State of Polish AI 2021

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▶ **Table of Content**

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#1. Forewords

#1. Foreword

Aleksander Kutela
President of the Digital Poland Foundation Council, Vice President, Ringier Axel Springer Media, Supervisory Board Member, ING Bank Śląski, Member of the Board of Trustees, University of Social Sciences and Humanities (SWPS)

Mark Loughran, PhD
Member of the Digital Poland Foundation Council, General Manager, Microsoft in Poland

As members of the Foundation's Council, we are pleased to jointly present our next report on artificial intelligence. State of Polish AI 2021 is the latest version of the highly acclaimed Map of Polish AI 2019 and the most comprehensive publication on the Polish AI ecosystem.

Since the beginning, the Foundation has been undertaking many activities aimed at promoting the Polish AI ecosystem, creating intellectual property locally, and enabling collaboration between Polish and foreign entities in various areas, including business cooperation, co-development of new initiatives, and raising funds. When we published the Map of Polish AI 2019, we were guided by the idea to explore the AI ecosystem in Poland, streamline the creation of the Polish AI Strategy, integrate this particularly vibrant ecosystem and present the AI capabilities to investors. We are convinced that we have contributed significantly to developing the national AI policy adopted by the Polish government through the bold actions of the Foundation.

We decided to update the report and conduct a comprehensive survey to provide the latest pulse of the Polish AI ecosystem. In our publication, we present Polish companies that are developing advanced products and services using AI tools, the challenges faced by AI companies, human capital, the R&D ecosystem, and the condition of the science sector. The report also includes insights from the leading industry experts, disruptive trends that shape the market and key AI policy recommendations. We believe that State of Polish AI 2021 will enhance dialogue and boost the development and use of the Polish technological sector's great potential. We also want to build bridges between Poland and the world, which is one of the key elements of the Foundation's activities and our joint initiative - aipoland.org.

Along the process of achieving these objectives, it is crucial to understand the market. Our research shows tremendous progress that Poland has made in the last ten years, including AI development. Poland comes in the seventh place in EU with a 4% share of the AI talent pool. Global leaders from across industries move their R&D and GDS centres to Poland in order to benefit from the access to Polish specialists who guarantee the highest worldwide standards in performing assignments crucial for their businesses.

Even though most companies have been adding AI services or products only since 2014, Poland conforms to global AI technologies trends. Furthermore, AI is clearly the domain of large metropolitan areas in Poland. Nearly all AI companies are located in one of the six major metropolitan areas, with Warsaw consistently garnering nearly half of them as the Polish AI capital.

However, research shows the lack of support for academic research teams. We emphasize that the long-term development of AI requires stronger research development and cooperation. It is the source of knowledge and experience for world-class specialists. As experts point out, Poland is still at an early stage of the adoption of AI-based solutions.

We hope that this publication will significantly contribute to the Polish Digital Valley and Europe artificial intelligence ecosystem's development. With a great AI talent, the entrepreneurial spirit and fast-transforming sector of enterprises, Poland has got huge potential to become a digital heart of Europe.

#2. Foreword

Justyna Orłowska
Prime Minister's High
Representative for
Government Technology,
The Chancellery of the Prime
Minister of Poland

Artificial intelligence, so often referred to as the technology of the future, has in fact already become so ubiquitous that many of us hardly realize when we are interacting with it. At the same time, AI is beginning to be present in almost every part of our lives - take the car, for example: AI is involved in its design, it is used in its production, and the car itself more often than not uses AI in some way, even if it is not autonomous. Therefore, regulating everything in this area goes beyond one department and even beyond the public sector. This prompted us to develop an entirely new approach to legislation and to shape national AI policy in such a way that the catalog of institutions and the activities they undertake remained open, while at the same time we made over 200 commitments to implement the changes necessary to build the Polish AI ecosystem. Our overarching goal was, and still is, to fully realize Poland's potential as a developer of AI-based solutions and as a driver of demand for them. We have a vast and dynamic digital sector - one of the fastest growing in Europe, and that's why we are called *Digital Challenger* by McKinsey. We have a creative and well-educated population of engineers and ICT professionals, and a society open to innovation (for proof, just look at the adoption rate of various FinTech tools or check Digital Poland foundation report on the pulse of society 5.0). Since these factors are working in our favor, the real challenge that remains is to turn potential into reality, and that, as I said, is a challenge that cannot be met by government alone. While we can't move mountains, we see our mission more as being the stone that starts the avalanche that will eventually be able to do so. In practice, this means that we will focus on supporting as flexibly as possible, those who are the real drivers of the digital revolution - investors, entrepreneurs, AI experts, researchers and leading NGOs. Of course, this will have to be done in close collaboration with these groups, which is why I am so pleased that this comprehensive report on AI in Poland has been published. I am sure it will be a key voice in the debate on this crucial technology. I would like to thank each and every one of you who contributed to making this happen.

Enjoy your reading!

#2. Foreword

Beata Lubos, PhD
Director of the Department for Innovation and Industrial Policy, Ministry of Development, Labour and Technology

This report accurately reflects the state of development of the market for artificial intelligence applications in Poland in the area of economy. I wish to thank the Foundation for its solid contribution to the discussion and evidence-based policy-making on AI in Poland. As the Ministry of Development, Labour and Technology, we are trying to meet the challenges that Polish small and medium-sized companies are currently facing in relation to the need to implement artificial intelligence as one of the necessary elements of digital transformation and to ensure competitiveness in the future. One of the main challenges often faced by Polish companies is the lack of readiness to invest in innovation and artificial intelligence. From the Ministry's level, we try to help overcome this barrier by building a network of Digital Innovation Hubs, under the Minister's program "Industry 4.0", and through the ongoing activities of the Future Industry Platform Foundation across the country. Our goal is to reach entrepreneurs unconvinced about digital transformation with adequate information, provide them with the best possible advice and possibility to try out these technologies within the framework of demonstration functions provided by the hubs. In a further perspective, the aim of the hubs is also to support them in gaining funds within the financing instruments for the transformation towards Industry 4.0 or for the implementation of artificial intelligence in companies. We also want to help in the preparation of technical personnel, fluent in issues related to the use of AI, by developing the "AI4Youth" project, where students from Polish secondary schools will be able to gain theoretical and practical knowledge in the field of AI. Together with the European Commission, within the DIH network currently being built, we also wish to make it easier for Polish research centers and companies to establish cooperation with EU partners and thus promote the most innovative Polish companies specializing in AI as potential providers of modern ICT solutions. At the same time, we want to help other companies from other industries establish cooperative ties and enter the supply chains with sophisticated and advanced semi-finished products and components.

#2. Executive Summary

Tracking the AI Boom in Poland

The Polish AI ecosystem is concentrated in **six major agglomerations**. **Warsaw is the capital of AI** and home to nearly **45%** of AI organizations and talents. The global trend of slowing down the pace of creating new AI companies is also visible in Poland. The years 2021-2022 will show if this is because of Covid-19.

Business, Markets, Financing and Collaboration of AI Companies

Nearly **40% of AI companies** derive a significant portion of their AI **revenue from abroad**. The main markets are Europe and the United States. Polish companies have **no presence in Asia**. Polish AI companies are financed mainly from their own capital and R&D grants. **VC funds** invested in **21% of AI companies**. This may indicate an early stage of market development or limited risk appetite of VC funds which are active in the CEE region. Nearly **60% of the organizations cooperate with foreign entities**, focusing mainly on networking, sales and grants.

Customers of AI Services and Products

AI is applied in the most digital sectors such as telecommunications, banking and finance, retail, media and insurance. This is partly **due to the amount of data** that is being created and available for AI processing. **AI is treated by organizations as an innovation**, as the main customers of AI solutions are innovation, research and development departments. AI has also been applied for years in **controlling, data analytics, and most digital departments - sales and operations**. In terms of applications and domains, AI is mainly applied in **data analytics, computer vision, and NLP**.

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Technology & Data

The **toolkit of AI** developers relies on **Docker** virtual environment (56%) and **Jupyter** notebooks (48%). Among cloud platforms, Amazon's **AWS leads the way**, with 50% of AI companies reporting using it. Platforms from competitors trail behind with 30% of AI developers using Google platform and 22% using Azure. Among **pre-packaged AI tools** Google leads with **Google AI** (21%). Microsoft **Azure ML** (13) and **Amazon SageMaker** (10%) rank 2nd and 3rd respectively. **Python** is the **most popular language** used by AI professionals (95%). Some of the most popular AI frameworks include **TensorFlow, PyTorch, Keras, Sci-kit learn**. In terms of processing data nearly **75% of AI companies use cloud computing**. Only 23% of organizations use proprietary or sector-specific data. **Most use public or customer-provided data**. **Poland ranks as a trend-setter** in Open Data Maturity index, but **lacks the quality** of public data, especially annotated data.

Human Capital

Poland ranks 7th in the EU with a **4% AI talent pool** share and at the same time **ranks 1st place in the entire CEE region**. Poland ranks **24th in terms of AI intensity** in the active workforce and has 40% AI intensity of Estonia, the digital leader of CEE region. The size of AI teams varies across the companies – almost 60% of companies hires less then 10 AI experts, but **13% of organization hires more than 40 AI experts**. **Women are strongly under-represented in AI teams - this is a global trend**. A third of companies have an all-male team. Poland ranks 24th in the EU in terms of "Women in AI" (13% of employees are women). In the search for talent, most of **AI organisations rely on networking (64%)**, job advertisements (55%) or access to universities (55%). Due to **remote-working**, more and more experts work for foreign companies from Poland increasing the salaries of AI experts in Poland.

Science

Poland, with 34 **AI programmes**, ranks **11th in the EU**. Poland is the **leader in CEE region in the field of specialized AI courses** in tertiary education, especially for postgraduate students. Even though Poland has **4% share in the EU in terms of producing of AI top scientists**, it is at the bottom of the ranking of the best scientists in the EU, as are other countries in the CEE region. This is due to the **brain drain** and migration of the best scientists to other countries (France, Netherlands, Sweden). Most of organizations dealing with AI have some **cooperation with universities**. Only 27% state that they do not cooperate with academia. On the other hand, only **13% of organizations exchange data with academic researchers**.

R&D and Tax Reliefs

Nearly half of AI companies benefit from NCBR grants which is quite a significant number. NCBR offered more than 15 bln PLN in Electronics and IT category in 2016-2019 years. Recently, there is a clear shift towards AI and machine learning in NCBR's Electronics & IT category of projects. In terms of tax relief (IP Box), nearly 16% of AI teams use it and about 2/3 are aware it exists. IP Box is used by 22% of AI companies.

AI & big data adoption in Poland and Europe

Only 6% of Polish large companies use machine learning. This is one of the lowest numbers in the EU. However, it is an outcome very similar to other EU members in the CEE region. When it comes to NLP and speech recognition, only 2% of Polish companies use this technology. Nonetheless, other countries in the region have a similar NLP adoption rate so Poland does not really stand out.

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Challenges for Polish AI Companies

The **main difficulty faced by Polish AI companies** in the area of sales and marketing is **raising brand awareness abroad** (55% tend to agree or strongly agree). When it comes to recruiting, **AI specialists (48%) are the hardest to find**, followed by salespeople (40%). Cooperation with external partners may be difficult, if it is the public sector. **61% of companies find it difficult to cooperate with Polish public institutions**. This statistic for foreign public sector is far lower (38%). Similarly, **cooperating with academia in Poland is seen as more difficult (34%) than in other countries (18%)**. On the client side the main issue is that potential **clients are often not ready to invest money in AI**. 44% of AI teams point at this implementation blocker. There are also more technical bottlenecks. **Moving from proof of concept to production can be difficult (39%) and there may be a problem with obtaining data that is of good quality (34%)**.

AI Policy & AI Ecosystem Development

In January 2021, an AI Policy was accepted by the government. It is still relatively unknown by the community. Those who actually read it tend to **rate it positively**. They note, however, that it **lacks clear goals and KPIs, clearly assigned responsibilities and a financial commitment**. In the context of making Poland an AI Hub, the community would especially value: **better promotion abroad, access to good quality public, annotated data, tax incentives, coding classes in schools, better access to research grants**.

AI Policy | Better coordination: **Currently, the AI policy has some flaws which should be fixed. In particular:**

1. **A roadmap for artificial intelligence event** - In the spring of 2019, the Ministry of Entrepreneurship and Technology (MPiT) has organized for a meeting called Roadmap for Artificial Intelligence. It is necessary to return to annual meetings where the market can meet and discuss in what direction the development of AI in Poland is heading. State of Polish AI reports can be linked to this event by preparing the annual AI market survey.
2. **Allocate responsibilities** – all initiatives should have owners.
3. **KPIs** – progress should be measured by clear and transparent KPIs
4. **Financial budget** – currently, many initiatives lack budgets. AI policy should have a clear financial budget which would be allocated to initiatives. EU funding could be used.

Science | Support academic research teams: **long-term development of AI requires stronger research teams. It is where world-class specialists get their experience. The currently implemented Constitution for Science seems promising. Nonetheless, we want to highlight main things here:**

1. **National Science Centre (NCN)|** Create a programme aimed at financing key AI research. The program should be directed to research in the most important problems for Poland, such as health care (cancer), agriculture or transport. Create ambitious, world-class project to solve major issues.
2. **Create leading event |** Poland does not currently have a region-wide leading scientific event. Current conferences should be analyzed and a minimum of two events should be supported (funding, contests, expo, papers).
3. **Promote cooperation |** Promote collaboration by mapping all researchers and research units and then outsourcing research to teams rather than individual researchers. Promote collaboration with foreign scientist.
4. **Increase in salaries |** To keep talented specialists in the scientific sector basic salaries should be increased on all levels from PhD students up to tenured professors.

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Promotion | **Promotion outside of Poland is viewed by many as the most important type of support the state could offer. Society should see benefits of automation:**

1. **Promotion of Polish AI solutions abroad |** Support for organizations that promote Polish companies outside Poland and facilitate networking (eg aipoland.org). Support for the creation of joint booths for AI companies and organizations at leading events such as Dubai Expo. State should also consider creating one website which promotes Polish tech (example https://www.swiss.tech/)
2. **Promotion of AI in the society |** Society must not be afraid of innovation and be open to automating work. This is especially true for the Polish society, which is aging. All initiatives explaining digitalization, such as Digital Festival, should be supported by the government. Any initiatives encouraging people to learn the basics of artificial intelligence such as #AIchallenge | Elementsofai.pl should also be promoted. Leading government officials and CEOs of state-owned companies should complete the above course, following the example of Finland.

Ecosystem | **A number of activities to support the entire AI ecosystem in Poland:**

1. **Access to good quality data in a public data bank |** For several strategic problems, such as cancer or climate change, the government should allocate public resources to prepare decently annotated data for AI. For example, there should be massive collection and release of annotated ultrasound (USG) results for AI companies.
2. **Tax relief, automation |** There should be tax relief for implementation of automation that applies not only to real robots and Industry 4.0, but also to AI implementations, especially in SMEs. It could be a kind of grant for automation in the amount of PLN 300 thousand per company (SMEs).
3. **Procurement templates for innovative AI projects |** The state could support the creation of templates that can later be used by officials to organize tenders for AI services. Many officials lack knowledge about AI, hence they are not able to prepare a normal market inquiry
4. **DIH AI |** The state should support the establishment of true AI DIHs to help SMEs as well as the public better understand AI. Leading centers should be supported, based on their experience in AI.

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#3. About the Report

State of Polish AI 2021 is the latest version of highly acclaimed **Map of Polish AI 2019.** We decided to **update the map of ecosystem** and do the survey to **present the latest pulse of Polish AI Ecosystem.** The main survey was conducted between **January and February 2021.** The survey was completed by **200+** companies and institutions which develop or use AI in their products, services or perform the fundamental research.

AI companies	AI Team (corpo)	AI R&D	AI institutions (science)
68%	11%	5%	16%

66 experts have contributed to this report by giving 90+ insights!

Since we wished to create the **most comprehensive report on the AI ecosystem** in Poland, we additionally used many other sources. We also wanted to compare Poland with other countries in Europe to obtain an answer to where we are in terms of AI market development. Therefore, we also used the **latest data from Eurostat and EIB on AI and big data** to present the adoption of this frontier technologies in **Poland and European Union**. To present the complete picture of the Polish AI ecosystem we also used **sources from our previous reports**, compiled data from i.a. **LinkedIn** and conducted **10+ in-depth interviews with leading and respected industry figures**. Last, but not least, we received more than **90+ insights from 66 AI experts, including Poles who live abroad and work for global AI champions**.

We would like to thank everyone who contributed to this report.
Only **#TOGETHER** we can make Poland a leading AI Hub in Europe.

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#4. Tracking the AI Boom in Poland

Where is the main office of your company located?

Location

- Warszawa
- Kraków
- Wrocław
- Gdańsk, Gdynia, Sopot
- Poznań
- Katowice urban area
- Other cities
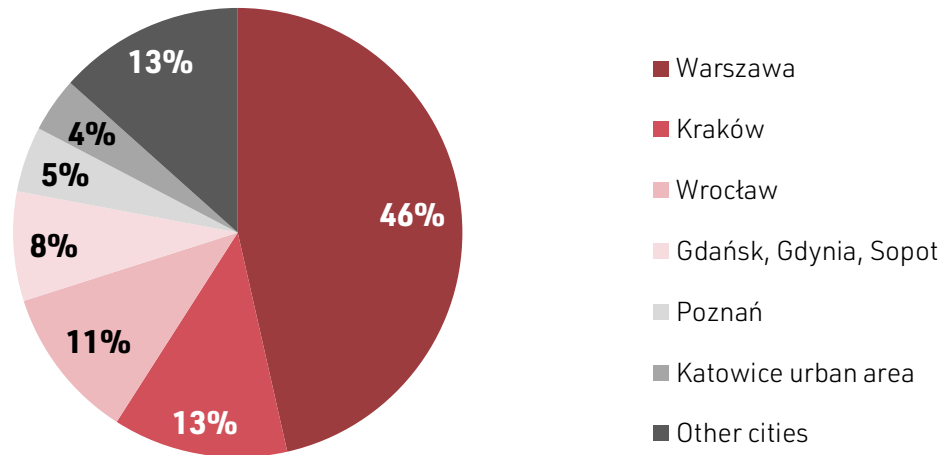
- **AI is clearly the domain of large metropolitan areas in Poland.**

- **Nearly all Polish AI companies are located in one of six big agglomerations.**

- **Warsaw is the capital of AI and accounts for 46% of AI organizations.**

Sample: AI companies, corporations & academic teams

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Agnieszka Szweda
Expert, Center for strategic Investment, Polish Investment and Trade Agency (PAIH)

The research results reflect the experience of the Investment Centre of PAIH which works on the new services and R&D projects involving AI technology. We observe that technology investors usually like to explore Warsaw as the first choice for their location. However, with a proper understanding and knowledge of the local markets and their tech ecosystems, investors start to appreciate and consider other places as well. This why it is essential to help new investors discover a full tech potential in different locations by providing them with accurate information and guidance. This is the role of PAIH.

Several reasons decide about the location preference. In the case of foreign companies, especially the big ones, vast majority of them target the capital city due to its excellent connectivity, good infrastructure, access to talent pool, an established tech and science ecosystem, and the presence of local players. The Polish IT talents, world-class programmers, and well-established universities are the magnet for AI projects and are available in all IT centres analysed in the report. The desired IT skills and talents are also found there, although a bit less. The rapidly growing centres such as Wrocław, Kraków, Tricity, Poznań, Katowice have their competitive edge and specific local strengths. Those may be less evident at first, but once discovered, they can lure new players and increase the number of AI companies in the future.

Jeroen van der Toolen
CEO, Ghelamco Poland

Large metropolises such as Warsaw have always attracted the best professionals. This is also the case for companies focused on AI development. They are also looking for top-class office buildings. We can see this by the interest in our skyscrapers that we build. Take for example the Warsaw HUB. It has attracted a large number of AI development companies, IT industry infrastructure companies or those from the dynamically growing gaming sector in Poland. Such organisations are looking for offices that are well connected to the city, offering something more than just ordinary office space. Attractive gastronomic and retail space, hotels and conference facilities are very important. The surroundings of buildings should also provide access to good quality public spaces and attractive residential developments. Warsaw, especially in the area of Rondo Daszyńskiego, which has become the new centre of Warsaw, offers all these facilities.

In what year did your company begin offering products/services, consulting, or conducting research in artificial intelligence?

Year of introducing AI

| 1990s | 2001-05 | 2006-10 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| 2% | 2% | 6% | 3% | 6% | 1% | 11% | 16% | 17% | 15% | 14% | 9% |
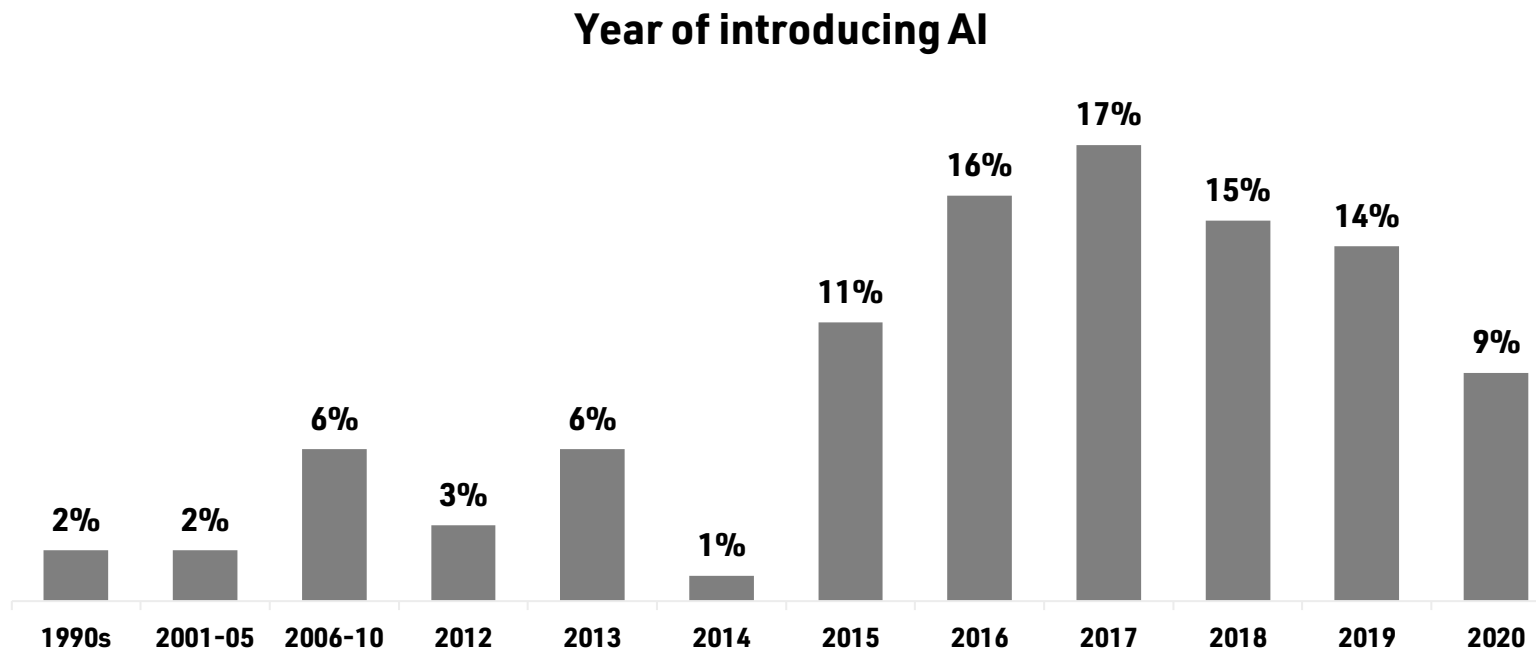
- There is a handful of companies which were doing AI even in the 90s.

- However, the technology was more widely introduced only in the last decade. Most companies have added AI services or products since 2015 onwards.

- The numbers for years 2018-2020 suggest that the time of exponentially growing number of AI companies is over.

- The low outcome for 2020 may be a direct result of Covid-19.

Sample: only AI companies & corporations | excluding academic teams

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Michał Chromiak, PhD
Director of AI R&D, UBS

AI in Poland conforms to a global trend of concentrating the AI efforts in metropolitan areas with good access to scientific community (top tire Universities) and access to large industry (global brands) with sufficient funding to support R&D processes. While the AI trends globally seems to accelerate, moving out from academia and Big Four companies to general industry and even start-ups across multiple domains - from protein folding to autonomous vehicles and linguistic applications - the survey points out that exposure to new AI products and services in Poland has decelerated already in 2019, and even more significantly in 2020. This might not necessarily mean the drop of interest in this area , as the first wave on AI products is already here. It is worth noting that COVID-19 has slowed the growth rate of new AI business creation. However, this is a global trend, as pointed out in the AI Index 2021 report from Stanford University. Moreover, despite the pandemic, many companies are still being formed, especially now in the health sector.

However, the slower growth rate of AI-related start-ups may be related to general market uncertainty, especially related to investing in cutting-edge technologies. These technologies are often considered too expensive, so investment in them should be undertaken with caution. This is especially true for AI as investment in AI may not be easy to plan and budget for compared to other, more legacy technologies.

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Boguslawa (Bogy) Cimoszko Skowronski
Co-founder, MIT EF CEE
Partner, FounderPartners

It is interesting to see that from early 90's and up to 2015/2016, Polish software companies were introducing AI products and services in growing numbers. Why did the growth rate reverse after 2016/2017? Could the reason lie in the fact that the Polish market is small and not sufficiently mature, while Polish AI firms find it difficult to build brand recognition in enterprise sales abroad?

Tech accelerators could play an important role in accelerating AI adoption among corporates and SMEs in Poland and abroad, esp. the tech accelerators who work with local and international corporations. They could be the gateway connecting Polish AI companies to the potential international clients.

AI companies fund themselves from own resources in 70%+. This is very comparable to the Polish start-ups' scene. Access to capital does not seem to be a problem. Being connected to the global community of potential clients, on the other hand, appears to be a challenge for the Polish AI firms.

Agnieszka Szweda
Expert, Center for strategic Investment, Polish Investment and Trade Agency (PAIH)

The last 10 years show tremendous progress that Poland has made in the R&D sector, including AI development. In 2010 there was a handful of R&D centres. However, it was just the beginning of the growing trend that is now achieving its boom. For some of the centres, AI remains the leading technology used in product or service development. Global players from across industries come to Poland to work with the Polish talents who guarantee the highest worldwide standards in performing the functions crucial for their global operations.

We expect that this growth will continue, not only due to the abundance of skilled human resources but also because Poland offers one of the most attractive incentive packages for R&D operations in the region, including tax incentives, grants, and EU schemes.

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#5. Business, Markets, Financing and Collaboration of AI Companies

How much revenue does your company have annually?

How large a share of your revenue over the past 12 months has come from products or services based on artificial intelligence?

Total revenue

- 4%
- 18%
- 20%
- 20%
- 30%
- 8%
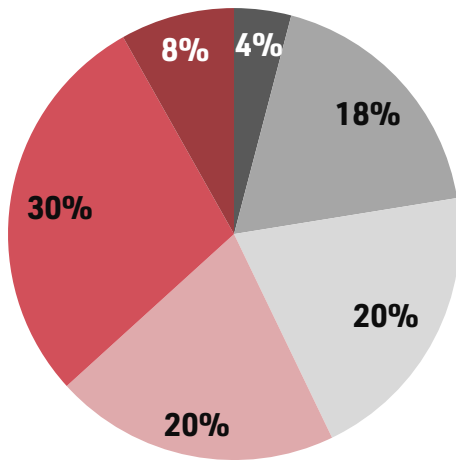
■ We don't have revenue yet
■ Less that PLN 500K
■ 500K - PLN 2 mln
■ 2 mln - PLN 5 mln
■ 5 mln - PLN 50 mln
■ PLN 50+ mln

Revenue from AI

- 5%
- 30%
- 19%
- 46%
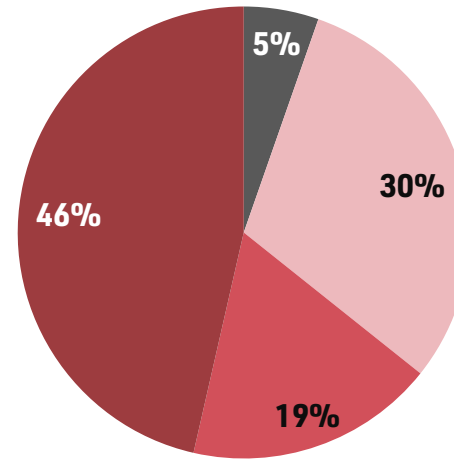
■ No revenues from AI yet (still in development)
■ Up to 30% of revenue from AI
■ 30% - 70% of revenue from AI
■ Over 70% of revenue from AI

- **Over a half of AI companies have seven-digit revenue. A few (8%) have revenue of over PLN 50 mln.**

- **46% of companies get most of their income from AI.**

- **A small fraction does not have any revenue yet (4%) or does not get any revenue from AI (5%).**

Sample: only AI companies | excluding corporations & academic teams

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Łukasz Kobyliński
Chief Science Officer,
Sages

Poland is still at an early stage of adoption of AI-based solutions. There is a limited number of organizations willing to invest in such solutions and even then the spending is cautious. This can also be observed from the perspective of revenues of AI-providers, where only 8% report income of over PLN 50 mln. There is a fragmented market of a large number of small-scale AI-providers which struggle to grow either by advocating AI on the local market or by turning to markets abroad.

Jerzy Brodzikowski
General Manager,
CIC Warsaw

It is interesting to observe the revenues of AI-driven companies in Poland as they showcase two trends. First, Artificial Intelligence products and services aren't necessarily the only revenue makers for AI-driven companies in Poland. These companies still provide services and products outside the AI spectrum, which proves, unfortunately, that AI activities still aren't enough to support many companies that should be concentrating solely on machine learning. The second trend is that a fair number of AI-driven companies still have relatively low revenues and are probably at early stages of development. It will be interesting to see how their revenues change in the upcoming years, as machine learning services and products will certainly be one of the highest revenue generating sectors of IT.

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What percentage of AI revenue do you have from abroad?

Which markets do you get most of your AI revenue from? Name your three most active regions.

Main markets for AI

Pie chart:
- 5%
- 32%
- 25%
- 6%
- 32%
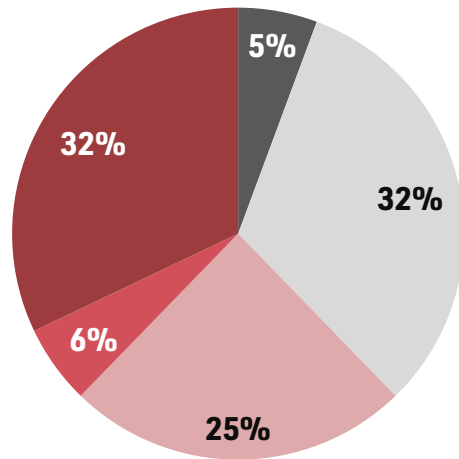
Legend:
- No revenues from AI yet (in dev.)
- Only local clients
- Up to 30% from AI from abroad
- 30% - 70% from AI from abroad
- Over 70% from AI from abroad

Bar chart:
- Poland: 67%
- CEE: 8%
- EU: 42%
- UK: 21%
- EFTA: 6%
- USA, Canada, Mexico: 44%
- Middle East: 8%
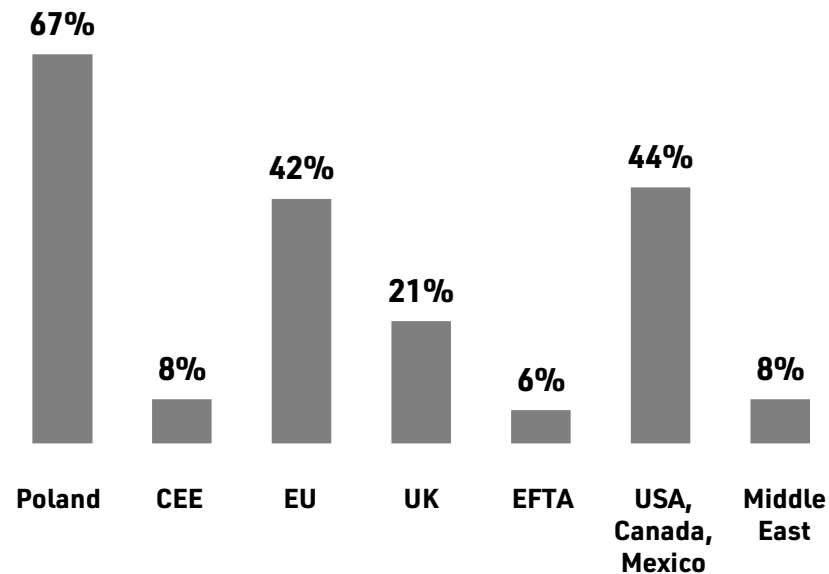
- A third (32%) of the companies get most of their revenue from abroad.

- On the other hand, also 32% rely solely on domestic clients.

- The main external markets for AI are Northern America (44%), EU (42%) and UK (21%).

- Polish companies do not have many customers in Asia.

Sample: only AI companies | excluding corporations & academic teams

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Błażej Chodarcewicz,
Data Science & AI Director,
Lingaro

As the leader of the Data Science and Artificial Intelligence Center of Excellence at Lingaro, I have observed that there are two types of Polish AI companies: those that focus on the domestic market and those that focus on international markets. This research confirms my perception. 57% of the AI companies generate less than 30%, if any at all, of their AI revenue from clients abroad. 37%, including Lingaro, generate most of their AI revenue internationally. Only 6% have a relatively balanced mix of AI revenue from domestic and international clients, i.e. generate 30-70% of AI revenue from abroad.

For Polish AI companies focusing on international markets, business strategies have traditionally been based on providing well-resourced clients – especially from Western Europe, North America, and the Middle East – with exceptional value for money. Poland has a highly skilled, well educated, and competitively priced talent pool, even as Polish IT specialists' financial expectations continue to grow. It is not a surprise, therefore, that the Polish AI companies do not have a strong presence in Asia. In the race to become the world's leading digital innovation centre, I would say that in Asia we see a growing number of competitors rather than prospective clients.

Jarosław Królewski
CEO, Synerise

Polish engineers, in particular in fields related to data science, have an exceptionally good reputation both in Poland and in the world – great evidence for that is the increasing level of revenues from services and products of Polish AI companies abroad. The share of foreign revenues will be higher from year to year. Difficulties with the absorption of AI are well known, regardless of the size of the company offering this type of solution or the one that intends to implement such technologies. Poor education and understanding of AI, without appropriate benchmarks and metrics and improper attribution of artificial intelligence created by many "fake AI" companies spoil the market and lead to disappointment which impacts the level of trust regarding professional services. The AI companies must systematize and build evaluation methods for the algorithms offered to be transparent and simple to understand by clients. Of course, problems such as access to data, data quality, the transition from PoC solutions to production deployments, which requires high Big Data expertise and model performance, also affect the speed and scale of implementation of individual solutions.

Paweł Rzeszuciński, PhD
Chief Data Scientist,
Codewise

It's encouraging to see that Polish companies are capitalizing on their AI investments. Generating revenue not only gives boost to team morale, increasing their work efficiency, but also creates space for further experimentation and creation of case studies, which in turn allows for much wider exposure and stronger business development. Correlating this with the increased share of revenue originating solely from the Polish market may be a positive indication of our domestic market slowly grasping the potential the introduction of AI can bring to their businesses. At the same time the expansion to external markets should seem like a natural step for the Polish-market-only companies. The fact that our companies struggle to do business in Asia (mostly China) comes as no surprise given the highly protective attitude Asian governments have towards their domestic markets. This is where the support of the Polish government could be invaluable, as the potential benefits of jumping through the Chinese wall are immense.

Aleksandra Cybulska
Expert, North America market,
Polish Investmet and Trade
Agency

There are two types of activity of Polish AI companies in the North American market. The first, less frequent, is the sale of products with artificial intelligence - an example here is the educational robot Photon (PAIH helped with the verification of a potential business partner and during the Tech Crunch conference in San Francisco in 2019).

The second type is the employment of Polish programmers specializing in AI by American companies. There are a lot of IT companies in Poland that are willing to subcontract their employees to "external" projects. Here, an example is the Tooploox company whose team cooperated, among others, with an American manufacturer of smart ovens. (PAIH consulted the business strategy and supported the promotion of a marketing event organized by the company in San Francisco).

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Jan Zborowski
Vice President,
SoDA

Poland is the primary market for most of the researched organizations because undoubtedly, it is cheaper and easier to focus on. Moreover, it is big enough to find one's clients, increase revenues and build recognition.

On the other hand, it is delusional to believe that one can develop their business further only by focusing on the local market or even worse, by implementing the local strategy to international markets. In fact, growing a global business or solution requires an international approach and strategy already from the beginning.

We often witness lots of Polish software companies that have been primarily focusing only on the Polish market, struggling to go international. As a result, hoping to be able to approach international clients many companies decided to join SoDA (Software Development Association Poland).

Based on the figures shown in the above-mentioned research, I am particularly pleased that more and more companies have their revenues from abroad. Especially, it is worth mentioning that close cooperation with the countries of North America and the EU confirms that Polish technology companies are able to use the opportunities offered by the global economy and that services and products being offered are of high quality.

Michał Chromiak, PhD
Director of AI R&D, UBS

Polish AI companies have clients in diverse locations. However, while most of the revenue is originating from local market, the scale, wide adoption and awareness of AI importance in US, has attracted Polish companies to obtain third of their revenue from North American market clients. Having international clients is a good sign and this translates to good financial indicators of having almost 50% of customers from abroad, with third of the companies getting most of the revenue from abroad.

Opinions expressed are solely my own and do not express the views or opinions of my employer

Darek Kociecki
Chief Growth Officer,
Neoteric

It is interesting to see that 32% of AI companies rely solely on the Polish market. It seems that the domestic AI market has finally matured and many clients turned their budgets into advanced data solutions.

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What is the source of the capital used to finance the business?
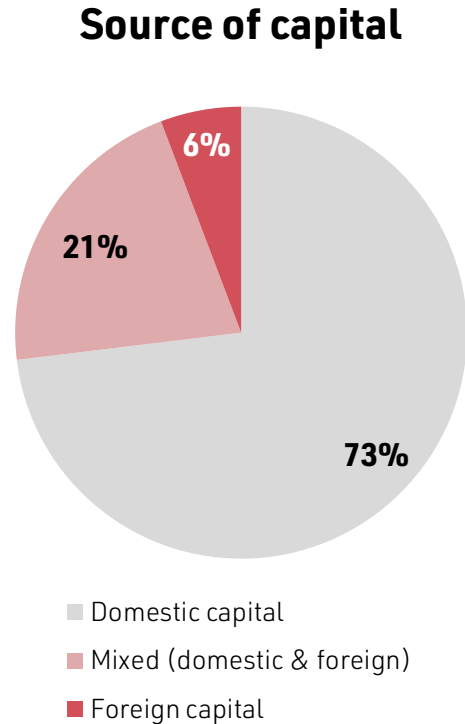
What is the type of capital you use to finance your operations? Select each correct answer.

Source of capital

6%
21%
73%

- Domestic capital
- Mixed (domestic & foreign)
- Foreign capital

Type of capital

74%	36%	21%	8%	6%	2%
Fully self-financed	Subsidies & grants	Venture capital	Angel investors	Bank credit, debt, bonds	Stock market
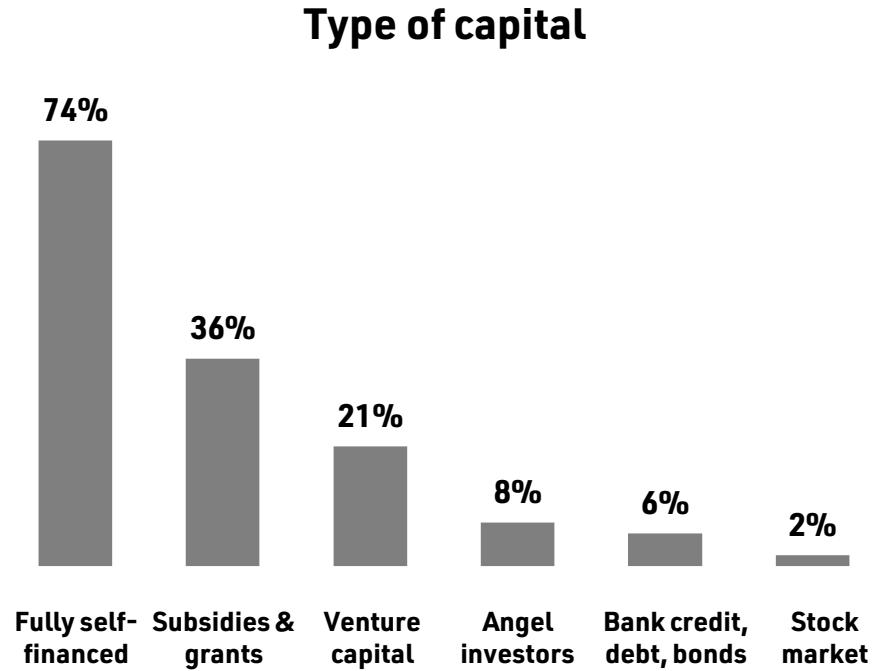
- Most AI companies rely on domestic capital. Only 27% are financed by foreign Capital, among these 6% are wholly funded by foreign investors.

- Generally, companies tend to be self-financed. Only 21% rely on venture capital and 8% on angel investors.

Sample: only AI companies | excluding corporations & academic teams

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Tech startup funding in the CEE region by type of investor

Type of investor

- Venture capital
- Corporate Venture Fund
- Angel
- Government & Non-profit
- Accelerator
- Corporate
- Crowdfunding
- Private Equity

46%
18%
10%
10%
8%
4%
2% 2%
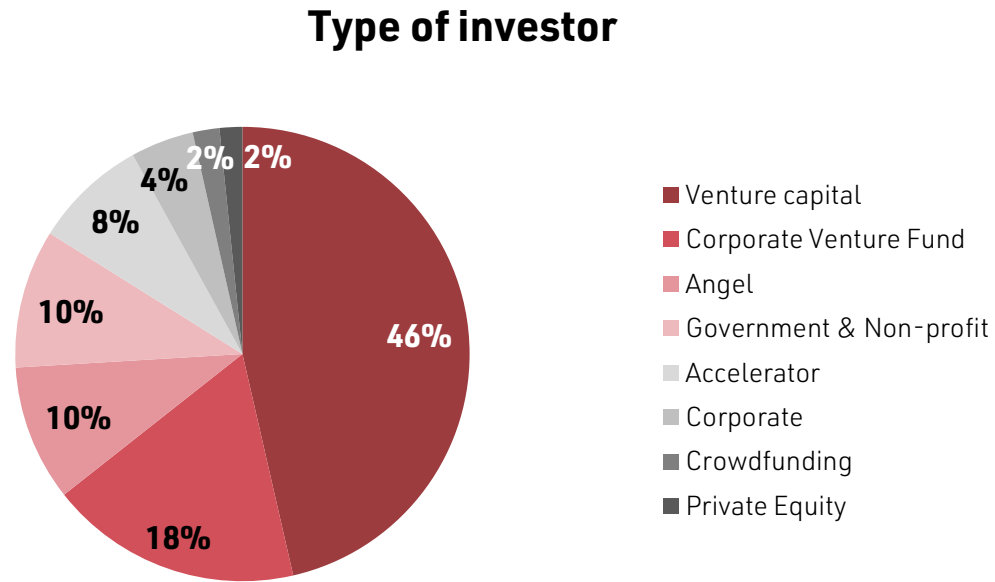
- **Almost 50% of startups obtained the founding from VC funds, and 18% of startups - from Corporate venture fund.**

- **The state's share has been growing dynamically in recent years due to the funding provided. However, from the perspective of recent years, the state have 10% in tech startup funding in the CEE.**

- **Considering that VCs have invested in 21% of AI startups in 2020 (previous page), but also in almost 50% of all tech startups in the last 10 years, VCs in CEE have been late to invest in AI or are afraid to invest in frontier tech.**

Source: Dealroom. The chart shows the percentage of funding for all technology startups by investor entity type from 2010 to 2020

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Wojciech Walniczek
Investment Director,
OTB Ventures

The sources of capital of Polish AI companies are quite surprising. AI is a globally-recognized and capital-intensive area to develop at scale. Thus my intuition would be that more projects than revealed would be funded from abroad and more would use external sources of capital. This is not the case here and there might be a couple of reasons for that. First of all, Polish AI companies might be at a very early stage of their development, thus are not able to yet reach out with their exciting technologies to external, foreign investors. Second, they might be developing within the structures of existing, larger organizations, where there is a more readily available capital for those solutions. Last but not least, those technologies might exist in areas where well-funded and fiercely competitive organizations already exist, detracting external and foreign investors from those start-ups. All in all, I would feel more confident and optimistic about the future of Polish AI companies if we saw a continued increase in the engagement of external, smart money from recognized investors.

Sergiusz Nowak
Senior investment Analyst,
MCI Capital

Interestingly, the results of the report indicate that almost 75% of AI companies in Poland self-finance their growth. This could either imply that those companies are already well-established in the market and can self-fund new AI-related ideas or that they are at a very preliminary stage with no traction and visibility among investors. In the latter case, this often hinders or delays gaining enough momentum to attract venture capital, even on the riskier end of VC spectrum.

When taking a closer look at external financing, we see that although majority of funding comes from local investors, there are more and more international sponsors looking favourably at the Polish AI ecosystem. This is clearly visible in recent high profile VC rounds led by foreign players, with most prominent examples including $10m Series A round of Infermedica, a Polish MedTech, led by Berlin-based Heal Capital, as well as $8.6 million of seed capital raised from Hoxton Ventures and Khosla Ventures by a developer of robotic solutions Nomagic, to name a few.

In our view such an upturn in international interest reflects strong perception of the Polish AI landscape, fuelled by the access to top-notch tech talent, thriving local innovation scene and entrepreneurs eyeing ambitious expansion plans from day one. Hopefully, we will see this trend going forward.

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Do you work with foreign entities (excluding direct sales to customers)? Select each correct answer.

Category	Value
No such cooperation	39%
Networking (business clusters, associations)	24%
Scientific cooperation (e.g. regarding science grants)	22%
Grants for R&D (e.g. Horizon 2020)	22%
Sales (joint client acquisition, offering in a consortium, solution reseller)	20%
Mentoring (e.g. acceleration programmes)	14%
We're a part of a global corporation (e.g. R&D of a global company)	13%
Student engagement (e.g. hackathons, competitions)	13%
Sharing of data & algorithms (e.g. sector data)	13%
Financial cooperation (e.g. foreign investment or credit)	12%
Joint software development and sales of an advanced product	12%
Joint development of a part of software	9%
Joint development of technology, incl. computing power	9%

- **Nearly 60% of companies and institutions collaborate with entities from other countries.**

- **This usually means networking (24%), scientific cooperation (22%) or in the area of R&D grants (22%).**

- **Sharing of data or algorithms is less common (13%). Only 9% develop technology together with entities from other countries.**

Sample: AI companies, corporations & academic teams

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Do you work with foreign entities (excluding direct sales to customers)? Select each correct answer.

	AI companies	Corporations	Academia
No such cooperation	55%	11%	4%
Networking (business clusters, associations)	16%	37%	39%
Scientific cooperation (e.g. regarding science grants)	13%	5%	70%
Grants for R&D (e.g. Horizon 2020)	15%	11%	57%
Sales (joint client acquisition, offering in a consortium, solution reseller)	25%	21%	4%
Mentoring (e.g. acceleration programmes)	14%	16%	13%
We're a part of a global corporation (e.g. R&D of a global company)	5%	68%	0%
Student engagement (e.g. hackathons, competitions)	5%	11%	48%
Sharing of data & algorithms (e.g. sector data)	6%	32%	22%
Financial cooperation (e.g. foreign investment, credit)	12%	26%	0%
Joint software development and sales of an advanced product	7%	37%	9%
Joint development of a part of software	5%	21%	17%
Joint development of technology, incl. computing power	2%	26%	17%

- **Nearly all corporate or academic teams cooperate with entities from outside of Poland.**

- **When it comes to AI companies, over a half of them do not involve in such cooperation. However, when they do, they tend to focus on sales (25%).**

- **In corporations, cooperation often stems from being a part of a global organisation. It is more likely to involve joint development of product (37%) or sharing of data and algorithms (32%).**

Sample: AI companies, corporations & academic teams

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Łukasz Grzybowski
Head of Machine Learning
& Data Engineering,
STX Next

According to the report, over a half of Polish AI companies cooperate with foreign entities, which I think demonstrates that the sector is maturing. However, as the data shows, the cooperation consists mainly of network building and business development: selling goods and services, expanding contacts, cooperating with other departments from within the same organization, and taking part in accelerator programs.

International technological cooperation, such as joint development of software solutions, research and development, as well as implementation of research grants, is less common.

The Polish AI sector is still at an early stage of growth: business development is carried out using the current state of technical know-how and it is self-financed with domestic capital.

The level of the sector's maturity is evidenced by, among other aspects, the companies' revenue structure which is heavily dependent on domestic clients, the limited cooperation with academia - which consists mainly in hiring or collaborating with individual scientists as opposed to entire research teams, and the fact that the annual revenue of 64% of the companies doesn't exceed PLN 5 million.

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Grzegorz Mrukwa
Deputy Data Science
Manager,
Netguru

Only 24% of companies declare foreign collaboration in terms of Sales (joint client acquisition, offering in a consortium, solution reseller), which is stunning. There is a lot of technical debt around AI and its real-life deployments, it usually makes a lot of sense to take advantage of the existing platforms for developing AI solutions. These may reduce time required for deployment from months to a week. This is further observed in „Challenges in implementing AI", where 39% of respondents indicate difficulties in moving PoC to production.

Michał Chromiak, PhD
Director of AI R&D, UBS

In terms of the survey statistics (Collaboration with foreign entities outside Poland, Cooperation with academia) the fact that raises concerns is a very modest foreign academia cooperation which is especially important as it is the foreign research institutions that conduct state-of-the-art research and help develop improvements in AI that are later mostly utilized by global AI leading companies and bring them the market advantage. This could prove the recreational and local nature behind the AI reality in Poland regarding technologies already researched abroad and present on global markets. In this aspect, one may favour the assessment of the local specificity rather as local follower market than global innovative market.

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#6. **Customers of AI Services and Products**

In which business sectors has your organization generated revenue or applied AI in the past 18 months? Select each correct answer.

Sector	%
IT & telco	58%
Finance & banking	41%
Commerce, incl. E-commerce	34%
Healthcare	31%
Insurance	23%
Science	21%
Media, incl. Social media	18%
Sports	17%
Education	16%
Energy	16%
Industry	16%
Transportation & logistics	16%
Public administration & services	11%
Entertainment	11%
Security & defence	8%
Construction & real estate	8%
Arts & culture	4%
Environmental protection	3%
Agriculture, forestry, fisheries	3%
Tourism	2%
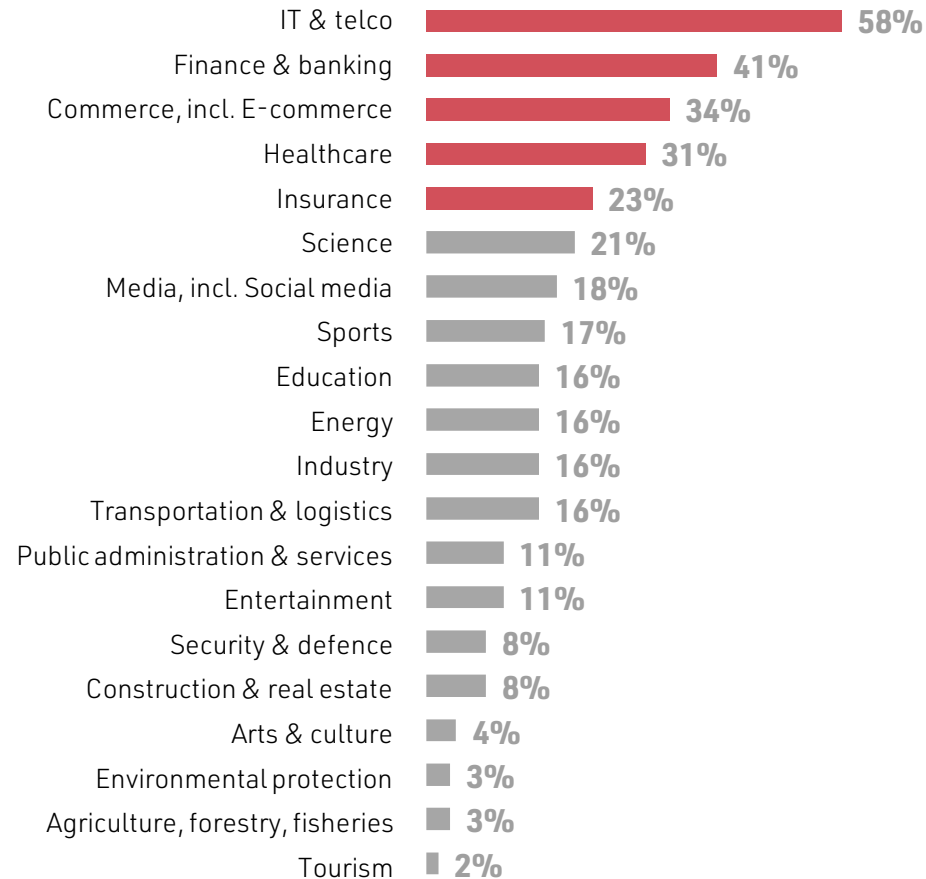
- **AI teams provide services mostly to sectors such as IT & telco (58%), finance & banking (41%) or e-commerce (34%).**

- **On the other hand, a few sectors seem to be mostly absent. Agriculture, forestry and fisheries (3%), security & defense (8%) provide plenty of use cases. Nonetheless, the Polish AI companies do not seem to specialize in these economy sectors.**

Sample: AI companies, corporations & academic teams

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Agnieszka Rynkowska
Chief Commercial
Officer (B2B),
T-Mobile Polska

The report's results on the use of AI to generate revenue are not surprising. Technology companies operating on big data, such as T-Mobile, are the leaders in the implementation of AI in Poland. This is mainly due to the scale of business, the amount of data we have in the company, but also the high quality of specialists working in Poland. That's why we created AI Skill center in Poland for the whole Deutsche Telekom group.

The study also found that the banking, finance, Retail, e-commerce and insurance industries naturally lead the way in the implementation of artificial intelligence in business. Currently, AI allows not only to better tailor products or services to the needs of specific clients, but thanks to AI we can develop communication channels, and this is where we see the greatest progress. In addition, it is also extremely important that artificial intelligence helps in increasing the overall cybersecurity, particularly in times of accelerated digitalization. Thanks to learning algorithms, we are able to detect completely non-standard attacks, not yet described in security bulletins. That kind of systems are already operating in our network and clients are eager to add them to the portfolio of services they use.

Magdalena Kasiewicz
Customer Success Lead,
Microsoft Poland

Polish companies are already proving that the use of AI is not a distant vision but a real business scenario providing concrete benefits. The presented research clearly shows that practically every company is able to build its competitive advantage on the basis of artificial intelligence algorithms. This is confirmed by the experience of our clients and partners as well as research, including AI&Skills 2020 in which we asked Polish managers about the degree of use of artificial intelligence. 23 percent confirmed a high degree of advancement in the use of this technology and as many as 44 percent were at the stage of recognition or first experiments with the use of AI. Thanks to artificial intelligence the Żabka chain can not only more accurately determine the location of a store, but also show its franchisees how much income it will generate from running it. Moreover, the Żappka application used by 4 million Poles also uses AI mechanisms for better personalization and product recommendation. In Polpharma, thanks to algorithms, measurement data from drug production becomes useful information from a business point of view. These capabilities are not reserved for the largest companies. Domański Zakrzewski Palinka law firm uses the possibilities of the Azure cloud and AI technology to securely organize, analyse and interpret its documentation. AI is used in health care, supporting doctors in medical consultations and analysis of diagnostic images. There are many more such examples.. Artificial intelligence technology using the computing power of the cloud supports human capabilities and, in the case of companies, increases their competitive strength.

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Bartosz Sokoliński
Innovation & Technology
Managing Director,
ARP

Artificial intelligence is becoming more and more popular. We often use it and don't even realize it. Not surprisingly, the major industries where it is being used are the most digitized ones. Those in which intelligent automation has been operating for a long time include IT, Telco, finance, banking, e-commerce. Healthcare has a very high and important position among AI clients. I think it will become number one or two very quickly. Especially given the pandemic and the rise of telemedicine. The high position of industry is gratifying. On the other hand, the low position of education, science, construction and above all security and defence is surprising. Especially since 81% are B2B orders. Security & defence creates a very large purchase value in the world. It is this sector that should drive Polish innovation (innovation and R&D departments were indicated in nearly 40% of cases). This unfortunately shows that the Polish public sector is just learning about artificial intelligence.

Jacek Kawalec
Partner,
VoiceLab

Agriculture, forestry and fisheries (3%), security & defence (8%) provide plenty of use cases – this shows that these areas, mostly managed by the state, do not explore AI and do not finance such projects. There are very few privately owned companies in defence.

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Grzegorz Mrukwa
Deputy Data Science
Manager,
Netguru

It seems like real estate, agriculture and environmental protection are not within the specialty of AI companies, though we observed a high interest in applying AI to these industries. The main challenge was the cost of Proof of Concept (PoC) and implementation. Clients in those fields were not ready to make an investment.

Ken Xu
Director of Cloud & AI
Business Group,
Huawei Poland

Huawei supports the development of solutions using machine learning and deep learning. The solutions developed in Poland are implemented by SMEs, corporations or academic institutions. Based on our experience in Poland I can say that the largest number of AI solutions are being implemented in the retail/commerce, manufacturing/industry, transportation, healthcare and finance sectors. We also see an upward trend in conducting scientific research in the field of artificial intelligence in Poland. On the other hand, if we look from the perspective of solutions implemented by our partners in 2020, by far the largest number of implementations we have had can be seen in the manufacturing, logistics, security, finance and sales sectors. As far as the type of solution is concerned, we most often implement solutions in the field of computer vision, speech recognition and time-series.

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Andrzej Wodecki
Associate Professor,
researcher, Dept. of
Management,
Warsaw University of
Technology

Artificial intelligence is most often used in industries and functional areas where there is a lot of good-quality data, decisions are made relatively often, and the business environment is rapidly changing. Additionally, an important factor contributing to the success of such implementations is the organizational culture in the field of monitoring the business effectiveness of key processes and the tendency to experiment (in particular: risk acceptance of innovative projects).

In this context, the State of Polish AI - 2021 report results indicate that while machine learning solutions themselves are relatively mature, Polish organizations are still learning their practical business applications. AI is most often used in industries saturated with data (IT & Telco, Finance & Banking, (e) Commerce, Healthcare, Insurance); however, it is surprising that there is a relatively smaller share of industries such as media, industry, transport, and logistics or energy, which seem ideal for AI implementations. Similarly, the dominant area of broadly understood innovation and R&D, and the relatively low share of implementations in operations and sales indicate the relatively low maturity of Polish companies to use AI to improve key business processes.

To sum up, having a relatively good technological and substantive base in the AI methods and techniques, Polish companies should start developing competencies in the area of creating AI business cases. In addition to technical, it is worth developing business competencies: we lack the so-called AI Business Value Architects, both on the client's and suppliers' sides.

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In which business sectors has your organization generated revenue or applied AI in the past 18 months? Select each correct answer.

	AI companies	Corporations	Academia
IT & telco	56%	63%	65%
Finance & banking	49%	26%	20%
Commerce, incl. E-commerce	42%	16%	20%
Healthcare	32%	11%	45%
Insurance	28%	11%	15%
Science	11%	5%	75%
Media, incl. Social media	20%	21%	10%
Sports	17%	5%	25%
Education	11%	11%	40%
Energy	12%	16%	30%
Industry	20%	11%	5%
Transportation & logistics	16%	5%	25%
Public admin. & services	11%	16%	5%
Entertainment	11%	16%	5%
Security & defence	7%	11%	10%
Construction & real estate	11%	0%	5%
Arts & culture	4%	11%	0%
Environmental protection	2%	0%	10%
Agriculture, forestry, fisheries	1%	11%	5%
Tourism	2%	0%	0%

- **Many AI companies provide services for financial & banking sector (49%), insurance (28%) or commerce (42%).**

- **Scientific teams working on AI tend to be more focused on public sector. For example, 45% work in the area of healthcare and 40% in education.**

Sample: AI companies, corporations & academic teams

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What type of customers have used your AI-enabled products/services/activities in the last 18 months? Select each correct answer.

Functional area	Percentage
Customer products (not B2B)	17%
R&D	41%
IT, incl. Software development	40%
BI & data analytics	39%
Innovation	36%
Operations	25%
Sales	23%
Financial & controlling	22%
Marketing & PR	22%
Client support & complaints	20%
Production	15%
Logistics	14%
Security	14%
Engineering	11%
Procurement	10%
Human resources	9%
Accounting & taxes	4%
Project management	4%
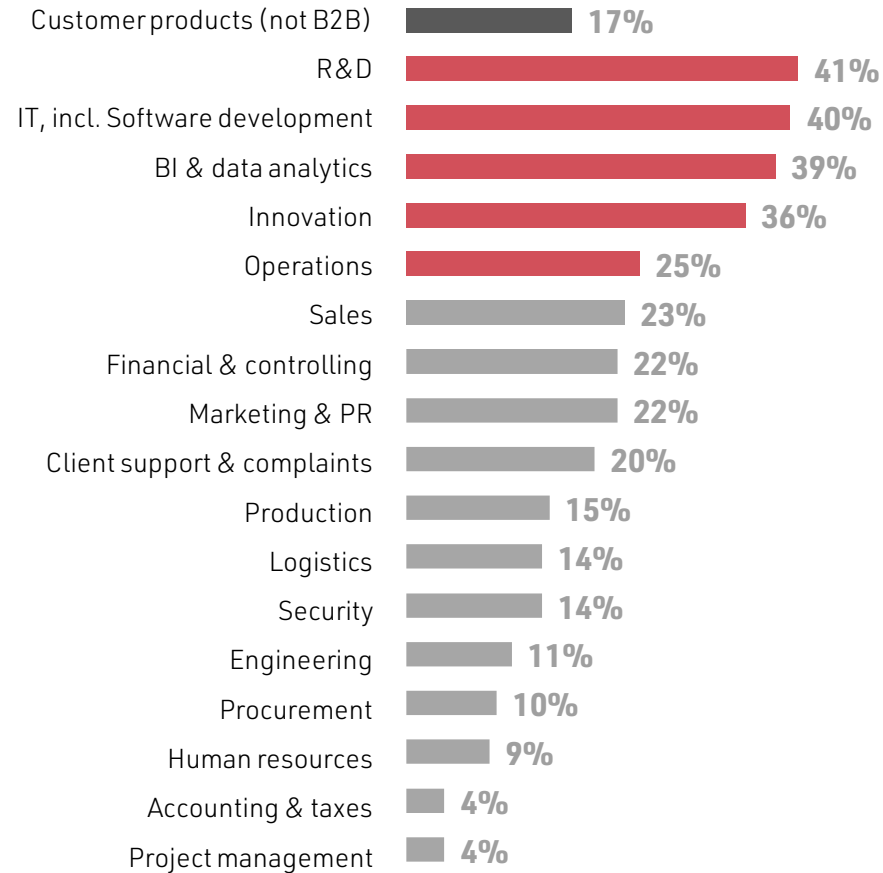
- **AI services revolve around corporate processes and needs. Only 17% of AI teams work on B2C services or products.**

- **As for B2B, services are provided usually to departments such as R&D (41%), IT and software development (40%), BI and data analytics (39%) and innovation (36%).**

- **Interestingly, few AI teams provide services to departments of production (15%) or logistics (14%).**

Sample: AI companies, corporations & academic teams

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What type of customers have used your AI-enabled products/services/activities in the last 18 months? Select each correct answer.

	AI companies	**Corporations**	**Academia**
Customer products (not B2B)	15%	33%	13%
R&D	33%	56%	61%
IT, incl. software development	40%	22%	57%
BI & data analytics	32%	50%	57%
Innovation	40%	39%	17%
Operations	26%	33%	13%
Sales	26%	22%	13%
Financial & controlling	25%	22%	13%
Marketing & PR	28%	22%	0%
Client support & complaints	25%	11%	9%
Production	19%	11%	4%
Logistics	14%	11%	17%
Security	11%	22%	22%
Engineering	8%	22%	13%
Procurement	13%	0%	4%
Human resources	6%	11%	17%
Accounting & taxes	5%	6%	0%
Project management	5%	0%	4%

- **Focus on AI will vary depending on institution.**

- **AI teams within corporations will work more often on customer products (33%), R&D (56%) or BI and data analytics (50%).**

- **Academic teams cooperate most often with R&D, IT or BI and analytics departments.**

Sample: AI companies, corporations & academic teams

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Konrad Korzeniewski,
Partner,
Enky Consulting

We have seen a steady growth of AI use-cases in areas such as big data and operations among our corporate clients. What's interesting is that in areas with potentially high ROI, such as production, logistics or procurement and HR, the AI adoption is still quite low. While deploying AI in production and logistics is connected with high initial investment costs and high risk (i.e. failures at the production line) it's interesting why in areas so susceptible to improvements, such as HR or procurement AI adoption is much lower. From our experience, in the times of COVID-19 cost-cutting, it might be that the budgets allocated to the supporting functions are not enough to enable digital transformation. Another reason for this could be that the skills and knowledge necessary to effectively deploy AI in these areas have not been established yet, as other areas have been prioritized. However, we believe that it's only a matter of time before we see increased AI adoption rates in supporting functions due to short break-even times and low risk associated with the investment.

Bartosz Górczynski
Managing Partner,
CIONET Polska

In the activities of CIONET, the topics of AI, ML, Deep Learning have been causing a dynamic debate for several years. And this means that corporations (IT users, not AI companies) are looking with hope at the application of AI algorithms in the areas the report showed. The implementation of AI by R&D and innovation departments indicates that, in fact, many companies are just experimenting with AI. On the other hand, the department of controlling or big data, has long used machine learning, such as for scoring customers or indicating the best offer to the customer. Marketing and operations, on the other hand, generate the most digital data, hence I am not surprised by the high position of these types of customers.

The gradual adoption is due, also shown by the report, to challenges with data quality, business case building and company management maturity, which is a key success factor in such projects. And this is because maturity in the areas of Data Management will grow, a topic that has undoubtedly become the No. 1 topic for 2021-2022.

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Maciej Szczepanek
Head of Automation, RPA,
Analytics, AI GDC in
Poland,
Atos

Low share of Production companies and departments as AI clients could mean that awareness of benefits which AI can bring to them is not sufficient. Therefore, AI solutions providers should have teams of strong business consultants, AI Evangelists, who not only know how to implement AI solutions, but also have beep knowledge of clients' processes and can advise on how to transform them using AI to bring the best benefits. In fact, AI Evangelists should be close to clients from all sectors, on the very early stage of every planned digital transformation. They can assess processes and make recommendations on how to improve them using AI. Many clients are positively surprised what currently existing AI solutions are capable of. The nearest future will bring even more powerful AI services, especially those available in the cloud.

Grzegorz Mrukwa
Deputy Data Science
Manager,
Netguru

Innovation, R&D, IT, incl. software development, BI & data analytics are the most popular areas of applying AI, though also the least specific. It seems that Polish companies experiment with AI a lot and work for clients with high willingness to experiment. This indicates relatively poor adoption of AI in general, still far from widespread usage for specific pain points.

What applications and domains are related to your products/services/activities performed in the last 18 months? Select each correct answer

Domain	Percentage
BI & data analytics	54%
Computer vision	54%
Data exploration	53%
Natural language processing (NLP)	47%
Big data	46%
Recommender systems	40%
Time series	31%
Signal processing	31%
Automatic planning & optimisation	29%
Fraud detection	25%
Expert systems	24%
AI tools & platfroms	19%
Optical character recognition (OCR)	19%
Speech recognition	15%
Robotics	15%
Sound processing	14%
Machine translation	13%
Virtual / augmented reality (VR/AR)	13%
Algorithms playing video games	12%
Industrial process control	9%
Artificial art	5%

- **AI is most often applied to BI & data analytics (54%), computer vision (54%) and NLP (47%). These are handbook applications of artificial intelligence.**

- **However, there are teams working on various other topics. 31% apply AI to signal processing, 29% build solutions for automatic planning & optimisation and 15% focus on robotics.**

Sample: AI companies, corporations & academic teams

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What applications and domains are related to your products/services/activities performed in the last 18 months? Select each correct answer

	AI companies	Corporations	Academia
BI & data analytics	49%	58%	70%
Computer vision	51%	63%	57%
Data exploration	44%	63%	78%
NLP	41%	74%	48%
Big data	41%	42%	65%
Recommender systems	38%	58%	35%
Time series	29%	42%	30%
Signal processing	27%	37%	39%
Autom. planning & optimisation	25%	42%	35%
Fraud detection	28%	26%	13%
Expert systems	24%	21%	30%
AI tools & platfroms	18%	26%	17%
OCR	18%	42%	4%
Speech recognition	14%	32%	4%
Robotics	14%	26%	9%
Sound processing	12%	32%	9%
Machine translation	6%	47%	13%
VR/AR	11%	11%	22%
Algorithms playing video games	5%	26%	26%
Industrial process control	9%	16%	0%
Artificial art	4%	5%	9%

- **Corporations using AI for internal purposes focus much more on language. 74% apply NLP and 42% use OCR.**

- **But the most striking thing is machine translation. Half of corporations apply AI to this area while among AI companies or in academia - few AI teams do so.**

Sample: AI companies, corporations & academic teams

aipoland   digitalpoland   IOSENSES

Piotr Lewalski,
Director of Deep Learning,
Site Leader,
Nvidia in Poland

BI & Data Analytics were among the first to adopt Machine Learning technologies (far before the current Deep Learning boom).

Computer Vision caught up quickly as this was an unsolved but essential problem in the IT world.

Yet, it's NLP that may show up as the real game-changer. It addresses domains like text analysis, through less expected like programming code generation to unbelievable ones like protein/DNA research. Those may allow computers to understand us, improve themselves, and effectively advance us respectively.

Marcin Kędzior, PhD
Data Science & Software
Development Leader @
DT IT Poland,
T-Mobile Polska

In Deutsche Telekom IT Poland, which is a part of T-Mobile Polska, every day we work to provide AI-based impactful products and systems which are tailored to fulfil the needs and requirements of our clients. Speaking of impactful products, by mentioning only some of them: NLP & sentiment analytics to provide high-level client experience, text classification applications, computer vision and recognition services where by using innovative deep learning algorithms it is possible to achieve higher and better output quality comparing with manual effort.

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Adam Gonczarek, PhD
CTO,
Alphamoon

We have recently seen that the interest of the large corporations regarding AI has mostly been focused on NLP technologies. This trend has been further accelerated by the COVID-19 pandemic since the companies realized that in the current extreme circumstances, access to human resources remains challenging. This led to the conclusion that the automation of the processes is crucial to ensure business continuity.

The interest in NLP technologies has mostly been caused by the fact that many business processes require some form of understanding of written or spoken language. Combined with the classic RPA tools, NLP provides a powerful ensemble to automate numerous processes such as client support, client's onboarding or claim processing. Additionally, there have been many recent technological advances in the area of NLP that have significantly improved accuracy. We have finally reached maturity that is necessary for many business applications

Bartosz Sokoliński
Innovation & Technology
Managing Director,
ARP

Not surprisingly, AI is most commonly used in BI and data analytics (52%), computer vision (52%) and NLP (47%). This is happening all over the world. More and more companies are also using sensor data, which requires some investment in infrastructure. It's apparent that the core application of AI is still very fragmented. I hope some applications will grow significantly soon and I'm thinking about automated planning and optimization, speech recognition, audio processing, and VR/AR.

Łukasz Kobyliński
Chief Science Officer,
Sages

It is interesting to note that NLP is the single most common AI-based application employed by corporations. The combination of high return-on-investment of NLP and the fact that many methods of processing still need to be perfected lead to a possible conclusion that this domain might be the fastest to rise on the Polish market in the next few years.

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#7. Technology & Data

Which of the following tools and products do you use?
Select each correct answer

Tool	%
Docker	56%
AWS Cloud	50%
Jupyter Lab/Notebook	48%
Google Cloud Platform	30%
Azure Cloud Platform	22%
Google AI	21%
MLFlow	20%
Google CloudML	17%
Azure Machine Learning	13%
Azure Cognitive Services	10%
Amazon SageMaker	10%
Amazon AI Services	10%
Azure Databricks	8%
Google MLKit	8%
Azure Cognitive Search	7%
Own tools	7%
Azure Bot Service	6%
DigitalOcean	6%
IBM Cloud	5%
Heroku	3%
RapidMiner	3%
IBM Watson Studio	2%
Neptune	2%
IBM Watson Products	2%

- **The toolkit of AI developers relies on Docker virtual environment (56% of AI teams use it) and Jupyter notebooks (48%).**

- **Among cloud platforms Amazon's AWS is the leader with 50% of AI teams. Platforms from competitors trail behind with 30% of developers using Google platform and 22% using Azure.**

- **Among pre-packaged AI tools Google leads with Google AI (21%) and CloudML (17%). Azure comes 2nd with 13%. Amazon ranks 3rd.**

Sample: AI companies, corporations & academic teams

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Witold Pawlus, PhD
Artificial Intelligence
Laboratory Lead,
Nokia in Poland

The popularity of Docker and Jupyter notebooks suggest that nowadays the majority of data science solutions are developed in a tailor-made approach using the Python code with a limited use of graphical drag and drop designers / machine learning automation tools.

However, as many of regular model development and maintenance tasks can be automated (e.g. model selection, scoring, deployment, etc.), IT companies offer a wide range of tools for empowering both professional and non-professional data scientists to create models rapidly (e.g. Azure Machine Learning, Amazon SageMaker, etc.). This allows, in turn, to save time on iterative tasks of model development and speed up time to market. Especially, as long as typical applications of AI are concerned (e.g. churn prediction, credit risk scoring, fraud detection etc.) which are proven to be solvable with a standard set of off-the-shelf algorithms normally offering production level performance without additional enhancements.

Although the survey shows that currently these tools are not so popular as the fully customizable Python code running in Docker / Jupyter notebook, it will be interesting to see if in the future majority of machine learning models will still be implemented hands-on in Python or if end-to-end cloud-based services helping to build and deploy models faster will take over.

In any case, the reality is that more and more model development tasks can be done through a drag and drop interface (without actually knowing any programming language) provided that a high-quality dataset with relevant features is available. So, apart from being math savvy, in order to help businesses generate tangible impact, data scientists should primarily contribute expertise on how to turn raw data into meaningful datasets leading to successful business stories.

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Jupyter Lab and notebooks have been the go-to solution for AI practitioners for years mainly due to the flexibility provided by a wide toolkit of libraries i.a. for Python and R. An added benefit is that we can run code, equations, data transformations, visualization and explanatory comments often in one notebook or a set of notebooks. And on top of that we can even mix languages for greater flexibility: querying data using SQL, build ML/AI model in python and then visualize it R.

However. historically deploying those solutions to production proved not so straightforward and often tedious. Fortunately, it's becoming easier thanks to a wider adoption of tools like Docker or newcomers like MLFlow which is not even 3 years old and already has a decent user base among Polish AI adopters. Then there are tools like Kubeflow and others that gravitate toward creating a common workspace to run those notebooks on computing clusters.

We observe an increasing demand (and supply) for tools that allow for governance of ML models and data flows. This gives rise to the MLOps discipline that aims at maintaining a common environment and effective collaboration of the data scientist, data engineers and data consumers.
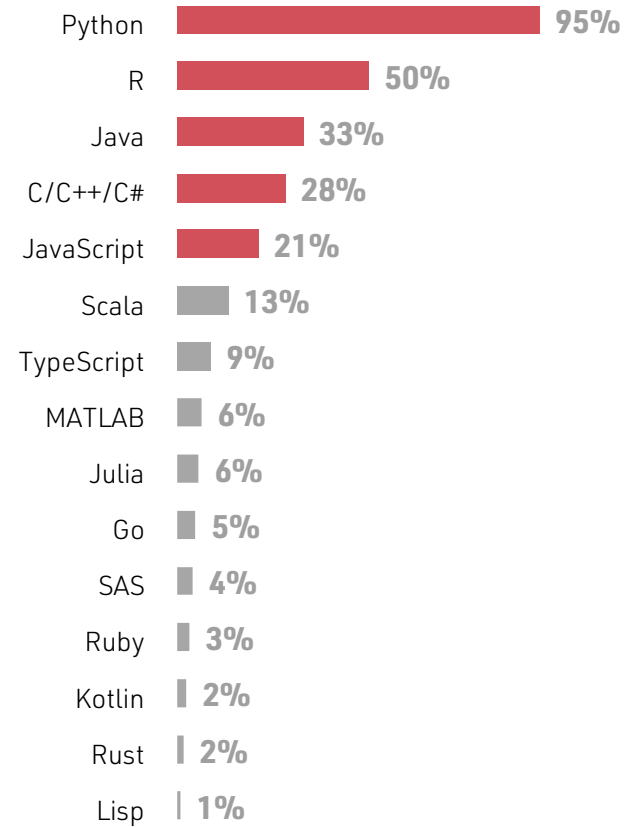
Marek Zieliński
Co-Founder, CTO,
10 Senses

What's surprising is that the Azure Cloud Platform is ranked lower than the Google Cloud Platform even though the former's estimated share of the global cloud services is considerably higher. Google's services and resources, such as Google AI and Google CloudML, also enjoy more popularity than those offered by Microsoft (Azure Cognitive Services and Azure Machine Learning) and the market leader Amazon (Amazon SageMaker and Amazon AI Services).

 Google's long-term AI strategy of investing in the development of methods, tools and communities has resulted in an increase in the number of users and the company's strengthened position as the AI market leader.

Łukasz Grzybowski
Head of Machine Learning
& Data Engineering,
STX Next

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What languages do you use in developing artificial intelligence?
Select each correct answer

Python — 95%
R — 50%
Java — 33%
C/C++/C# — 28%
JavaScript — 21%
Scala — 13%
TypeScript — 9%
MATLAB — 6%
Julia — 6%
Go — 5%
SAS — 4%
Ruby — 3%
Kotlin — 2%
Rust — 2%
Lisp — 1%

- **Python is the dominant language when it comes to developing AI – 95% of companies use it. R comes second with 50%.**

- **Other languages are also used, e.g. for building frontend, backend or embedding services on devices. As such, Java is used by 33% of companies, C/C++/C# by 28% and JavaScript by 21%.**

- **Low usage of Swift and Kotlin suggests that AI is still not often embedded in smartphones.**

Sample: AI companies, corporations & academic teams

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- **Looking onto Linkedin profiles, there seems to be not much of a difference between a Polish AI specialist and an EU-average.**

- **However, a significantly smaller share of specialists in Poland declare skills in MATLAB or LaTeX.**

Skillset owned by AI specialists (self-declared in Linkedin profile)

	Poland	EU
Python	46%	52%
Java	42%	48%
C++	38%	44%
SQL	51%	41%
MATLAB	18%	37%
CSS	27%	30%
Java Script	26%	28%
LaTeX	12%	24%
R	20%	22%
HTML	15%	21%
MySQL	16%	19%
C#	19%	18%
PHP	13%	17%
XML	11%	12%
NoSQL	8%	9%

■ **Poland** ■ **EU**

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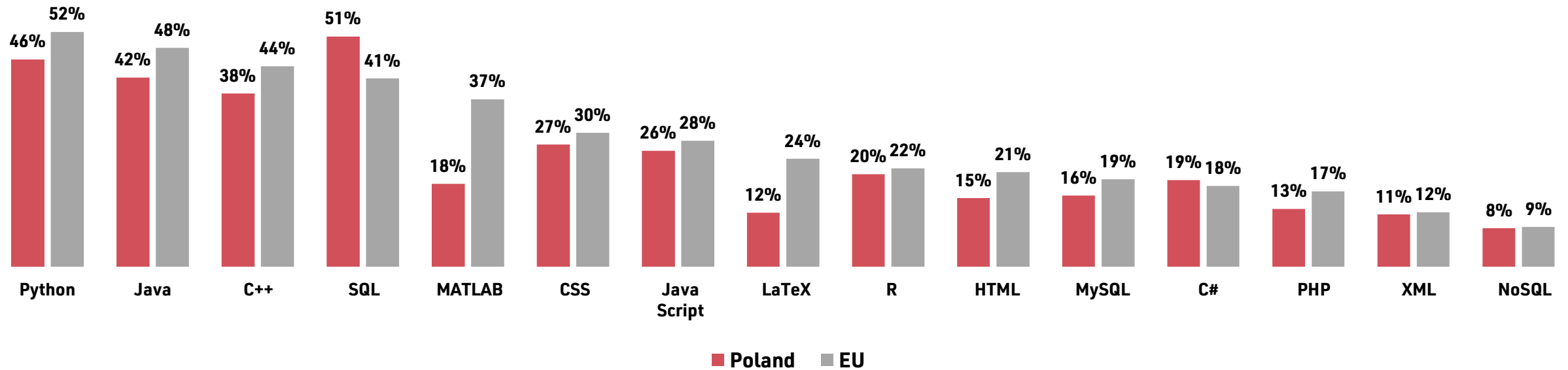
What frameworks/libraries do you use for artificial intelligence?
Select each correct answer

2019

Framework	%
TensorFlow	69%
Keras	49%
Sci-kit learn	45%
PyTorch / Torch	38%
Caffe / Caffe2	19%
DMTK/CNTK	17%
TensroFlow.js	15%
Theano	11%
Deeplearning4j	9%
Apache Mahout	6%
SystemML	6%
Mxnet	3%
BigDL	3%
DyNet	1%
Chainer	1%

2021

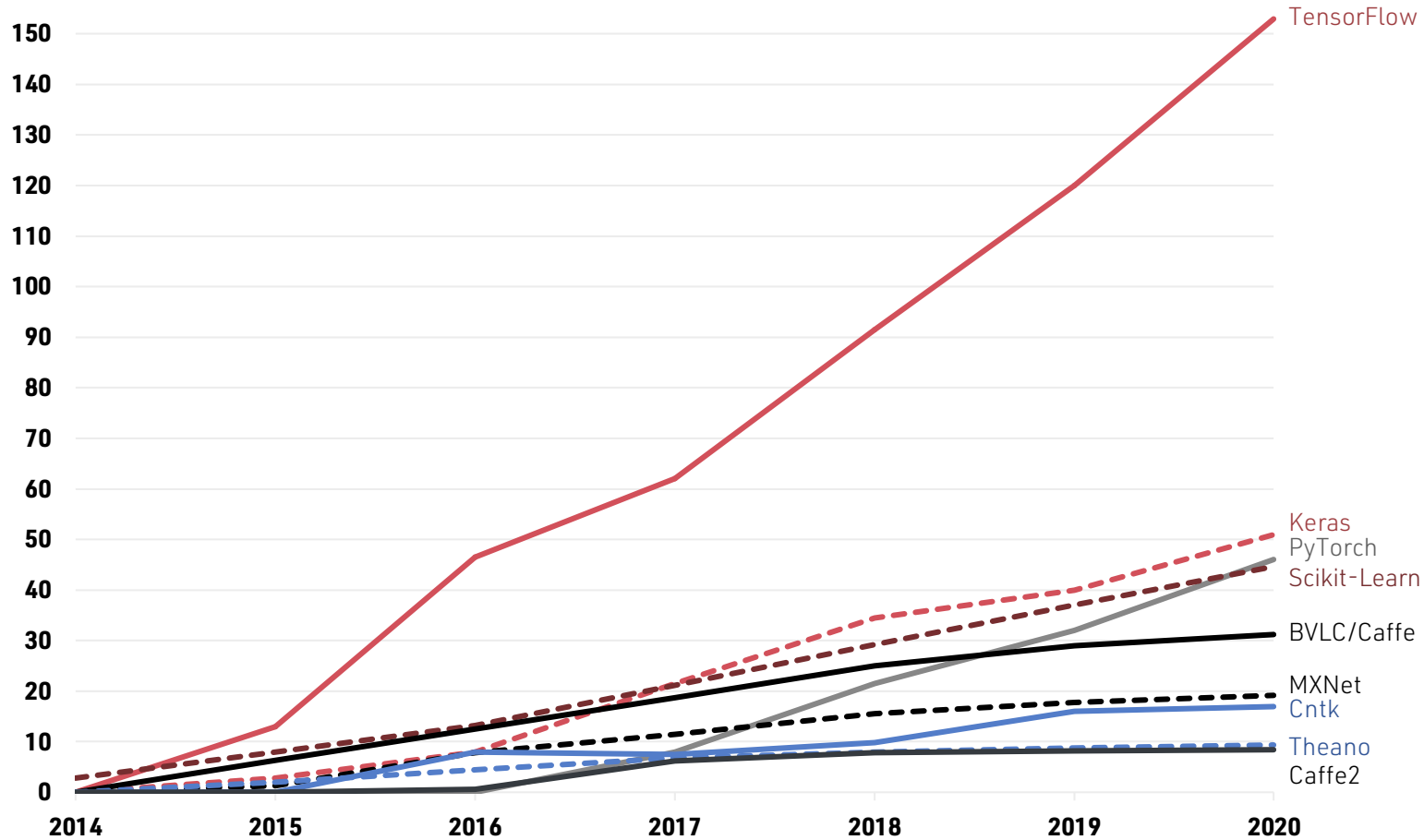| Framework	%
TensorFlow	76%
PyTorch/ Torch	62%
Keras	55%
Sci-kit learn	48%
Own frameworks	42%
Apache Spark	24%
TensorFlow.js	21%
Apache Hadoop	17%
Caffe / Caffe2	16%
DMTK/CNTK/Cognitive Toolkit	11%
Theano	9%
Deeplearning4j	6%
Mxnet	6%
Apache Mahout	4%
Dask	4%
SystemML	4%
SpaCy	2%
BigDL	1%

- **TensorFlow is still the most popular framework.**
- **Compared with the 2019 edition of the report, PyTorch gained in popularity closing some gap to Tensorflow and overcoming Keras.**
- **Importantly, 42% of AI teams declare using their own libraries or frameworks.**

Sample: AI companies, corporations & academic teams

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Number of GitHub stars (in thousand)

- **GitHub users can use stars to mark projects they find valuable or which they are interested in. For this reasons stars can be used as a measure of popularity of different AI frameworks.**

- **The results show that TensorFlow is the main framework currently used.**

- **Among other frameworks PyTorch has gained popularity in the recent years.**

Source: GitHub (2020), in: Daniel Zhang, Saurabh Mishra, Erik Brynjolfsson, John Etchemendy, Deep Ganguli, Barbara Grosz, Terah Lyons, James Manyika, Juan Carlos Niebles, Michael Sellitto, Yoav Shoham, Jack Clark, and Raymond Perrault, "The AI Index 2021 Annual Report," AI Index Steering Committee, Human-Centered AI Institute, Stanford University, Stanford, CA, March 2021.

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Marek Cygan
CTO, Nomagic
Associate Professor,
University of Warsaw

It is quite clear that Pytorch is on its way to replace Tensorflow as the most popular framework, which in fact has already happened on the academic side. It will be interesting to see what the main alternative to Pytorch will be in the future, some people believe it will be JAX, which is becoming popular in projects from Deepmind and Google Brain.

Jacek Kawalec
Partner,
VoiceLab

Among cloud platforms Amazon's AWS is the leader with 56% of companies . Platforms from competitors trail behind with 31% of companies using the Google platform and 23% using Azure. This information concerns inference (application) but not training facilities which typically require larger number of hardware accelerators which are prohibitively expensive in the cloud. Also clients do not always want to process data in the public cloud. Importantly, 45% of companies declare to be using their own frameworks. There are NO frameworks which one can compare to TensorFlow or PyTorch. This is a misunderstanding of the word frameworks, so I understand that the real answers is libraries.

Rafał Korycki, PhD
Chief AI Development
Specialist, Data Analysis
Chapter Lead @ Innovation
Tribe,
T-Mobile Polska

The value of innovative products built in T-Mobile Polska comes from the application of mature AI frameworks selected from the market, and from the creation of own solutions based on agile experimentation. This approach has its confirmation in the survey and proves why AI developers still rely on Jupyter notebooks and use Python and R as tools for accessing appropriate libraries. Today's innovations grow on insights stemming from processing a large amount of structured and unstructured data. This is reflected in the survey by the soaring share of tools such as Hadoop and Spark. Moreover, it's vital to merge data from different sources: own, publicly available, and taken from external partners. By turning experiments into value, T-Mobile Polska continuously tests the applicability of solutions in various areas, such as geospatial data analytics, chatbots, and text classification. This is unsurprisingly confirmed by the growing popularity of PyTorch, fuelled by its application to deep learning and natural language processing. Finally, our goal is to build products with the highest quality for clients , and additional input given by AI solutions.

Łukasz Grzybowski
Head of Machine Learning
& Data Engineering,
STX Next

Tensorflow is still the leader in the category of most commonly used AI frameworks. It needs to be said that Google does a great job of developing this tool, building a user community, publishing additional documents, and making smart business moves.

Keras, one of the most preferred alternative tools, became an essential part of the Tensorflow 2.0 environment and, consequently, stopped supporting rival libraries such as Theano and CNTK. As a result, the number of Tensorflow users increased, and plenty of improvements and features were introduced.

Paweł Gora, PhD Candidate
Founder & CEO,
Quantum AI Foundation

TensorFlow still seems to be the most popular machine learning framework, but PyTorch is gaining in popularity. Since moving code from one framework to another is costly, it is likely that companies using these most popular libraries will also be using them in the near future. However, it is worth observing what tools are chosen by new companies and in new projects. Despite the fact that the most popular frameworks are still in active development and we can expect new versions of them in the future, it is worth monitoring new libraries such as Jax or libraries for quantum-enhanced machine learning. It can also be interesting to analyse trends for specialized NLP libraries (like HuggingFace) or reinforcement learning libraries (like RLlib or stable baselines). A relatively large percentage of companies using their own frameworks gives hope that in the future we will be able to observe the growing popularity of machine learning tools made in Poland.

Mikołaj Koziarkiewicz
Machine Learning Engineer,
SoftwareMill

The results for 2021 starkly demonstrate that, with the maturation of the current professional AI development space, the market focus shifts from low-hanging fruit (in terms of complexity) into specialized, advanced use cases. This explains the high share of the "own libraries and frameworks" category - for many research and business problems, it becomes a necessity to develop custom components for one's Machine Learning pipeline. As a corollary, it is now crucial to have a well-rounded AI team, composed of people with knowledge both of the AI domain and of software engineering - something we realized early on, and take full advantage of, at SoftwareMill.
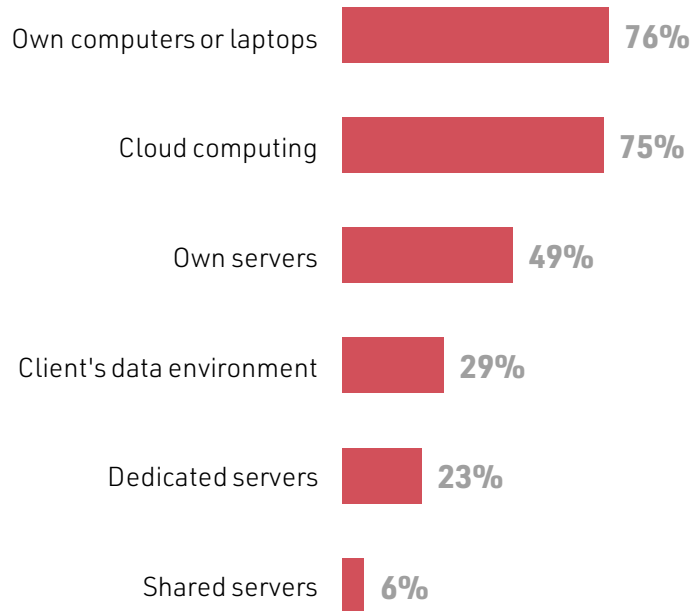
Marcin Kędzior, PhD
Data Science & Software
Development Leader @
DT IT Poland,
T-Mobile Polska

Our Data Scientists rely mainly on Jupyter Notebooks and Docker as solutions for development and deployment of produced software. Python and Scikit-learn are being used as a main programming languages and their libraries – provide both desired and satisfying functionalities and features needed when speaking about robust AI product development. Moreover, it is observable that PyTorch is getting higher utilization of usage nowadays as a main platform for Machine and Deep Learning applications.
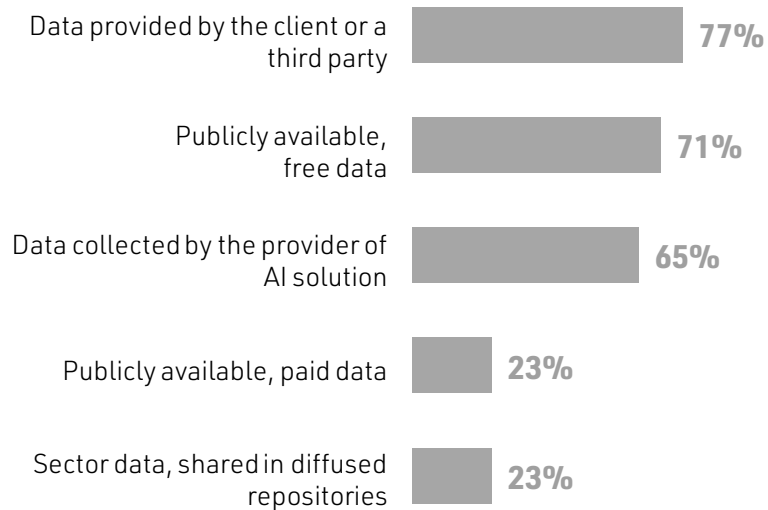
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Which type of computing power do you use in product/service development, research, or to deliver AI services? Select each correct answer
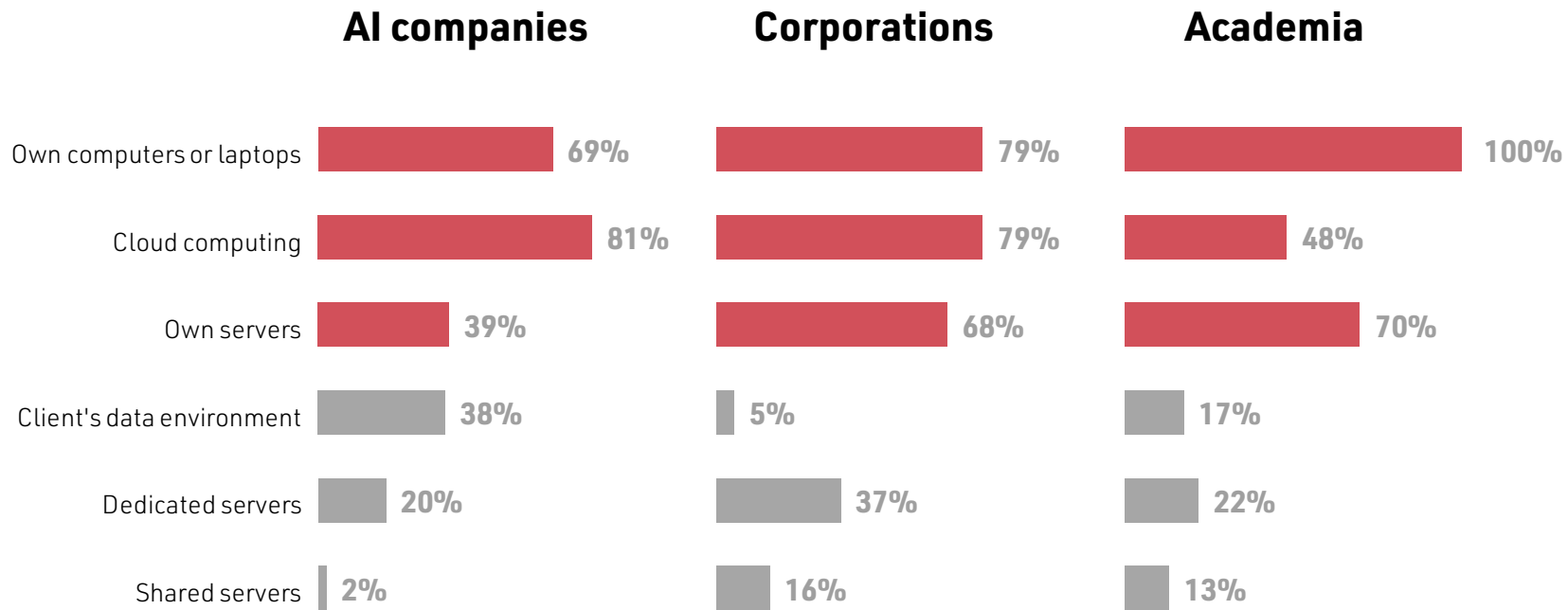
Which data type do you use in product/service development, research, or to provide services? Select each correct answer

Computing power

Own computers or laptops	76%
Cloud computing	75%
Own servers	49%
Client's data environment	29%
Dedicated servers	23%
Shared servers	6%

Data sources

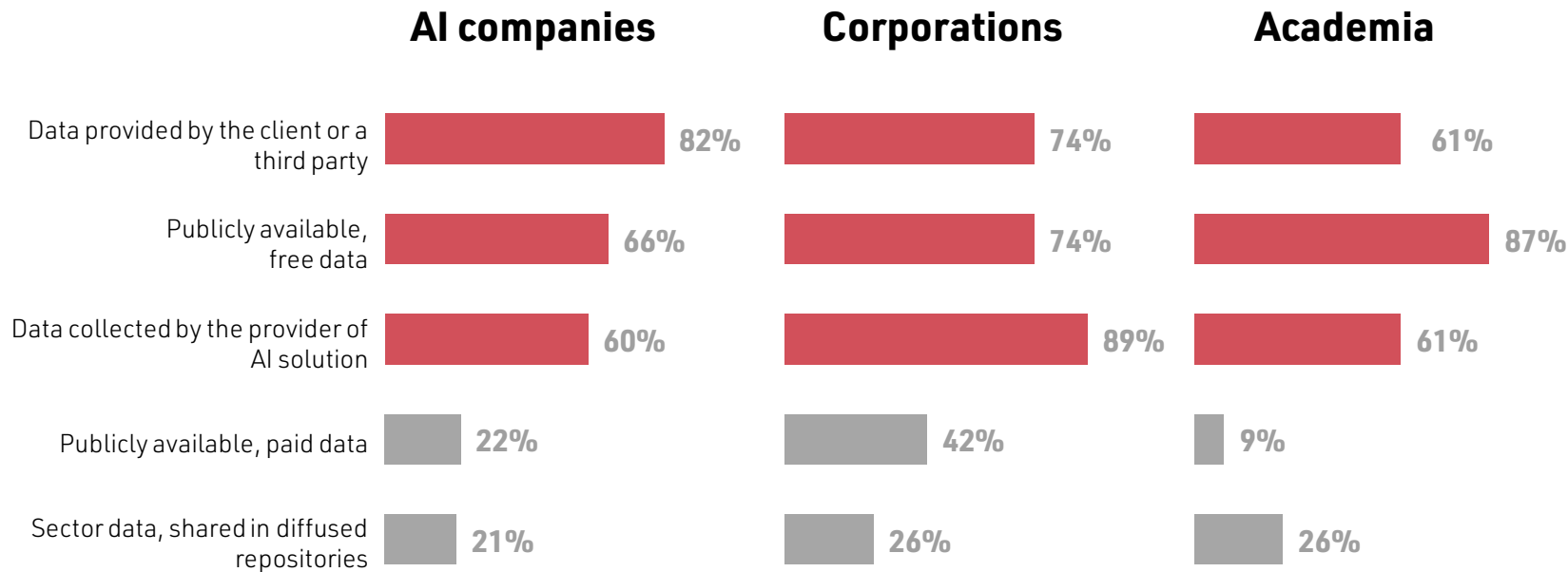|	
Data provided by the client or a third party	77%
Publicly available, free data	71%
Data collected by the provider of AI solution	65%
Publicly available, paid data	23%
Sector data, shared in diffused repositories	23%

- **When it comes to computing power, AI teams rely mostly on own computers or laptops (76%) and cloud computing (75%).**

- **Only 29% use the client's data environment. This suggests that clients are not that reluctant to share data to be used in AI providers' infrastructure.**

- **As for data sources, usually it is the client's data, publicly available data or data collected by the provider of AI solution.**

- **Paying for data is still not common (23%), which suggests that either they are unwilling to do so or the usefulness of paid data is low.**

Sample: AI companies, corporations & academic teams

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Which type of computing power do you use in product/service development, research, or to offer them? Select each correct answer

AI companies

Own computers or laptops	69%
Cloud computing	81%
Own servers	39%
Client's data environment	38%
Dedicated servers	20%
Shared servers	2%

Corporations

Own computers or laptops	79%
Cloud computing	79%
Own servers	68%
Client's data environment	5%
Dedicated servers	37%
Shared servers	16%

Academia

Own computers or laptops	100%
Cloud computing	48%
Own servers	70%
Client's data environment	17%
Dedicated servers	22%
Shared servers	13%

- **AI companies use own servers less often. It stems from the fact that many of these companies are still small, they don't have the infrastructure and rely on the cloud.**

- **Specialists in the scientific sector rely, to a larger extent, on own computers and relatively less on computing power available in the cloud. 48% of specialists in the academia use the cloud - as compared to 79% and 81% of AI companies and corporations respectively.**

Sample: AI companies, corporations & academic teams

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Which data type do you use in product/service development, research, or to provide services? Select each correct answer

	AI companies	Corporations	Academia
Data provided by the client or a third party	82%	74%	61%
Publicly available, free data	66%	74%	87%
Data collected by the provider of AI solution	60%	89%	61%
Publicly available, paid data	22%	42%	9%
Sector data, shared in diffused repositories	21%	26%	26%

- **Scientific communities tend to use publicly available data. They have a significantly lower access to data provided by clients or a third party. They also rarely pay for data.**

- **Corporations tend to purchase data more often (42% do so). This may reflect higher budgets for AI solution available internally.**

Sample: AI companies, corporations & academic teams

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Jacek Kawalec
Partner,
VoiceLab

Still not many companies pay for data (25%), which suggests that either they are unwilling to do so or the usefulness of paid data is low.

The only reason for that is the PRICE. It is prohibitively expensive to have data manually processed – labelled for the purposes of machine learning. Also big annotations platforms are required.

Grzegorz Mrukwa
Deputy Data Science
Manager,
Netguru

82% declare computing in the cloud, which is similar to our experience at Netguru, as with the varying demand of computational power over time, this is a cost-effective solution for most cases that we deal with. 79% of companies use data provided by the client or a third party, indicating that these companies understand that the data is really domain-specific and a generic dataset is not always an option.

Tomasz Klekowski
Digital Transformation,
Advisor

Efficiency and impact of AI clearly depends on data availability and quality. The report indicates a very early stage of data ecosystem development. Publicly available, free data usage as the second most important source of data, equal to AI providers' use of their own data, shows low maturity and sophistication of AI business models and applications. AI ecosystem obviously needs more data. The data are broadly generated but they are either not useful or accessible, due to technical and regulatory issues. There are 2 main efforts which need to be undertaken parallelly to address these problems: development of data governance practices in multi-stakeholder environments, and further development of data culture in companies. Polish AI ecosystem players should engage in international initiatives like Gaia-X, learn from the experience of ODI, join vertical initiatives like Data Room Mobility or launch local data trusts, to name a few. Efficient participation in multi-stakeholder projects is primarily an organizational challenge which requires skills other than technical competence. These skills are often undervalued or missing in the current AI ecosystem, which puts at risk full participation of Polish companies and Polish economy in Data Driven Economy. Having said that, I believe there is a light in the tunnel. A proper definition of Digital Innovation Hubs agenda may be a good starting point in the journey to a stronger data ecosystem.
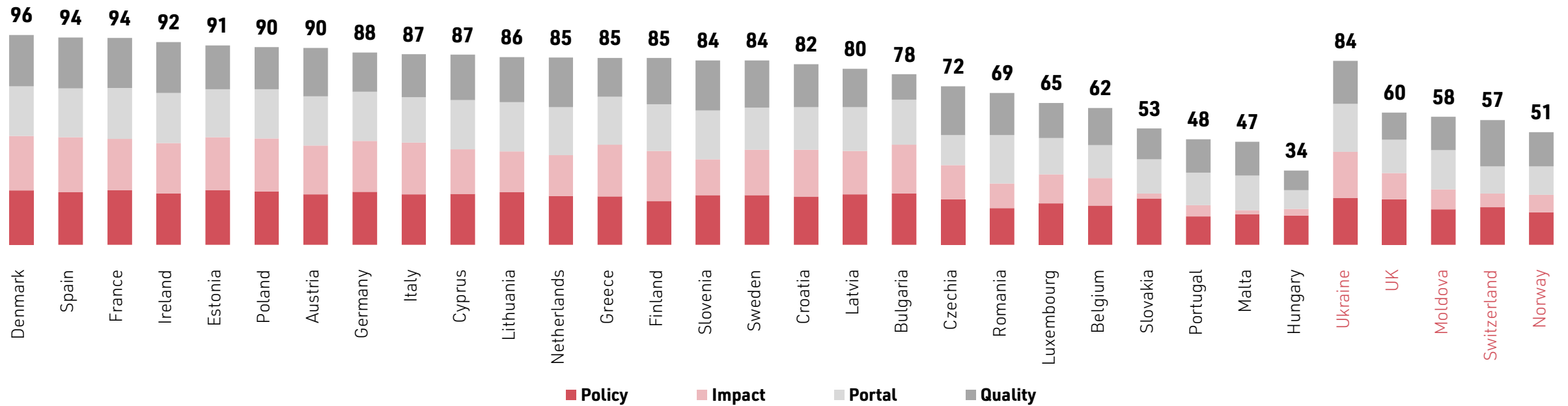
Marcin Kędzior, PhD
Data Science & Software
Development Leader @
DT IT Poland,
T-Mobile Polska

Each of the products that we develop at T-Mobile requires large datasets, both structured and unstructured, which have to be processed before feeding any AI and ML models. To train, tune and test AI & ML models we have to provide reliable data.. In our situation data comes from many different sources – for majority of cases our internal data sometimes combined with data provided by the client or free & publicly available data are used.

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- **There is a general focus on increasing the availability of data. The Open Data Maturity Index allows for comparison of open data initiatives in European countries.**

- **The leaders are Denmark (96%), Spain and France (both: 94%). Poland scores 90% and ranks 6th among EU countries. This makes Poland a trend-setter. Open data doesn't necessarily mean properly annotated data. This should be underlined, since many countries think that by opening raw data, they would support the developing of AI.**

Open Data Maturity Index [%]

Country	Value
Denmark	96
Spain	94
France	94
Ireland	92
Estonia	91
Poland	90
Austria	90
Germany	88
Italy	87
Cyprus	87
Lithuania	86
Netherlands	85
Greece	85
Finland	85
Slovenia	84
Sweden	84
Croatia	82
Latvia	80
Bulgaria	78
Czechia	72
Romania	69
Luxembourg	65
Belgium	62
Slovakia	53
Portugal	48
Malta	47
Hungary	34
Ukraine	84
UK	60
Moldova	58
Switzerland	57
Norway	51

■ **Policy** ■ **Impact** ■ **Portal** ■ **Quality**

Jan J. Zygmuntowski, PhD
Fellow,
Koźmiński University

At the moment the Polish AI ecosystem relies, to a large extent, on data provided by clients themselves, so no wonder that the scope usually covers automatization of processes and optimisations. However, the most valuable databases are strictly personal (i.a. healthcare, mobility, financial) or confidential due to property rights (industrial), so the possibilities of providing products and services based on them is currently limited. The State of Polish AI survey shows just 22% of data sources come from shared repositories. This is the crucial space for improvement and the public sector plays a leading role here in providing digital infrastructure for trusted exchange. Poland needs to start piloting data co-ops and data commons to unlock the value of data now hidden in the private silos. Countries that move in this direction faster will shape the EU's broader data governance framework and enjoy much more vibrant AI ecosystems.
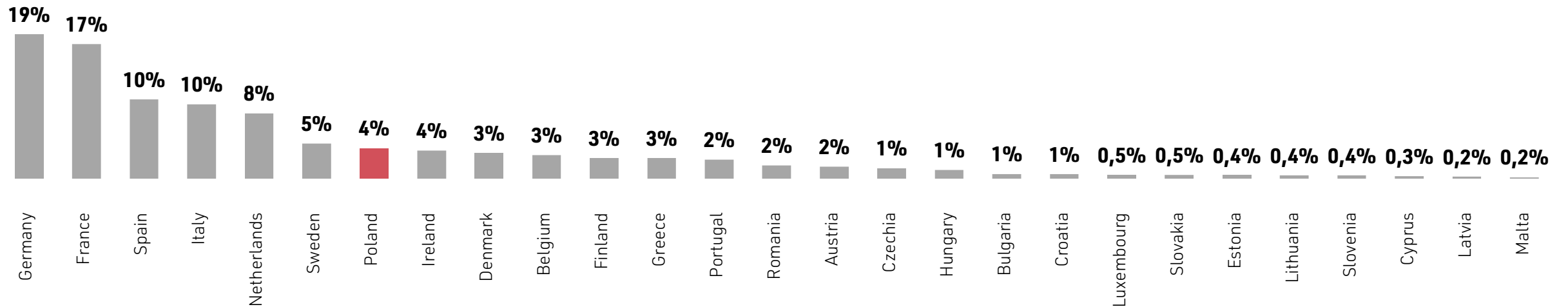
#8. Human Capital

- **Germany and France have the most AI specialists. Together, they have over a third of all specialists working in the EU.**

- **Poland comes 7th with a 4% AI talent pool share and at the same time ranks 1st place in the entire CEE region.**
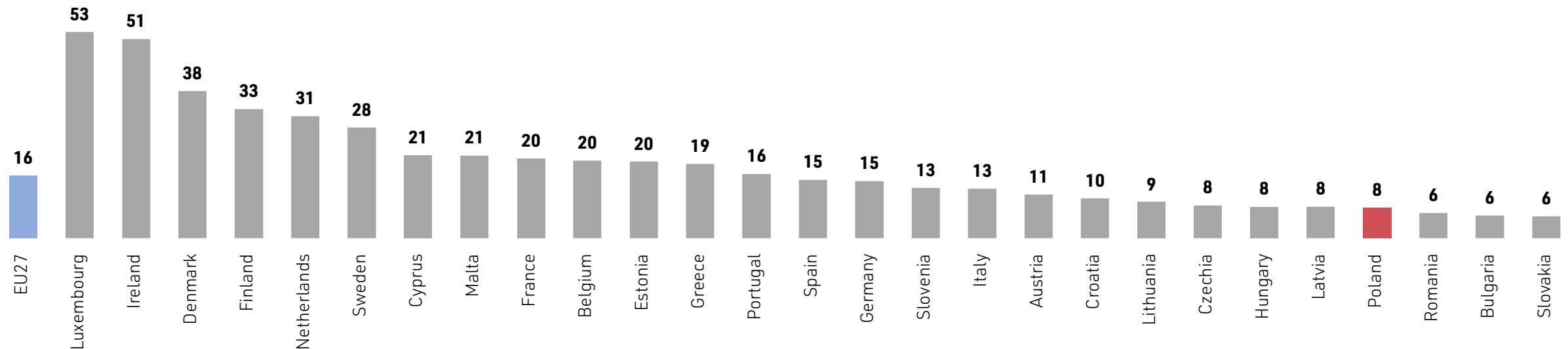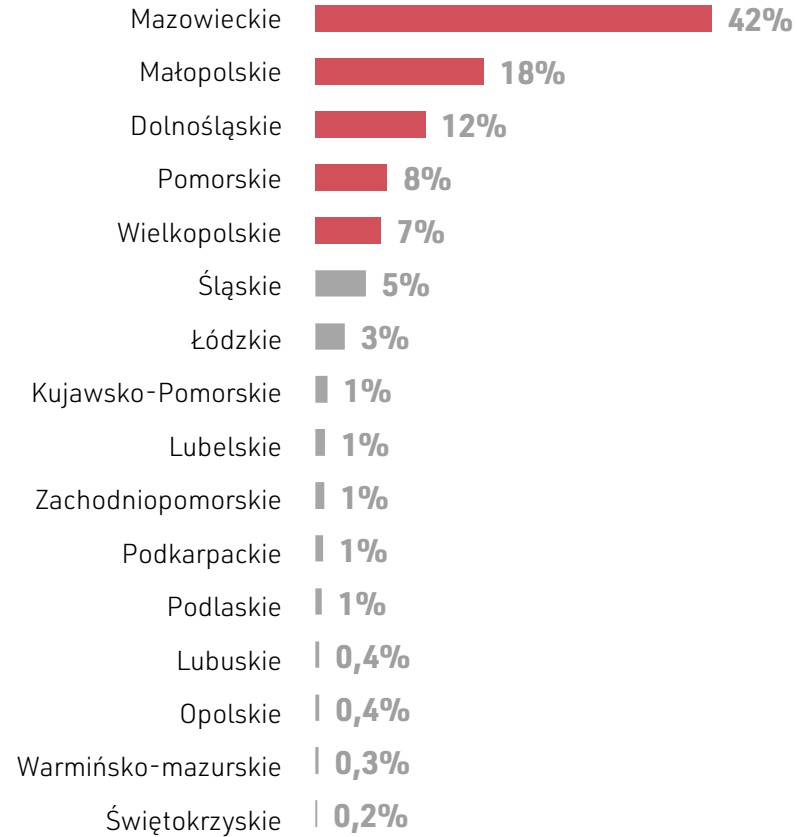
AI specialists – by country in the EU

Germany	France	Spain	Italy	Netherlands	Sweden	Poland	Ireland	Denmark	Belgium	Finland	Greece	Portugal	Romania	Austria	Czechia	Hungary	Bulgaria	Croatia	Luxembourg	Slovakia	Estonia	Lithuania	Slovenia	Cyprus	Latvia	Malta
19%	17%	10%	10%	8%	5%	4%	4%	3%	3%	3%	3%	2%	2%	2%	1%	1%	1%	1%	0,5%	0,5%	0,4%	0,4%	0,4%	0,3%	0,2%	0,2%

- **Countries with the highest rate of AI specialists in the workforce are Luxembourg and Ireland. Both these countries have over 50 AI specialists per 10 000 economically active people in the population.**

- **Poland with 8 AI specialists per 10 000 workers fares pretty poorly compared to other EU countries. However, comparable countries such as Czechia, Hungary or Slovakia have a similar outcome. Poland has 40% AI intensity of Estonia, the digital leader of CEE region.**
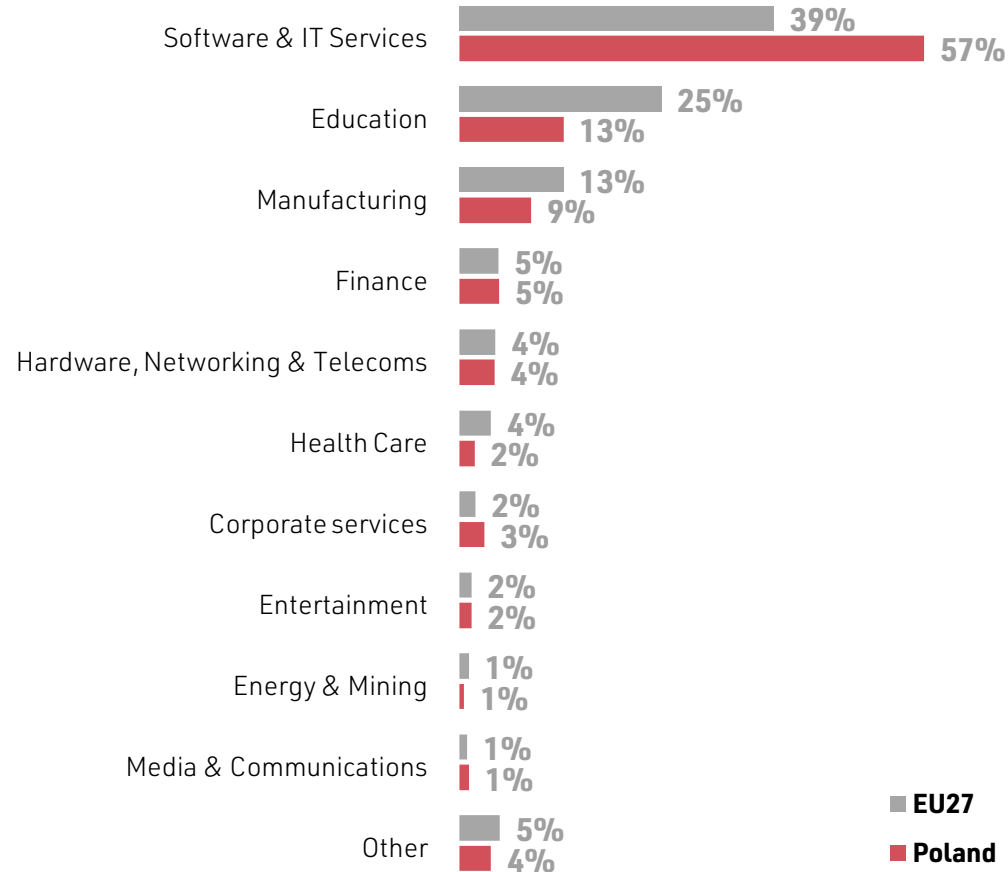
AI specialists – per 10 000 active population

Country	Value
EU27	16
Luxembourg	53
Ireland	51
Denmark	38
Finland	33
Netherlands	31
Sweden	28
Cyprus	21
Malta	21
France	20
Belgium	20
Estonia	20
Greece	19
Portugal	16
Spain	15
Germany	15
Slovenia	13
Italy	13
Austria	11
Croatia	10
Lithuania	9
Czechia	8
Hungary	8
Latvia	8
Poland	8
Romania	6
Bulgaria	6
Slovakia	6

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AI specialists in Poland – by region

Region	Percentage
Mazowieckie	42%
Małopolskie	18%
Dolnośląskie	12%
Pomorskie	8%
Wielkopolskie	7%
Śląskie	5%
Łódzkie	3%
Kujawsko-Pomorskie	1%
Lubelskie	1%
Zachodniopomorskie	1%
Podkarpackie	1%
Podlaskie	1%
Lubuskie	0,4%
Opolskie	0,4%
Warmińsko-mazurskie	0,3%
Świętokrzyskie	0,2%

- **The regions with the highest number of AI specialists are the ones with large aglomerations.**

- **Nearly a half of AI specialists in Poland live in the Mazowieckie region (capital of the region is Warsaw).**

- **Other regions are Małopolskie (Kraków), Dolnośląskie (Wrocław), Pomorskie (Gdańsk, Gdynia, Sopot), Wielkopolskie (Poznań).**

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AI specialists – distribution by economy sector

Sector	EU27	Poland
Software & IT Services	39%	57%
Education	25%	13%
Manufacturing	13%	9%
Finance	5%	5%
Hardware, Networking & Telecoms	4%	4%
Health Care	4%	2%
Corporate services	2%	3%
Entertainment	2%	2%
Energy & Mining	1%	1%
Media & Communications	1%	1%
Other	5%	4%

■ **EU27**
■ **Poland**

- **In Poland, software houses play a much bigger role in the IT ecosystem. This translates into distribution of AI specialists across the economy.**

- **57% of Polish AI specialists work in software and IT services while in the EU it is only 39%.**

- **On the other hand, only 13% of AI specialists in Poland work in education while in the EU this number is twice higher - at 25%.**

Source: LinkedIn Research, Fall 2019, Artificial intelligence in Poland - competences of AI experts, Digital Poland Foundation

Ⓜ aipoland   digitalpoland   IDSENSES

How many people does your company employ?

What is the size of your AI team?

Number of employees*
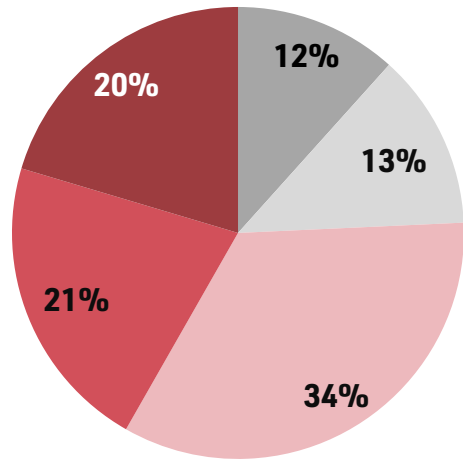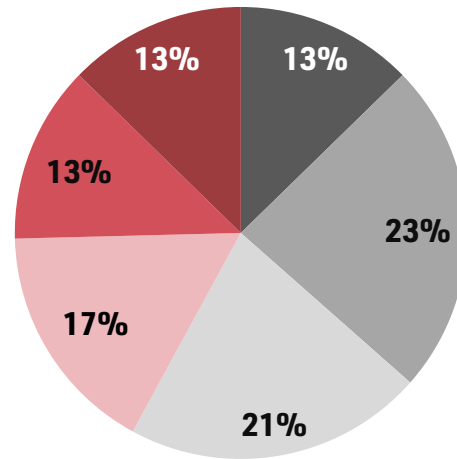
- 1-5 employees
- 6-10 employees
- 11-50 employees
- 51-250 employees
- Over 250 employees

Number of AI specialists**

- 1-2 AI specialists
- 3-5 AI specialists
- 6-10 AI specialists
- 11-20 AI specialists
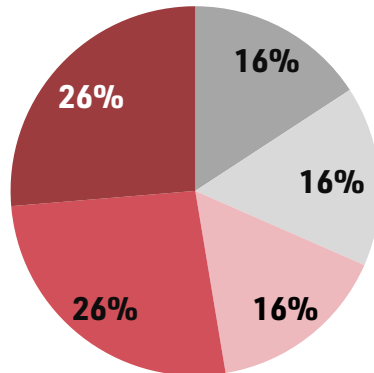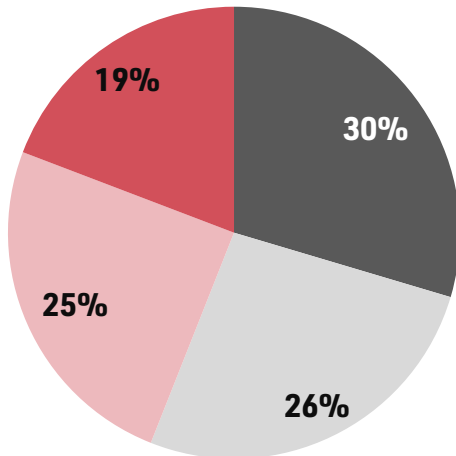- 21-40 AI specialists
- Over 40 AI specialists

- **Companies dealing with AI differ in size. However, most have up to 50 employees.**

- **The size of AI teams varies too (in either companies, corpora-tions or academia). Many teams are of considerable size. 13% employ over 40 AI specialists. In total, 43% have over 10 people dealing with AI on board.**

Sample: *only AI companies & corporations | excluding academic teams | **AI companies, corporations & academic teams

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What is the size of your AI team?

AI companies
Corporations
Academia
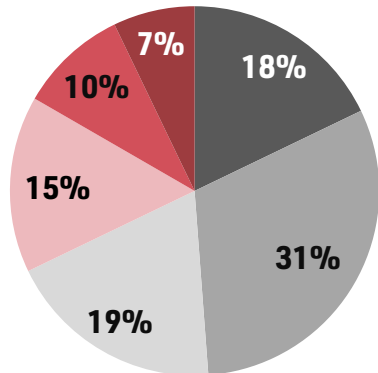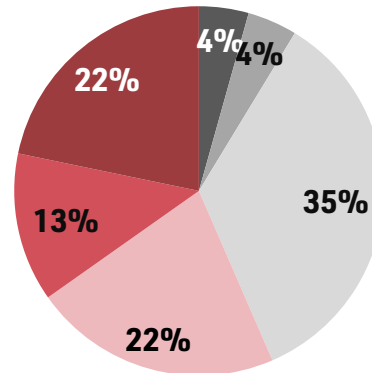
AI companies pie chart:
- 18%
- 31%
- 19%
- 15%
- 10%
- 7%

Corporations pie chart:
- 16%
- 16%
- 16%
- 26%
- 26%

Academia pie chart:
- 4%
- 4%
- 35%
- 22%
- 13%
- 22%

Legend:
- ■ 1-2 AI specialists
- ■ 3-5 AI specialists
- ■ 6-10 AI specialists
- ■ 11-20 AI specialists
- ■ 21-40 AI specialists
- ■ Over 40 AI specialists

- **Definitely corporations have the largest AI teams in the Polish ecosystem. They simply can afford it. Half of them have built a team of over 20 people.**

- **Even academic teams tend to be larger than those in AI companies.**

- **This shows that many AI teams in startups are still relatively small and that large corporations play a very important role in the ecosystem by building teams and training specialists along the way.**

Sample: AI companies, corporations & academic teams

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What is the proportion of women on your AI team?

How many people in your AI team have a scientific degree (PhD)?

Share of women*

- 30%
- 26%
- 25%
- 19%

■ None
■ Up to 10% women in the AI team
■ 10%-30% women in the AI team
■ Over 30% women in the AI team

Number of PhDs**

- 43%
- 27%
- 20%
- 10%
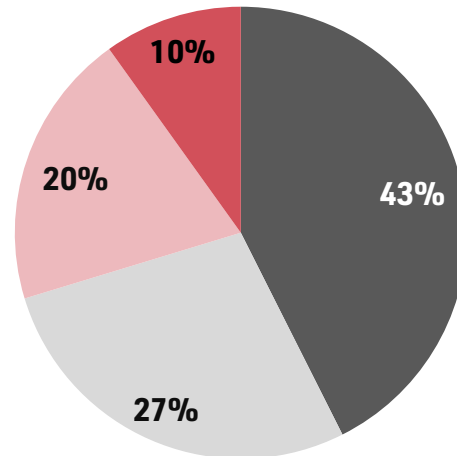
■ None
■ 1-2 PhDs in the AI team
■ 3-5 PhDs in the AI team
■ 6 or more PhDs in the AI team

- **Women are strongly under-represented in AI teams. A third of companies have an all-male team. Only one in five companies has more than 30% of women in their AI team.**

- **Over a half of companies or corporations have at least one PhD in the AI team.**

- **10% have a strong scientific background with at least 6 PhDs.**

Sample: *AI companies, corporations & academic teams | **only AI companies & corporations | excluding academic teams

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- **Women are a minority among AI specialists. On the EU level they constitute 17% of people working in the domain. In some countries, sucha as Latvia, Finland or Italy, this share is higher, within the 25%-30% range.**

- **Poland has a very low share of women in the AI workforce. Only 13% of AI specialists are female.**

Share of women among AI specialists
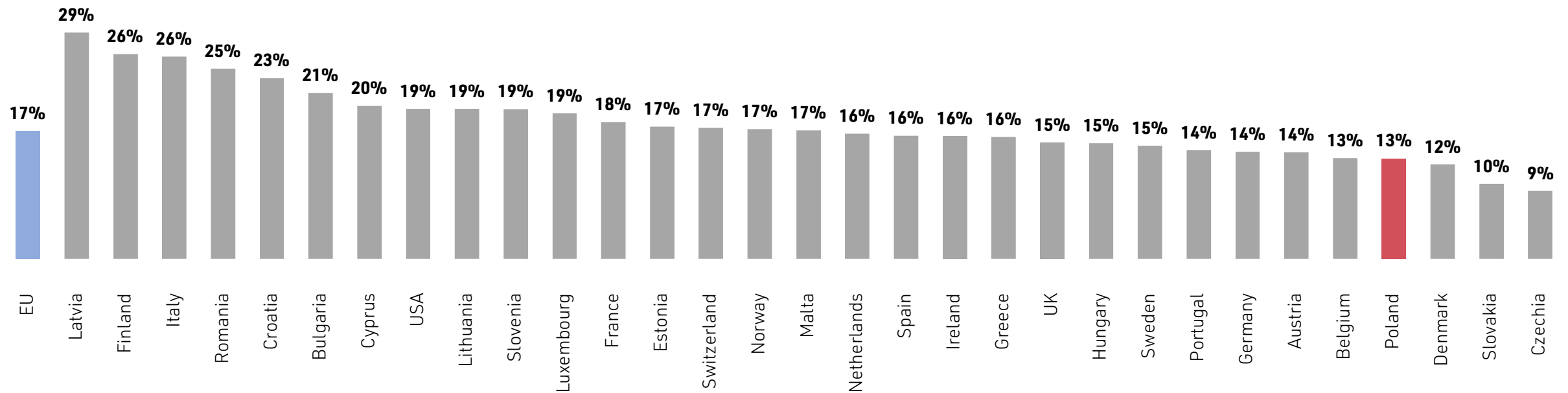
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Dorota Pietrzak
Business Strategy
Consultant,
Accenture

It is worth mentioning that according to the Digital Foundation report: "Artificial intelligence in Poland - competences of AI experts", based on LinkedIn data (link) unfortunately, only 13% of AI specialists in Poland were women and in the European Union the share of women among AI professionals was slightly higher - 17%.

Women's participation in AI can be viewed from different angles. The impact and range of artificial intelligence in subsequent industries will increase and deepen, therefore, the small share of women in this area will also result in a lower share of women in other sectors of the economy in the future, so it is crucial to reinforce changes aiming at increasing women's participation.

Moreover, the development of AI solutions is currently carried out in less diversified teams, which may limit their innovativeness and the ability to consider various groups of recipients. Assuring diversity of such teams helps prevent incorporating biases in AI solutions (such as algorithmic bias).

Additionally, not using the overall pool of available talent simply represents a missed opportunity for faster development in a field in which there is a very strong demand for professionals.

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Kinga Stanisławska
Managing Partner,
Co-Founder, Experior VC
Founder, European Women
in VC

The low percentage of women in AI results in algorithms having an in-built gender bias, as AI tools reflect the biases of those who build it. We must, therefore, bridge the gap by involving more women, in the design and deployment of AI tools. The creators of AI tools should resemble the society they are trying to transform. If AI is based on data sourced predominantly from men and/or based on male profiles, the result is not only discrimination, it is also detrimental to the very livelihood of women in a society – think med-tech as an example. Moreover, a greater gender diversity must also be present in board rooms, where decisions are made! The number of women holding board seats in the sector is still a low single digit percentage and thus must be measured, communicated and prioritized!
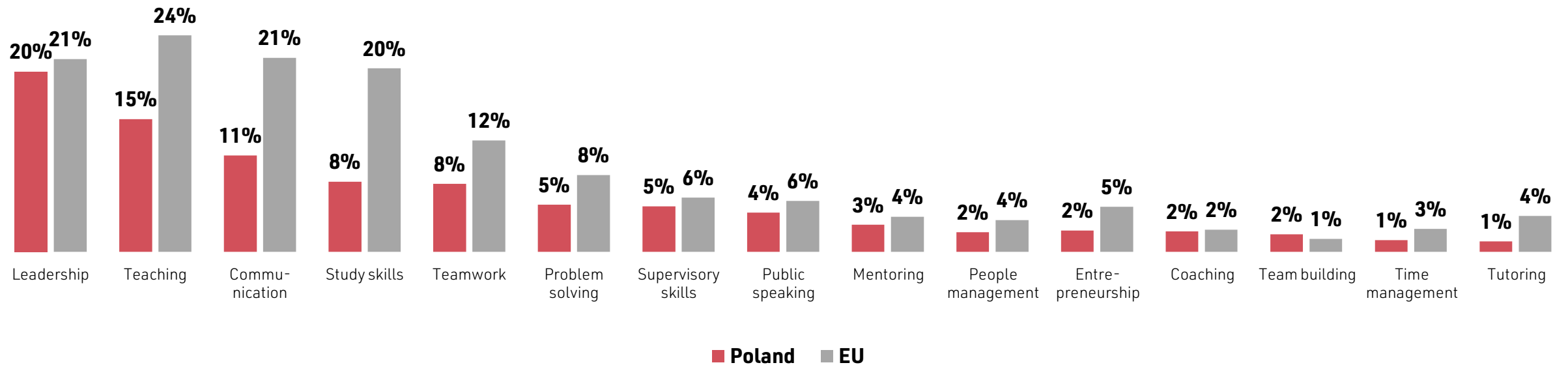
Edyta Janas
Business Development
Director,
Randstad Sourceright

The survey results clearly show a gap in gender diversity and at the same time the direction in which efforts could go. . Recruitment is one of the channels. However, in order to create a greater impact on gender diversity & attract more women to the AI area, it will be important to utilise an integrated approach throughout the employee lifecycle, organisational culture and business strategy.
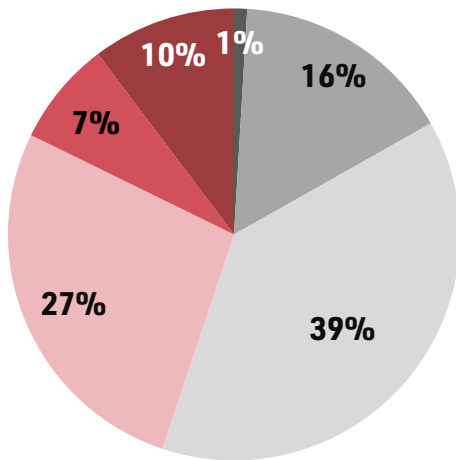
- **Polish AI specialists potentially exhibit a gap in certain soft skils. These are teaching, communication studying or teamwork.**

- **The numbers are based on Linkedin profiles so are self-declared. However, they may show a perceived lower importance of soft skills among AI specialists in Poland. This would not be surprising given that many of those people are subcontractors tasked with developing solutions.**

Skillset owned by AI specialists (self-declared in Linkedin profile)

	Leadership	Teaching	Commu-nication	Study skills	Teamwork	Problem solving	Supervisory skills	Public speaking	Mentoring	People management	Entre-preneurship	Coaching	Team building	Time management	Tutoring
Poland	20%	15%	11%	8%	8%	5%	5%	4%	3%	2%	2%	2%	2%	1%	1%
EU	21%	24%	21%	20%	12%	8%	6%	6%	4%	4%	5%	2%	1%	3%	4%

■ **Poland** ■ **EU**

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Are you planning any changes to the size of your AI team?

What are your main sources of recruiting AI professionals? Select each correct answer.

Change in the size of AI team

- 1%
- 16%
- 39%
- 27%
- 7%
- 10%
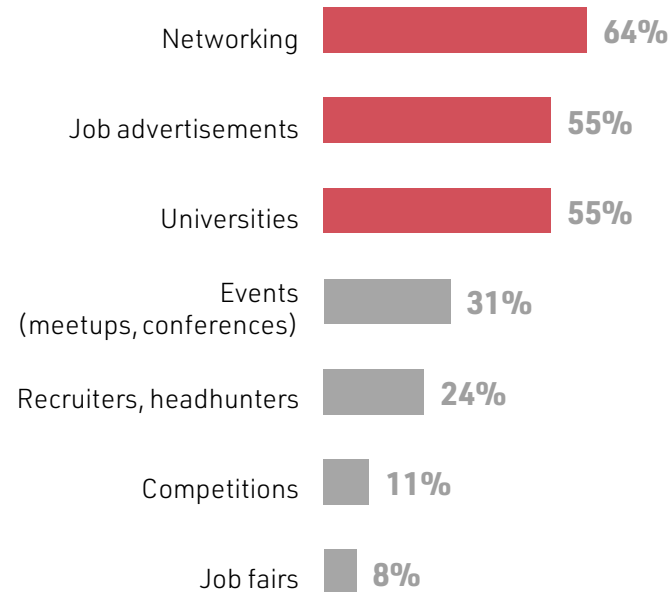
■ Reduction or liquidation of the team
■ No change
■ Increase by 1-2 people
■ Increase by 3-5 people
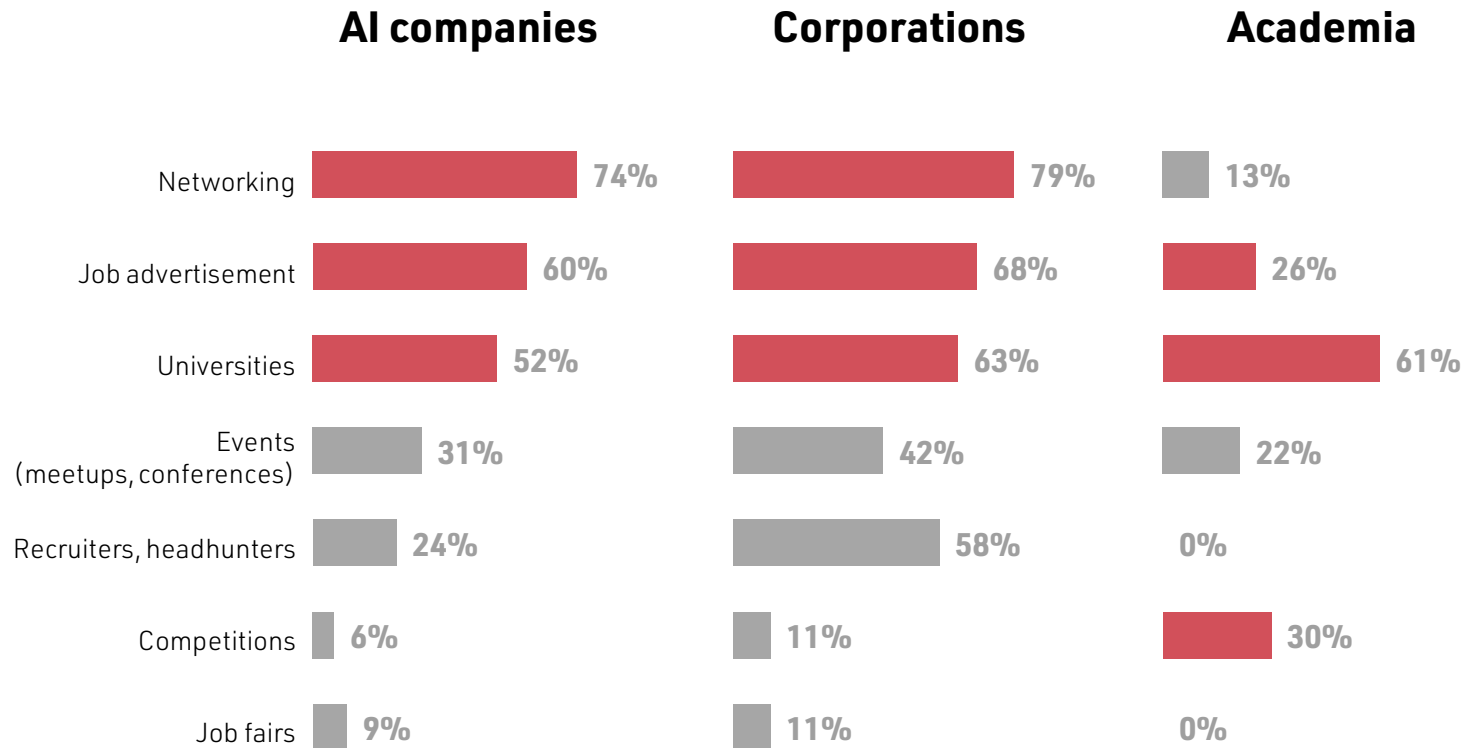■ Increase by 6-10 people
■ Increase by over 10 people

Source of AI specialists

Networking	64%
Job advertisements	55%
Universities	55%
Events (meetups, conferences)	31%
Recruiters, headhunters	24%
Competitions	11%
Job fairs	8%

- **Five in six of organisations surveyed plan to expand their AI team. One in ten have plans to add more than 10 people to the team.**

- **In the search for talent, most organisations rely on networking (64%), job advertisements (55%) or access to universities (55%).**

Sample: AI companies, corporations & academic teams

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What are your main sources of recruiting AI professionals?
Select each correct answer.

AI companies

Networking	74%
Job advertisement	60%
Universities	52%
Events (meetups, conferences)	31%
Recruiters, headhunters	24%
Competitions	6%
Job fairs	9%

Corporations

Networking	79%
Job advertisement	68%
Universities	63%
Events (meetups, conferences)	42%
Recruiters, headhunters	58%
Competitions	11%
Job fairs	11%

Academia

Networking	13%
Job advertisement	26%
Universities	61%
Events (meetups, conferences)	22%
Recruiters, headhunters	0%
Competitions	30%
Job fairs	0%

- Both AI companies and corporations have a similar strategy of recruitment based on networking, job ads and access to universities.

- However, corporations will relatively more often rely on recruiters or headhunters – 58% vs 24% in AI companies.

- Interestingly, academic teams often rely on contests to recruit new team members (30%).

Sample: AI companies, corporations & academic teams

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Krzysztof Nowakowski
Managing Director &
Country Head,
Korn Ferry

Polish companies seem to be rather optimistic about access to talent in AI, which sounds counterintuitive. Poland is a part of the global 'talent war zone', our IT specialists in all sectors of the tech industry are sought after globally and we should be afraid of brain drain that may hamper the development of the industry in Poland. Global technology leaders declare to be in a systemic deficit of tech specialist at all levels hence competition can only become more intensive. Covid validated the remote working model, which opens access to geographies and less obvious pools of talent (people in need of reskilling for example). In the future companies will need to think more about what to offer to employees to attract them and keep them, rather than where these employees are located. More and more money will be spent on 'well being' and employers' proposition to employees, and here many Polish companies seem to be more parsimonious. We also seem to be quite traditional in the way we source talent, while elsewhere the employment of the very AI to recruitment practices is believed to be the main sourcing platform. Poland is similar to other countries in serious under-representation of women in AI and technology in general. The problem starts long before women decide about education and career path, and that is clearly determined by cultural patterns and broader problem of gender inequalities. We have a generation-wide gap in the low number of women and the solution to that problem will not come from the tech industry alone.

Edyta Janas
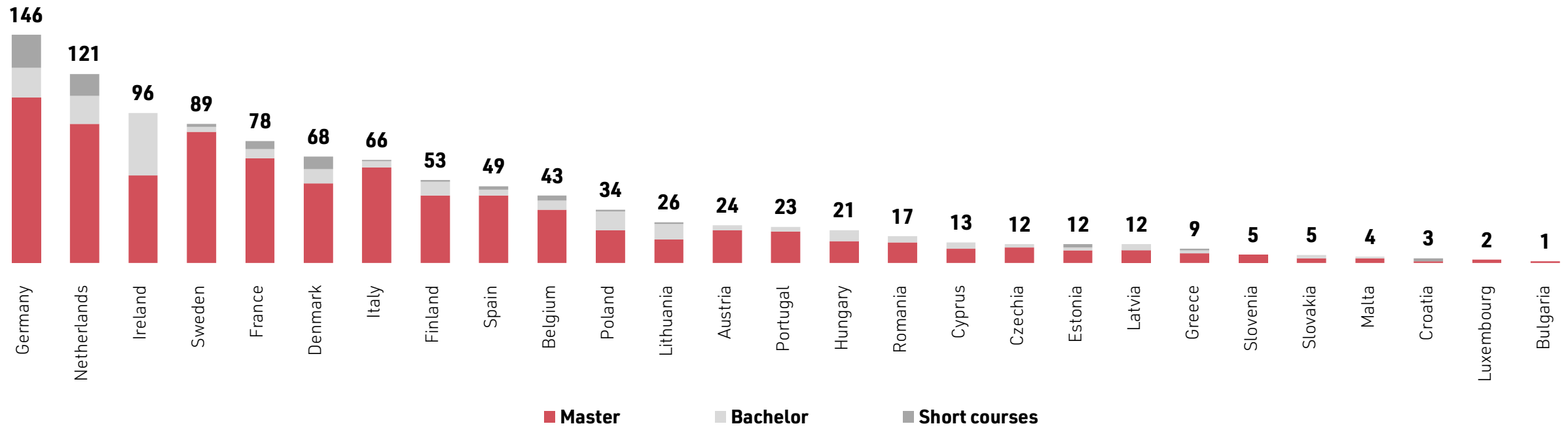Business Development
Director,
Randstad Sourceright

We observe companies' great interest in hiring AI skills, the appetite for growth indicated by surveyed organisations supports this trend. Building a strong employee-centred culture will support all networking efforts to bring new talents and keep the ones already hired. For start-ups and new corporations entering the market the recruitment approach will vary, however, what will remain consistent is the need to stand out in terms of the company's Employer Value Proposition.

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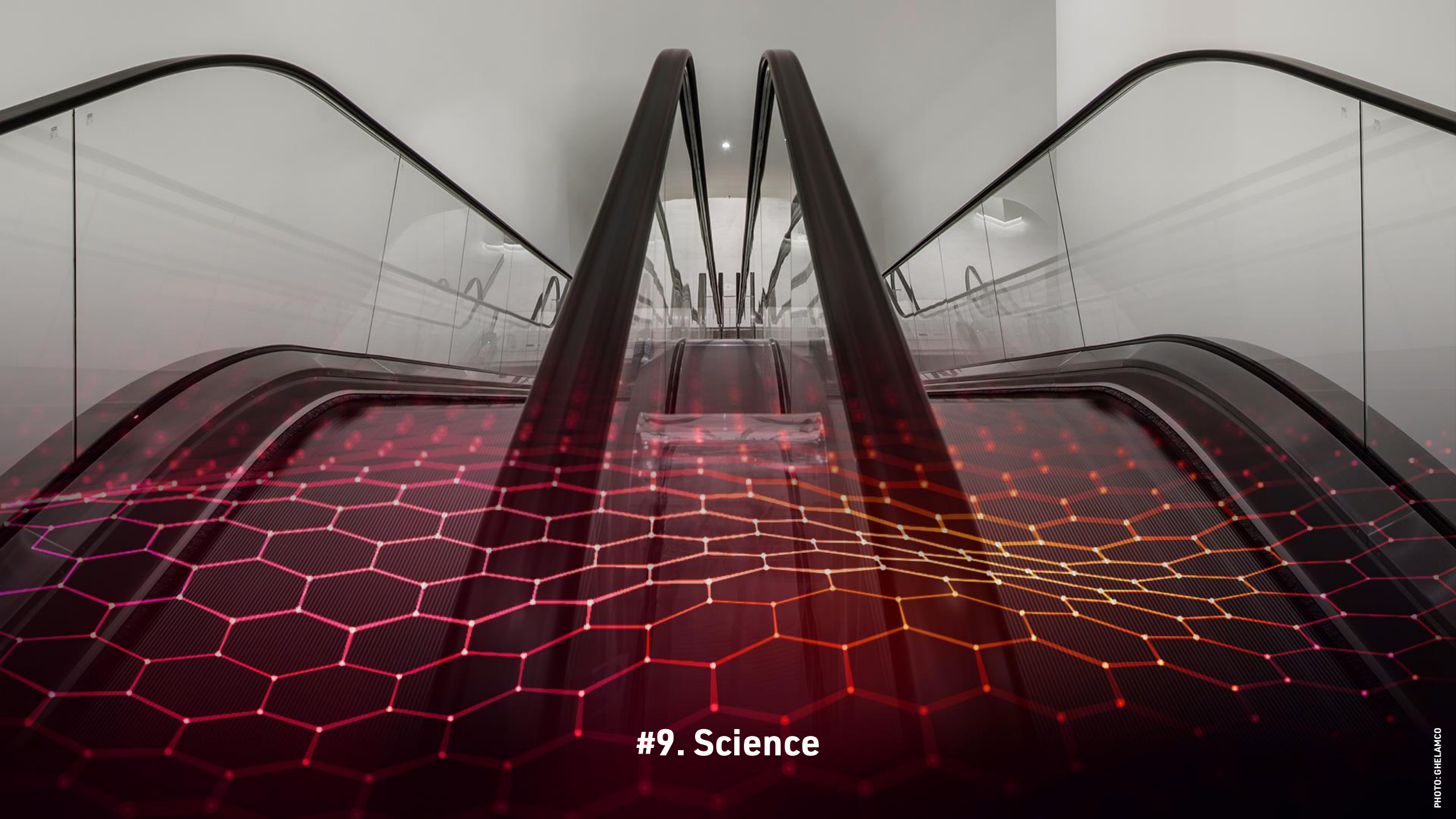
#9. Science

- **Many universities in the EU offer AI education. Germany, Netherlands and Ireland are the leaders in the number of AI programmes. Poland, with 34 AI programmes ,comes at the 11th place in the EU.**

- **Since the Brexit the UK is not a part of the Union. However, with its 1 275 AI programmes it would easily dominate this list.**

AI programmes at Universities by country, level and scope, 2019-20

Bar chart showing AI programmes by country: Germany 146, Netherlands 121, Ireland 96, Sweden 89, France 78, Denmark 68, Italy 66, Finland 53, Spain 49, Belgium 43, Poland 34, Lithuania 26, Austria 24, Portugal 23, Hungary 21, Romania 17, Cyprus 13, Czechia 12, Estonia 12, Latvia 12, Greece 9, Slovenia 5, Slovakia 5, Malta 4, Croatia 3, Luxembourg 2, Bulgaria 1.

Legend: ■ Master ■ Bachelor ■ Short courses

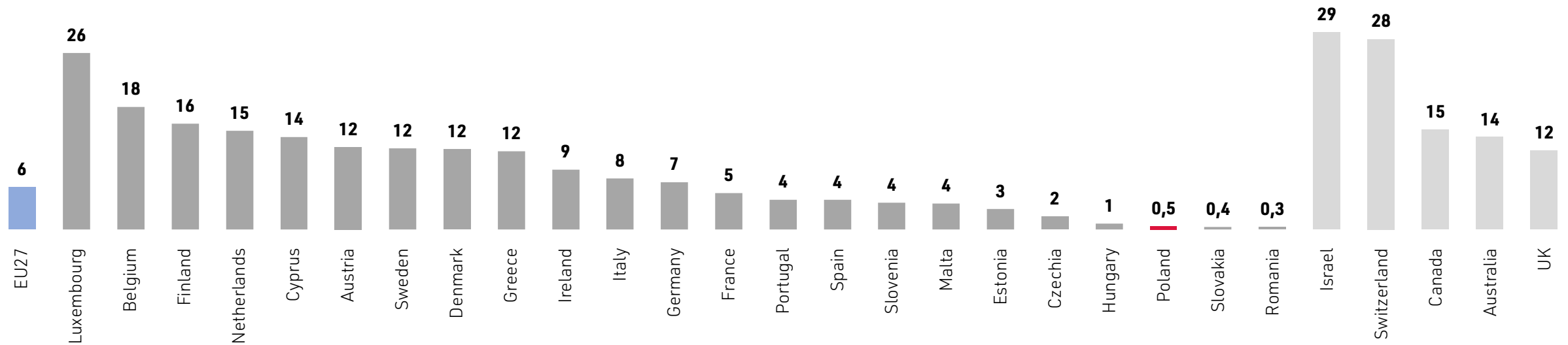aipoland   digitalpoland   10SENSES

Adam Czerniak, PhD
Chief Economist,
Polityka Insight

Poland is the CEE leader in specialized AI courses in tertiary education, especially for postgraduate students. The reasons for that can be traced back as far as to the 1920's Polish School of Mathematics which included such worldwide recognized scholars as Stefan Banach or Alfred Tarski. Their success stories gave birth to a long-lasting tradition of top-tier courses in mathematics, informatics, mechanics, physics and logic at Polish universities and institutes of technology. In recent years, the boom in game development, triggered by the success of Polish computer games, gave an additional push to increase the number of AI master's programmes at Polish schools, both, private and public. Many students – not only from Poland, but also from neighbouring countries - want to graduate from local universities, which gives them an advantage in competing for jobs in the fast-growing Polish programming industry.

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- **Guide2research provides information on top 6 000 computer scientists. When compared to the size of active population, the highest saturation of top computer scientists can be found in Luxembourg, Belgium and Finland. Outside of the EU, Israel and Switzerland are the leaders.**

- **Poland is at the bottom of the EU ranking, as are other countries in the region.**

Number of top computer scientists per 1 mln active population

EU27	Luxembourg	Belgium	Finland	Netherlands	Cyprus	Austria	Sweden	Denmark	Greece	Ireland	Italy	Germany	France	Portugal	Spain	Slovenia	Malta	Estonia	Czechia	Hungary	Poland	Slovakia	Romania	Israel	Switzerland	Canada	Australia	UK
6	26	18	16	15	14	12	12	12	12	9	8	7	5	4	4	4	4	3	2	1	0,5	0,4	0,3	29	28	15	14	12

Source: guide2research.com, Top 6000 Computer Science Scientists

aipoland digitalpoland IOSENSES

Piotr Sankowski
President of IDEAS NCBR,
Profesor at University of
Warsaw,
CEO of MIM Solutions

It is clear that with respect to other big EU countries Poland is underperforming in the production of top AI researchers, and even if we are able to successfully educate such people, they very often leave Poland. There is a need for boosting AI talent pools not only by starting new AI programmes, but by creating places where cutting-edge AI research can be done. Research on AI is application driven and requires cooperation with industry. Hence, especially in the case of AI, building any research institutes/teams needs to be based on ambidextrous Pasteur type researchers - ones that bridge the gap between "basic" and "applied" research. With this idea in mind, NCBR is creating IDEAS NCBR, a research organization that aims at educating such innovators.

Where do the most elite (top 0.5%) AI researchers in Europe come from?

Received degree

Poland
Czechia
Belgium
Austria — 4%
Sweden — 4%
— 4%
— 4% — 4%
France
29%
7%
Italy — 7%
Hungary — 7%
Germany 14%
9%
Netherlands
11%
Greece
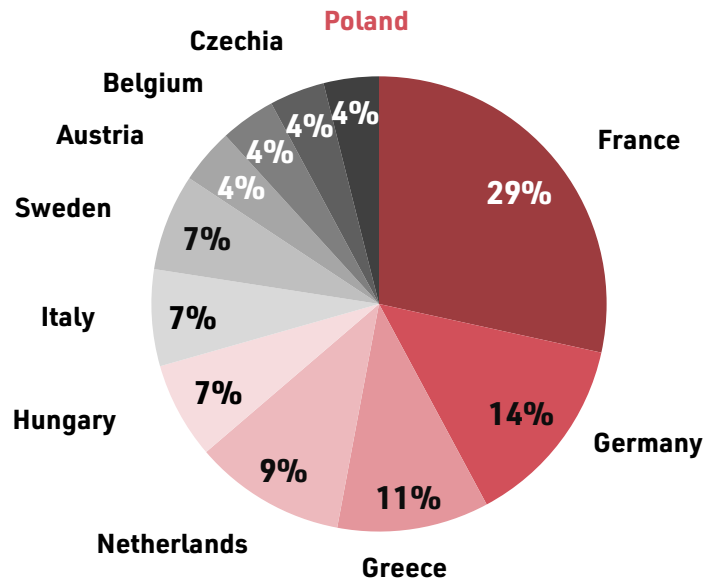
Where do the most elite (top 0.5%) AI researchers in Europe work today?

Currently working

Germany
Belgium
5%
Sweden — 5%
16%
France
53%
21%
Netherlands
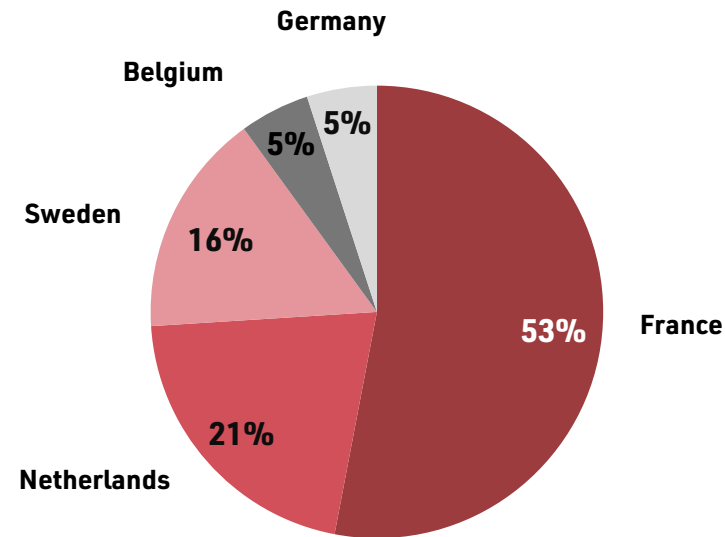
- In the post-Brexit Europe, France stands as a clear centre of elite AI expertise.

- Graduates of French universities make up 29% of elite AI specialists coming from the EU. It is twice as much Germany which holds the second place.

- France is also the place where a half of top specialists finally end up continuing their career.

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Janusz Marecki, PhD
Lead Scientist,
Google DeepMind

I believe that the primary reason why so many scientists that have received their advanced AI degrees in Poland choose to emigrate to the West has to do with their desire to keep enhancing and applying these hard - earned skills in real domains rather than seeing these skills not needed by employers in Poland. It is a simple fact these days that the most exciting AI R&D in the industry happens at big multinational corporations and these corporations choose to open their AI labs close to where they are headquartered, that is, rarely in Poland. To reverse this trend, I believe that Poland must strategically choose to start directing state resources and regulatory support to Polish headquartered AI firms rather than to foreign multinational corporations whose branches in Poland are not meant to be AI research oriented.

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Over the years 2013-18, there were 12 thousand publications covering research on AI and related topics registered in the Polish Scientific Bibliography database. **These publications were produced by 6.5 thousand researchers**.

Computer scientists play a major role in the research. Nearly half of publications were produced by 1.5 thousand researchers from this domain of science.

Computer Science & Telecommunication

1 521

Number of AI researchers

who during the years 2013-18 published at least one research article on AI

5 286

Number of publications

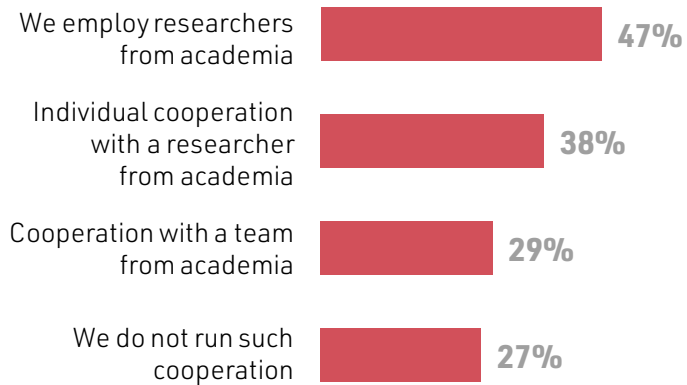covering keywords specific to AI published during the years 2013-18

Other branches of science

4 981

Number of AI researchers

who during the years 2013-18 published at least one research article on AI

7 322

Number of publications

covering keywords specific to AI published during the years 2013-18

Source: analysis by OPI PIB based on PBN system, Digital Poland Publication in English, 2019

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Regions and agglomerations of Poland with the highest number of scientists publishing in the field of AI

Number of AI researchers

- ● > 300
- ● > 600
- ● > 900
- ● > 1200
- ● > 1500

Number of artificial intelligence researchers in the Voivodeship

400
300
200
100

Region	Value
Mazowieckie	1956
Małopolskie	969
Śląskie	895
Dolnośląskie	564
Wielkopolskie	473
Pomorskie	444
Łódzkie	318
Zachodniopomorskie	305
Lubelskie	249
Kujawsko-pomorskie	156
Podkarpackie	155
Opolskie	122
Podlaskie	106
Świętokrzyskie	77
Warmińsko-mazurskie	66
Lubuskie	64

- **The Mazowieckie region has a strong lead in the number of AI researchers with 1 956 people publishing in the field**

- **Two other regions with a considerable number of researchers are Małopolskie (969 people) and Śląskie (895 people)**

- **Warszawa, Kraków, Wrocław, Gliwice, Poznań, Gdańsk have the best AI professors and research teams. Additionally, individual outstanding AI researchers are located in Toruń and Częstochowa**

Source: analysis by OPI PIB based on PBN system, Digital Poland Publication in English, 2019

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Do you collaborate with the academic community on AI? Select each correct answer

Cooperation with Academia

We employ researchers from academia	47%
Individual cooperation with a researcher from academia	38%
Cooperation with a team from academia	29%
We do not run such cooperation	27%

What is the scope of collaboration with the academic community? Select each correct answer

Scope of Cooperation
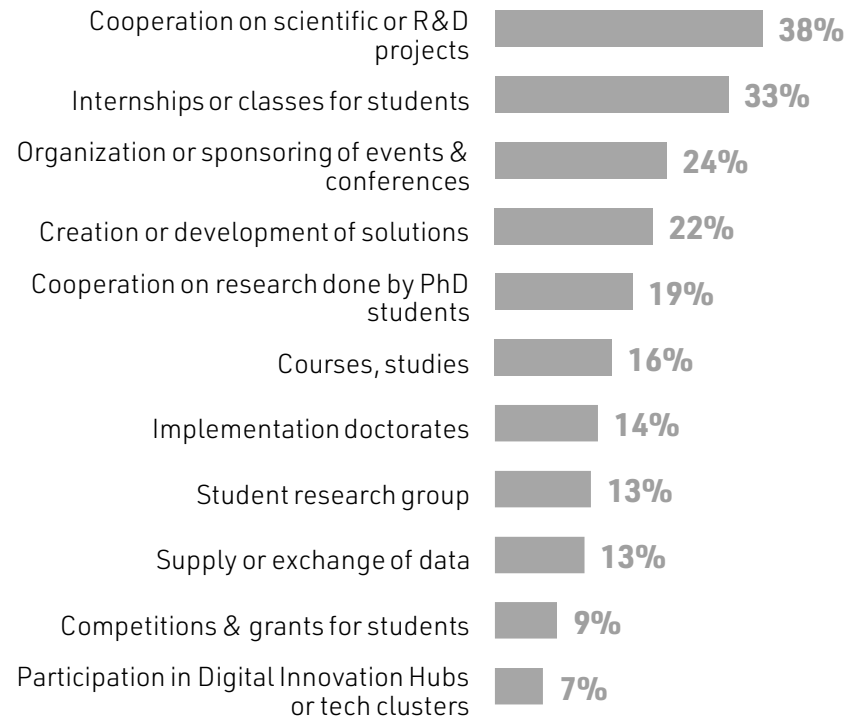
Cooperation on scientific or R&D projects	38%
Internships or classes for students	33%
Organization or sponsoring of events & conferences	24%
Creation or development of solutions	22%
Cooperation on research done by PhD students	19%
Courses, studies	16%
Implementation doctorates	14%
Student research group	13%
Supply or exchange of data	13%
Competitions & grants for students	9%
Participation in Digital Innovation Hubs or tech clusters	7%

- **Most of organizations dealing with AI have some cooperation with universities. Only 27% state that they do not cooperate with academia.**

- **Usually, this means cooperation on scientific or R&D projects (38%) or internships or classes for students (33%).**

- **On the other hand, only 13% of organizations exchange data with academic researchers. Similarly, only 7% are involved in tech clusters or Digital Innovation Hubs.**

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Jerzy Stefanowski,
Professor at the Institute of
Computing Science,
Poznań University of
Technology

The current survey provides a lot of interesting observations on the developments of Polish AI companies, their activity fields and possibility of selling intelligent products or services. While comparing this survey to the previous version of AI map one can notice the growth of this sector and changes in AI applications. In particular, it concerns a better cooperation between companies and scientific units. The most of AI companies confirmed various forms of such co-operation. Nearly half of survey respondents answered that they employ researchers from universities or research institutes. Many others run different projects with individual researchers from academia, where they clearly indicated their scientific or R&D characteristics. In my opinion it is a very positive and promising change signal, perhaps partly coming from recent joint efforts in the national and EU projects.

Other positive answers of the respondents on the collaboration between companies and academia cover internships or classes for students, cooperation in Ph.D. research, supporting student research groups and partnership in scientific conferences or other AI events.

Barbary Belpaire
General Manager,
TomTom Poland

We have been systematically expanding our teams of AI specialists for many years now and are having partnerships with Universities and industry frontrunners allowing us, amongst others, to perform joint research, content co-creation and new solution piloting. We employ a very diverse team and have academia on board to stimulate discussion & innovation through a diversity of thoughts. Last but not least, we show interns, who might become future AI professionals, and external specialists, how fascinating, rewarding and essential their adventure with artificial intelligence can be to develop scalable products & solutions for better mobility and to drive innovation in this novel domain.

aipoland   digitalpoland   10SENSES

Aleksandra Przegalińska
Vice Rector, Associate
Professor,
Koźmiński University

As we observe within the report, scientific cooperation - as far as AI development is considered - continues to be a challenging area. According to the report, scientific cooperation is less common (13%) and only 7% of all examined respondents develop their technologies in close cooperation with international partners. In the context of these study outcomes, particularly in the realm of scientific discovery, global cooperation is very beneficial. It basically has zero disadvantages, whereas advantages are usually spectacular. International R&D cooperation allows for reaching synergetic effects for the R&D teams, greater networking possibilities as well as more efficient and more scalable study results. On top of that, one should also mention significantly greater exposure in terms of results dissemination. I believe that this aspect of scientific AI development should be addressed and incentivized. Science, especially in the context of general-purpose technology like artificial intelligence, develops globally and rapidly. Poland should be an important voice in this field and participate in the global efforts.

Dominik Batorski, PhD
Scientist, ICM University of
Warsaw
Co-founder, Member of the
Board, Sotrender,
Data Science Warsaw
Meetup organizer

The interaction between business and science is not always easy. AI development is an area that stands out in this regard. Moreover, it is a two-way cooperation - companies benefit from hiring scientists and students for R&D projects, and Universities from raising the level of education by offering more practice. However, in research, it is still a collaboration between companies and individual scientists rather than an institutional partnership. Universities are also one of the important places for recruitment. However, the essential way of attracting new employees to AI teams is through networking. Of particular importance here is the thriving ecosystem of meetups and conferences in Poland. This ecosystem both supports recruitment and facilitates networking.

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The cooperation between business and academia in the field of AI is still at its early stages. Most often, it takes the form of hiring individual researchers from academia rather than collaborating with the institution. Not much has changed in this area compared to the previous report from 2019 and things will not change soon without incentives to collaborate on more partnership-based terms.

At universities, companies are looking for young talents, hence the interest in offering courses for students, internships, conferences and grants supporting students. The growing number of programmes in data science, machine learning and artificial intelligence at leading universities is a good response to the increasing business demands.

On the horizon, we see a growing number of advanced AI projects in which businesses commission specific expertise to universities, ask for the development of specific AI solutions or ask for an audit of AI tools developed internally. Interesting collaborations are taking place in new areas where the business has not yet developed skills, such as fair, transparent and responsible AI. Also, among employees of companies, we see a growing interest in developing competencies in the research area, for example through the applied PhD programme. I hope that these personal bridges between academia and business will strengthen the AI community in Poland.

Przemysław Biecek
Head of MI2DataLab, vice-dean for research and innovation at the Faculty of Mathematics and Information Science, Warsaw University of Technology

Raising the popularity of AI requires the preparation of substantial workforce, which eventually can be used in Companies operating in AI. It happens both on the Academia level and in Companies directly. We cooperate with different universities and academia in the area of several projects. It is a good access to competence, up-to-date technology and professional expertise. We also engage students in summer practice where they can train their theoretical knowledge in a practical business environment. However, cooperation with academia has some limitations due to a small number of employees working there and a limited possible engagement from their side. It is easily visible in NCBR grants which require cooperation with academia but it is difficult to engage an appropriate partner in a particular scope.

Zenon Szczepkowski
Sales director,
VoiceLab

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#10. R&D and Tax Reliefs

Did your organization use NCBR grants to develop AI?

Use of NCBR grants

Corporations

AI companies   **Academia**

6%

50%

44%

51%

47%

2%

21%

53%

26%

74%

26%
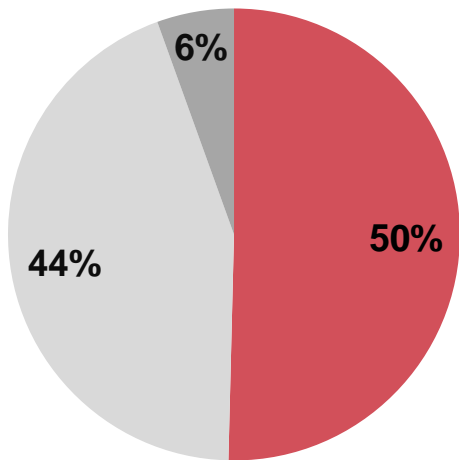
■ Yes   ■ No   ■ Don't know
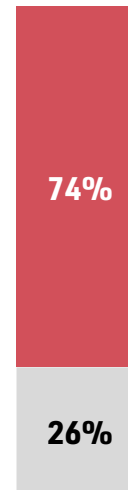
- **Narodowe Centrum Badań i Rozwoju (NCBR, English: National Centre for Research and Development in Poland) is a governmental agency focused on supporting R&D activities in the economy.**

- **About a half of AI companies benefit from NCBR grants.**

- **However, only 21% of corporations do so. This may reflect the criteria of NCBR which promote SMEs.**

- **74% of teams in academia are beneficiaries of such grants - and this may reflect NCBR criteria too as many grants may require that a company cooperate with the academic sector.**

Sample: AI companies, corporations & academic teams

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Total value of projects which received NCBR grants, Smart Growth Operational Programme in 2016-2019 [PLN bln]

Own funding **NCBR grants**
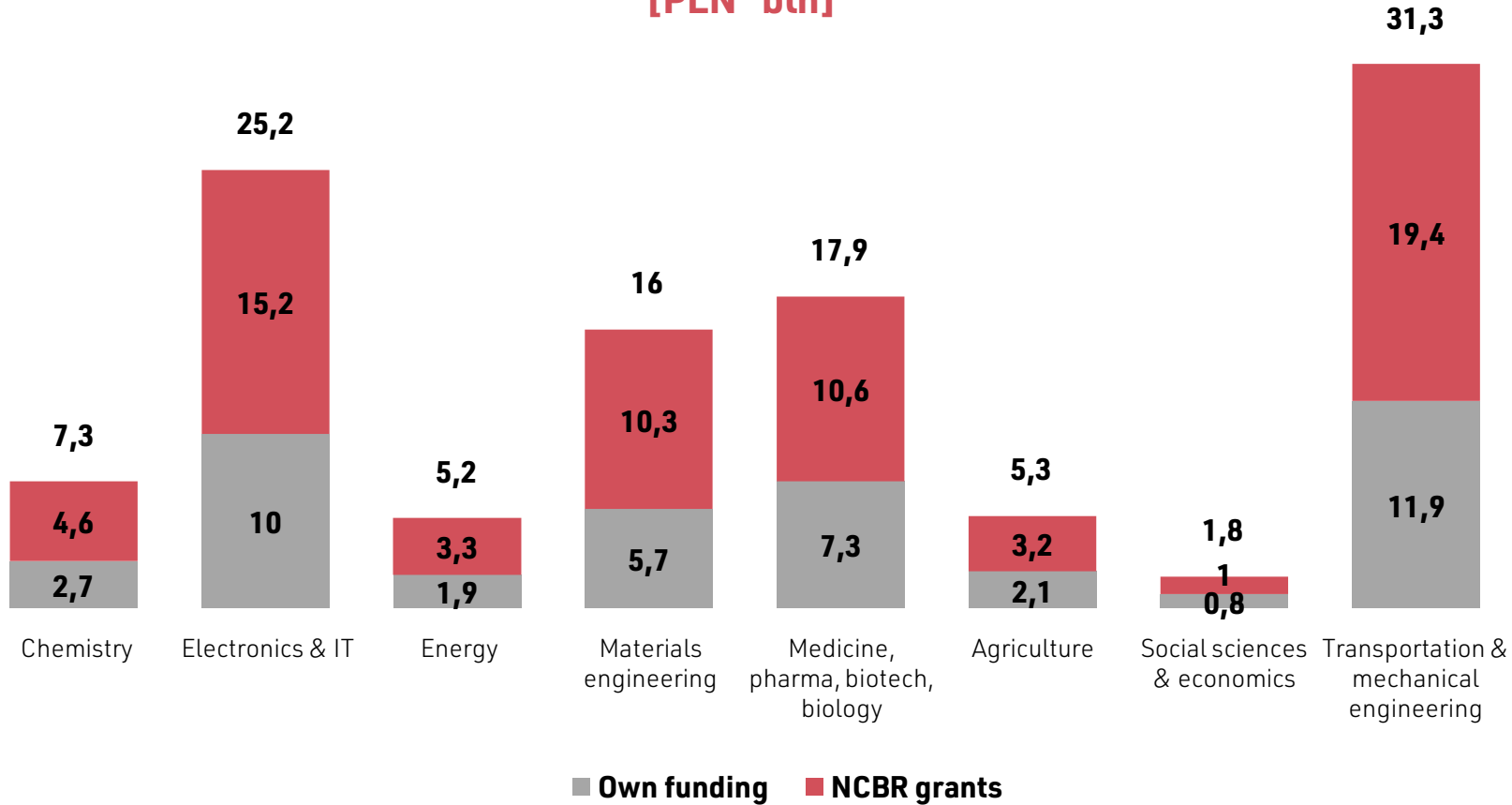
- **In years 2016-2019, NCBR co-financed projects in various domains. It spent most on transportation & mechanical engineering and Electronics & IT.**

- **Total value of projects in Electronics & IT was 25 bln PLN. Out of this, 15 bln was NCBR grants.**

Source: NCBR (2020) Analiza trendów badawczych we wnioskach o dofinansowanie składanych do NCBR w ramach PO IR w latach 2016-19

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Technologies in Electronics & IT category, NCBR grants, Smart Growth Operational Programme in 2016-2019 [projects mentioning particular technology]
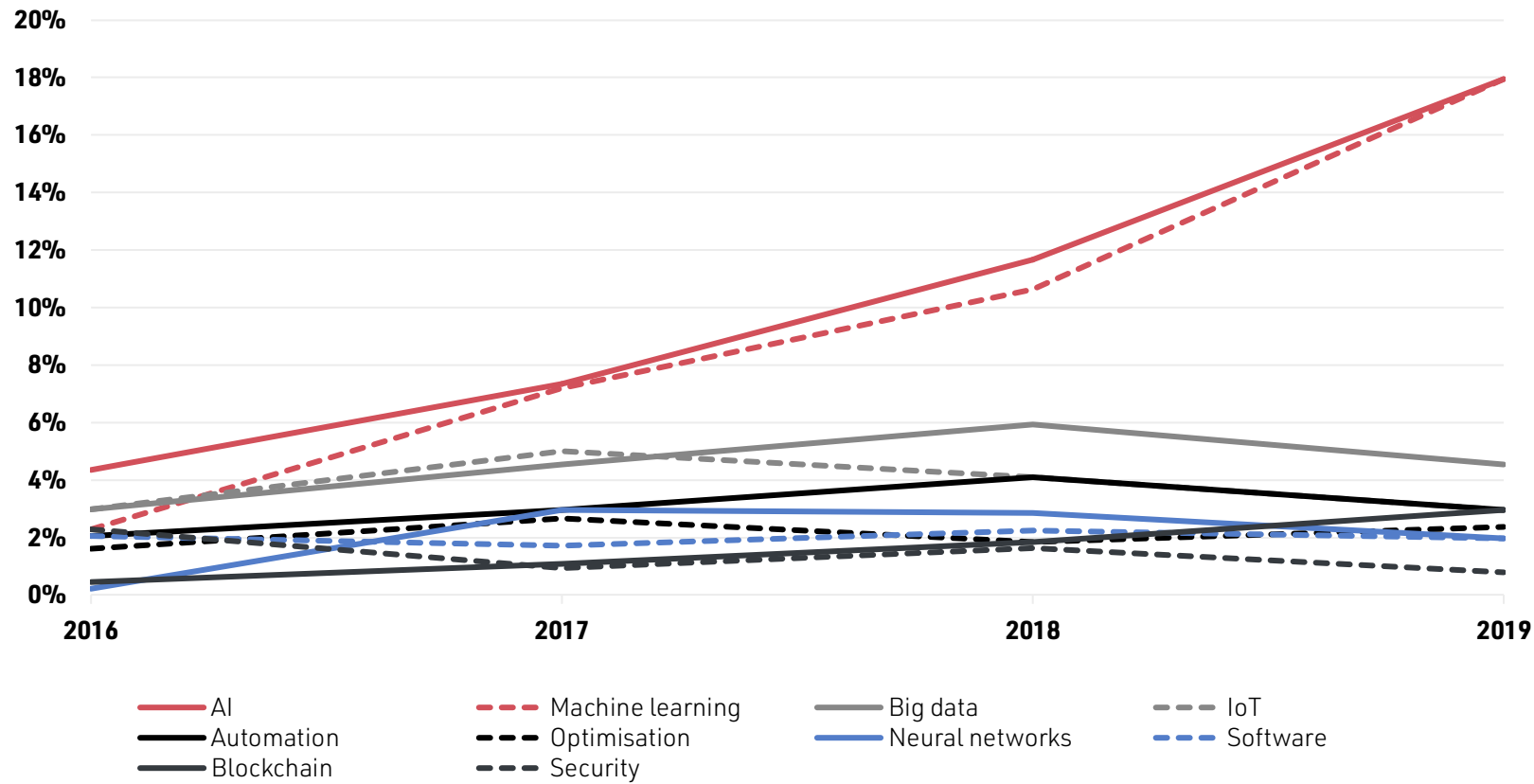
- **Recently, there is a clear shift towards AI and machine learning in NCBR's Electronics & IT category of projects.**

- **NCBR analysts counted keywords in project applications to get an estimate of how the technical side of projects is evolving over time.**

- **It turns out that the importance of AI and machine learning is rising fast. In 2019 these two categories clearly dwarfed other technologies.**

Legend:
AI — Machine learning — Big data — IoT — Automation — Optimisation — Neural networks — Software — Blockchain — Security

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Wojciech Kamieniecki, PhD
Director,
National Centre for
Research and Development

It may not come as a surprise that half of the entities surveyed reach for funds from NCBR. One of the research trends revealed in the analysis of applications submitted to NCBR under PO IR 2016-2019 is their interdisciplinarity. In practice, this means that our beneficiaries are increasingly using AI-based solutions. We predict that this trend will intensify in the future and that AI will be increasingly used in research and development in all fields.

We are listening to the needs of the market, the scientific community, and the state. In the area of AI, we launched a thematic program INFOSTRATEG with the allocation of PLN 840 million. The first edition of the content was devoted to the detection of fake news and improvement of diagnostics of frequently occurring types of cancer. The key undertaking of NCBR supporting the development of digital and AI economy is the recently established scientific and research centre IDEAS NCBR . We will employ qualified scientists and doctoral students there, then we will commercialize the results of their works, and in cooperation with NCN we are also planning to establish several Centres of Excellence of AI in order to develop scientific personnel needed in this area in Poland as broadly as possible.

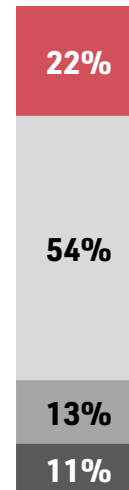## Does your organization use IP Box tax relief to develop AI?

Use of IP Box

Corporations

AI companies   **Academia**
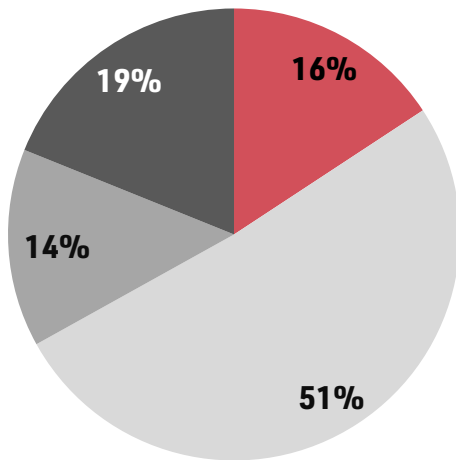
- Yes
- No, but I know what IP Box is
- No, I don't know what IP Box is
- I don't know the answer

Pie chart:
- 16% Yes
- 51% No, but I know what IP Box is
- 14% No, I don't know what IP Box is
- 19% I don't know the answer

AI companies bar:
- 22%
- 54%
- 13%
- 11%

Corporations bar:
- 5%
- 47%
- 5%
- 42%

Academia bar:
- 43%
- 26%
- 30%
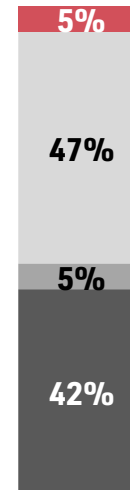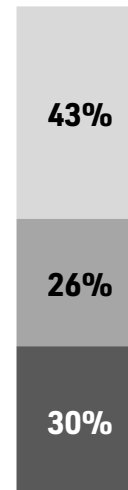
- **IP Box is a preferential income tax rate applicable to development of intellectual property. It was implemented in 2019.**

- **16% of teams use it and about 2/3 are aware it exists.**

- **IP Box is used by 22% of AI companies.**

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#11. AI & big data adoption in Poland and Europe

- **Only 6% of Polish large companies use machine learning. This is one of the lowest numbers in the EU. However, it is an outcome very similar to other EU members in the CEE region.**

- **Actually, it is Scandinavia that stands out. In this region around 20% or more companies use machine learning.**
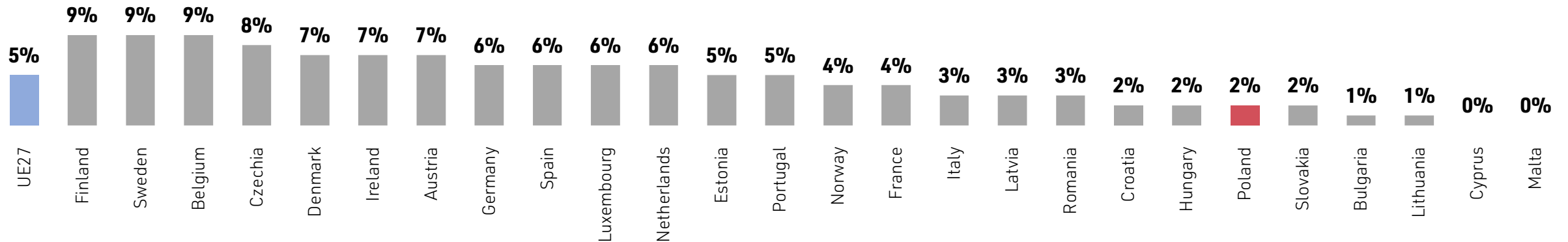
Large companies (250+ employees) that analyze big data internally using machine learning
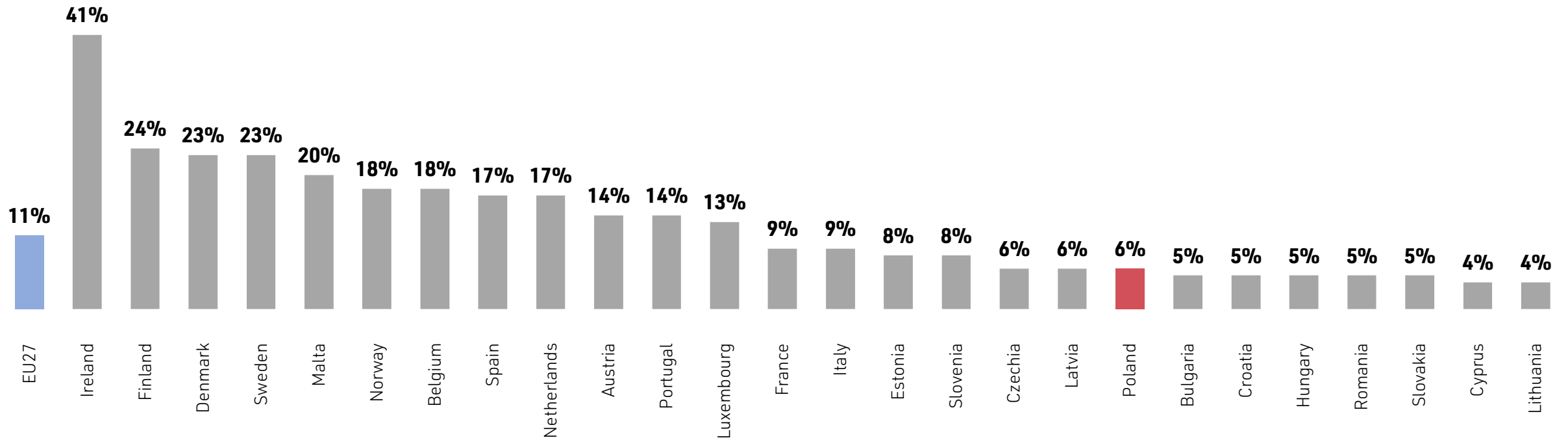
Country	Value
EU27	11%
Ireland	41%
Finland	24%
Denmark	23%
Sweden	23%
Malta	20%
Norway	18%
Belgium	18%
Spain	17%
Netherlands	17%
Austria	14%
Portugal	14%
Luxembourg	13%
France	9%
Italy	9%
Estonia	8%
Slovenia	8%
Czechia	6%
Latvia	6%
Poland	6%
Bulgaria	5%
Croatia	5%
Hungary	5%
Romania	5%
Slovakia	5%
Cyprus	4%
Lithuania	4%

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- **When it comes to NLP and speech recognition, only 2% of Polish companies use this technology. Nonetheless, other countries in the region have a similar NLP adoption rate so Poland does not really stand out.**

- **Scandinavia evidently leads, with adoption of NLP and speech recognition in the 7%-9% range.**

Large companies (250+ employees) that analyze big data internally using natural language processing, natural language generation or speech recognition

UE27	5%	
Finland	9%	
Sweden	9%	
Belgium	9%	
Czechia	8%	
Denmark	7%	
Ireland	7%	
Austria	7%	
Germany	6%	
Spain	6%	
Luxembourg	6%	
Netherlands	6%	
Estonia	5%	
Portugal	5%	
Norway	4%	
France	4%	
Italy	3%	
Latvia	3%	
Romania	3%	
Croatia	2%	
Hungary	2%	
Poland	2%	
Slovakia	2%	
Bulgaria	1%	
Lithuania	1%	
Cyprus	0%	
Malta	0%	

Source: Eurostat ICT panel, data for 2020, December

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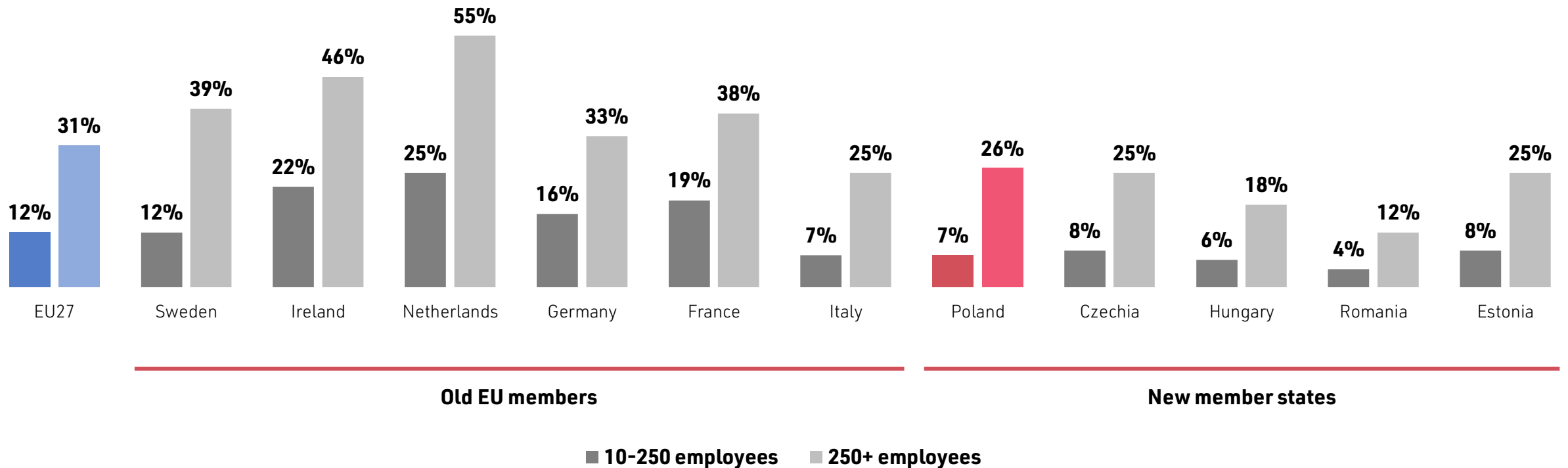**Zbigniew Gajewski**
Partner,
Think Tank

The Eurostat research quoted here, as well as data from other sources, indicate a serious backwardness in the digitization of companies from the Central and Eastern Europe compared to Western European companies. Our region is paying a high price for the decades-long experiment with a centrally controlled economy, which was to ensure equality and justice for all citizens, and ended up in poverty and humiliation.

The economic and cultural effects of this experiment could, in my opinion, be overcome more quickly if the political and business elites in our countries seriously took artificial intelligence and its already available applications for practical use. Rapid implementation of the latest technologies combined with universal digital education would allow us to accelerate economic and social development. Unfortunately, this opportunity looks wasted for the time being.

Since in April 2018, the Visegrad Group countries declared their joint participation in the race to use AI to modernize their economies and public services, no new, specific initiative has emerged. Also in Poland, the government policy on AI is based on declarations, and not on vigorous, targeted and consistently implemented measures. In this way, our jump into the economic top league must remain just a dream.

- **26% of large Polish companies analyze big data. It is slightly less than the average for EU (31%) but it is quite a good outcome comparing to other CEE countries and on par with Italy. There is a gap compared to Germany (33%) or France (38%) but it is not huge.**

- **It is Polish SMEs that trail behind. Just 7% of them analyze big data while in France or Germany over twice as many do so.**

Companies that analyze big data from any data source

Old EU members   **New member states**

■ **10-250 employees**   ■ **250+ employees**

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Ewa Drozd
Enterprise Commercial
Lead, Board Member,
Microsoft Poland

Data is the fuel powering the cloud-based growth engine of many Polish companies. Research shows that 26 percent of large enterprises in Poland conduct advanced analysis of huge data sets (Big Data). The average for the 27 EU countries is 31 percent, so there is still plenty of room for growth in this area. Polish market leaders are already proving that the computational power of cloud computing unleashes the potential of data, giving the possibility to better identify clients, create new offers and models of operation. This is also confirmed by the AI&Skills 2020 study conducted by Microsoft - more than 80 percent of advanced AI users in Poland see its tangible value for their business. For example, in the CCC Group technology enables a better, more personalized relationship with the customer, which translates into measurable business results and benefits for customers. Importantly, cloud computing opens up a powerful arsenal of off-the-shelf tools. Artificial intelligence algorithms running in the Azure cloud today can be used to rapidly build solutions that increase business innovation and enhance their ability to compete. As a result, they provide greater process efficiency, cost minimization, and better customer service without having to make their own investments in the AI technology development.

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- **16% of large Polish companies use data from smart devices or sensors. It is just one percentage point below the EU average and may be perceived as a pretty good outcome given smaller IT budgets in Poland.**

- **Only 2% of SMEs in Poland use data from smart devices or sensors. However, even in more developed EU countries the use of this type of data is low among smaller enterprises.**
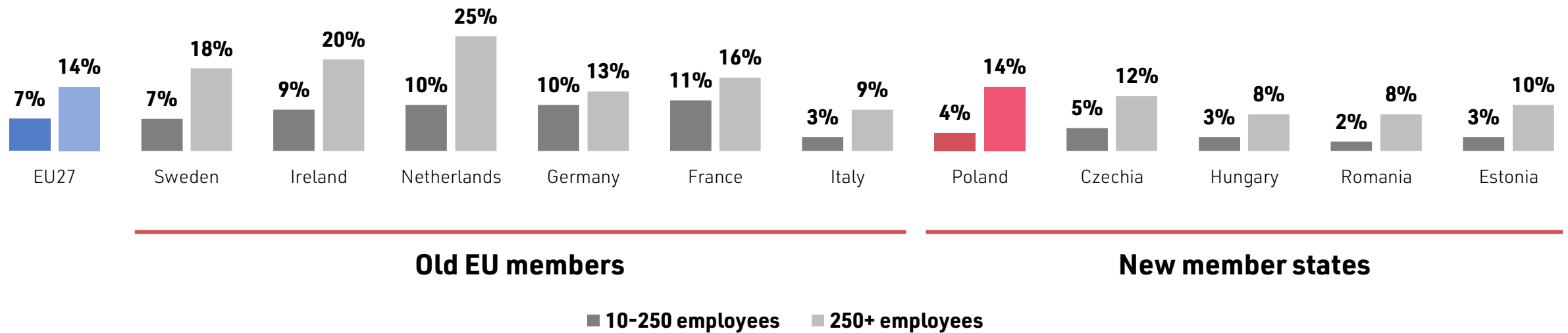
Companies that analyze big data from smart devices or sensors

	10-250 employees	250+ employees
EU27	3%	17%
Sweden	3%	20%
Ireland	5%	21%
Netherlands	7%	28%
Germany	3%	14%
France	3%	20%
Italy	2%	16%
Poland	2%	16%
Czechia	2%	14%
Hungary	2%	14%
Romania	1%	6%
Estonia	4%	17%

Old EU members

New member states

■ **10-250 employees** ■ **250+ employees**

Source: Eurostat ICT panel, data for 2020, December
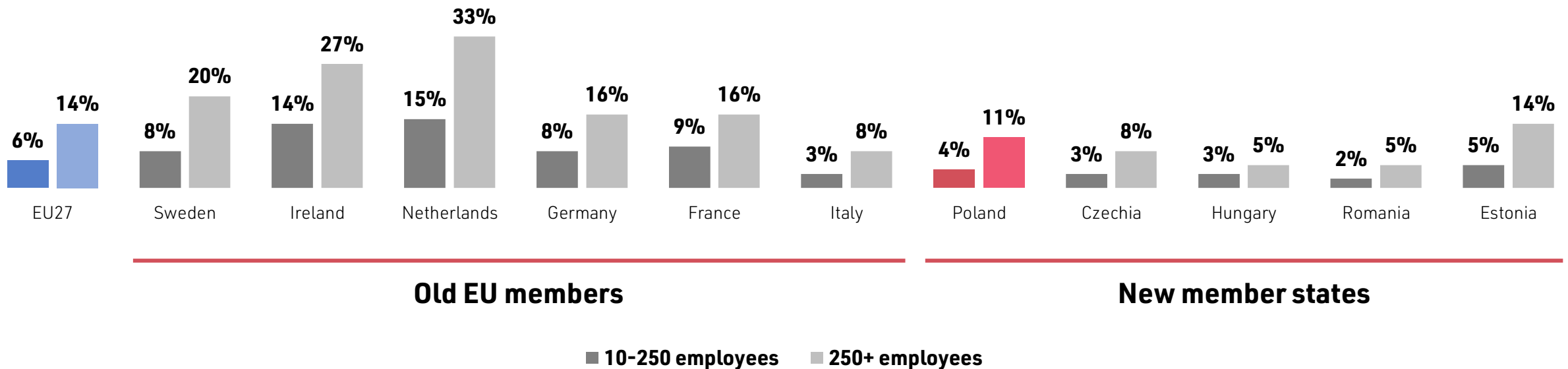
aipoland   digitalpoland   IOSENSES
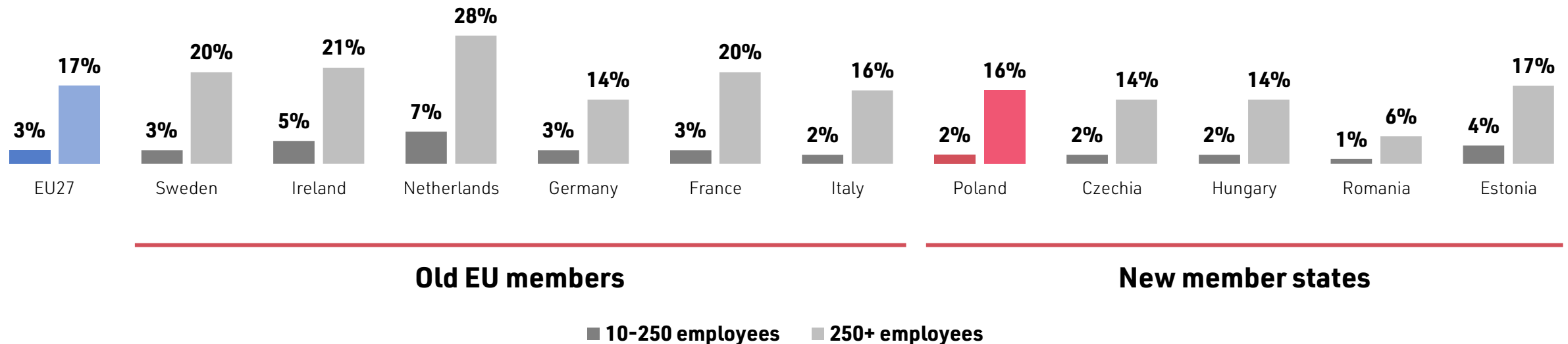
- **As for geolocation data coming from portable devices, there is a slightly lower usage among large Polish companies (14%) compared to Western European countries. The gap, however, is just a few percentage points.**

- **Again, it is the Polish SMEs which exhibit a significantly lower usage of such data in comparison to Western Europe.**

Companies that analyze big data from geolocation of portable devices

	EU27	Sweden	Ireland	Netherlands	Germany	France	Italy	Poland	Czechia	Hungary	Romania	Estonia
10-250 employees	7%	7%	9%	10%	10%	11%	3%	4%	5%	3%	2%	3%
250+ employees	14%	18%	20%	25%	13%	16%	9%	14%	12%	8%	8%	10%

Old EU members   **New member states**

■ **10-250 employees**   ■ **250+ employees**

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- **Polish large companies seem not to use data from social media much. Only 11% do so. In Sweden and Netherlands 20% and 33% of large companies use such data.**

- **The same goes for Polish SMEs. Only 4% of them use such data, which is far lower than in Western countries.**

Companies that analyze big data from social media

			Old EU members						New member states			
	EU27	Sweden	Ireland	Netherlands	Germany	France	Italy	Poland	Czechia	Hungary	Romania	Estonia
10-250 employees	6%	8%	14%	15%	8%	9%	3%	4%	3%	3%	2%	5%
250+ employees	14%	20%	27%	33%	16%	16%	8%	11%	8%	5%	5%	14%

Old EU members   **New member states**

■ **10-250 employees**   ■ **250+ employees**

Source: Eurostat ICT panel, data for 2020, December

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Ignacy Święcicki
Digital Economy Team
Leader,
Polish Economic Institute

The data presented in the report shows a relatively low use of Big Data in Polish companies, which is in line with a generally below average performance in terms of the use of modern technologies. The reasons for such a meagre performance can be tracked to the levels of digital competences and the attitude of Polish entrepreneurs towards digital transformation. Adults in Poland rank well below the EU average in terms of digital skills, but the gap is especially large when one compares the level of above basic skills (21 per cent compared to 31 per cent in the EU, according to Eurostat data, which ranks Poland 25th in the EU). This is reflected in other parts of this report, where 47 per cent of AI companies report problems with recruiting AI specialists. But low levels of digital skills are not only a problem for HR departments, but also impact broader attitudes towards digitisation. In a recent survey conducted by the Polish Economic Institute over 40 per cent of companies in all size groups agreed with a statement that the need for a fast digitisation of the company is just another fad, that will fade away. A lot needs to be done not only to stimulate the Polish AI ecosystem, but also to boost the overall digital mindset in Poland's economy and society at large.

- **European Investment Bank ran a study on adoption of AI and big data analytics and reached conclusions similar to those of Eurostat.**

- **According to data from EIB 12% of Polish companies have adopted AI and big data analytics. It is a low number, compared to other EU members. However, this result is similar to that of comparable countries – Czechia, Slovakia and Hungary.**

Share of firms that report having partially or fully adopted cognitive technologies such as AI and big data analytics

Country	Value
EU	19%
Netherlands	38%
Finland	38%
Denmark	37%
Cyprus	35%
Estonia	26%
USA	24%
Austria	24%
Belgium	23%
Greece	23%
Sweden	22%
Spain	22%
Luxembourg	21%
Great Britain	20%
Portugal	18%
Slovenia	18%
Italy	17%
Germany	17%
Romania	16%
Bulgaria	16%
Croatia	16%
France	15%
Czechia	14%
Ireland	14%
Latvia	14%
Montenegro	14%
Poland	12%
Slovakia	10%
Hungary	9%
Lithuania	9%
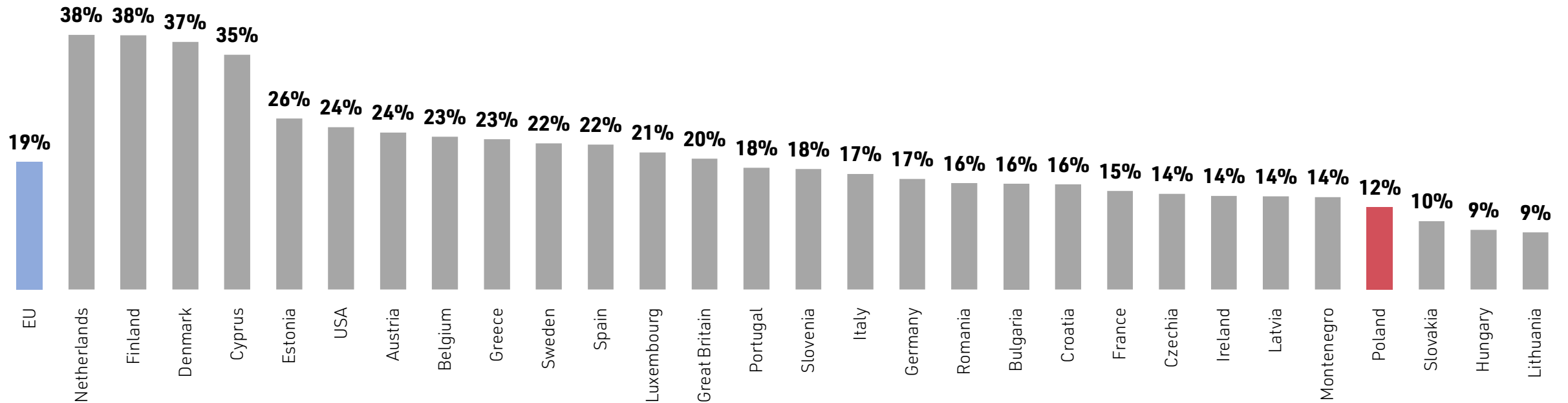
Source: Cathles, Nayyar & Rückert (2020) „Digital technologies and firm performance: Evidence from Europe", EIB Working Papers

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Łukasz Marć, PhD
Economist,
World Bank

"Despite Poland's unprecedented economic growth in the last three decades, there is still a large gap in the productivity of Polish firms - particularly MSMEs - compared to the EU-27 average. Given that the recent economic literature indicates a positive relation between digital technology adoption and productivity, low adoption of digital technologies in Poland is likely one of the key factors behind the productivity gap. World Bank's flagship report Europe 4.0 shows that new digital technologies create an opportunity to help Europe achieve its objective of competitiveness, market inclusion and geographic convergence, but require a comprehensive set of policies at the European, national and sub-national level. At the European level, the way forward includes completing the single digital market by e.g. removing constraints on trade in services. At the national and sub-national level in Poland, investments in frontier innovation should be complemented by support to applied R&D and straightening managerial capabilities for digitization and technology adoption, particularly among smaller firms and firms in lagging regions".

Zbigniew Gajewski
Partner,
Think Tank

The data on the use of AI solutions in companies around the world are most often different and difficult to use for comparisons. Artificial intelligence is a new, very young field of technology. Researchers who study it use heterogeneous terminology and ask companies ambiguous questions. In addition, AI is developing at a rapid pace and research results are often outdated at the time of publication.

These facts should, on the one hand, encourage AI observers to be cautious in formulating statistical conclusions, and, encourage them to cooperate to establish a common framework for the methodology and terminology of such research.
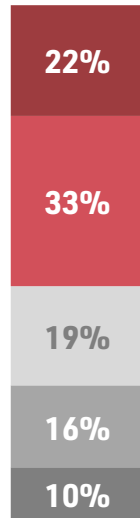
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#12. Challenges for Polish AI Companies
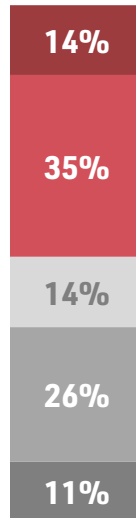
Is it difficult for your organization to…?
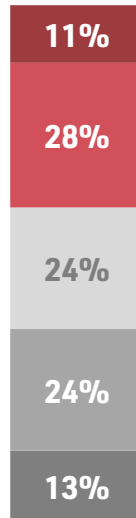
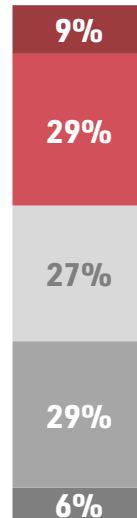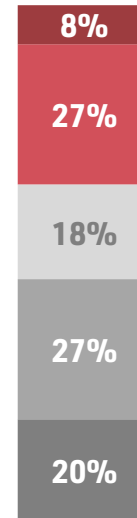| Raise brand awareness in Poland	Raise brand awareness abroad	Acquire clients in Poland	Acquire clients abroad	Convince the client to buy the product	Create a scalable product	
12%	22%	14%	11%	9%	8%	Definitely yes
34%	33%	35%	28%	29%	27%	Rather yes
18%	19%	14%	24%	27%	18%	Hard to say
25%	16%	26%	24%	29%	27%	Rather no
11%	10%	11%	13%	6%	20%	Definitely no
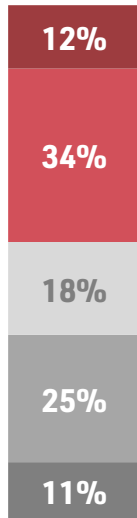
Not applicable:

14%	15%	15%	14%	9%	12%

- **The main difficulty Polish AI companies face in the area of sales and marketing, is raising their brand awareness abroad (55% rather agree or strongly agree).**

- **The least difficult challenge seems to be the creation of scalable product. Only 35% of companies agree with this statement.**

Sample: only AI companies & corporations | excluding academic teams

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Piotr Sankowski
President of IDEAS NCBR,
Profesor at University of Warsaw,
CEO of MIM Solutions

Small AI companies and start-ups face many challenges starting form access to data and ending with building awareness of their brand. Although, we start to have some very successful companies doing consulting in AI, there seem to be not that many product-based start-ups. Only such product-driven enterprises can potentially lead to creation of unicorns. If we want to see more Polish companies taking part in the global race, we need to restructure our ecosystem accordingly. The report correctly identifies obstacles in doing this in Poland. In particular, we need to see more incubator/accelerator/VC driven development of ideas. Only this way will we be able to support deeptech as it by definition requires time, funds and risk tolerance.

Błażej Chodarcewicz,
Data Science & AI Director,
Lingaro

According to the research, one of Polish AI companies' biggest challenges is building brand awareness. I agree. For companies like Lingaro -- whose goal is to become Global Fortune 500 organizations' partner of choice in the fields of artificial intelligence, machine learning, and data science -- brand awareness is a key to success. I would also emphasize the importance of having a clear value proposition and the scale necessary to be a true partner to such enterprises.

 Another top challenge identified is recruiting AI specialists. I agree here as well and would even say that hiring the right people is the most important success factor for an AI company. I thought it was interesting that 47% of the AI companies covered in the report have experienced hiring challenges, but only 18% reported experiencing these challenges abroad. To me, these statistics suggest that there is a big opportunity to tackle domestic hiring challenges by cooperating with foreign companies. At the moment, most of Polish AI companies' business relationships with international partners are focused on sales, not hiring.

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Arek Kwoska
Managing Partner,
Rebels Valley

Polish AI companies struggle with many challenges to achieve commercial success on an international scale. There is no easy way to fund and built a proprietary IP that can rule the world, however, the number of companies using their frameworks, libraries grows and brings hope that in the future we may become creators, not only assembling blocks from Google, MS, Amazon or others. There are many struggles on the way, but I hope we can soon convince every stakeholder that we need a strong, cooperating ecosystem. We need to invest in the domain, convince corporations to help commercialize AI technologies, open as many datasets as possible, and last, but not least - prepare our academia to educating researchers in the AI domain.

Michał Chromiak, PhD
Director of AI R&D, UBS

The nature of current highly specialized focus around optimization of specific processes seems a good start as a niche filling model. On the other hand, the lack of a holistic platform ecosystem is a challenge for gaining brand awareness (Challenges for AI companies | Sales & marketing), especially when competing with products delivered by market largest, FAANG-class players with scalable AI ecosystems supported by the multi-billion-dollar marketing budgets with already established brand awareness. From the technical point of view, the key is the volumes of quality data that is available to corporate AI teams, but at high cost, while on the other hand, it is hardly available for the academic researchers.
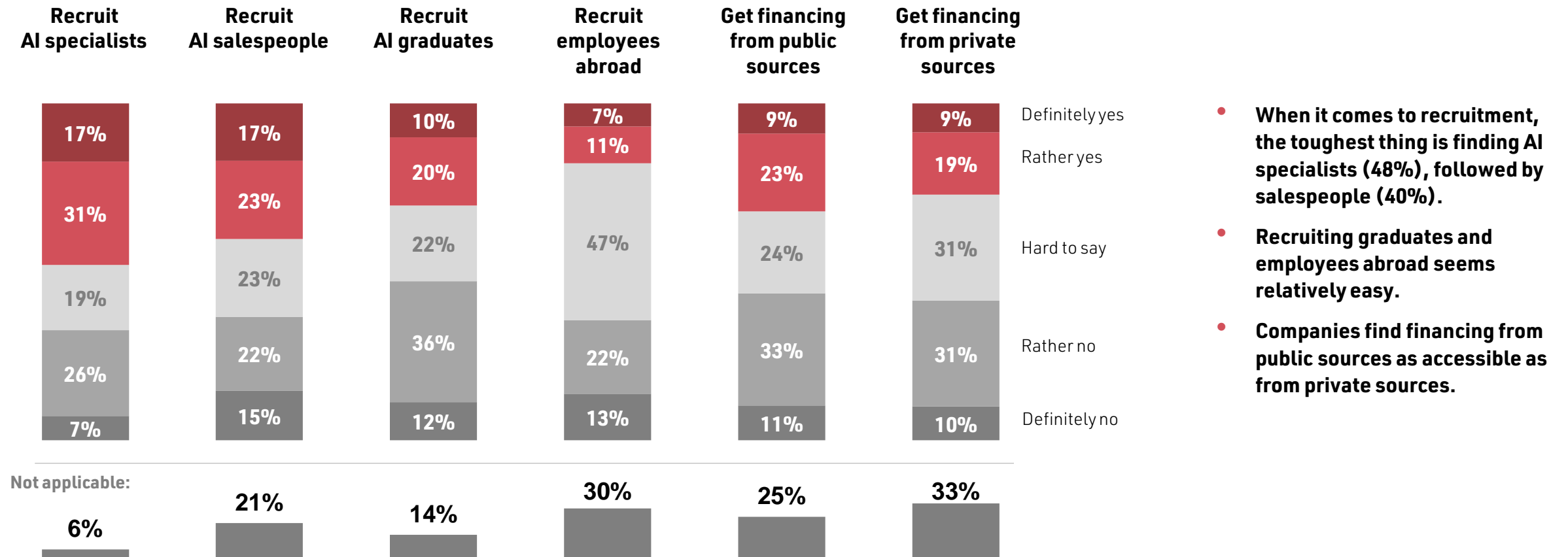
aipoland   digitalpoland   10SENSES

Boris Stokalski-Dzierzykraj
CEO,
Rethink

Product & marketing strategy challenges show an interesting discrepancy. While creating an internationally recognizable brand is the most challenging factor of all, winning the international accounts appears to be less challenging than winning domestic clients. It sounds as if Polish AI players were focused on more mature markets and better educated clients. Once the AI players have a chance to pitch the product to a buying client, they are able to communicate their value proposition, and get the deal. The problem of getting valuable international leads is of a different nature – Polish companies are arguably more skilled in product design than in brand management and international sales. This deficiency might be overcome if Polish AI vendors were supported by meaningful technological diplomacy, but apparently this is not what is happening. The public sector does not support the growth of AI business in Poland – on the contrary, it is considered its most challenging partner. And not just harder to cooperate with than commercial entities, but significantly more challenging than foreign public sector organizations.

Is it difficult for your organization to...?

Recruit AI specialists	Recruit AI salespeople	Recruit AI graduates	Recruit employees abroad	Get financing from public sources	Get financing from private sources	
17%	17%	10%	7%	9%	9%	Definitely yes
31%	23%	20%	11%	23%	19%	Rather yes
19%	23%	22%	47%	24%	31%	Hard to say
26%	22%	36%	22%	33%	31%	Rather no
7%	15%	12%	13%	11%	10%	Definitely no

Not applicable:

6%	21%	14%	30%	25%	33%

- **When it comes to recruitment, the toughest thing is finding AI specialists (48%), followed by salespeople (40%).**

- **Recruiting graduates and employees abroad seems relatively easy.**

- **Companies find financing from public sources as accessible as from private sources.**

Sample: only AI companies & corporations | excluding academic teams

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The digital culture of an organization is not only about technology, but above all about people, their knowledge and their ability to use innovation. And it is their competencies that are the key if we think about unlocking the digital potential and taking full advantage of the opportunities that artificial intelligence brings. The market landscape clearly shows an increase in demand for positions that require increasing use of technology, including such specialized areas as machine learning or just AI. Securing employees or acquiring talent with the right skills is increasingly a difficulty for companies, and this is confirmed by the results of the report. At the same time, companies that are already implementing this technology - leaders in the use of AI - are investing more in their employees' skills. 66 percent of representatives from companies in our country that participated in the AI&Skills 2020 survey say they are actively building team skills. The remaining 34 percent have such plans in the near future. Therefore, bearing in mind the need to quickly prepare Polish employees to operate in the new digital world, we realize how important it is to engage technology providers in the development of digital competencies. Announcing in May 2020 Microsoft's investment in the development of Polska Dolina Cyfrowa, we set a goal of training 150,000 specialists over 5 years as part of initiatives and programs aimed at improving digital competencies. So far, after less than a year, we have already trained over 57 thousand people.

On the other hand, the answer to the difficulties in obtaining graduates may be close cooperation with the education sector at the academic level. Properly implemented technologies and training programs that show how to use them allow students to already use the right tools to prepare for the challenges of the labour market they will find after graduation. We support young people in acquiring the practical skills they need to collaborate and meet the global challenges of the digital economy.
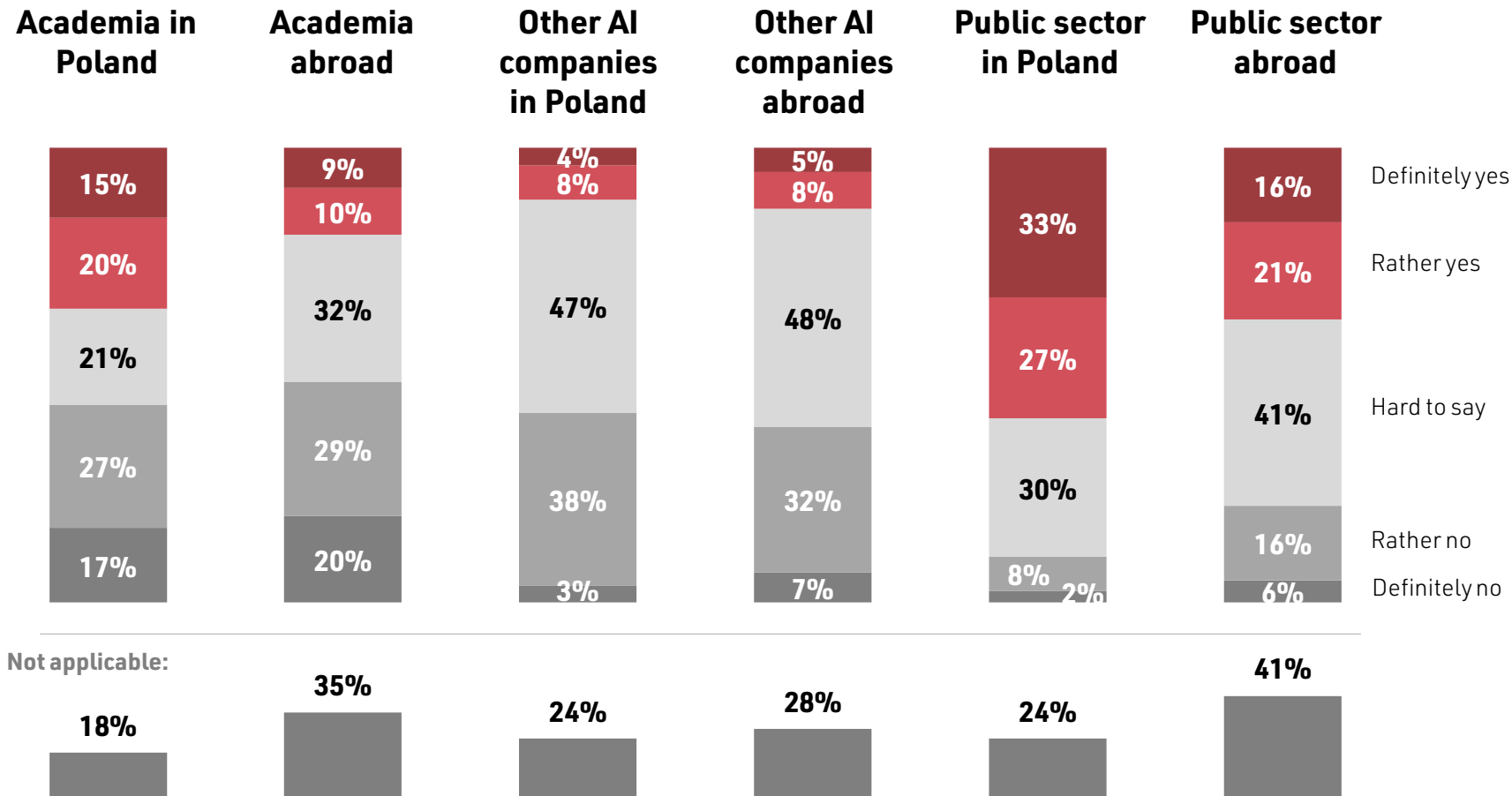
Rafał Albin
Chief Marketing and Operations Officer, Board member,
Microsoft Poland

Edyta Janas
Business Development Director,
Randstad Sourceright

Challenges in recruitment for the position of AI Specialist & AI Sales are strongly connected with the size of the talent pool, maturity of the market and type of organisations hiring the AI talent. Companies have to look for more creative ways of reaching out to candidates in the market and building their engagement in the recruitment process. Looking at the growth trends in the AI industry we should be prepared for a fierce competition regarding AI talent pooling.

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Is it difficult for your organization to cooperate with…?

Academia in Poland	Academia abroad	Other AI companies in Poland	Other AI companies abroad	Public sector in Poland	Public sector abroad	
15%	9%	4%	5%	33%	16%	Definitely yes
20%	10%	8%	8%	27%	21%	Rather yes
21%	32%	47%	48%	30%	41%	Hard to say
27%	29%	38%	32%	8%	16%	Rather no
17%	20%	3%	7%	2%	6%	Definitely no

Not applicable:

18%	35%	24%	28%	24%	41%

- **Cooperation with external partners may be difficult, if it is the public sector. 60% of companies find cooperation with Polish public institutions difficult. This statistic for foreign public sector is far lower (37%).**

- **Similarly, cooperating with academia in Poland is seen as more difficult (35%) than in other countries (19%).**

- **Cooperation with other AI companies is generally viewed as unproblematic.**

Sample: only AI companies & corporations | excluding academic teams

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Piotr Mieczkowski
Managing Director,
Digital Poland Foundation

Two things struck me strongly when I began to analyze the results of the survey on the quality of collaboration.

First, you can see a huge difference in the range of problems in collaboration with the scientific sector. The Polish science sector, according to AI companies, is rated much lower than their peers outside of Poland.

Secondly, a similar big difference in the quality of cooperation can be seen in terms of cooperation with government administration. Cooperation with the public sector in Poland is rated much lower than with governments in other countries.

Both results show how much more we could achieve if we in Poland cooperated better with each other. That is why I see all the more the need for the Foundation which first of all stakes on the inclusive dialogue that does not exclude anyone, but also encourages to discuss the issues. Without cooperation we will not be able to build a leading AI ecosystem in the world.

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What difficulties do you face in implementing AI solutions? Choose three most correct answers.

Challenge	%
No readiness to invest in innovation and AI by the client	40%
Difficulties in moving from PoC to production	36%
Cannot obtain quality data	33%
No understanding of AI among client's management	29%
High cost of obtaining quality data	23%
No understanding of AI among client's operations and lower ranks	20%
High cost of computation	11%
Lack of business case for AI	10%
Lack of ready-made algorithms	7%
High cost of licensing & software	3%

- **There are many difficulties in implementing AI. On the client side the main issue is that potential clients are often not ready to invest money in AI. 40% of AI teams point at this implementation blocker.**

- **There are also more technical bottlenecks. Moving from proof of concept to production can be difficult (36%) and there may be a problem with obtaining data that is of good quality (33%).**

- **On the other hand, cost of technology is usually not the problem. Only 11% of AI teams see high cost of computation as a blocker and only 3% point at cost of licensing and software.**

Sample: AI companies, corporations & academic teams

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Michał Mądry
Managing Partner, Enky Consulting

The scaling of AI innovations and securing resources of the receiving organization prove to be the main challenges in implementing AI. Such endeavours are inherently risky and in times of high uncertainty they are often dropped in favour of other projects. Effective implementation of AI in complex organizations requires not only money, but also time & effort of employees to – among others – properly collect, process and consolidate data. In a corporate world of limited resources and politics this becomes a difficult obstacle. However, companies need to be able to overcome these challenges, as innovation becomes the key contributing factor to achieving a competitive advantage. Most of the solutions to these challenges lie in the efficient program management and change management. Utilizing best practices of program benefit management, strategy alignment or sponsorship allows to increase probability of a successful AI implementation.

Radosław Kita
Head of AI,
Ringier Axel Springer Polska (RASP)

Our organization is quite specific. We are a technology hub for a large publishing group. I have no problems finding clients. But we face two serious problems.

The first is to recruit the right specialists. Unfortunately, in our case, the crossbar is hung quite high. We process huge amounts of data. And our solutions need to be fast and reliable. So apart from the knowledge in the area of machine learning or AI, we expect candidates to also have a high programming culture, the ability to create efficient code and work in a very modern environment. During the last recruitment, we had to go through almost 100 CVs before we found the right person.

The second challenge is the inability to delegate PoC to smaller organizations or research units at academia. In this case, we are struggling with exactly the same problems that we know from the search for employees.

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Ewa Nowakowska
 Associate Partner,
Head of Data Science,
EY

For those who acknowledged the AI opportunities, we see the interest advancing from thinking where AI can bring value, to understanding what it takes to effectively implement it. This is the phase when technical and practical challenges could occur. Whether it is a custom implementation of an existing solution or a move from PoC to its productization, with AI solutions this can hardly be done in isolation. The successfully managed process requires engagement on multiple levels - starting with the availability of the AI ready deployment platform with broad data access to company resources, through close collaboration between engaged functions, to adjustable processes and paradigm shift in assessment of compliance with regulatory requirements. For organizations facing these challenges and being anxious to productize AI solutions principally for the first time, it could be valuable to rely on professionals and their expertise. We see the learning curve to be steep with the first AI project typically triggering the foundational effort and hence accelerating subsequent implementations.

Kamil Konikiewicz
Head of AI,
PKO Bank Polski

It's great to see how dynamically the Polish Artificial Intelligence industry is developing, but we should always want more. Responsible popularization of this technology requires many activities - building awareness of technology in the society, encouraging education in sciences, supporting start-ups and small businesses through networking, financing and organizational and regulatory facilitations. I am glad that the community is becoming more and more involved in these issues, but I see potential for improvement in each of these aspects.

From my perspective, the biggest limitation of AI development in Poland are: the number of domain experts available on the market, insufficient focus on finalizing AI initiatives with implementations, and insufficient activities attracting foreign investors, including companies from the big tech sector. Although, in the last aspect, major changes have been seen recently - for example in the context of cooperation between the National Cloud Operator and global technology providers such as Microsoft or Google.

Darek Kociecki
Chief Growth Officer,
Neoteric

Lack of business case for AI is perceived as a blocker by only 11% of respondents while no readiness to invest in innovation and AI by the client is perceived by 44%. It seems that the key to the market is in the hands of the clients.

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What difficulties do you face in implementing AI solutions? Choose up to three most correct answers.

	AI companies	**Corporations**	**Academia**
No readiness to invest in innovation and AI by the client	48%	24%	22%
Difficulties in moving from PoC to production	41%	24%	26%
Cannot obtain quality data	33%	29%	35%
No understanding of AI among client's management	35%	18%	13%
High cost of obtaining quality data	20%	53%	13%
No understanding of AI among client's operations and lower ranks	24%	18%	9%
High cost of computation	9%	18%	13%
Lack of business case for AI	14%	0%	0%
Lack of ready-made algorithms	8%	0%	9%
High cost of licensing & software	2%	0%	9%

- **AI companies will tend to see obstacles in implementation in clients' not being ready to finance AI projects (48%) or in their management not understanding the technology (35%).**

- **However, the key challenge for AI teams in corporate structures is the cost of obtaining high quality data (53%).**

- **For Academic teams the main issue is access to good quality data (35%).**

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Andrzej Sobczak
Associate Professor, SGH,
Editor-in-chief of
Robonomika.pl

The results of the survey on barriers to AI implementation by Polish companies aptly confirm my observations. The main obstacles relate to organizational, cultural and data acquisition issues, not strictly technological aspects. The observation that in Poland innovation management consists in avoiding them is also confirmed. This can be seen in the reluctance to invest in AI solutions.

I am afraid that huge work will be required to change the attitude of Polish managers - that it is the production implementation of AI that will constitute the source of the competitive advantage of companies in the upcoming years. In order to change this, it is necessary in the first step to build at least basic knowledge among the managerial staff about AI, in the second - to indicate the role of well-prepared data, and only finally, talk about preparing and scaling AI implementations. Of course, companies are not uniform, and those that already decide to implement large, innovative AI projects will overtake other companies in their industry.

Marcin Stachowiak
Head of Intelligent
Automation Lab,
Capgemini

The report confirms one of the biggest challenges for companies looking to use AI is operationalizing machine learning (moving from pilot to full-scale production) as well as good understanding of AI by investors and end users.

To overcome these difficulties, AI projects should be spread over four stable pillars:

- Client Journey and Client Education - before looking into what AI can technically do, the good understanding of clients must be the first step toward excellent client experience that lifts satisfaction, loyalty and minimizes the gap between expectation and reality.

- Reproducibility - having achieved the first step the next step is to make the AI project reproducible so that other team members with minimum effort can get the same results, even at distant time intervals.

- Pipeline Versioning - treating ML training code, models, and datasets as first-class citizens and having all them versioned as well as well-integrated with a Continuous Delivery pipeline makes machine learning easy, accurate, and fast at scale.

- Continuous Learning - the work of data scientists is often seen as traditional software engineering where a set of fixed rules must be implemented. Machine learning is the opposite - based on changing data, AI models are allowed to change and grow - that's why ML models rotation is an ongoing and natural process, since data and conditions often change.

Regardless of the platform and technology used, sticking to all these patterns is the 'holy grail' these days and establishes the first-class Machine Learning Craftsmanship approach.

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#13. AI Policy & AI Ecosystem Development

1 **Beginning of the work on AI strategy** [Apr 2018] Visegard 4 countries declaration on AI

2 **Assumptions for AI Strategy** [Nov 2018] the document is published as a result and summary of workshops

3 **Conference on AI strategy** [Jan 2019] a 2-day conference is held during which AI strategy is discussed between the government, researchers and private companies

4 **Draft of the Policy for the Development of AI** [Aug. 2019] draft version of the document is presented, it contains the outline of an AI strategy

5 **Consultations** [2020] Consultations regarding both the planned Policy for the Development of AI and the plans for AI on the EU level

6 **Policy for the Development of AI** [Dec 2020] AI policy adopted by the Council of Ministers

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- **Polish AI strategy assumes the coordination of various public institutions. Some are already in place and operate. Others will be created.**

- **The AI Policy Task Force will be the main body responsible for coordinating the strategy.**

- **The goal is to boost the R&D output and increase the compe-titiveness of the economy. At the same time it puts emphasis on ethical, legal and societal effects of adopting AI.**

1

**Coordination
AI Policy Task Force**

2

**Public Services
GovTech Poland**

3

**Cybersecurity
Cybersec AI as part
of NASK Institute**

4

**Science
Virtual Research
Institute**

5

**Legal Framework
AI Legislation
Group**

6

**Implementation
Platform for Industry
of the Future**

7

**Implementation
Digital Innovation Hub**

8

**Implementation
Learning Factory**

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1   **University courses:** financing of additional 1000 students on AI and cybersecurity

2   **R&D implementation:** USD 190 mln on early stage projects in 12 AI problems

3   **Open data:** Initiative on raising the accessibility of public data

4   **Data trust:** Legal framework around contracts which allow for data exchange

5   **Raising awareness:** Plans on raising the understanding of AI among general public

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How do you rate Poland's AI policy?

Negative

Positive

12%

25%

23%

I did not know it was
created

40%

I had no time to read it
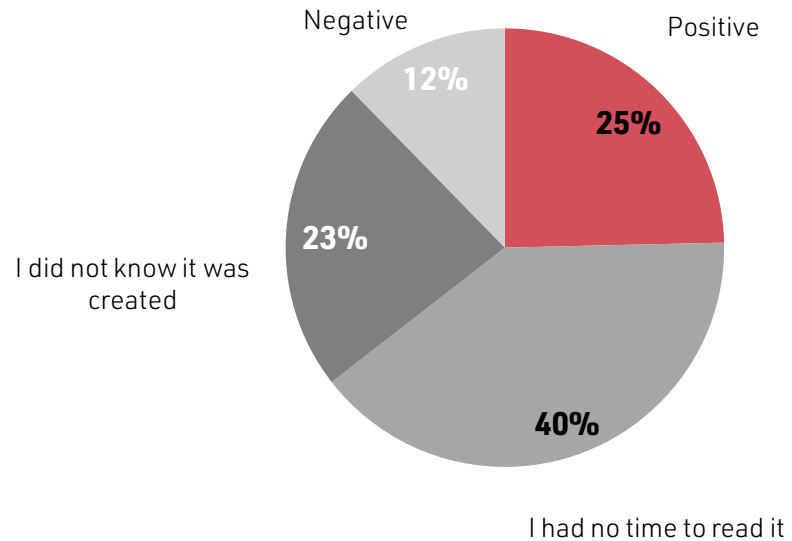
- **The AI policy was adopted by the Council of Ministers in early January 2021. We conducted our survey through February 21. A significant part of the ecosystem has not yet had time to read it, even though the document has been publicly available since the fall of 2020.**

- **One in four participants in the AI ecosystem is unaware that a document has finally been completed. Public administration definitely needs to improve the AI policy communication.**

- **68% of market participants who have had time to get acquainted with it evaluate it positively.**

Sample: AI companies, corporations & academic teams

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Weronika Kuna
Government Affairs Lead,
Microsoft

Every technological revolution, which is undoubtedly the case with the development of artificial intelligence, requires cooperation and teamwork in order to serve both the economy and society as a whole. "Policy for the Development of Artificial Intelligence in Poland" is a directional document, the result of many months of cooperation and dialogue between interested groups. It manages to include many aspects of the complex ecosystem of artificial intelligence development, such as education, regulation and ethics. We are aware that strategic documents age quickly - in this context, we are very pleased that the Policy is to be a living document, as evidenced by the very strong composition of the appointed Artificial Intelligence Working Group at the Chancellery of the Prime Minister.

Poland is on the eve of intensive development of AI solutions. We are working intensively to ensure that Microsoft's investment in a state-of-the-art data centre will unlock the enormous technological potential that Poland has. It is good that the discussion about the shape of the ecosystem is taking place before the moment of rapid intensification of development of this technology in the country. This is a clear signal to us in what direction we want to go as a society so that the development of AI is not just an end in itself but a tool for real social and economic change. At Microsoft we believe that the development of artificial intelligence is a great opportunity, but we do not turn our eyes away from the risks it brings. Ethical and sustainable development of the digital ecosystem is a global priority for us, which we are realizing in Poland by jointly building the Polish Digital Valley.

Paweł Rzeszuciński, PhD
Chief Data Scientist,
Codewise

It's worrying to see that the great majority of the companies didn't get acquainted with the content of the Polish AI strategy nearly half a year after its release. The reason may be that Polish companies don't perceive the government as a stakeholder that can bring anything of value to the functioning of their business. The government should focus on engaging in activities that would result in successful, business-oriented case studies and communicate it relentlessly. This should help in convincing the businesses that the government's AI-related initiatives are spaces worth watching. Goverment should also engage with leading NGOs, like Digital Poland, and AI community to build fit-to-purpose Digital policies.

Frequently raised opinions on Polish AI Policy

Lack of financial commitment

- "No additional financial resources were assigned. This makes it impossible to achieve most of the goals set up in the document"
- "The strategy assumes that the goals can be reached without spending large amounts of money"

Unclear goals and absent KPIs

- "It lacks indicators, and there is no time horizon for meeting them"
- "More concrete mid-term goals. There are tasks [...] but what then? Who will be working on accomplishing them? How? When will it be announced?"

Lacks clearly assigned responsibilities

- "The responsibility for execution is not assigned. A list of a dozen strategic partners gives us nothing"
- "It lacks details and assignments for particular institutions"

International promotion is needed

- "It should concentrate [among others] on supporting the promotion of brands and products internationally"
- "It seems that we have many SMEs with considerable achievements, but they need promotion abroad"

Piotr Mieczkowski
Managing Director,
Digital Poland Foundation

Polish AI ecosystem very clearly pointed out in our survey some of the weaknesses of the announced AI Policy. It is a certain Polish affliction that when a strategy or policy is announced, it is not followed by any or very modest public money. Such is the case with the 5G strategy, cybersecurity, or AI in particular. I'm glad that there are funds e.g. in NCBR within INFOSTRATEG for R&D, but it is still NOT enough. AI policy must receive comprehensive funding from the government, otherwise Poland will lose its future. AI Policy should also get specific funding from the EU (EU Recovery Fund, MFF 2021-2027). I am concerned that we have not been able to work very closely together in 2020 to come up with detailed ideas in this area, and I did not find them in the "KPO" (EU Recovery Fund) that was announced in March 2021.

Coming from a business background, I know very well what it means to implement a strategy. Some even say in business that strategy without clear KPIs is a mirage in the desert. This is why a strategy needs specific KPIs, so that we know after a year whether a certain objective has or has not been achieved. This would allow to fine-tune the policy after couple of year.

The last very important thing is accountability. The strategy should be well communicated and should also be translated to English to help bring in AI experts and scientist to Poland. The tasks should be clearly assigned to specific entities. This way it is clear what can be required of whom.
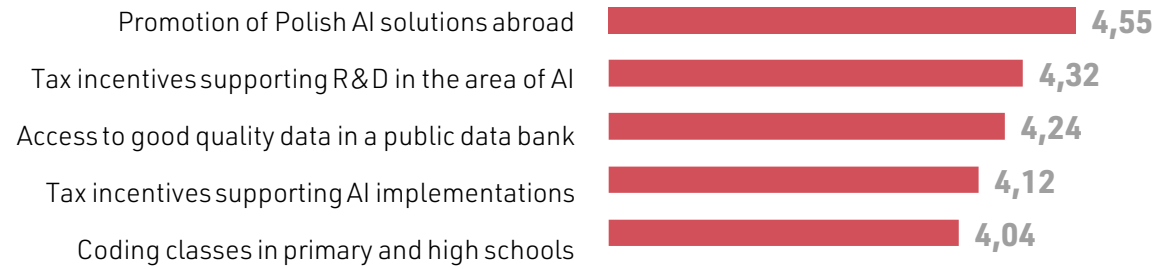
Nevertheless, I consider the creation of an AI policy to be a good start, and as the Digital Poland Foundation we are making every effort to see it implemented. We have already made our contribution, for example by co-creating the INFOSTRATEG programme, but we can still do a lot together. That is what is most important - cooperation. Therefore, if you want to run fast, run alone but If you want to run further, run together. Only together. That is why I invite absolutely everyone to cooperate with us in order to make Poland a world's leading center of digital innovation and AI. It will also allow Europe to develop its full potential and build bridges between European AI hubs.

We asked a series of 35 questions about activities that could support the development of AI in Poland. Statements were rated on a scale from 1 to 5 (from unimportant to the most important). Answers were collected from the whole AI Polish ecosystem and later anonymized. On the next several pages we presents the main findings.
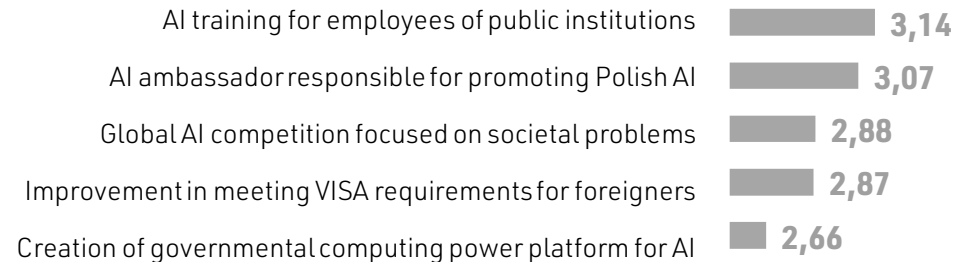
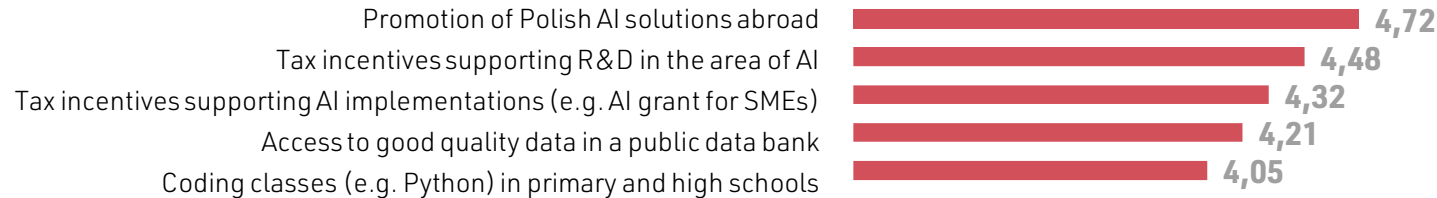## What should be primarily done to make Poland a hub for AI in Europe?

TOP 5
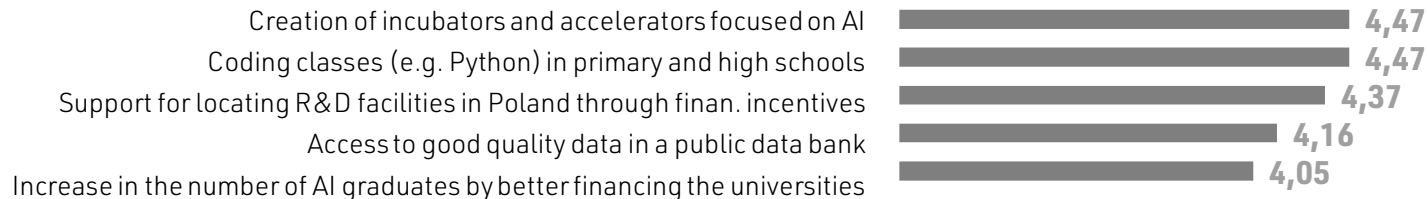
Promotion of Polish AI solutions abroad	4,55
Tax incentives supporting R&D in the area of AI	4,32
Access to good quality data in a public data bank	4,24
Tax incentives supporting AI implementations	4,12
Coding classes in primary and high schools	4,04

BOTTOM 5

AI training for employees of public institutions	3,14
AI ambassador responsible for promoting Polish AI	3,07
Global AI competition focused on societal problems	2,88
Improvement in meeting VISA requirements for foreigners	2,87
Creation of governmental computing power platform for AI	2,66

- **The activity most desired is promotion of Polish AI companies (average of 4,55). Followed by tax incentives for R&D (4,32) and access to quality public data (4,24).**

- **On the other hand, respondents are most critical of creating a public computing platform for AI (2,66), improving VISA requirements (2,87) or creating a global AI competition (2,88).**

Sample: AI companies, corporations & academic teams

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What should be primarily done to make Poland a hub for AI in Europe?

AI companies

Promotion of Polish AI solutions abroad	4,72
Tax incentives supporting R&D in the area of AI	4,48
Tax incentives supporting AI implementations (e.g. AI grant for SMEs)	4,32
Access to good quality data in a public data bank	4,21
Coding classes (e.g. Python) in primary and high schools	4,05

Corporations

Creation of incubators and accelerators focused on AI	4,47
Coding classes (e.g. Python) in primary and high schools	4,47
Support for locating R&D facilities in Poland through finan. incentives	4,37
Access to good quality data in a public data bank	4,16
Increase in the number of AI graduates by better financing the universities	4,05

Academia

Better access to research grants for AI researchers	4,61
Promotion of Polish AI solutions abroad	4,57
Access to good quality data in a public data bank	4,43
Support in international grants, e.g. point of contact for Horizon Europe	4,22
Increase in salaries of AI scientists	4,22

- **While everyone agrees as to the value of better access to data, expectations regarding support for AI vary significantly depending on professional affiliation.**

- **People from AI companies support tax incentives which would reduce cost of their services to end clients.**

- **Corporations see more value in incubators, accelerators and support in locating R&D centers.**

- **Scientists point to the importance of financial and organizational support in science.**

Sample: AI companies, corporations & academic teams

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Magdalena Piech, PhD
Head of Regulatory
Affairs,
Allegro
Chair of the European
Tech Alliance

Polish and European tech companies have the potential to seize the opportunities offered by AI and take a global leadership position in this field.

However, this will only be achieved if the right conditions are in place, providing businesses like ours with a conducive environment for talent development, innovative R&D and investment as well as an educational system that provides the necessary skills for future generations.

While the Polish national strategy is a good first step, there is still much to be done to make Poland and Europe a global AI Hub, as Digital Poland's report points out.

The upcoming EU regulation on AI and Data Governance and currently negotiated Digital Services Act will be essential elements in this equation.

Allegro and the European Tech Alliance (the EUTA) I have the honour to be the Chair of is an active player in this debate. As the Alliance brings together Europe's digital champions and scaleups we stand ready to share our views and expertise on AI and Machine Learning with Polish and EU policy-makers as they continue shaping the policy framework for AI.

Allegro continuously strives to offer the best service to our clients. Innovations and efficiencies that machine learning and AI bring translate into better service to our clients and employees, technological improvements and eventually make our companies more competitive.

It is important that any new rules take a risk-based approach and adopt a clear and not overly broad definition of AI. Introducing heavy AI requirements for non-high-risk applications would create knock on effects on competitiveness and innovation and can lead to algorithmic systems' bypass and humper users' experience.

The EUTA supports self-regulation as an appropriate tool for low-risk applications, in order to ensure flexibility and safe AI performance. For instance, most known AI uses in sectors like e-commerce do not pose systemic threats to public health, legal or financial stability and should not be faced with the same requirements as high-risk applications.
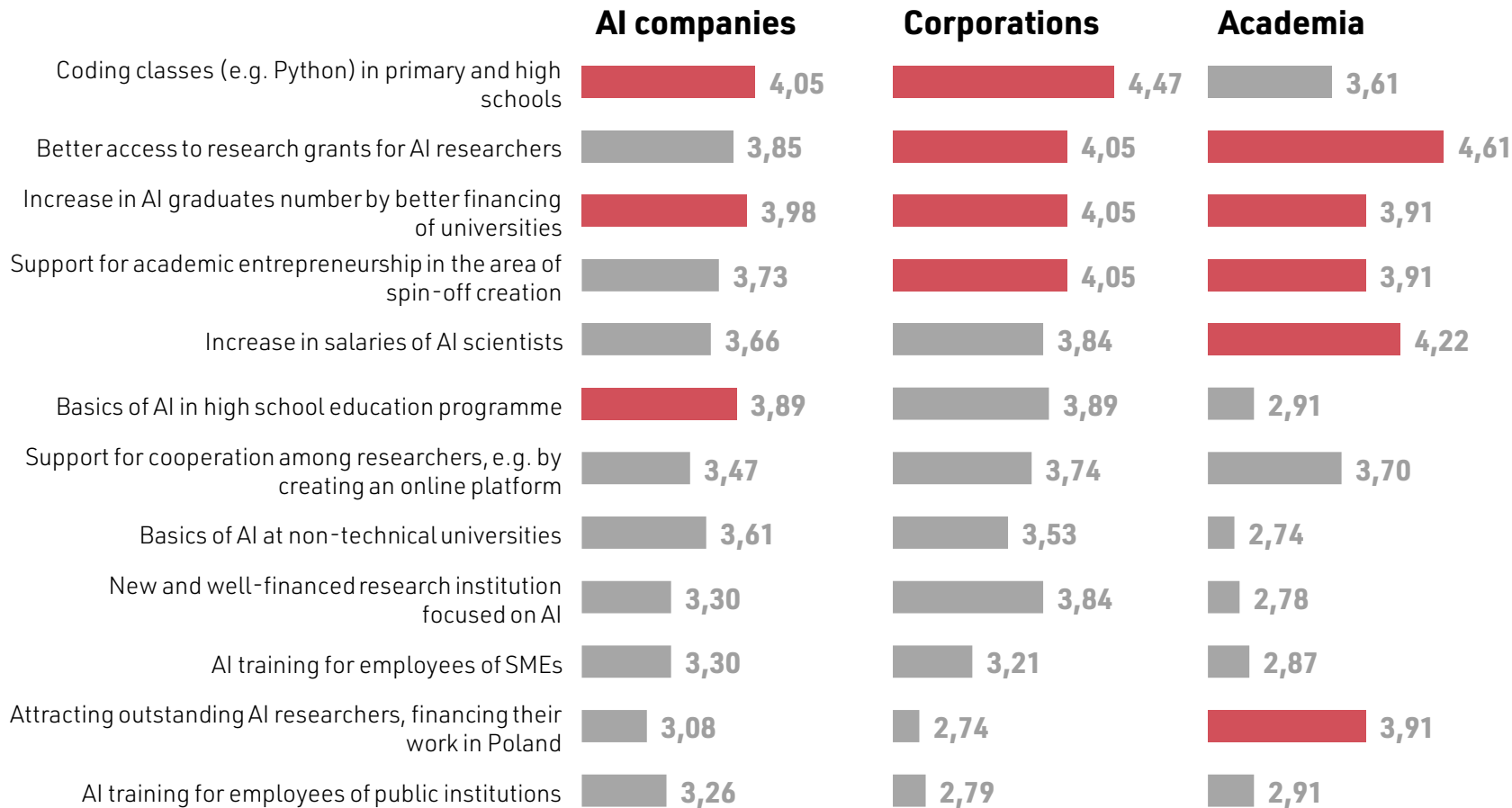
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What should be primarily done to make Poland a hub for AI in Europe?

Coding classes (e.g. Python) in primary and high schools	**4,04**
Better access to research grants for AI researchers	**4,01**
Increase in AI graduates number by better financing of universities	**3,98**
Support for academic entrepreneurship in the area of spin-off creation	**3,80**
Increase in salaries of AI scientists	**3,78**
Basics of AI in high school education programme	**3,72**
Support for cooperation among researchers, e.g. by creating an online platform	**3,54**
Basics of AI at non-technical universities	**3,46**
New and well-financed research institution focused on AI	**3,29**
AI training for employees of SMEs	**3,22**
Attracting outstanding AI researchers, financing their work in Poland	**3,17**
AI training for employees of public institutions	**3,14**

- **As for education, three best viewed policies would be coding classes (4,04), better access to research grants (4,01) or financing a higher output of AI graduates (3,98).**

- **On the other hand, various forms of AI training for non-specialists are viewed as non-essential.**

- **At Digital Poland, we see academic research as a key, yet often over-looked, aspect of the AI ecosystem. Thus we emphasize the importance of organizational and financial support for scientific research. Both from the government and the private sector. It is crucial for long-term development of AI in Poland.**

Sample: AI companies, corporations & academic teams

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What should be primarily done to make Poland a hub for AI in Europe?

	AI companies	Corporations	Academia
Coding classes (e.g. Python) in primary and high schools	4,05	4,47	3,61
Better access to research grants for AI researchers	3,85	4,05	4,61
Increase in AI graduates number by better financing of universities	3,98	4,05	3,91
Support for academic entrepreneurship in the area of spin-off creation	3,73	4,05	3,91
Increase in salaries of AI scientists	3,66	3,84	4,22
Basics of AI in high school education programme	3,89	3,89	2,91
Support for cooperation among researchers, e.g. by creating an online platform	3,47	3,74	3,70
Basics of AI at non-technical universities	3,61	3,53	2,74
New and well-financed research institution focused on AI	3,30	3,84	2,78
AI training for employees of SMEs	3,30	3,21	2,87
Attracting outstanding AI researchers, financing their work in Poland	3,08	2,74	3,91
AI training for employees of public institutions	3,26	2,79	2,91

- **Generally, AI companies and corporations have similar expectations in the area of education. One exception would be that people from corporations value the idea of creating a new and well-financed research institution focused on AI.**

- **People from the scientific community, however, expect a better access to research grant, support in the area of spin-offs and an increase in salaries of scientists.**

Sample: AI companies, corporations & academic teams

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Michał Chromiak, PhD
Director of AI R & D, UBS

AI – along with blockchain technologies – is the cutting edge of the technology and the global market will promote only those solutions that give the market an advantage with the innovation or performance. There is a great market for AI, thus good local products that can compete with global alternatives will be able to gain funding, however, to obtain this class of innovation in local products the government should focus on building a grant and consortium-based ecosystem of academia and industry cooperation without the need to move research scientists from Universities to industry. Moving researchers to industry usually means they are expected to focus on implementation and not innovation, and thus results in a drop of the number of experts dedicated to found the innovation.

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Jerzy Stefanowski
Professor at the Institute of
Computing Science,
Poznań University of
Technology

The Polish research community is also changing. In order to boost research and integrate various groups, the main AI oriented societies founded the Polish Alliance for the Development of Artificial Intelligence (PP-RAI).

Furthermore, the international visibility of Polish AI and ML researchers is also slowly increasing. It is in line with one important question in the survey "What should be done to make Poland a European AI hub"- where the most common answer is – promote Polish AI solutions abroad. The indications for a better access to research grants for AI researchers and financing the higher output of AI graduates are also clearly visible in other answers, which I strongly support. Although some universities have recently started new AI, ML or Data Science specializations or similar interdisciplinary study programs, many more efforts should be made and it has to be definitely better financially supported by the State. Bear in mind that many respondents indicate they expect many more well-educated specialists from universities. To sum up, this survey nicely demonstrates the authentic commercial and industrial rise of interest in Artificial Intelligence and the increasing role of Polish companies and organizations in the international context. I hope it will not only concern applications of the research results, but also supporting scientific investigation.

Nevertheless, the greater involvement of companies and government institutions in establishing new and specialized research, excellence centres at universities, such as in many European countries, should be expected. Good inspirations to new forms of the public-private partnership in the more applied AI, Big Data or Robotics are definitely and even desperately needed, see e.g. DFKL (German Research Center for Artificial Intelligence) or other joint university-industry AI or ML oriented centres, just recently started to work on cutting-edge research projects. In this context the answer on the relatively low companies' current involvement in knowledge-industry transfer clusters or special Digital Innovation Hubs is a bit alarming, also knowing EU plans on AI policy

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Sylwia Sysko-Romańczuk,
Professor of
Entrepreneurship and
Technology Management,
Faculty of Management,
Warsaw University of
Technology

Quantitative aspects and everyday needs of the surveyed companies, such as more coding classes (4.04), better access to research grants for AI researchers (4.01) and increasing the number of AI graduates (3, 98), seem to be a panacea for creating an image of Poland as an AI hub in Europe. These claims are not surprising, because companies and their clients are currently at the stage of "fast path" adoption of AI solutions. We will have to wait a while for the effect of the scale of these solutions for companies, economy and society.

It is interesting that the opinions between business and academia differ a bit. Business is looking first of all for hands to work "for now": developers, engineers and data science analysts. Companies expect the AI ecosystem to provide a mechanism for systematic and constant delivery of "AI resources" to the market. The academy, on the other hand, needs financial capital to create internal and new capabilities in order to produce AI resources that are so needed by the market.

The quantitative needs of the market can only be satisfied under the condition of radical qualitative changes in academia. Inevitable, ground-breaking and global changes in the social structure of the work, taking place thanks to the AI technology saturation, call for a new approach to education system modelling. More and more physical work is becoming automated, as well as more and more intellectual work is becoming automated. There is a growing demand for creative and innovative work in every area of the economy. The traditional educational model fits the third industrial revolution and is currently generating masses of the unemployed. According to the surveyed companies, half of the failures in adopting their AI solutions are due to the internal obstacles of their clients. The transformation of work processes does not have a central oversight centre. It takes place in a distributed network with all its consequences. New wine must be poured into new wineskins.

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What should be primarily done to make Poland a hub for AI in Europe?

Promotion of Polish AI solutions abroad	**4,55**
Support for networking and organisations (AI foundations, societies, clusters)	**3,72**
Joint Polish AI stand on main tech events	**3,62**
Support in international networking, e.g. financing the participation in tech events	**3,54**
Creation of public guidebooks, case studies, lists of suppliers	**3,49**
Promotion of best AI solutions (including foreign ones) internally in Poland	**3,44**
English guidebooks on AI in Poland, promoting points of contact	**3,30**
AI ambassador responsible for promoting Polish AI	**3,07**
Global AI competition focused on societal problems	**2,88**

- **Promotion outside of Poland is viewed by many as the most important type of support the state could offer.**

- **Support in networking or a joint Polish AI stand on main tech events is also seen as helpful.**

- **Two ideas which were clearly rejected were the creation of an AI ambasador and a global competition focused on societal problems.**

Sample: AI companies, corporations & academic teams

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What should be primarily done to make Poland a hub for AI in Europe?

	AI companies	Corporations	Academia
Promotion of Polish AI solutions abroad	4,72	3,68	4,57
Support for networking and organisations (AI foundations, societies, clusters)	3,71	3,58	3,91
Joint Polish AI stand on main tech events	3,73	3,32	3,39
Support in international networking, e.g. financing the participation in tech events	3,66	3,26	3,30
Creation of public guidebooks, case studies, lists of suppliers	3,60	3,21	3,26
Promotion of best AI solutions (including foreign ones) internally in Poland	3,58	2,95	3,26
English guidebooks on AI in Poland, promoting points of contact	3,45	2,95	2,96
AI ambassador responsible for promoting Polish AI	3,27	2,58	2,61
Global AI competition focused on societal problems	3,01	2,58	2,57

- **AI specialists from all domains would value better promotion of Polish AI solutions abroad. However, for people from corporations it is relatively less important.**

- **Scientific community sees also the importance of support in international networking.**

Sample: AI companies, corporations & academic teams

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Kamil Rocki, PhD
Software Engineer, Brain-
Machine Interfaces,
Neuralink Corp.

Promoting Polish AI solutions abroad is good but will not necessarily make those solutions remain in Poland.

The three most important things are 1. Money, 2. Money and 3. Money.

Students in Poland should not have to find part-time jobs to complete their Ph.D. courses. Universities should fund scholars well enough to support them as well as equip the labs and be competitive. Moreover, being competitive in terms of resources is going to bring even more talent to Poland. To promote the entire ecosystem for innovation, both the government and corporations should contribute some funds to help start-ups/incubators. Possibly there should be some preferential treatment of foreign capital flowing into this AI area, such as tax incentive for R&D.

What should be primarily done to make Poland a hub for AI in Europe?

Tax incentives supporting R&D in the area of AI	**4,32**
Access to good quality data in a public data bank	**4,24**
Tax incentives supporting AI implementations (e.g. AI grant for SMEs)	**4,12**
Support in international grants, e.g. point of contact for Horizon Europe	**3,99**
Support for locating R&D facilities in Poland through finan. incentives	**3,96**
Creation of incubators and accelerators focused on AI	**3,90**
Significant public financing of Polish AI strategy	**3,78**
Creation of AI excellence centres	**3,75**
Procurement of selected AI technologies by the state	**3,54**
Better access to financing, e.g. creation of a public AI investment fund	**3,53**
Attraction of AI domain experts (e.g. healthcare) by establishing regulatory sandboxes	**3,43**
Better access to already available public computing power	**3,28**
Improvement in meeting visa requirements for foreigners	**2,87**
Creation of a governmental computing power platform for AI	**2,66**

- **Tax incentives in various forms are viewed as playing an important role in building a strong AI ecosystem,**

- **On the other hand, not all financial support is seen as supportive. In particular, the creation of a novel computing power platform received the lowest score (2,66).**

Sample: AI companies, corporations & academic teams

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What should be primarily done to make Poland a hub for AI in Europe?

	AI companies	Corporations	Academia
Tax incentives supporting R&D in the area of AI	4,48	3,95	3,96
Access to good quality data in a public data bank	4,21	4,16	4,43
Tax incentives supporting AI implementations (e.g. AI grant for SMEs)	4,32	3,68	3,65
Support in international grants, e.g. point of contact for Horizon Europe	3,97	3,84	4,22
Support for locating R&D facilities in Poland through financial incentives	4,00	4,37	3,48
Creation of incubators and accelerators focused on AI	3,85	4,47	3,61
Significant public financing of the Polish AI strategy	3,94	3,16	3,61
Creation of AI excellence centres	3,72	3,95	3,74
Procurement of selected AI technologies by the state	3,65	3,32	3,30
Better access to financing, e.g. creation of a public AI investment fund	3,58	3,53	3,30
Attraction of AI domain experts (e.g. healthcare) by establishing regulatory sandboxes	3,45	3,26	3,48
Better access to already available public computing power	3,15	3,26	3,83
Improvement in meeting visa requirements for foreigners	2,93	2,84	2,65
Creation of a governmental computing power platform for AI	2,64	2,68	2,74

- **Most AI specialists agree that access to good quality data from a public data bank is important in building the AI ecosystem. Especially the scientific community emphasises that.**

- **AI companies pinpoint the need for tax incentives both in the area of R&D and implementations.**

- **Corporations, highlight the need for supporting the location of R&D facilities in Poland. They also find the creation of incubators and accelerators important.**

- **The scientific community needs better access to computing power – something that is of lower importance to AI companies or corporations.**

Sample: AI companies, corporations & academic teams

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Kamil Rocki, PhD
Software Engineer, Brain-Machine Interfaces, Neuralink Corp.

The adoption rate of AI technologies in Poland should be drastically accelerated. AI technologies are directly linked to streamlining complex tasks requiring expensive human labour. Automation leads to increased productivity and GDP per capita, which will boost the budget for AI investments, creating a self-perpetuating mechanism. Some initial incentive needs to be provided to bootstrap this process.

The state should get serious about opening up public data such as that collected in the health, agriculture and transportation sectors. I would like to emphasize here that the key to AI development is annotated data, i.e. describing data for AI, and not the data itself, unstructured. I have the impression that many people do not realize that publishing data, completely undescribed, does not allow to achieve the full potential that lies in AI. Therefore, the government should pick a few strategic problems and start publishing concrete data so AI companies can use it and come up with solutions.

#14. Key AI Policy Recommendations

AI Policy | Better coordination: Currently, the AI policy has some flaws which should be fixed. In particular:

1. **A roadmap for artificial intelligence event** - In the spring of 2019, the Ministry of Entrepreneurship and Technology (MPiT) has organized for a meeting called Roadmap for Artificial Intelligence. It is necessary to return to annual meetings where the market can meet and discuss in what direction the development of AI in Poland is heading. State of Polish AI reports can be linked to this event by preparing the annual AI market survey.
2. **Allocate responsibilities** – all initiatives should have owners.
3. **KPIs** – progress should be measured by clear and transparent KPIs
4. **Financial budget** – currently, many initiatives lack budgets. AI policy should have a clear financial budget which would be allocated to initiatives. EU funding could be used.

Science | Support academic research teams: long-term development of AI requires stronger research teams. It is where world-class specialists get their experience. The currently implemented Constitution for Science seems promising. Nonetheless, we want to draw attention to the most important issues:

1. **National Science Centre (NCN)|** Create a programme aimed at financing key AI research. The program should be directed to research in the most important problems for Poland, such as health care (cancer), agriculture or transport. Create ambitious, world-class project to solve major issues. This will attract leading AI scientists and support scientific research teams.
2. **Create leading event |** Poland does not currently have a region-wide leading scientific event. Current conferences should be analyzed and a minimum of two events should be supported (funding, contests, expo, papers).
3. **Promote cooperation |** Promote collaboration by mapping all researchers and research units and then outsourcing research to teams rather than individual researchers. Promote collaboration with foreign scientist.
4. **Increase in salaries |** To keep talented specialists in the scientific sector basic salaries should be increased on all levels from PhD students up to tenured professors.

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Promotion | Promotion outside of Poland is viewed by many as the most important type of support the state could offer. Society should see benefits of automation:

1. **Promotion of Polish AI solutions abroad |** Support for organizations that promote Polish companies outside Poland and facilitate networking (eg Aipoland.org). Support for the creation of joint booths for AI companies and organizations at leading events such as Dubai Expo. State should also consider creating one website which promotes Polish tech (example https://www.swiss.tech/)
2. **Promotion of AI in the society |** Society must not be afraid of innovation and be open to automating work. This is especially true for the Polish society, which is aging. All initiatives explaining digitalization, such as Digital Festival, should be supported by the government. Any initiatives encouraging people to learn the basics of artificial intelligence such as #AIchallenge | Elementsofai.pl should also be promoted. Leading government officials and CEOs of state-owned companies should complete the above course, following the example of Finland.

Ecosystem | A number of activities to support the entire AI ecosystem in Poland:

1. **Access to good quality data in a public data bank |** For several strategic problems, such as cancer or climate change, the government should allocate public resources to prepare decently annotated data for AI. For example, there should be massive collection and release of annotated ultrasound (USG) results for AI companies.
2. **Tax relief, automation |** There should be tax relief for implementation of automation that applies not only to real robots and Industry 4.0, but also to AI implementations, especially in SMEs. It could be a kind of grant for automation in the amount of PLN 300 thousand per company (SMEs).
3. **Procurement templates for innovative AI projects |** The state could support the creation of templates that can later be used by officials to organize tenders for AI services. Many officials lack knowledge about AI, hence they are not able to prepare a normal market inquiry
4. **DIH AI |** The state should support the establishment of true AI DIHs to help SMEs as well as the public better understand AI. Leading centers should be supported, based on their experience in AI.

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#15. Polish AI Ecosystem and Why to Invest in AI in Poland

01 Leading cities

AI development concentrated in six large metropolitan areas. Warsaw is the AI Capital of Poland

02 AI Companies

300+ Polish dynamic AI companies with revenue mix from Poland and abroad. This includes i.a. Lingaro, Sales manago, Synerise, Netguru, Tooploox, RTB House, STX Next, Predica, Spyrosoft and many more!

03 R&D | GDS

40+ global companies that placed R&D, GDS, SDC in Poland. This includes i.a. Amazon, Aptiv, Citi, Google, Intel, EY, Nokia, Nvidia, Ringiex Axel Springer Tech, Samsung, T-Mobile, TomTom, UBS

04 AI Policy

AI policy took effect in 2021. This includes i.a. creating AI Virtual Research Institute, Three centers of AI excellence, New AI Institute - NCBR Ideas, 190 mln USD funding for applying AI, Open data policy

05 Institutions

Set of institutions supporting the development of AI in Poland. This includes i.a. NCBR, NCN, IPI PAN, OPI PIB, Digital Poland Foundation with aipoland initiative

06 Science

Several Scientific AI societies. In 2018, Polish Initiative for the Advancement of Artificial Intelligence (PP-RAI) was formed as an umbrella organization

07 AI events

Nine leading AI events that bring together AI professionals and researchers. This includes i.a. PP-RAI, ICAISC, TFML, PL in ML, Data Science Summit, PyData Warsaw

08 AI Communities

A dozen of dynamic communities and study groups that meet regularly, which a.i. include Warsaw.ai, MLGdańsk, Deep Learning Labs, SKALP Robotics Association, GMUM, Data Science Warsaw, DataOps Poland

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Allegro	Comarch	Lingaro	Sales manago	Ardigen	Synerise	Netguru	Tooploox	VirtusLab
Sages	RTB House	Applica	Deepsense	Future processing	PGS software	Digica	Brainly	QED Software
eDrone	Infermedica	Onwelo	STX Next	Nethone	Predica	Spyrosoft	alphamoon	SoftwareMill
Neurosys	Nomagic	Neoteric	Neptune.ai	VoiceLab	Lekta.ai	Yosh	addepto	Sotrender
BrainScan	Cosmose	Emplocity	Sport Algorithmics and Gaming	StethoMe	GetResponse	MIM Solutions	SentiOne	Codewise

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Nokia	Intel	UBS	Google	Samsung R&D Institute	IBM	Roche	Accenture
Epam	Credit Suisse	SII Group	EY	Capgemini	ABB	Aptiv	TCL Research Europe
Citi	P&G	Amazon	IQVIA	ING	TomTom	Ocado Group	OLX Group
Atos	Nvidia	T-Mobile	Bosh	ByteDance	Pearson OKI	Revolut	Nielsen IQ

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Financing of basic research on AI

Financing of AI implementation

Conducting research on AI

There are several institutions supporting the development of AI in Poland. These range from basic research through implementation to research on a broader impact of technology on the socjety.

Supporting digital and AI initiatives in Poland

Conducting research on AI, promoting AI in the society

Conducting research on AI

Conducting research on AI

Conducting research on AI

Organisation	Foundation	President
Polish Initiative for the Advancement of Artificial Intelligence (PP-RAI: Polskie Porozumienie na Rzecz Rozwoju Sztucznej Inteligencji)	**2018**	Coordination committee consists of 9 members who represent each of the 5 founding societies
5 PP-RAI societies:		
Polish Artificial Intelligence Society (Polskie Stowarzyszenie Sztucznej Inteligencji)	**2009**	Grzegorz J. Nalepa, AGH University of Science and Technology
Polish Neural Network Society (Polskie Towarzystwo Sieci Neuronowych)	**1995**	Leszek Rutkowski, Częstochowa University of Technology
Polish Special Interest Group on Machine Learning (Polska Grupa Systemów Uczących się PL SIGML)	**2013**	Jacek Koronacki, Polish Academy of Sciences; Jerzy Stefanowski, Poznań University of Technology; Michał Woźniak, Wrocław University of Science and Technology
IEEE Systems, Man, and Cybernetics Society, Polish Chapter		Ireneusz Czarnowski, Gdynia Maritime University
IEEE Computational Intelligence Society, Polish Chapter		Joanna Kołodziej, Warsaw University of Technology
Other societies:		
IEEE Robotics and Automation Society, Polish Chapter		Krzysztof Kozłowski, Poznań University of Technology
Association for Image Processing (Polish Member Society of the IAPR logo International Association for Pattern Recognition)	**1998**	Leszek Chmielewski, Warsaw University of Life Sciences
Network Science Society, Polish Chapter		Przemysław Kazienko, Wroclaw University of Science and Technology
Poland Chapter of IEEE Signal Processing Society		Piotr Augustyniak, AGH University of Science and Technology
International Neuroinformatics Coordinating Facility Node of Poland	**2007**	Tomasz Piotrowski, Nicolaus Copernicus University

- **There are many scientific societies focused on AI. Some have been active for more than two decades.**

- **In 2018, Polish Initiative for the Advancement of Artificial Intelligence (PP-RAI) was formed. It is an umbrella organisation aiming at coordinating activities of other societies.**

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PP-RAI
The Polish Initiative for the Advancement of Artificial Intelligence organises a conference aimed at discussing research and challenges facing the scientific community. It is held each year in different locations in Poland.

ICAISC
The International Conference on Artificial Intelligence and Soft Computing is focused on various aspects of artificial intelligence and machine learning. It is held annually in Zakopane and lasts five days.

TFML
The conference on Theoretical Foundations of Machine Learning Conference is organized by the Department of Machine Learning, Institute of Computer Science and Computational Mathematics, Faculty of Mathematics and Computer Science, Jagiellonian University.

PL in ML
A conference for young researchers focused on research and applications of deep learning. It is held annually, lasts four days and is addressed to researchers.

PyData
The largest data science conference focused on users of the Python language. It is held annually, lasts two days and is addressed to specialists.

Why R?
A conference focused on applications of R language. It is held annually, lasts two days and is addressed to specialists.

GHOST Day
Organised by the Staff of the Faculty of Computing and Telecommunications, Poznań University of Technology. It is held annually in Poznań, lasts two days and is addressed to specialists.

AI & NLP Day
A conference covering various topics of AI but with more focus on NLP. Includes the PolEval competition for NLP tools. It is held annually, lasts two days and is addressed to specialists.

Data Science Summit
A conference on various data science topics, including machine learning, big data and data visualisation. It is held annually, lasts one day and is addressed to specialists and students, employer branding.

AIPoland is an initiative of Digital Poland Foundation with aim to promote Polish AI ecosystem and enable collaboration between Polish and foreign entities in various areas including business cooperation, co-development of new initiatives and raising funds.
We hope to achieve this by providing a complete overview of Polish AI scene which includes key facts, events, the database of Poland-based companies, R&D centres, Universities as well as Public Policy and support for AI development.

Interactive, updated Map of Polish AI 2021 will be presented on our website after 16th May 2021. Don't forget to visit us!

Click to see aipoland.org
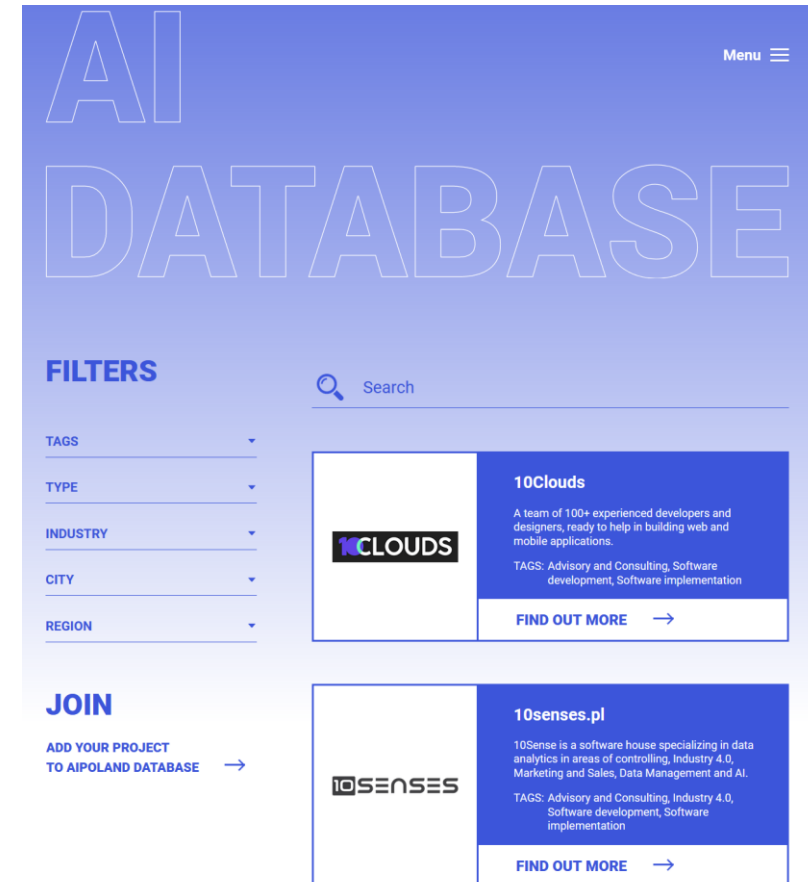
If you plan to invest in AI, then Poland is a perfect spot. It offers a highly-skilled workforce and a vibrant AI and tech ecosystem. It is for that reason that tech heavyweights have already invested here. It is also the reason why you should do so too.

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Human Resources

01

Each year about 15 000 computer science and nearly 100 000 STEM students graduate from Polish universities.

Strong Scientific Community

02

- More than 650 PhD or Professors have written their theses in the field of AI within the last 30 years.

- Almost 5 000 researchers have published their scientific papers in the field of AI within the last 5 years. Among them 1 500 are IT specialists.

Exceptional Quality

03

HackerRank ranks Polish developers 3rd in the world. Polish teams scored 4th both at The International Olympiad in Informatics and Google Code Jam.

Cultural Fit

04

All graduates speak English and their culture is similar to that of other Northen European countries.

Know-how

05

Leading companies run numerous BPO and R&D centres in Poland. This makes green field investment easy.

Tax Incentives

06

- Preferential 5% tax rate on income related to Intellectual Property.

- The entrepreneur can deduct costs related to R&D even twice.

- Lower minimum expenditure for the R&D sector to qualify for CIT exemption.

- Long-term tax incentive – a taxpayer can set off R&D deductions in the 6 following tax years.

AI communities

07

Dozen of dynamic AI experts communities and study groups at leading Universities that meet regularly.

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❝ Amazon's investment in Poland started with the acquisition of Ivona, a text-to-speech software company. Since then, the city of Gdańsk has become one of the major development centres behind Alexa. Afterwards, further R&D investment came, focused among others on the development of AI technology.

amazon

Mariusz Mielczarek
Head of Public Policy CEE
Amazon in Poland

❝ Aptiv Technology Centre's 20-year presence in Poland allowed our engineers to gain experience in creating autonomous vehicles all the way from concept to production.

• A P T I V •

Paweł Skruch,
Associate prof.
Artificial Intelligence Manager
Aptiv in Poland

❝ Poland is one of the most important hubs in Intel AI space. The high-quality ICT education, offered at Polish universities, and the excellent track record of local software engineers makes this possible.

(intel)

Victor Canseco
General Manager Data Platforms Group
Intel in Poland

❝ NVIDIA decided to open a site in Warsaw to take advantage, but also to grow the local talent pool. The local teams optimize Deep Learning platforms across the software stack, from low-level changes in CUDA, through data pipeline improvements, up to changes in neural network implementations and topologies, leading to more accurate and faster results.

◉ NVIDIA.

Piotr Lewalski
Site Leader
Nvidia in Poland

❝ The Polish R&D centre is among key Samsung Research facilities and the biggest one in Europe. For many years it was developing advanced AI technology, powering our consumer electronics and telco Solutions.

SAMSUNG

Adam Roś
Vice President
Samsung R&D Institute in Poland

❝ We selected Poland as our R&D location due to the availability of talented engineers. This is especially important, given the game changers, such as AI and machine learning.

❈ UBS
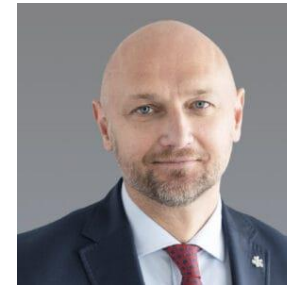
Michał Stępień
Country Head
UBS in Poland

#16. Authors of the Report

Łukasz Borowiecki, PhD
Co-founder and CEO at 10 Senses
AI Expert at Digital Poland Foundation

Co-founder and CEO of 10 Senses, a company providing services in the area of data science, machine learning and process mining. He holds a Phd degree in Economics from Warsaw School of Economics, and an MA degree in Sociology from Jagiellonian University in Kraków. Prior to founding 10 Senses, Łukasz worked as a consultant at EY Business Advisory (former Ernst and Young). Overall, he has over 10 years of experience in data science and data-focused projects in market research and consulting companies. Łukasz interests lie in applying machine learning techniques to various problems and specific datasets. As an economist, his focus is on understanding how data and machine learning impact the economy and the society. Łukasz is the author of several publications on the application of AI in the Polish economy published in Digital Poland Foundation."

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Piotr Mieczkowski
Managing Director
at Digital Poland Foundation

Piotr has 17 years of experience in the implementation of projects in the sector of new technologies. Currently he leads Digital Poland foundation which promotes digitalisation as an element of Poland's competitive advantage. Creator or co-author of many reports and digital policies on new technologies, including artificial intelligence. Co-creator of the strategic AI program called INFOSTRATEG which supported the implementation of AI in Poland with the amount of PLN 840 million. Creator and lead of aipoland.org.

Piotr has practical experience in digital transformation, business processes, strategic consulting or ICT solutions design. He has up-to-date knowledge of issues such as artificial intelligence, RPA, big data, cloud computing, IoT, 5G or smart cities. Piotr previously worked for a global advisory company (EY), media, mobile and fixed operators (Cyfrowy Polsat, Plus, Orange) and a global energy company (Shell). He graduated from Faculty of Electronics and Information Technology at Warsaw University of Technology and Faculty of Management at Warsaw University. He holds several specialist tech certificates.

e-mail: piotr.mieczkowski at digitalpoland.org

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#17. About Digital Poland Foundation

Our dream

Poland is one of the Leading Global Digital Innovation Hubs

How do we want to achieve it

1 **Strengthening Polish Digital Ecosystem**
by building synergies between companies and initiatives from different industries and by creating best digital policies

2 **Merging with global leading digital hubs**
by connecting Polish leaders and companies with global digital leaders

3 **Local and international promotion**
in the biggest international media outlets of the best Polish digital initiatives, companies and leaders

Strategic Founders & Strategic Partners

Baker McKenzie.

daftcode

GHELAMCO

MCI CAPITAL S.A.

Microsoft

polpharma

sage

ringier axel springer

tvn

T··

upc

VISA

Partners

ABB

KORN FERRY | HayGroup

straal

STRÖER out of home media

Do you want to become a partner? Write to us, we are open to ALL who want to cooperate in order to accelerate the digitisation of Poland

Info at digitalpoland.org

We Work with More than 175 Companies, Institutions and Brands!

Only TOGETHER!

We Are a Part of a European Initiative | Over 200 Companies!

digitalswitzerland

Digital Hungary

digital-liechtenstein.li

digitalpoland

Inicijativa Digitalna Srbija

logos of selected companies only

Areas of Our Activities

01
Dialogue | our events

02
Dialogue | events powered by the foundation

03
Strengthening the Polish Digital Ecosystem

04
Digital Advocacy

05
International connectivity

06
Digital Education and Talents

07
Think and Do Tank

08
Strong media coverage

09
Strategic Founders bold initiatives

10
Founders' and Partners' support

Example of Our Cross-industries Initiatives
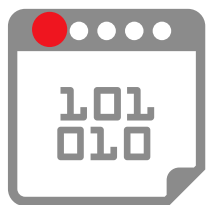
Digital Festival
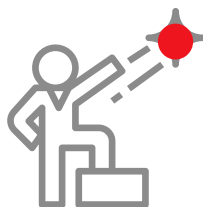
Digital Shapers
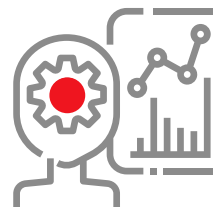
Digital Policies
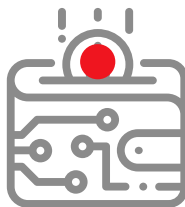
FinTech incubator
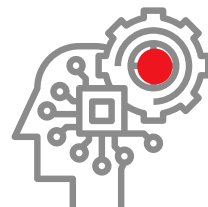
AI Hub

∧aipoland

Smart Cities & buildings
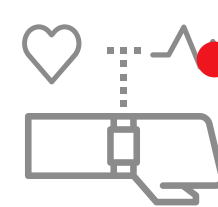
eHealth

Digital Connectivity (5G, Fiber)
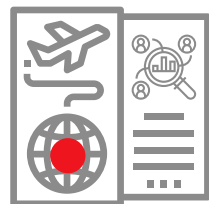
Study Tours

Digital Marketing Hub

Digital CEO

Startup Ecosystem

Digital Fitness
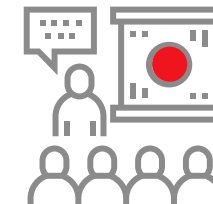
Digital Summit

Poland as a R&D Hub

Digital education

#18. About AIPoland

AI HUB | Maipoland | Our experience

Support of key policy-makers

onet WIADOMOŚCI

Jarosław Gowin: potrzebna strategia wdrażania sztucznej inteligencji

Support of key AI policy documents

Support of Polish AI Roadmap

Roundtables | Digital Policies

Think Tank | AI Research

Map of Polish AI

E-learning

Witaj na internetowym kursie „Elements of AI"!

Dołącz do ponad 620,000 osób uczących się podstaw sztucznej inteligencji.

Wybierz kraj 🔴 Polska ↓

Rozpocznij kurs →

AI Academy for managers

Co-creation of Applied AI grants
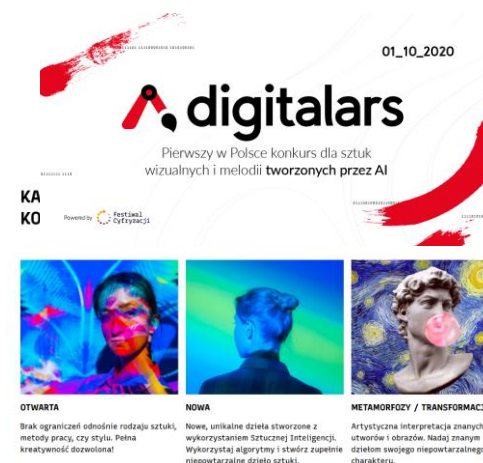
First contest in Poland for art created by AI

Want to see the entire Polish AI ecosystem and work with us? Visit aipoland.org

aipoland

AIPoland is an initiative of Digital Poland Foundation with aim to promote Polish AI ecosystem and enable collaboration between Polish and foreign entities in various areas including business cooperation, co-development of new initiatives and raising funds.
We hope to achieve this by providing a complete overview of Polish AI scene which includes key facts, events, the database of Poland-based companies, R&D centres, Universities as well as Public Policy and support for AI development.

An interactive, updated Map of Polish AI 2021 will be presented on our website after May 16, 2021. Don't forget to visit us!

Supporting partner

Enky Consulting

AI POLAND

Menu ≡

AIPoland is an initiative of Digital Poland Foundation with aim to promote Polish AI ecosystem and enable collaboration between Polish and foreign entities in various areas including business

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03

01

AI DATABASE

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10Clouds

A team of 100+ experienced developers and designers, ready to help in building web and mobile applications.

TAGS: Advisory and Consulting, Software development, Software implementation

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10senses.pl

10Sense is a software house specializing in data analytics in areas of controlling, Industry 4.0, Marketing and Sales, Data Management and AI.

TAGS: Advisory and Consulting, Industry 4.0, Software development, Software implementation

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Digital Skills | Artificial Intelligence for managers | AI Alumni

The "**Artificial Intelligence for managers**" initiative, organized by the Digital Poland Foundation, has the form of a training cycle. The training, conducted twice a year, is intended for people holding managerial positions in medium and large enterprises, excluding IT and consulting companies. Each trainee joins **AI Alumni**, a community of AI professionals who share knowledge.

The training series is divided into 8 modules:
- What is AI and how will it impact my business?
- Data as the foundation of AI
- From RPA to intelligent robotization of business processes
- Characteristics and applications of Machine Learning and Deep Learning
- AI in natural language and image processing
- Practical aspects of implementing AI in a company
- The future of AI and the future of companies and their customers in the AI world
- Full day practical workshop: Introducing AI / RPA to my company.

The training takes place in the office of Digital Poland Foundation, on the 35th floor of the "Warsaw Spire" building or in an online version (Covid19).
The training is conducted by Andrzej Sobczak, PhD, Professor of Warsaw School of Economics and Marek Sowa, responsible for the development of AI and Intelligence Process Automation in Capgemini. Such a selection of speakers allows to combine systematic knowledge and practice.

If you are interested, please contact us by e-mail: education at digitalpoland.org - we will provide a detailed program and answer all your questions related to this undertaking.

Link to course description on our website

Digital Skills | Elements of AI | Join #AIChallenge

In 2019, during Digital Festival (Festiwal Cyfryzacji), largest educational and technological initiative in our country, we started 1st edition of **#AIChallenge in Poland.** Our partners were OPI PIB and Navoica portal. More than 10 000 people joined the initiative! Then in 2020, during the second edition of Digital Festival, we launched the **original Elements of AI course in Polish**.

"**Elements of AI**" is a series of free online courses created by Reaktor and the University of Helsinki. The Polish version of the training is the result of cooperation between the **University of Helsinki**, **Reaktor**, the **European Commission**, **Digital Poland Foundation** and **Jagiellonian University**. So far more than 8000 people from Poland have signed up for the course. We are rank 5th in Europe!

More than **30 companies** have signed up for the #AIChallenge and pledged to train at least 1% of their employees. More than **25 ambassadors** are promoting the course.

You too can join the people who know the basics of AI. All you have to do is **take the course and then share the certificate of completion on social media with the hashtag AIChallenge**!

Link to course in Polish

Ambassadors
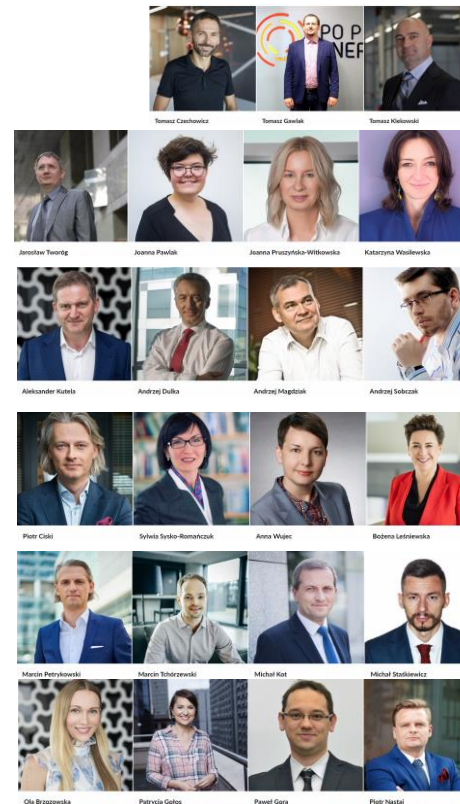
#AIChallenge | Social media
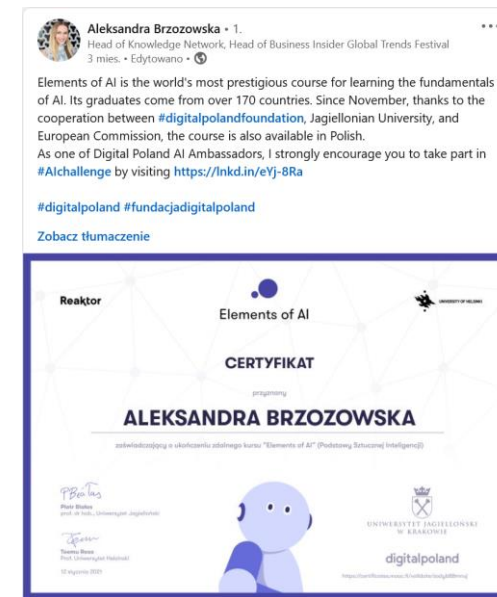
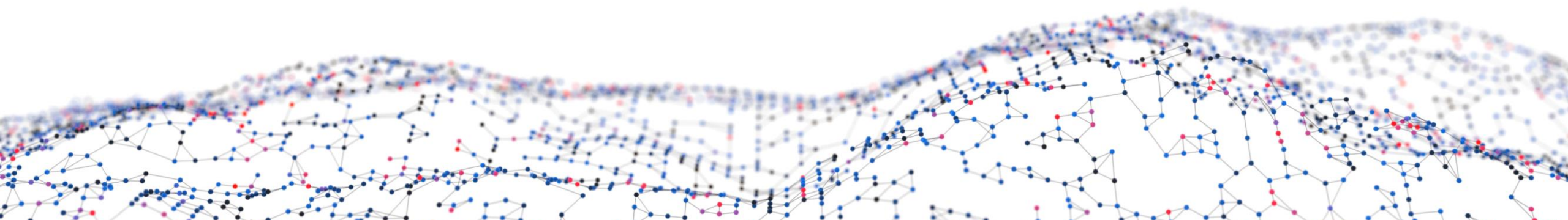# #19. About 10 Senses

10 SENSES

Discover the potential of your data

Implementation | Coding | Training

10 Senses is a Warsaw-based team specialising in data science, AI and process mining. We support companies in their daily data-related tasks. Our team has broad experience in advanced analytics and dealing with business challenges using cutting-edge technology.

At **10 Senses** we see value in cooperation and building a community. For this reason since a few years we support **Digital Poland Foundation** in all AI-related activities.

Visit us at: **10senses.pl**

#20. About Digital Festival

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