do not understand and can ask as many times as they want.

AI in education also has the potential to improve teaching at a national level. As AI enables large-scale analysis and pattern recognition, collecting and analysing data from thousands of students could identify patterns and connections in learning processes that would otherwise be impossible to detect. This can lead to insights that improve teaching and learning in a systematic way, while being broken down to individual schools and classes.

Photo: Ground Picture/Shutterstock

The AI Commission believes that universities and colleges should urgently introduce relevant AI content in all programmes.
Photo: Gorodenkoff/Shutterstock

More AI in higher education

There is a great need for qualified staff with a technical background in AI, both at universities and colleges, and in the private and public sectors. However, Sweden not only has a major shortage of technical AI expertise, but there is also a need for a broader understanding of AI among students and teachers at universities and colleges in all areas. There are few programmes today that meet the need for AI-related skills in, for example, chemistry, biology, law, economics, medicine, social sciences and the humanities. To address this shortage and strengthen Sweden's competitiveness, greater integration of AI in all higher education is therefore required.

It is the AI Commission's assessment that universities and higher education institutions should urgently introduce relevant AI content in all programmes. This involves both a basic understanding of what AI is and how it affects the specific field of study, and a deeper understanding of how AI can be used to improve the specific field. For example, lawyers should understand what legal questions AI can raise. But lawyers also need to understand how they can use AI tools to become more effective in the field.

The AI Commission welcomes the fact that in 2023 the Government tasked the Swedish Higher Education Authority (UKÄ) with analysing how AI can affect higher education provision in relation to the future skills needs of the labour market. In its report, UKÄ emphasises in its report, among other things, that there is a need increased cooperation between higher education institutions to develop the AI programme (U2023/02126). Here, it would be beneficial to build on what has been done in WASP-ED.[110] For example, a new course plan has been developed for the new broader AI subject, research and development has been conducted to introduce AI in all higher education programmes, and technical higher education in AI has been scaled up.

Proposal

- The AI Commission believes that a total of SEK 750 million should be allocated to higher education institutions between 2025 and 2027. The aim is to give teachers the opportunity to develop their skills in AI and to future-proof the content of the programmes. The Swedish Council for Higher Education should be tasked with responsibility for the initiative and be allocated SEK 5 million annually for the extended assignment.

Skills development for employees and retraining for jobseekers

Major technological shifts have historically led to the disappearance of jobs, but also of certain professions, altogether. Typically, human muscle power has been replaced by machines and robots. This time it is more about human computational or analytical skills and how machines, or more specifically computer programmes, will perform these tasks faster, cheaper and with higher quality.

[110] Abbreviation for The Wallenberg AI and Transformative Technologies Education Development Programme. The programme aims to increase the capacity of Swedish universities to provide relevant and scalable education in areas such as AI.

AI and the labour market - a brief overview of the implications of new technologies[111]

Historically, technological progress has led to increased productivity and prosperity, and the creation of more and better jobs. But change has often taken time and led to more people becoming unemployed for periods as jobs and professions disappeared. Nor has the increased prosperity always benefited everyone. Much research is currently underway on the impact of AI on the labour market and whether historical relationships hold true.

What is new about AI compared to previous technology shifts?

AI is expected to impact the labour market in several ways. Like other technological shifts, AI offers great opportunities for automation and efficiency gains of existing tasks. It will it easier for us to solve tasks quickly and with better precision. In many cases, this will evolve tasks so that, for example, tedious or dangerous tasks can be avoided. In some cases, however, it will lead to the disappearance of professions and entire industries, as tasks are better managed with the help of AI. However, AI is also an 'Invention of a Method for Invention' (IMI), which means that AI will impact the entire innovation and research process. It means that we will find ways to do things that we cannot today. This will in turn lead to the emergence of entirely new professions and industries.

This is one reason why AI can be expected to have a different impact on the labour market compared to previous technology shifts. For example, more occupations are expected to be affected than before - not least white-collar occupations. Data on the proportion of jobs that will be covered varies. Some estimates based on US data suggest that 80 per cent of all employed people have work tasks that may be affected by AI to some extent. Of these, one in four - i.e. 20 per cent of all employed people are estimated to be more significantly affected. Other calculations, based on Swedish data but with partly different approaches, report other percentages but confirm the picture AI is expected to affect more occupations and tasks than in previous technology shifts.

Unlike previous technology shifts, AI technology is expected to have a greater impact on people with higher education. People with higher education have generally enjoyed a stronger labour market than those with lower education during the structural transformation driven by automation and digitalisation. With AI, that relationship may not continue to apply.[112] Indeed, in an analysis Swedish data, people with shorter educational backgrounds appear to benefit slightly more from AI technology than those with longer educational backgrounds. This is because AI can enable workers to perform more advanced tasks that previously required higher levels specialisation. Thus, the relationship between educational attainment and expected employment growth is more equitable here, compared with during the structural transformation of recent years. However, the differences between different levels of education are relatively small and researchers are quite cautious in their conclusions.

Some professions and occupations will be more exposed than others to change due to AI. Occupations that rely on skills such as creativity, reasoning and creation, and where text management, image processing, data analysis and fact-finding are common tasks, often considered more affected than other professions. What these tasks have in common is that they can now be automated and improved to a greater extent than before.

Transition and forecasts

It is of course possible to outline other development directions for both jobs and the economy than those described above. For example, organisations such as the IMF and OECD are clear in their warnings that AI may also have unintended consequences - not least in terms of income and equality. While they describe the risk of this as greatest in countries with less developed economies, they emphasise the importance of ensuring that this new technology does not only benefit certain groups.

The IMF emphasises, among other things, the importance of functioning public security systems and good opportunities for education for those who need to make the transition. Without these protections and support, there is a risk that AI will increase income inequality and gender inequality - the opposite of what is desirable. At the same time, the OECD emphasises the importance of well-founded - evidence-based - measures to prevent and manage the undesirable consequences of the new technology. At the same time, the organisation points out the obvious dilemma that developments are so rapid that it is difficult to determine what constitutes well-founded measures.

[111] The fact box is based on the SNS Economic Council's report 2023, *Structural transformation of the Swedish labour market and policy measures*.
[112] See for example Brynjolfsson, E et al (2023), *Generative AI at Work*, NBER, Working Paper 31161 or Choi, J et al (2023) *Lawyering in the Age of Artificial Intelligence*, Minnesota Legal Studies Research Paper no. 23-31.

A crucial factor in meeting the challenges of the future is a well-functioning education system for working people. Sweden has also had an ambitious adult education policy for a long time, and the education system and funding have been expanded at all levels. There is no lack of infrastructure or resources to meet the need for lifelong learning in the future in general. In this context, however, higher education institutions are an exception, where the incentives and resource allocation for lifelong learning must be reviewed. The AI Commission therefore welcomes the inquiry tasked with analysing a special compensation model for retraining and further education for professionals.[113] The inquiry is to analyse the need for a specific reimbursement model and make proposals on how a model for parts of the resource allocation system can be developed to stimulate courses and programmes at basic or advanced level that strengthen the individual's position in the labour market.

The historical investment in adult education in Sweden is a strength in this situation, a strength that few other countries can match. But it is also something of a problem. There is now a proliferation of adult education programmes, with a large number of principals and sometimes an unclear division of responsibilities between them.[114] The resources invested are not always documented or systematically followed up. It is the AI Commission's view that future efforts must be evidence-based and ensure that current systems and resources are used effectively and efficiently. There also needs to be more systematic guidance for employers and workers on how the labour market is likely to evolve in the light of the ongoing technological shift. Under the following headings in this section, we discuss the skills development needs of those who are employed, self-employed, jobseeking or unemployed.

Skills development for employees

The need for AI skills will not met by high school or alone. A contributing factor to this is that it takes time to complete such training programmes, time that we do not have at present. Therefore, there will be a need for increased investment in AI skills development among current professionals. The opportunity for lifelong learning, in addition to what the employer normally offers, will thus play a very large role in Sweden's competitiveness in the future. Many stakeholders, such as the Swedish Higher Education Authority (UKÄ) and the Swedish National Agency for Higher Vocational Education (MYH), point to the need to close the gap between AI expertise and domain or industry expertise.

Who shall fund skills development?

It is traditionally the responsibility of employers to ensure that employees have the skills they need to do their jobs. However, major technological shifts like this are characterised by the fact that the new technology is largely applicable to all professions and activities. It is not self-evident, then, that an employer will provide training to its employees to the extent that is optimal for society at large. This is partly because developing the skills of employees also makes them more attractive to other employers.

The risk of this is that society invests too little in new technologies and skills. To avoid this, there is therefore a reason for the state to offer subsidised training and study funding for employees as well. At the same time, we must not overinvest in training because of alarmist signals that certain skills are disappearing as a result of new technologies. Nor is it desirable for the state to take over the costs of training that companies or employees should actually pay for themselves. These are not simple optimisation problems and it is therefore important to carefully identify how the responsibility for training costs should be shared between employees, companies and the state in the future.

At present, however, the AI Commission's assessment is that the problem of whether the state were to invest too little in new knowledge is significantly worse than whether the state is investing too much in it. The AI Commission thus considers that the availability of transition study support for workers is of great importance for the transition of the entire labour market in the future. Similarly, it considers that we believe that the AI Hub, discussed on page 70, can be of great help to workers and employers in, for example, identifying which skills are needed in the future, identify which courses can provide these skills, and enabling them to try out some AI services for free.

Proposal

- The AI Commission encourages the government to invite the social partners, both from the private and public sectors, to a joint discussion. The focus should be on developing solutions to the problems arising in the labour market as a result of AI through consensus and broad and long-term collaboration.

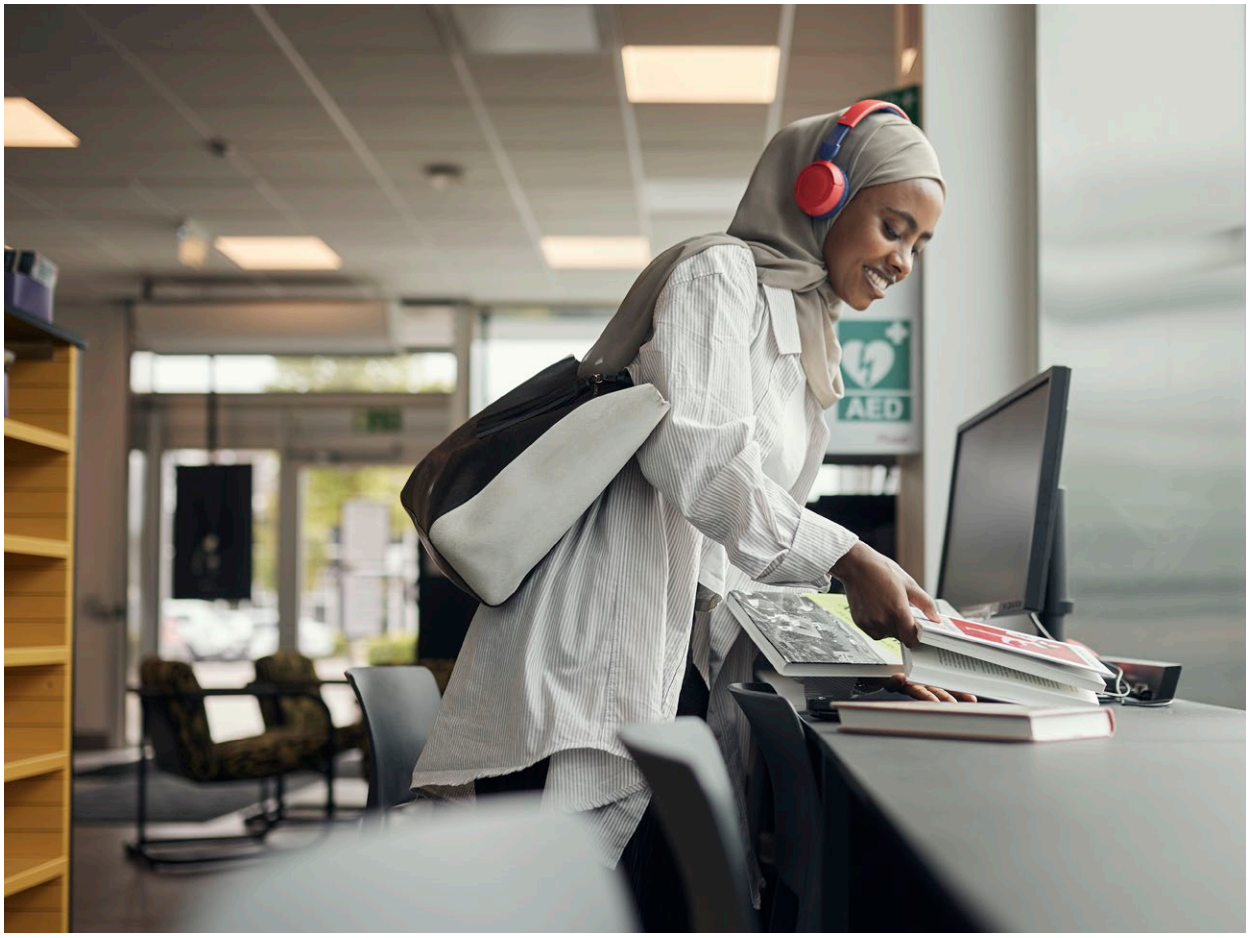
[113] See *Assignment to investigate a specific reimbursement model for training for retraining and further training for professionals* (U 2024:C).
[114] Examples include study associations, folk high schools, adult education centres, vocational education and training, initiatives within the framework of the European Social Fund, the social security councils, higher vocational education and training, and commissioned courses at universities and colleges.

What knowledge do professionals need?

Both professionals and employers, especially small and medium-sized enterprises and public organisations lacking strategic HR skills need to know what skills will be needed in the future. This is to be able to take responsibility for learning new things in order to remain employable, and to be able to support employees' continuous learning. At present, however, understanding what these skills are on their own is no easy task for either professionals or employers.

This is not because there is a general lack of information. Rather, the obstacle is that the information that is available is not sufficiently transparent. We currently lack a coherent, relevant and user-friendly compilation of information on what skills will be in demand in the future and what programmes are available to meet these needs. To address this, we need to regularly analyse the impact of AI. Analyses should focus in particular on heterogeneous effects where some groups (geographically, sectorally, occupationally or in terms of wages) are negatively affected. In this way, we can be responsive and act in time to assist these identified groups in the transition. This is necessary, given the rapid pace of change. Research provides some indications that such heterogeneous effects are visible.[115]

Much is already being done in this area. For example, the Swedish National Agency for Higher Vocational Education (MYH) is producing area analyses of the skills needs of different sectors, while the Swedish Higher Education Authority is responsible for producing planning documents for the dimensioning of education by educational institutions. Within schools, a major reform is now being launched which aims to ensure that the needs of the labour market rather than the wishes of the pupils will govern to a greater extent. In the light of this, the National Agency for Education will produce regional planning documents describing the needs of the labour market, which the municipalities will take into account in their educational provision.



Both professionals and employers need to know what skills will be needed in the future. Photo: Scaninav bildbyrå

[115] See, for example, Magnus Lodefalk, *Artificial intelligence and jobs*, Ratio 2024.

Proposals

- The AI Commission sees a need for further action in this area. Among other things, we believe that the Swedish Public Employment Service, with the help of authorities such as MYH and Statistics Sweden,[116] should be tasked with producing biannual forecasts of the impact of AI on the labour market and the training needs that exist.

- The Commission also believes that the Institute for Evaluation of Labour Market and Education Policy (IFAU) should annually compile the state of research on developments in the labour market in relation to developments in AI. This is with the aim of making labour market and education policy more evidence-based in the future. This information could be made available within the AI Hub (for more information on the proposed AI Hub, see below). The Commission estimates that IFAU should be allocated SEK 3 million annually for this task.

As a further step in this direction, the AI Commission believes that universities, colleges and other education providers urgently need to develop a relevant range of courses and programmes tailored to the AI skills needs of professionals. The programmes can be offered digitally, be short and free of charge, as they should be seen first and foremost as an extension of existing skills. In order to avoid duplication, the Commission recommends that these programmes be developed in collaboration between higher education institutions, public authorities, municipalities, folk high schools and other education actors. The private and public sectors and the social partners should also be involved and given influence in the process.

Proposals

- The AI Commission believes that the education system should receive a total of SEK 250 million in 2025-2027. The aim is to free up time for teachers to develop their skills and to make the necessary additions to the range of training courses for professionals.

- The task of coordinating and compiling the national initiative on lifelong learning should be given to the Swedish Council for Higher Education UHR) and the Swedish National Agency for Higher Vocational Education (MYH). Authorities should coordinate their missions and they should each be allocated SEK 5 million annually for two years for the assignment, thereafter SEK 2 million each per year. The course offering should be available on the AI Hub, which is presented in more detail below.

To reduce the lack of transparent information on which to base important decisions in the labour market, the AI Commission believes that an AI hub should be established. With the help of an AI hub, it is possible to gather information about available training and courses in AI, as well as information about developments in the labour market. The hub also provides the opportunity to offer and collect free AI tools on a common and easily accessible platform.[117] In addition to promoting AI adoption among Swedes, the hub would thus serve as an effective launch platform for free, quality-assured, AI services.

It is the AI Commission's assessment that such an AI hub should build on the work done within the framework of the Government Offices' collaborative programme *Skills supply and lifelong learning*, and the cross-functional work currently underway as a result of the collaborative programme.[118] In particular, the Social Security Fund (TSL) has made great progress in linking the supply of publicly funded AI training with labour market forecasts.

Proposal

- The AI Commission believes that the analysis and proposals developed in the Government Offices' Collaborative Programme on Skills Supply and Lifelong Learning should form the basis for an AI hub. The Swedish National Agency for Higher Vocational Education (MYH) may be a suitable lead organisation for the assignment, but this needs to be investigated quickly by the task force proposed in the chapter *Leadership and Governance to implement the Roadmap*. However, the government should immediately allocate SEK 10 million annually for the establishment and operation of the AI Hub.

Validation to build on existing knowledge

In order for the skills development of professionals to be as effective as possible, it is important to build on the skills they already have. For this reason, skills mapping and validation of professional experience and foreign education have long been discussed and partly implemented in Sweden. With mapping and validation as a starting point, relevant AI training programmes can then be identified.

[116] It is worth noting in this context that Statistics Sweden is tasked with making long-term forecasts on population, education and the labour market.
[117] See the proposal around Popular Education earlier in this chapter.
[118] This is an initiative launched by the government in 2019; see *Joint agenda for skills supply and lifelong learning*, Vinnova (2022).

The AI Commission considers it important to build a high-quality validation system to which all professionals and job seekers can turn to get their AI skills certified. Concrete proposals can be found in the Validation Delegation's report SOU 2017:18. The Swedish National Agency for Higher Vocational Education and Training has also been given a national responsibility for vocational validation. This is a good thing. However, the Commission believes that at present there is no specific mandate for universities and higher education institutions to validate knowledge needed for further studies in academia. This can involve the crediting of previous education but also the assessment of prior learning. Such validation can then be used to be eligible for admission to a particular course or programme.

Proposal

- The AI Commission proposes that universities and colleges should take greater responsibility than today for the validation of AI skills for further studies in academia.[119] The task should also include developing an AI service that can facilitate the work, including the compilation of documentation from a variety of sources. A greater public commitment than today is likely to be required to ensure that skills mapping and a validation system work in practice and maintain high quality. Resources for validation for this should be reallocated within the framework of adult education.

Effective transition for the unemployed

While the experience of past technology shifts indicates that the net effect on employment is unchanged in the long run, some groups may face unemployment in the near term, as the use of AI will in some cases replace existing jobs. Society's ability to help unemployed people find new jobs will therefore be important for the transition. Government labour market policy has gradually evolved since the 1950s and is currently exercised primarily by the Swedish Public Employment Service.

This is done in the form of job placement, various forms of preparatory measures such as labour market training, and various types of wage subsidies to give those with lower productivity a chance in the labour market.

Nowadays, large parts of the labour market policy measures are also carried out by independent actors, procured by the Public Employment Service. Labour market policy has since been supplemented with joint social security councils. These have been assigned similar tasks to the Public Employment Service, but with a slightly different target group. Broadly speaking, it can be said that these councils help jobseekers who are closest to the labour market, while the Public Employment Service, in its own operations or via a contracted operator, helps those who are long-term unemployed or have never had a permanent job.

It is the AI Commission's assessment that both government labour market policy and the joint social security councils have a very important role to play in the transition of the labour market in this technological shift. That said, it is important that measures to help the unemployed are both appropriate and effective. For example, government labour market policy has been criticised in recent years for focusing too little on labour market training (see, for example, the Fiscal Policy Council's report *Swedish Fiscal Policy* from 2024). The AI Commission shares this view and believes that online training in AI knowledge and how common AI tools can be used should be a matter of course for everyone registered with the Public Employment Service and social security organisations. This is because the cost of being absent from the labour market during rapid technological change is particularly high. Labour market policy thus has a particularly important role to play in compensating the unemployed for the loss of skills development in AI issues that takes place in the workplace. If labour market policy does not play this role, there is a risk that the gap in society between those who do and do not have a job will widen. It is the hope of the AI Commission that the proposal for an AI hub (see page 70) can help the unemployed to acquire relevant AI skills.

Proposal

- The AI Commission believes that all unemployed people should participate in courses, under the auspices of the Swedish Public Employment Service and transition organisations, aimed at improving their AI skills. Resources for this should be provided within the framework of labour market policy.

[119] Validation in higher education is about several different things. It can involve both the assessment of previous studies and the assessment of prior learning (e.g. professional experience). The assessments can then be used both for admission (fulfilment of eligibility requirements) and for credit transfer for certain courses/months. See, for example, the Swedish Council for Higher Education's report Pilot activities for the assessment of prior learning (REKO) (dnr 00399-2019). Work on this is also underway in the EU.

Innovation, entrepreneurship and venture capital

ChatGPT summarises:

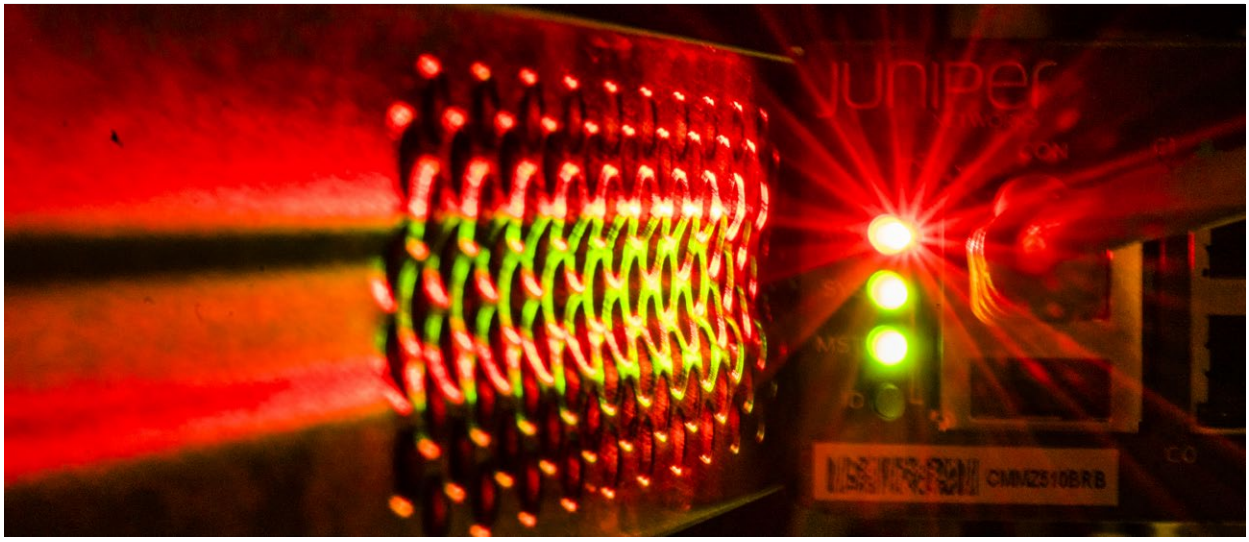
AI has already begun to profoundly reshape our society, and its potential to drive innovation is endless. But the question we need to ask is: how is Sweden faring in this transformation? We have long been at the forefront of innovation, but the rapid development of AI presents us with new challenges. While we are at the forefront in some areas, we are lagging behind when it comes to AI commercialisation and development. This imbalance must be addressed if we are to remain competitive.

In this chapter, we explore Sweden's current position in a global innovation context and highlight the actions needed to realise the full potential of AI. How can we ensure, through the right policies and targeted interventions, that we not only keep up but lead the way forward?

Sweden's current position in innovation, entrepreneurship and venture capital

Sweden has long been one of the most innovative countries in the world. This is confirmed by many international comparisons. The European Innovation Scoreboard (EIS) measures various aspects of innovation performance, organised into four categories and twelve dimensions. Sweden and Denmark have topped this index in recent years. The picture is also reinforced by the broad innovation index The Global Innovation Index, published annually by the World Intellectual Property Organisation. In 2023, Sweden was ranked second after Switzerland. The Ease of Doing Business Index from the World Bank shows how well or poorly business regulation works in different countries over time. In recent measurement periods, Sweden has been ranked as the fourth best country[120].

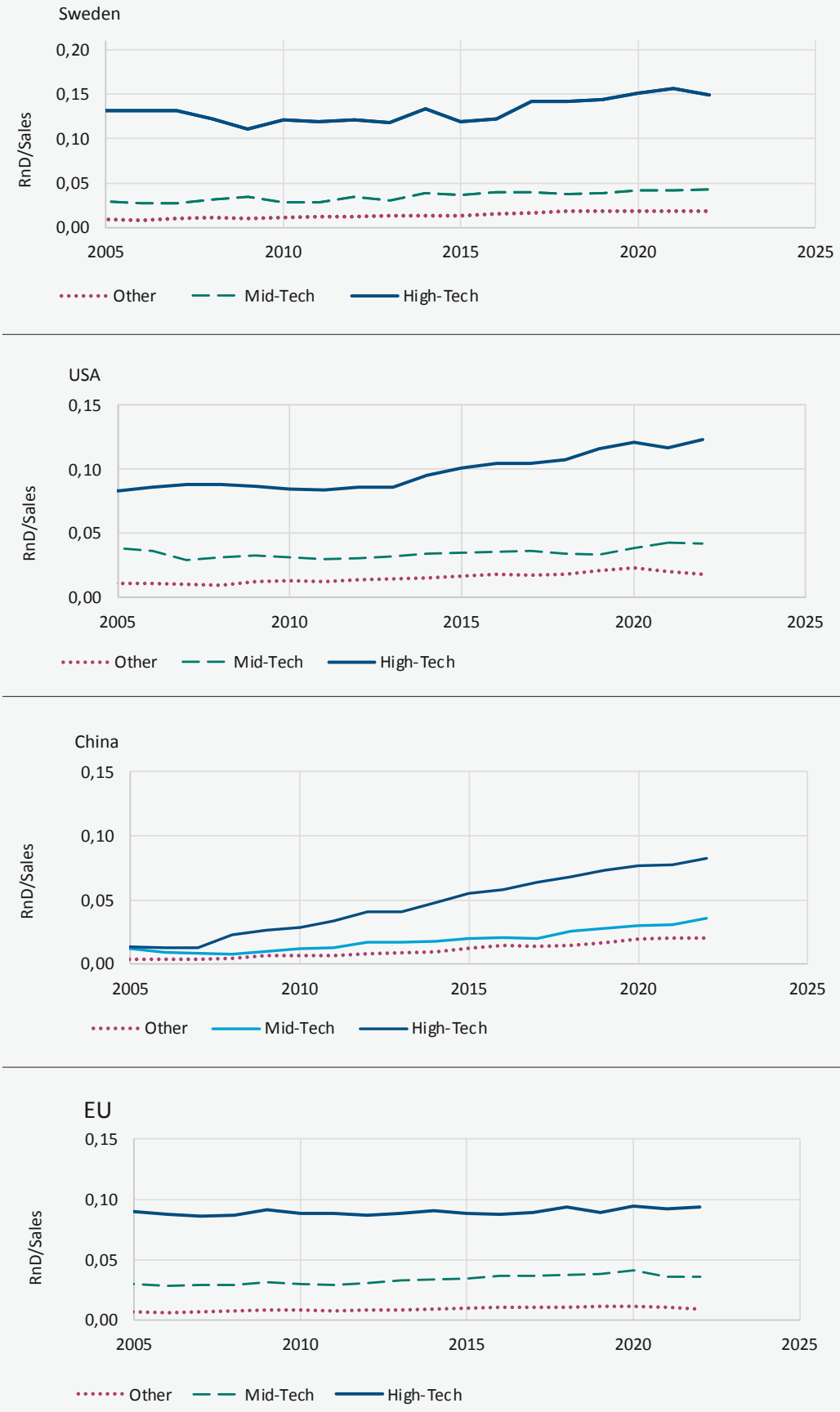
If we go into more detail and focus on AI-related variables, the picture becomes more mixed. In general, Sweden is relatively well advanced in research and development (R&D) and investment. As shown in Figure 1, Swedish firms exhibit relatively high research intensity in high-tech industries. R&D levels in Sweden are higher than the EU average, the US and China.



In general, Sweden is relatively well advanced in research and development (R&D) and investment. Image from inside the Berzelius supercomputer. Photo: Thor Balkhed/Linköpings University

[120] See Lappi, E., Norbäck, P., & Persson, L. (2024) *Productivity and productivity development in Sweden: International comparison and opportunities for reform*. Background report to the Productivity Commission.

Figure 1: R&D expenditure as a share of revenue in three different categories of industries

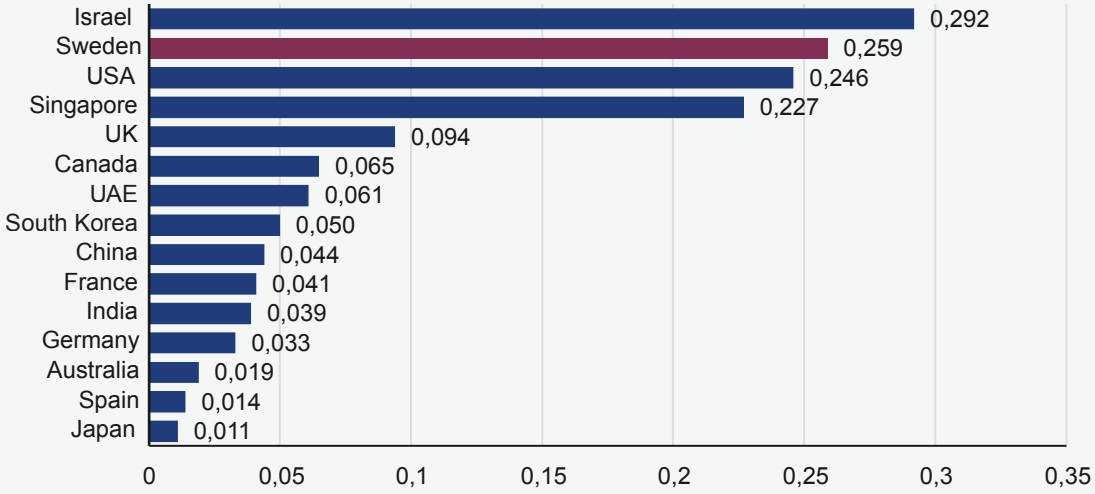


Source: EU Industrial R&D Scoreboard. Norbäck and Persson, 2024, *The AI-driven structural transformation of Swedish industry*, mimeo, IFN, Stockholm

Looking at total private investment in AI as a share of GDP, only Israel has a larger share than Sweden, see Figure 2.

Figure 2: Private investment in AI as a share of GDP, 2023

Total investment (per cent of GDP), 2023

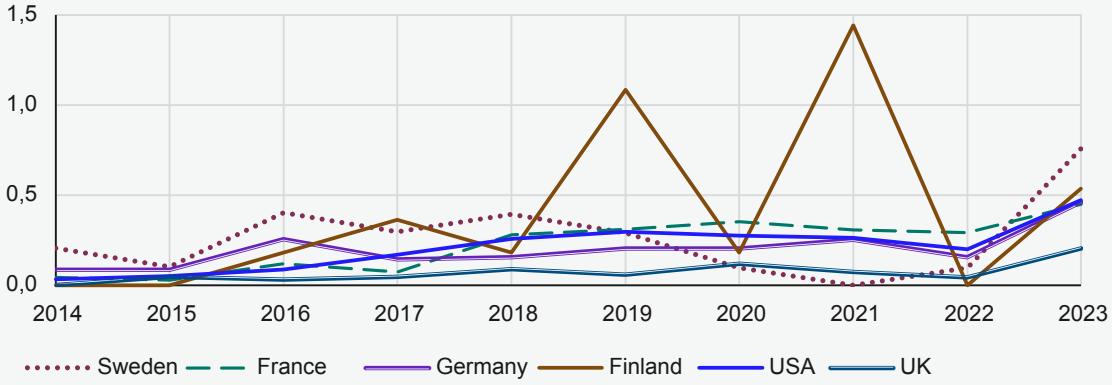


Note: The figure shows the 15 countries with the highest private investment in AI.
Source: The Artificial Intelligence Index, Stanford, 2024, Figure 4.3.8. Norbäck and Persson, 2024, *The AI-driven structural transformation of Swedish industry*, mimeo, IFN, Stockholm

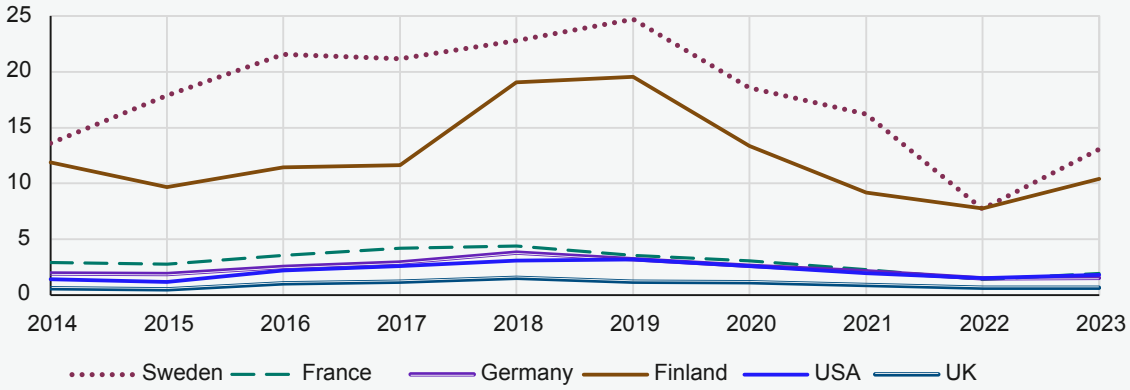
At the same time, Sweden has dropped places in the Global AI Index. In the sub-index measuring *Commercialisation*, which gives a relatively broad picture of the situation of AI companies in a country, Sweden has dropped from 16th to 18th place compared to last year's measurement. In the *Development* sub-index, the corresponding change is from 17th to 30th place. The Global AI Index is discussed in more detail in *Annex 2 KPIs for follow-up*. Another important measure of innovation performance is the number of patents applied for. As shown in Figure 3, Sweden ranks very high in several technology classes, such as digital communications and computer technology.

Figure 3: ***Number of patents applied for per million inhabitants***

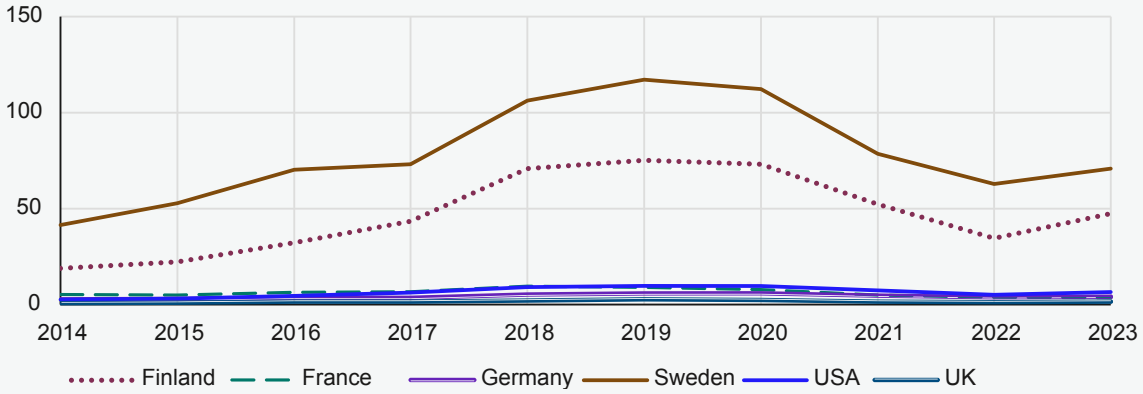
IT methods for management



Telecommunication



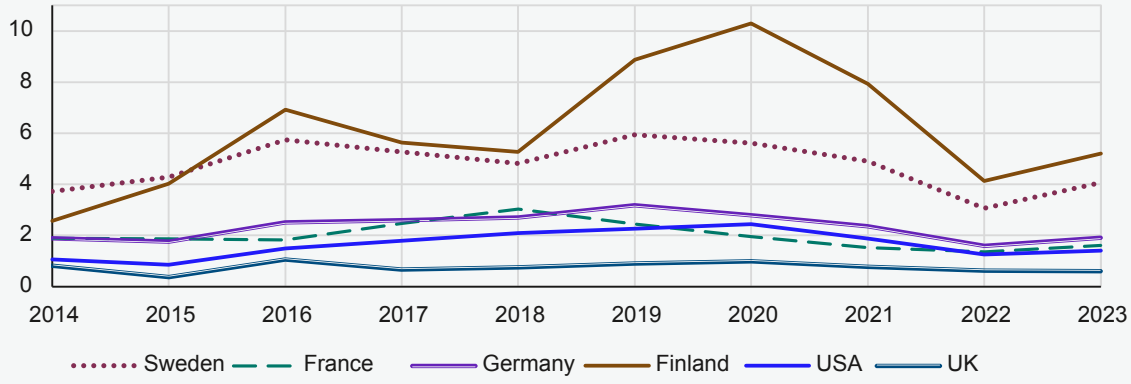
Digital communication



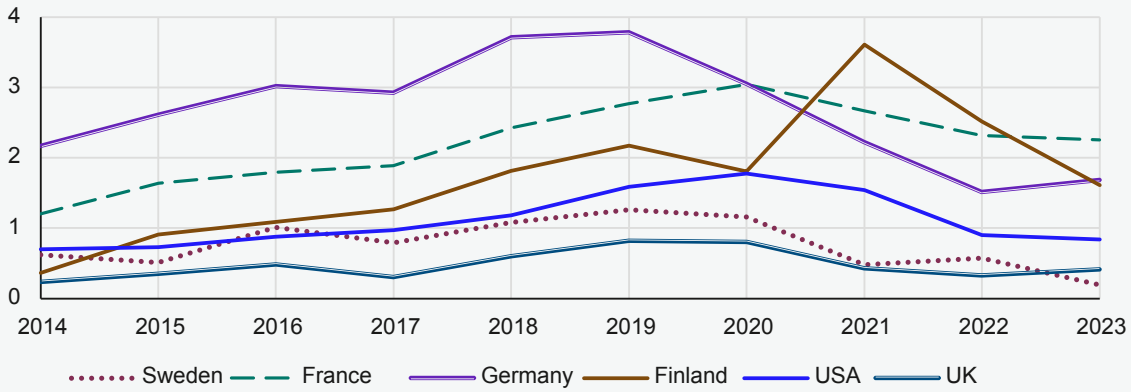
Source: EPO. Norbäck and Persson, 2024, *The AI-driven structural transformation of Swedish industry*, mimeo, IFN, Stockholm

Figure 3: ***Number of patents applied for per million inhabitants***

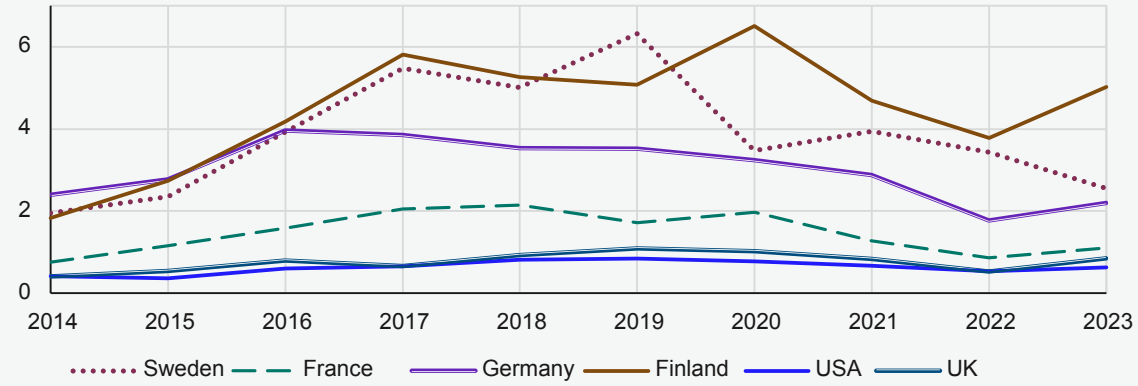
Audio-visual technology



Semiconductors



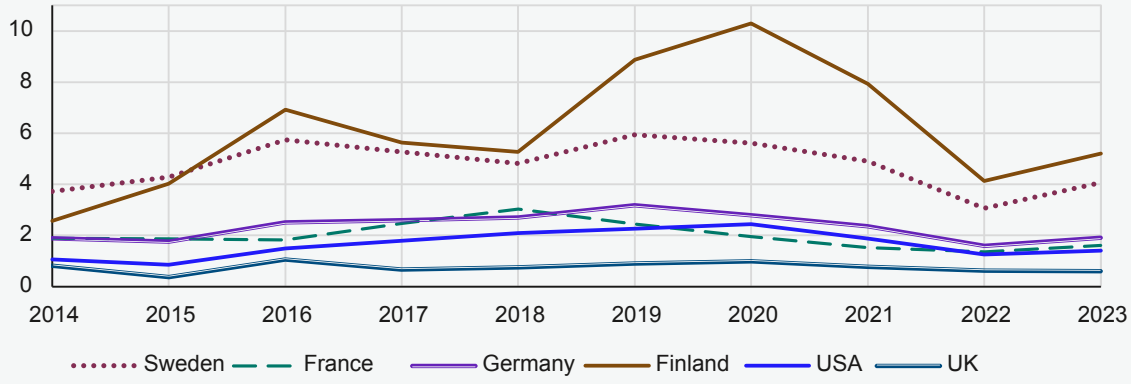
Environmental technology



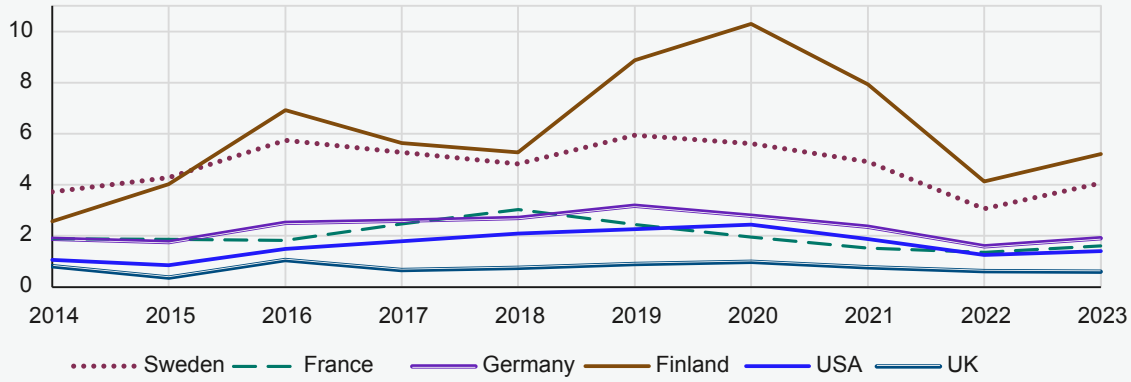
Source: EPO. Norbäck and Persson, 2024, *The AI-driven structural transformation of Swedish industry*, mimeo, IFN, Stockholm

Figure 3: ***Number of patents applied for per million inhabitants***

Computer technology



Biotechnology

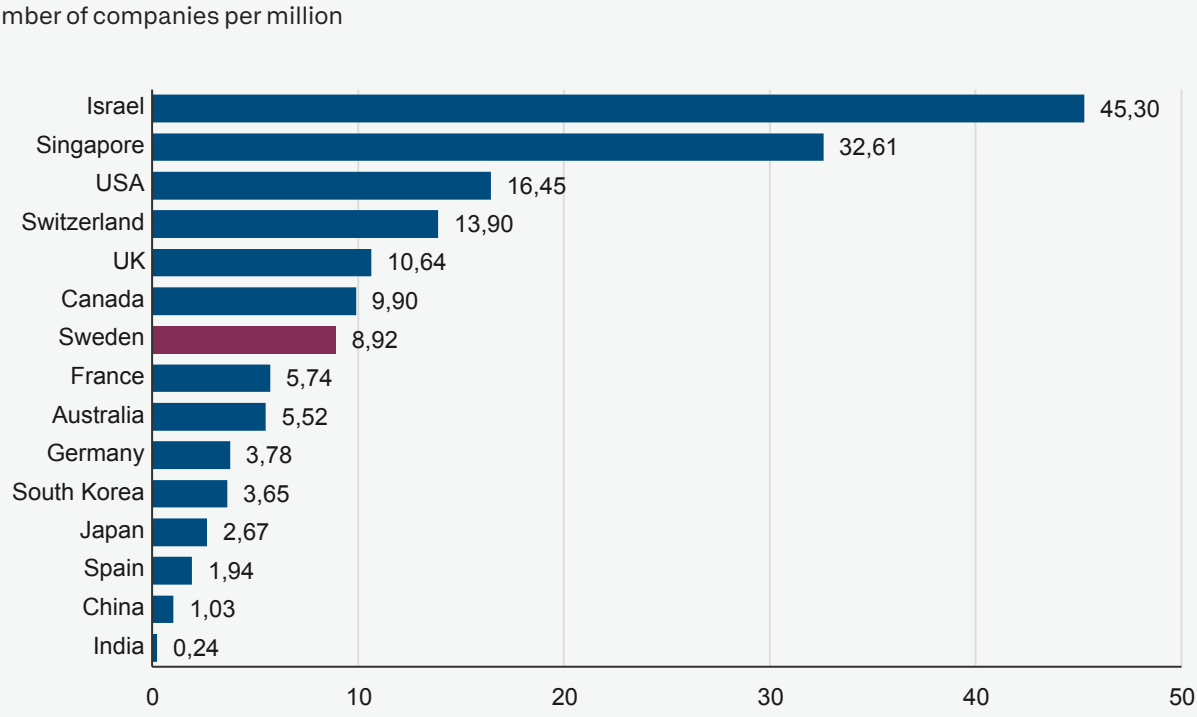


Source: EPO. Norbäck and Persson, 2024, *The AI-driven structural transformation of Swedish industry*, mimeo, IFN, Stockholm

However, the relatively high number of patents applied for appears to be AI-related to a limited extent. According to *Artificial Intelligence Index Report 2024*, we are not among the top 15 countries in the number of AI patents granted per 100,000 inhabitants.

Another way of studying the results of investment in AI is to look at the number of AI start-ups, see Figure 4. In relation to our population, Sweden is in seventh place. In other words, we are relatively well advanced, but not among the very best.

Figure 4: Number of AI start-ups in the period 2013-2023 per million inhabitants

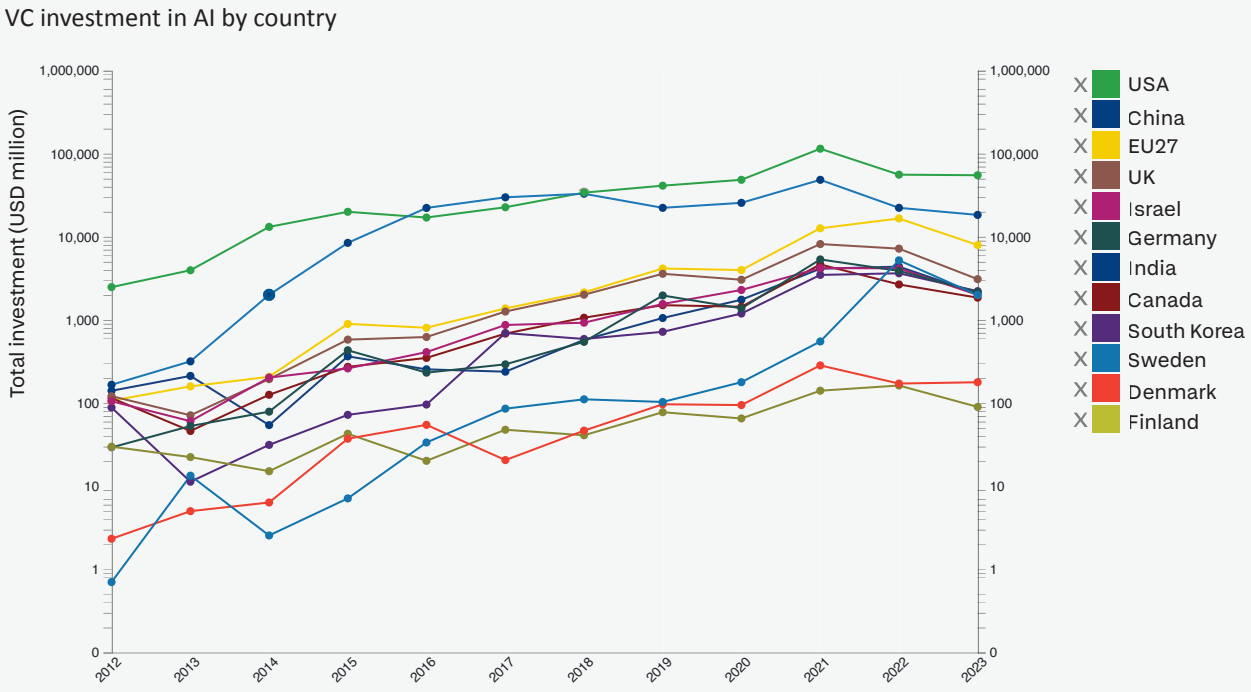


Source: *Artificial Intelligence Report 2024*, Figure 4.3.13. Norbäck and Persson, 2024, The AI-driven structural transformation of Swedish industry, mimeo, IFN, Stockholm

The financing of new businesses is crucial to a country's innovative capacity. Sweden has in recent decades had a well-functioning venture capital market and financed a number of successful start-ups in various sectors, not least in the digital field. Figure 5 shows venture capital investments received in the AI field for the top ten countries plus Sweden, Denmark and Finland. The vertical axis has a logarithmic scale so that different countries' venture capital investments can be illustrated in the same figure despite large differences in amounts. The figure shows that the three countries that have received the most venture capital in AI are the United States, followed by China and the United Kingdom. However, Sweden (indicated by circles) has also received a lot of venture capital in AI, especially in relation to GDP.

Sweden also has a very strong and well-functioning investor market for so-called business angels. Exactly how much capital is provided by these investors is difficult to say, as these are private individuals. However, in the wake of many successful company builds, there are a large number of wealthy people in Sweden who are now reinvesting part of its capital in the early development of companies. This early venture capital is very important for stimulating innovation. All in all, it can said that there is generally no lack of capital for early business development in Sweden. This is in stark contrast to the rest of Europe, where such capital is in short supply. This is particularly highlighted in the Draghi report on how to improve the EU's competitiveness, see also the chapter *International positions*.

Figure 5: Venture capital (VC) investments in AI and data companies



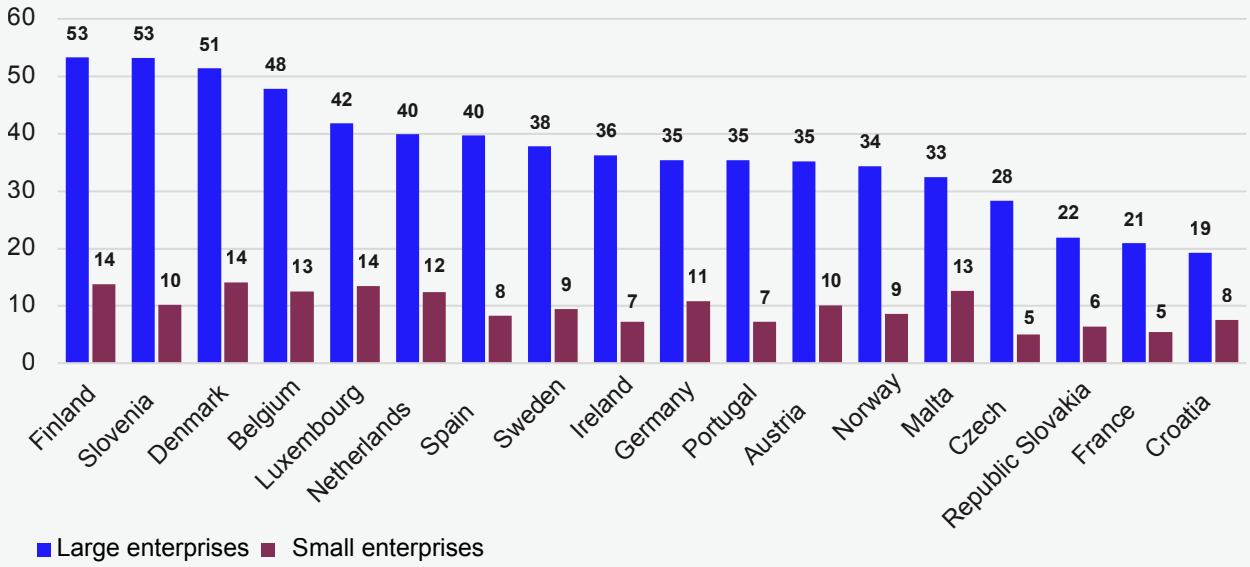
Source: OECD.AI.

The overall picture shows that the general innovation climate is good in Sweden. This is something we must uphold. General innovation policy should therefore continue to focus on stable rules of the game, limiting regulatory burdens and ensuring a well-functioning capital market. However, it would be a big mistake to interpret the current situation as if we can rest on our laurels. Firstly, there are indications that the situation is not as favourable in the AI field as it is elsewhere. The fact that we rank as low as 18th in Commercialisation and 30th in Development in the Global AI Index is a clear signal that all is not well. Secondly, experience shows that when it comes to major technological shifts, which are also developing at a tremendous pace, it is important to look not only at historical data but also at the direction and speed of development.

The AI Commission's view is that the introduction of AI as an innovation tool is generally too slow. This is something we have experienced in countless contacts with actors from both the private and public sectors. There are also several studies showing that Swedish companies use AI to a lesser extent than companies in comparable countries.[121] Figure 6 shows, for example, how Swedish companies are lagging behind many EU countries in the use of AI.

[121] See, for example, the European Commission's report *Digital Economy and Society Index* (DESI) 2022. p. 55.

Figure 6: Use of AI technologies among small and large enterprises (in per cent) for different EU countries



Notes: 'Large enterprises' refers to enterprises with more than 250 employees while 'Small enterprises' refers to enterprises with 10 to 249 employees. The vertical axis shows the percentage of companies that in 2023 used one of the following AI technologies at some point: text mining, speech recognition, natural language generation, image recognition and processing, machine learning (e.g. deep learning) for data analysis, AI-based software robotic automation as well as autonomous robots, self-driving vehicles and autonomous drones.

Source: Eurostat

AI places new demands on innovation. So what actions need to be taken? To understand this, we need to realise that AI places new, or more stringent, demands on the innovation process. The first thing to note is the speed of development. The second is AI's need for data, which dramatically changes the perspective on data and its value. This raises many complex issues, not least legal ones. We must ensure that we adapt our regulatory framework in time to the new reality we find ourselves in[122] . The third is that we will not realise the full potential of AI unless research, industry and the public sector find new ways to collaborate. Fourth, the network effects that characterise many AI tools contribute to significant economies of scale. This means that the first mover easily gains a dominant position.

Addressing these challenges and opportunities effectively requires a sound policy approach in the form of a framework. It can be used to identify socio-economically effective policy reforms or policy measures. An important starting point is to avoid government intervention, such as support measures, if market forces lead to favourable outcomes without intervention. However, sometimes market failures occur. This means that market forces alone cannot be expected to lead to an economically optimal outcome. For example, firms may tend to invest too little in training their staff if there is a risk of losing employees to competing companies. Therefore, government training measures targeted at employees may be justified when major technology shifts occur.[123] However, finding the right measures can difficult because governments do not have full knowledge, for example, of how AI technology will develop. In economics, this is known as regulatory failure. Support measures can thus be misdirected, costly and, in the worst case, counterproductive. It is therefore important to carefully consider what hinders and what favours innovation.

In the rest of the chapter, we will look at some key aspects of AI innovation:

- Data sharing, collaboration and problem solving.
- The importance of effective and understandable regulation.
- Measures for effective funding of AI innovation.
- The creative destruction process and technology dissemination.
- Maximising synergies in AI clusters and ecosystems.

[122] See also the chapter *Data as a prerequisite for AI development*.
[123] See more in the chapter *Skills boost for all*.

Data sharing, collaboration and problem solving

AI innovation and AI as a tool for product and process innovation have become an increasingly important part of the innovation market.[124] Here, access to data is crucial. This applies to private companies' access to public data, but also to data sharing within the public sector, as well as between private actors. Without access to data, there will be no AI innovation. This is particularly evident for young and small businesses, as access to self-generated data is limited. Larger companies may have access to their own data, but here too there is a great need, especially to access public data to train and develop AI models.

As noted in the chapter *Data as a prerequisite for AI development*, Sweden is unusually well supplied with data, but the opportunities to fully utilise it are limited. The AI Commission therefore proposes a number of measures to further facilitate access to data, both for private and public actors.

One measure is a reversal of the logic of the Public Access to Information and Secrecy Act. The basic rule should be that there is no confidentiality for the protection of the individual between authorities and between independent branches of activity within an authority. We also propose that a function be established to help and assist actors who wish to gain access to data from the public sector. This would significantly improve the conditions for AI-driven innovation in society.[125]

However, access to data is not all that is needed to capitalise on the innovation opportunities inherent in AI. It also requires collaboration, both within and between organisations. This is a challenge, but above all an opportunity, for a collaboration-oriented country like Sweden.

To varying degrees, this type of cooperation can be expected to occur spontaneously. For example, within each organisation, there is a higher demand for collaboration between different types of functions. For example, people with knowledge of business problems need to collaborate with AI experts, data managers and lawyers in order for AI solutions to contribute effectively to the development of the business. This is something that falls under the responsibility of each organisation.

It may be somewhat different with collaborations where the aim is to exploit synergies between different companies. There are a large number of companies that own data that could be of great use to other organisations and to society at large. In some cases, companies themselves can find business solutions that allow these synergies to be exploited to the benefit of all parties. For example, AstraZeneca has made its data available to smaller innovation companies, see box *Data as a competitive tool - an example from AstraZeneca*.

Data as a competitive tool - an example from AstraZeneca

In the development of new AI-based technology platforms, access to high-quality data is essential and often a limiting factor when developing AI-based solutions. This is especially true for smaller innovation companies that do not have large amounts of their own data.

As part of AstraZeneca's ambition to support and collaborate with smaller innovation companies, the company has established AZ BioVentureHub. It is an innovation platform that offers smaller development companies an opportunity to take advantage of the infrastructure and industrial expertise available within AstraZeneca. The environment has attracted companies from e.g. the US, UK, the Netherlands and Israel. Within the framework of BioVentureHub's activities, and in order to catalyse the development of AI-based methodologies, AstraZeneca offers access to its data in cases where mutually beneficial arrangements can be created.

The offer has resulted in the Israel Innovation Authority (IIA), the country's equivalent of Vinnova, now providing support to Israeli companies that want to establish operations in BioVentureHub in Gothenburg. One result of this is that in the spring of 2024, the company QurisAI chose to locate part of its development activities in Sweden. QurisAI combines the latest technology in chip-based biology with AI-generated prediction. A technology platform that not only accelerates clinical development but also reduces costs.

The example highlights that access to data is a powerful competitive tool. By offering access to industrial data, companies can cost-effectively attract world-leading partners. At the same time, the approach helps to increase expertise in the area concerned.

[124] See, among others, Babina, T., & Fedyk, A. (2024). *Artificial intelligence, firm growth, and product innovation*. Journal of Financial Economics, 151.
[125] For a full discussion of the AI Commission's proposals in the area of data, see the chapter *Data as a prerequisite for AI development*.

For Swedish society, the potential added value of this type of collaboration is significant. Firstly, our access to high-quality data can attract foreign AI expertise to Sweden. On the other hand, it can help Swedish technology companies to grow and develop. In the short term, it is likely that the companies will find market solutions on their own, as in the example of AstraZeneca. In the short term, however, there may be reason to consider the need for limited public support to strengthen this type of cooperation between companies.

However, AI also has the potential to help solve broader, cross-industry and cross-sector societal challenges - challenges that no single actor is able to solve on their own, and where the value of the solution benefits more than the parties involved. In these cases, it is unlikely that the market will solve it on its own. This could be finding innovations to help track down organised crime, facilitating the climate transition or addressing the shortage of doctors and nurses. This work should include actors from both the private and public sectors. It is urgent to find solutions that contribute to the realisation of this form of cooperation. A visionary example of what could be achieved through this type of collaboration is presented in the box *A vision of a Swedish health model*. As this type of project is relatively infrequent and can be relatively costly, it is not appropriate to cover the cost with annual budget allocations. It is therefore important to find alternative ways of financing this type of project.

The public sector, together with private actors, has a very important role in innovation cooperation. Public sector innovation can also benefit significantly from public cooperation. The chapter *AI for a public sector at the forefront* describes, among other things, a public AI Workshop. A lot of innovation could take place there. There are also good examples of successful collaboration between large and small public organisations. The smaller ones can benefit from the AI expertise and development of the larger ones. At the same time, the larger actors can use the smaller ones as test beds for their own AI innovations. There is potential here that can lead to increased innovation and adaptability and promote equal development among all parties involved, regardless of size or geographical location. The proposed AI Workshop is also intended to serve as a platform where private companies can contribute solutions to the challenges faced by public actors.

Proposals

- Vinnova should be commissioned to work with the business sector and public sector actors as soon as possible to investigate what is required to bring about major cross-sectoral projects, where the value of an innovation benefits more than the parties involved. The study should analyse how the state can financially support these projects, including the possibility of public-private partnerships, given that the projects cannot be expected to take place on a regular basis, and should often require relatively large amounts of money. The mission should also involve the creation of fora, with representatives of the private and public sectors, to identify possible cross-sectoral projects.

- Vinnova should be tasked with investigating, together with the business sector and the public sector, how opportunities can be improved for data to be shared to foster innovation.

The public sector, together with private actors, has a very important role in innovation collaboration. Photo: Shutterstock

Vision: A Swedish health model

Summary

This vision aims to describe how to set up a national project for the development a large-scale AI model based on Swedish health data. The project, called the Swedish Health Model (SHM), would build on the existing health bank infrastructure at Stockholm University. The aim is to create a world-unique resource for research and innovation in healthcare.

Swedish health model

Sweden is facing a historic opportunity to become a world leader in AI-driven healthcare. Our country is uniquely positioned with extensive digitised health data and a personal identity number system that enables seamless linkage between different data sources. This infrastructure, combined with our strong reputation for innovation and technology, puts us in an exceptional position to revolutionise global healthcare. The health bank project at Stockholm University has already demonstrated the enormous potential of using such data for the development of AI-based tools for healthcare (Dalianis et al., 2015). Now it is time to take the next step and launch a national signalling project on the scale of the US Apollo programme - a project that aims not only to create a world-unique resource for health research, but also to position Sweden as the global hub for health innovation.

The aim of this ambitious initiative would be to create a national AI-driven health model of international excellence - the Swedish Health Model (SHM) - which could revolutionise everything from diagnostics to treatment planning.

The SHM would provide a large language model with a comprehensive understanding of healthcare problems. By collecting and processing data from sources such as electronic health records, quality registries and genetic databases, the model can serve as a powerful tool in healthcare, providing decision support to healthcare professionals, identifying risk factors and predicting disease progression.[126]

SHM has the potential to fundamentally change healthcare through more precise, personalised and proactive treatment. This would not only improve public health but also lead to significant economic savings. It could also attract significant international investment in the Swedish health sector, creating thousands of skilled jobs and attracting world-leading experts in AI, medicine and data science to Sweden. By strengthening our position as a global knowledge nation, SHM would drive strong growth in health technology entrepreneurship and establish Sweden as an international centre for innovation in health technology. In addition, SHM can pave the way for a new export industry in AI-driven healthcare technology and contribute to improved health the world over.

By investing heavily in this project, Sweden is showing leadership on one of the most crucial issues of our time - how we can use the latest technology to improve health and quality of life for all. This is not just a research project, but a national vision with the potential to redefine Sweden's role in the global economy while contributing to a healthier world.

Structure of the project

The project is structured around three main areas: governance, which aims to coordinate and anchor the initiative within the sectors of society that need to be involved; a regulatory committee, responsible for addressing data protection, ethics and patient safety issues; and a research centre, whose main task is to develop SHM.

Governance

Those who will govern the SHM need to bring together a diversity of perspectives while anchoring the initiative both practically and ethically. One possible solution could be to establish an independent foundation with overall responsibility for the governance of the initiative and the task of data management. Given the multidisciplinary nature of SHM, such a foundation should include prominent representatives from many different sectors of society.

To provide key scientific expertise, leading researchers in AI, medicine and ethics are needed, both from top Swedish and international universities. Industry should be represented by tech companies with expertise in AI and large-scale data management, global pharmaceutical companies interested in AI-driven drug development, and health technology companies with practical knowledge of implementation. The public sector plays a key role in this initiative, with representatives from authorities such as the National Board of Health and Welfare and the Swedish Authority for Privacy Protection, as well as regions and municipalities that can ensure the link to practical healthcare. The board should also include investors, such as venture capital firms and large pension funds, who can provide the necessary resources for long-term development. International organisations such as the WHO and the

[126] The initiative is inspired by international projects such as Med-PaLM 2, a health model with deep knowledge of medical issues. See Singhal, Karan, Tao Tu, Juraj Gottweis, Rory Sayres, Ellery Wulczyn, Le Hou, Kevin Clark et al. *Towards expert-level medical question answering with large language models*. arXiv preprint arXiv:2305.09617 (2023), and for example applications: Qian, Jili, Zhengyu Jin, Quan Zhang, Guoqing Cai, and Beichang Liu. *A Liver Cancer Question-Answering System Based on Next-Generation Intelligence and the Large Model Med-PaLM 2*. International Journal of Computer Science and Information Technology 2, no. 1 (2024): 28-35.

EU Health Commission should be included to ensure that the project follows global standards. Patient organisations are also important to keep the patient perspective in focus.

The Foundation will actively seek funding from several sources, such as investments from industry in the form of capital and in-kind resources, research grants from national and international funders, and philanthropic donations from both Swedish and international donors. At the same time, core government funding will be necessary to ensure the sustainability of the project.

To ensure transparency and accountability, the Foundation will report annually to Parliament and the public on its activities and finances. There will also be an ethics committee that continuously reviews compliance with ethical guidelines. The Foundation's international organisation creates a unique platform for collaboration between sectors and countries. It allows for global exchange expertise and resources, while anchoring the project in Swedish healthcare values.

Regulatory Committee

A dedicated committee, the Health Data and Ethics Committee (HDEC), should be established with a mandate to address regulatory issues related to data protection, ethics and patient safety. The HEC should design an innovative legal framework for the implementation of the project, with the highest standards for privacy and ethics. The Committee will be composed of lawyers with expertise in health and data law, doctors and health experts with experience in clinical research and AI, computer scientists with knowledge of large-scale data management, ethicists specialising in medical and technological ethics, patient representatives and international experts in data protection. The KHE will propose new legislation to enable the safe and ethical use of health data, including a potential 'Swedish Health Model Act". This is to provide the project with the necessary legal framework.

The KHE will also lead a public dialogue on the ethical implications of AI to build public trust and support. In addition, the Committee will have the potential to act as an advisory body to the government and other relevant stakeholders. The KHE will report directly to the government and the Foundation's Board of Trustees, and its recommendations will guide the implementation of the project. With a strong mandate and a broad composition, the KHE can develop a legal and ethical framework that can become a global role model for balancing innovation, privacy and societal benefit in AI-driven healthcare.

Research centre

A world-class interdisciplinary research centre, the Centre for AI and Health (CAIH), will be established as an international centre of excellence. CAIH will be the hub for the development of the Swedish health model and serve as a global hub for pioneering research in AI and health. The main campus could be located at Karolinska Institutet with nodes at other leading Swedish universities and international partnerships with top universities such as MIT, Stanford, Oxford and Tsinghua.

CAIH research should focus on developing the Swedish health model and conducting basic research in AI and machine learning, as well as clinical studies to validate AI models in healthcare settings. CAIH can also conduct ethical AI research with a focus on transparency and fairness, and combine AI with genomics and other "omics" fields.

The Centre would attract world-leading researchers, including through visiting researcher programmes for international experts. In addition, the initiative provides an excellent opportunity to establish a PhD programme in collaboration with global partners to train future leaders in AI and health. To foster innovation, CAIH can establish the "Swedish AI Health Prize", an annual award for ground-breaking ideas. The centre can also advise regions and authorities on innovation procurement, develop standards for AI implementation and organise training for policy makers.

CAIH can launch inspiring initiatives to stimulate AI development in Sweden. For example, the centre could organise an annual international conference on AI and health in Stockholm, where researchers, innovators and industry leaders gather to share ideas and insights. By publishing an open access journal on AI innovations, CAIH can make cutting-edge research accessible to a wider audience. In addition, a fellowship programme for clinicians could be established. It provides the opportunity to work directly at CAIH, thus bridging the gap between research and practice.

What could it cost?

The total cost over a five-year period could be SEK 5 billion.

This cost corresponds to approximately four per cent of Sweden's annual healthcare budget of approximately SEK 110.3 billion (2023/24). The investment is justified by the potential for significant efficiency gains and improved quality of care through AI-supported decision-making and research, and ultimately by enabling the Swedish people to be healthier, live longer with a high quality of life and receive more effective treatment in case of illness.

Conclusion

By building on Sweden's unique position in health data and AI research, the Swedish Health Model (SHM) has the potential to revolutionise healthcare, strengthen Sweden's position as a leading research nation and create significant societal benefits.

Effective and understandable regulation

One of the clearest messages the AI Commission has received in its meetings with industry representatives is the need for effective and understandable regulation. It is clear that the design and implementation of new regulation is often perceived as difficult to understand and varying across EU Member States. Mario Draghi, in his report *The Future of European Competitiveness*, emphasises that European regulation needs to strike a better balance between prudence and innovation with more coherence across EU Member States. According to the report, more than 60 per cent of EU businesses identify regulations as a barrier to investment. 55 per cent point to regulations and administrative burdens as their biggest challenges.

In the AI field, it is the upcoming AI Regulation,[127] the General Data Protection Regulation (GDPR) and the new Data Regulation that are relevant. In these cases, it is clear that there are many ambiguities and that there are major problems in interpreting the rules. This calls for measures to reduce information and coordination problems between different supervisory authorities in the field of AI. Companies' compliance costs can also be reduced by harmonising regulations where authorities have overlapping responsibilities, or simplifying and integrating related regulations. This applies within Sweden as well as within the EU. The AI Commission therefore welcomes the government's assignment to eleven authorities to reduce the regulatory burden on businesses, as well as the establishment of the Council for Simplification.[128][129] The Commission emphasises the importance of the work placing great emphasis on AI-related regulatory challenges.

One way to clarify and develop the regulatory framework for AI adoption in business is through regulatory sandboxes. These allow companies to develop and train AI tools in a confined and secure environment. A regulatory sandbox programme provides an institutional framework that allows regulators to authorise and monitor companies testing an innovative product or business model, often with some regulatory support or relief for participating companies. Using sandboxes increases the incentives for companies to invent and commercialise in AI.[130] To maximise innovation, it is important that the authority actively supports companies adapting their business models to comply with existing regulations. The implementation of regulatory sandboxes not only means that companies receive help to navigate within existing regulatory frameworks. It also allows regulators to learn about new technologies in a better and faster way and therefore to develop better regulation of new technologies more quickly.[131]

Since 2022, Sweden has had a regulatory sandbox under the responsibility of the Swedish Authority for Privacy Protection (IMY). It is open to both private and public sector organisations and is set up in addition to the regulatory sandbox to be established under the AI Regulation. The chapter *AI for a public sector at the forefront* proposes to expand the IMY sandbox with a dedicated public sector track, including an advisory function. Private companies have the same need to be able to test business ideas in a controlled environment, and to receive guidance on AI and data protection regulations.[132]

Proposals

- Develop and expand IMY's regulatory sandbox for private companies. To meet the business community's need for clarity on data protection regulations, IMY should be tasked with providing individual private actors with non-binding information within a maximum of four weeks on whether various AI solutions are in line with data protection regulations. The authority should also be able to provide information to small and medium-sized enterprises on where to turn regarding issues that are outside the IMY's area of expertise. The estimated need for appropriations for these tasks is SEK 8 million annually. The service will be available through the single entry point proposed by the AI Workshop.

- Instruct the appropriate authority to establish as soon as possible an advisory and regulatory sandbox function for both the private and public sectors in line with the requirements of the AI Regulation. It is crucial that the government acts to remove the uncertainty that currently exists around the application of the new regulation. An inquiry was set up in September to make proposals on the application of the AI Regulation.[133]

[127] The AI Regulation is described in the chapter *Access to international AI resources*.
[128] See *Assignment to simplify the regulatory framework in order to reduce the regulatory burden on businesses* (KN2024/01546).
[129] The Council for Simplification will identify areas of particular interest to the business community from a simplification perspective and submit well-reasoned, concrete and elaborate proposals for simplification measures to the government.
[130] Norbäck, P., & Persson, L. (2024) *Why generative AI can make creative destruction more creative but less destructive*. Small Business Economics, 63, 349-377.
[131] Fahy (2022). Fahy (2022). Fahy, L. (2022). *Fostering regulator-innovator collaboration at the frontline: A case study of the UK's regulatory sandbox for fintech*. Journal of Public Policy, 44(2), 162-184.
[132] The AI Regulation's requirements for regulatory sandboxes are described in more detail in the chapter *Access to international AI resources*.
[133] Safe and trusted use of AI, Dir. 2024:83.

Measures for effective funding of AI innovation

A well-functioning financial market is of great importance for an AI-based structural transformation. However, financial markets have some specific challenges. A fundamental problem in corporate finance is asymmetric information. The owners of the company typically know more about its potential than potential financiers. As a consequence, some profitable investments risk not receiving financing on market terms because owners value the company more highly than financiers.

Getting bank loans can also be a challenge for young AI companies. This is because banks are less well placed to handle investments in intangible assets, such as algorithms and models, which are often the asset class AI companies have. The venture capital market and the stock market are therefore usually better suited to finance investments in AI, as they manage risk by taking a large share of the potential upside in company returns if the company performs well.

While capital and equity market financing is generally very well-functioning, there may be structural reasons that make it problematic for some AI companies. These include the fact that some AI investments are made very early in a company's development. These investments are often associated with extremely high upfront costs, high technology risk and slow revenue streams. This means that it is not always appropriate for venture capital firms to enter these businesses at an early stage. Companies may have a sound business idea but if the time horizon, technology risk and initial investment do not match the natural dynamics of the venture capital firm, funding may not materialise. There is therefore a risk that there will be too few such investments from a socio-economic perspective. It is particularly important to promote the development of disruptive technologies and capabilities that aim to unlock new opportunities for innovation. This is about tomorrow's breakthrough innovations that have the potential to revolutionise the use of AI, just as the development of large-scale language models has done. It can also be difficult to find funding for companies that are not scalable enough to meet the return requirements of venture capital firms. If the business idea is more localised, for example in the form of solving a problem that is specific to Swedish healthcare, there may also be problems with funding, even if the idea is viable and can deliver significant societal benefits.

It is also of great importance that Swedish innovation companies benefit from the resources provided by the EU. The chapter *Computing power* describes the EU's AI Factory initiative. The initiative means that, through co-financing between the host country and the EU, small and medium-sized enterprises, among others, have heavily subsidised access to computing power and resources for innovation and development of AI models and applications. Sweden has also applied to host an AI Factory.

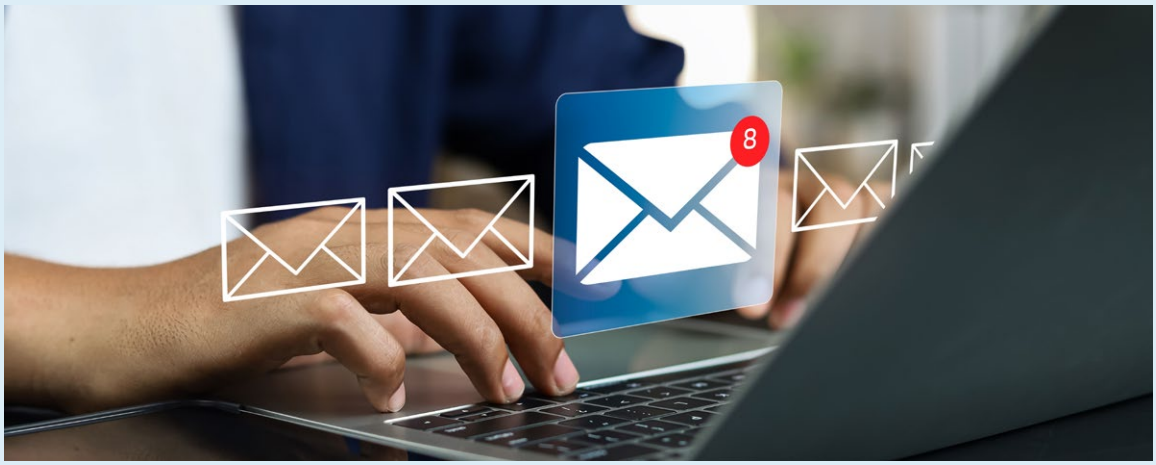
If the application is approved, it would further contribute to developing an ecosystem for AI among Swedish companies. The chapter *International positions* also proposes measures to increase opportunities to participate in various EU programmes, including through increased funding for co-financing of Digital Europe projects in the order of SEK 200 million per year.

Proposal

- Increase support via Vinnova and Almi to projects and viable AI start-ups that for structural reasons, such as high technology risk, for example due to the development of disruptive technologies, or lack of scalability, do not receive financing in the private capital market. In total, the annual support should be increased by SEK 100 million per year, over a five-year period.

The creative destruction process and the dissemination of technology

Crucial to an effective AI-driven creative destruction process is that the companies using the new technology most effectively grow (organically or through acquisition) while less effective companies decline in size. This requires well-functioning competition. Competition policy therefore plays an important role in counteracting market failures in the form of market power of dominant firms.



Creative destruction

Joseph Schumpeter's theory of creative destruction describes how innovation and entrepreneurship drive economic development by replacing outdated technologies and business models. According to Schumpeter, entrepreneurs' innovations lead to the breakdown of existing structures and companies, creating space for new developments and knowledge. An example of creative destruction is how email revolutionised communication, making older technologies like fax and telex obsolete.

There is a risk that the creative destruction process in business will deteriorate in the wake of AI development if only the very largest companies are able to successfully utilise AI in their operations. A recently published study by Statistics Sweden shows that AI use in Swedish small businesses is significantly lower than in large Swedish companies. According to the EU Digital Economy and Society Index (2023), around 10 per cent of Swedish companies with more than ten employees used AI - the corresponding proportion was around 15 per cent in Denmark and Finland.

The use of AI allows larger companies to become more productive and expand their market share. This affects the competitive situation and poses new challenges for competition authorities. The risk of increased market power of the leading firms in an AI-based structural transformation must be assessed as relatively high. This is because the AI-based market is strongly associated with network effects and strong economies of scale in gathering large amounts of data and training models.

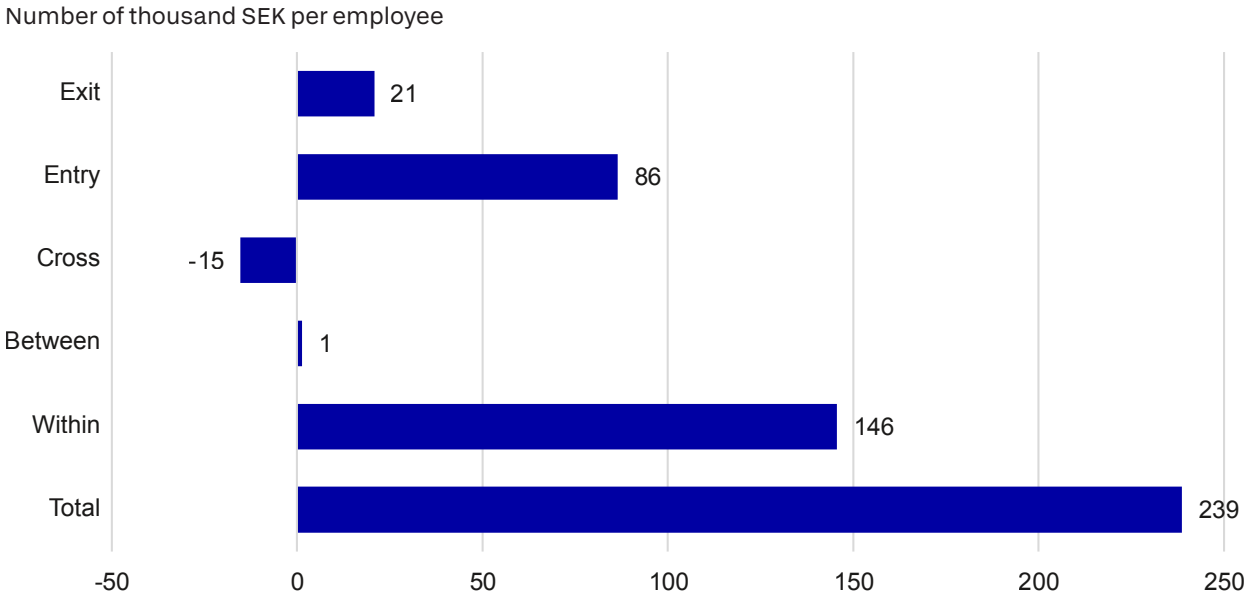
The creative destruction process can be improved if open-source AI models become widely available. An open-source AI ecosystem enables different types of actors from industry, the public sector, non-profit organisations, academia and individual coders to have broad access to developed AI models. This gives these actors access to industry-leading production technologies that they would never otherwise have access to. It stimulates entrepreneurship and the creative destruction process. It is thus important to ensure that open source models can operate without major competitive constraints. At the same time, it is important to recognise that open source also means that users can remove security roadblocks in large basic language models.

However, technology disseminiation in the Swedish corporate sector is not just about the development of young AI firms and the elimination of low-productivity firms, which do not absorb the technology. Instead, the major increase in productivity tends to come from already established companies increase their productivity. This is largely done by groups creating new subsidiaries through acquisitions and supporting them by implementing new technologies, such as AI. In Figure 7, this relationship is illustrated by the fact that the bar for within-firm effects is significantly longer than the bars for entry and exit.

The above analysis suggests that mergers and acquisitions (M&As) may become an increasingly important part of AI technology dissemination and productivity development, but at the same time represent a risk of excessive concentration and market power.[134] It is also very important that foreign acquisitions are scrutinised in terms of security aspects and other national interests. This is because companies' AI activities are often associated with sensitive data and technology.

[134] Persson, L., Edmark, K., Norbäck, P.-J., & Prawitz, E. (2024). *Productivity development in the business sector*. SNS Business Council Report.

Figure 7: Contribution of different factors to the change in productivity in the Swedish business sector from 1999 to 2021



Source: Norbäck and Persson, 2024, *The AI-driven structural transformation of Swedish industry*, mimeo, IFN, Stockholm.

Maximising synergies in clusters and eco-systems for AI

The Swedish climate for research, innovation and production is important for both business and the public sector. This includes effective collaboration in an ecosystem of academia, public authorities, municipalities, regions and companies. The larger private companies in particular are dependent on a well-functioning ecosystem for their operations in Sweden and to anchor continued investments in the country. A well-functioning and coordinated ecosystem stimulates synergies, reduces the risk of innovative double-tracking and further develops the knowledge and solutions of different actors.

Unlike many other technologies, the implementation and adoption of AI technologies and solutions involves value creation and synergies across all sectors of society. This also means that crucial aspects of systematically introducing AI in organisations, such as leadership, organisation, skills supply, legal, software, hardware, data and deployment, are more or less the same regardless of sector and application. Active packaging and dissemination of lessons learnt, use cases, solutions and tools are therefore a cost-effective way to invest. The Swedish ecosystem, characterised by collaboration and a high degree of trust, has for many years successfully established national collaboration platforms that create value, strengthen the ecosystem, and share practices and use cases.

The research suggests that it is difficult to create new clusters from scratch. A better approach is deemed to be to reduce the local costs of experimenting with ideas, and provide a good quality of life for potential participants in existing AI clusters. AI technology support is more likely to succeed if it is broadly based on a sector and avoids trying to "pick winners" by targeting individual companies.[135] The AI Commission notes here that a national programme for collaboration and sharing in an ecosystem around AI is already established in Sweden. AI Sweden, the national centre for applied AI, has shown positive effects of such work and, as of September 2024, had brought together around 140 partners representing many sectors.

Another important component of enabling experimentation and innovation is increasing links between industry and academic research. As described in the chapter *Collaborative cutting-edge research*, technological developments are now so rapid that the boundaries between basic research, applied research and innovation are being erased. On the one hand, industry in some cases lacks the cutting-edge AI expertise of academia that is needed to develop advanced AI solutions. Academia, on the other hand,

[135] In this context, the Government's assignment to Vinnova to identify strategically important technologies can be noted. See *Assignment to identify and propose strategically important technologies for Sweden* (KN2024/00977).

has limited access to the industry-based data needed to develop new innovations in certain fields. This coordination problem hampers the innovation market. To address this problem, Canada has implemented an industry-academia collaboration, the Mitacs programme, where companies define business opportunities and related AI technology problems and provide data, and where graduate students, under the supervision of PhD researchers, work on the AI technology solutions, see the box *Example from Canada*.

Photo: Shutterstock

Example from Canada

Canada's Mitacs is a major programme for innovation projects across all sectors in the country. Participating organisations have access to research teams, talented individuals and funding. Over the past decade, Canada has invested more than the equivalent of 6 billion Canadian dollars in the programme. In the current three-year phase, the equivalent of 10.6 billion Canadian dollars is being invested. Over the past five years, 8,000 industrial partners and 85,000 graduate students have participated.

Se www.mitacs.ca

The further development of large language models for the Swedish language

The commercial large language models that are available today, such as ChatGPT, are trained on text data from the web. As Swedish is a relatively small language, and thus represents a small proportion of all text data on the web, these models tend to be less good in Swedish. This limitation means that interpreting services, health care documentation services and other language driven algorithms that are developed on the basis of commercially produced language models risk being of too low a quality to be useful. When a language model is trained on another language (such as American English) and then translated into a Swedish version, nuances in the language are also lost. The translations tend to become Americanised in their linguistic logic.

Against this background, there are a number of reasons for developing language models in Swedish, such as preserving Swedish cultural identity and national security considerations. This is because even critical services and tools would otherwise have to be developed on the basis of inadequate language models. To develop a language model of its own also contributes to valuable capacity building. The AI Commission therefore believes that language models should be developed in Sweden in Swedish.

Access to large language models in Swedish should be seen as a public good[136] for which the state should have ultimate responsibility. One of the reasons for this is that there is otherwise a risk that larger companies, with the resources to build their own large models, will gain an unfair competitive advantage over smaller companies by restricting access to these models. However, it should be possible to develop the models in cooperation between the public and private sectors, so that they can be used both in the private sector and in public sector. For reasons of efficiency, cooperation within the Nordic region or the EU is desirable.

What is available today?

One actor regarding the creation of a Swedish language model is the National Library of Sweden (KB). Since 1661, it has collected everything printed in Sweden. It has also digitised huge quantities of newspapers, music, radio programmes, etc. This means that KB has access to material that is virtually unique in the world. This access is a great advantage in the work to create a Swedish language model of good quality. KB has also used the material to produce several smaller, customised language models

[136] A public good is a good or service whose value to a consumer is not affected by someone else consuming the good or service. In addition, it is difficult to prevent someone from consuming, making it difficult to pay for the good.

in Swedish. These are freely available to the public under open licences.

Another actor is AI Sweden, which together with the governmental research institute RISE[137] and WASP WARA Media & Language,[138] has developed GPT-SW3. It is the first really large language model for the Nordic languages, mainly Swedish. The model is based on the same technical principles as OpenAI GPT-4. GPT-SW3 is trained on Linköping University's supercomputer, Berzelius. This model is also freely available to the public with an open licence.

Copyright and the way forward

With regard to the further development of language models, it is crucial to consider the copyright protection of material used to train language models. KB's view is that the Agency has the possibility to train and make models available under an exception in the Copyright Act.[139] However, several right holders do not share this view. They also object to the methodology used to develop GPT-SW3. It is therefore necessary to develop and implement a generally accepted remuneration model, probably based on a system of contractual licences. Resolving this issue can avoid lengthy legal processes and increase public acceptance for the models being developed. If the models are to be used for research purposes, this should be possible at virtually no cost.

Proposals

- The AI Commission believes that a national coordinator should be appointed within the framework of the comitology system to coordinate further work on the development of large-scale language models for the Swedish language. Given the central role of the state, the need to involve several different actors and the necessity of solving the copyright challenges in a satisfactory manner, the AI Commission believes that it is natural for the state to coordinate and drive this work. Alongside KB and AI Sweden, representatives from universities, the public sector[140] and private industry should participate in the development work.

- The national coordinator should be tasked with coordinating and driving forward the development of large-scale multimodal models for the Swedish language together with relevant stakeholders and possible international partners. The coordinator should also drive the development of a remuneration model that fairly compensates right holders whose works are used to train large models. As part of this task, the coordinator should work closely with right holders, model trainers and collective rights management organisations. In addition, the coordinator should consider the need to establish cooperation with other Nordic countries and within the EU. Finally, the coordinator should also consider the need to develop large-scale language models for the national minority languages.

[137] RISE (Research Institutes of Sweden AB) is a Swedish state-owned research institute, which collaborates with universities, industry and society for innovation development and sustainable growth.

[138] WASP WARA Media & Language is a platform within WASP that focuses on interdisciplinary collaborations in media, AI and language. The platform promotes collaborations between academia and industry to develop and analyse media data, such as text, image, audio and video, with the goal of understanding and improving how these types of data are generated, managed and impact society.

[139] As KB has legal access to material submitted to it in accordance with the Act (1993:1392) on depository copies of documents, KB considers that it can utilise a specific limitation of copyright that allows certain research and cultural heritage institutions that have legal access to a work to make copies of the work for text and data mining for research purposes (§ 15 b URL). It should also be mentioned in this context that a government inquiry (SOU 2024:4) has recently proposed a clarification that use in the interests of national security is not prevented by copyright regulation.

[140] Among public actors, special mention should be made of the Institute for Language and Folklore (Isof), the National Archives and the Swedish Tax Agency, which are some of the authorities that have access to large data sets. It should also be natural to involve other public actors who use large language models in their activities, as well as SKR.

AI for a public sector at the forefront

ChatGPT summarises:

AI has the potential to transform Sweden's public sector and create an organisation that is not only more efficient, but also more accurate, robust and adaptable to meet the societal challenges of the future.

This chapter explores how AI can help to strengthen the welfare system, improve public services and increase Sweden's international competitiveness. It asks how the public sector - with the help of AI technology - can meet the growing demands of an ageing population and increasingly personalised societal needs. The chapter will highlight concrete examples of AI's contribution, such as faster processing times and increased legal certainty, and describe the technological and structural transformation required to successfully integrate AI. We will also discuss the legal and ethical considerations that accompany the use of AI in government and public administration. By collaborating and creating a common AI infrastructure, Sweden can lay the foundation for a future where all citizens - regardless of where they live - have access to modern, digital and high-quality public services. The chapter highlights the way forward for the public sector and points to the key investments and changes needed for AI to become a powerful tool for societal benefit.

The public commitment

Public sector activities are very much about administration - regardless of whether responsibility lies with the state, region or municipality. But the public sector's mission also involves the long-term development of society and equipping Sweden for the future. Given the development of technology and the challenges facing society today, this places high demands on both adaptability and development capacity.

In Sweden, the public commitment is very extensive. It has provided basic security for many people, not least during times of change and periods when our society has been under great strain. Our welfare system, combined with a spirit of understanding and cooperation, has played a very important role in the development and economic prosperity of our country. The vast majority of people living in Sweden also want it to continue to be so.

The public sector

The public sector is a large and important part of the Swedish economy. It is organised by the central government through some 367 government agencies, 21 regions and 290 municipalities.[141] There is a wide range of actors, both in terms of size and in terms of breadth and diversity of responsibilities. Activities range from maternity care, early childhood education, pensions and from elderly care to justice, education, infrastructure and culture - to name a few.

Together, public expenditure accounts for about half of Sweden's GDP, SEK 2 841 billion, which is high by international standards. Of this, almost SEK 700 billion goes to procured goods and services. This means that these resources strengthen the private sector. In addition, some public activities are carried out by private actors, for example in schools and care for the elderly. Furthermore, a large share of the population works in the public sector. In 2023, 1.5 million people worked in the public sector, representing around 30 per cent of all jobs in the country. Moreover, in the vast majority of localities, public employers are the single largest employer.

[141] See https://www.statskontoret.se/fokusomraden/fakta-om-statsforvaltningen/myndigheterna-under-egeringen/#:~:text=Det%20finns%20367%20myndigheter%20 under%20the%20government,-the%20f%C3%B6rst%20January. See the Swedish Agency for Public Management report Public Administration in Brief 2024.

In the introduction to this Roadmap, the AI Commission describes the challenges our country faces. Against this background, there is a strong need for the public sector as a whole to embrace and realise the development potential offered by AI.

The challenges for public services

One of the biggest challenges for the public sector is demographic change, reflecting the fact that we are living longer and having fewer children. In the 2020s, for example, the proportion of people aged over 80 is projected to increase by 49 per cent, while the proportion of people of working age will increase by only 4 per cent. This trend puts a great deal of pressure on public services, both in terms of workload and tax funding. As society in general develops, people's expectations of what the public sector should deliver are also increasing. In order to meet these expectations, the public sector must fulfil more tasks, or the same tasks, to a higher standard.

However, the costs of public activities cannot increase correspondingly, partly because the employed part of the population is declining over time. Nor will the labour market be able to meet the public sector's skills needs to the same extent as before. Research shows that within a few years, Sweden will need to provide 125 per cent of welfare services in relation to today's standards, with only 75 per cent of the workforce.[142] It must therefore be possible to carry out activities more cost-effectively and less labour-intensively.

Public administration is expected to be able to deliver fast results, not least when the pace of society in general is increasing. In addition, the service commitment requires accessibility and increasingly personalised responses. The public sector therefore needs to develop its ability respond more quickly to both citizens and businesses.

Photo: Jeppe Gustafsson/Shutterstock

Round the clock, 7 days a week at the Swedish Tax Agency

The Swedish Tax Agency has nearly thirty AI services in production around the clock every day. In March 2024 alone, ahead of the tax return period, the Swedish Tax Agency's chatbot Skatti responded to 225,000 conversations, compared to a more normal 50,000 conversations per month. Each conversation contains several different questions, 47 per cent of which were answered when the tax information service was closed. With the support of Skatti, the Swedish Tax Agency reaches more customers than before, with service available around the clock throughout the year. At the same time, the agency has been able to relieve its manual tax information and make cost savings.

Every year, the Swedish Tax Agency receives around 300,000 business registration cases. To handle these, 200 full-time positions were previously needed. Thanks to an AI service, the Swedish Tax Agency has reduced processing time by about three and a half days. This has freed up time for more than 100 employees and 40 managers, who can now devote their time to other more qualified work such as quality assurance and development.

[142] Torell, J., Berbyuk-Lindström, N. and Magnusson, J. 2024. Group-wide digitalisation and governance in Halmstad municipality. Digital Governance. The report is available at https://usercontent.one/wp/digitalforvaltning.se/wp-content/uploads/2024/04/Rapport-Halmstad.pdf?media=1708415703.

In addition, essential public services must function at all times, in large and small municipalities, regions and authorities - often around the clock, every day of the year. If law and order or the defence of our territorial borders is not maintained, if people do not receive care when they need it, if pensions are not paid or if social security insurance for loss of income fails, then the very foundations of the Swedish social contract are shattered. At the same time, the public sector must become more robust and able to fulfil its commitments under demanding conditions. The fact that we are in a very serious security situation and have just recovered from a pandemic illustrates the challenge. The continued digital transformation of public services must therefore be carried out with clear requirements for sustainability and resilience.

These challenges are particularly problematic because the conditions differ considerably between different actors. State authorities differ in both size and mission, while regions and municipalities have basically the same mission, but very different sizes. This is particularly true of municipalities. Despite this, citizens should receive equivalent services regardless of whether they live in Dorotea or Stockholm. To achieve this, more use of AI will be needed in the organisation. Worth noting is that at present, research shows significant and growing inequalities in access to public services in digital form.[143]

In summary, public services must be enabled to become more efficient, faster, more responsive, safer and more robust - in big and small ways. Meeting this expectation will be crucial for citizens' trust in the public sector's ability to manage security in transition.

Societal benefits of using AI

Today, we cannot foresee everything that will be possible in the future. However, there is no doubt that AI will play a crucial role in the transformation that public services must undergo to meet the challenges. AI will not automatically lead to increased welfare, but if used correctly, AI will be able to solve problems, accelerate digitalisation and thus provide great benefits to society. AI is already being used in the public sector for this purpose.[144] Our view is that this is something that must be done on a much larger scale in the future. The question is at what pace the development should take place. The AI Commission's view is that the pace needs to be particularly high.

Examples of urgent areas where increased AI use creates great societal benefits

The AI Commission would like to highlight a few areas where we consider it particularly urgent that AI is used more widely and becomes a tool for generating major societal benefits.

Fighting crime

AI must be increasingly used to prevent, deter and detect crime.[145] One example of use is data analytics, to identify patterns in welfare payments (already at application stage) or to uncover complex crime networks. Another example is the use of advanced predictive algorithms to inform which individuals should be prioritised by municipal social services to prevent crime. These future possibilities should lead to a noticeable increase in the safety of society. Reducing crime would also have clear economic effects, in addition to the positive consequences for individuals.

[143] https://digitalforvaltning.se/rapport/kommunala-digitaliseringsstrategiers-utveckling/, see, inter alia, the report Sveriges kommuners digitaliseringsstrategier, Innehållsanalys av mål- och resursplaner 2021-22, University of Gothenburg and Fredrik Carlsson, Marcus Matteby, and Johan Magnusson. 2023 Digital Transformation Drift: A Population Study of Swedish Municipalities. In Proceedings of the 24th Annual International Conference on Digital Government Research (dg.o '23). Association for Computing Machinery, New York, NY, USA, 318-326.

[144] A description of how government agencies use AI can be found in the State Treasury's report Myndigheterna och AI - En studie om möjligheter och risker med att använda AI i statsförvaltningen, 2024.

[145] See also the chapter *AI and societal security*.

Fighting crime at the Swedish Tax Agency

Every year, the Swedish Tax Agency's criminal investigators assist, on the instructions of prosecutors, in around 1 600 preliminary investigations into financial crime. At the same time, there is always a large number of cases waiting to be investigated. The Swedish Tax Agency is investing in a number of AI-powered services to speed up investigations and reduce the backlog of cases more quickly. Examples of AI-powered services combined are real-time transcription of interrogations, analytical services based on a large fine-tuned language model that helps to find patterns in both interrogations and other pre-trial material, and masking services that anonymise data when necessary. This chain of AI-powered services is estimated to streamline the work of criminal investigators by 20-45 per cent, reducing lead times. Other effects that are clear, but difficult to quantify, are that AI services contribute to greater legal certainty and increased quality.

A healthier population

The use AI in healthcare is growing rapidly worldwide. The quality of care is improving, as is the efficiency of healthcare organisations and operations. AI technologies will be much more widely used to identify risks of different diseases and to prevent them. This enables faster diagnosis of diseases and development of treatments. Sensor technology to prevent falls in the elderly, for example, is another way of utilising new technologies to improve health. This can make it easier to prevent illness and disease, reducing human suffering in particular, but also costs.

Fall sensors with AI technology to reduce fall accidents in Sundsvall

From January to September 2023, the municipality of Sundsvall tested fall sensors equipped with AI technology at Norra Kajens nursing home in Sundsvall. The aim of the project was to reduce the risk of residents falling. The fall sensor, which is now fully operational, is installed in the resident's room. Using infrared light, it scans movements in the room and reacts to different types of movements. In consultation with the resident, the staff at the nursing home set which movements the sensor should react to.

The fall sensor can also be set to react at different times of the day. If the fall sensor detects a movement to which it is set to react, it triggers an alarm. When the alarm goes off, staff are called in three ways: via a mobile phone application, via text message and via the existing call system that sounds an alarm in the resident's room. The fall sensor was tested by 20 people, and an evaluation showed, among other things, that there was a significant reduction in falls (77 per cent). As a result, the previous motion alarms have been fully replaced.[146]

Calculations made by the municipality of Sundsvall show that the use of fall sensors throughout the country would lead to savings of around SEK 8 billion annually, including reduced healthcare costs for fall injuries.[147]

[146] A description of the fall sensor test can be found at https://utveckling.sundsvall.se/initiativ/exempel-fran-vardagen/2023-08-16-fallsensorer-med-ai-teknik-minskar- fall-accidents-at-norra-kajens-elderly-housing.

[147] In total, the costs of fall accidents in the report for 2020 total SEK 16.8 billion, of which SEK 11.3 billion relates to direct costs for the region and municipality. https://www.socialstyrelsen.se/globalassets/sharepoint-dokument/artikelkatalog/ovrigt/2022-5-7923.pdf.

Despite the fact that healthcare is an area where AI can be of great benefit,[148] national strategies, targets and action plans for AI in healthcare, as well as sufficient investment to create the conditions for its implementation, are currently lacking. This could be a contributing factor to Sweden lagging behind comparable countries in AI maturity in health and medical sector.[149] There is thus a need for a national strategy and action plan for AI in healthcare, which aims to create a shared vision, goals, priorities and plan for further work on AI in healthcare - for all involved.

Proposal

- The AI Commission therefore considers that the Swedish eHealth Agency should be tasked by the government with promoting a level playing field for the implementation of AI applications in healthcare. The eHealth Agency should also be able to act as a unifying and coordinating body for AI-related issues, for all actors with a mission in healthcare.

More efficient use of public resources

The handling of different cases can be accelerated with the support of AI, for example through more automated authorisation processes. It will make life easier for both individuals and businesses, and increase Sweden's competitiveness and attractiveness. Other services to individuals can also be developed with the help of AI. Public sector organisations, for example, will be able to offer more efficient and accessible customer service with the help of AI. The potential gains are significant, as administration in public organisations is quite similar. The needs are thus present in all public organisations. The daily lives of employees will be made easier with the help of AI tools. This frees up resources that can be used to fulfil more core tasks and spend more time, for example, on meetings with citizens or skills development.

Translation and interpreting services at the National Courts Administration

The National Courts Administration has developed an AI service that translates legal texts in other languages into Swedish. According to representatives of the National Courts Administration, the estimated cost savings are 90 per cent compared to sending the texts to a translation agency. It is also much faster. The AI application translates text in three seconds, compared to the three weeks it took to get the texts back from one agency. The National Courts Administration is working to launch the service for all courts, which could mean savings of up to SEK 20 million per year.

According to calculations by the National Courts Administration, the agency could save even more with a new masking service for anonymising documents. The service is estimated to save up to 220 man-years, equivalent to around SEK 300 million annually. Both translation and text masking are examples of services that could lead to savings in large parts of the public sector.

The National Courts Administration is also trialling, together with some other actors, an interpretation service for rapid interpretation in various situations, for example while waiting for a human interpreter. Public administration spends around SEK 1.5 billion annually on interpretation services. A realistic assumption is that in some situations it is possible to use AI-supported interpretation in

20-30 per cent of all interpretation situations. This represents a potential saving of SEK 300-450 million annually.

Photo: Tommy Hvitfeldt (National Courts Administration)

[148] See, for example, Haug, C. J. et al. 2023, `Artificial Intelligence and Machine Learning in Clinical Medicine, 2023', N Engl J Med 2023; 388.
[149] See AI maturity in health care: An overview of 10 OECD countries (Castongay, et. al, Health Policy 140 (2024) 104938). The study, published in February 2024, provided an overview of the maturity of 10 leading OECD countries in AI for health care. The results show that Sweden lags behind the other countries in maturity.

The estimated economic value

With the estimated economic value, as illustrated by the examples above, the full introduction of AI in Swedish public administration will bring considerable economic benefits. A rough estimate by Digg and the consulting firm McKinsey in 2020 is around SEK 140 billion per year. This corresponds to around five per cent of total public spending.[150] However, this figure is based on using the AI services that were in place at the time of the calculation. After that, the potential should have increased further, as AI technology has made great progress since then.

These estimates do not take into account the potential costs of implementing AI. However, although the assessment is highly uncertain, it indicates a large potential cost saving in the public sector. However, even very cautious assumptions about how much of this potential will actually be realised justify significant investments on purely economic grounds. In addition to this, there are other more qualitative benefits that are currently difficult to measure and estimate, such as increased speed, quality, legal certainty and saving lives.

Public sector's AI journey to create societal value

Public actors are thus already developing, experimenting with and implementing a wide range of AI services in their organisations. We have provided just a sample of them above. These services have often been developed in-house. This is because there are currently a number of barriers for actors to work in secure AI environments to work together to develop AI services for similar needs. It is costly to ensure a sufficiently developed and secure IT environment that can also include platforms and tools for the development of AI.

From previous needs analyses, we know that only a few actors in the public sector have the resources and expertise to do this.

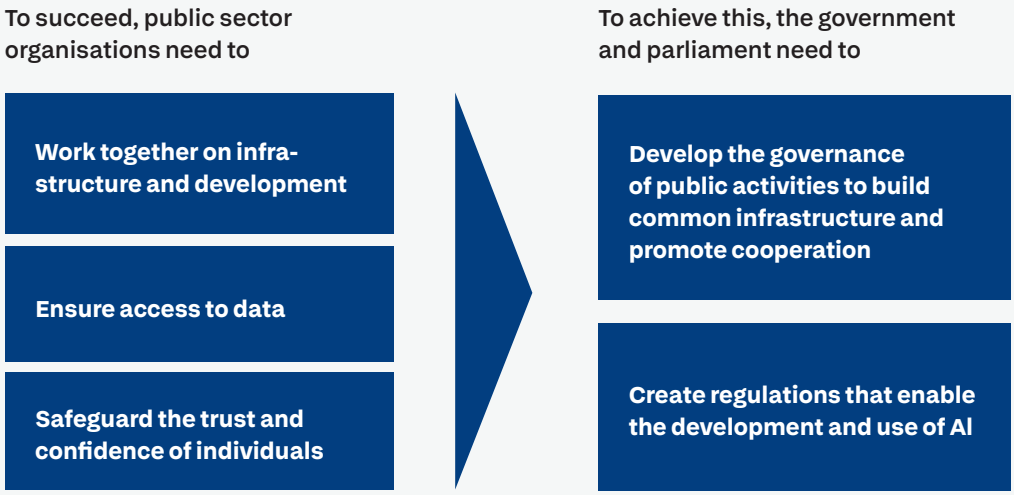
If the public sector, with its large and small authorities, municipalities and regions, is to be able to use AI to fulfil its tasks and manage its challenges, a number of key conditions must be met. In part, this is about the general conditions discussed in other chapters of this Roadmap, such as innovation, security and employees who are knowledgeable and dare to test and develop new technologies. But there are also more specific prerequisites for the public sector to be able to make the necessary shifts and increase its use of AI and thus the benefits to society.

One of the key prerequisites needed is a common, secure and robust AI infrastructure linked to cloud services for computing power for example. In addition, the governance of AI use in the public sector needs to be developed and the possibilities for the exchange of data between authorities, municipalities and regions need to be significantly improved. This means that a number of regulations need to be modernised and adapted to the digital world we live in.[151] This requires the government and parliament to be able to make wise long-term decisions on issues relating to the direction of public sector development - a development in which the use of AI must occupy a central position.

The prerequisites for increased use of AI in the public sector are summarised in *Figure 1*, and the rest of the chapter discusses and makes suggestions for the various areas in the figure: 1) AI infrastructure and technology development, 2) Data, 3) Trust and confidence, and 4) Governance and enabling regulatory frameworks.

[150] Agency for Digital Government (Digg), Promoting public administration's ability to use AI, 2021.
[151] See also chapter *Data as a prerequisite for AI development*.

Figure 1: Conditions for increased use of AI in the public sector



Source: Swedish Social Insurance Agency

Area 1: Working together on AI infrastructure and technology development

In order for public actors to meet the ever-increasing demands placed on their activities, it will be necessary to take a deeper look at existing ways of working and operating models, but also to enable greater collaboration. This can be done with the support of digitalisation and AI, which has been a consistent message from sector representatives to the AI Commission.

Cooperation between actors is currently severely hampered by the lack of a common AI infrastructure that fulfils the requirements of the public sector in terms of secrecy and transparency, privacy, cybersecurity, information separation, data protection and security protection – and that is also easy enough for actors to use.[152] Instead, there are often a large number of technical systems and infrastructures that communicate with each other.

The lack of a common AI infrastructure means that it is not possible to experiment with, develop and deploy AI solutions together. Different actors are also unable to share solutions and expertise or to create much-needed shared services at the scale and speed required. Today, private providers can help solve some of the public administration's problems, but often these solutions do not provide a sufficient level of security, nor do they offer the full control of solutions, infrastructure and data needed.

The public sector must therefore quickly establish a coherent technical AI infrastructure that gives both state authorities and municipalities and governments, regardless of size and starting point, the conditions to benefit from the opportunities created by AI development - and to be able to do so in collaboration with each other. There also needs to be joint support functions that can support public actors with the expertise they lack in the short term and help them build their own capacity in the long term.[153]

Requiring all public actors to develop their own AI capabilities would take an unacceptably long time and lead to further fragmentation with different solutions of varying security and quality. It would also be an inefficient use of limited resources - to the extent that it would be possible. The challenge would be particularly great for smaller operators, including a large proportion of municipalities.

[152] There is a major backlog in digital infrastructure: a majority of actors lack a modern foundation to stand on. There is also a lack of control over the underlying systems and development capacity. See the Swedish National Audit Office's report Obsolete IT systems - obstacles to effective digitalisation (RiR 2019:28).

[153] For more information on digital sovereignty, see the chapter *AI and societal security*.

Foto: Shuterstock

Ena - Sweden's digital infrastructure

Today, the Swedish Agency for Digital Government (Digg) manages a common digital infrastructure for public administration. Ena - Sweden's digital infrastructure, is a collective name for various systems, components and standards that enable public administration to share digital information with citizens and with other authorities in Sweden and the EU. In this context, however, it is important to note that Ena is not a common infrastructure for the development and provision of AI-driven services in public administration - there is no such thing. On the other hand, parts that exist within the framework of Ena can contribute to a common core infrastructure for AI in public administration, such as authentication and authorisation.

The AI Workshop

To meet these needs, the AI Commission therefore proposes the establishment of a common core infrastructure for the development and delivery of AI-driven public sector services - an "*AI Workshop*". Such a workshop will be a central component of a larger AI management ecosystem. In it, public actors, both individually and collectively, and in interaction with the business community, could explore and develop new AI services and functionalities and share and use quality-assured data, models and components. Through connections to other cloud infrastructures, the workshop would have access to necessary computing power beyond its own. The AI Workshop would be able to catalogue the AI solutions and models already developed to promote the reuse of other public actors' work. An important task for the workshop will be to ensure that all this is done in a safe and lawful manner. Building and operating an AI Workshop will also help build important skill-sets across the public sector, which will also help strengthen our civilian preparedness and sovereignty.

Those actors with capacity and ability will need to contribute by developing core services and functionalities that can also be used by others, and by sharing their expertise. Smaller actors should also be able to contribute, despite limited technical resources and expertise. With their lower organisational complexity and more agile governance, they can play an important role as platforms for innovation and testbeds for new solutions - which can be expected to increase the innovation and transformation capacity of the public sector as a whole. This will allow for a mutual exchange of capabilities to the benefit of all involved, and promote the equitable development of all parties involved, regardless of their size or geographical location.

There are only a few public organisations that have made major investments in building an IT and AI infrastructure that meets modern requirements for accessibility and security, and that are also used to providing IT services to other actors. The Swedish Social Insurance Agency and the Swedish Tax Agency are in a special position here.[154] Scaling up the capabilities of these authorities would lead to a cost-effective and appropriate solution to the infrastructure challenges described above and significantly accelerate the ability of public organisations to develop and use AI.

[154] In this context, it is relevant to mention that the *IT Operations Inquiry*, which was presented at the end of 2021, proposed a new regulation on coordinated government IT operations in which the Swedish Tax Agency and the Swedish Social Insurance Agency would be supplier authorities (together with two other authorities). The inquiry assessed that these authorities have the ability and capacity to be able to offer IT operations services in the relatively short term within the framework of a coordinated government service offering. See SOU 2021:1 Secure and cost-effective IT operations.

When a common core infrastructure is to be built, it will also be important to develop a funding model as soon as possible where an appropriate proportion of the costs of operation, management and further development are financed through fees. Such a fee model needs to be designed so that *all* actors in public administration - at the state, regional and municipal levels - can afford to be involved in developing and using the AI-driven services made available through the AI Workshop. It is therefore reasonable to differentiate such a fee based on the size of the participant and the extent to which the participant uses the various functions of the AI Workshop.

The creation of a common core infrastructure for public actors raises certain legal issues. These include, for example, the issue of competition if the state, in the form of the Swedish Social Insurance Agency and the Swedish Tax Agency, is to deliver a service to municipalities and regions. From this perspective, it is important to note that the AI Workshop will fulfil a clear need that is not currently being met. An AI Workshop also needs to fulfil high standards of information security, which is necessary in public administration. Since

The AI Workshop also contributes to Swedish sovereignty and our civil defence, the AI Workshop should not be seen to restrict competition in a way that is incompatible with current legislation.

AI Task Force and connectivity support

Recruiting AI skills into the organisation is a challenge, especially for smaller authorities, municipalities and regions. This risks making it difficult for them to fully realise the potential of AI – including to utilise the AI Workshop. It should therefore create an *AI Task Force* - dedicated teams of experts and generalists tasked with supporting public actors with AI expertise on the ground.[155] Such teams can be composed of people who work in different parts of the public sector on a daily basis, and activated when needed. The AI Commission believes that it is most appropriate that the authorities that are given responsibility for establishing the AI Workshop are also tasked with setting up and administering the AI Task Force, although more actors can and should contribute members to it.

Specific assistance may also be needed when a new actor wants to join and start working in the AI Workshop. Coherent and customised *connection support* therefore needs to be an integral part of the workshop's service offering. This can involve resolving technical issues, as well as providing support in identifying needs and opportunities and then helping the organisation to get started with the change process.

The support should also cover the training of the newly joined actor's staff, who in turn should be able to train further within their own organisation. The AI Commission believes that it is most appropriate that the authorities that are given responsibility for establishing and managing the AI Workshop are also tasked with providing connectivity support.

Proposals

- The AI Commission proposes that the Swedish Social Insurance Agency and the Swedish Tax Agency be tasked with jointly establishing and managing a public sector AI Workshop and act as its supplier authority. The task also includes providing connectivity support and, together with other appropriate actors, establishing and managing an AI Task Force. The authorities will examine the legal issues and, if necessary submit legislative proposals for the establishment of the AI Workshop. There are advantages in clarifying the tasks of the supplier authorities in a statute.

- The AI Commission is of the opinion that the supplier authorities should develop a structure for managing the work of developing and managing the AI Workshop. In this work, it is important that the heterogeneous conditions in authorities, municipalities and regions are taken into account.

- The AI Workshop is proposed to be established in stages over a five-year period, 2025-2029. During the first two years, basic capabilities can be set and the infrastructure established. Already during the first years, some value-creating AI services can be developed and started to be used. The full scale-up will take place in years three to five.

- The cost is estimated at SEK 145 million in the first year and SEK 500 million per year thereafter, totalling SEK 2 145 million. It is possible to distribute this cost among the actors joining the workshop. However, the AI Commission proposes that the start-up cost should be fully financed by grants, combined with loan financing, where appropriate, to ensure a high and predictable pace of deployment and low thresholds for large and small actors to join the cooperation. As mentioned above, once fully established, the AI Workshop will be mainly financed by fees from the participating actors.

[155] Similar structures exist in other areas. The government recently commissioned the National Board of Health and Welfare to propose how the state, through national development teams, can assist the regions in a more operational way in the field of specialised psychiatry. In the judiciary, a reinforcement force has been in place since 2012 to assist courts when needed.

When developing the common AI infrastructure, it is essential to take into account current and future regulatory frameworks as early as possible, in particular in the areas of civil preparedness, security protection and cybersecurity.

Guidance to overcome legal uncertainty

Alongside the technical environment, there is a need for AI Workshop users to also benefit efforts to overcome the uncertainty that exists among public sector actors regarding the application of various legal norms in relation to the use of AI. But also on issues related to digitalisation at large. In the chapter *Data as a prerequisite for AI development*, we discussed the legal norms that can make it difficult in various ways for data to be made available between different actors. Our overall picture is that it is mainly the regulations designed to protect personal data, such as the GDPR, that public actors perceive as legal obstacles.[156]

There will always be a degree of uncertainty surrounding the interpretation of legal norms. Responsible employees in the public sector will continue to have to deal with complicated legal issues. However, the legal uncertainty in this area has become so extensive that investments in new technology are not being made. This in turn leads to a loss for both the individual business and society at large. One way to reduce this uncertainty is to give authorities with specific expertise in a particular area of law a mandate to provide guidance to other public actors on the interpretation of applicable law. In these mandates, it is essential that all public actors are included and benefit from the reduction of uncertainty that the mandates aim to achieve. Although the responsibility for legal interpretation ultimately lies with the person responsible for the activity in question, guidance can reduce uncertainty.

Strengthen IMY's regulatory sandbox and gather AI advisory expertise at Digg

Since autumn 2022, the Swedish Authority for Privacy Protection (IMY) has operated a regulatory sandbox for innovation actors.[157] Similarly to what is proposed for the private sector in the chapter *Innovation, entrepreneurship and venture capital*, the AI Commission believes there is a strong case for scaling up and strengthening this by creating a dedicated track focused on public actors. In this way, IMY can provide guidance to a public activity, while at same time disseminating the knowledge and lessons learnt in the context of a development or innovation project to a wider audience. For example, it should be possible for a public actor who is uncertain whether the use of a particular AI system is in breach of the GDPR, or other legislation protecting personal integrity, to ask IMY and receive a clear answer on the matter in a reasonable time.[158]

Proposal

- The AI Commission believes that the government should mandate IMY to establish a dedicated track focussed on public actors in its regulatory sandbox. This specific track should be integrated into the activities of the AI Workshop. IMY should also be tasked providing guidance to public actors, within the framework of the AI Workshop, on AI and the interpretation of data protection regulations. The estimated need for appropriations for these tasks is SEK 8 million annually.

Digg has expertise and experience in providing guidance on digitalisation issues. The agency is currently tasked with providing guidance to the public administration on legal issues within the framework of the Common Administrative Digital Infrastructure (Ena), which also includes issues related to AI.[159] Several guides have been developed to support digitalisation using AI, such as the Trust Model, a separate website supporting the use of AI in social services, and guides on how regulations and procedures can be adapted for digitalisation and automation.[160] The AI Commission therefore believes that it is appropriate for Digg to continue to provide guidance to the public sector on AI in its respective activities.

Proposal

- The AI Commission believes that the government should task Digg with providing guidance on the use of AI in the public within the framework of the AI Workshop. The estimated funding need for this assignment is approximately SEK 4 million annually.

[156] In the chapter *Data as a prerequisite for AI development*, the Commission makes a number of proposals that are of course also relevant to public sector actors.
[157] See also the chapter *Innovation, entrepreneurship and venture capital*.
[158] In this context, it should also be noted that IMY, together with Digg, has been tasked by the government to develop indicative guidelines for the use of generative artificial intelligence in public administration. See Assignment to the Swedish Agency for Digital Government and the Swedish Authority for Privacy Protection to develop guidelines for the use of generative artificial intelligence in public administration (Fi2024/01535).
[159] See section 6 pt. 6 of the Ordinance (2018:1486) with instructions for the Agency for Digital Government.
[160] The guides are available on the Digg website, www.digg.se. AI in social services is available atwww.digg.se/ai-for-socialtjansten. See also the Dig report Final report of the government assignment Fi2023/02301 regarding the latter assignment.

Vision: An illustration of how the future AI Workshop could be used

To make the need for an AI Workshop clear, we illustrate here how one could be used. An AI Workshop enables rapid customisation - in terms of security, functionality and tools - based on the needs of those who will use it. This applies whether it's for the development of new AI services or for using existing ones.

For those with some experience in developing AI-powered services and using pre-trained models, it will be fairly straightforward, as the AI Workshop has standard tools that are used by the vast majority of people engaged in some form of AI development.

Example case 1 (operator with limited own AI capability)

For a small municipality or public authority that wants to start using AI-powered services from the AI Workshop, the process can start with a site visit by the AI Task Force. They offer help with identifying which AI services the operator could benefit from. The AI Workshop's connection support then assists with the application for authorisation to the desired AI services and provides guidance on how to connect securely. Connection agreements are made electronically, and information on the costs of the services is provided at the same time. For a small operator, the cost is low. Accessibility is facilitated by the existence of a catalogue of generic AI services from which the actor can choose. Possible services include secure interpretation, translation, transcription, masking and digital assistant services. Once connected, the operator can now safely use and benefit from the effects the services in their business.

Example case 2 (operator with innovative idea requiring development)

One region has previously hosted a visit from the AI Task Force and received assistance in identifying AI solutions for its needs. The region is connected to the AI Workshop and has started using some of the AI services. Now it needs to develop a service that does not exist.

Employees look at the AI Workshop website to find out if someone else is already solving the same or similar problems, but they are not.

The region contacts the AI Task Force for assistance. The task force helps with understanding what is required to achieve a solution - for example, by consulting with IMY and perhaps conducting a regulatory sandbox to see if there are any regulatory barriers. Along the way, staff come across some other regions and authorities with similar problems.

The work also raises a number of legal issues that are helped to resolve with the support of a guidance team from Digg. Problems also arise because it is difficult to retrieve data from legacy systems. Here, support from the AI Workshop is offered to jointly set requirements for suppliers on how data should flow from existing systems to the new AI service.

Once the foundation for the development of the AI service is laid, a workshop room that is virtual is commissioned. The connectivity support ensures that there is a customised room with access to basic models and other tools suitable for the task. Now the development and realisation of the new AI-driven service can take place, either alone or together with others.

The examples illustrate how the AI Workshop can become a catalyst for knowledge about AI and the development of solutions that can significantly contribute to Sweden's innovation and competitiveness. Through the AI Workshop, stakeholders will also be able to take part in others' solutions that can be used in day-to-day operations. The AI Workshop, together with the AI Task Force and guidance support, can also help to overcome the problem that some of the systems are old and it is difficult to extract data from them.

The AI Workshop - a way in

There is a great demand for comprehensive information on issues related to the use of AI and how it will affect society. This could the application of the GDPR, the AI Regulation or any other relevant regulatory framework. Where can AI models be trained and developed in a safe environment? How can AI influence educational and professional choices? What AI tools exist and how can you learn to use them? How can you as a commercial provider contribute to developing AI solutions for the public sector? Where is the appropriate data that can be used to solve a specific problem? These are questions that everyone has the right to easily answer - individuals, entrepreneurs, academia and the public sector.

It is therefore urgent to establish a clear portal for various AI-related issues - a place where people can turn

to find answers to their questions, or guidance on how to proceed.[161] It is therefore a question of creating a new AI authority, but that authorities with different responsibilities for AI issues link their respective functions to the AI Workshop. This means, for example, that Digg's guides and IMY's regulatory sandboxes for training AI models, for both the private and public sectors, can be easily found via the AI Workshop.

The AI Hub proposed in the chapter *Skills boost for all* could also be based here. The hub will provide information on what skills will be in demand in the future and what training programmes are available to meet these needs.

Proposal

- The AI Commission believes that a portal function as described above is an important part of promoting the use of, and knowledge about, AI in society. However, how such a function can be realised needs to be investigated further, possibly in connection with the investigation being conducted for the establishment of the AI Workshop.

Area 2: Ensuring access to data

Public organisations have a large amount of relevant data that can be used to exploit the potential of AI, but there are a number of obstacles that need to be addressed. First and foremost, public sector organisations must ensure that the data generated in their operations is relevant and of high quality. They also need to allow data to be shared between different parts of the public sector and to use data to a sufficient extent. This is about changing the legal framework. In addition, it needs to be technically possible and easy for public organisations to access, use and share the data they need. Security and sovereignty need to be safeguarded in this context.

In the area of data, a clear shift is needed the public sector to fully exploit the opportunities of AI and minimise its risks. Concrete actions are discussed in the chapter *Data as a prerequisite for AI development*.

Area 3: Maintaining the trust and confidence of private citizens

In few other countries do citizens have such a high level of trust in the state and their fellow citizens as in Sweden.

It makes most things less cumbersome and more efficient when it comes to decision-making and human interaction.[162] One example is the great trust we have in our tax authorities, which, for example, has enabled us to declare our income easily.[163] However, this trust and confidence in the public sector must not be taken for granted and needs to be protected.[164] Thus, when setting up an AI Workshop, and when increasing the use of AI services in the public sector, trust in the public sector must be taken into account.

A societal development that makes public actors' decision-making more difficult to understand can quickly lead to an erosion of trust. As AI is increasingly used to support decision-making, and in the long term also for the direct exercise of public authority, it is therefore necessary to take measures to preserve trust and confidence. It is also a matter of ensuring that the Swedish exercise of public authority continues to be transparent. The Administrative Procedure Act, in particular, requires the public sector to ensure that individuals can understand the grounds on which a particular decision has been made. Unfortunately, there are recent examples from Sweden and other countries where automated decision-making has been a basis for an exercise of authority that has proved to be incorrect and even illegal.[165]

The exercise of authority where the individual is not given the opportunity to understand how a decision has been made can lead to a lack of trust, in relation to technology as such and to the public sector. It is therefore important that the individual can understand how a decision has been made, especially if digital tools are used to support decision-making. In this context, it is important that developers use open source code wherever possible. This makes it easier to understand why an AI tool produced a certain result. It will also make it easier to scrutinise how a public actor made a particular decision. The EU AI Regulation will play a role in this work by setting requirements for transparency, traceability and information. Ethical guidelines are also important to build a solid foundation of trust[166] .

[161] In this respect, activities in the AI Workshop can also be linked to the communities of excellence created within the framework of SKR's Handslag för digitalisering.
[162] Holmberg, Sören & Rothstein, Bo (2022). Swedish trust remains high - but declines in vulnerable groups. In Ulrika Andersson, Henrik Oscarsson, Björn Rönnerstrand & Nora Theorin (eds) You fragile new world. Gothenburg: SOM Institute, University of Gothenburg.
[163] See Anders Stridh and Lennart Wittberg, Från fruktad skattefogde till omtyckt servicemyndighet, Skatteverket, 2015.
[164] The realisation of the importance of trust between citizens and those who govern society for a country's economic prosperity was rewarded with the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel in 2024.
[165] A Swedish example is the algorithm used by the City of Gothenburg in 2020 to determine school placements for children. The algorithm used was misprogrammed in that it was based solely on the route as the crow flies and not the actual travelling time. This proved particularly problematic in a city intersected by a river.
[166] The need for ethical guidelines is discussed in more detail in the chapter *AI and societal security*.

Proposal

- The AI Commission considers it important that public actors use AI in their activities in a transparent manner in order to maintain citizens' trust. This is not least important for building trust in the proposals we have made above. The government should therefore consider tasking authorities to develop ethical guidelines in their areas of responsibility should the need arise.

Area 4: Stimulating the use of AI through long-term governance and enabling regulatory frameworks

As we have previously pointed out, the use of AI is not an end in itself, but it is a crucial tool in the necessary development and renewal of public services. The insufficient use of AI services is therefore problematic. In this chapter, we have made a number of suggestions for the necessary measures to increase their use in the public sector[167] .

This may not be enough. A further challenge to progress is the caution that in many ways characterises public administration. To too great an extent, risk minimisation has been, and still is a guiding principle for development. If public sector activities are to be digitalised, it must be possible to test new solutions to a greater extent. This requires changes both to the regulatory framework and to the content of the governance of public activities.

At present, existing law largely prevents or slows down the necessary technological development, both through general rules and the design of activity-specific regulations. The regulatory frameworks that govern large parts of the public sector therefore need to be significantly more enabling. Without a comprehensive review, the necessary development towards more automated work processes and decisions in public organisations will not take place.

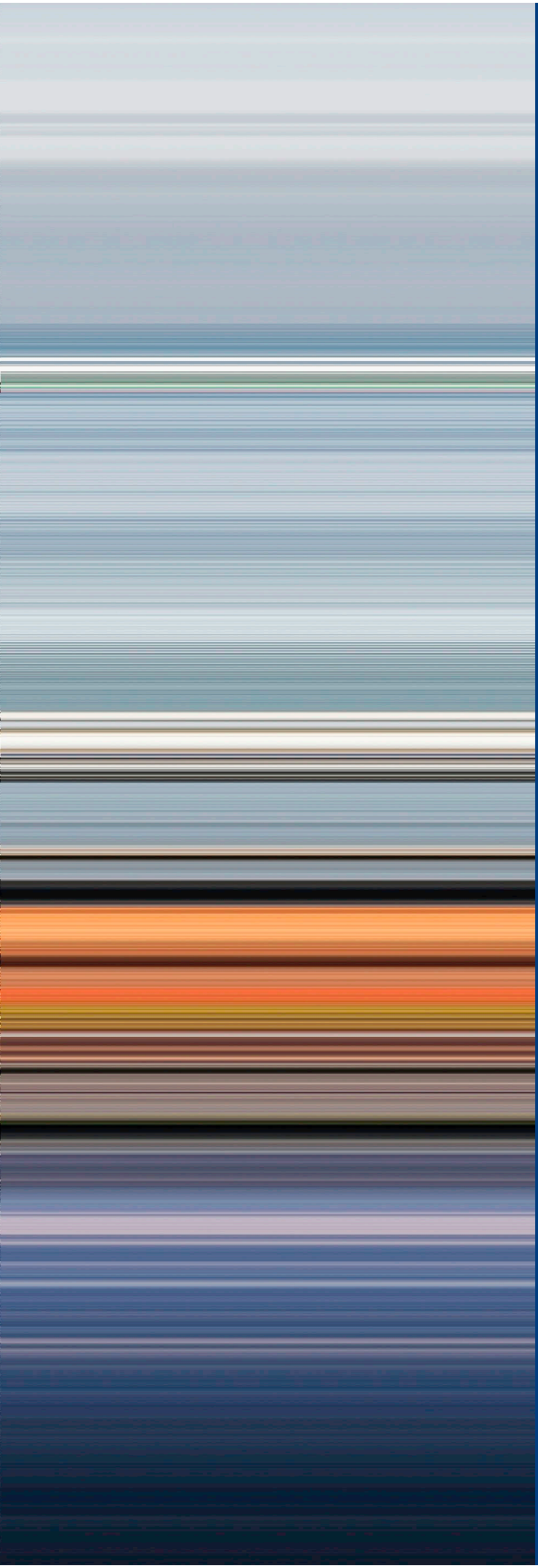
Proposal

- The government should carry out a review of the regulatory frameworks governing public activities with a view to adapting them to a digital transformation with a high degree of AI. This could be done, for example by instructing authorities to review regulations and general guidelines for which they are responsible, and to submit proposals for amendments to laws and regulations in their respective areas of activity.

Finally. The proposals described above provide the public sector with better conditions to utilise the potential of AI. It is then up to the public sector actors to take advantage of these opportunities and develop their respective activities using AI as a tool.

[167] In the chapter *Leadership and governance to implement the Roadmap*, we make further proposals aimed at clarifying the government's governance towards an increased use of AI.

The government should carry out a review of the regulatory frameworks governing public activities in order to adapt them to a digital transformation with a high degree of AI. Photo: Municipality of Stockholm/Johnér



4 Leadership and governance

When major changes take place that create new conditions for societal development, different demands are placed on leadership and governance. The development of AI is one such system-wide change. In the chapter *International positions*, we first discuss what this means for our international engagement. If we want to help steer developments, we must take an active part in the international dialogue on AI.

Finally, in the chapter *Leadership and governance to implement the Roadmap*, we discuss the demands of change on our political leadership and governance processes and the adjustments needed for relevant measures to be taken and implemented.

This section contains:

Photo: Per Pixel Petersson

Leadership and governance

International positions

ChatGPT summarises:

At a time when AI is evolving rapidly and affecting all sectors globally, international cooperation is becoming crucial for Sweden's future competitiveness. For an export-dependent country like Sweden, where the domestic market is limited, it is necessary to have an active role in global AI cooperation.

This chapter explores how Sweden can participate in international policy processes and regulations to promote safe and ethical AI development, while fostering innovation and growth. Through EU cooperation we have a unique opportunity to shape the AI rules of the future, while having to navigate a world where different countries are implementing their own AI strategies. Sweden's strengths, such as an advanced tech sector and a public sector with considerable access to data, give us a platform to become a strong international AI player. However, to ensure success, a clear strategy is needed to attract international expertise and collaborate with the top research environments. This chapter also explores how Sweden can take a leading role in Nordic and global AI cooperation.

The international policy landscape

International policy cooperation takes many forms and takes place in many different fora. The UN, the OECD, the G7 and the G20 have all started to develop guidelines as the pace of AI development is accelerating, see box *Work in various international fora* for a brief description of the work. The aim is to find common principles in terms of ethics, transparency, accountability and fairness.

Summit of the future Photo: UN Photo/Mark Garten

Work in various international fora

- The OECD discussed early on what principles should apply to trustworthy AI. Principles were already adopted in 2019 and updated in May 2024. The EU AI Regulation, the Council of Europe, the United Nations and the United States, among others, use the OECD definition of an AI system.
- The Hiroshima AI Process was launched during Japan's G7 presidency and led to the G7 agreeing to *International Guiding Principles for all AI Actors* in December 2023.
- In March 2024, the UN adopted a resolution supported by more than 120 countries including the United States and China on respecting, protecting and promoting human rights in the design, development, application and use of AI. The General Assembly also emphasised the potential of AI systems to accelerate and enable progress in achieving the 17 Sustainable Development Goals. At the *Summit of the future* in September 2024, a *Pact for the future* was agreed, including a *Global Digital Compact*, which is the first comprehensive global framework for digital collaboration and governance of AI.
- In May 2024, the Council of Europe adopted a *Framework Convention on Artificial Intelligence and Human Rights, Democracy and the Rule of Law*, which will be legally binding signatories. The Convention was opened for signature on 5 September 2024.
- In November 2023, a global AI safety meeting was held in the United Kingdom, leading to the *Bletchley Declaration on AI Safety*. It agreed on the importance of safety testing of new AI systems and to prepare a state of the science report to build international consensus on the capabilities and risks of *frontier AI*.
- AI is a priority area of cooperation under the EU-US *Trade and Technology Council* (TTC). The TTC is seeking common approaches to AI, including risk management, interoperability and transparency.

Some of these collaborations are more global in nature, while others are regional. Both perspectives are important and it is crucial that the government and authorities allocate sufficient resources to participate. However, given our limited resources, it is important that Swedish authorities focus their efforts where they can do the most good. To do so, it is important agree on which aspects are most central from a Swedish perspective, and let this be reflected in Swedish participation and action in each organisation.

The number of individual countries adopting their own national AI regulations is also growing rapidly as awareness of the need to regulate increases. According to the Stanford AI Index, which examined AI legislation in 128 countries from 2016 to 2023, 32 countries have at least one AI regulation.[168] But it's not just about regulations.

Many countries have also adopted an AI strategy. Canada was the first country to have a national AI strategy in 2017. Currently, there are 75 national AI strategies and more are under development.[169]

EU cooperation is central to both the regulation and development of AI in Sweden

EU cooperation is the single most important international engagement for Sweden. The framework for how we can design Swedish laws and regulations is often set at EU level, through joint decisions in the EU Council of Ministers and the European Parliament. In recent years, activity in the work to regulate AI in the EU has been intense. For example, the EU was the first in the world to adopt a legal framework for specific uses of AI. The AI Regulation entered into force on 1 August 2024.[170] The Regulation aims to ensure that AI in the EU is developed in a safe way that safeguards citizens' fundamental human rights. Common EU regulation and implementation is also important to avoid the fragmentation of the EU single market by different national regulations. This can be crucial for a company's ability to grow in Europe - instead of directly establishing itself in the US.

[168] Stanford University, Artificial Inteligence Index Report 2024, Chapter 7.
[169] Stanford University, Artificial Intelligence Index Report 2024. p. 391.
[170] The AI Regulation is described in more detail in the chapter *Access to international AI resources*.

US AI regulatory framework

By virtue of its dominance in the tech sector and its economic strength, the US regulatory framework is of particular importance and is becoming a factor in international competition. The US regulatory landscape is complex as it encompasses the federal level, the state level and various agencies' guidelines and the courts.

The number of US AI regulations has increased in recent years. In 2023, there were 23 AI regulations compared to just one in 2016. In 2023 alone, the number of regulations grew by 50 per cent. California is the state with the most AI regulations (7), followed by Virginia (5).

At the federal level, there are mainly so-called *Executive Orders*. The most well-known is Executive Order 14110 *On the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence*. It contains eight general principles to guide the development and use of AI, particularly by federal agencies and the development of foundation models. It also mandates certain federal agencies to develop additional AI-specific guidelines and regulations. The United States has also adopted a *Blueprint for an AI Bill of Rights*, a non-binding framework of principles for the design, use and application of AI systems and a voluntary *AI Risk Management Framework* to help organisations address AI risks.

At the state level, several AI laws have been introduced in recent years, many with more specific requirements. Colorado was the first US state to introduce a comprehensive AI law in 2024. In California, for example, political adverts must state whether they used AI to create images. It also recently introduced a law on transparency in the development of generative AI. Michigan and Washington have similar requirements for all AI-generated advertising, whether or not they were intended to mislead. In New York, the use of automated tools for hiring decisions is prohibited under specific circumstances.

The EU cooperation has also adopted other common regulatory frameworks relevant to the development of AI, such as rules on data protection and data use. The 2018 General Data Protection Regulation (GDPR) is perhaps the best known and is designed to protect individuals' personal data. The Open Data Directive has given rise to Public Sector Data Access Act (2022:818). The aim is to enable different actors in society to use public information to create new products and services. In addition, there is the Data Governance Act (DGA), which came into force in September 2023 and is intended to regulate voluntary data sharing. I

On 1 January 2024, the DGA was complemented by the Data Act, which clarifies who has the right to create value from different data and under what conditions. To take a concrete example - who owns the rights to the data generated by your connected washing machine or fridge?

In the discussion on the balance between focusing on safe AI and fostering innovation, US and European regulatory frameworks are often compared, see box *US AI regulatory framework* for a description of US AI regulation. There are notable differences. The EU has chosen to set strict rules for high-risk AI systems and also prohibits certain AI applications. The US, on the other hand, has opted for a more decentralised and case-by-case approach with a greater focus on best practices and voluntary industry standards. Another important difference is that violations of the EU AI Regulation can lead to significant fines, which has not previously been the case in the United States. However, in California, for example, there are now legislative proposals that also include large fines.

But EU cooperation is not just about rules - it also aims to promote European research and innovation. For example, as an EU member, Sweden has the opportunity to participate in and receive funding for various

AI research programmes and the build-up of computing power in the form of supercomputers. How Sweden is utilising this opportunity is discussed later in this chapter and in the chapter *Computing power*.

European Commission President Ursula von der Leyen emphasised the importance of the EU becoming a global leader in AI innovation. To achieve this, supercomputers will be made available to AI start-ups and companies through an AI Factories Initiative.[171] The Commission also intends to present a new Apply AI Strategy. The aim is to promote new industrial uses of AI and improve services provided by the public sector, for example in healthcare. Furthermore, the intention is to set up a European

[171] For a description of AI Factories see the chapter *Computing power*.

AI Research Council to pool European scientific resources like CERN.[172]

Sweden should be active and pursue priority issues

The many AI initiatives being taken within the EU emphasise the importance of Sweden being active in this area. To achieve an AI regulatory framework within the EU that is well suited to Swedish conditions, it is important that we exercise the influence we can have in the EU's decision-making processes, especially at the stage that AI is now at. In our contacts with representatives of various groups in society, the AI Commission has received a relatively consistent picture that Sweden's relative influence is too small and that we do not prioritise advocacy work sufficiently. However, finding evidence to support this view is not easy. There are studies, for example from the University of Gothenburg, which instead indicate that other countries are happy to cooperate with Swedish representatives in negotiations on various legislative proposals produced by the European Commission. This suggests that Sweden could gain a great deal by prioritising its advocacy work.

Another important aspect is the extent to which we succeed in influencing legislative proposals even before they have been presented by the European Commission. Here, it is of great importance that the Government Offices try to develop early positions to use in lobbying the European Commission, instead of waiting until a formal proposal is on the table. It is also crucial to have Swedes in place in the Commission. It would facilitate contacts between Swedish representatives, both from the government sphere and the private sector, and contribute a Swedish perspective to the Commission's internal work. Here it is undeniable that Sweden is under-represented. If we were represented in line with our relative population, 2.7 per cent of Commission officials would be Swedish, but the real figure is only 2.0 per cent. Correcting this imbalance should be a priority for Swedish authorities. It is therefore welcome that the Swedish government and the European Commission have agreed on an action plan for this.

The need to quickly get Swedes into important positions in the EU institutions applies not least to the AI area. The EU is currently building up its organisation for the implementation of the AI regulation. This means, among other things, that a special AI agency is being created within the European Commission. Getting qualified people from Sweden to apply there should also be a priority task for the government. The cost of temporarily assisting with staff to an EU institution should not be borne unilaterally by a unit within the Government Offices, as this discourages such placements.

Proposal

- Steps should be taken to address Sweden's under-representation within the EU institutions. Specifically, more Swedish officials will be needed in the Directorate-General for Communication (DG Connect) and the AI agency now being set up in Brussels. To achieve this, among other things, placements of officials from authorities and ministries should be financed centrally. The unit lending staff should not be burdened with the cost. The cost linked to AI issues is expected to gradually increase and amount to SEK 10 million per year within four years.

The positions Sweden should pursue in the negotiations vary depending on the legislative proposal in question. But an important general position to pursue, which is clearly confirmed in Mario Draghi's report, is that regulation must not hamper European competitiveness, unless there are very strong reasons. In addition, the regulatory framework must be clear and implemented in a harmonised way across the 27 EU Member States. It must be "easy to do the right thing". With an overly heavy and complicated European regulatory burden, the use of AI in the EU risks becoming even more coloured by the language and values of other parts of the world.[173]

Proposals

- The Government Offices and Swedish authorities should ensure more active participation in AI issues within EU cooperation. Sufficient resources must therefore be given to the units within the Government Offices and to the authorities that participate in EU negotiations in this area.

- In the negotiation process, Swedish representatives should, inter alia, endeavour to ensure that:

- Regulation at EU level does not unduly hamper the global competitiveness of European companies, for example by denying European companies access to the latest technology from third countries.

[172] CERN is an acronym for the European Organization for Nuclear Research - formerly the Conseil Européen pour la Recherche Nucleaire. CERN operates the world's largest particle physics laboratory outside Geneva.
[173] For a further discussion on this and the implementation of the GDPR, see the chapters *Data as a prerequisite for AI* and *Access to international AI resources*.

- The regulatory burden is not unnecessarily heavy for businesses. The aim must be to make it easy to do the right thing within the framework of the overall regulation.
- The implementation of regulations will be as harmonised as possible across EU Member States, not least the GDPR.
- Swedish views are conveyed early to the EU Commission on their planned work on the AI area (even before formal proposals are put on the table).
- Common solutions are found to issues related to copyright and the use of generative AI.
- Swedish interests and existing standards are taken into account when new data standards are developed within the EU.

- Open and transparent structures are established for consultation with business, academia and representatives of municipalities and regions, to enable Swedish negotiators to have access to information on the latest developments and Swedish interests in the field.

Sweden must benefit more from EU research and infrastructure projects

The EU is currently investing heavily in various research and infrastructure projects linked to AI. Project proposals are continuously being presented that researchers and innovators from the member states can apply to lead or participate in.[174] Such projects provide excellent opportunities for Swedish actors to build expertise and networks, and strengthen Sweden's role as a leading research nation in AI. The projects being fully or partially funded by the EU budget (50 per cent in Digital Europe) keeps the cost down for Swedish stakeholders. The *Horizon Europe and Digital Europe* fact box describes these programmes.

Horizon Europe and Digital Europe

Horizon Europe covers research and innovation cooperation in many different sectors. The budget for the period 2021-2027 is €93.5 billion. The programme focuses on AI in different parts.

1. Investment in basic research
2. Funding for promising innovators and SMEs through the European Innovation Council
3. Projects at the cutting edge of science ('scientific excellence') through the European Research Council.
4. European research partnerships between private and/or public actors in the framework of 'AI, Data and Robotics'.

The Digital Europe Programme specifically focuses on AI cooperation. For the period 2021-2027, the budget is €7.6 billion and there are six strands.

1. High Performance Computing (HPC)
   Artificial intelligence, data and cloud solutions
2. Cybersecurity
3. Advanced digital skills
4. Accelerating the Best Use Of Technology
5. Semiconductors (Chips).

[174] See also the discussion in the chapter *Computing power*.

Unfortunately, we can see that Sweden's take-up of these programmes is lower than we would like. In terms of Sweden's relative population, we generally lag behind the other Nordic EU countries, but also non-EU country Norway. There are probably several contributing explanations for the low Swedish utilisation. One reason is that awareness among companies that these opportunities exist appears to be low. Another seems to lie in weaknesses in our own funding models for research and innovation, and Vinnova's ability to facilitate participation in this type of project. In order to be able to apply for participation in a Digital Europe project, Swedish co-funding must already be secured. However, Vinnova, which is the contact authority for this type of EU programme, is currently unable to give advance notice of such co-financing. One reason for this is that it would expose Vinnova's budget to substantial risk, as it is not known in advance how many, or which, of the EU projects in question will be approved. The problem is described by many stakeholders as something of a Catch-22 where the EU requires advance notice of co-financing from Sweden. Vinnova, in turn, can only approve co-financing of EU projects that have complementary funding ready. Moreover, if Vinnova authorises co-financing, it can only give a decision for one year at a time. This makes it difficult for Swedish actors to participate in multi-year EU projects.

Another challenge for researchers to participate in EU projects is that the coverage for indirect costs is relatively low. This means that participation in an EU project can be relatively costly for a participating university, for example. In the AI Commission's contacts with Swedish researchers, it has emerged that they have on several occasions had to refrain from applying to participate in EU projects due to the risk of the costs crowding out other research activities. This applies to both the Horizon Europe programme (which is generally 100 percent funded by the EU budget) and Digital Europe.

An important aspect of our engagement with the EU is the need to focus on our strengths and also be prepared to emphasise these in order to be attractive to different EU projects. One area where Sweden has already shown leadership is the development of open large-scale models for European languages. Here, the EU is contributing to the funding and development of important capabilities and technologies for Sweden.

This is an example of areas where Sweden has good opportunities to strengthen its position in the AI field.

Proposals

- Give Vinnova the possibility to fund multi-year EU projects, by giving the agency an order authorisation. The AI Commission welcomes the government's proposal on this.

- Allocate increased funding to Vinnova and the Swedish Research Council for co-funding of Digital Europe projects in the order of SEK 160 million per year. A buffer should also be created in order to be able to provide advance guarantees of co-funding to a greater extent than at present. An earmarked buffer fund, with an initial capacity of around SEK 50 million, should make it possible to deal with annual fluctuations in the proportion of applications approved.

- Investigate the possibility, following the Norwegian model, of giving ex post grants to higher education institutions in relation to how many EU projects they participate in. The aim is to compensate for the often low overhead compensation from the EU. The government should set aside around SEK 30 million annually for such compensation.

- Swedish participation in EU-funded programmes is particularly low on the business side. The government should therefore review the current model for monitoring calls for proposals and disseminating information about EU-funded programmes to all relevant stakeholders. Consultation with business and academia is also important from this point of view. Vinnova and Digg should also take steps to increase the visibility of EU programmes such as Horizon Europe, including the EIC deep tech fund, and Digital Europe.

Much to gain from Nordic cooperation

There are many reasons for the Nordic countries to deepen their cooperation in the field of AI. This is especially true in the work of developing international rules and standards for AI, a rapidly evolving field. Given our many commonalities, such as a strong democratic tradition and value-based societal systems, more coordinated Nordic action would increase our chances of influencing work towards innovative, safe and ethical use of AI. There should be room for the Nordic region to carve out a niche in the development and use of AI. The fact that the Nordic region, and also the Nordic-Baltic region, is a region with a strong position in IT and IT-related innovation means coordinated action in international contexts could carry considerable political weight. Not least within the EU.

Other areas where Nordic cooperation can be fruitful concern the coordination of requirements for foreign establishments in data centres. Common or similar requirements for companies and access to computing power for domestic stakeholders can maximise added value for society.

In light of the above, the AI Commission welcomes the plans to establish a Nordic AI Centre with co-funding from the Nordic Council of Ministers.

Proposal

- Work for more coordinated Nordic action in international negotiations on AI regulation, not least in the EU.

Strategic international collaborations

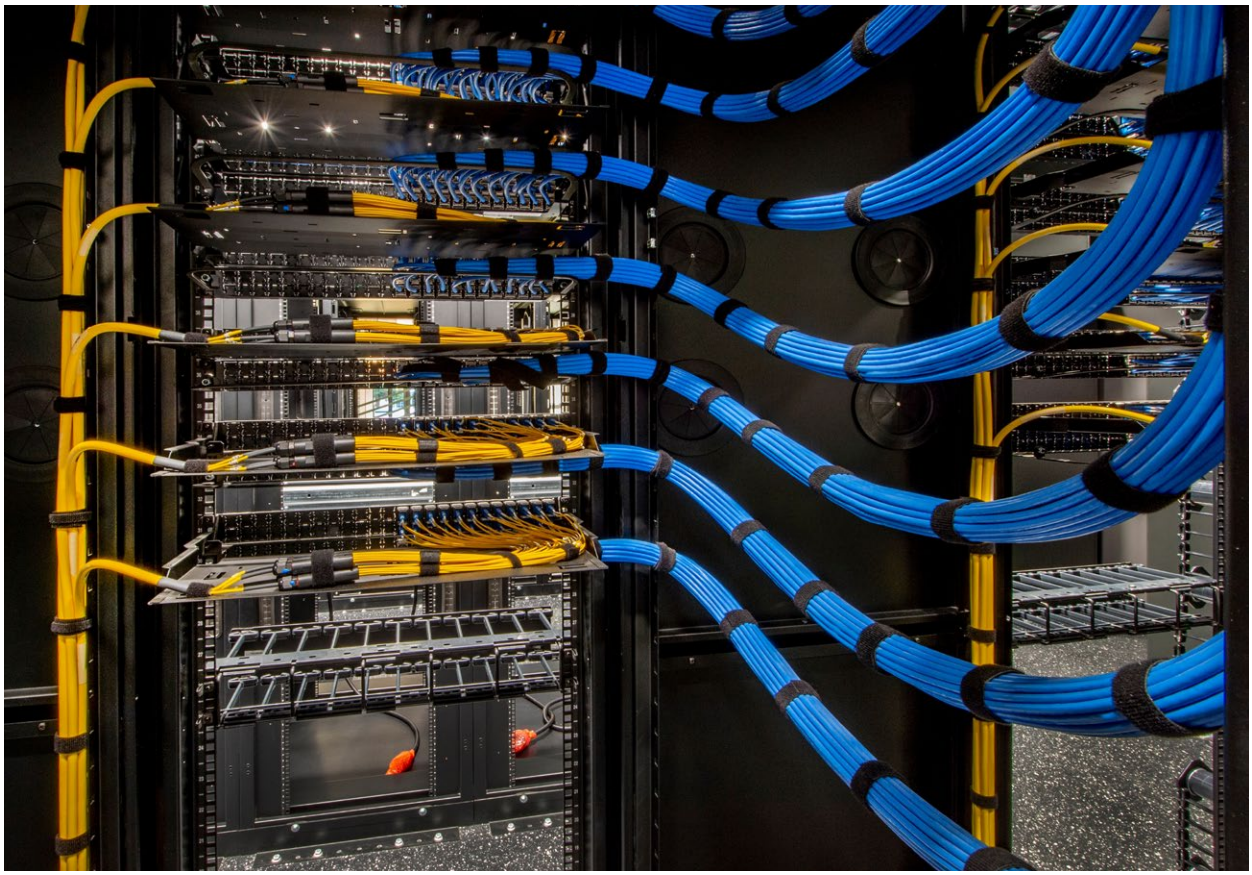
As expertise on the new technologies is being developed worldwide, it is essential that we seek strategic collaborations with the best research and innovation environments.

In addition to EU and closer Nordic cooperation, we should expand contacts with countries that are at the forefront of AI development. The United States, Canada, Germany, France, the United Kingdom and Singapore are examples of countries that rank high on various AI rankings. The Canadian example can serve as inspiration for successful cooperation. Sweden has been present in the Canadian AI ecosystem since 2022, and relations between the partners in each country are now very well established. A number of concrete collaborations are also in the start-up process, including in healthcare with exchanges between several Canadian and Swedish hospitals.

Proposals

- Technical attachés with broad knowledge of the Swedish AI ecosystem should be stationed in key countries to build strategic partnerships between Swedish and foreign parties. A total of SEK 15 million per year should be allocated to appropriate authorities and organisations for this purpose.

- The government should promote transatlantic cooperation, for example in the *Trade and Technology Council* (TTC). As a small and heavily export-dependent country, transatlantic cooperation is of particular importance to Sweden, which would benefit from common transatlantic rules.



Other areas where Nordic cooperation could be fruitful include coordinating requirements for foreign establishments in data centres. Photo: MTZ Graphics/Shutterstock

The Draghi report

Mario Draghi recently published the report *The future of European competitiveness*. In the report, Mr Draghi points out several aspects that are of great importance for the development of AI, especially in relation to Europe's competitiveness.

Here Draghi argues that European productivity has lagged behind that of the US. As a result, real disposable income[175] per capita, i.e. income after taxes and adjusted for inflation, has grown almost twice as fast in the US compared to Europe since 2000. According to Draghi, the difference in productivity largely depends on the development of the tech sector. While the US and China are rapidly expanding their technological leadership, Draghi shows that Europe lags behind in key areas such as AI adoption and investment in advanced technologies. Only four of the world's 50 largest tech companies are European, while the ten largest platforms in Europe are owned by US or Chinese companies.

Draghi also highlights that it is currently difficult for European AI start-ups to grow and compete globally. This is mainly because European capital markets are both fragmented and underfunded. The lack of venture capital thus forces many European companies to seek funding outside the Union, weakening the EU's technological sovereignty. This problem is particularly severe in the AI sector. Of the most successful AI start-ups in the world, only 6 per cent of investments to companies in the EU, compared to 61 per cent to companies in the US and 17 per cent to companies in China.

The AI sector is characterised by economies of scale and network effects, making Europe's fragmented capital markets and regulations particularly problematic for smaller countries, although Sweden stands out in this regard by virtue of our relatively well-functioning capital market. AI companies rely on a lot of funding and a broad customer base to grow. This makes it difficult for European companies to scale up and become global players, especially compared to larger players in the United States and China that have access to both capital and broad markets right from the start.

To maintain Europe's future competitiveness, Mr Draghi believes that comprehensive measures are needed to regain a leading position in technological development and AI. This is particularly important given the demographic challenges ahead: the European labour market is expected to shrink by two million people of working age per year, and the ratio of working to retired people will change from 3:1 to 2:1.

The AI Commission recognises the need for action to improve productivity growth in Sweden and in the EU. We therefore welcome the Productivity Commission's interim report and look forward to the final report in October 2025.

Photo: European Commission

[175] Real disposable income is income after taxes and contributions, adjusted for inflation.

Leadership and governance to implement the Roadmap

ChatGPT summarises:

AI technology is poised to profoundly transform our society, and maximising its benefits requires clear governance models and committed leadership.

This chapter explores how AI can address some of our most pressing challenges, but also why current fragmented governance risks slowing down progress. How can we ensure that AI is integrated effectively and responsibly into our systems? Through concrete proposals for coordination and centralised initiatives, this chapter provides a blueprint for how Sweden can strengthen its leadership and take a global position in AI. The chapter highlights the key steps required to ensure success in this major technology shift.

Political leadership is lacking

During the many meetings the Commission has had with stakeholders in Swedish society, it has become very clear that the current national governance of AI-related issues is in many respects unclear and fragmented. This may involve public and private actors waiting to take the necessary action due to a lack of directives, guidance or necessary resources. As regards public administration, the government itself notes in the budget proposal for 2025 that there is a great deal of caution and uncertainty, that there are no joint AI initiatives and that, as a result, public administration risks missing out on the potential of AI.[176]

Compared to the previous major technology shifts, the need for national political leadership is also possibly even greater this time, given the lack of large, technology-leading Swedish companies in the AI field. However, there is no effective central governance of AI-related issues in Sweden today. This may be due to the Swedish administrative model, a model that has largely served us well for centuries. Governments generally have a clear responsibility and mandate within their specific area of responsibility, but a much weaker one when it comes to cross-sectoral issues. When it comes to the management of AI issues within the Government Offices, we can see that these are currently fragmented across many ministries. Given that the proposals in this report cover virtually all areas of central government expenditure, and thus all ministries, this is a challenge.

The Swedish governance model

Sweden's decentralised model of governance has many advantages. In addition to placing many decisions close to the citizens, in local assemblies, it offers a measure of democratic robustness. In times of crisis or rapid change, there are often calls for stronger national governance. This issue is addressed in all its complexity by the *Committee on preparedness under the Constitution's* report *Strengthening constitutional preparedness* (SOU 2023:75). Rapid system-wide technological shifts, such as the breakthrough of AI technology, do not constitute a crisis, but may still warrant clear centralised governance.

A number of attempts to create structures for more integrated governmental governance of cross-sectoral issues have been trialled in the Swedish public administration. The experience from many of these initiatives seems to recognise that cross-sectoral work in the Government Offices is difficult. The necessary preconditions are political support, clear governance and sufficient resources.[177]

Experience of cross-sectoral governance in Sweden

National strategies and *action plans* are often used for cross-sectoral issues, which require action at several levels of government and in different areas of activity to realise the government's objectives.[178] However, these documents are by their nature non-binding. For example, in 2018, the government adopted a *National roadmap for artificial intelligence.*

[176] See Prop. 2024/25:1 Spending Area 22, p. 112.
[177] See Swedish Agency for Public Management, The Government's governance of cross-sectoral issues - A study of experiences and development opportunities, 2022.
[178] See SOU 2024:43 The state and the local government sector - cooperation, autonomy, governance. p. 140.

One solution often used to address issues that affect multiple public (and private) actors is to create different forms of fora for consultation and cooperation.[179] The intention is that the actors will meet with some regularity and exchange information, but take the decisions they deem necessary themselves.

In a recent report, the Swedish Civil Contingencies Agency (MSB) has analysed how authorities have dealt with three different societal crises that occurred over the past year.[180] In its report, the Agency found that there is a lack of proactive action, especially when there is a lack of information. The MSB proposes in its report that the government should consider introducing a principle of action. Such a principle means that stakeholders should act proactively and take necessary measures even in situations of uncertainty and lack of information.[181] The AI Commission believes that such a principle could also promote the use of AI in Sweden.

Cybersecurity is an issue that spans virtually all sectors of society. In December 2023, the Government decided to give over 100 authorities a reporting requirement or assignment in their letters of appropriation in which the authority is to report on how they work with issues related to cybersecurity.[182] When the Government decided in September 2024 to gather the national cybersecurity work in a national cybersecurity centre under the leadership of the FRA, this was justified by a need for clearer guidance from the government.[183] In the area of *security protection,* certain authorities have been authorised to supervise other authorities and to issue guidance on how authorities and private actors should interpret the legislation.[184]

International experiences of central governance

The question of whether the technological shift represented by AI requires a new form of central governance, at least for a certain period of time, has been addressed to some extent in the international literature.[185] The question of the powers and possibilities of the Center of Government (CoG), what in Sweden and in many other countries is called the Prime Minister's Office or equivalent, is the subject of ongoing work at the OECD.[186] A recent report from there indicates that the CoG has come under increasing pressure navigating increasingly complex environments of synchronised crises, polarisation and declining trust in public institutions.

To bridge the gap between politics and management, manage cohesion policy, guide public administration reforms and engage with citizens and other stakeholders, the OECD describes that centralised governance requires a number of preconditions. The OECD emphasises the importance of a clear vision from the government as crucial to the outcome. The central function also needs clear mandates, clearly defined roles, combined with trust between CoGs and line ministries. An open and confidential exchange of information is essential for line ministries to implement guidelines or standards decided by CoGs. CoGs also need the right people, with the right skills, in the right place. Skills such as political acumen, holistic thinking, mediation and data analysis have proven to be important. In addition, the CoG needs the right support (e.g. budgets or data access) to work effectively.

System-wide change requires centralised control

It is the AI Commission's view that we as a society cannot rely solely on existing models of governance to realise the great benefits or risks that AI brings. The Swedish governance model serves us well but, as shown above, it is not optimal when it comes to solving a challenge that spans several different sectors. There is a need, at least temporarily, for clearer central leadership that can look across all sectors of society. Below we make proposals that we believe are necessary for us as a country to be able to take advantage of the opportunities and manage the risks that AI brings.

Proposals

- The government should decide on an AI strategy for Sweden in 2025, with this Roadmap as the basis.
- The need for rapid decisions on system-wide measures is the very reason why the AI Commission chose to bring forward its report. Funding for the government's AI strategy should therefore be included in the spring bill for 2025 or in an extra amending budget to be submitted to parliament in spring 2025.

[179] See SOU 2024:43 p. 159 ff. for a summary of some of these fora.
[180] See MSB, Evaluation of the joint management of three events from a crisis preparedness perspective (Fö2024/00366).
[181] See MSB, Ansvar, samverkan, handling - Åtgärder för stärkt krisberedskap utifrån erfaringerheterna från skogsbranden i Västmanland 2014 (Ju2015/1400/SSK).
[182] https://www.regeringen.se/pressmeddelanden/2023/12/starkta-krav-i-myndigheternas-regleringsbrev-kring-informations--och-cybersakerhetsarbetet/.
[183] The National Cyber Security Centre (NCSC) was previously established by four government agencies following a mandate from the government in 2020. From 1 November 2024, the FRA will be responsible for the Centre, its activities will be regulated by decree and its director will be appointed directly by the government.
[184] See Chapter 8, sections 1, 11 and 12 of the Security Protection Ordinance (2021:955).
[185] See, among others, United Nations System White Paper on AI Governance, 2024, European Court of Auditors, Special Report 08/2024, EU AI Ambitions, and Dan Huttenlocher, Asu Ozdaglar and David Goldston, A Framework for U.S. AI Governance, 2023. Several AI policy frameworks are available on the Center for AI and Digital Policy's website, www.caidp.org.
[186] OECD, Steering from the Centre of Government in Times of Complexity: Compendium of Practices, OECD Publishing, Paris, https://doi.org/10.1787/69b1f129-en 2024.

AI developments require the coordination of policy decisions at a speed that the system is not currently capable of. In order to centralise and streamline the handling of issues relating to AI, a special task force should be set up at the Prime Minister's Office.[187] Such a task force will act as a bridge between politics and the employees at the Government Offices who implement and follow up the Government's AI strategy. The AI Commission does not otherwise propose any changes to the Government Offices' organisation. The work of a task force can also be a natural continuation of the work carried out by the AI Commission. By picking up where the Commission's work leaves off, the momentum built up in 2024 with a very large number of social contacts are utilised. The AI Commission believes that SEK 35 million should be allocated annually to this task force.

The group should be chaired by a State Secretary with experience of working in the Government Offices. It is necessary to have both generalist and specialist competences within the group. For example, specialists in AI technology (equivalent to a Chief Technology Officer), data governance (equivalent to data steward skills[188]), people with expertise in the legal framework and security issues relevant to the development and use of AI, and international negotiation experience. After five years, it should be evaluated whether this task force should continue its work, or whether there can be a return to a more normal situation regarding the handling of AI-related issues within the administration.

This task force should include a group of state secretaries and an interdepartmental working group. It should also be responsible monitoring key issues in the world around us, including in the EU, relating to AI in order to keep policymakers informed. It should hold regular consultations with industry, the public sector, academia and social partners to keep abreast of technological developments. AI Commission members could usefully be used as a scientific advisory council in future work.

- The government should annually follow up on the measures taken to fulfil the objectives of Sweden's AI strategy. This should be presented in an annual report, which the AI Commission's proposed task force should be responsible for. To facilitate follow-up of the implementation of the measures, Key Performance Indicators (KPIs) should be developed. We provide suggestions for these in Annex B. In order to clarify the public investments made to strengthen Sweden's AI capability, these AI expenditures should be reported separately under all expenditure areas in the budget bill.

- The government should encourage public authorities to use AI in their activities. This can be done in several ways:

  - All government agencies should be required to report back on how they are working for the responsible implementation of AI in their respective agencies. Compare with previous assignments concerning Agenda 2030, gender equality or homeworking during the pandemic. Several similar mandates have already been issued by various ministries, but the Commission would like to emphasise the signal given when all authorities receive the same mandate.

  - The government also has the opportunity to individual agencies that it perceives as lagging behind in their AI development. This is done by giving more specific assignments to increase the use of AI, investigating which of the authority's activities could be carried out with the support of AI and developing an AI strategy or similar assignment.

  - Questions about AI should also be part of the regular follow-up talks held between the Government Offices and government agencies.

- Regions and municipalities should, as we suggest for the government, encourage and incentivise regional and municipal administrations to increase the use of AI.

- In conclusion, the importance of personal leadership in major technology shifts cannot be emphasised enough. The AI Commission therefore calls on the government, the Government Offices, Directors-General, heads of municipalities and regions, together with CEOs and boards of private companies to lead by example and acquire the necessary AI skills in 2025. It is crucial that our decision-makers understand what AI is, as well as the potential and risks the new technology. We also believe that the Government Offices should set a target a certain percentage of employees in each ministry to have AI expertise.

[187] In this context, it can be noted that the Productivity Commission recently proposed that a coordination function be created in the Prime Minister's Office for prioritised cross-sectoral issues. See SOU 2024:29 *Good opportunities for increased prosperity*. p. 492.

[188] A Data Steward is defined here as a person with a high level of expertise in data management. In the chapter *Data as a prerequisite for AI development*, the Commission also proposes the creation of a Data Steward function, which is a separate proposal to the one mentioned here.

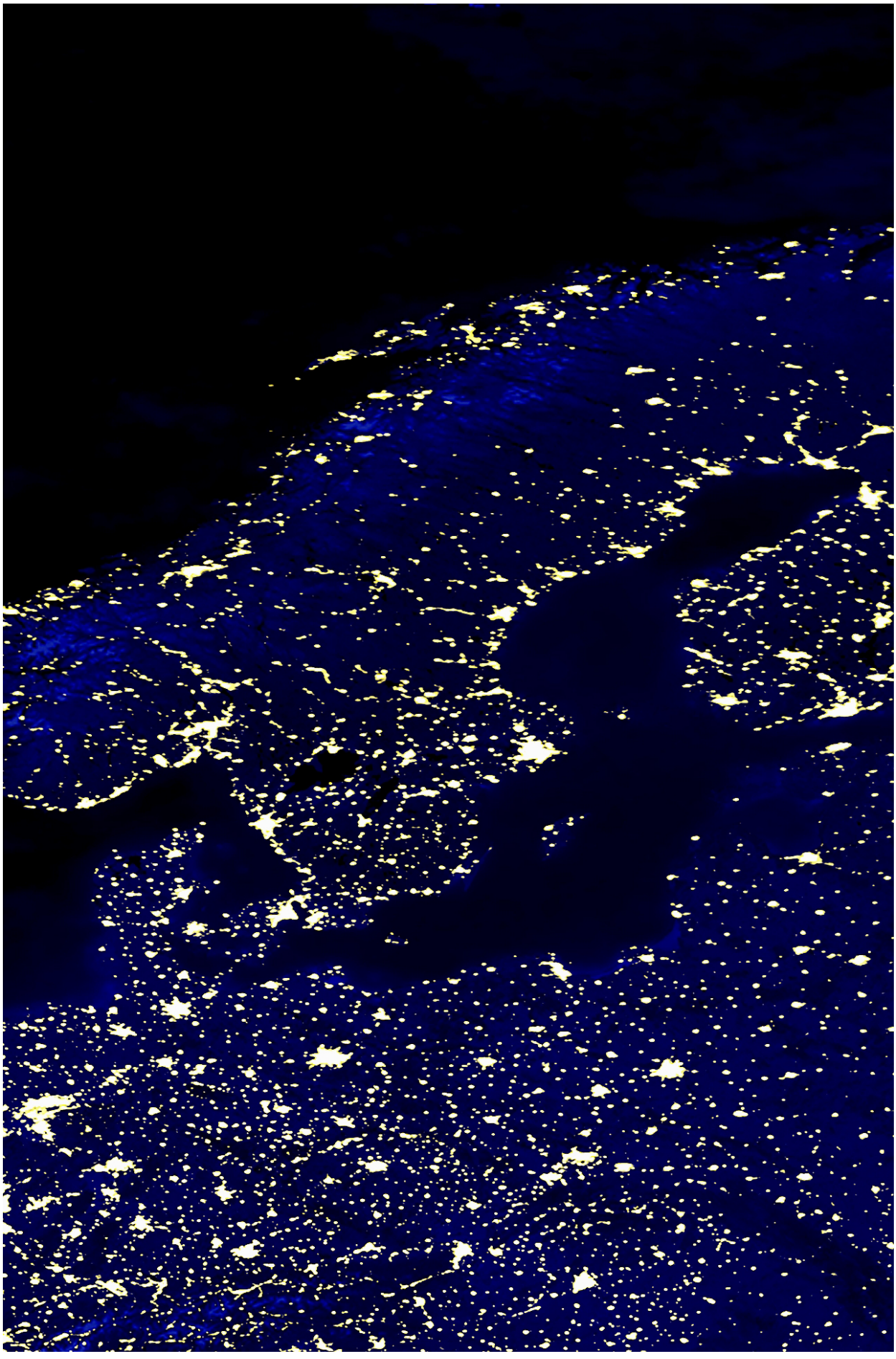


Photo: Shutterstock

Annex A
List of proposals

The table below summarises all the proposals presented in the Roadmap together with a breakdown of their costs. Cost proposals are not coloured, and proposals that are expected to be carried out within the framework/ at no extra cost are blue. Suggestions for inquiries that will need appropriate funding are orange. These inquiries have been allocated a standard amount of SEK 5 million, but the exact funding will need to be determined on a case-by-case basis. Proposals whose costs are covered within another proposal are red.

Area	Proposal	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6-10	Total years 1-5	Total years 1-10
Energy	Dialogue when establishing data centres							0	0
	Plan for a doubling of electricity demand in 2045							0	0
	Monitor electricity consumption							0	0
	Better statistics on data centres							0	0
Telecoms	Explore proposals in the Draghi report							0	0
Computing power	Computing power for training	300	25	25	25	25	125	400	525
	Computing power for use	200	25	25	25	25	125	300	425
	Co-financing of AI Factory	345	115	115	115	115		805	805
	Annual follow-up of the calculation							0	0
	Computing infrastructure as critical infrastructure							0	0
Data	Investigate OSL for increased data sharing within and between authorities							0	0
	Secrecy-breaking provisions for health care data							0	0
	Modernising data protection legislation. Framework law for personal data processing							0	0
	Review the application of the GDPR							0	0
	Research on PET techniques							0	0
	Digitisation friendliness and data consequences in regulatory proposals							0	0
	Good data management and data plan for public actors							0	0
	Sector-specific standards for data management							0	0
	Statistics Sweden coordinator for good data management in the public sector							0	0
	Data Steward function at Statistics Sweden	4	4	4	4	4	20	20	40
	Fee model for access to public data							0	0
	Clarify requirements for public actors' use of cloud services							0	0

Area	Proposal	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6-10	Total years 1-5	Total years 1-10
Security and safety	Consideration of digital sovereignty in AI in critical activities							0	0
	Research on AI and cybersecurity at Cybercampus Sweden	50	50	50	50	50	250	250	500
	Emergency preparedness in critical functions							0	0
	Establish AI safety institutes	80	30	30	30	30	150	200	350
Cutting-edge research	Establish centres of excellence in AI	300	300	300	300	300	1 500	1 500	3 000
	Establish 200 AI postdoc positions	50	50	50	50	50	250	250	500
	Create 50 visiting professorships in AI	30	30	30	30	30	150	150	300
	Establish 500 combined posts	35	35	35	35	35	175	175	350
	Research schools for 600 PhD students	240	240	240	240	240	1 200	1 200	2 400
International resources	Making foreign AI platforms and AI tools available							0	0
Skills	More AI knowledge in public education	100	100	100	100	100		500	500
	Public libraries to teach about AI	100	100	100	100	100		500	500
	Investigate free access to certain AI services							0	0
	Investigate access to AI services for pupils, students and teachers							0	0
	Teacher skills boost for AI in higher education	205	255	305				765	765
	Tripartite dialogue in the labour market							0	0
	Forecasts for labour market and training needs due to AI							0	0
	Annual review of the state of research on AI	3	3	3	3	3	15	15	30
	Skills development and range of educational programmes in AI for lifelong learning	80	85	85				250	250
	Coordinate lifelong learning	10	10	4	4	4	20	32	52
	Investigate and resource establishment and operation of the AI Hub	10	10	10	10	10	50	50	100
	Universities to validate AI knowledge							0	0
	AI courses for all unemployed people							0	0
Innovation	Cross-sectoral projects							0	0
	Data sharing to promote innovation							0	0
	Regulatory sandbox for businesses	8	8	8	8	8	40	40	80
	Consultancy and regulatory sandbox according to the requirements of the AI Regulation							0	0
	Support for viable AI start-ups	100	100	100	100	100		500	500
	National coordinator for the development of large language models							0	0

Area	Proposal	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6-10	Total years 1-5	Total years 1-10
Public sector	National implementation of AI in the health sector							0	0
	Public sector AI Workshop with AI Task Force and connectivity support	145	500	500	500	500		2145	2145
	IMY's regulatory sandbox	8	8	8	8	8	40	40	80
	Digg's guidance on the use of AI	4	4	4	4	4	20	20	40
	The AI Workshop as a one-way in							0	0
	Ethical guidelines in public authorities' areas of responsibility							0	0
	Adapt regulatory frameworks to digital transformation with AI							0	0
International positions	More Swedes in the AI agency	2	4	6	8	10	50	30	80
	More proactive behaviour in the EU							0	0
	Work towards reducing the regulatory burden in the EU							0	0
	Open structures for consultation for EU negotiations							0	0
	Financing of multi-annual EU programmes							0	0
	Co-financing for Digital Europe projects	210	160	160	160	160	800	850	1 650
	Compensation for low OH in EU projects	30	30	30	30	30	150	150	300
	Increasing the visibility of EU programmes							0	0
	More coordinated Nordic action							0	0
	Technical AI attachés to key organisations	15	15	15	15	15	75	75	150
	Increased transatlantic cooperation							0	0
Leadership and governance	Deciding on an AI strategy 2025 with this Roadmap as a basis							0	0
	Funding in the Spring Fiscal Policy Bill							0	0
	Task force at the Prime Minister's Office	35	35	35	35	35		175	175
	Clearer accounting and follow-up							0	0
	Encourage public actors to use AI in their operations							0	0
	Increased AI competences in the public sector							0	0
Costed proposals	24 proposals	2 699	2 331	2 377	1 989	1 991	5 205	11 387	16 592
Standard amounts for inquiries	12 inquiries at SEK 5 million per year	60	60					120	120
TOTAL:	**75 Proposals**	**2 759**	**2 391**	**2 377**	**1 989**	**1 991**	**5 205**	**11 507**	**16 712**

Annex B
KPIs for follow-up

All policy work aims at some kind of goal fulfilment. These goals may different, but they often have in common the fact that they are not easy to measure, such as well-being, which in some sense is the goal of almost all policies. The AI Commission's proposals are no exception. According to their terms of reference, they should contribute to " . . . strengthen the development and use of artificial intelligence (AI) in Sweden in a sustainable and safe way"[1]. To monitor progress, and see to what extent we are moving towards the goal, we therefore propose the use of *Key Performance Indicators* (KPIs) developed by an independent external party that has expertise to assess different countries' capabilities in the AI field. The most useful external assessment in this regard is done in The Global AI Index (GAII). It assesses countries' relative strength in AI based on a range of indicators divided into seven areas: *Political governance, Development, Infrastructure, Research, Commercialisation, Talent* and *Operational environment*. GAII is then an aggregation of all indicators in these seven areas. Countries are also ranked separately in each area.

GAII currently covers 83 countries. Other commonly used indices are the Stanford AI Index, which however mainly focuses on AI development in general without prioritising country comparisons, and The Government AI Readiness Index, which has a narrower focus on the public sector. No index is perfect in all respects, but it is the AI Commission's judgement that GAII is currently best suited for monitoring our Roadmap, not least because it allows for cross-country comparisons. However, it cannot be ruled out that some other index will prove more useful over time. Moreover, climbing the rankings is not an end in itself. The aim of our proposed actions is to improve the real-world conditions for the development and use of AI in society.

The indicators used in GAII differ in two fundamental ways. Some indicators measure a country's absolute capacity, such as the number of AI companies, or total AI investment measured in dollars. Other indicators are adjusted for a country's size, such as the number of AI companies per capita or compared to GDP. When GAII is presented, all these indicators are weighted together and each country is given a score. The score is a mix of countries' absolute capabilities in AI (which largely reflects the size of the country and its AI sector) and their size-adjusted capacity in the AI field.

[1] See page 1 of the Directive https://www.regeringen.se/contentassets/8cefd88e6a454da8901a399e2bfdc875/forstarkt-ai-formaga-i-sverige-dir.-2023164.pdf.

Figure 1: Sweden's ranking in GAII 2020-2024 and Sweden's ranking for the seven areas in 2024

Figure 1a

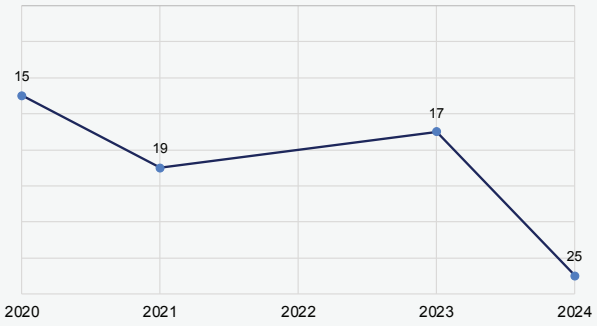
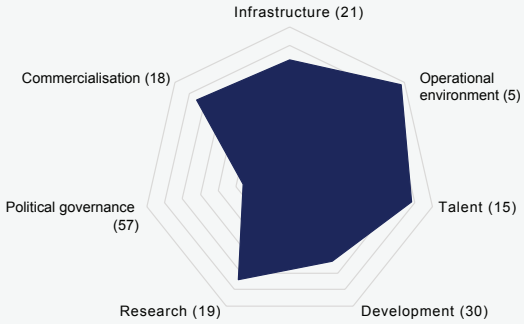


Figure 1b



Source: The Global AI Index

As shown in Figure 1a, Sweden's ranking has deteriorated from 15th to 25th place since the GAII was introduced in 2020. The fall between the years 2023 and 2024 can be partly explained by the fact that the construction of the index has changed between these years. The 2024 ranking takes less account of the fact that countries vary in size, which means that smaller countries generally rank lower than before. The justification for this new weighting is that it better reflects the fact that AI is strongly associated with economies of scale, giving larger countries and economies a natural advantage. However, this change is not the only explanation for Sweden's drop in ranking, as both Finland (5 places) and Denmark (6 places) have fallen less than Sweden (8 places). This is worrying, as Sweden, which is larger than Denmark and Finland, should "mechanically" be less negatively affected by the changes in the construction of the index.

Sweden's ranking in the different areas of the GAII in 2024 survey is shown in Figure 1b. The greatest challenges for Sweden are in the areas of *Political governance* (57th place) and *Development* (30th place). *Political governance* refers to the countries' strategic work on AI issues, while *Development* reflects Sweden's innovative strength in AI. Sweden's strongest area, *Operational environment*, reflects, among other things, the population's attitude to AI and trust in the technology.

Below, we go through the seven areas in Figure 1b separately and describe Sweden's position in relation to other countries. We also look at the indicators used in each area, to give a better picture of what actually influences our ranking. This makes it easier to assess the extent to which the measures we propose can be expected to lead to an improvement in Sweden's position. Following this discussion, we propose a target for how our ranking should improve by 2030 in the seven areas. The timeframe chosen reflects our belief that the measures we propose can be expected to have taken full effect by then. In conclusion, based on the target levels for the different sub-areas, we discuss an ambitious but reasonable target for the overall GAII for 2030.

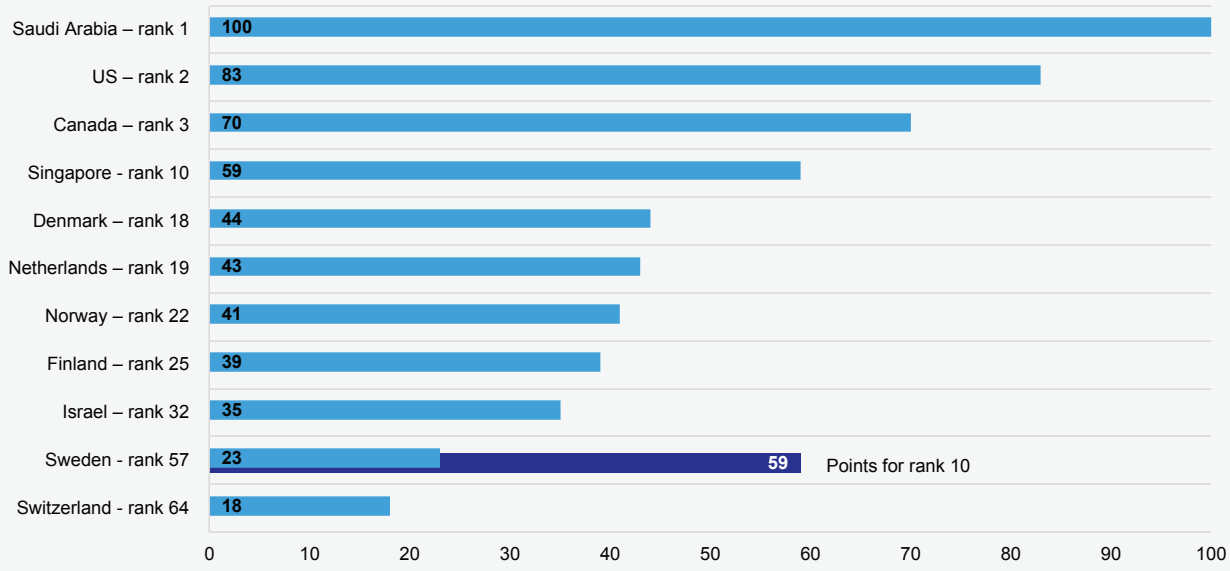
For country comparisons to be meaningful, it is important that they are made on the basis of relevant comparator countries, for example in terms of size, openness or current ranking in the GAII. We have therefore chosen to compare Sweden with our Nordic neighbours Denmark, Finland and Norway, as well as two small open European economies, the Netherlands and Switzerland, with similar conditions to Sweden. We also compare with the top three countries in the weighted GAII in terms of the size-adjusted indicators, namely Singapore, the United States and Israel - these three being the best performers given their relative size. In the review of the seven areas, we also include the top three countries in each area. All this to get a sense of what is an ambitious and reasonable target for Sweden in 2030, given the efforts made in this Roadmap.

Political governance

In times of rapid system-wide change, the need for leadership and governance increases. In the area of Political governance, Sweden ranks 57th.

Figure 2 shows the ranking of the comparator countries on the vertical axis and the scores used to determine the ranking on the horizontal axis. The scoring scale works so that the best country receives a maximum of 100 points. The figure shows that Sweden is in a weak position relative to the comparator countries, with only Switzerland ranking worse.[2] Denmark, the Netherlands and Norway have almost twice as many points as Sweden, while Singapore is well ahead of the other comparator countries. Overall, Figure 2 indicates that Sweden has a lot of work ahead of it in terms of policy governance of AI issues.

Figure 2: Political governance - ranking and points



Note: The ranking for each country in Political governance is shown after the country name. The horizontal axis shows the score for each country, calculated from indicators related to the area. The highest score a country can receive is 100. The grey bar represents the score required to rank 10th in Political governance in the 2024 edition.

Source: The Global AI Index, 2024 edition.

[2] The reason for Switzerland's low position is that the GAII does not consider that the country has a full AI strategy in place. However, this is a truth with modification, as Switzerland has adopted a shorter strategy. The country's decentralised governance is also a disadvantage, as it - like in Sweden - makes data collection difficult for some of the underlying indicators. See further discussion below.

Table 1 shows some of the indicators that form the basis of the *Political Governance* domain. The indicators in the table show whether the country has central structures and resources in place for AI development, such as earmarked funds, an AI strategy with measurable objectives and effective follow-up mechanisms.

Table 1. Green colour means that the condition is fulfilled.

	Ministries responsible for AI issues	Earmarked money for AI	The government has an AI strategy	The government has measurable AI targets or KPIs	Mechanisms to follow up on AI initiatives	Academia, industry etc. have contributed to AI strategy	The Head of State has signed AI strategy[3]	AI-minister
Sverige								
Finland								
Norge								
Danmark								
Nederländerna								
Schweiz								
Singapore								
Israel								
Saudiarabien								
USA								
Kanada								

Source: The Global AI Index, 2023 edition.

Sweden's situation would improve considerably if the government follows the AI Commission's proposals in the chapter *Leadership and governance to implement the Roadmap*. With an agreed AI strategy and clearer governance, many of the boxes in Table 1 would turn green.

Another important indicator in this area - not included in the table - is public sector investment in AI development, which according to the indicator is low in Sweden. This may be partly due to our administrative structure, where any AI-related investments are not easily aggregated for authorities, municipalities and regions. In the chapter *Leadership and governance to implement the Roadmap*, we propose new reporting requirements and specific tasks for authorities to address this. The chapter *AI for a public sector at the forefront* also contains a number of proposals for AI-related investments, such as a national infrastructure for AI (an AI workshop) that would, among other things, enable the implementation and sharing of AI solutions between authorities, regions and municipalities.

What, then, could be an ambitious and realistic target for the area of *Political governance*? This roadmap contains several proposals to improve Sweden's ranking and there are already many good examples from the Swedish public sector but which are currently difficult to measure. This means that Sweden should be able to rank among the top 10 countries in 2030.

- By 2030, Sweden will have moved from 57th place to the top 10 in the area of *Political governance*

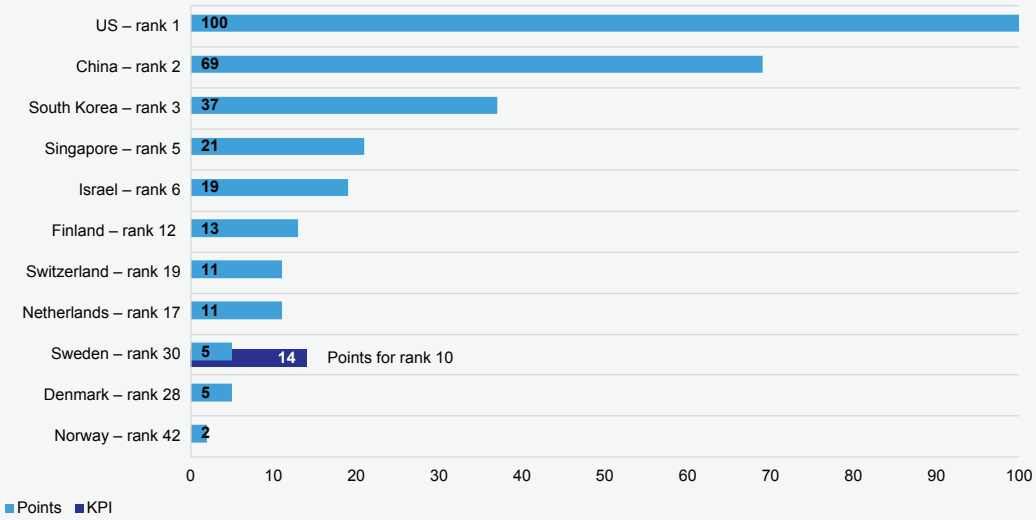
Development

AI opens up new opportunities for development. These are disruptive innovations that can create great value in the form of new creative solutions and applications. In the area of *Development*, Sweden ranks 30th.

Figure 3 shows Sweden's and the comparison countries' ranking and scores in the area of *Development*. The area reflects to a large extent what could be described as innovative capacity. Sweden's scores are low: only 5 out of 100 possible. Although many indicators in this domain favour large countries, relatively small countries such as Finland, Switzerland and the Netherlands are ahead of Sweden in terms of scores. The leading comparator countries, Singapore and Israel, score almost four times higher. This is remarkable given that Sweden is often seen as a country of innovation and is usually ranked highly in international comparisons of innovation performance.

[3] This indicator shows whether a nation's AI strategy has been signed by a head of state, head of government or equivalent higher authority.

Figure 3: Development - ranking and points



Note: The ranking of each country in *Development* is shown after the country name. The horizontal axis shows the score for each country, calculated from indicators related to the area. The highest score a country can receive is 100. The grey bar represents the score required to rank 10th in *Development* in the 2024 edition.

Source: The Global AI Index, 2024 edition.

The *Development* area is mainly based on two classes of indicators. The first is made up of indicators that focus on patents, which is a well-established measure of innovation. The second class, which aims to provide a broader picture of AI innovation, includes indicators that show the extent to which actors in the country contribute to the development of open source[4] This is particularly relevant for AI development, as many advances are not patented but shared openly.

Sweden's innovative capacity in AI depends on our ability to build a functioning eco-system, as described in the introductory chapter of the Roadmap, for example, where academia, industry and the public sector work together to drive development forward. The roadmap contains a number of proposals to strengthen Sweden's innovative power in the AI field. For example, it is important to strengthen the link between academia and industry, which is discussed in the chapter *Collaborative cutting-edge research*, including by establishing centres of excellence in AI. In the chapter *Innovation, entrepreneurship and venture capital*, we propose increased financial support and guidance for innovative companies. Together with the proposal, in the chapter *Computing power*, on the funding of an AI factory, this would contribute greatly to improving the conditions for innovation in Sweden.

What, then, could be an ambitious and realistic objective for the *Development* area? Considering that Sweden often ranks highly as an innovation country in general, and given the proposals in this Roadmap, we should be able to climb in the rankings. However, the indicators in their current form favour larger countries, but this has not prevented countries like Singapore and Israel from achieving high rankings. This means that Sweden should be able to rank among the top 10 countries by 2030.

- **By 2030, Sweden to move from 30th place and be among the top 10 in the area of *Development***

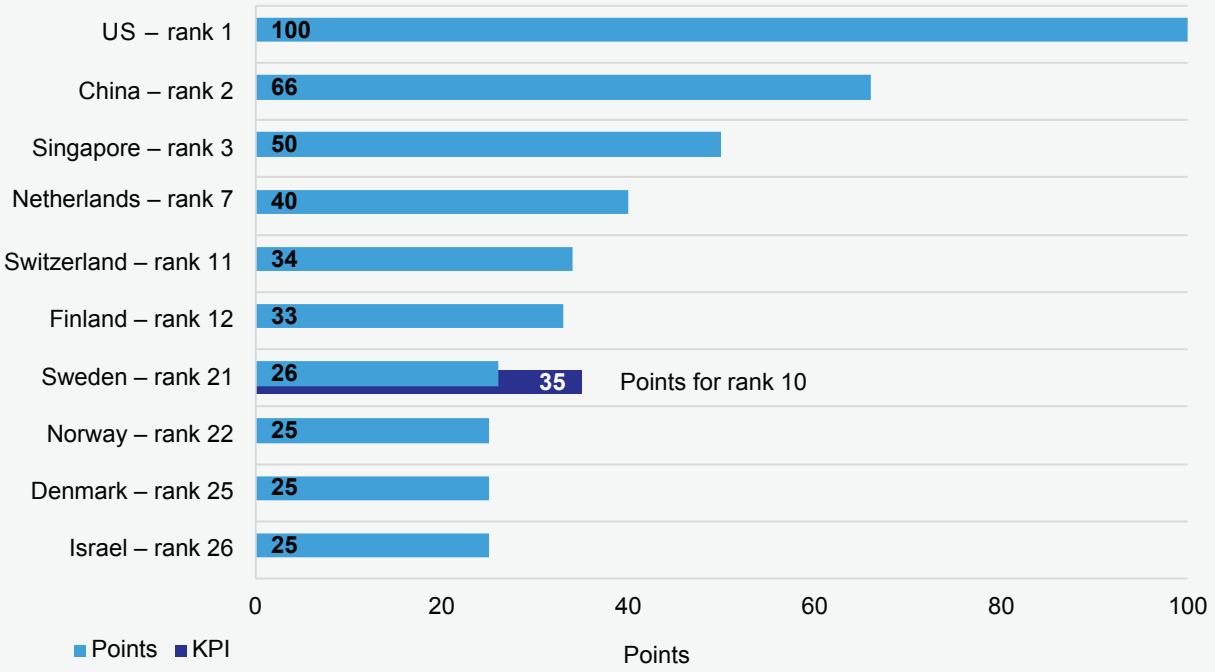
Infrastructure

For Swedish actors to be able to develop competitive AI services, access to a certain infrastructure is required, such as computing power for training and using AI models, telecommunications and electricity. Sweden ranks 21st in the area of *Infrastructure*.

Figure 4 shows that the score difference with neighbouring countries is small, which indicates that many countries are at a similar level to Sweden. Minor improvements in infrastructure can therefore strengthen Sweden's position and competitiveness in this area. Singapore and the Netherlands show that smaller countries can reach the top ten in this area too.

[4] Open source refers to software code that is freely available for anyone to use, modify and share. This means that anyone can see how the programme works, improve it or adapt it to their own needs.

Figure 4. Infrastructure – ranking and points



Note: The ranking for each country in *Infrastructure* is shown after the country name. The horizontal axis shows the score for each country, calculated from indicators related to the area. The highest score a country can receive is 100. The grey bar represents the score required to rank 10th in *Infrastructure* in the 2024 edition.

Source: The Global AI Index, 2024 edition.

In the area of *Infrastructure*, the underlying indicators focus mainly on computing power, which is assessed using two main types of indicators. The first is based on the Top 500 list of the world's most powerful computers. The second focuses primarily on imports and exports of semiconductor materials, which are an important prerequisite for AI.

The assessment of telecoms infrastructure is based on average download speeds, the number of mobile phone subscriptions, and the proportion of the population with internet access.

This Roadmap proposes a number of measures to strengthen Sweden's AI infrastructure. In particular, the emphasis is on computing power for training and using AI models. The chapter *Computing power* contains several proposals aimed at both academia and the private sector. In the chapter *AI for a public sector at the forefront*, we propose additional computational resources for the public sector.

What, then, could be an ambitious and realistic objective for the *Infrastructure* area? With the proposals made in this report and with the opportunities that closer EU cooperation can bring, Sweden should be able to climb in the rankings. This means that Sweden should be able to rank among the top 10 countries in 2030.

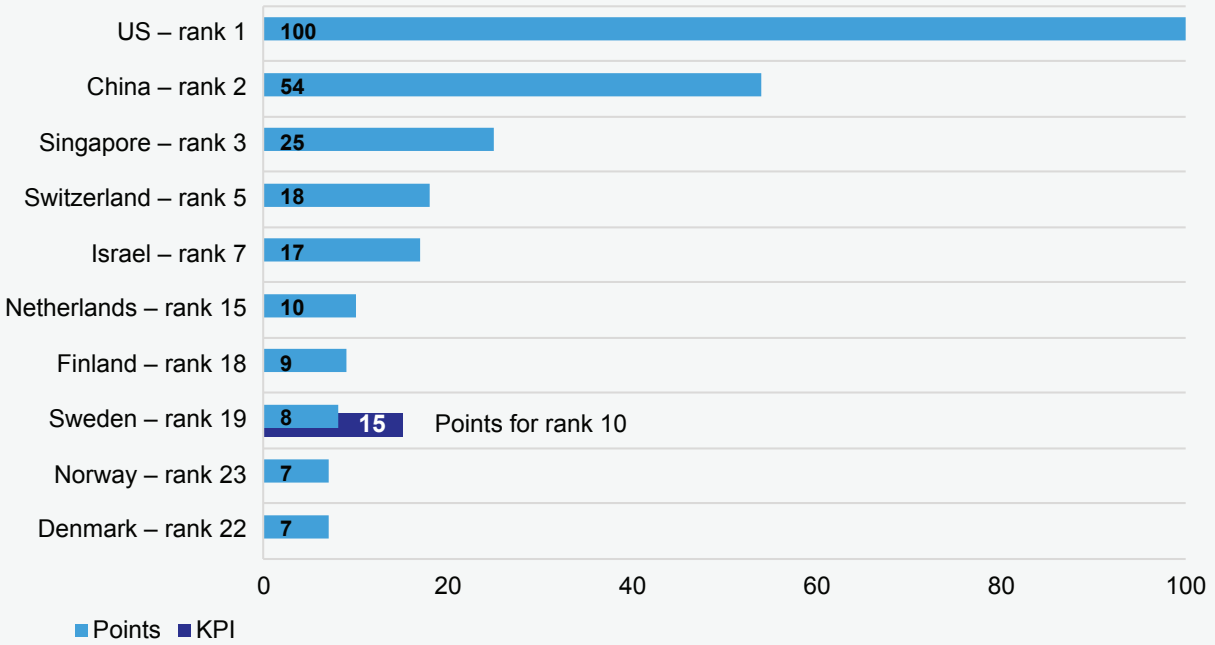
- **By 2030, Sweden to move from 21st place and be among the top 10 in the area of *Infrastructure***

Research

The development of AI is characterised by a short step from research to application and product. Companies at the forefront must therefore conduct their own research or collaborate with leading academic institutions. Cutting-edge research in AI is crucial for Sweden to maintain and strengthen its competitiveness. Sweden is ranked 19th in the area of *Research*.

Figure 5 shows that Sweden is at the same level in terms of scores as many of the comparator countries, including Finland, Norway and Denmark. However, it is a long way from the top. Singapore, Switzerland and Israel are well ahead of the other comparator countries, both in terms of points and ranking.

Figure 5. Research - ranking and points



Note: The position of each country in *Research* is shown after the country name. The horizontal axis shows the score for each country, calculated from indicators related to the field. The highest score a country can receive is 100. The grey bar represents the score required to rank 10th in *Research* in the 2024 edition.

Source: The Global AI Index, 2024 edition.

The *Research* area is based on a large number of underlying indicators, including data on the number of STEM researchers, development of leading AI systems, publications on AI in academic journals, participation in academic AI conferences, and rankings of universities and researchers in computer science. It also includes aggregate measures of how much countries generally spend on research and development.

The chapter *Collaborative cutting-edge research* contains proposals that can strengthen Sweden's position in AI research. Key measures include establishing centres of excellence for AI in collaboration between academia, the private and public sectors, visiting professorships and graduate schools. Sweden's relatively good access to data can also be a decisive factor in retaining and attracting researchers from other countries. In the chapter *Data as a prerequisite for AI development*, we discuss how these can be made more accessible while maintaining respect for personal privacy and copyright.

What, then, could be an ambitious and realistic goal for the *Research* area? Given the comprehensive proposals we make in this Roadmap, Sweden should be able to rank among the top 5 counties in 2030.

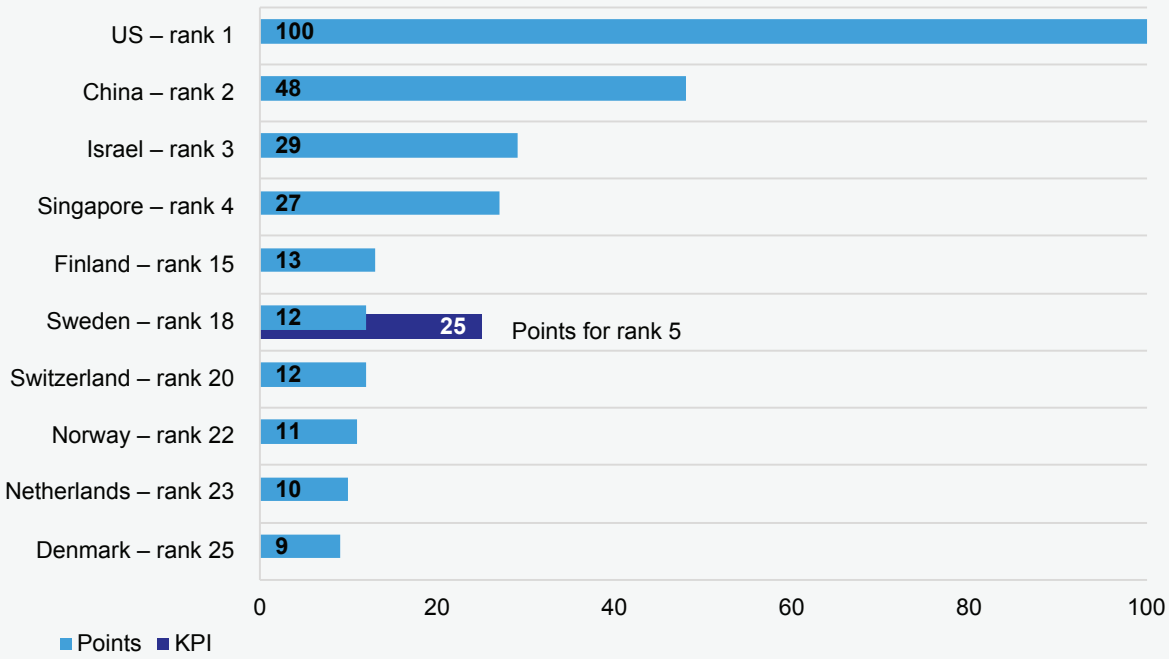
- **By 2030, Sweden to move from 19th place and be among the top 5 in the area of *Research***

Commercialisation

Commercialisation is about transforming innovations into products and services that create value in the market. A strong position in this area is crucial for Sweden's future competitiveness - it is in this area that innovation is transformed into a product or service, new companies are born and investments drive growth and job creation. In the area of *Commercialisation*, Sweden ranks 18th.

Figure 6 shows Sweden's ranking and score in relation to the comparator countries. The figure shows that Sweden is at a similar level to Finland, Switzerland and Norway. In addition to the top countries, the United States and China, Israel and Singapore are also far ahead of Sweden and the other comparator countries.

Figure 6 Commercialisation – ranking and points



Note: The ranking for each country in *Commercialisation* is shown after the country name. The horizontal axis shows the score for each country, calculated from indicators related to the area. The highest score a country can receive is 100. The grey bar represents the score required to rank 5th in *Commercialisation* in the 2024 edition.

Source: The Global AI Index, 2024 edition.

The area of *Commercialisation* is based on indicators such as the number of AI companies and AI start-ups, access to financial capital for these companies, the number of AI companies listed on the stock exchange, and the existence of so-called "unicorns" in the country's AI sector.

Again, these are both absolute and relative indicators, with the greatest emphasis on the absolute indicators. As shown in Figure 6, this does not prevent relatively small countries, such as Israel and Singapore, from being at the absolute top.

Commercialisation, like innovation, is heavily dependent on a well-functioning AI ecosystem. Sweden's conditions should therefore be strengthened by the proposals in the Roadmap. For example, the chapter *Innovation, entrepreneurship and venture capital* proposes increased support for viable AI start-ups. The chapter *Computing power* also proposes the establishment of an AI Factory in Sweden, an EU initiative that will give small and medium-sized enterprises access to advanced infrastructure and expertise at a heavily subsidised price. Sweden should also actively work in EU negotiations to ensure that AI regulation does not hamper competitiveness or create unnecessary regulatory burdens, as detailed in the chapter *International positions*.

So what could be an ambitious and realistic goal for the area of *Commercialisation*? Looking beyond AI to society at large, Sweden already has well-developed venture capital markets and a relatively strong ecosystem for start-ups. The roadmap also makes a number of proposals to strengthen and complement what already exists. This creates a good basis for approaching the top nations. Sweden should therefore be able to rank among the top 5 countries in 2030.

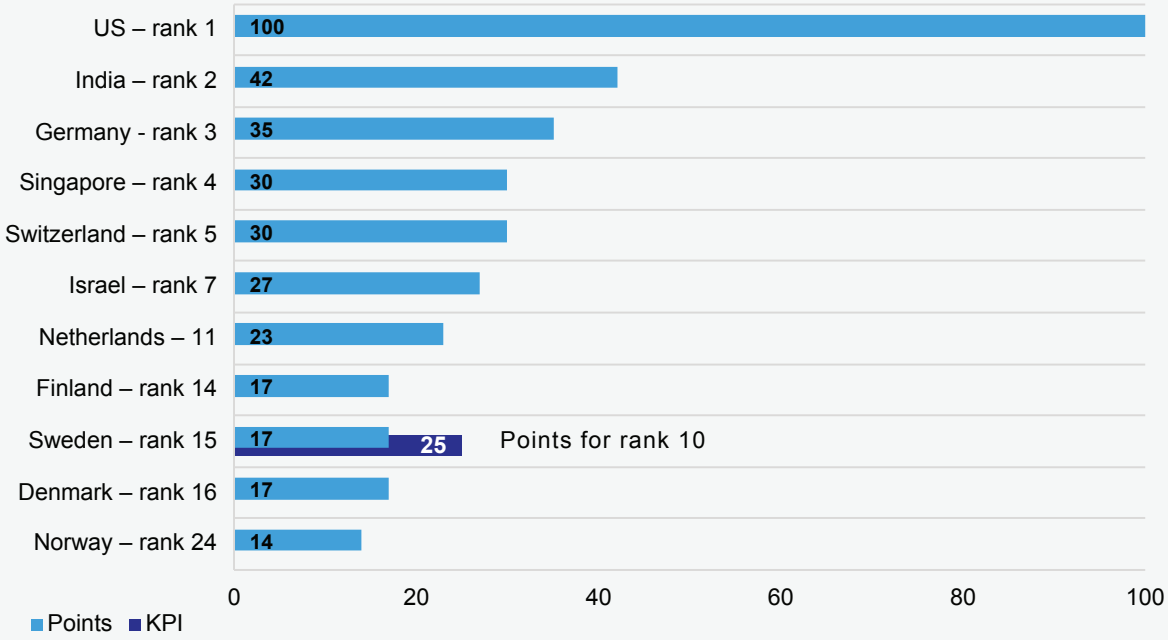
- **By 2030, Sweden to move from 18th place and be among the top 5 in the area of *Commercialisation***

Talent

Talent is about access to a skilled labour force in AI, which is a crucial factor for a country's competitiveness. A broad base of professionals with AI skills is necessary to integrate the technology sustainably and effectively into society. In the area of *Talent*, Sweden ranks 15th.

Figure 7 shows that Sweden has a similar ranking to neighbouring Finland and Denmark. We are far behind the top three ranked countries, in particular the US. Significant improvements are also needed to catch up with Singapore and Switzerland, which score almost twice as high as Sweden.

Figure 7 Talent – ranking and points



Note: The ranking for each country in *Talent* is shown after the country name. The horizontal axis shows the score for each country, calculated from indicators related to the area. The highest score a country can receive is 100. The grey bar represents the score required to be ranked 10th in *Talent* in the 2024 edition.

Source: The Global AI Index, 2024 edition.

The underlying indicators for this area include the number of recent graduates in STEM and IT, as well as data from LinkedIn.[5] [6] The indicators also relate to measures of how active actors from different countries are on popular discussion forums for AI development.[7]

The assumption is that countries with a large digital footprint in the areas of the internet where AI developers are active also have better access to skilled labour in AI. This roadmap contains several concrete measures to ensure AI skills in Sweden. For example, the chapter *Skills boost for all* presents proposals for a teacher boost in AI at the academy. The chapter *Collaborative cutting-edge research* contains initiatives that could strengthen Sweden's access to skilled labour, including the proposal to train 600 doctoral students over a ten-year period.

What, then, could be an ambitious and realistic goal for the area of *Talent*? Through the strategic investments made in this Roadmap and by other actors, Sweden should be able to rank among the top 10 countries by 2030.

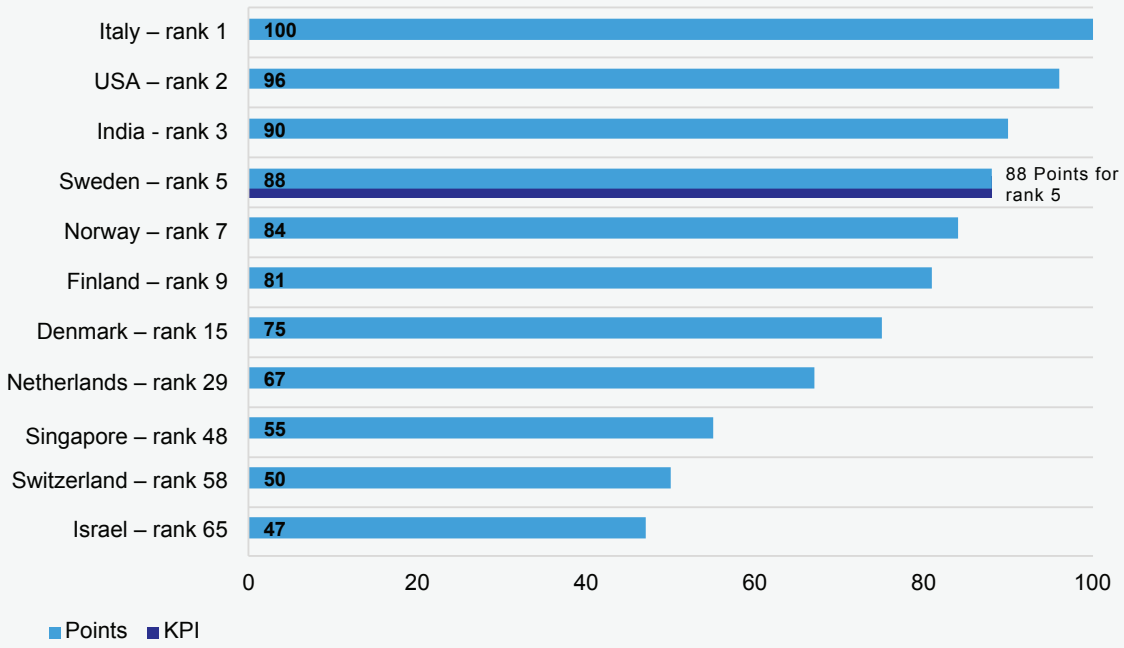
- **By 2030, Sweden to move from 15th place to top 10 in the area of Talent Operational *environment***

A supportive and predictable operating environment is important to create the conditions for development and implementation of AI. It is about aspects such as trust, security and regulations on data and privacy. In the area of *Operational environment*, Sweden is ranked 5th.

Figure 8 shows Sweden's ranking in relation to the comparator countries. Sweden and other Nordic countries rank high, reflecting among other things their high levels of trust. Sweden has a comparative advantage in this area, especially compared to countries that rank high in other areas, such as Singapore and Israel. These rank significantly lower, at 48th and 65th respectively. Of note is the strong position of Italy[8].

[5] Note that this refers to recent graduates in the STEM field; the Research field uses the number of researchers in the same field.
[6] To document the prevalence of AI experts in different countries, data is collected on the number of people who describe themselves as "Engineer", "Researcher" or "Scientist" in AI-related fields such as machine learning, deep learning, computer vision, natural language processing and robotics on LinkedIn.
[7] GAII includes various measures of activity on the online forums Stack Overflow and GitHub, which are central platforms where programmers ask questions, share solutions and exchange knowledge about coding and technical problems. These platforms help developers learn and solve problems together.
[8] Italy's top position is due to several factors. The population has relatively high trust in AI - slightly more than in Sweden. Additional contributing factors are their implementation of GDPR, low visa costs for tech workers, high security scores according to Kaspersky (security service), and the fact that Italy has signed the International Open Data Charter or equivalent.

Figure 8. Operational environment – ranking and points



Note: The ranking of each country in *Operational environment* is shown after the country name. The horizontal axis shows the score for each country, calculated from indicators related to the area. The highest score a country can receive is 100. The grey bar represents the score required to rank 5th in *Operational environment* in the 2024 edition.

Source: The Global AI Index, 2024 edition.

The indicators in this area depict a wide range of societal aspects, such as public trust in AI and AI companies, the level of data protection legislation (the GDPR is held up as a model here), cybersecurity, the gender balance of engineering graduates, and the cost of work visas.

In order for Sweden to maintain a well-functioning operational environment, measures are needed in several areas. In the chapter *Data as a prerequisite for AI development*, it is proposed that the government investigates how the GDPR is applied in Sweden, as current practice makes effective data sharing difficult. Similarly, a review of the Public Access and Secrecy Act is proposed. Another category of relevant measures are those that can strengthen trust and confidence in technology. The chapter *Skills boost for all* includes proposals for support for public education actors to create legitimacy and acceptance for AI. The chapter *AI and societal security* proposes, among other things, research into AI and cybersecurity and the creation of an institute for AI security.

What, then, could be an ambitious and realistic goal for the *Operational environment* area? Sweden's strengths in terms of trust, access to unique data sources, a strong tradition of popular education, supported by the proposals in this Roadmap, suggests that we should continue to be among the highest ranked countries in this field, i.e. among the top 5 countries in 2030.

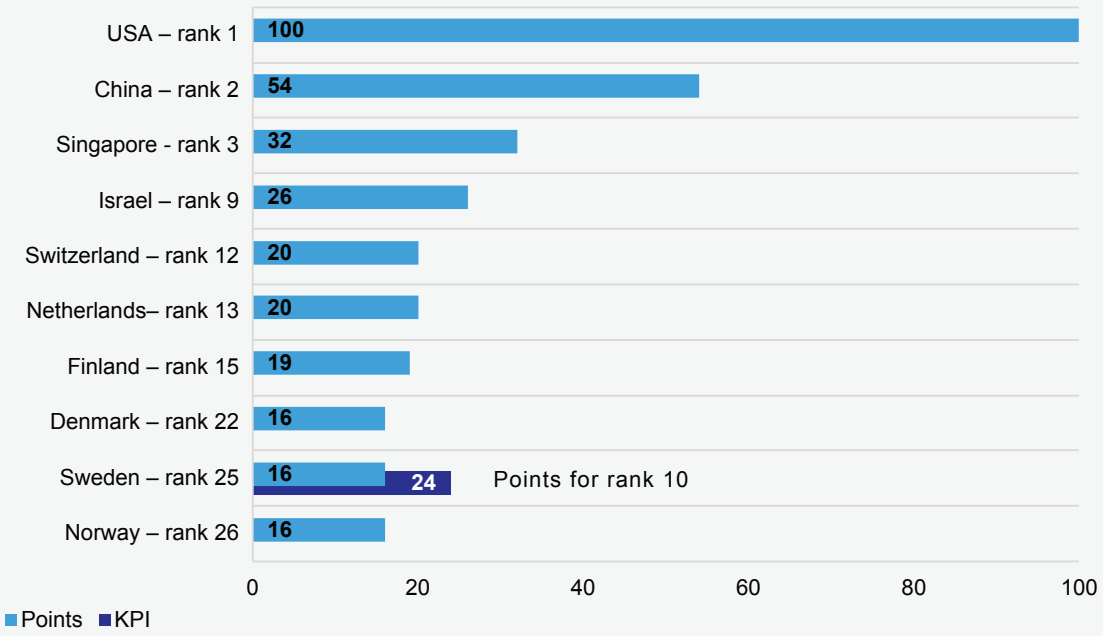
- **Sweden to remain top 5 in the area of Operational *environment***

Global AI Index (GAII)

Although Sweden has slipped in the overall GAII in recent years, there is no reason why this trend should continue - on the contrary. Sweden has many strengths to build on, and determined implementation of the broad measures proposed in this Roadmap for Sweden, the situation should improve rapidly.

Figure 9 shows Sweden's ranking in the GAII, which is based on all indicators from the seven different areas. Sweden is ranked 25th with a score in line with many of our comparator countries.

Figure 9. Global AI Index (GAII) – ranking and points



Note: The position of each country within the *GAII* is shown after the country name. The horizontal axis shows the score for each country, calculated from indicators related to the area. The highest score a country can receive is 100. The grey bar represents the score required to rank 10th in the *GAII* in the 2024 edition.

Source: The Global AI Index, 2024 edition.

An overall CPI for Sweden's development in the AI area should be based on expectations in the seven different areas measured in the GAII. Sweden's ranking in these categories varies, with strong rankings in *Operational environment* and to some extent in *Talent*, but significant potential for improvement in *Political governance* and *Development*. By prioritising the proposed actions in this Roadmap, Sweden should be able to improve its ranking quite significantly within 5 years. An ambitious and reasonable level is therefore that Sweden should be able to rank among the top 10 countries by 2030. This would reflect a strategic investment that strengthens the country's competitiveness and capacity in AI at global level.

- By 2030, Sweden will have moved from 25th place to be among the 10 highest ranked countries in the GAII

Finally, countries around us will also be making strategic investments in AI in the coming years. To maintain and strengthen our competitiveness, it is therefore important that we monitor developments closely and are prepared to take further action when needed. In this context, it is also important to emphasise that all indicators have their pros and cons. They cannot therefore be expected to provide a perfect picture of underlying developments. The proposed indicators should therefore not be seen as an absolute truth, but as a tool to help keep the right course and speed in a complex world in efforts to strengthen the development and use of AI in society.