Appendix
to the Resolution no. 196
of the Council of Ministers
of 28 December 2020
(item 23)

Policy for the Development of Artificial Intelligence in Poland from 2020

Introduction

AI policies in Poland in relation to strategic documents

The "Policy for the Development of Artificial Intelligence in Poland from 2020", which will hereinafter be referred to as the "AI Policy was drafted in line with the activities of the state and the European Union (EU) in this regard, and as a result of the adoption of strategic documents by several international organisations — such as the Organization for Economic Cooperation and Development (OECD) — of which Poland is a member. In particular, the AI Policy takes into account the objectives defined in the following strategic documents:

Public Data Opening Programme[1], Strategy for Responsible Development[2], "From Paper to Digital Poland" Programme[3], "Dynamic Poland 2020" Strategy for Innovation and Efficiency of the Economy[4], Communication of the European Commission (EC) "Coordinated plan on Artificial Intelligence"[5], Position of the Visegrád Group on Artificial Intelligence[6], Recommendations of the High Level Expert Group on Artificial Intelligence (HLEG AI) to the European Commission in the form of "Ethics Guidelines for Trustworthy AI"[7] and Recommendations on Policy and Investment in Trustworthy AI[8], as well as recommendations[9] concerning the management of trustworthy artificial intelligence, in the Strategy of Polish Foreign Policy[10] and the "Memorandum on the Development of Artificial Intelligence in Poland[11]'.

More documents are planned to be released soon, including the Council of Europe and UNESCO recommendations, which are currently drafted by their respective Member States, and whose results may constitute the basis for future international treaties and agreements on artificial intelligence. In addition, an update of the European Commission's "Coordinated Plan on Artificial Intelligence" is also expected, along with the initiatives concerning the legal framework for *Artificial Intelligence* (AI).

The AI Policy directly constitutes an element of the new Polish Productivity Strategy and the *Efficient and Modern State 2030* strategy, which are currently being drafted.

This AI Policy does not cover state activities in the area of national security and defence; however, it assumes the cooperation of the civilian sector with the military sector in all areas considered useful for the needs of national defence in accordance with the priorities set out in the *National Security*

1) https://mc.bip.gov.pl/programy-realizowane-w-mc/programu-otwierania-danych-publicznych.html
2) https://www.gov.pl/web/inwestycje-rozwoj/informacje-o-strategii-na-rzecz-odpowiedzialnego-rozwoju
3) https://www.gov.pl/web/cyfryzacja/od-papierowej-do-cyfrowej-polski
4) http://kigeit.org.pl/FTP/PRCIP/Literatura/006_1_Strategia_Innowacyjnosci_i_Efektywnosci_Gospodarki_2020.pdf
5) https://eur-lex.europa.eu/resource.html?uri=cellar:22ee84bb-fa04-11e8-a96d-01aa75ed71a1.0016.02/DOC_1&format=PDF
6) https://www.gov.pl/web/cyfryzacja/stanowisko-grupy-wyszehradzkiej-dotyczace-sztucznej-inteligencji
7) https://ec.europa.eu/digital-single-market/en/news/ethics-guidelines-trustworthy-ai
8) https://ec.europa.eu/digital-single-market/en/news/policy-and-investment-recommendations-trustworthy-artificial-intelligence
9) http://www.oecd.org/going-digital/ai/
10) https://www.gov.pl/attachment/8196524f-687b-40e6-aca8-82c53ff8e6db
11) https://www.gov.pl/documents/31305/436699/DEKLARACJA_26022019.pdf/f0d107c8-5935-ca86-da8b-9290e3c3dc26?download=true

Strategy of the Republic of Poland, approved by the order of the President of the Republic of Poland from 12 May 2020 (Monitor Polski, item 413).

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Executive Summary

"The Policy for the Development of Artificial Intelligence in Poland from 2020" sets out a number of activities that Poland should undertake, as well as objectives that the country should achieve in the short term (until 2023), medium term (until 2027) and long term (after 2027) to foster the growth of Polish society, Polish economy and science in the field of *Artificial Intelligence* or AI for short.

All the listed objectives and tools are divided into six areas:

1. **AI and society** – activities, whose goal is to make Poland one of the major beneficiaries of a data-based economy, while raising awareness of the need for the continuous improvement of knowledge and skills, including digital competences.
2. **AI and innovative companies** — activities aimed at supporting Polish AI companies, creating financing mechanisms to foster their growth, increasing the number of orders, ensuring cooperation between start-ups and the government and introducing new pro-development regulations — digital sandboxes.
3. **AI and science** — activities supporting the Polish academic and research communities in designing interdisciplinary challenges or solutions in the field of AI, taking into account both the humanities and social sciences; establishing AI departments, training PhD students, awarding grants for researchers and other activities aimed at preparing a staff of experts capable of creating AI-based solutions, taking into account the framework for ethical and safe use of this technology, for the benefit of the economy and the welfare of citizens.
4. **AI and education** — activities that are supposed to be implemented at every level of education — from primary, through secondary education up to the university level, including course curricula for people threatened with losing their jobs as a result of progressing automation and deployment of new technologies, educational grants aimed at helping to prepare the best staff for Polish AI economy.
5. **AI and international cooperation** — international activities that will support the promotion of Polish business in the field of AI and the development of AI technologies that respect human dignity and fundamental human rights, in accordance with EU and OECD standards, as well as digital diplomacy activities in the area of policies or regulations concerning artificial intelligence.
6. **AI and the public sector** – activities aimed at supporting the public sector in the implementation of contracts concerning AI, better coordination of activities and further development of programmes such as GovTech Polska, as well as protecting the people from relevant risks and threats. Other tills will comprise virtual data repositories or *data trusts* (trusted data space initiatives), the Government Cloud[12)] and making as much public data as possible open and available for use by citizens and businesses.

12) https://chmura.gov.pl/informacje/rzadowa-chmura-obliczeniowa/

The overarching aim of the AI Policy is to support the society, companies, representatives of the academia and public administration in taking advantage of opportunities related to AI development, while ensuring the protection of human dignity and conditions for fair competition in this global race.

The AI Policy takes into account the international, legal, ethical, technical and organisational standards, which shape the requirements and conditions to reap the benefits of using AI throughout its life cycle, which encompasses design, research, development, deployment, application, use, decommissioning and disposal.

Poland has the potential to make a dynamic transition from being a contender to an internationally recognised leader in AI technologies[13)]. However, making use of this potential depends on **all of us** and on how well we can coordinate the activities of all participants in the Polish AI ecosystem.

[13)] Digital McKinsey, *Polska jako cyfrowy challenger. Cyfryzacja nowym motorem wzrostu dla kraju i regionu*, 2018, also *The Rise of Digital Challengers. How digitization can become the next growth engine for Central and Eastern Europe. Perspective on Poland*, 2018.

Introduction

Why is AI important?

The process of digital transformation of society and the algorithm economy are the greatest developmental challenges in the 21st century. Public and commercial services and industries need to be saturated with data to enter the era of artificial intelligence. In recent years, data has become one of the most important materials. The acquisition, collection, analysis, processing and informed use of data and the continued development of AI algorithms are becoming a fundamental competence of economies and countries alike. This competence determines their place in the global supply chain and the added value associated with data processing in the fields where artificial intelligence is used.

Data-driven economy changes the rules of growth that we knew in the past. This is a great opportunity for Polish companies and Polish economy, because these new solutions and services have been developed and implemented only recently, and in addition, it is much easier to build one's position in a new, fledgling industry. This means that the Polish society can stop being just a consumer of others' inventions, while Poland can become a country of inventors and creators of new solutions.

It is also an opportunity to make another developmental leap and uplift Poland from the group of middle-income countries to the group of highest-income states. If Poles are to become a prosperous society, they must take advantage of all the opportunities and benefits coming with the development of AI, while having an impact on the drafted regulations and laws regarding the operation of robots and self-learning systems, which will become increasingly important in our lives, work, education and leisure activities. Global trends and risks, such as the SARS-CoV-2 virus pandemic, have a great impact on the accelerated digitalisation of many areas of our lives. The manner and extent of the use of AI-based technologies requires further in-depth reflection, based on a substantive debate involving both experts in new technologies and ethics, as well as humanities and social science scholars.

AI will also have a key impact on energy, climate and the environment at large. AI-based solutions in smart grids will allow integration and stabilisation of distributed energy generation and renewable energy sources, efficient management of energy consumption, and thanks to increased flexibility and control of the power system, introducing dynamic pricing formulas while increasing reliability level and quality of electricity supplied to the customers.

Algorithmic economics tells us that much of the work in the future –will be done by robots or multifunctional systems with minimal human intervention. Poland's advantage in the form of competitive wages compared to highly developed countries will cease to matter. If Poland and Polish companies do not invest and develop solutions in the field of AI, robotics, as well as developing modern hardware and software solutions, other countries will do that first. As a result we will no longer be competitive in the European and global markets. For example, a factory that once employed 500 people will be able to manufacture the same items, while reducing the number of operators to 5 people. Services such as call centres, accounting, travel agencies, diagnostic laboratories and financial consultancy are already increasingly supported by AI-based solutions, and thus traditional jobs are gradually being replaced by smart software. Thus, it is necessary to ensure conditions for the upskilling of the general public in order to counteract technological unemployment.

The development of new communication technologies, such as 5G, will make the progress and development of automation and robotics even more dynamic, as we have seen in the case of communications, which underwent such a revolutionary transformation in recent years. The modern phone is a very different device than it was even 15 years ago. Transformation at a similar scale awaits not only devices such as the electricity meter or cars, but also entire industries such as energy, transport, education, defence and agriculture. AI-based solutions will play a central role and their importance will continue to grow in smart grids, logistics and transportation, food production, autonomous cars and smart cities.

Societies that produce and effectively implement new solutions, in particular in the area of artificial intelligence, will enjoy a better growth than those, who will merely use them. It is also crucial that the developed AI-based solutions always serve humanity at large, putting human rights and dignity first. That is why it is so important for the Polish voice to be constantly heard in the global debate on AI ethics, as well as on the functioning and operation of the smart or autonomous agents — algorithms that determine access to public services, surveillance robots, or autonomous cars.

In the near future, we will see a drastic increase in the use of AI-based solutions in virtually all areas of life and the economy. At the same time, this is the first industrial revolution in history, in which we can take part as a sovereign state and free citizens. It is up to all of us to grasp the opportunities of the ongoing industrial revolution to build our wealth and increase our role in the global economy.

Poland's achievements

We can already boast first global success stories that can make artificial intelligence a driving force for the Polish economic growth. The intellectual potential of Poles and their achievements to date are the foundation on which we should build further development of technology.

AI is a field in which Poland has a tangible chance of becoming one of the international leaders, contributing more than what the Polish GDP or population in relation to the entire global economy and population could suggest. It is a market in which *know-how*, intellectual property and creative skills are the main assets, and our country has them.

Poland regularly achieves some of the best results in the Programme for International Student Assessment (PISA) coordinated by the OECD. In the area of mathematical reasoning, the results of the 2018 study saw Polish 15-year-olds score 516 points, or 27 points higher than the average for OECD countries (compared to 504 points in 2015). Putting Asian countries aside, only two European countries achieved a higher result than Poland: Estonia and the Netherlands.

No.	Country	Mean (standard deviation)		Significance	OECD	EU
1	China B-S-J-G	591	(2.5)	↑		
2	Singapore	569	(1.6)	↑		
3	Macau (China)	558	(1.5)	↑		
4	Hong Kong (China)	551	(3.0)	↑		
5	Taiwan	531	(2.9)	↑		
6	Japan	527	(2.5)	↑	OECD	
7	S. Korea	526	(3.1)	↑	OECD	
8	Estonia	523	(1.7)	↑	OECD	EU
9	The Netherlands	519	(2.6)	↑	OECD	EU
10	Poland	516	(2.6)	↑	OECD	EU
11	Switzerland	515	(2.9)	↑	OECD	
12	Canada	512	(2.4)	↑	OECD	
13	Denmark	509	(1.7)	↑	OECD	EU
14	Slovenia	509	(1.4)	↑	OECD	EU
15	Bel	508	(2.3)	↑	OECD	EU

Figure 1. PISA 2018 study — student mathematics scores

Source: Michał Sitek (ed.), *Program Międzynarodowej Oceny Umiejętności Uczniów PISA – Wyniki badania PISA 2018 w Polsce*, Instytut Badań Edukacyjnych, Warsaw 2019, https://pisa.ibe.edu.pl, p. 13

Poland is recognised as one of the leaders in the field of video games — a new technology field that takes advantage of many of the competencies useful in AI development. In both areas, programming skills, dynamically changing standards and creativity , as well as cooperation across various and numerous fields are considered crucial. *The Witcher* may serve as a very good example of this phenomenon — as a world-famous game, it has won more than 250 game of the year awards. It also became a tool for Polish diplomacy. More than 150 million people have played the games, read the books or watched the series set in the world of *The Witcher*.

Poles also work on some of the projects that constitute key achievements and advances in the field of artificial intelligence. The following are examples of AI-based solutions that are known by all AI specialists in the world, and were created or co-created by Poles:

- OpenAI[14] — one of the world's most important organisations dedicated to the development of artificial intelligence,
- PyTorch[15] – a neural network and numerical calculations library in the Python programming language (second most popular library in applications, first place in research),
- FastText[16] — an algorithm that allows machines to process natural languages and meaning of words. One of the algorithms created for inflected languages, including Polish,
- Flo[17] — Application that detects gynaecological diseases with advanced algorithms,
- Inception-v3[18] — deep neural network architecture, best network for image recognition in 2016,
- AlphaStar[19] — a self-learning neural network that plays the StarCraft II real-time strategy game at the grandmaster level.

To sum up, Poland has a great potential in the field of artificial intelligence thanks to:

- high educational results in mathematics and natural sciences achieved by Polish students;
- introducing programming classes for all students and at all stages of school education and focusing education on problem-solving and developing computational thinking;
- international success in the field related to AI — developing modern video games;
- creating internationally recognised and widely used solutions that make a key contribution to the development of AI in the world;
- large number of companies and teams that are already active in the area of AI.

14) https://openai.com/blog/authors/wojciech/

15) Adam Paszke et al., *PyTorch: An Imperative Style, High-Performance Deep Learning Library*, 33rd Conference on Neural Information Processing Systems (NeurIPS 2019), Vancouver 2019, https://arxiv.org/abs/1912.01703.

16) Piotr Bojanowski et al*., Enriching Word Vectors with Subword Information, Transactions of the Association for Computational Linguistics*, vol. 5, 2017, https://arxiv.org/abs/1607.04606.

17) Cf. https://www.innovatorsunder35.com/the-list/kamila-staryga/.

18) Christian Szegedy, [...], Zbigniew Wojna, *Rethinking the Inception Architecture for Computer Vision*, 2016 IEEE Conference on Computer Vision and Pattern Recognition (CVPR), Las Vegas 2016, https://arxiv.org/abs/1512.00567.

19) Oriol Vinyals, Igor Babuschkin, Wojciech M. Czarnecki et al., *Grandmaster level in StarCraft II using multi-agent reinforcement learning*, Nature 575, (2019), https://doi.org/10.1038/s41586-019-1724-z.

The potential of AI

As of now, we are witnessing a worldwide race in connection with the AI. The competitiveness of economies leading the way in building high-tech solutions, including AI, closely correlates with their innovation level.

Over the past few decades, we have been seeing a new reality being ushered in at a breakneck pace — one that is no longer based on natural resources, workforce and financial capital, but rather on knowledge and intangible assets. In this new economy, the nature of investments in intangible assets — digitalised information and processing models (data and algorithms), intellectual property (research, development, design) as well as economic competences (networking and cooperation, market understanding, training and business process re-engineering) — has changed fundamentally. Leading economies in the Transatlantic region, such as the USA, Canada, Sweden, the UK, Finland, France and the Netherlands, are already investing more in intangible capital than in physical assets; on average, this investment amounts to around 10 % of GDP annually.[20)] Artificial intelligence will also enable radical new ways to access cultural heritage, while bringing about new quality of education.

Artificial intelligence will increasingly use data and involve human talent — ushering in the end of the age of traditional means of production known since the industrial age.

Poland's benefits from the development of AI hinge upon more than just the ability of companies and experts to deliver working solutions. A well-functioning market also needs numerous and informed customers that create demands for the products, which is particularly important with the list of AI-based solutions and applications growing with every subsequent month. Even today, it is hard to find a single industry that is not impacted by artificial intelligence.

Poland is currently in a convenient position, since the country’s economy is based on industries that can reap maximum benefits from implementing artificial intelligence. Priority sectors include:

- public administration;
- construction (in particular *smart buildings*);
- cybersecurity;
- energy;
- retail and marketing;
- healthcare;
- industry;
- agriculture;
- transport and logistics.

In the case of the priority economic sectors for AI, the benefits of its implementation constitute about 2.65% of the total GDP.

[20)] Cf. J. J. Zygmuntowski, Kapitalizm sieci, Wydawnictwo RozRuch, Warsaw, 2020.

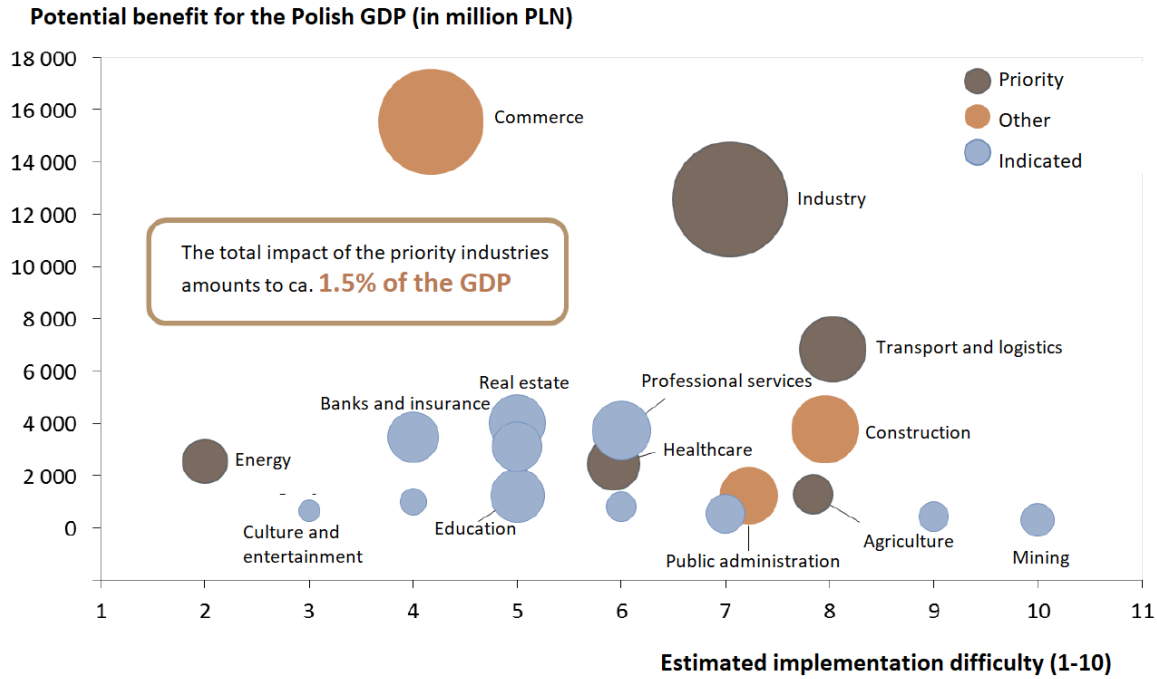

Figure 2. Potential benefits for Polish GDP stemming from AI implementation.

Source: Group 2 at the MoDA, *Finansowanie badań i rozwoju, Założenia strategii AI w Polsce*, Warsaw, 2018

Artificial intelligence combined with automation will have a big impact on the job market as a whole:

- it is estimated that for 100 existing jobs, 130 new ones will be created[21];
- by 2030, as much as 49% of working time in Poland can be automated using already existing technologies. On the one hand, this represents an opportunity to boost productivity; on the other, it poses challenges, particularly for the education system for young people and adults, in terms of adapting workers and their skills to the new labour market and developing appropriate tools to combat technological unemployment[22];
- the use of AI-based solutions may lead to a decline in employment in some sectors in the short-term perspective, while in the long-term perspective it can increase total employment rate, as well as job quality (leading to the creation of higher quality jobs)[23].

21) Gartner Research, *Predicts 2018: AI and the future of work*, November 2017, https://www.gartner.com/en/documents/3833572/predicts-2018-ai-and-the-future-of-work.

22) Ibid.

23) European Commission Report, Michel Servoz, *Future of Work? Work of the Future*, April 2019 https://ec.europa.eu/digital-single-market/en/news/future-work-work-future.

Among the important factors that impact the potential of Poland in the context of creating AI-based solutions, the following circumstances are particularly evident:

- the Polish economy is strongly dependent on the flow of electronic data (46% of its GDP)[24]. This fosters the creation of algorithms that process data and generate added value for international data processing value chains;
- according to the Global Creativity Index,[25] the creative class in Poland encompasses more than 33 percent of its population. That is more than in the USA, Spain, and even Japan, and comparable to Italy or Israel. This potential can be used in the possible AI research and applications;
- high quality of school education — PISA study results place Poland at the level of countries in Northern Europe. We have over 110,000 STEM graduates every year – Poland ranks 4th in the EU in that regard, alongside Northern European countries.[26]

AI funding sources

The global leaders in spending on AI-based solutions are the United States, China, France and the United Kingdom. China — as one of the first countries in the world — announced its AI strategy called Next Generation Artificial Intelligence Development Plan back in July 2017. An important part of China's plan was to invest in local start-ups, with more than $1 billion earmarked for this purpose over the course of two years, focusing mostly on healthcare solutions.[27] France announced its strategy in March 2018, entitled *AI for Humanity*. Its objective — which saw €1.5 billion earmarked for it — is to make France a world leader in artificial intelligence. The French strategy envisions focusing on four key areas — healthcare, environment, transport and defence. In the US and the UK, private companies remain the main investors in AI-based solutions.

In Poland, due to the small number of large private enterprises, the involvement of the public sector, as well as the largest state-owned companies in financing AI projects is necessary. Table 1 below shows the main public programmes supporting the development of innovation and innovative enterprises, which also enable financing projects related to the development and implementation of AI-based solutions.

[24] Report prepared for the Ministry of Digital Affairs: Grzegorz Koloch et al., *Intensywność wykorzystania danych w gospodarce a jej rozwój – analiza diagnostyczna*, Warsaw, 2017.

[25] Table – Creative Class Share 2015 (item33); http://creativeclassgroup.com/_wp/wp-content/uploads/2019/11/Global-Creativity-Index-2015.pdf.

[26] https://www.oecd.org/pisa/publications/pisa-2018-results.htm

[27] https://www.arp.pl/__data/assets/pdf_file/0008/89918/_Raport_ARP_druk_po_stronie_calosc.pdf

Table 1. List of programmes financing implementation and development of innovative solutions in Poland

Financing organisation	Programme/project/initiative name	Short description of programme/project/initiative	Programme/project/initiative addressees	Available funds (in M PLN)
National Fund for Environmental Protection and Water Management	Nowa Energia (New Energy)	The programme is designed to support entrepreneurs and local government bodies in activities aimed at implementing innovative technologies in the energy sector, comprising "Smart Cities for Growth" and "Self-Sufficient Energy Clusters."	Entrepreneurs, local government bodies and entities providing public services, implementing tasks of local government bodies.	2,500[28)]
NCBIR – National Centre for Research and Development	Szybka Ścieżka (Fast Track) 1/1.1.1/2020	The competition is aimed at industrial research and/or experimental development projects that result in the development of an innovative solution that can be implemented in businesses and companies.	Entrepreneurs, consortia of enterprises, scientific and industrial consortia.	1,200
NCBIR – National Centre for Research and Development	INFOSTRATEG Programme	The aim of the INFOSTRATEG programme is to develop Polish research potential in solving selected machine learning problems that provide opportunities for development on a larger scale.	Enterprises, academic entities, public administration bodies.	840
NCBIR – National Centre for Research and Development	BRIdge Alfa (1.3.1 SG OP)	The programme supports the implementation of ideas at the *seed* stage, when the risk of investment failure is the highest, but can be verified at a relatively low cost.	Project teams and/or young technology companies that have an innovative idea and need funding.	400
NCBIR – National Centre for Research and Development	BRIdge VC: PFR NCBR CVC. SpeedUp Energy Innovation and	Funds launched by the PFR NCBR CVC Fund of Funds invest in technology companies in the growth and/or expansion phase.	New technology companies.	110

[28)] Including the budget of the areas "Smart Cities for Growth" and "Self-Sufficient Energy Clusters" — 600 (currently in preparation).

	EEC Magenta funds			
NCBIR – National Centre for Research and Development	LIDER	The main objective of the programme is to enhance the competencies of young scientists concerning independent planning, management and leadership of scientific projects whose results can be implemented in the economy.	Young scientists.	100
NCBIR – National Centre for Research and Development	Measure 4.1 of the SG OP "Scientific research and development works" Application projects 2/4.1.4/2020	The competition is aimed at industrial research and/or experimental development projects that result in the development of an innovative solution. Under KIS (in the case of AI — KIS 10).	Companies, scientific and industrial consortia.	150
NCBIR – National Centre for Research and Development	BRIdge VC - TDJ Pitango Ventures fund	Polish-Israeli Venture Capital fund focused on investments in technology start-ups.	Start-ups	40
Polish Agency for Enterprise Development	EPOP 1.1.2 Development of start-ups in Eastern Poland	The aim of the programme is to finance the development of start-ups in the initial phase of their activity, as well as to launch their products on the domestic or international markets and systematically increase their sales.	Small businesses that have completed the acceleration phase and have been recommended for further growth.	300

Polish Agency for Enterprise Development	SG OP Measure 2.5 Acceleration programmes	The aim of the measure is to increase the involvement of large and medium-sized enterprises in the development of start-ups by using their own financial, human and technical resources in the acceleration process, enabling them to gain experience and create a legal framework for such cooperation.	Technology accelerators.	133
Polish Agency for Enterprise Development	SG OP Measure 2.4.1 Poland Prize Pilot	The aim of the competition is to encourage international start-ups to do business in Poland.	International start-ups	30
Polish Agency for Enterprise Development	SG OP Measure 2.4.1 GovTech inno_LAB Pilot	The aim of this pilot project is to improve the competencies of local government bodies in the field of innovation implementation, in particular their use of technical dialogue and the competitive selection processes specified in the Public Procurement Law.	Entrepreneurs and local government bodies.	5
Polish Agency for Enterprise Development	Norwegian Financial Mechanism 2014-2021, Welfare technology scheme;	The aim of the programme is to develop and market new or significantly improved products and services based on modern technologies which will improve the quality of life of the most vulnerable groups in society, in particular by responding to the needs of the elderly and improving their quality of life.	Small and Medium-sized Enterprises, Micro-companies	79
Office of the Minister in charge of digital affairs and computerisation	Innovative Applications of Digital Technologies Academy (AI Tech)	The Innovative Applications of Digital Technologies Academy project comprises a series of activities aimed at supporting the education of the second-level and top-level	Students of AI-related majors, universities.	81

		professionals in artificial intelligence, machine learning and cybersecurity. Project submitted for co-financing under DP OP Measure 3.2.		
Ministry of Education and Science	Doktorat wdrożeniowy II – Sztuczna Inteligencja (Implementation PhD II — Artificial Intelligence)	The programme supports scientific activities concerning the use of artificial intelligence in technological or social processes, including those related to cybersecurity.	Entrepreneurs and PhD students.	47
Polish Development Fund	PFR Starter FIZ, PFR Biznes FIZ, PFR Otwarte Innowacje FIZ, PFR KOFFI FIZ, PFR NCBR CVC	The programme includes *venture capital* support investing in new technologies at both early and later stages.	Enterprises, start-ups and established companies.	ca. 2,500
GovTech Polska	GovTech Polska competitions	Competitions organised as part of the GovTech Polska programme connect the most innovative private companies with the public sector. The presented solutions, financed from funds allocated for competitions, support the modernisation of public administration with the help of innovative technologies.	Companies.	145 for the entire program me
Fundacja Platforma Przemysłu Przyszłości (Future Industry Platform Foundation)	-	The aim of the Future Industry Platform Foundation is to foster the growing competitiveness of entrepreneurs and their development towards Industry 4.0 solutions. This includes supporting their digital transformation in the areas of processes, products and business models using the latest developments in	Companies.	20[29)]

[29)] Foundation's annual operating budget.

		automation, artificial intelligence, ICT technologies, as well as machine-to-machine and human-to-machine communication solutions.		
Digital Innovation Hubs (DIH) in Poland Ministry of Economic Development, Labour and Technology	Ministerial programme for 2019-2021 entitled "Przemysł 4.0" ("Industry 4.0")	The aim of the programme is to identify potential Digital Innovation Hubs and supplement their capacity, develop best practices and standardise services provided by these hubs, as well as provide support support for entrepreneurs in the area of product, service and organisational transformation with the help of innovative technological solutions.	Companies and public administration.	30[30)]
European Digital Innovation Hubs (DIH) European Commission/Ministry of Economic Development, Labour and Technology	Network of European Digital Innovation Hubs	The aim of the Digital Europe Programme established by the European Union for the years 2021-2027 is to develop digital infrastructure and to increase the level of use of digital technologies in public administration and the private sector in the Member States, focusing in particular on small and medium-sized enterprises (SMEs). The main objective is to create a network of European Digital Innovation Hubs. to support the digital transformation of public administrations and enterprises.	Companies and public administration.	470[31)]

The above-mentioned tools, while already serving the development of AI in Poland, will be periodically evaluated by the funding institution and the AI Policy Task Force at the Committee of the Council of Ministers for Digital Affairs in terms of their alignment with the AI Policy, including their integration with the specifics of the Polish market for AI-based solutions and sufficient consideration of AI

30) Programme budget for 2019-2020.

31) Estimated budget for 2021-2027 (EC funds and Polish contribution).

investments in the fund allocation. Thanks to dialogue with the market representatives and social organisations, some of them may be redesigned to better support:

1) investment in human capital — competences of managers and executives, experts and other employees who work with AI-based solutions, as well as preventing the outflow of human capital and the generated innovations;
2) acquisition of suitable hardware and software, including tools used for the digitalisation of production and business processes;
3) research and development investments;
4) transfer of research results into production environments;
5) investment in strategic infrastructure projects;
6) creation and sharing data and software under open licenses, as well as making products for the development of AI in Poland available free of charge;
7) keeping Polish AI talent in the Polish AI ecosystem.

In addition to domestic funds, Poland intends to promote an ambitious approach to funding AI development internationally.

This approach will be reflected in Poland's active suggestions to include AI funding in particular in the structure of the European Union's Multiannual Financial Framework for 2021-2027. To this end, Poland will push for the inclusion of separate instruments supporting activities in the areas of AI research and implementation within the framework of the:

- Cohesion Fund,
- European Regional Development Fund,
- European Social Fund Plus,

as well as programmes, such as:

- Digital Europe Programme (DEP);
- Horizon Europe;
- Connecting Europe Facility in the area of telecommunications (CEF Telecom).

Poland also supports the establishment of separate and dedicated financial support mechanisms for AI development by individual Member States. At the same time, it claims that the funds should be distributed proportionally, according to the size of a country's economy, so as to maximise the number of beneficiaries and ensure sustainable development in the EU.

It always seems impossible until it's done.

Nelson Mandela

1. AI and society

Artificial intelligence is redefining many professions due to process optimisation and automation, and as a result machines replace humans in doing standard and repeatable tasks on an unprecedented scale. This risks aggravating problems in socially and economically excluded regions, increasing unemployment, as well as exacerbating various forms of inequality and discrimination. The effects of automation and process optimisation are likely to affect different populations in various ways, and their impact will be not only economic but also social and political in nature.

One of the features of automation is that it replaces humans in doing tedious, repetitive and difficult tasks. It is also a way to compensate for labour shortages due to unfavourable demographic situation in developed countries. Therefore, it highlights the need to support the development of workers towards performing more creative work and to get the employees working at the occupations at risk for upcoming new challenges.

The ongoing social changes should be analysed using the potential of scientific methods for modelling social processes.

In order to involve the society as a whole in the creation of new professions in a data-based economy, the state is responsible for creating proper conditions for people at risk of losing their jobs due to the implementation of AI to gain new skills in fields compatible with market trends. Preparing for these changes will also require changes in the legal framework. The issues of AI-related skill development and the use of AI-based tools in educational processes are the key issues of the Integrated Skills Strategy 2030 in Poland, which is currently undergoing development.

In order to develop and fully exploit the potential of artificial intelligence, it is first and foremost necessary to respond to technological developments in a flexible manner by establishing R&D–friendly legal framework, creating new economic models, removing obstacles and improving the readiness of the legal system for market changes. Poland also needs to ensure its ability to retain a highly-specialised AI workforce and attract experts from abroad — entrepreneurs, researchers, and workers — while maintaining a high level of protection for fundamental human rights. Thus, these changes should be made in line with the European approach to human-centric and trustworthy artificial intelligence, which enables the broadest possible use and access to AI-based solutions, as well as reaping their benefits, while protecting human rights at the highest possible level. Therefore, these changes should be implemented in line with the European approach to trustworthy human-centric artificial intelligence, which is to create an ethical framework and recommendations for AI policy and investment. In a globally competitive environment, this enables making the most of AI opportunities, while mitigating social, political and economic risks potentially brought about by the use of AI. One of the elements of this approach includes providing access to AI-based solutions, including algorithm libraries, as well as access to the benefits stemming from the use of these technologies. International organisations such as the EU and the UN are working on ethical and regulatory frameworks concerning AI. These documents also cover the issue of mitigating social exclusion and avoiding inadvertent discrimination. Polish representatives should continue their participation in the work of these organisations and – if possible – intensify their work, pointing out the issues pertaining to human dignity and human rights, as well as practical ways of implementing these overarching values within the framework of technical and non-technical ethical rules dedicated to the evaluation of AI in terms

of meeting the requirements of trustworthiness and responsibility attributed to humans or their organisations, which may potentially have legal capacity.[32)]

Strategic partners for AI and Society:

1) Council of Ministers Committee for Digital Affairs;
2) Office of the Minister in charge of digital affairs and computerisation;
3) Ministry of Education and Science;
4) Ministry of Funds and Regional Policy;
5) Ministry of National Defence;
6) Ministry of Family and Social Policy;
7) Ministry of Agriculture and Rural Development;
8) Ministry of Climate and Environment;
9) Ministry of Culture and National Heritage;
10) Ministry of State Assets;
11) Statistics Poland;
12) Social Security Administration (ZUS);
13) Voivodeship authorities;
14) Marshal's offices;
15) Non-governmental organisations (NGOs).

Short-term objectives (until 2023)

1. Effective prevention and mitigation of the negative consequences of the development of artificial intelligence for the labour market. Starting dialogue with the market in order to introduce protective measures, preceded by a socio-economic analysis. Tools:
    1) identifying which professions are potentially at risk of disappearing in the near future and preparing re-education programmes for workers;
    2) preparing and refining sectoral and thematic forecasts on a regular basis to assess potential risks and opportunities for job creation;
    3) preparing and updating analysis of the labour market risks associated with smart automation on a regular basis;
    4) methodical approach to monitoring the impact of technological change on the labour market by drafting reports and publishing the results;

[32)] One example of testing the requirements of trustworthy artificial intelligence is ALTAI https://futurium.ec.europa.eu/en/european-ai-alliance/pages/altai-assessment-list-trustworthy-artificial-intelligence.

5) promoting informed career choices in line with the needs of the future market and economy;

6) effective career counselling, coaching, education, targeted grants, loans or tax amortisation;

7) preparing staff for new jobs related to the use of AI-based solutions;

8) introducing changes in the legal framework concerning flexible forms of work and virtual working environment (remote work).

2. Analysis of the ethical ramifications of AI implementation and the impact of AI systems on the sphere of human rights. Tools:

   1) support for AI ethics research through grants, competitions, and other forms of funding;

   2) assessing the societal impact of AI-based systems (in particular the impact on human rights and freedoms) and developing methods for their independent auditing, according a predefined manner and scope;

   3) supporting, preparing and consulting future regulations related to this scope — developed on a national and (where possible) EU level, as well as within other international organisations; monitoring emerging recommendations and regulations on AI ethics issued by the OECD, UN, EU and Council of Europe;

   4) supporting the principles of personal data processing stemming from the GDPR[33)] (in particular the principle of data minimisation), sound risk assessment for AI-enabled systems and the prevention of errors in their design (for example algorithmic bias), transparency, accountability and explainability of AI-enabled systems, in particular those that perform tasks in the public domain or affect the sphere of human rights and freedoms as part of the work on AI regulation;

   5) monitoring and moderating emerging OECD, UN, EU and Council of Europe recommendations or regulations on AI ethics and accountability in the AI life cycle;

   6) initiating research grants aimed at studying the transparency and accountability of AI algorithms, in particular in the context of public tasks and commercial purposes that involve significant impact on human beings.

3. Ensuring security and building public trust and willingness to use AI-based solutions combined with democratising access to AI.

   Tools:

   1) promoting awareness of artificial intelligence and its impact on society through the media, including online media;

   2) combating misinformation and misrepresentation of AI, as well as opportunities and risks stemming from automation;

   3) implementing awareness-raising campaigns for the general public and companies concerning algorithms (in particular complex and learning algorithms), their operation,

[33)] Or future regulations on personal data protection that will become part of the legal framework in Poland.

model applications, risks associated with algorithmic decision-making based on predicting human behaviour;

4) supporting independent risk assessment tools for AI-based systems, including through company-oriented campaigns, incentive schemes and research grants;

5) supporting the education of consumers (users) of AI-based systems, aimed at fostering understanding of their operation, critically assessing possible consequences of their use and being able to estimate individual risks;

6) raising the competencies of officials connected with the use of AI tools in relations between the state and the citizens, including counteracting the risk of discrimination;

7) fostering conditions conducive to attracting highly qualified human resources in the AI field;

8) presenting the benefits of artificial intelligence to farmers, including establishment of model farms in Poland using AI-based solutions with the participation of agricultural advisory bodies;

9) programmes and incentive schemes counteracting the outflow of qualified AI experts from Poland.

4. Launching campaigns to prepare society for changes related to the adoption of a data-driven economy model (algorithmic economy). Tools:

   1) information campaigns on the opportunities offered by artificial intelligence and on how to deal with the emergence of new professions and changes in the ways of working (for example remote work);

   2) information campaigns on the opportunities offered by artificial intelligence for the state administration and state-owned companies;

   3) campaigns promoting interdisciplinary fields of study, online courses and individual education;

5. Making Poland an attractive country for highly skilled AI experts and workforce. Tools:

   1) legal, technological and information facilities for domestic companies and third-country residents who want to run AI-based businesses in Poland;

   2) cooperation with leading academic centres in the world and promoting Poland as a place for professional growth in the field of AI;

   3) direct cooperation with the business on a periodic review of the existing facilities and incentives for attracting highly skilled AI experts to Poland.

Medium-term objectives (until 2027)

1. Analyse and eliminate legislative barriers and administrative burdens for artificial intelligence start-ups. Tools:

   1) creating conditions for increased labour market flexibility through appropriate changes in the legal framework and consultations with employers and trade unions;

2) developing new licence types for algorithms and ICT solutions enabling open use of AI technologies (created with public funding) by the public sector;

3) updating the law to ensure access to data, including sensitive data (e.g. medical) and the conditions for functioning of trusted spaces for sharing this data, taking into account the protection of privacy and personal data;

4) preparing and updating the legal system in terms of the opportunities concerning practical implementation of AI-based solutions, concerning not only algorithms, as well as data processing in the cloud with the use of edge computing, the use of the Internet of Things (IoT) in the industrial context, public data collection, as well as citizen data security and industrial data sharing;

5) preparing and updating the legal framework in terms of practical implementations of autonomous AI-enabled drones, which will be used in agriculture to inspect crops and the infrastructure;

6) consultations with the academic, social and business circles in order to develop and update the directions of promotional activities, changes in the legal framework and activities aimed at eliminating legislative barriers and administrative burdens in the dynamically changing environment.

2. Taking action in specific areas related to the development of artificial intelligence, in particular for efficient and easy access to data and its use by all economic actors, regardless of the size. Tools:

   1) promoting open data solutions, including through the development of the Digital Government Sandbox,[34)] the Open Data portal,[35)] digital repositories in the cultural sector, commercial and academic solutions based on open data, as well as piloting sectoral trusted data spaces;

   2) enabling access to high-speed infrastructure solutions - data centres (with GPUs) and broadband (based on 5G and newer technologies) for computing.

3. Supporting programmes preparing society for changes brought about by the development of algorithmic economy in Poland. Tools:

   1) creation of new and aggregation of existing knowledge bases and educational materials in a one-stop shop for people retraining to join high-tech industries;

   2) continued expansion of the offer of courses, majors and interdisciplinary scientific and research programmes (including online and hybrid courses, which combine in-person learning with online education) organised in cooperation with representatives of the business environment and combined with elements of vocational guidance and building a network of industry contacts.

4. Preventing unemployment and flexible job creation in the labour market for disadvantaged groups. Tools:

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34) https://cpa.gov.pl/store/

35) http://dane.gov.pl/

1) information, education and retraining programmes aimed at counteracting unemployment;

2) training and retraining courses for workers in the most threatened professions, including encouraging the acquisition and development of skills in the field of modern technologies, through the development of market qualifications included in the Integrated Qualification System.

5. Defining regular programmes for supporting artistic and creative activities in the area of AI. Tools:

   1) co-organising ongoing exhibitions of works created and co-created with the use of AI;

   2) regulating the issue of intellectual property of works created using AI;

   3) organising international contests for works created with the help of AI and support for Polish artists winning competitions organised abroad.

Long-term goals

1. Poland is one of the biggest beneficiaries of the data-driven economy (algorithmic economy).
2. Poles are aware of the opportunities and threats brought about by the development of modern technologies and make career choices based on them, using a wide range of educational materials and dedicated curricula.
3. Poland is among the top ten countries in the AI Readiness Index[36)].
4. Poles foster a culture of lifelong learning and the ability to quickly re-skill, while the government policy curbs technological unemployment.
5. Poles are prepared to consciously and critically use AI-based systems.
6. Poles exposed to AI-based systems, especially in the public sphere, are aware of their rights and have access to mechanisms that protect them from system errors or other violations of their rights and freedoms.

[36)] Cf. https://www.oxfordinsights.com/ai-readiness2019

You cannot create anything of value without a lot of effort. To avoid effort is to fail as a civilisation.

Władysław Grabski in his book entitled "Dwa lata pracy u podstaw państwowości naszej (1924-25)" (Two Years of Grassroots Work on our Statehood)

2. AI and innovative companies

Poland's prosperity depends on the growth of the Polish economy and the success of Polish companies. AI-based solutions are an opportunity that needs to be seized, if Poland wants to join the ranks of the world's wealthiest countries. In order to pursue this objective, we will need to support the process of creating Polish AI-oriented companies, to use AI-based solutions in everyday life and to promote cooperation between private companies and the public sector in the area of research and pilot implementations. It is also crucial to reinforce the demand side (number of orders and projects) for AI-based solutions in the public sector, state-owned companies and the Polish Armed Forces.

Today, AI-based systems can be found in many different applications - from smartphones, through CRM systems, all the way to the stock market. The widespread use of AI-based business applications include financial risk assessment, price optimisation, customer targeting and service customisation, medical diagnostics, recommendation systems and virtual assistants, among many others.

In order to face the rapid growth of this technology and determine how best to exploit its potential and avoid risks, we should get ready to tackle specific tasks in advance.

A good example of combining multiple AI-based solutions in one product are autonomous vehicles, also known as self-driving cars, which combine various sensors that receive signals from the environment, such as laser scanning, sonar, radar, GPS, odometer and inertia sensors. What is more, they feature machine vision technologies – one of the most well-known and widespread AI-based technologies in use today. Precision agriculture, on the other hand, already uses decision-making algorithms. *Digital Farming* systems, remote sensing, precise fertiliser application based on soil analysis and crops, real-time monitoring of crops and fertilisation evaluation make Agriculture 5.0 – taking care of the condition of individual plants — a reality.

Artificial intelligence also has great potential for use in cinematography — in digital restoration, automatic film translation, preparing dubbing or matching film scores to individual scenes, as well as in quality assurance or editing. It also enables restoring footage from the last century back into circulation in order to make it more attractive for the audience, which leads to its increased use in the audio-visual and audio production chain various kinds of media, as well as in journalism.

Another key benefit associated with AI is that AI-based systems used in autonomous transport can significantly lower the number of accidents, and – as a result – the number of fatalities. In healthcare, on the other hand, AI-based systems can ensure high-quality medical services, while optimising treatment time, cost and effectiveness. AI in healthcare also offers the possibility to use tools that predict epidemiological situations and detect abuse. Implementing simple robotics in businesses can lead to tangible savings and increased production efficiency. This allows humans to work on tasks that require skills that AI-based systems do not have, or where the systems can only support work done by human workers. The data-driven economy itself is thus contributing to the emergence of new products, services and – as a result – companies, while ushering in new competencies that employees can now learn.

This is an opportunity for the Polish economy and our domestic companies, since it is much easier to compete with others in relatively new fields and areas. For historical reasons, there are not many global companies in Poland, which makes AI a true opportunity for all small and medium-sized

enterprises that want to grow. It is crucial for innovative companies that Poland is as open as possible to the implementation and use of AI-based solutions.

Thanks to the broad range of possibilities concerning the use of AI-based systems — in the energy sector, EU external border protection, environmental protection, water retention, agriculture, healthcare and senior care, communication and housing infrastructure — Poland is the perfect place for piloting various solutions and programmes, as well as organisational models and forms of cooperation. Increasing the number of such pilot projects and reinforcing the demand side for AI-based solutions is one of the main goals of the AI Policy in this area.

Strategic partners for AI and Innovative companies:

1) Council of Ministers Committee for Digital Affairs;
2) Ministry of State Assets;
3) Office of the Minister in charge of digital affairs and computerisation;
4) Ministry of Finance;
5) Ministry of Funds and Regional Policy;
6) Ministry of Climate and Environment;
7) Ministry of National Defence;
8) Ministry of Agriculture and Rural Development;
9) Ministry of Economic Development, Labour and Technology;
10) Ministry of Education and Science;
11) Ministry of Health;
12) Centre for eHealth;
13) GovTech Polska Programme Team;
14) sectoral organisations of entrepreneurs;
15) Statistics Poland;
16) NCBIR – National Centre for Research and Development;
17) Polish Agency for Enterprise Development;
18) Polish Investment and Trade Agency;
19) Future Industry Platform;
20) Polish Development Fund;
21) Social Security Administration (ZUS).

Short-term objectives (until 2023)

1. Increasing demand for AI-based solutions. Tools:

1) adding the requirement for AI-based solutions in the specifications of other strategic investments (or in their broadly-understood environment) financed from public funds – examples include restoring bus transport across Poland, the "Clean Air" Programme, Via Carpathia and Via Baltica, expansion of the gas pipeline network and others;

2) strengthening the process of opening up public administration data that can be used for testing algorithms,[37] supporting the development of *open-source* applications, providing user interfaces (e.g. API) and sharing solutions between public entities (shared services);

3) creating incentives for non-state actors and cultural institutions to share data via trusted data spaces, such as data trusts or virtual data repositories, including incentives to provide libraries of algorithms for AI development;

4) creating incentives for reciprocal sharing of access to data by entities that collect large volumes of various kinds of data;

5) using AI-based solutions for continuous monitoring and improvement of the environment in Poland;

2. Increasing the supply of AI-based solutions developed in Poland. Tools:

1) launching new and developing existing financing mechanisms, for example in the form of loans guaranteed by the authorities for the development of innovative AI-based solutions, especially in agriculture (Smart Farming solutions), in cities (Smart City solutions), in rural areas (Smart Villages solutions), in energy sector (Smart Grid solutions), industry (smart factories), transport (solutions for the Central Airport programme) and for energy cooperatives;

2) adapting the existing tax mechanisms for companies investing in innovative solutions to the needs of developers of AI-based technologies;

3) providing opportunities for testing ground-based, water-based and airborne autonomous vehicles in designated zones (road sections, public areas, smaller towns, districts of larger cities) and under pre-defined conditions. These tests are intended to help determine the limits of legal liability for the algorithm developer, the vehicle maker and the person in control;

4) continuous analysis of solutions applied abroad in order to support the establishment of modern high-tech companies, as well as their assessment in terms for their possible implementation in Poland.

3. Increasing the number of Polish state-owned companies implementing AI projects.

Tools:

1) participation of the Ministry of State Assets in identifying companies that could develop AI potential;

[37] https://dane.gov.pl

2) including in business documentation of the identified companies (e.g., corporate strategies) information related to the development of AI and the implementation of AI-based technologies in their operation;

3) including expert positions, units, teams or functions dealing with the use and implementation of AI-based technologies in state-owned companies or capital groups, thus eventually building a knowledge and competence exchange network among state-owned companies.

4) developing mechanisms that enable promoting and rewarding attitudes and activities aimed at developing and implementing AI-based solutions in state-owned companies.

4. Increasing the use of new AI-based technologies by companies operating in Poland. Tools:

   1) standards and incentives for commercial institutions developed to foster open data, while respecting the principles of business confidentiality;

   2) special consideration for AI-related operations and transparent rules concerning the R&D tax relief, the innovation tax relief, the IP Box and other support instruments;

   3) supporting demand among companies through incentives in the form of support programmes for AI-based technologies;

   4) developing a system fostering efficient use of resources, taking into account the time and decision-making mechanisms to ensure the commercialisation of AI-based technologies in Poland.

5. Identify talent, especially teams that develop innovative AI-based solutions.

   Tools:

   1) organisation of competitions promoting teamwork (e.g. *hackathons*, *service jams*, *game jams*) by public sector entities within the framework of GovTech Polska programme or on the basis of standards developed by the programme;

   2) increasing defence and security sector spending on AI, providing start-ups, SMEs and university teams with more opportunities to participate in public procurement processes;

   3) financial grants and bank guarantees programmes for engineering teams that win international competitions, wish to develop new products or systems and have a high potential for implementing innovative solutions;

   4) facilitating the setting up and running businesses (“virtualisation of work”), based on the example of Estonia and other countries. Introducing incentives for establishing innovative companies by foreign entities in Poland and for moving their operations to Poland;

   5) promoting the use of AI-based technologies in creative disciplines, including AI-created computer games, architectural solutions, audio-visual and entertainment production, etc.

6. Creating knowledge bases and developing good practices for implementing and using AI-based solutions. Tools:

1) providing Polish managers and executives with a source of reliable knowledge on how to adapt their companies to the requirements of a data-driven economy;

2) launching financial gratification mechanisms for companies that share their knowledge and experience with the Future Industry Platform and other public entities.

Medium-term objectives (until 2027)

1. Increase the number of companies providing AI-based solutions, including those listed on the Warsaw Stock Exchange. Tools:

    1) eliminating legal barriers hindering the development of AI-based technologies by regularly monitoring existing legal framework concerning supporting investments in technology companies and funds supporting investments in technology companies in terms of their applicability to AI companies;

    2) continuing investment fund creation programmes and further development of the Polish *venture capital* ecosystem;

    3) promoting technological change to *data-driven enterprises*. Developing mechanisms for implementing data strategies in enterprises and promoting these solutions;

    4) soliciting the development of international projects dedicated to the development of AI-based products to foster experience exchange with international enterprises;

    5) building research laboratories and proving grounds — physical and in the cloud — reflecting actual facilities, where AI-based solutions could be developed and tested on mapped real data, and then implemented in real-world environments;

    6) developing a simplified mechanism of permanent or temporary (e.g. participation in conferences) attraction of foreign talent to Poland for AI-related scientific or commercial purposes;

    7) promoting the Polish AI ecosystem abroad to increase the export potential of Polish companies and solutions.

2. Poland perceived as a leader in implementation projects and scientific research in agri-food sector. Tools:

    1) ongoing mapping of the impact and use of modern technologies in the agri-food sector;

    2) supporting projects concerning the collection of data and its use to improve agricultural efficiency;

3. Poland perceived internationally as a developer of AI systems. Tools:

    1) increasing the effectiveness of the promotion of Polish AI companies by Polish diplomatic posts, as well as the Polish Investment and Trade Agency;

    2) increasing the participation of Polish experts from the AI sector in expert meetings, at least the key ones, where strategies and future solutions are worked out;

3) ensuring participation of representatives of Polish AI companies in government delegations, especially to countries where the public sector is dominant (the majority of the Middle East region, Africa and Asia) in order to promote solutions developed by these companies and expand international cooperation in the field of artificial intelligence.

4. Increasing the competencies of Polish managers in the field of AI. Tools:

    1) new mechanisms enabling financing training courses for managerial staff and executives in the best Polish and global AI centres, focused on change management, adapting new technologies and support for employee retraining;

    2) developing a training programme for members of management board in companies, cooperatives and entities, based on existing government and EU programmes, aimed at supporting the participation in fairs and international expansion financially.

Long-term goals

1. Poland has at least one globally recognised Polish company that operates in the field of AI.
2. There are Polish technology companies listed simultaneously on the Warsaw Stock Exchange and one of the world's largest stock indices.
3. The Polish economy has a significant level of *venture capital* investment from both private and public funds, covering all stages of small business growth.
4. Poland is among the top 25% of economies producing innovative AI-based solutions.

Science lies at the heart of all developments that make human life easier and reduce suffering.

Marie Curie–Skłodowska

3. AI and science

Artificial Intelligence – just like other future technologies — is inextricably linked with the world of science, which is constantly discovering new fields of application for this technology, while also striving to embed it into ethical, sociological and cultural frameworks. In the future, the ability to educate competent Polish scientists will largely determine the position of Poland in the global technological race. In recent years, there has been a marked increase in interest in AI topics among students, which can be seen in their participation in numerous competitions concerning algorithms and AI. At the same time, the interest has also been growing among academic staff, which is reflected in the number of publications and dedicated research programmes. The annual national computer science competition also includes the field of artificial intelligence. Nevertheless, all Polish universities lag far behind the top organisations in terms of any research criteria.[38)] In the case of AI, Poland as a country, Polish universities as well as companies trail behind developed countries.[39)] This is a phenomenon typical for the CEE region.[40)]

The objectives of any activities concerning AI and science concern:

- promoting the use of AI as a tool supporting research work in all fields of science;
- providing adequate support for students (including PhD candidates) interested in pursuing AI-related research through scholarships, grants, tuition reimbursement, assistance in publishing their academic output and other means deemed appropriate by the entities of the AI ecosystem in Poland;
- turning Poland into a centre that attracts expert scientific staff and students from other countries;
- aligning academic teaching methods with the needs of AI development;
- increasing the degree of commercialisation of AI research results and development of cooperation between academia and business.

Treating this aspect as a cross-sectional one is crucial for the implementation of the AI Policy. This needs to take into account not only STEM, but also the humanities and social sciences, which are important for defining the subsequent framework for the use of AI in social and economic life, and in particular its ethical framework. This is the only way to ensure that the use of AI translates into increased quality of life consistent with the public interest and the well-being of the society. At the same time, however, the greatest emphasis should be placed on the practical application of research

38) World University Ranking List https://perspektywy.pl/portal/index.php?option=com_content&view=article&id=13:swiatowy-ranking-uniwersytetow&catid=9&Itemid=119.

39) Gleb Chuvpilo, *AI Research Rankings 2019: Insights from NeurIPS and ICML, Leading AI Conferences*, 2019, https://medium.com/@chuvpilo/ai-research-rankings-2019-insights-from-neurips-and-icml-leading-ai-conferences-ee6953152c1a.

40) Razvan Pascanu, Viorica Patraucean, Doina Precup, *Eastern European Machine Learning Summer School 2019 – Summary*, https://www.eeml.eu/resources.

results, technology transfer and its commercialisation. Only ensuring smooth cooperation between academia and business will enable the implementation of the AI Policy.

Strategic partners for AI and science:

1) Council of Ministers Committee for Digital Affairs;
2) Office of the Minister in charge of digital affairs and computerisation;
3) Ministry of Education and Science;
4) Ministry of Finance;
5) Ministry of Funds and Regional Policy;
6) Ministry of National Defence;
7) Ministry of Family and Social Policy;
8) Ministry of Health;
9) Medical Research Agency;
10) National Science Centre;
11) Social Security Administration (ZUS);
12) Foundation for Polish Science;
13) Research and Academic Computer Network;
14) Universities, institutes and other academic entities conducting research in the field of AI;
15) Copernicus Science Centre.

Short-term objectives (until 2023)

1. Disseminating practical knowledge concerning AI at the undergraduate and graduate level in teaching activities and research.

   Tools:

   1) introducing classes increasing the awareness of the potential applications, risks and opportunities connected with new technologies, including artificial intelligence, in everyday life;
   2) training cognitive approach, computational thinking and creative problem solving from different fields with conscious use of methods and tools derived from computer science and scientific achievements of AI application fields. The inclusion of AI topics in curricula should be encouraged, including practical workshops on building AI-based models and performing data analyses, as well as topics on assessing the impact of AI on humans, society, the economy, the environment, and international relations;
   3) introducing mechanisms encouraging teachers to collaborate with experts from the private sector in order to obtain expert support in the preparation of teaching

materials and implementation of the teaching process, including through in-class support (after meeting the requirements provided for in the law). Teaching university-level courses concerning various aspects of practical use of AI — in the faculties of humanities, social studies and art, where artificial intelligence becomes a tool for analysis and creation; as well as in technical faculties, where the benefits of using AI-based tools should be pointed out, thus creating a foundation for generating future demand for AI-based products and solutions;

4) supporting the creation of interdisciplinary university courses, reflecting the entire spectrum of knowledge necessary to achieve success in the field of new technologies, as well as introducing more flexible admission criteria, taking into account the skill set aligned with the needs of modern society and knowledge-based economy;

5) promoting individual course of studies or flexible STEAM (*science, technology, engineering, arts, mathematics*) courses at universities.

2. Development of projects tailored to Polish problems and challenges, such as machine processing of the Polish language and its translation into foreign languages, through research cooperation between Slavic language-speaking countries and involvement of Polish speakers at foreign universities. Tools:

    1) grants and scholarships of the Foundation for Polish Science, the National Science Centre and the National Centre for Research and Development for projects related to Polish language processing based on world-leading algorithms;

    2) eliminating legal barriers to the exploration of Polish language text corpora under copyright protection;

    3) rewarding projects that make architectures and trained models and training datasets available for widespread use.

Medium-term objectives (until 2027)

1. Establishing ties between academia and business. Tools:

    1) facilitating financing the activities of universities and research institutes in the field of AI and other new technologies by supporting legislative changes and introducing tax breaks for entrepreneurs;

    2) increasing the number of implementation PhDs in the area of AI applications[41)];

    3) creating better working environment for university professors, who have practical experience in the field of AI.

2. Increasing the attractiveness of Polish universities for the most talented students and academic staff through, among other things, a more flexible course plan and openness towards interdisciplinary classes in AI and new technologies. Tools:

41) https://www.gov.pl/web/nauka/doktoraty-wdrozeniowe

1) increasing the number of practical classes in the form of new technology workshops;
2) establishing programmes supporting combining teaching and research activities with editorial work for editors of bulletins and scientific journals in the field of AI;
3) establishing a grant system for teaching projects, assuming that all teaching materials will be made available under an open licence.

3. Internationalisation of higher education and doctoral training with two-way movement of doctoral students between countries. Tools:
    1) funding for graduate studies and doctoral schools (with conference and research activities) at a competitive level, thus attracting top talent;
    2) funding for graduate studies and doctoral schools for developing teaching methodologies concerning new technologies, including AI;
    3) grants for *open-source* AI-based projects (research and practical ones), increasing the visibility of Poland as a place of AI development in the world.
4. Increasing visibility of research in international markets. Tools:
    1) increasing the requirements concerning published papers and conference participation in international teams;
    2) encouraging universities to create special units (chairs, departments, etc.) for artificial intelligence and related disciplines;
    3) supporting and promoting interdisciplinary research and education in AI.

Long-term goals

1. Polish universities are internationally competitive in terms of AI-related educational offering.
2. Polish scientists are often nominated for the most important industry awards, including the Turing Prize. The number of publications in leading journals and conferences (e.g. Conference on Neural Information Processing Systems, Conference on Computer Vision and Pattern Recognition, Association for Computational Linguistics conferences) in the field of AI exceeds the OECD average.
3. The number of patents on artificial intelligence obtained by Polish inventors exceeds the OECD average.

There is no doubt that the knowledge of logic is particularly important to virtually anyone who wants to think properly.

Alfred Tarski

4. AI and education

The key resource, which has a significant impact on the development of artificial intelligence is human capital in the form of an educated population — this concerns primarily mathematics, logic, technical and natural sciences, as well as creative thinking and teamwork. Poland manages to achieve some of the best results in Europe and ranks among the world's best in the global school knowledge study at the secondary school level (PISA 2018). At the same time, Polish school and university students regularly win international programming competitions, while graduates of the best mathematics and computer science faculties find employment in the most innovative international companies. This is an asset that we want to boost even more. The objectives of any activities concerning AI and education concern:

- strengthening Poland's high position in terms of the achievements of its secondary school students;
- developing curricula for all stages of education, taking into account the additional potential of AI, as well as other new technologies for learning and the related challenges, including the need to review the core curriculum and revise it if necessary in the medium term perspective;
- introducing modern AI curricula in schools and educational institutions at all stages of education;
- equalising educational opportunities in the field of AI and new technologies, while providing students with a high level of education regardless of where they live;
- ensuring high availability of educational tools in Poland, including online tools, enabling all people who want to get educated in the field of AI to gain knowledge, both theoretical and practical.

If we strive to create the right conditions for Poland to develop by deploying AI-based solutions on a large scale, retaining talent in the country is absolutely crucial. In a global and open world, the only way to achieve this is to create attractive, challenging and well-paid jobs. Talent will stay in Poland if Poland remains competitive. This will only happen if adequate resources are invested in the development of new technologies. The aim of the AI Policy is to convince the top talent to stay in Poland, while also promoting working in Poland as an attractive choice among top talent from other countries.

Strategic partners for AI and education:

1) Council of Ministers Committee for Digital Affairs;
2) Office of the Minister in charge of digital affairs and computerisation;
3) Ministry of Education and Science;
4) Ministry of Finance;
5) Ministry of National Defence;
6) Ministry of Family and Social Policy;

7) universities, institutes and other research centres conducting research projects in the field of AI;

8) Social Security Administration (ZUS);

9) Polish Development Fund (Central Technology House);

Short-term objectives (until 2023)

2. Dissemination of practical knowledge of artificial intelligence at all stages of education.

   Tools:

   1) introducing classes that raise awareness of applications, risks and opportunities connected with using artificial intelligence in everyday life, the use of basic AI-based tools and solutions in the teaching process at early education schools;

   2) developing a digital education strategy that incorporates the use of AI-based tools and solutions in the learning process, while taking into account AI ethics;

   3) developing methods of shaping skills and competences in algorithmic and computational thinking;

   4) boosting the role of statistics and other disciplines used to develop AI-based solutions within mathematics curricula at all stages of education;

   5) introducing mechanisms encouraging teachers to collaborate with experts from the private sector in order to obtain expert support in the preparation of teaching materials and implementation of the teaching process, including through in-class support (after meeting the requirements provided for in the law);

   6) intensification of the use of tools and *embedded systems* in education, accompanied with training for teachers in their proper use in the teaching process;

   7) pilot introduction of Python[42)] programming language in computer science classes with an interactive environment such as Jupyter Notebook, due to its educational and practical benefits; frequently updating the catalogue of languages and tools used in education, based on the market requirements;

   8) introducing commonly used and applied machine learning and neural network packages such as Scikit-learn, PyTorch or TensorFlow with Keras interface[43)] in primary and secondary schools;

   9) developing mechanisms to support teachers and educational staff in improving their qualifications and skills in the area of AI and modern technologies, along with tools for rewarding students and their teachers for outstanding achievements in these areas;

[42)] Cf. https://pl.wikipedia.org/wiki/Python

[43)] Piotr Migdal, Rafał Jakubanis, *Keras or PyTorch as your first deep learning framework*, https://deepsense.ai/keras-or-pytorch/.

10) developing standards and best practices for the use of AI-based solutions and embedded systems in education so that they are consistent with AI ethics and protect the rights of participants in the education system.

3. Support for the development of the most talented school and university students in Poland. Tools:
    1) launching and developing projects supporting the identification and development of young IT and programming talent in Poland, including students proficient in *Quantum Computing Language* - QCL, as well as talented individuals from disciplines useful in building AI-based solutions (e.g., mathematics, logic, philosophy);
    2) funding scholarships and public support for entities that enable Polish students to participate in research work at universities[44];
    3) supporting patronages over secondary schools and individual classes by academic and research institutions, as well as innovative companies, providing additional teaching tools and other ways to support the learning process, ensuring more attractive working conditions for academic teachers, in particular for young scientists;
    4) supporting students participating in international competitions in AI and other emerging technologies financially.

4. Development of educational materials about AI for different age and professional groups. Tools:
    1) offering micro-grants to make AI teaching materials freely available under an open license;
    2) organising competitions*, service jams* and *hackathons* focused on creating materials that can be used in teaching and examples of AI applications.
5. Using the National Educational Network[45] in interactive education on AI-based solutions and techniques.

    Tools:
    1) promoting new educational approaches and curricula that incorporate the development of skills, including digital skills, in particular concerning algorithms and programming;
    2) enabling students at all stages of education to use advanced *software* tools for developing creative competencies, for example by using remote desktop technology;
    3) supporting knowledge and experience exchange between educational institutions using modern technologies by promoting good practices using e-learning platforms designed for this purpose (e.g. in the *Massive Open Online Course* formula);

[44] https://fundusz.org

[45] Cf. https://ose.gov.pl

4) providing educational content for schools and supporting them in teaching digital skills, including AI-related competencies.

Medium-term objectives (until 2027)

1. Implementing a comprehensive educational curriculum on AI in primary and secondary schools, with support for customised education.

   Tools:

   1) ensuring proper and effective implementation of the core computer science curriculum, as well as its review in terms of provisions pertaining to the development of computational thinking, algorithmics and programming;
   2) developing curricula that take into account cross-sectional education on issues related to data processing, including practical approach;
   3) supporting the use of commercially available programming languages and libraries in primary and secondary schools;
   4) preparing teachers to introduce issues related to artificial intelligence in particular subjects or fields of education;

2. Boosting the image of Poland as an attractive place to acquire qualifications and develop skills in the field of AI thanks to competitions at national and international level. Tools:

   1) organising or co-organising (e.g. within the framework of the Visegrád Group [V4] or the Three Seas Initiative) international AI Olympics at secondary school and university level;
   2) supporting students in joining existing competitions.

Long-term goals

1. Poland is the European leader in education in AI and other digital technologies at secondary school level;
2. Polish students are at the forefront of educational research in Europe (measured by PISA and others).
3. Poland co-organises mathematics and AI competitions at the European and global level.

Europe will not be made all at once, or according to a single plan.
It will be built through concrete achievements which first create a de facto solidarity.
Robert Schuman – Declaration of 9 May 1950

5. AI and international cooperation

Artificial intelligence is increasingly visible in many debates on economic growth, both on national and international levels. In the coming years, the discussion on international principles for the development of this technology will take place in various international institutions, between countries and organisations. It is necessary for Poland to be an active and strong player on the international scene, with a clear position and even clearer priorities.

Given the required technology base — innovative companies, subject matter experts, infrastructure with access to various databases, any significant AI development is not possible within a single country that is left to its own devices. To become globally competitive, Poland should cooperate as much as possible with other countries, and above all with the EU Member States, with the United States, Japan and the NATO countries. The impact of international activities should include:

- strengthening Poland's position in the global and European arena;
- increasing the productivity of Polish companies;
- attracting international talent and innovative companies to Poland;
- bringing international AI development centres, including digital innovation hubs and AI test centres co-funded by the EU to Poland;
- better knowledge and innovation flows;
- ensuring interoperability of AI-based solutions developed in Poland with widespread standards, norms and solutions.

The transformational nature of artificial intelligence, which is associated with major economic and social changes around the world, constitutes an opportunity for Poland, Polish companies and Polish science to become known and make a name for themselves in this new, rapidly changing world.

Strategic partners for AI and international cooperation:

1) Council of Ministers Committee for Digital Affairs;
2) Office of the Minister in charge of digital affairs and computerisation;
3) Ministry of Education and Science;
4) Ministry of Finance;
5) Ministry of Funds and Regional Policy;
6) Ministry of Climate and Environment;
7) Ministry of National Defence;
8) Ministry of Family and Social Policy;
9) Ministry of Agriculture and Rural Development;
10) Ministry of Economic Development, Labour and Technology;

11) Ministry of Foreign Affairs;
12) Ministry of Health;
13) Centre for eHealth;
14) GovTech Polska Programme Team;
15) Polish Investment and Trade Agency;
16) Business & Science Poland;
17) NCBIR – National Centre for Research and Development;
18) Social Security Administration (ZUS);
19) industry organisations for digital entrepreneurs and other sectors;
20) think-tanks participating in international consultations and projects;
21) universities and other centres carrying out research in the field of AI.

Short-term objectives (until 2023)

1. Creating an environment that fosters international investment in innovative ventures implemented in Poland. Tools:
    1) introducing tax reliefs and friendly taxation for entrepreneurs, including international entities building research centres in Poland and employing highly-skilled staff;
    2) simplifying the process of setting up and running an online business for every EU citizen (following the example of Estonia), regardless of nationality and place of residence (virtualisation of the workplace);
    3) developing an appropriate catalogue of incentives and procedural, financial and legal facilities to facilitate the implementation of innovative solutions in Poland and investments in the Polish AI ecosystem;
    4) Poland's participation in new public-private partnership on AI, data and robotics set up by the EU under the new Horizon Europe programme;
    5) establishing a Digital Innovation Hub in Poland, specialised in trustworthy AI, which will collaborate with other DIH within the European DIH network, with ambitions to become a DIH on a European level, responding to the needs of our region.
2. Strengthening cooperation within the EU, NATO, Three Seas Initiative, Visegrád 4, the Weimar Triangle and the United Kingdom, Switzerland and Norway.

    Tools:

    1) launching *data trust* initiatives in cooperation with international partners, where data from European public institutions or the private sector would be available on an equal and reciprocal basis to any European actor, to be operated as programmes and pilot projects;

2) implementing pilot programmes of model risk assessments for AI-enabled systems and model explanations addressed to users of these systems to inspire work on similar standards at EU level;

3) establishing bilateral or multilateral exchange programmes for researchers and subject matter experts within these countries and other countries deemed appropriate;

4) developing bilateral cooperation and building coalitions of like-minded countries with an agenda to design innovation-friendly legislation and mechanisms for joint project financing;

5) enhancing cooperation between national regulatory bodies responsible for the development of AI and the exchange of best practices, identification of trends, cooperation in the field of standards and certification, active participation in the work of international organisations, aimed at working out a consensus concerning the ethical use of AI for civilian and security purposes.

3. Increasing the international visibility of Polish research teams. Tools:

    1) introducing a requirement for a transnational element in selected publicly funded research projects;

    2) introducing incentives for undertaking international cooperation by Polish research teams.

4. Identifying priority areas where Poland has a chance to be internationally competitive. Tools:

    1) consultations with the Polish enterprise and business circles aimed at understanding the needs of the labour market and the potential for AI applications;

    2) supporting Poland in developing and promoting a unified methodology for evaluating progress in implementing AI-based solutions in EU member states;

    3) establishing a platform in the form of a working group, bringing together stakeholders interested in ongoing cross-border cooperation on AI and consultations concerning planned regulations on that issue;

Medium-term objectives (until 2027)

1. Active cooperation with other countries on innovation, development of new technologies and artificial intelligence. Tools:

    1) meetings within the Visegrád 4 and the Weimar Triangle to develop a common agenda for the digital economy;

    2) developing the Digital Three Seas initiative in the area of research and implementation of AI for infrastructure, energy and cybersecurity, as well as services based on data processing and analysis, such as digital highways, IoT or data trusts;

    3) developing bilateral cooperation and building coalitions of like-minded countries with a similar agenda;

4) establishing activities and projects concerning artificial intelligence as a subject for partnerships, joint action agendas and promotion at international cooperation level;

5) undertaking consultations with foreign experts on business, scientific and legal activities aimed at developing the Polish economy and increasing its competitiveness in global markets;

6) building permanent cooperation in the field of AI with the United States of America, Canada, Israel, Japan, North Korea, India, Singapore, Australia, Germany, France and the United Kingdom, joining the group of countries associated in the Digital Nations community.

2. Coordinating Polish action plans within broader European and international initiatives. Tools:

    1) ensuring the highest possible participation of Polish entities in international programmes within the EU (including the Digital Europe and Horizon Europe programmes, the Innovation Council Initiative, as well as EU agendas addressing issues related to digital skills and education);

    2) actively participating in implementing and subsequently updating the Coordinated Plan on Artificial Intelligence, as well as other EU initiatives, including within international groups.

3. Promoting EU international funding programmes for AI development. Tools:

    1) supporting companies and other entities in Poland in taking advantage of EU funds;

    2) taking advantage of the experience of Polish public administration and specialised institutions supporting the uptake of international funds earmarked as part of the previous financial perspective in the process of obtaining information on tenders, preparing applications and promoting existing support tools;

    3) reaching out to school and university students, doctoral candidates, trainees, teachers, trainers and youth workers, professional learners and adult education staff with the offer of educational programmes related to new technological developments, such as the new ERASMUS programme.

4. Building the international image of Poland as an innovative country, open to new technologies. Tools:

    1) regular communication with other countries and promoting Polish activities in the field of artificial intelligence;

    2) organising international conferences on artificial intelligence;

    3) taking into account the issue of artificial intelligence development in Poland as part of the regular bilateral and multilateral consultations with interested countries;

    4) promoting thematic publications developed by Polish think-tanks and research institutes in the international press in order to promote Polish achievements in research and development of artificial intelligence.

Long-term goals

1. Poland is positioned as a country with a significant role in the creation and broad application of AI-based solutions internationally.
2. Poland has innovative AI centres of excellence and testing that collaborate internationally with public and private sectors.
3. Poland has a long-term strategy for AI development, taking into account the situation and European and global regulations in this field.

In reality, what justifies the existence of any political activity is service to man.

John Paul II during his address to the United Nations in 1979

6. AI and the public sector

The public sector needs to play a key role in the development of artificial intelligence in Poland. Without its conscious and coordinated activity, the success of Polish companies, economy and science will be much harder to achieve.

Firstly, Poland has the highest level of state ownership of enterprises among all OECD countries[46]. Besides, the public sector has a direct and significant impact on the operation of the largest Polish strategic companies.

On the other hand, based on the examples from countries such as the United States, France or Israel, we are aware that the right development and research policies are crucial for the emergence of innovative solutions and companies.

What is more, the development of AI is determined by access to high-quality data – its absence makes it impossible to properly test the algorithms.

The role of the public sector is to ensure that access to public data is as widespread as possible, to guarantee the highest possible quality and easy access for entities that develop products and services for the public. This will allow Polish companies to build new solutions, design better self-learning algorithms, find new application areas and offer new services.

AI-based solutions can improve the efficiency of central government and local government bodies. The constantly improving technical capabilities makes process automation a more and more attractive avenue pursued by public administration. Thanks to advances in artificial intelligence, processes that had to be done by numerous clerks just a couple of years ago can be partially automated these days. At the same time, public administration should focus on setting standards for the implementation of AI-based solutions, in particular ensuring that AI ethics and the citizens' rights are respected and that the quality of public services offered is increased.

There is a need for further development of support programmes that help the public administration and the public sector in the implementation of AI-based solutions, such as the GovTech Polska, as well as projects established with the aim of developing data trusts, made available to the public under the Open Data programme on the data.gov.pl website.

Further support is also needed in areas such as the creation of a decentralised repository for industrial and raw data (virtual data repositories, *data trusts*) and a programme to build a trusted public IT cloud for the public sector to hold and process data of Polish citizens using edge computing technology

Strategic partners for AI and the public sector:

1) Council of Ministers Committee for Digital Affairs;
2) Office of the Minister in charge of digital affairs and computerisation;
3) GovTech Polska Programme Team;

[46] https://www.oecd.org/daf/ca/corporategovernanceofstate-ownedenterprises/35678920.pdf

4) Ministry of Education and Science;
5) Ministry of Finance;
6) Ministry of Funds and Regional Policy;
7) Ministry of Infrastructure;
8) Ministry of National Defence;
9) Ministry of Agriculture and Rural Development;
10) Ministry of Economic Development, Labour and Technology;
11) Ministry of Justice;
12) Ministry of Interior and Administration;
13) Ministry of Health;
14) Centre for eHealth;
15) Polish Development Fund;
16) Statistics Poland;
17) Social Security Administration (ZUS);
18) Voivodeship authorities;
19) Marshal's offices;
20) mayors, district governors and village administrators;
21) economic and public policy think-tanks.

Short-term objectives (until 2023)

1. Effective coordination of all work and activities related to the development of the Polish AI ecosystem. Tools:
    1) centralising strategic planning for AI development in Poland within the Committee of the Council of Ministers for Digital Affairs;
    2) involving non-governmental organisations, including organisations of entrepreneurs, in the process of creating a framework for the development of the Polish AI ecosystem;
    3) defining the AI Policy as a living document and introducing changes on an ongoing basis as part of the process of regular reviews carried out by the Council of Ministers, in particular in the part concerning the tools used for implementing the objectives of the document in question, as well as undertaking activities supporting the development of AI going beyond the AI Policy spectrum;
    4) interdisciplinary teams working on individual topics, involved in ongoing work on such issues as: AI and society, AI and the economy, AI and research policy or AI healthcare and senior care, trustworthy AI and practical challenges.

2. Developing rules ensuring transparency, auditing and accountability concerning the use of algorithms by public administration. Tools:
    1) introducing a mandatory ex-ante self-assessment that identifies issues, the distribution of responsibility for system operation, potential errors and mistakes (including algorithmic bias) and preventive measures taken;
    2) developing a model explanation for AI-assisted decision-making and the possibility of appealing such decisions, particularly if they have a direct impact on citizens' rights and freedoms.
3. Opening public data. Tools:
    1) increasing support for the Open Public Data Programme and the scope of data made available through the Open Data portal; making public data available is done in compliance with the law on the protection of classified information, business secrets, statistical confidentiality and other legally protected secrets, the protection of personal data and the free flow of and access to non-personal data;
    2) introducing a requirement to support the development/building of digital data repositories, an obligation to develop APIs (*Application Programming Interfaces*) and making the databases available as required by the Open Data Directive in operational programmes;
    3) organising open data competitions and *hackathons* rewarding the use and development of *open-source* solutions;
    4) taking advantage of existing data to develop complex information services based on processed data (for data not available in raw form, for example due to legal restrictions).
4. Developing regulations aimed at obtaining public APIs from public and municipal enterprises with access to the widest possible catalogue of up-to-date data, respecting the principles of personal data protection and the priority of improving the quality of public services. Tools:
    1) developing the Open Data programme and the Central Administration Sandbox project in terms of technical and substantive support for these entities;
    2) implement relevant legislative changes in legal framework;
5. Enhancing the ability of the state to use AI in emergency situations to forecast threats and support decision-making, as well as in situations requiring intervention or support from various government bodies at different levels.
6. using AI-based solutions for continuous monitoring and improvement of the environment in Poland;
7. Exploiting the research potential of medical data to improve citizens' health, taking into account the protection of privacy and personal data with or without the use of privacy protection techniques (e.g. anonymisation or pseudonymisation) if the explicit consent of the data subject is present. Tools:
    1) pilot programmes for storing anonymised medical data;

2) supporting the development of tools and solutions using medical data, in particular telemedicine and e-health solutions;

3) analysing data on medical events (medical services), which can contribute to the effectiveness of prevention;

4) optimising activities in the health sector based on the analysis of data such as, but not limited to, maps of needs, supply and demand for services, resource utilisation, data from digital services;

5) sharing medical data for the development of more effective medicines and treatments.

8. Increasing the number of AI procurements in the public sector, including central and local government, as well as state-owned companies and municipal companies run by local government bodies, thanks to the development of tools developed by the GovTech Polska Programme. Tools:

   1) promoting the *learning by doing* approach by organising pilot projects and implementation programmes concerning AI applications in public institutions, using the experience gained during the organisation of GovTech Polska competitions[47)];

   2) organising pilot projects and implementation programmes on risk assessments and model-based explanations for citizens exposed to AI-based systems;

   3) promoting the use of non-conventional (other than tender) public procurement modes, more conducive to procuring innovative solutions in the public sector;

   4) training staff of public administration bodies in the use of public procurement procedures enabling them to achieve the best results in the procurement of innovative solutions and in counteracting discrimination;

   5) preparing and frequently updating a catalogue of best practices for contracting authorities, including reduction of bureaucracy and prerequisites, methods of independent auditing and regular risk assessment, innovative and *agile* implementation methods, data sharing, promoting shared services and modern intellectual property management;

   6) conducting regular workshops and conferences on public procurement of AI-based solutions;

   7) creating a set of networking tools to facilitate the participation of private entities, in particular SMEs, in public procurement contracts for new technologies.

9. Take advantage of Poland's role as the host of the 2020 UN Internet Governance Forum organised in Katowice to exchange experiences and promote Poland in the area of modern technologies and artificial intelligence. Tools:

   1) covering the subject of AI during the “zero day” organised on the day before the main event;

   2) organising discussion panels devoted to AI;

47) https://konkursy.govtech.gov.pl

3) preparing and launching accompanying promotional campaigns highlighting Poland's potential as a country where modern technological solutions, including AI, are developed by the public and private sectors.

Medium-term objectives (until 2027)

1. Public data is available and widely used. Tools:
    1) all open data under the Public Information Act is directly accessible (downloadable as a file or via APIs); sharing public data respects the laws on protection of classified information, business secrets, protection of personal data and free movement of and access to non-personal data;
    2) implementing electronic document management systems using AI-based components in public institutions, for sharing selected information based on sensitive data sets held by the administration, with due respect for regulations on the protection of classified information;
    3) boosting competences and digital skills of public sector staffers , including promoting modern, *agile* working methodologies and tools;
    4) strengthening the role of Statistics Poland as an aggregator of real-time statistical data and provider of statistical expertise to public sector bodies.
2. Poland is one of the most active countries in developing ethical use of data according to the concept of trustworthy AI.[48] Tools:
    1) developing a dynamic code of ethics for AI by the Polish government, the Virtual Research Institute and AI experts, taking into account Article 30 of the Polish Constitution and the EU Charter of Fundamental Rights, as well as principles such as *human-centric AI*, reliability (assuming, among others, the prevention of errors such as *algorithmic bias*) transparency and explainability;
    2) Poland's activity in the UNESCO *Global Ethics Code for AI* initiative[49] initiative;
    3) Poland's continued participation in the OECD's *Stewardship of Trustworthy AI* initiative[50] initiative;
    4) Poland's continued activity in the Council of Europe in the initiative to develop recommendations for AI with regard to the protection of human rights, the rule of law and democracy.

Long-term goals

1. Polish public data is accessible and easy to use for citizens, researchers and industry. The data is adapted to machine analysis and accessible via modern APIs. The release of public data

48) https://ec.europa.eu/digital-single-market/en/news/ethics-guidelines-trustworthy-ai
49) https://en.unesco.org/courier/2018-3/towards-global-code-ethics-artificial-intelligence-research
50) https://www.oecd.org/going-digital/ai/principles/

respects the laws on the protection of classified information, business secrets, the protection of personal data and the free movement of and access to non-personal data.

2. The rights and interests of Polish citizens whose data may be used by researchers or industry have been secured with appropriate guarantees (including but not limited to the protection of their privacy).
3. Transparent mechanisms for sharing non-public data are developed.
4. Polish diplomacy promotes Polish AI businesses and scientific centres.
5. Thanks to the work of Polish specialists and Polish international activities, Poles are among the leading authors cited in AI publications.

Conclusions and next steps

The mission of Poland's strategic policy in the field of artificial intelligence is to use AI research and development to increase innovation and productivity of data-driven economy, as well as to support citizens in the processes of transforming their work environment and building their competencies, taking into account the protection of human dignity and ensuring the conditions of fair competition.

Poland has the potential for a dynamic transition from the role of a *challenger*[51)] to an internationally recognised leader in artificial intelligence with the *Invented* in *Poland* brand.

Only by coordinating the activities of all participants of the Polish AI ecosystem will Polish society and economy be able to take advantage of the opportunities provided by the current technological revolution brought about by AI. In view of the above, we need cooperation in the following areas:

1) building a culture of cooperation between the public and private sectors in the area of innovation;
2) ensuring conditions conducive to the development of citizens' creativity by strengthening the labour market;
3) supporting and promoting AI-based solutions developed by Polish entrepreneurs;
4) developing an effective and agile central coordination mechanism for public initiatives on AI and modern technologies;
5) supporting cooperation between academic centres and business;
6) developing analytical and digital skills, including programming skills, at all stages of education, establishing rules for the organisation of classes and apprenticeships relevant to the level of education;
7) developing lifelong learning, establishment of a staff development/retraining programme and encouragement of informed career choices, in line with the Integrated Skills System;
8) supporting cooperation opportunities among participants in the Polish AI ecosystem (e.g. joint R&D, experience sharing, cluster solutions);
9) promoting innovative technological solutions among entrepreneurs in order to raise the level of development and to establish a dialogue with other EU economies;
10) active cooperation in the European field in the development of trustworthy AI;
11) building trust in AI by supporting practical solutions to increase accountability and transparency of these systems (e.g., through dedicated research grants, pilot implementations and soft standards);
12) implementing practical mechanisms in the public sector to protect individuals against violations of their rights and freedoms (e.g. model implementation of the right to an explanation) and promoting similar implementation in the private sector;

[51)] Cf. https://www.mckinsey.com/pl/our-insights/polska-jako-cyfrowy-challenger

13) supporting projects in the field of e-Health, including activities aimed at the interoperability of existing systems, with a particular focus on projects aimed at the care for the elderly and projects aimed at preventing and combating epidemic outbreaks;

14) supporting educational and cultural projects, with a special focus on the reliability of knowledge sources, scepticism, counteracting the spread of violence, etc.;

15) supporting cybersecurity and projects aimed at combating disinformation, including building a culture based on accountability and the ability to explain the use of algorithms;

16) supporting development of an API standard for accessing public data and a standard for sharing non-public data;

17) promoting open interoperability standards, including mutual recognition of certificates and compliance protocols.

By design, this AI policy is a document that will need to be subject to regular evaluations to reflect the ever-changing nature of the high-tech sector and AI in particular. Thus, coming up with new objectives, refining activities, evaluating and changing tools and expanding the catalogue of partners will be integral parts of the implementation of the AI Policy. This approach is consistent with the best business practices and the interests of the state in a situation where the regulated sector is constantly changing. Defining the objectives, measures, additional actions and scope for adapting the document to the changing reality, as well as other ongoing adjustments in the area of AI Policy implementation will be the task of the AI Policy Task Force at the Committee of the Council of Ministers for Digital Affairs (hereinafter referred to as the ”CCMDA”), which will recommend action plans, priority projects and schedules.

Coordinating these changes and the overall implementation of the activities described in this document will be carried out by the minister in charge of computerisation. The current plans envision supporting the CCMDA in the future, whose tasks will be expanded by the Prime Minister by amending or issuing a new Ordinance on the Committee of the Council of Ministers for Digital Affairs, including in particular new competences resulting from this AI Policy.

What is more, if achieving the objectives resulting from the AI Policy will require extending or changing the competencies of other institutions or bodies, as well as any other legislative solutions, they will be implemented by making appropriate adjustments to the currently binding legal acts or programme documents.

Operational aspects of AI Policy implementation will be the responsibility of the AI Policy Task Force, which is planned to be established at the CCMDA in accordance with Section 17 of the Ordinance No. 48 of the Prime Minister of 12 April 2016 on the Committee of the Council of Ministers for Digital Affairs (Monitor Polski of 2018, item 705, Monitor Polski of 2020, item 226). This will at the same time ensure coherence across the public sector and continuity of implementation activities. Planning within the AI Policy will be based on implementation plans presented annually to the minister in charge of computerisation by each of the responsible ministers. These will include a list of actions, objectives and planned costs together with funding sources. These plans will be then reviewed by the AI Policy Task Force. Ministers will also include specific actions they will take to ensure that their aid, grant and subsidy programmes, procurement and other funding tools reward the use of AI by beneficiaries and

contractors. When submitting their plans, the ministers will take into account the activities of their own departments and the institutions they supervise.

What is more, all citizens, all companies, public and private schools and universities, non-governmental organisations and all other participants of public life will also determine the directions of development of Polish AI on a daily basis thanks to their actions, while the role of public institutions will be to support this process. This cannot be done in any other way than through continuous consultation with domestic and international entities and involving them in the continuous process of improving the Polish AI ecosystem of which they are a part.

Appendix no. 1: Definition of AI

To date, no legal definition of artificial intelligence has been developed in national legislation framework and international conventions; however, some attempts are made to approach this phenomenon and various AI technologies from a descriptive point of view.

Artificial intelligence or AI for short[52] is thus defined as a field of study including neural networks, robotics and development of intelligent behaviour models, as well as software simulating these behaviours, also including machine *learning*, deep *learning* and reinforcement *learning*.

Thanks to modelling knowledge and data, as well as thanks to the development of algorithms and growing computational power, the current state of technology enables us to build relatively automated systems for collecting, processing and analysing data, which offers autonomous improvement of the system or prediction of behaviour and actions based on the analysis of collected data and correlations between them, with the possibility of influencing the external environment and interacting with it through sensors and actuators. These interactions can occur mechanistically or with human intervention throughout the life cycle of an artificial intelligence from its inception, through development, deployment, application, up to deactivation and disposal.

Consensus on the definition of AI

There is an international consensus to define artificial intelligence based on the system model approach, based on technical development of the intelligent agent model. This approach amounts to describing artificial intelligence as an AI System. This AI Policy is based on the adoption of AI System as a central concept to describe AI from a technical point of view. Thus, the AI Policy adopts as its own the definition of AI System developed within the OECD by the AI Group of Expert.

An AI system according to OECD[53] is a system based on the concept of a machine that can influence its environment by making recommendations, predictions or decisions based on a pre-set set of goals. It does this by using input, machine or human data to:

- perceive and analyse real and virtual environments;
- summarise the perceptions and analyses with models – manually or automatically;
- use model interpretation to formulate outcome options.

In this approach, an AI system comprises three main components:

- sensors;
- operational logic (models of algorithms);
- actuators (executive system);

Sensors collect raw data from the environment and actuators take action to change its state. The key strength of an artificial intelligence system can be found in its operational logic (algorithm models)

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52) Bartłomiej Michałowski, *Internet of Things (IoT) i Artificial Intelligence (AI) w Polsce. Jak wykorzystać rewolucję technologiczną Internetu rzeczy i sztucznej inteligencji w rozwoju Polski*, Instytut Sobieskiego, Warsaw, 2018.

53) http://www.oecd.org/going-digital/ai/

which, for a given set of objectives and based on sensor input, extracts output data for the actuators – recommendations, predictions or decisions that can affect the environment.

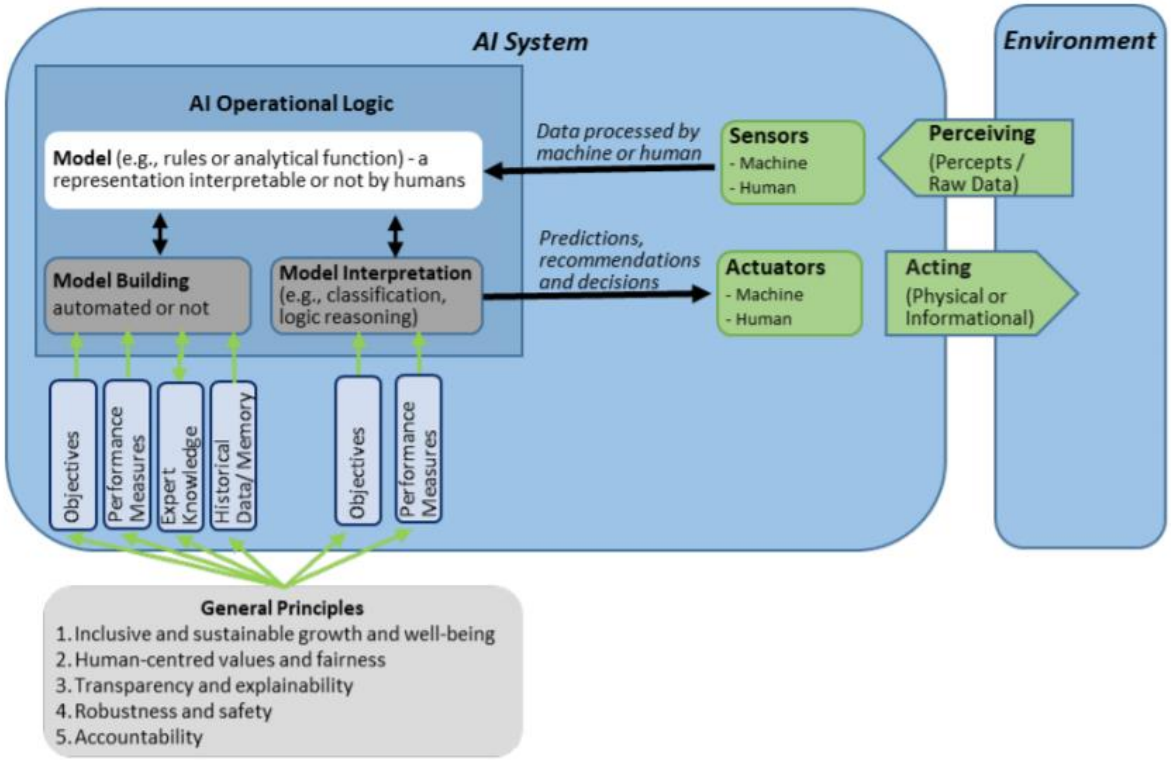

Figure 3. AI system according to the OECD. Source: AIGO study — OECD Digital Economy Papers November 2019 No. 291[54)]

The AI system should follow the ethical principles contained in the guidelines for trustworthy AI, such as:[55)]

- human agency and oversight;
- technical robustness and safety;
- privacy and data governance;
- diversity, non-discrimination and fairness;
- environmental and societal well-being;

54) *Scoping the OECD AI Principles Deliberations of the Expert Group on artificial Intelligence at the OECD* (AIGO) https://www.oecd-ilibrary.org/docserver/d62f618a-en.pdf?expires=1603987342&id=id&accname=guest&checksum=28E90DC24CF15EF5DCB93E1076E7ED08.

55) Ethics Guidelines for Trustworthy Artificial Intelligence developed by the independent High Level Expert Group on Artificial Intelligence established by the European Commission in June 2018: https://ec.europa.eu/digital-single-market/en/high-level-expert-group-artificial-intelligence .

- transparency;
- accountability.

Appendix no. 2: Polish AI ecosystem

The AI ecosystem is a horizontal environment designed to initiate and support activities undertaken by numerous stakeholders to develop Polish innovation in the field of AI and to position Polish intellectual property at the highest possible levels of the global value chain related to data processing, as well as to minimise potential risks related to the ongoing global competition in the field of AI and the ongoing transformation of the economy and society.

The AI ecosystem will engage citizens, entrepreneurs, academia, cultural institutions and archives, and government, providing a basis for the systematic growth of AI innovation, with attention to cybersecurity, fair competition, as well as ethics and the paradigm of human individual sovereignty over AI in respect of social solidarity and sustainable development.

Actions taken within the AI ecosystem are supposed to:

- support the emergence of Polish businesses developing AI-based solutions;
- promote the use of AI-based solutions in Polish economy;
- support the exports of Polish AI companies;
- foster learning, training skills and development of competencies in the field of AI;
- support research, in particular interdisciplinary research in the field of AI;
- promote the participation of Polish scientists and entrepreneurs in international bodies focusing on AI and its development.

For this to be possible, developing a coordinated state policy in the field of AI and organising a management centre for the Polish AI ecosystem seem to be required.

The Polish AI ecosystem also focuses on the international and legal frameworks, as well as emerging technical and organisational standards, defining actions of people functioning in society and the environment based on ethical principles for trustworthy AI. Together, these dimensions constitute a dynamic framework for the ecosystem, stabilising its operation on the one hand and reshaping it on the other, as the AI challenge has only just started — both in socio-political research and in the solutions included in policies and global regulations.

The strategic factors for building the potential of Polish AI include:

- data;
- knowledge, competences, skills and qualifications;
- funding;
- Infrastructure.

The factors listed above represent the necessary areas for improvement, where the organised and coordinated management will lead to the achievement of AI Policy objectives.

AI Policy Coordination

The minister in charge of computerisation is responsible for the coordination of the implementation of the AI Policy. A key role in monitoring and supporting the coordination of AI Policy implementation will be played by the AI Policy Task Force, which is to be established at the CCMDA. The Task Force will be appointed by the CCMDA upon request of the minister in charge of computerisation. The AI Policy Task Force will provide draft information on the implementation of AI Policy activities for a given year to the CCMDA. This draft, after consideration by the CCMDA, will be presented to the Council of Ministers by the minister responsible for computerisation.

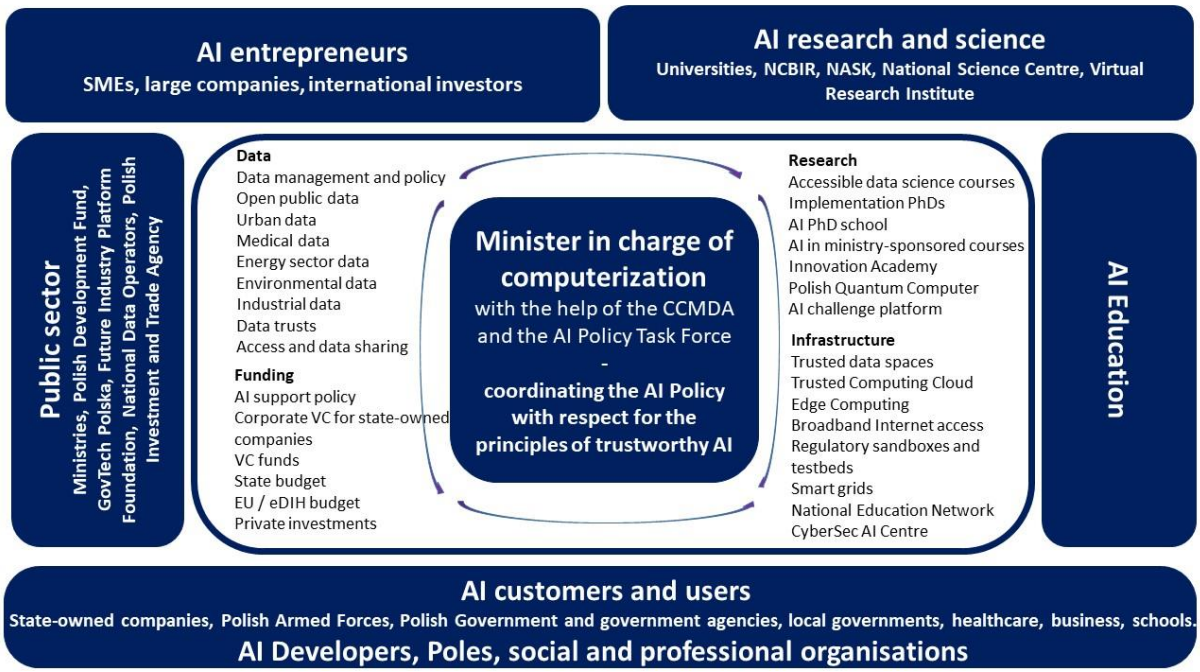

Figure 4. Polish AI ecosystem. Source: own compilation

In order to effectively monitor, implement and coordinate the AI Policy, there are plans to establish the:

- **AI Policy Task Force** – an entity operating at the CCMDA, chaired by the Prime Minister's Plenipotentiary for GovTech. The Task Force will be tasked with monitoring and coordinating public institution activities within the scope of the implementation of the AI Policy, in cooperation with the bodies specified below.
- **AI Contact Point** – appointed by the minister in charge of computerisation at Centre for the Operational Programme Digital Poland in order to support and coordinate stakeholders of financial assistance programmes based on the central EU budget such as Digital Europe or Horizon Europe;
- **AI Observatory for the Labour Market** – appointed by the minister in charge of computerisation to monitor and study the impact of AI on the labour market, in cooperation with the minister in charge of labour;

- **Observatory for International Artificial Intelligence and Digital Transformation Policy** – appointed by the minister in charge of computerisation to monitor AI policies and regulations enacted in other countries, formulate recommendations for international initiatives in the field of AI, monitor global trends in AI development, in cooperation with the Ministry of Foreign Affairs;
- **AI Council** - appointed on *an ad hoc* basis by the minister in charge of computerisation, in order to support the identification of challenges for scientific research and flagship projects, define standards for AI use in Poland and coordinate arrangements for public aid programmes, as defined by NCBIR, National Science Centre, Horizon Europe and other available sources, as well as to allocate state budget funds or issue recommendations concerning the budgets of local government units. The list of members of the AI Council will include appointed representatives of academia, business, NGOs and public administration. The AI Council will consult its recommendations with the Innovation Council and the Digital Affairs Council;
- **AI Legislative Team** – appointed by the minister in charge of computerisation to address legal and ethical challenges supporting the implementation of the AI Policy.

The AI Policy Task Force will propose the lists of members of the aforementioned bodies, their mode of operation, competences and sources of funding for their activities, suggesting necessary changes as required, including staffing changes or clarification of the scope of activity of each body and their respective action plans within the scope defined in the AI Policy.

The AI Policy will focus on the development of the AI ecosystem, keeping in mind the following actions for each of the four dimensions of the Polish AI ecosystem framework:

Table 2. Framework for the Polish AI ecosystem

Framework for the Polish AI ecosystem	
Dimension	**Policy orientations**
international	• European and supra-European cooperation • virtualisation of work and mobility • territorial virtualisation and fair competition • preventing monopolisation of access to data and closing value chains • promoting equal and decentralised cooperation between research and development centres • protection of talent • exports of AI services • organisation of cross-border AI testbeds • coordination of public aid and foreign investment programmes
ethical	• human dignity and human autonomy support in the face of digital machine automation • Global Code of AI Ethics • trustworthy AI

legal	• legal definition of AI • counteracting the granting of legal personality to AIs • ownership and transferability of personal data • protection of business secrets and lack of ownership of industrial data • intellectual property • damage liability for AI developers on the basis of the diligence principle, for AI operators on the basis of the risk principle; distinction between the liability of end users and that of AI operators; • support for procurement specifications for AI-based solutions and facilitating the procurement process
technical and organisational standards	• technical standards • mutual recognition of certificates and certificates of conformity • rules for interoperability • data management standards