

State of Polish AI 2021

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 SENSES



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#1	Forewords	04
#2	Executive Summary	08
#3	About the Report	15
#4	Tracking the AI Boom in Poland	17
#5	Business, Markets, Financing and Collaboration of AI Companies	23
#6	Customers of AI Services and Products	38
#7	Technology & Data	54
#8	Human Capital	73
#9	Science	88
#10	R&D and Tax Reliefs	101
#11	AI & Big Data Adoption in Poland and Europe	107
#12	Challenges for Polish AI Companies	119
#13	AI Policy & AI Ecosystem Development	135
#14	Key AI Policy Recommendations	158
#15	Polish AI Ecosystem and Why to Invest in Poland	161
#16	Authors of the Report	172
#17	About Digital Poland Foundation	174
#18	About AI Poland	182
#19	About 10 Senses	187
#20	About Digital Festival	189



#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**.

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 than 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.

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.

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.



#3. About the Report

► #3. About the Report

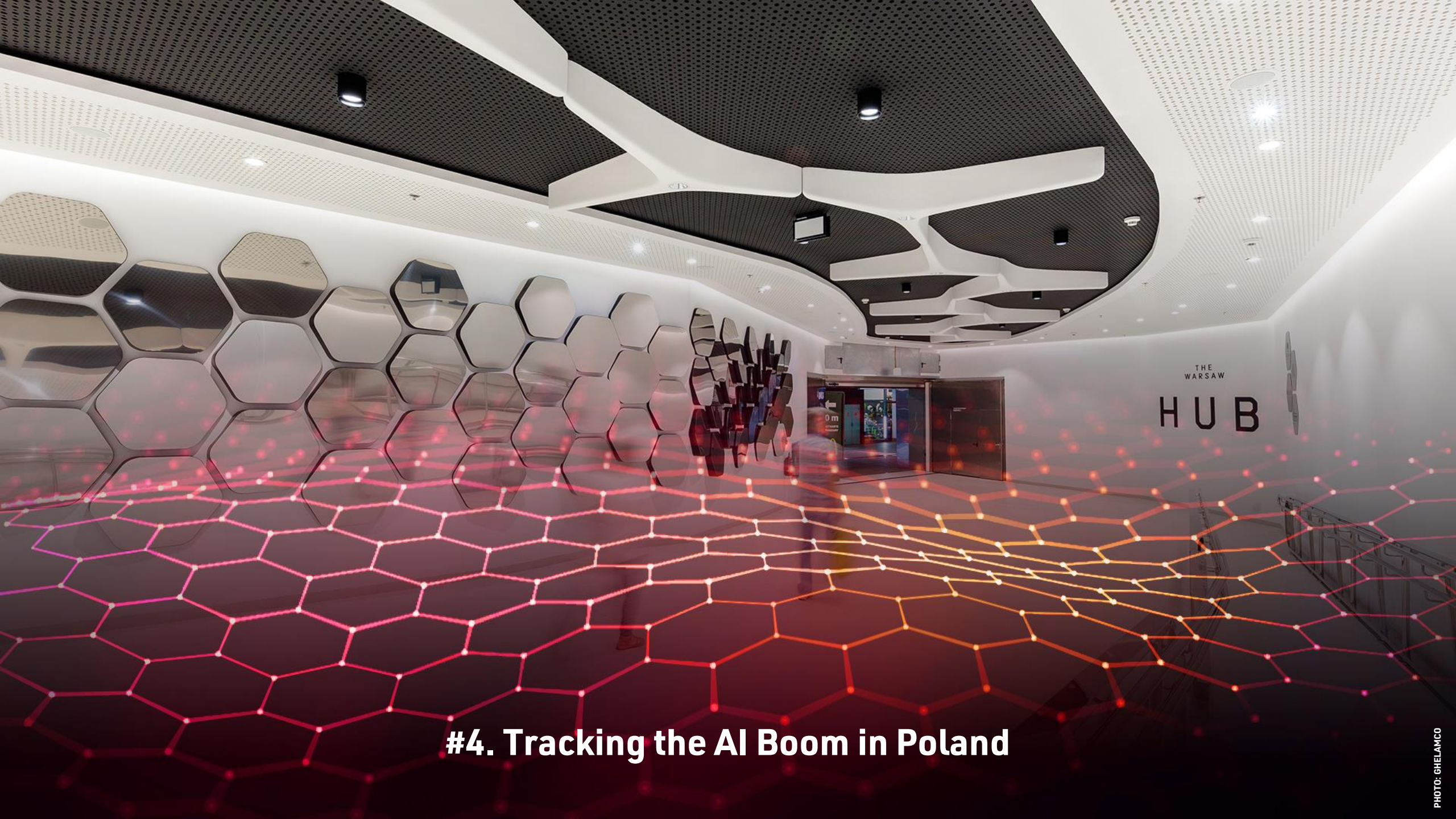
State of Polish AI 2021 is the latest version of highly acclaimed **Map of Polish AI 2019**. We decided to **update the map of ecosystem** and do the survey to **present the latest pulse of Polish AI Ecosystem**. The main survey was conducted between **January and February 2021**. The survey was completed 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!

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

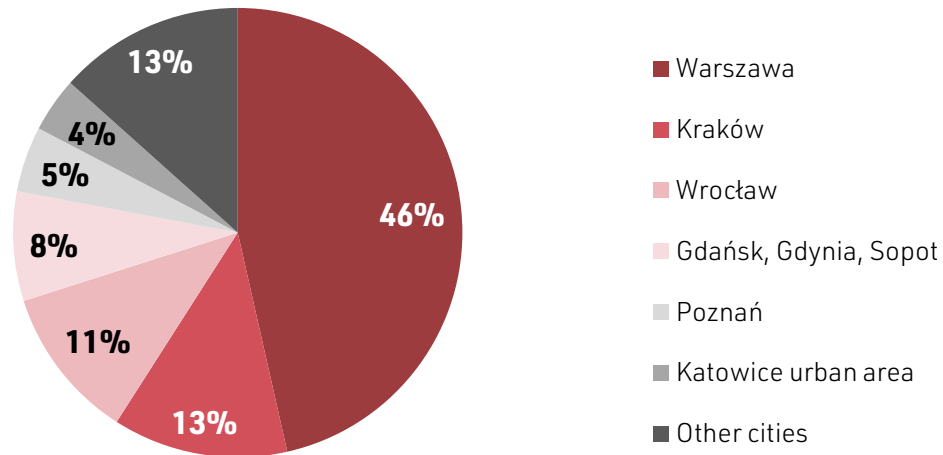
Since we wished to create the **most comprehensive report on the AI ecosystem** in Poland, we additionally used many other sources. We also wanted to compare Poland with other countries in Europe to obtain an answer to where we are in terms of AI market development. Therefore, we also used the **latest 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.



#4. Tracking the AI Boom in Poland

Where is the main office of your company located?

Location



- **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.**

► Insights



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.

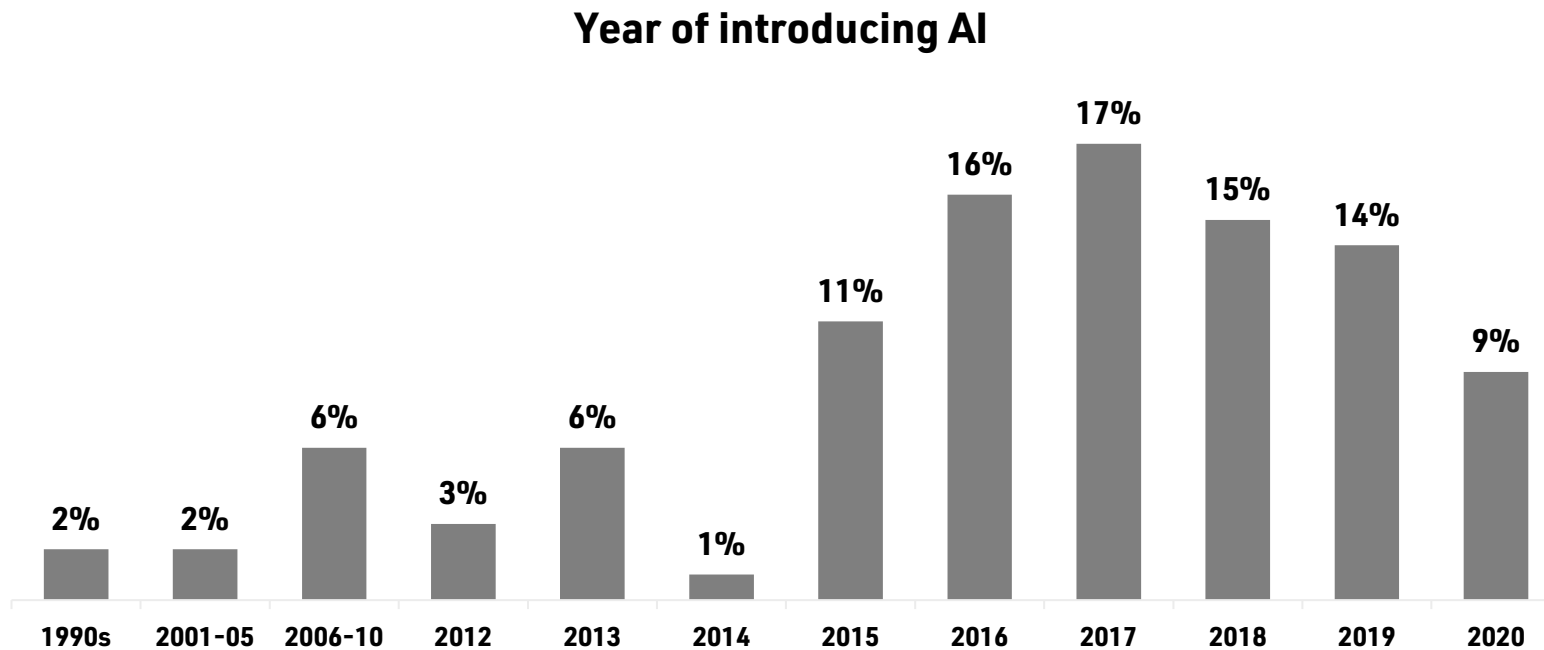
Several reasons decide about the location preference. In the case of foreign companies, especially the big ones, vast majority of them target the capital city due to its excellent connectivity, good infrastructure, access to talent pool, an established tech and science ecosystem, and the presence of 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?



- 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



Piotr Mieczkowski
Managing Director,
Digital Poland Foundation

AI in Poland conforms to a global trend of concentrating the AI efforts in metropolitan areas with good access to scientific community (top tier 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 creation of new AI startups 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.

► Insights



**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.

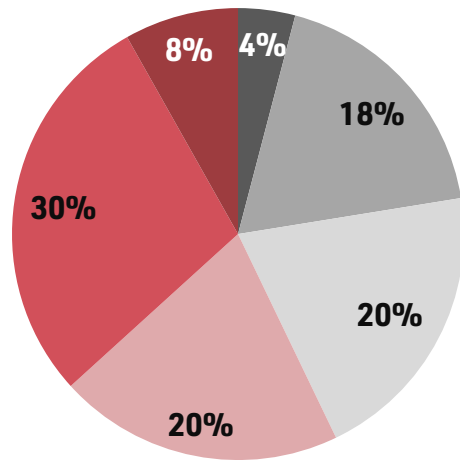
We expect that this growth will continue, not only due to the abundance of skilled human resources but also because Poland offers one of the most attractive incentive packages for R&D operations in the region, including tax incentives, grants, and EU schemes.



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

How much revenue does your company have annually?

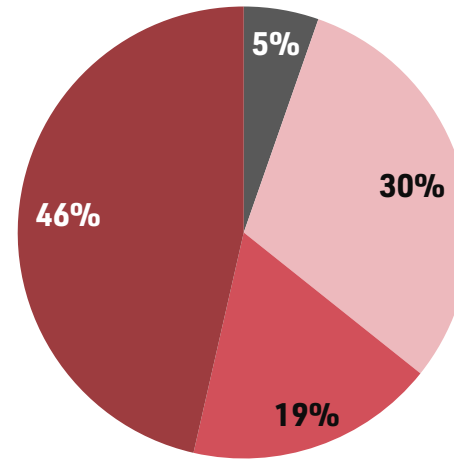
Total revenue



- We don't have revenue yet
- Less than PLN 500K
- 500K - PLN 2 mln
- 2 mln - PLN 5 mln
- 5 mln - PLN 50 mln
- PLN 50+ mln

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

Revenue from AI



- 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

► Insights



Łukasz Kobyliński
Chief Science Officer,
Sages

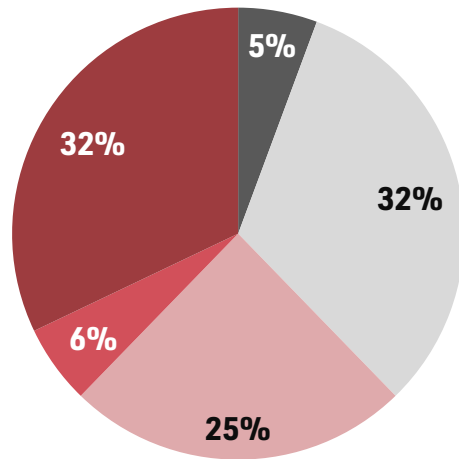
Poland is still at an early stage of adoption of AI-based solutions. There is a limited number of organizations willing to invest in such solutions and even then the spending is cautious. This can also be observed from the perspective of revenues of AI-providers, where only 8% report income of over PLN 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.

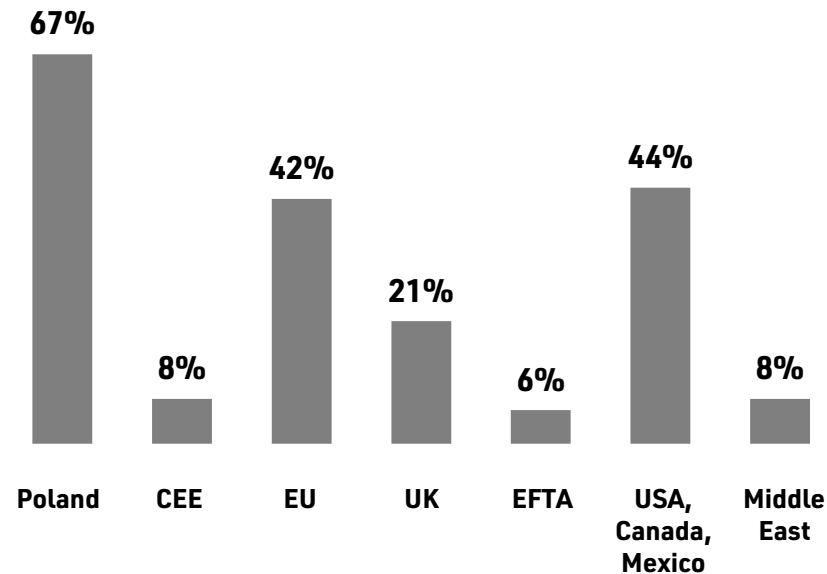
What percentage of AI revenue do you have from abroad?



- 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

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

Main markets for AI



- 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

► Insights



Błażej Chodarczewicz,
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.

► Insights



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).



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.

► Insights



Łukasz Borowiecki
CEO, 10 Senses
AI Expert, Digital
Poland Foundation

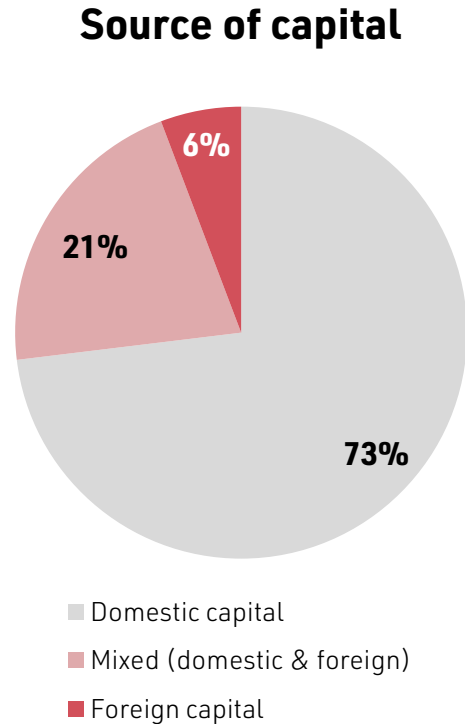
Polish AI companies have clients in diverse locations. However, while most of the revenue is originating from local market, the scale, wide adoption and awareness of AI importance in US, has attracted Polish companies to obtain third of their revenue from North American market clients. Having international 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.



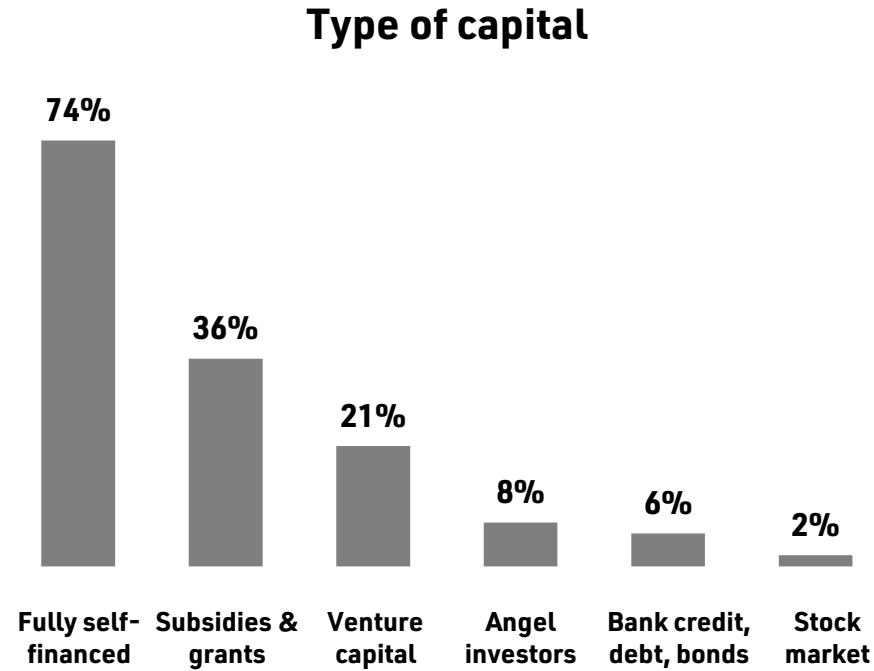
Darek Kociecki
Chief Growth Officer,
Neoteric

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.

What is the source of the capital used to finance the business?

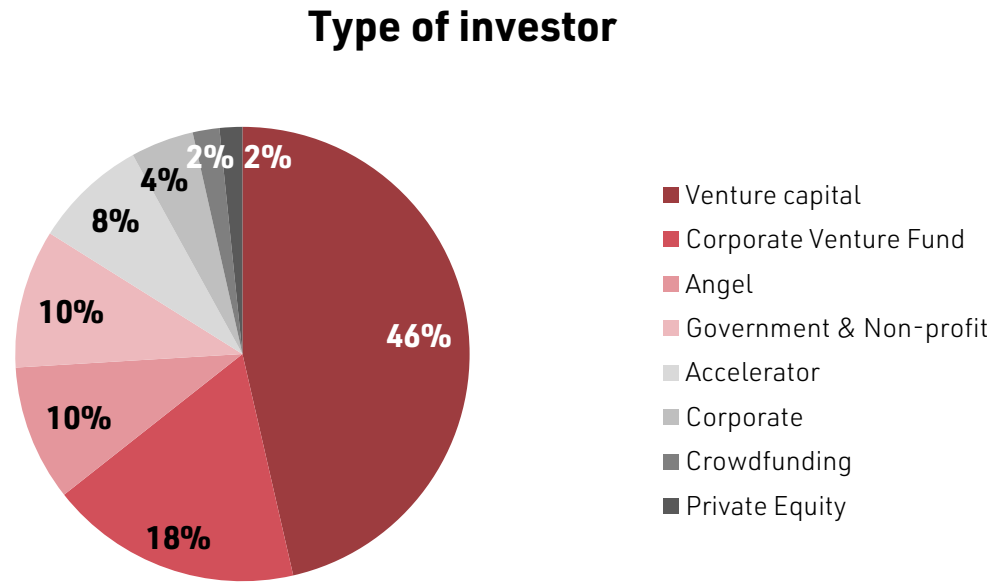


What is the type of capital you use to finance your operations? Select each correct answer.



- 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.

Tech startup funding in the CEE region by type of investor



- **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

► Insights



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.



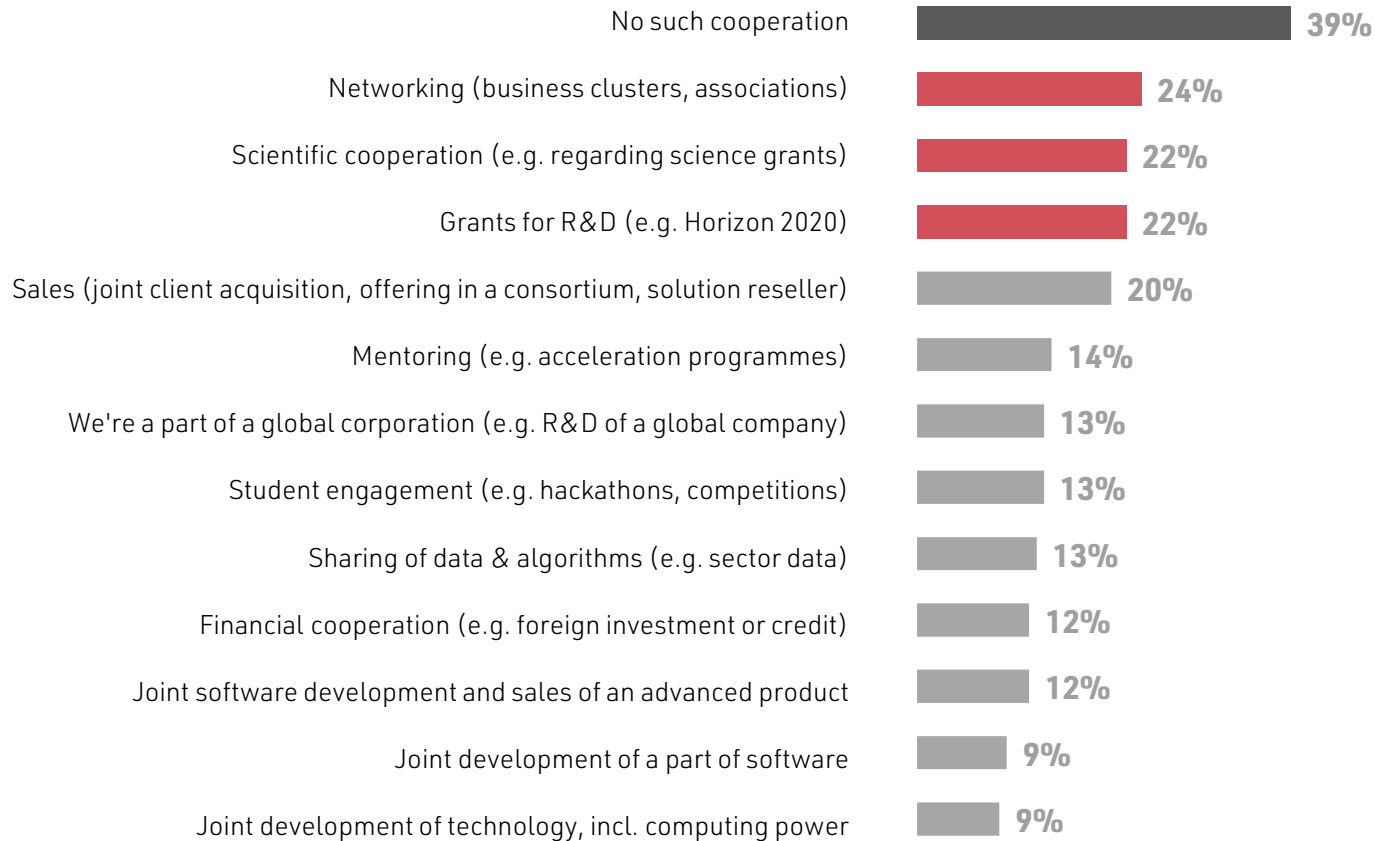
Sergiusz Nowak
Senior investment Analyst,
MCI Capital

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.

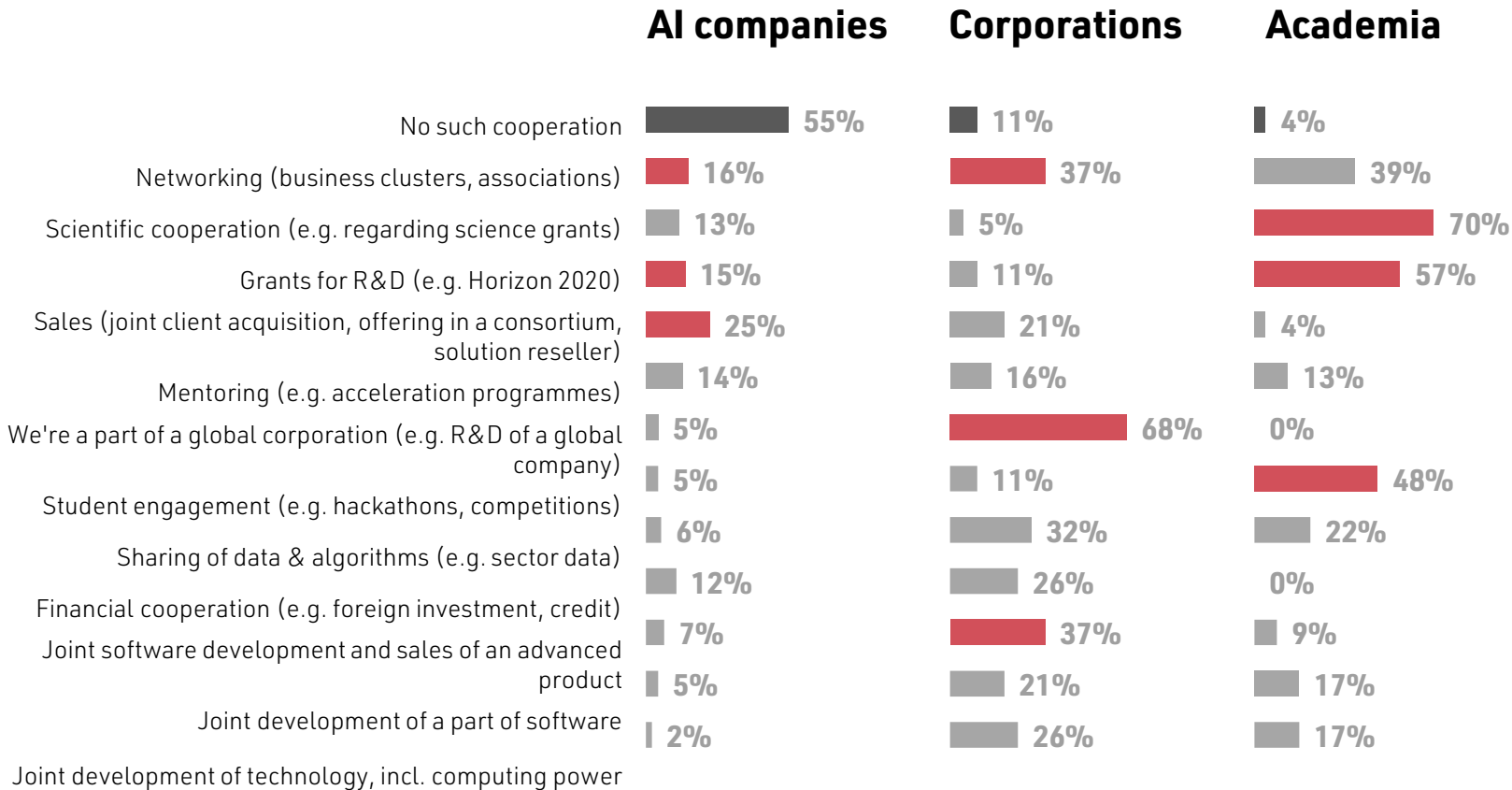
In our view such an upturn in international interest reflects strong perception of the Polish AI landscape, fuelled by the access to top-notch tech talent, thriving local innovation scene and entrepreneurs eyeing ambitious expansion plans from day one. Hopefully, we will see this trend going forward.

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



- **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.**

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



- **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



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.

► Insights



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.



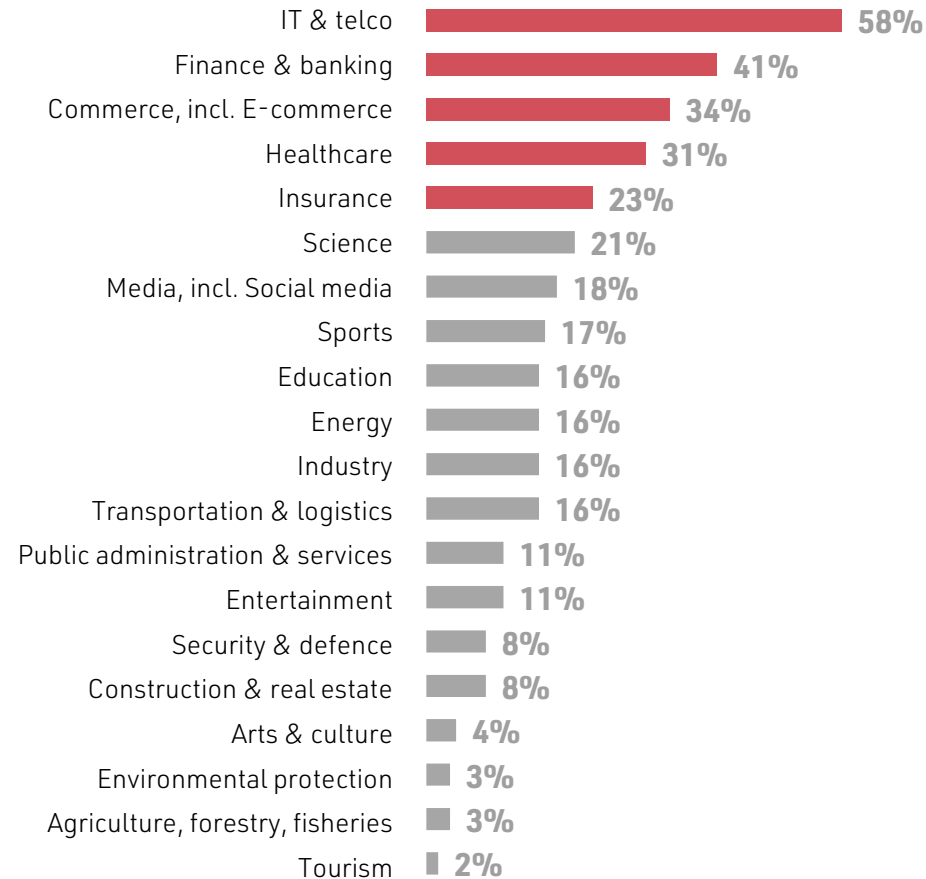
Dorota Pietrzak
Business Strategy
Consultant,
Accenture

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.



#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.



- 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 & defence (8%) provide plenty of use cases. Nonetheless, the Polish AI companies do not seem to specialize in these economy sectors.

► **Insights**



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.

► Insights



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.

► Insights



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.



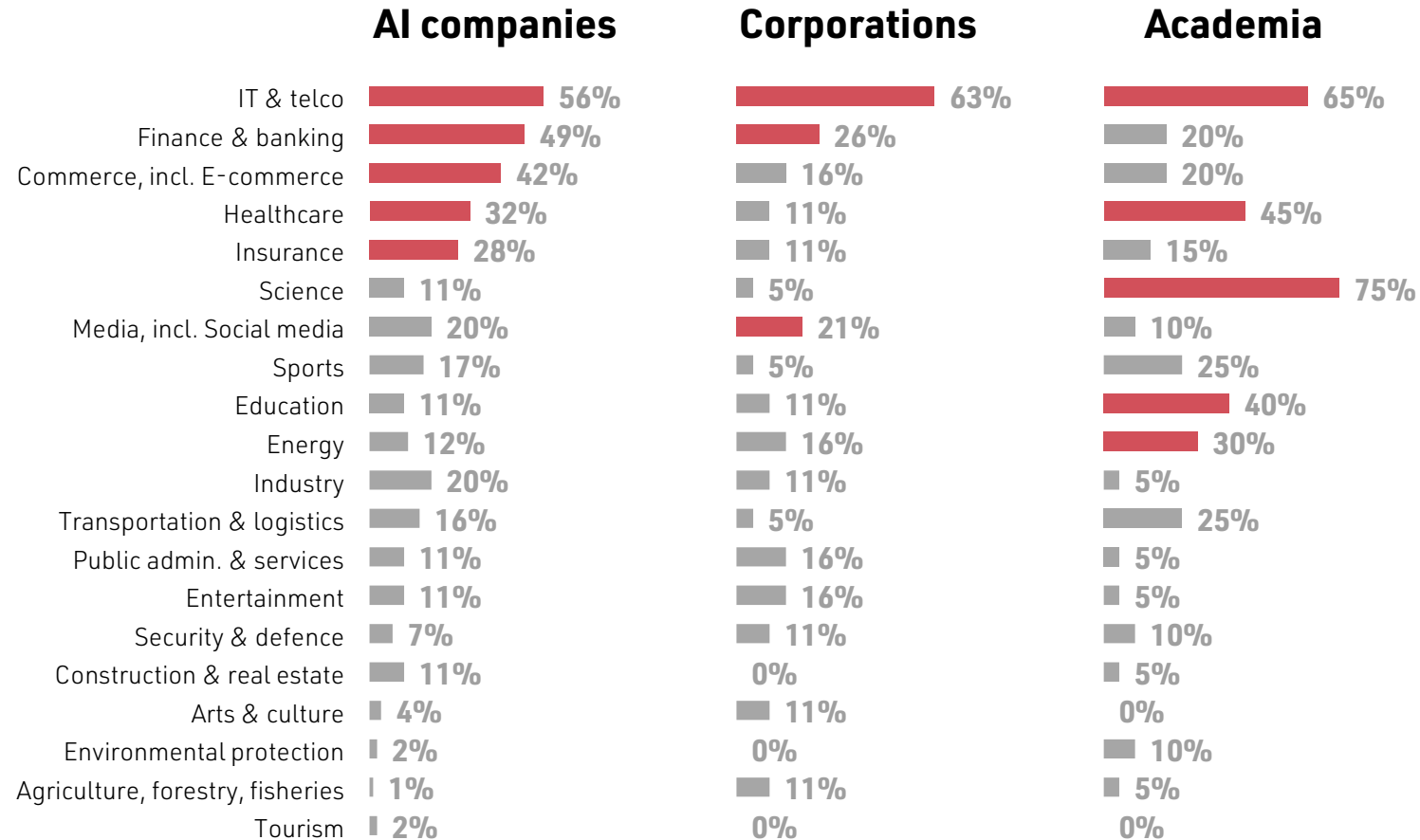
Andrzej Wodecki
Associate Professor,
researcher, Dept. of
Management,
Warsaw University of
Technology

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.

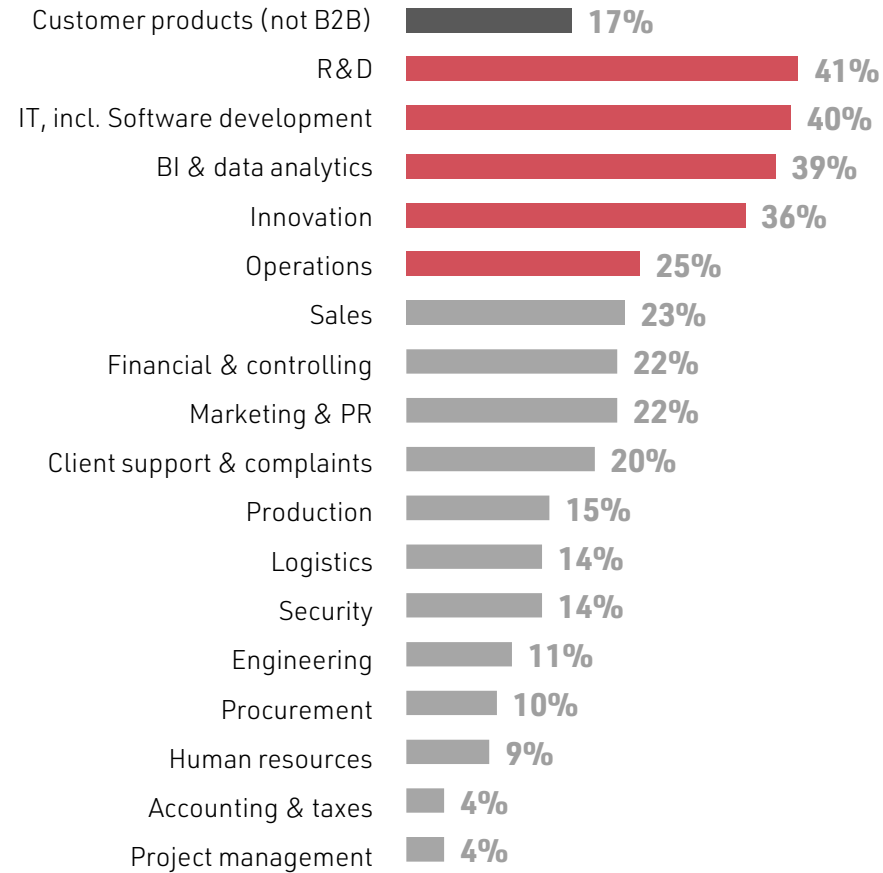
In which business sectors has your organization generated revenue or applied AI in the past 18 months? Select each correct answer.



- 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

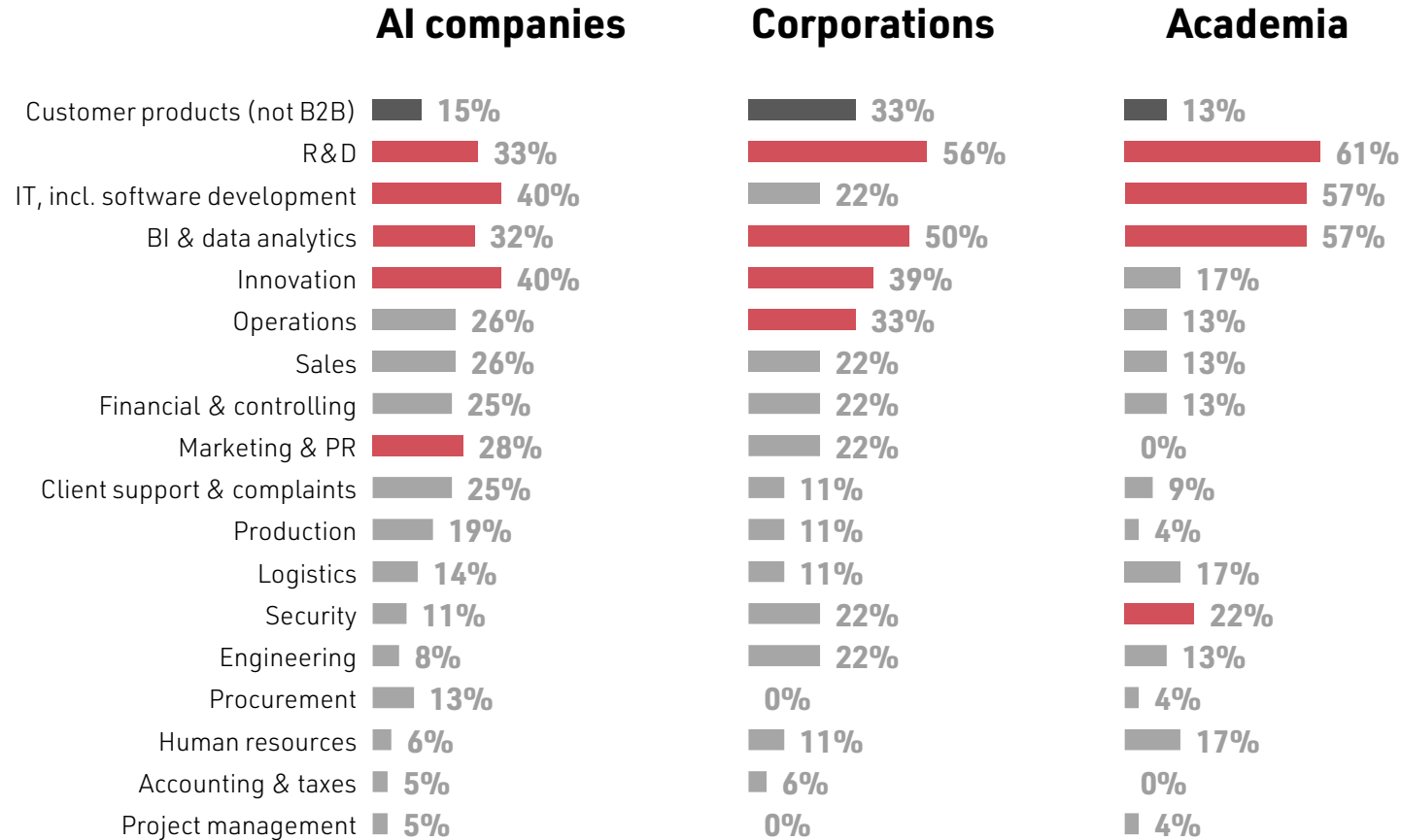
What type of customers have used your AI-enabled products/services/activities in the last 18 months? Select each correct answer.



- **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

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



- 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.

► Insights



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.

► **Insights**



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

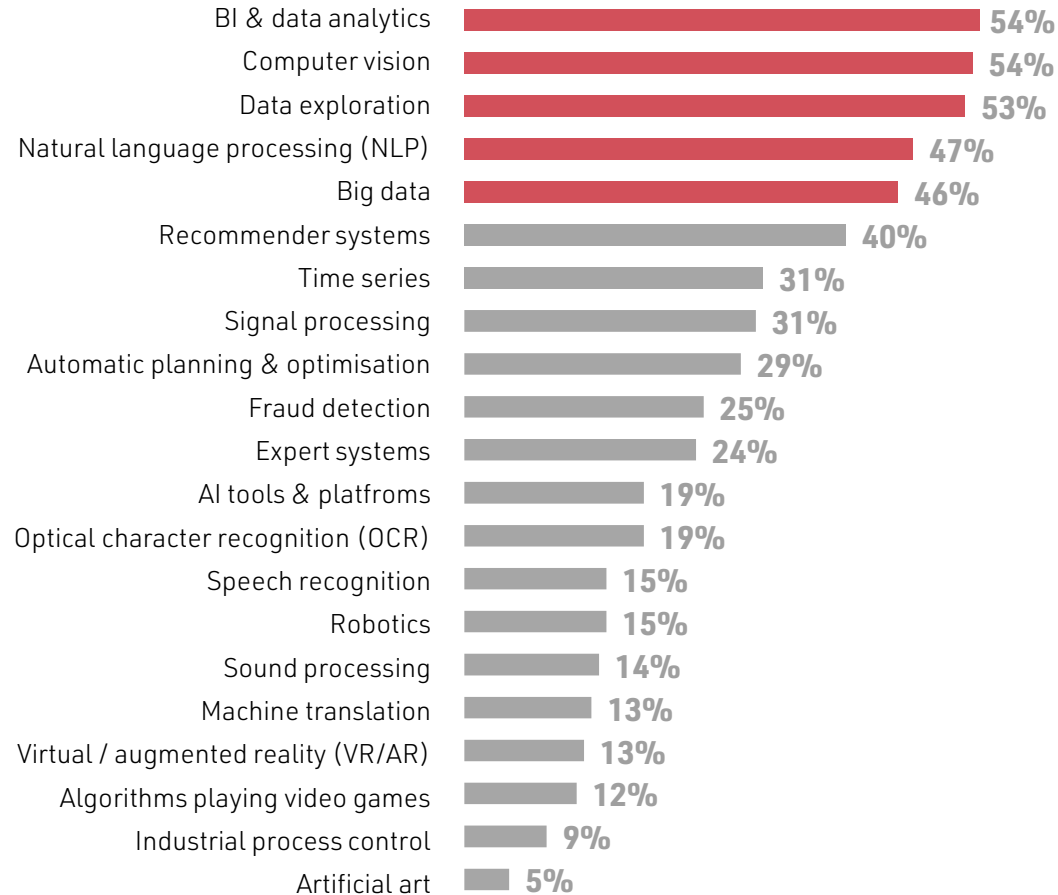
Low share of Production companies and departments as AI clients could mean that awareness of benefits which AI can bring to them is not sufficient. Therefore, AI solutions providers should have teams of strong business consultants, AI Evangelists, who not only know how to implement AI solutions, but also have deep 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

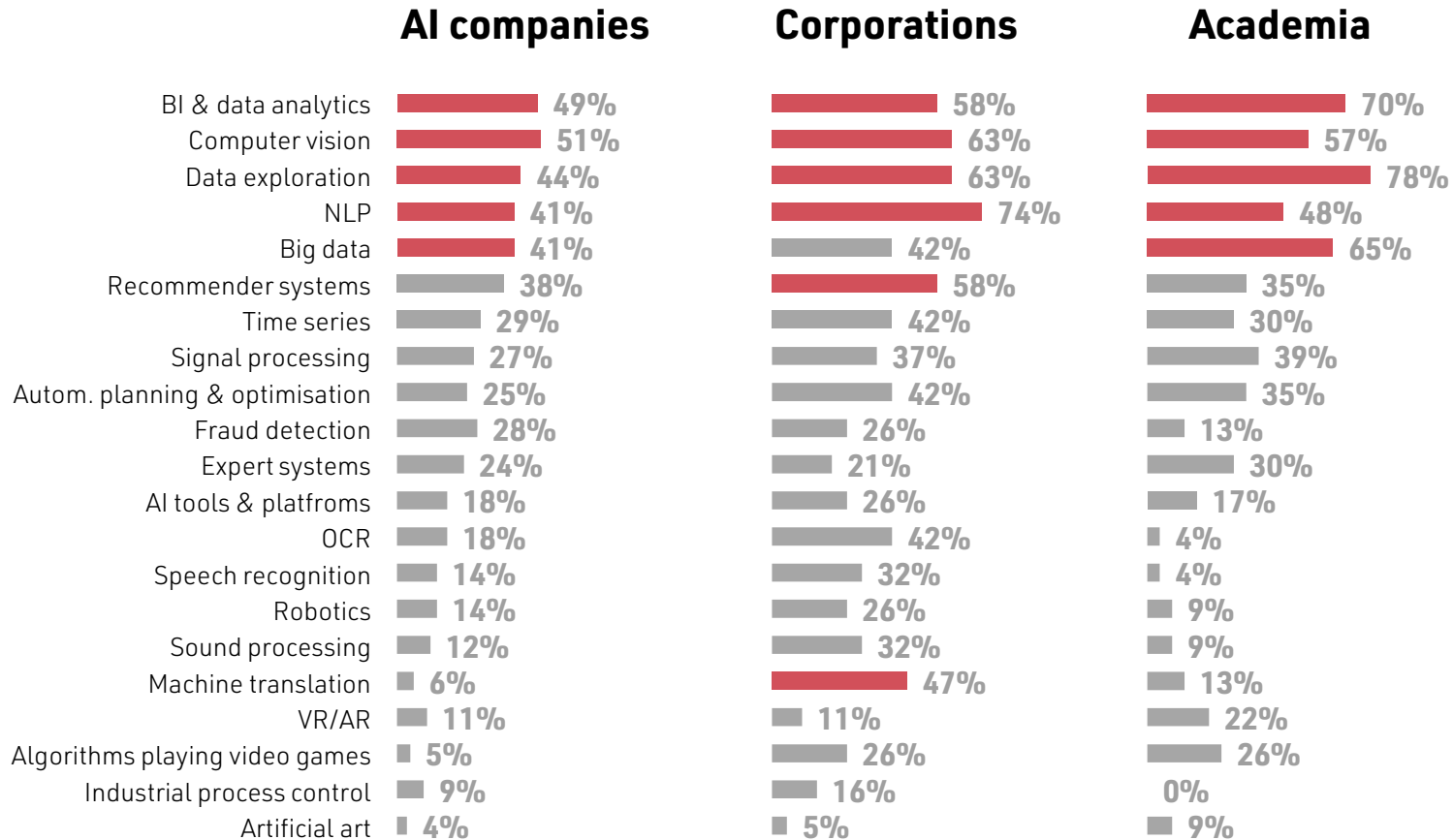
Innovation, R&D, IT, incl. software development, BI & data analytics are the most popular areas of applying AI, though also the least specific. It seems that Polish companies experiment with AI a lot and work for clients with high willingness to experiment. This indicates relatively poor adoption of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



- **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.**

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



- **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.**

► Insights



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.

► Insights



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



Marek Zieliński
Co-Founder, CTO,
10 Senses

We clearly see the rise of the NLP use cases especially for corporations. Some of it is likely due to recent advancements like GPT-3 or its open alternative GPT-Neo. The second factor is an ever growing open community where pretrained AI models are shared and can be quite quickly adapted to the use case at hand.

On the technical side - the Moore's law does not really apply to AI/ML. The true culprit right now is how to efficiently move the data to GPUs, TPUs or NPUs often bypassing the CPUs.

To effectively combine the two above one needs a specialized AI team working on the business use-case and the MLOps team that takes care of scaling the infrastructure. This way it is possible to support the demand for high computing power, repeatability and version control for models and data

► Insights



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.



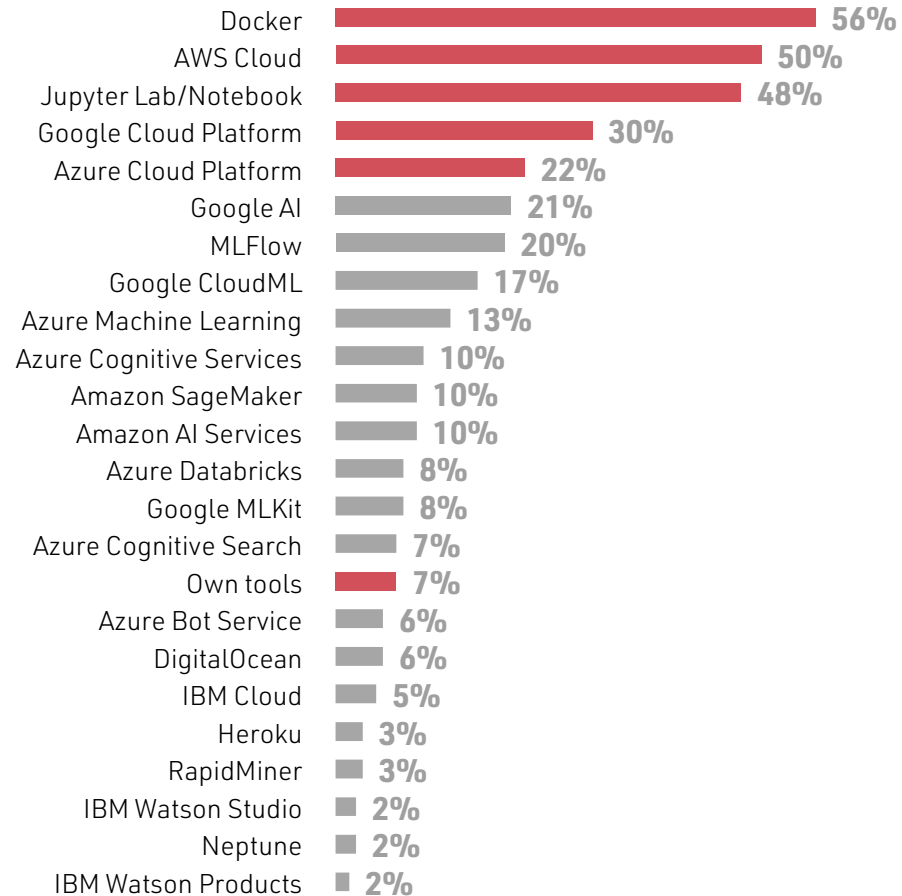
Łukasz Kobyliński
Chief Science Officer,
Sages

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.



#7. Technology & Data

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



- 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.



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.

► Insights



Marek Zieliński
Co-Founder, CTO,
10 Senses

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.

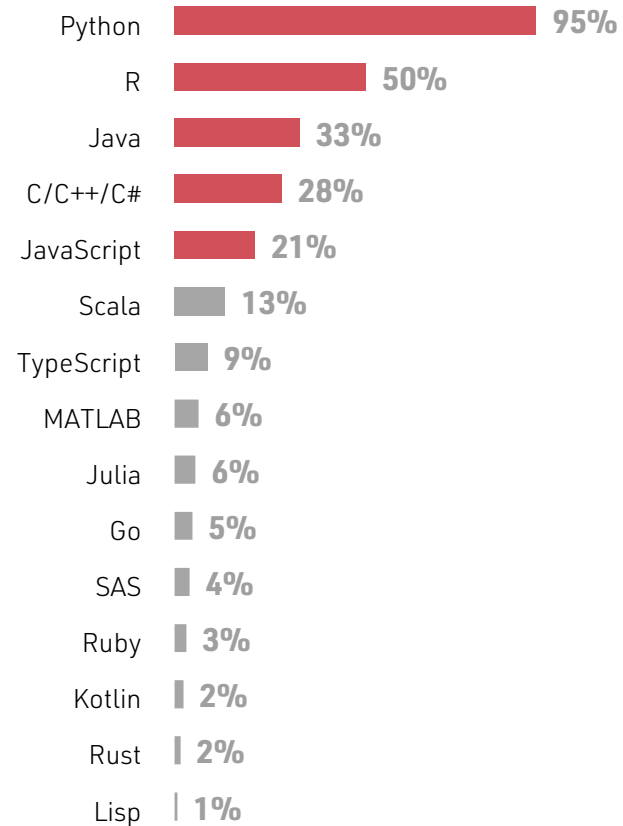


Łukasz Grzybowski
Head of Machine Learning
& Data Engineering,
STX Next

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.

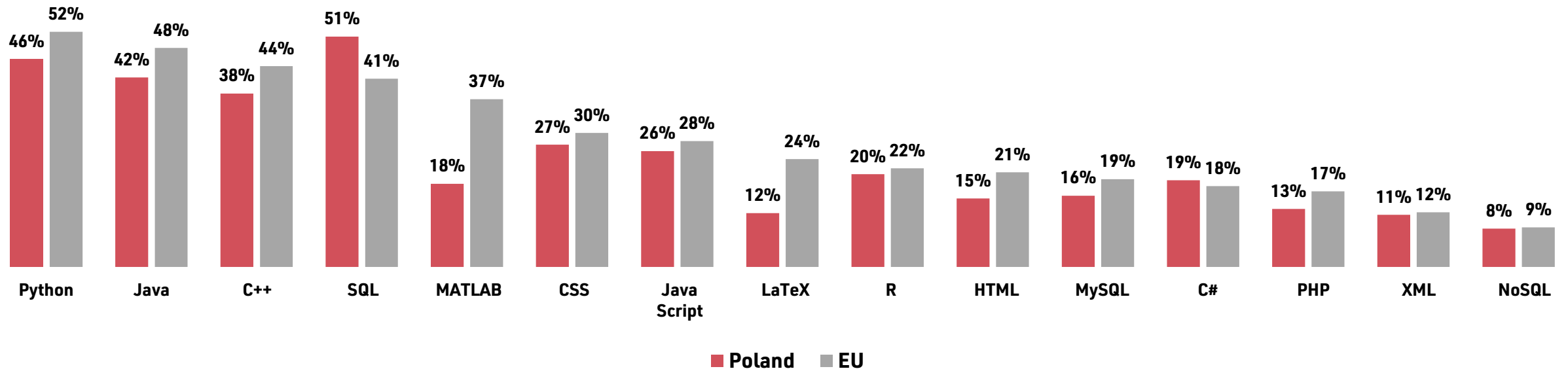
What languages do you use in developing artificial intelligence? Select each correct answer



- 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.

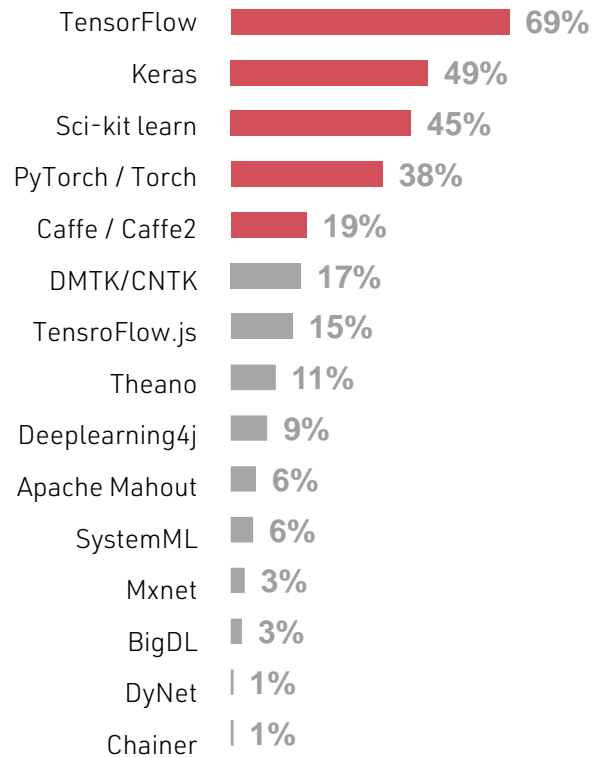
- Looking onto LinkedIn profiles, there seems to be not much of a difference between a Polish AI specialist and an EU-average.
- However, a significantly smaller share of specialists in Poland declare skills in MATLAB or LaTeX.

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

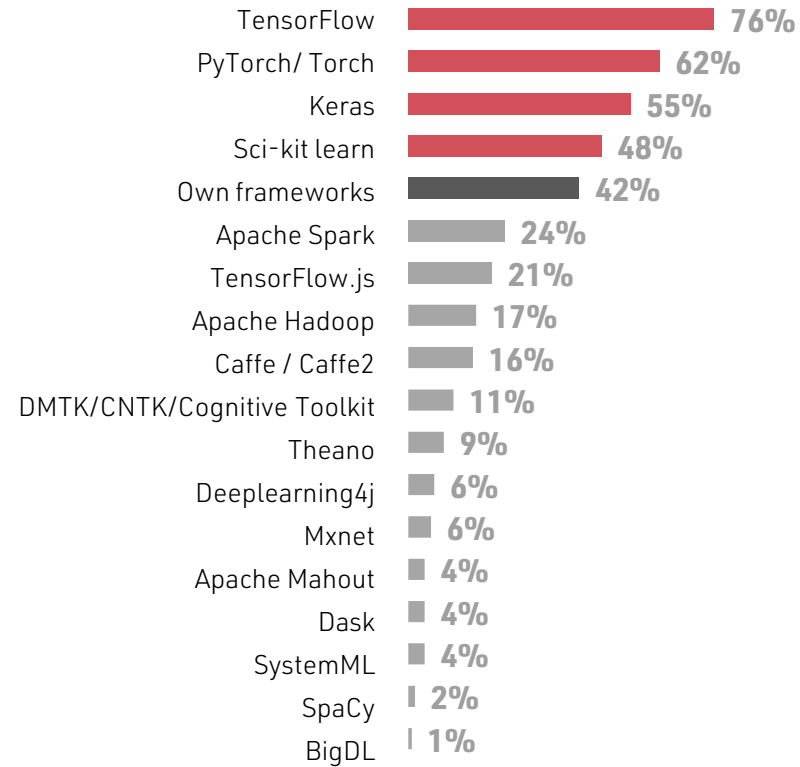


What frameworks/libraries do you use for artificial intelligence? Select each correct answer

2019

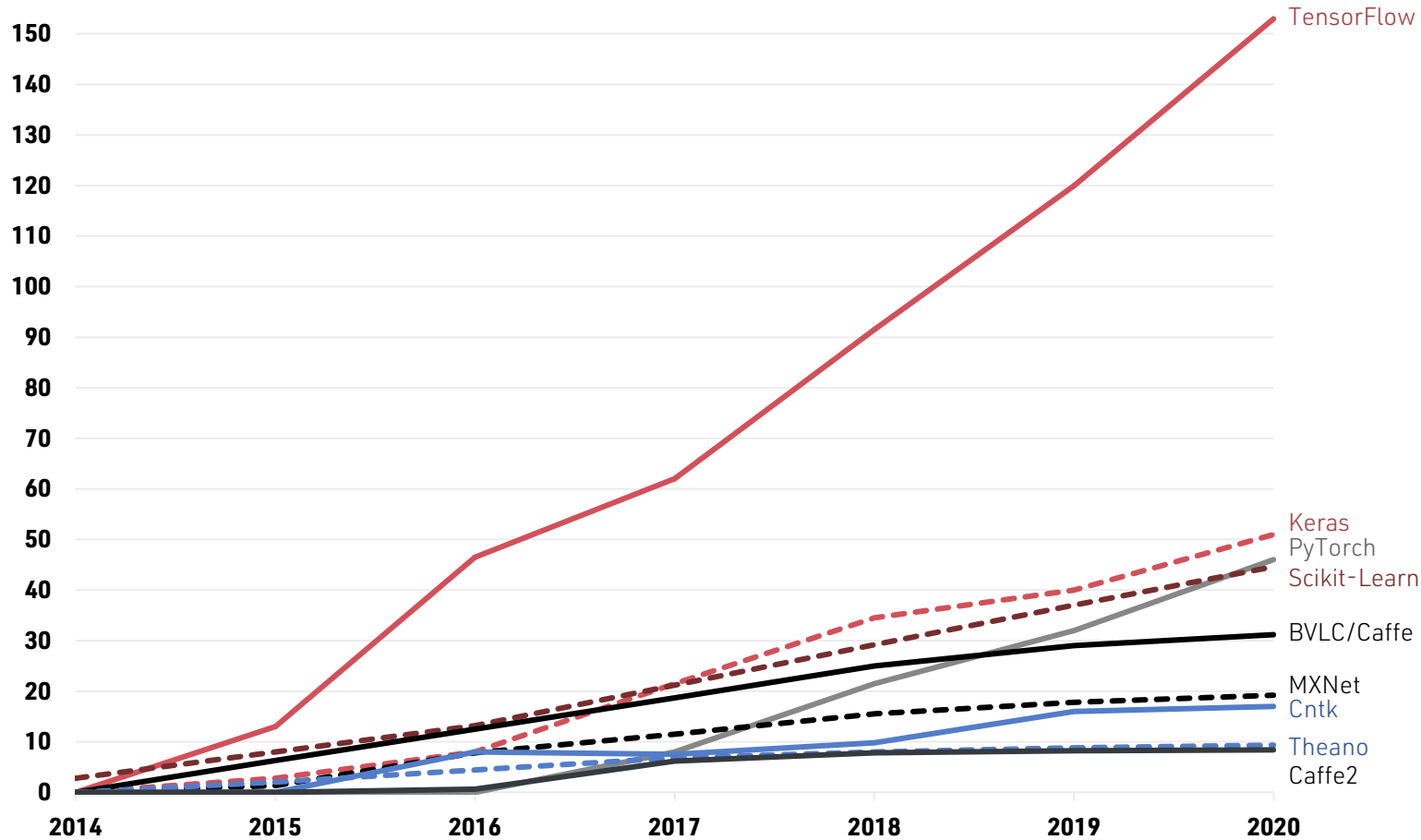


2021



- 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.

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.

► Insights



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 answer 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.

► Insights



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.

► Insights



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.

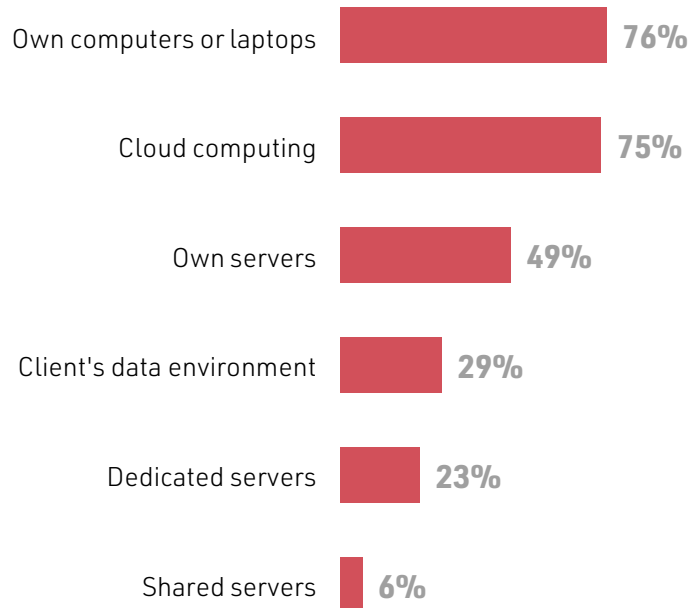


Marcin Kędzior, PhD
Data Science & Software
Development Leader @
DT IT Poland,
T-Mobile Polska

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.

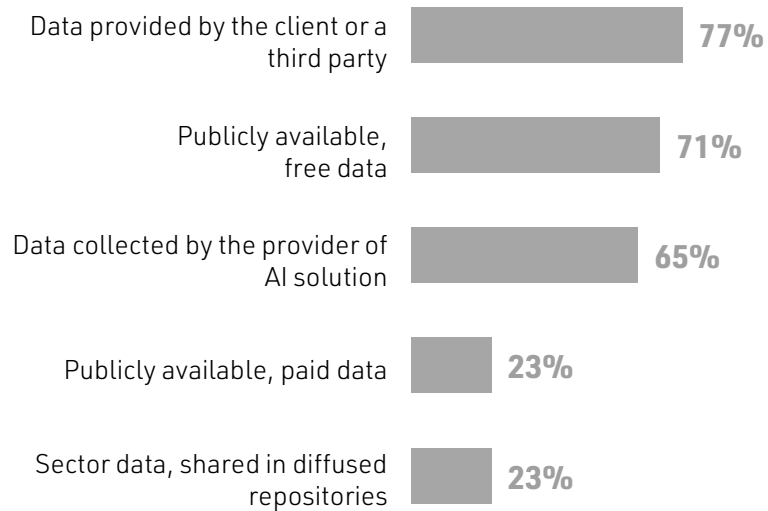
Which type of computing power do you use in product/service development, research, or to deliver AI services? Select each correct answer

Computing power



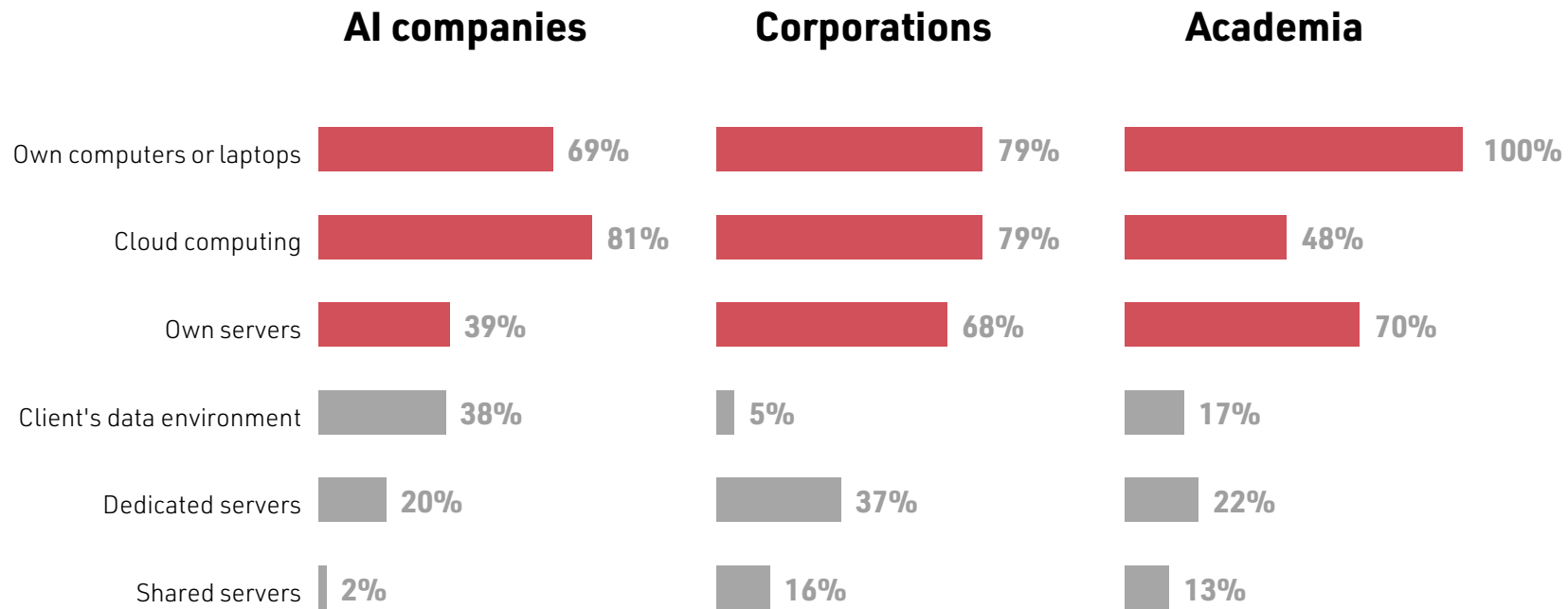
Which data type do you use in product/service development, research, or to provide services? Select each correct answer

Data sources



- 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.

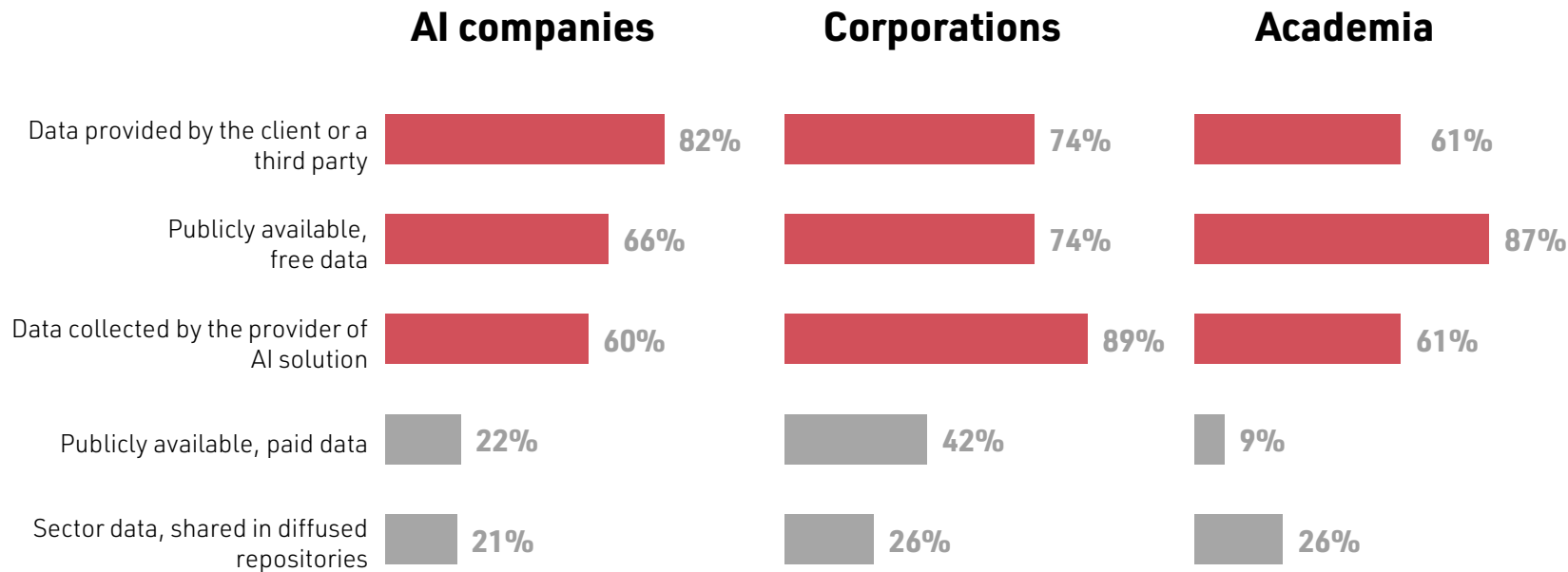
Which type of computing power do you use in product/service development, research, or to offer them? Select each correct answer



- **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

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



- **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.**

► **Insights**



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.

► Insights



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.

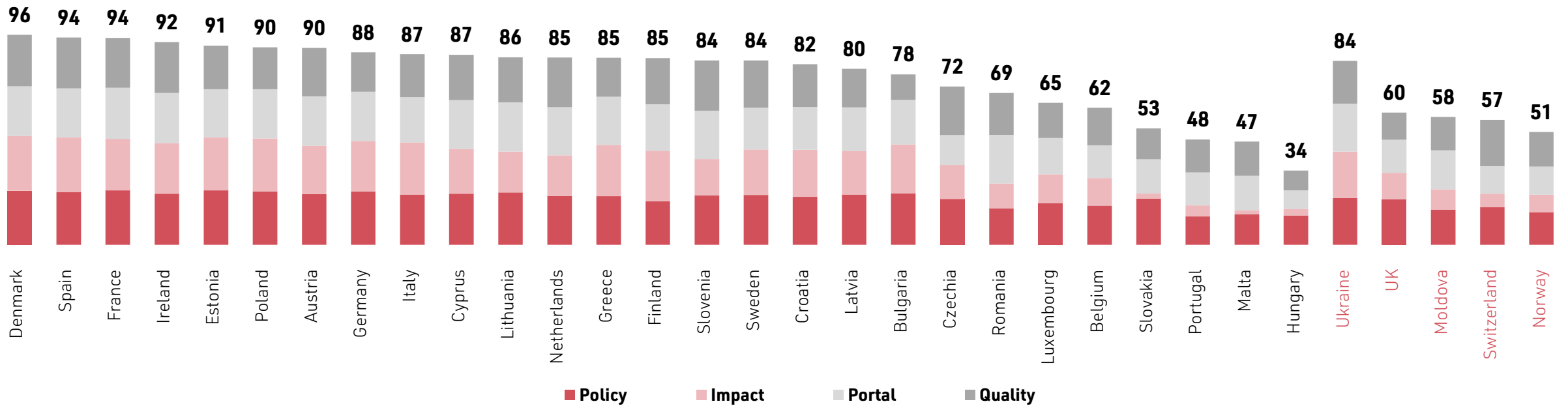


Marcin Kędzior, PhD
Data Science & Software
Development Leader @
DT IT Poland,
T-Mobile Polska

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.

- 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 [%]



Source: European Data Portal, 2020



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.

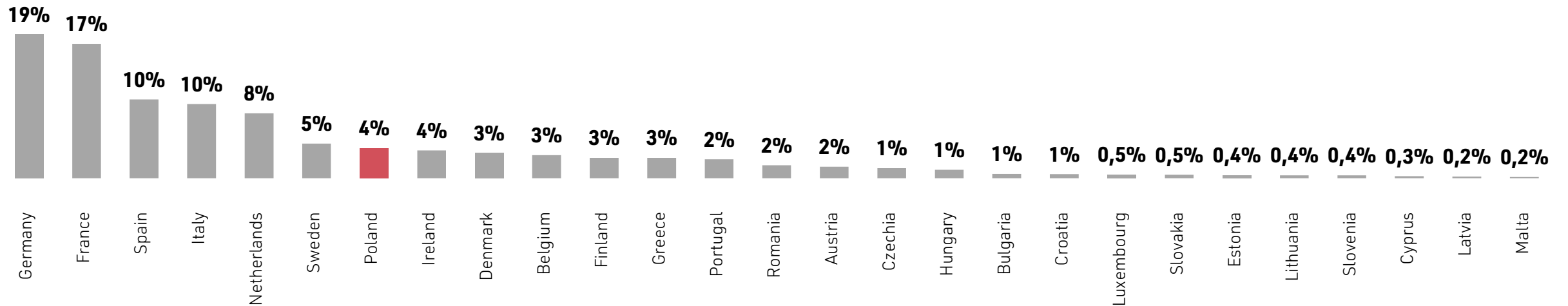


#8. Human Capital

► #8. Human Capital / AI Specialists by Country in the EU

- 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

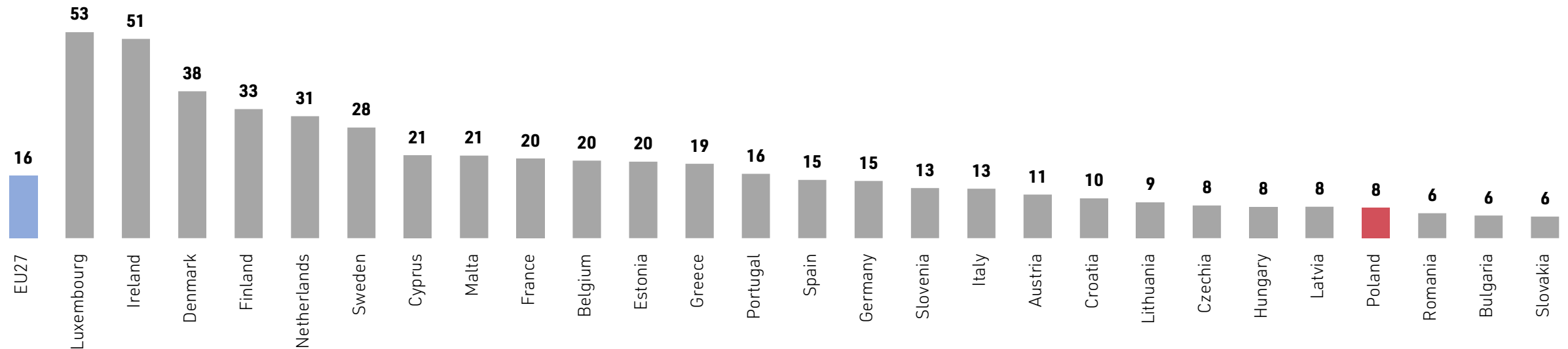


Source: LinkedIn Research, April 2021

► #8. Human Capital / AI Intensity in Workforce by Country in the EU

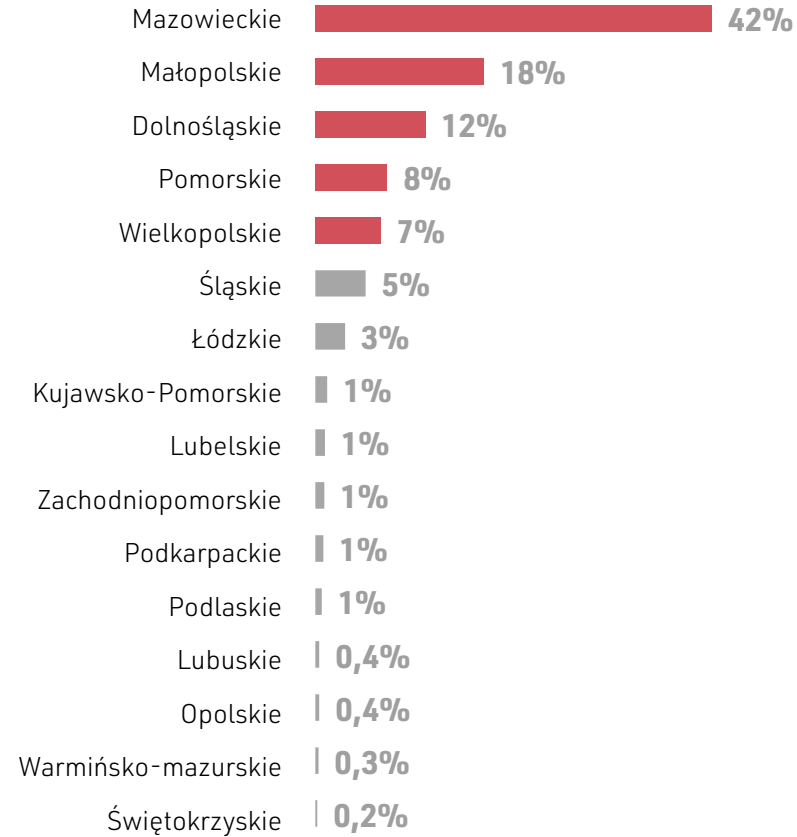
- Countries with the highest rate of AI specialists in the workforce are Luxembourg and Ireland. Both these countries have over 50 AI specialists per 10 000 economically active people in the population.
- Poland with 8 AI specialists per 10 000 workers fares pretty poorly compared to other EU countries. 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



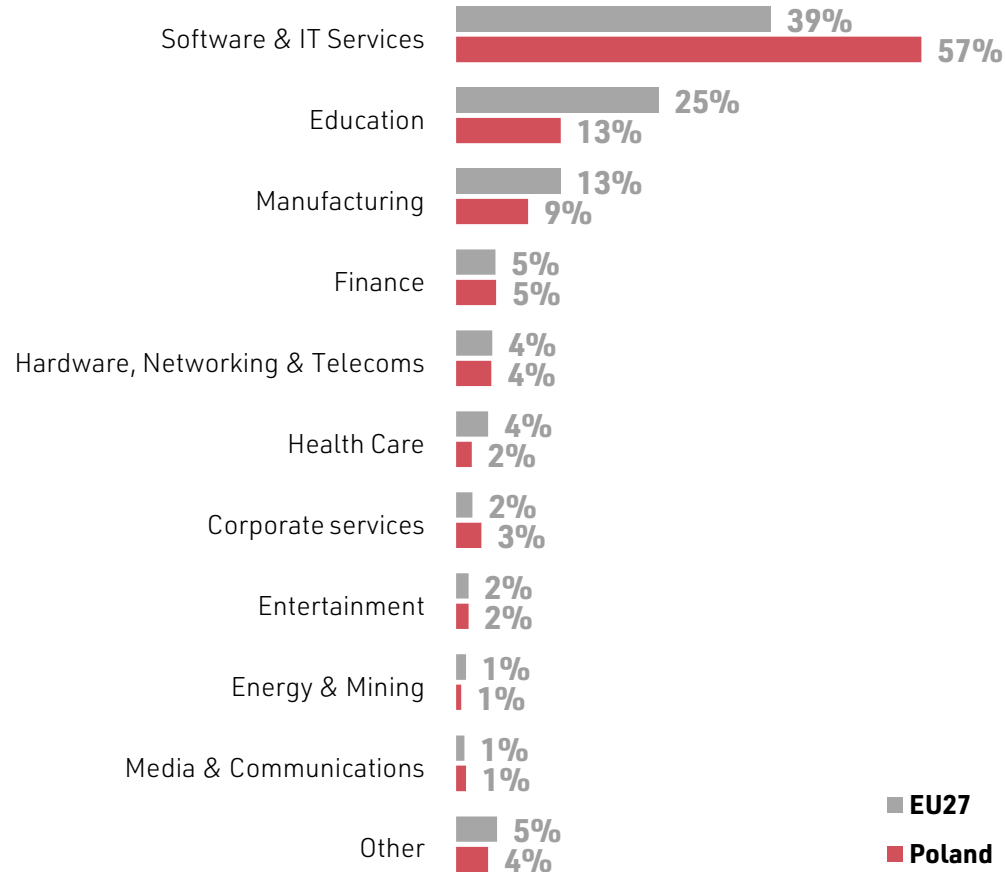
Source: LinkedIn Research, April 2021

AI specialists in Poland – by region



- The regions with the highest number of AI specialists are the ones with large agglomerations.
- 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).

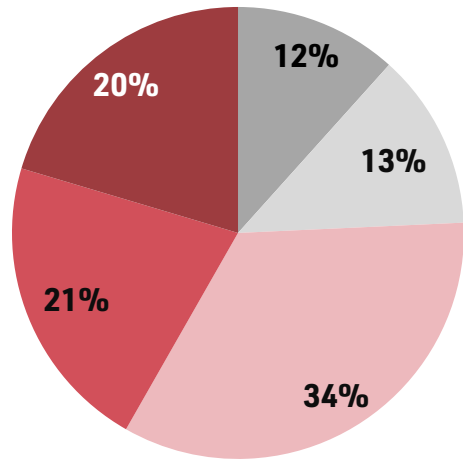
AI specialists – distribution by economy sector



- 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%.

How many people does your company employ?

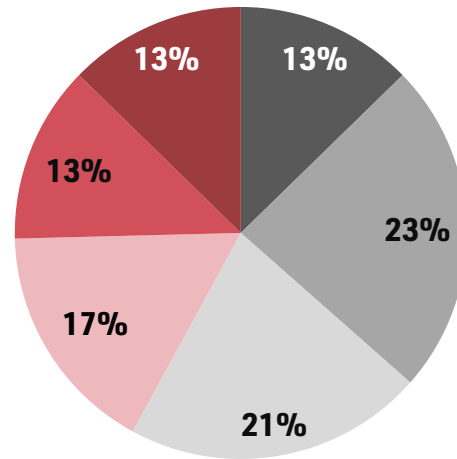
Number of employees*



- 1-5 employees
- 6-10 employees
- 11-50 employees
- 51-250 employees
- Over 250 employees

What is the size of your AI team?

Number of AI specialists**



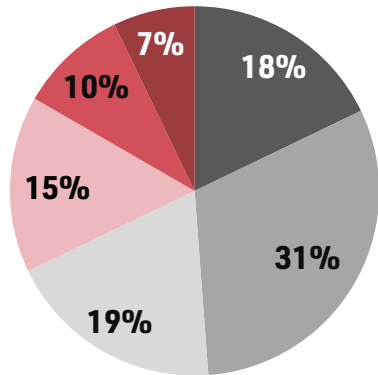
- 1-2 AI specialists
- 3-5 AI specialists
- 6-10 AI specialists
- 11-20 AI specialists
- 21-40 AI specialists
- Over 40 AI specialists

- Companies dealing with AI differ in size. However, most have up to 50 employees.
- The size of AI teams varies too (in either companies, corporations 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.

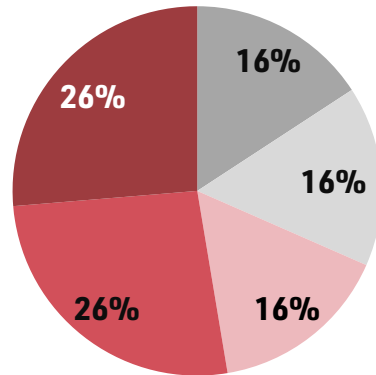
Sample: *only AI companies & corporations | excluding academic teams | **AI companies, corporations & academic teams

What is the size of your AI team?

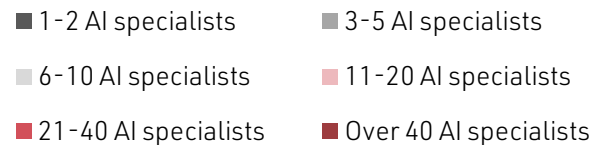
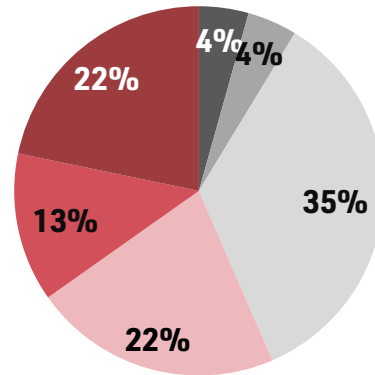
AI companies



Corporations



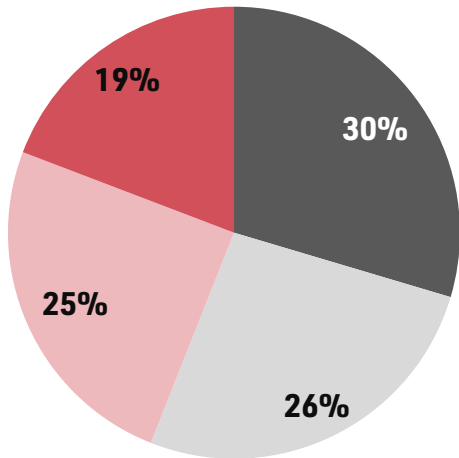
Academia



- **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.**

What is the proportion of women on your AI team?

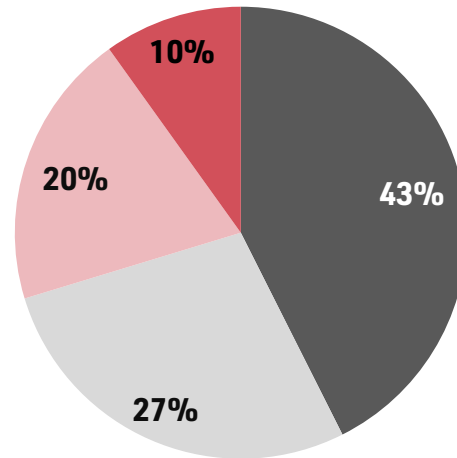
Share of women*



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

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

Number of PhDs**



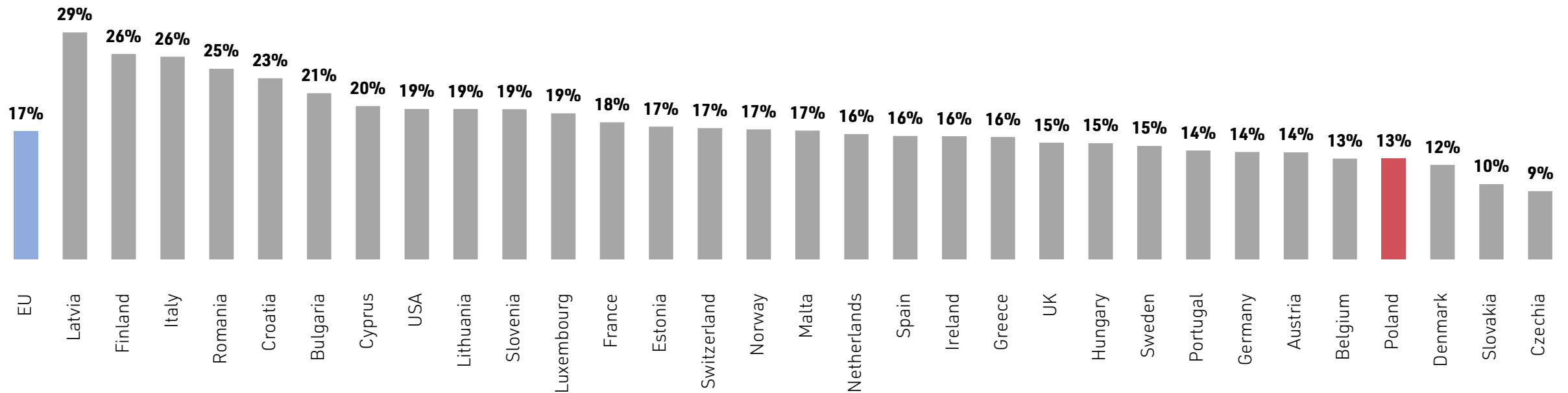
- None
- 1-2 PhDs in the AI team
- 3-5 PhDs in the AI team
- 6 or more PhDs in the AI team

- **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

- **Women are a minority among AI specialists. On the EU level they constitute 17% of people working in the domain. In some countries, such 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



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



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.

► Insights



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!

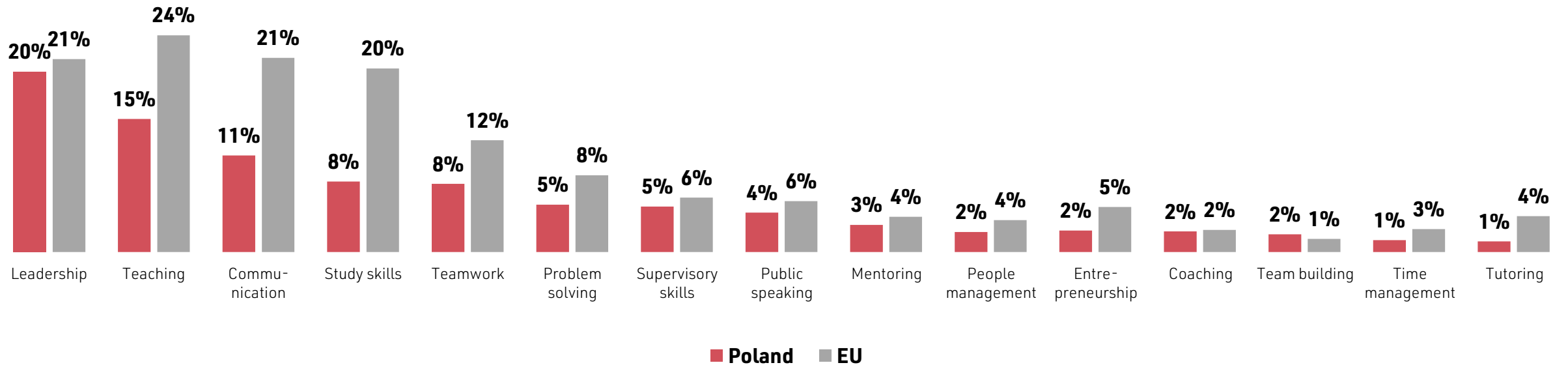


Edyta Janas
Business Development
Director,
Randstad Sourceright

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 skills. 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.

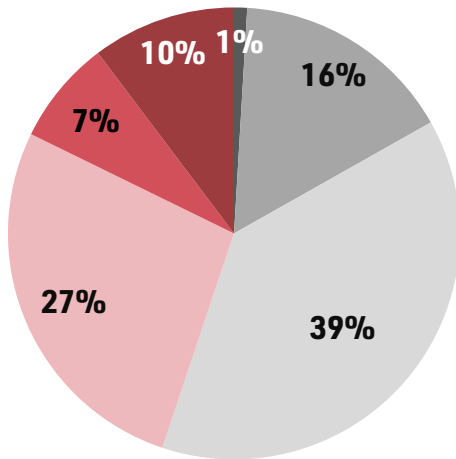
Skillset owned by AI specialists (self-declared in LinkedIn profile)



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

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

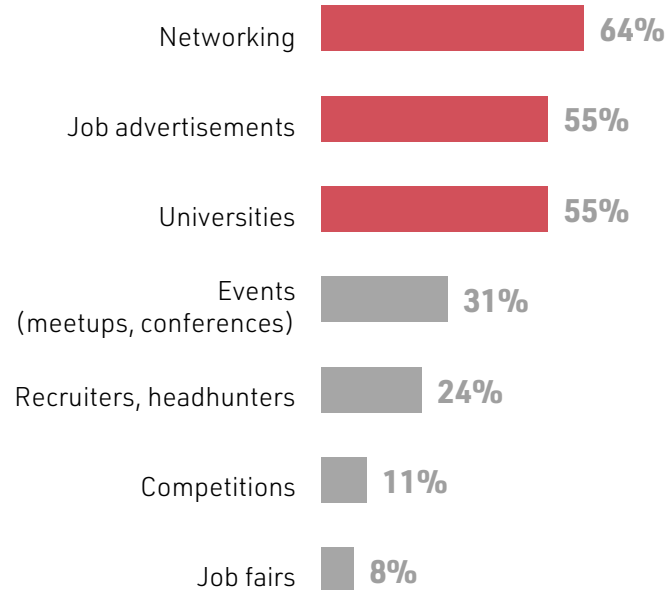
Change in the size of AI team



- 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

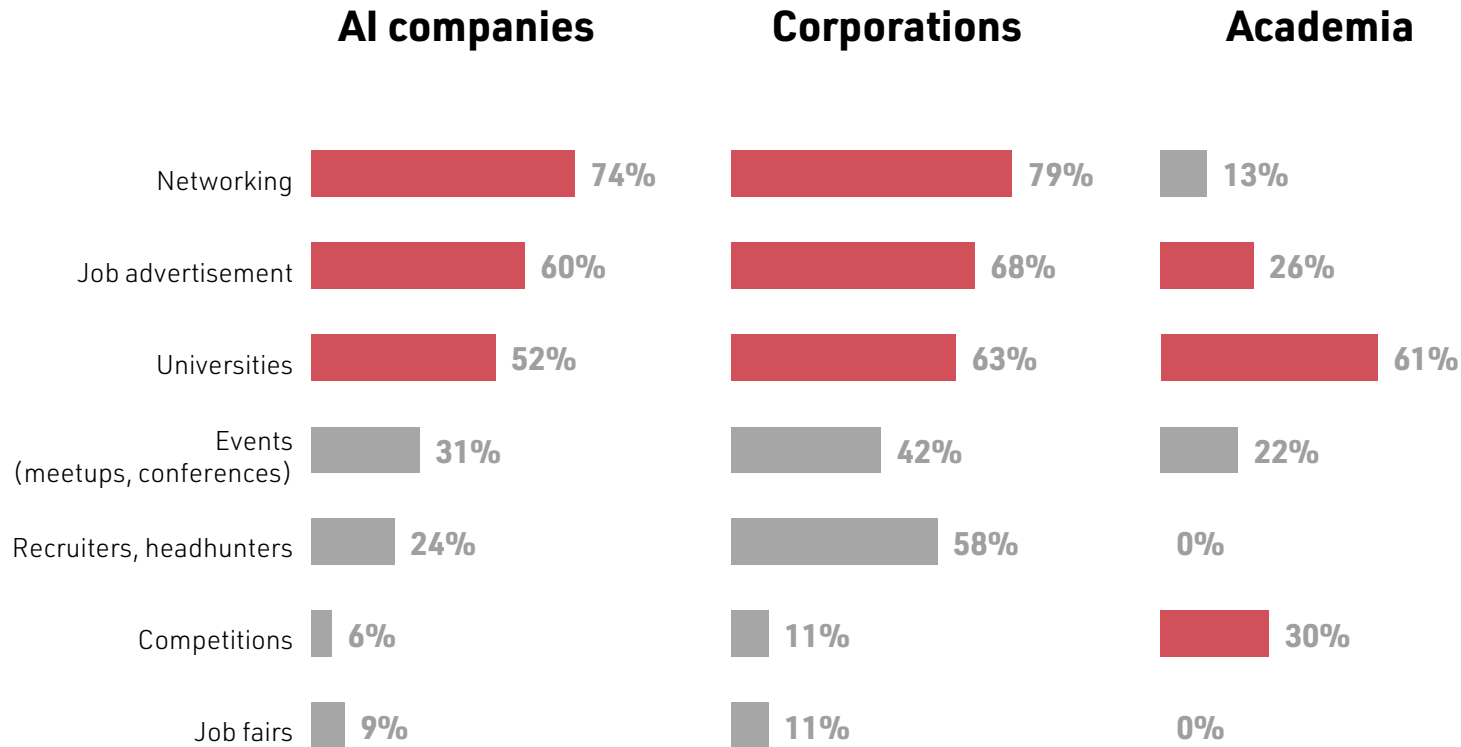
What are your main sources of recruiting AI professionals? Select each correct answer.

Source of AI specialists



- 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%).

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



- 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

► Insights



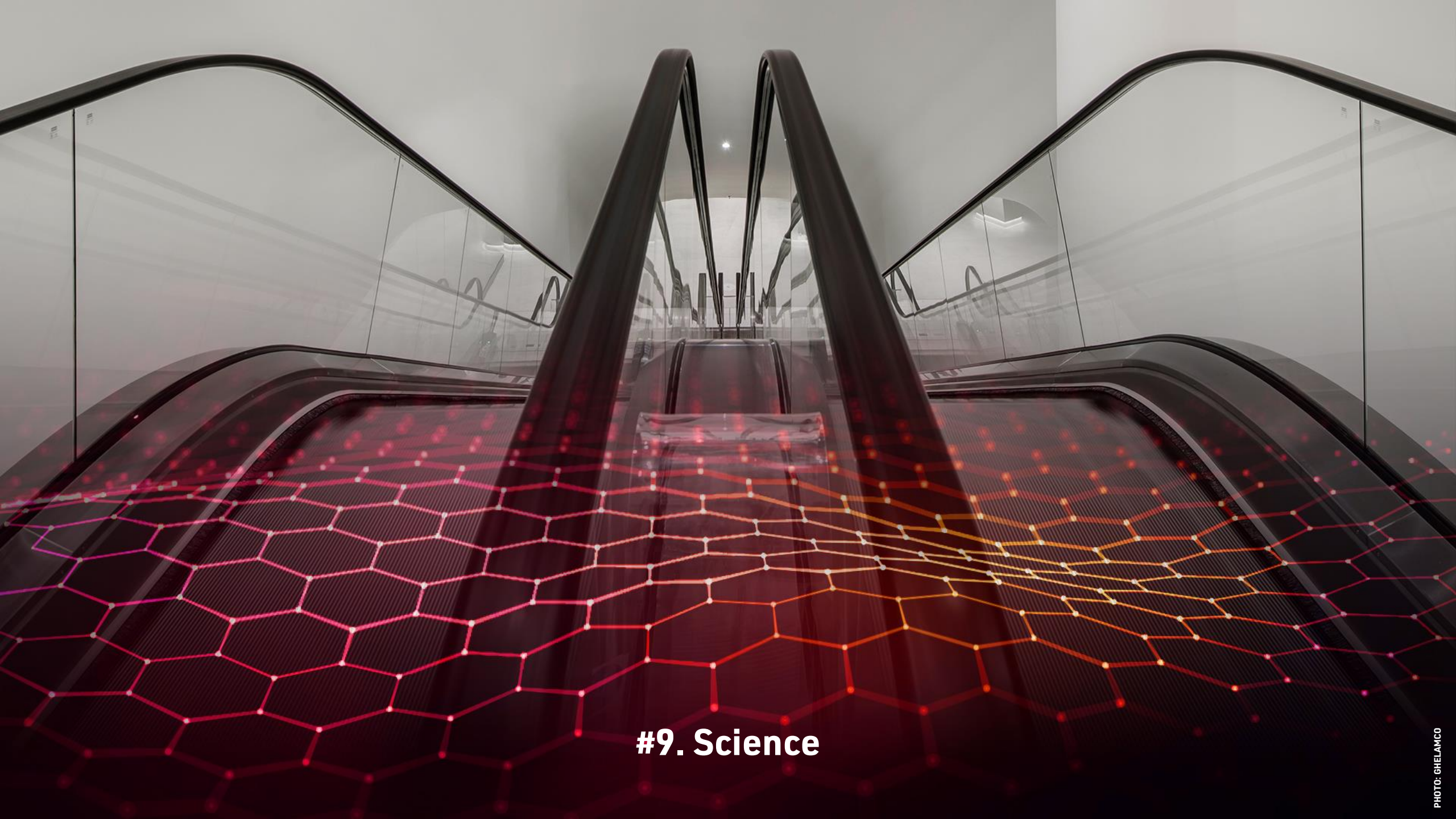
Krzysztof Nowakowski
Managing Director &
Country Head,
Korn Ferry

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.

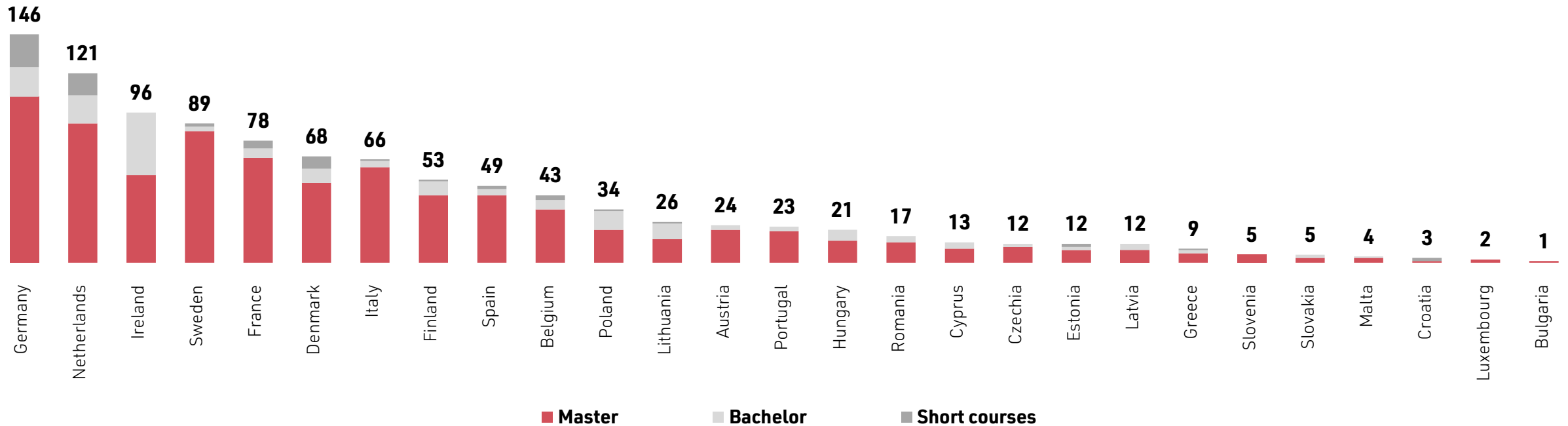


#9. Science

► #9. Science / AI Programmes at Universities by Country in the EU

- 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



Source: Righi, R., López-Cobo, M., Alaveras, G., Samoil, S., Cardona, M., Vázquez-Prada Baillet, M., Ziembra, L.W., and De Prato, G., Academic offer of advanced digital skills in 2019-20. International comparison. Focus on Artificial Intelligence, High Performance Computing, Cybersecurity and Data Science, EUR 30351 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-21451-9, doi:10.2760/225355, JRC121680.

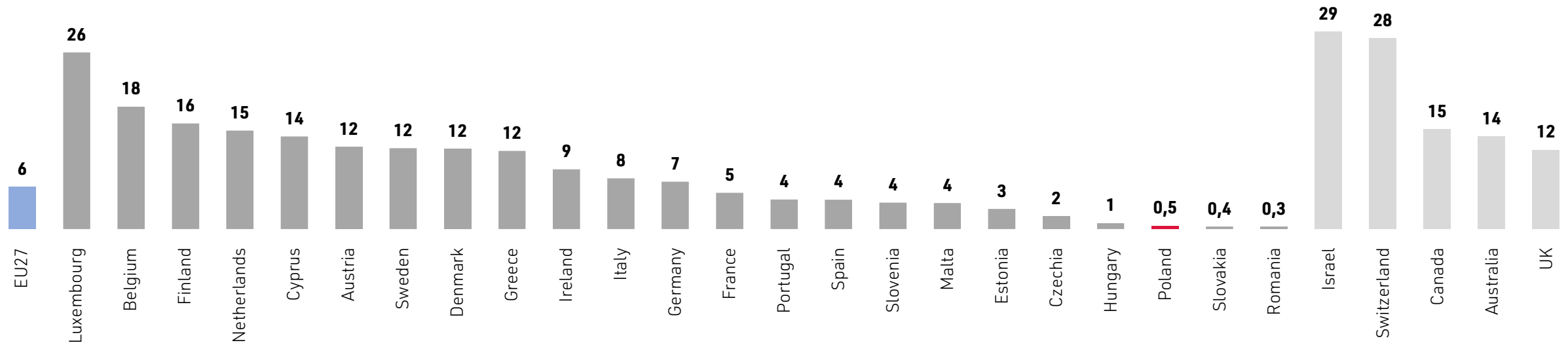


Adam Czerniak, PhD
Chief Economist,
Polityka Insight

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.

- 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



Source: guide2research.com, Top 6000 Computer Science Scientists

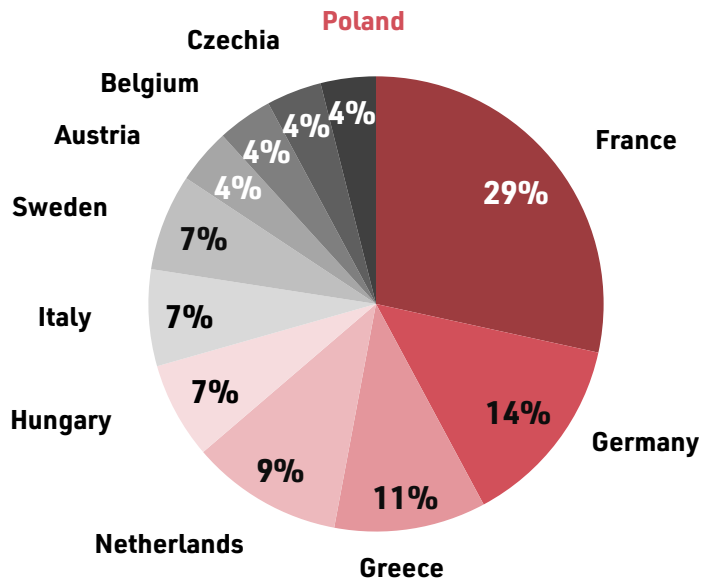


Piotr Sankowski
President of IDEAS NCBR,
Profesor at University of
Warsaw,
CEO of MIM Solutions

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.

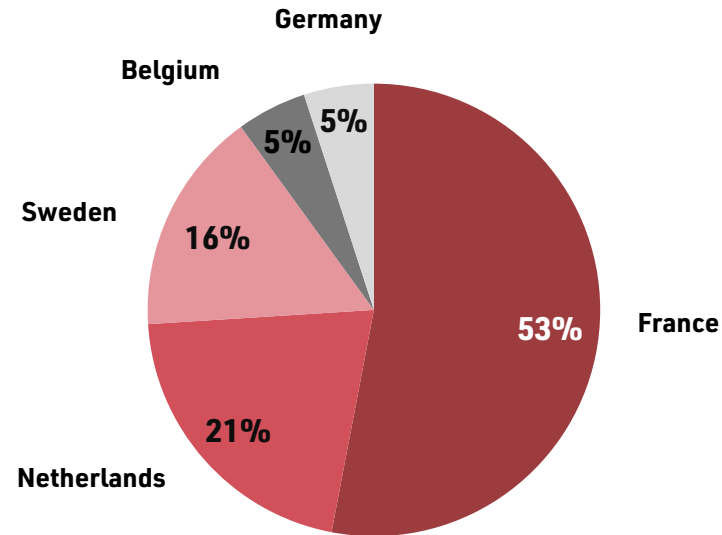
Where do the most elite (top 0.5%) AI researchers in Europe come from?

Received degree



Where do the most elite (top 0.5%) AI researchers in Europe work today?

Currently working



- 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.



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.

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

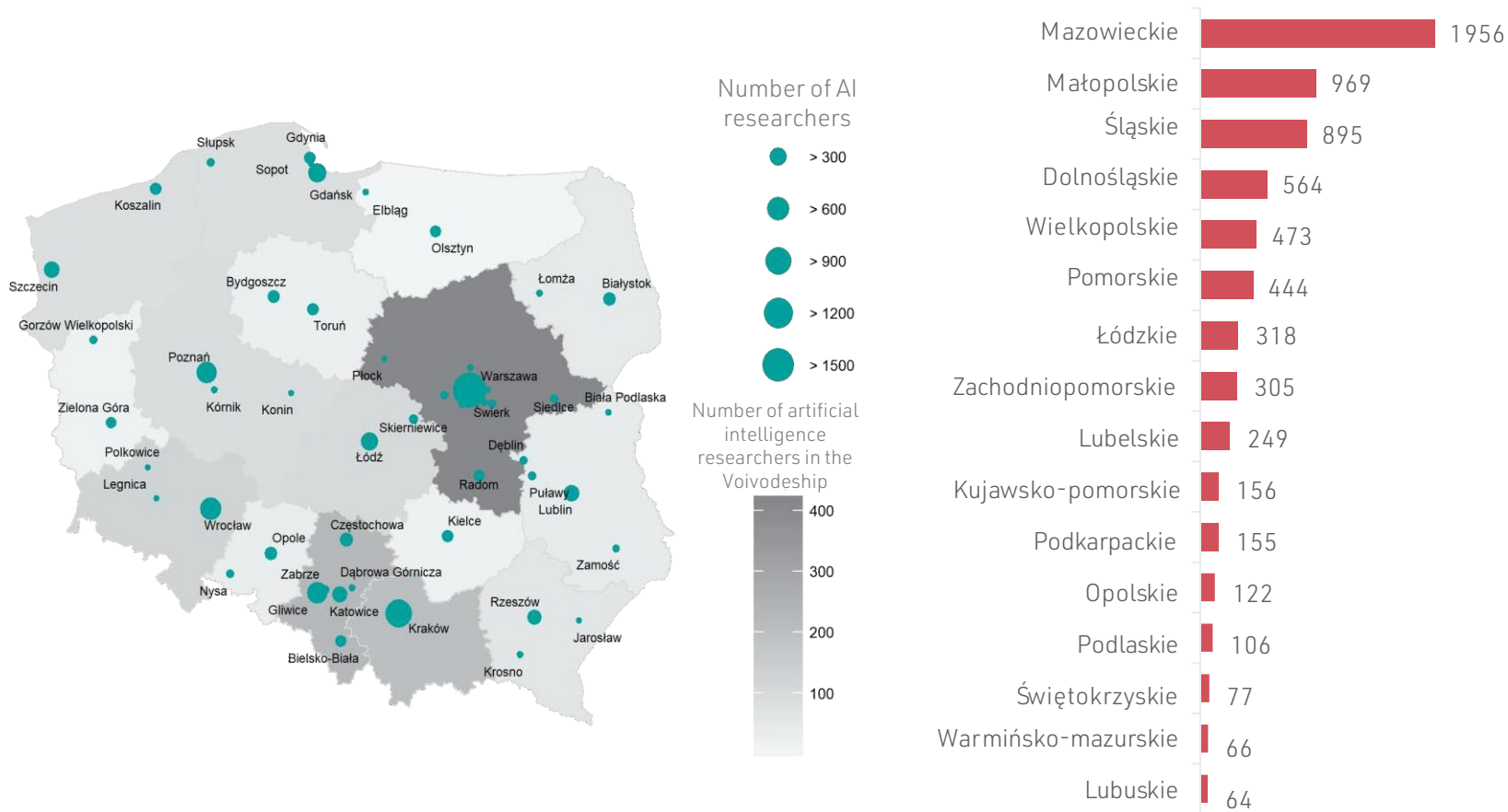
who during the years 2013-18 published at least one research article on AI

7 322

Number of publications

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

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

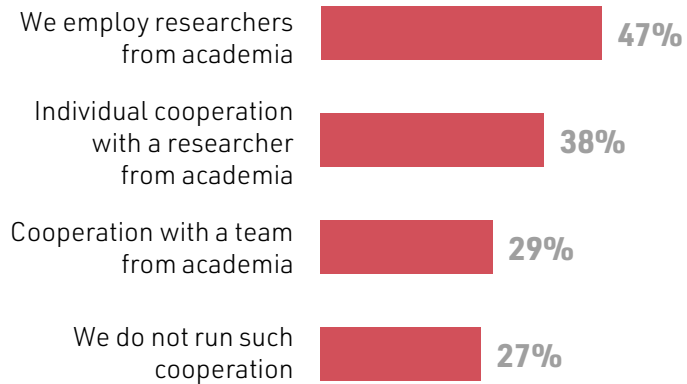


- **The Mazowieckie region has a strong lead in the number of AI researchers with 1 956 people publishing in the field**
- **Two other regions with a considerable number of researchers are Małopolskie (969 people) and Śląskie (895 people)**
- **Warszawa, Kraków, Wrocław, Gliwice, Poznań, Gdańsk have 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

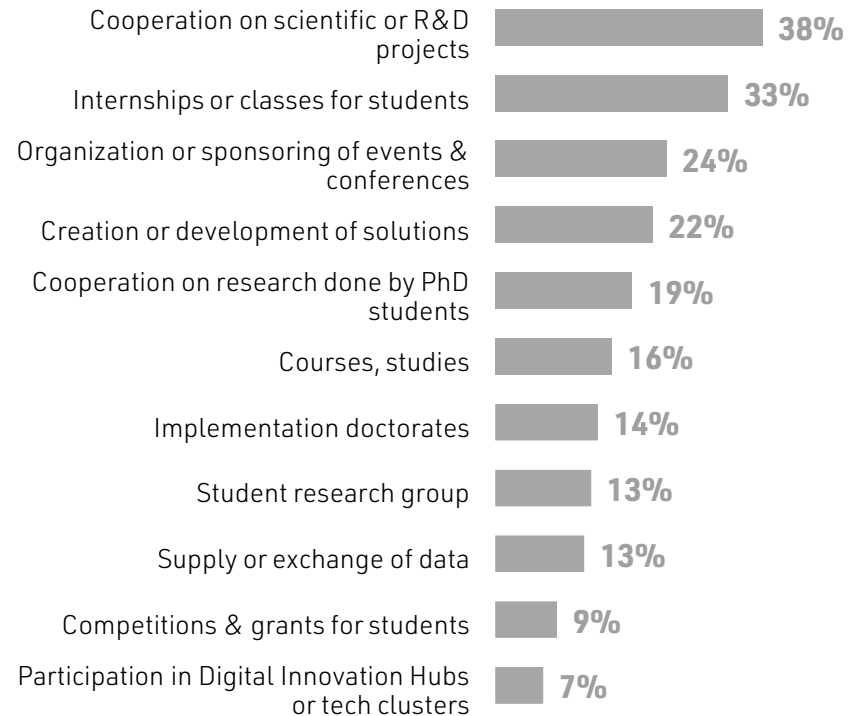
Do you collaborate with the academic community on AI? Select each correct answer

Cooperation with Academia



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

Scope of Cooperation



- **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.**

► Insights



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.



Barbara 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.

► Insights



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.

► **Insights**



Przemysław Biecek

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

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.



Zenon Szczepkowski

Sales director,
VoiceLab

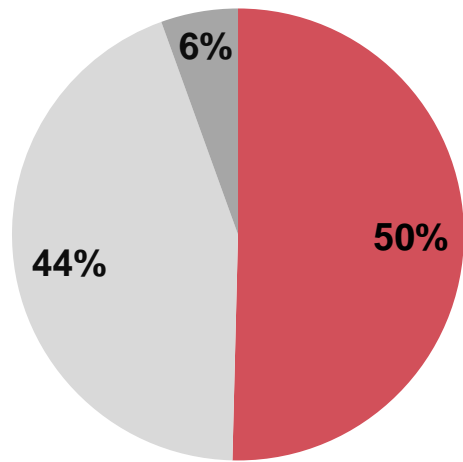
Raising the popularity of AI requires the preparation of substantial workforce, which eventually can be used in Companies operating in AI. It happens both on the Academia level and in Companies directly. We cooperate with different universities and academia in the area of several projects. It is a good 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.



#10. R&D and Tax Reliefs

Did your organization use NCBR grants to develop AI?

Use of NCBR grants



■ Yes ■ No ■ Don't know

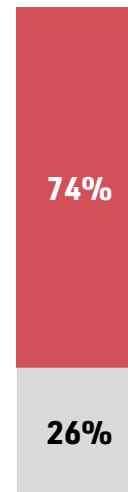


Corporations

AI companies

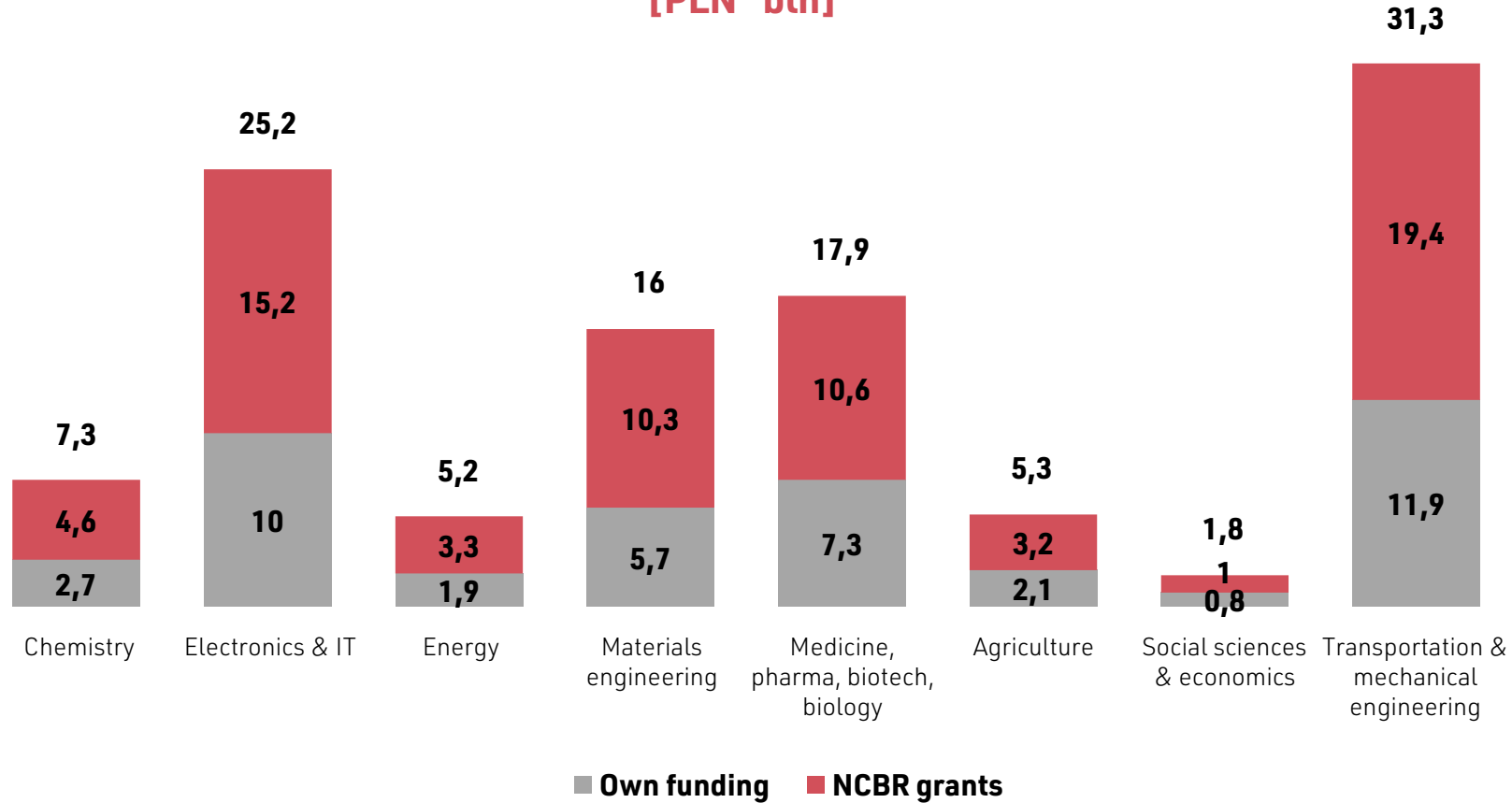


Academia



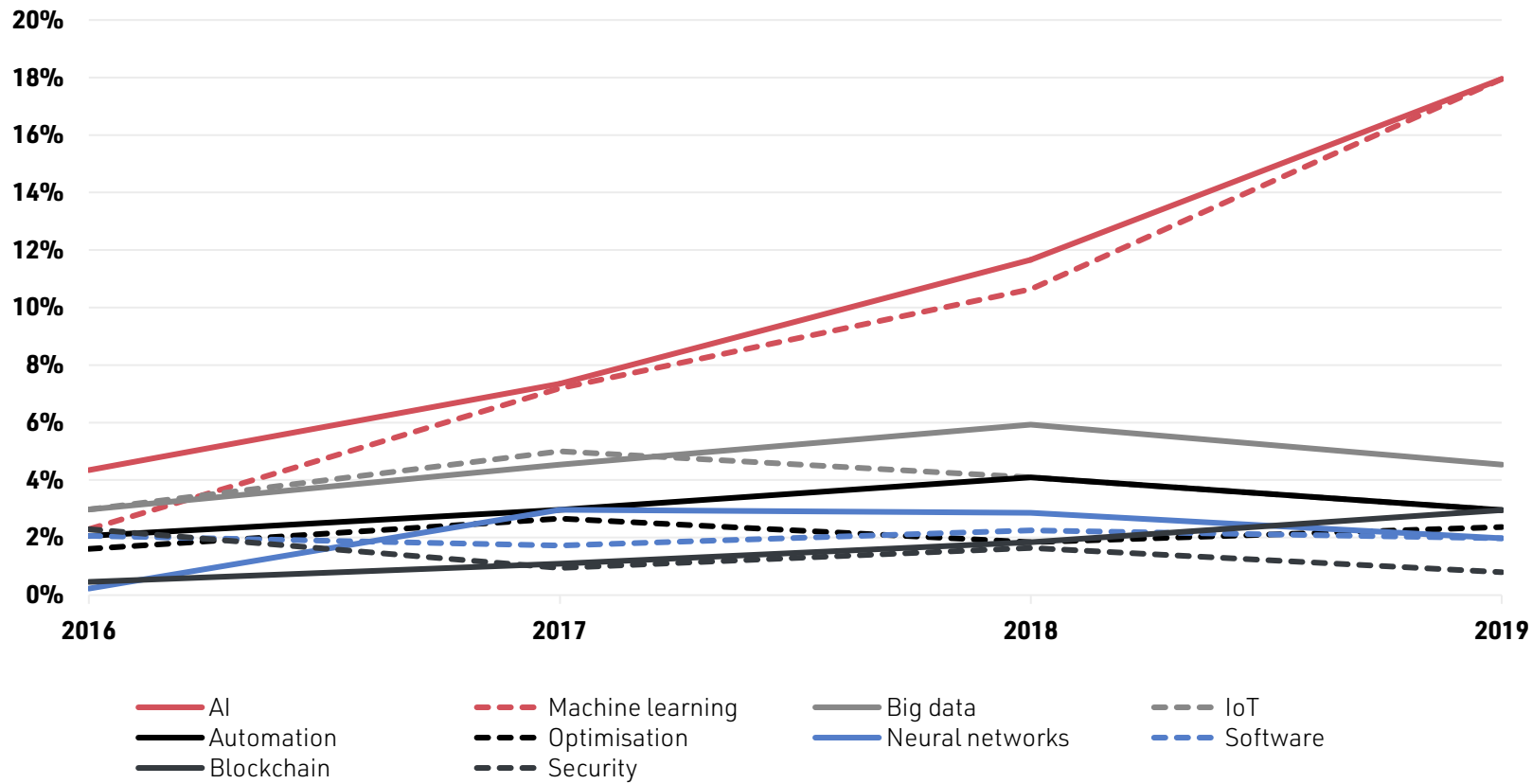
- Narodowe Centrum Badań i Rozwoju (NCBR, English: National Centre for Research and Development in Poland) is a governmental agency focused on supporting R&D activities in the economy.
- About a half of AI companies benefit from NCBR grants.
- However, only 21% of corporations do so. This may reflect 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.

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



- 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.

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.

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



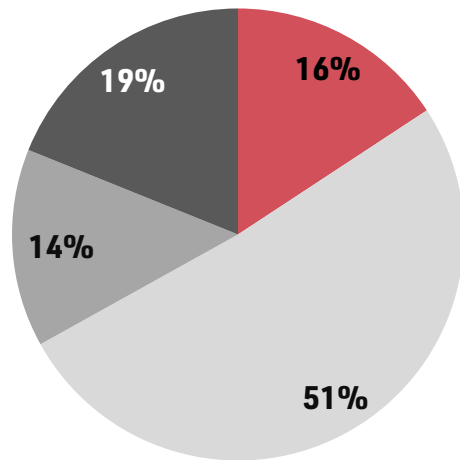
Wojciech Kamieniecki, PhD
Director,
National Centre for
Research and Development

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

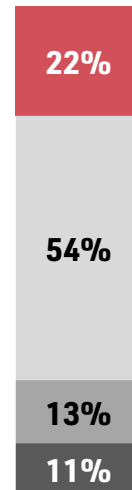


- Yes
- No, but I know what IP Box is
- No, I don't know what IP Box is
- I don't know the answer

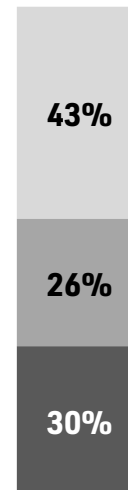


Corporations

AI companies



Academia



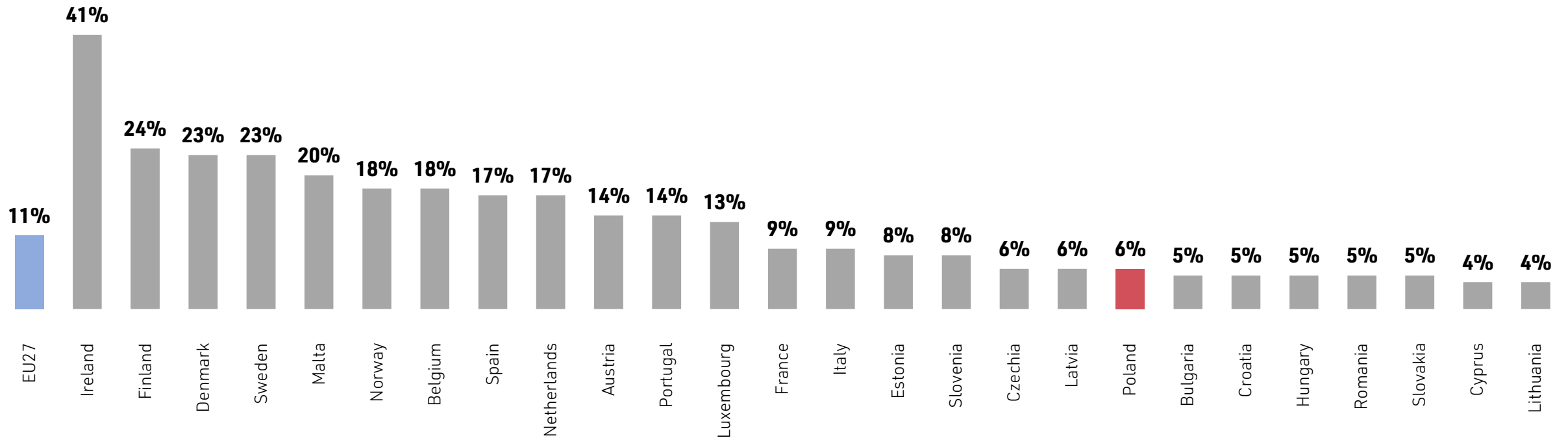
- IP Box is a preferential income tax rate applicable to development of intellectual property. It was implemented in 2019.
- 16% of teams use it and about 2/3 are aware it exists.
- IP Box is used by 22% of AI companies.



#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.**

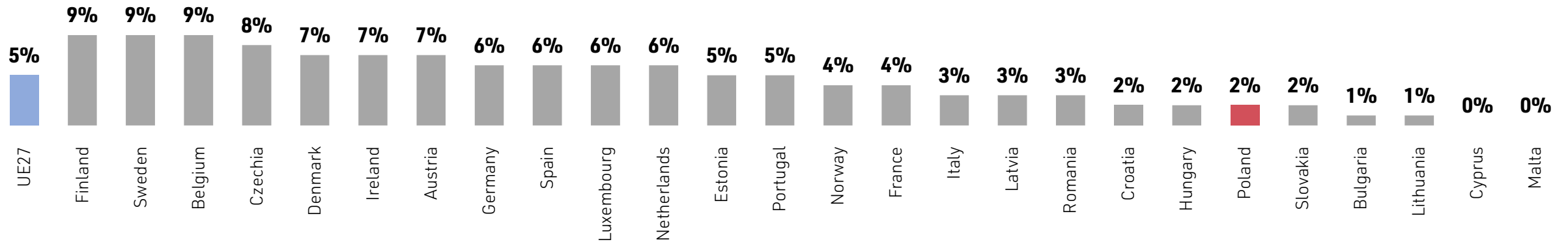
Large companies (250+ employees) that analyze big data internally using machine learning



Source: Eurostat ICT panel, data for 2020, December

- 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



Source: Eurostat ICT panel, data for 2020, December



Zbigniew Gajewski
Partner,
Think Tank

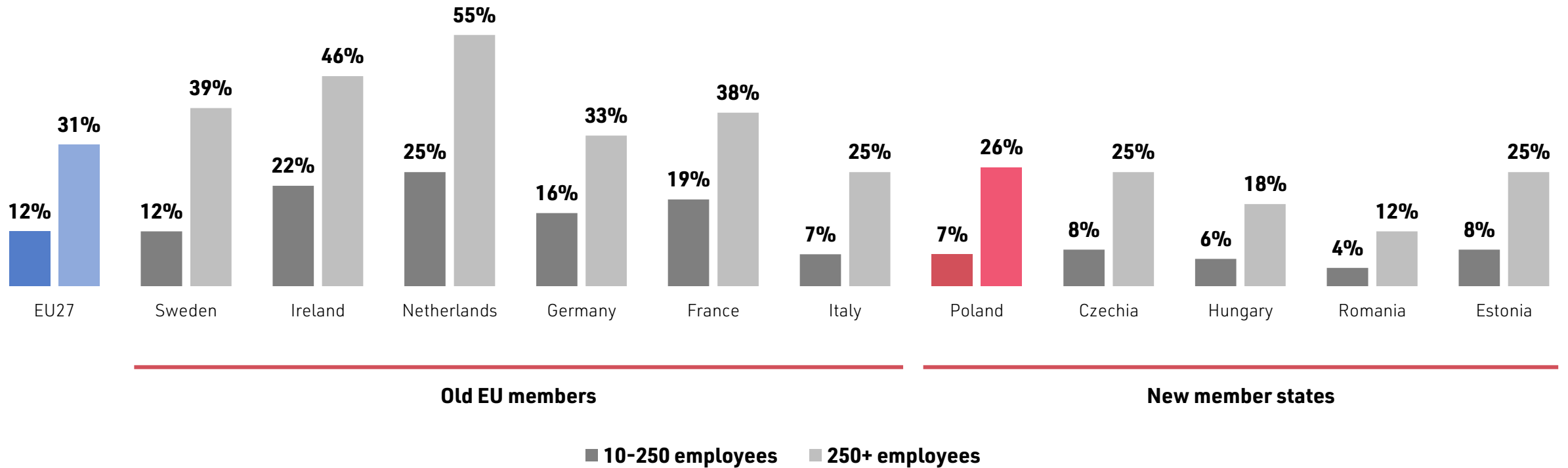
The Eurostat research quoted here, as well as data from other sources, indicate a serious backwardness in the digitization of companies from the Central and Eastern Europe compared to Western European companies. Our region is paying a high price for the decades-long experiment with a centrally controlled 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



Source: Eurostat ICT panel, data for 2020, December

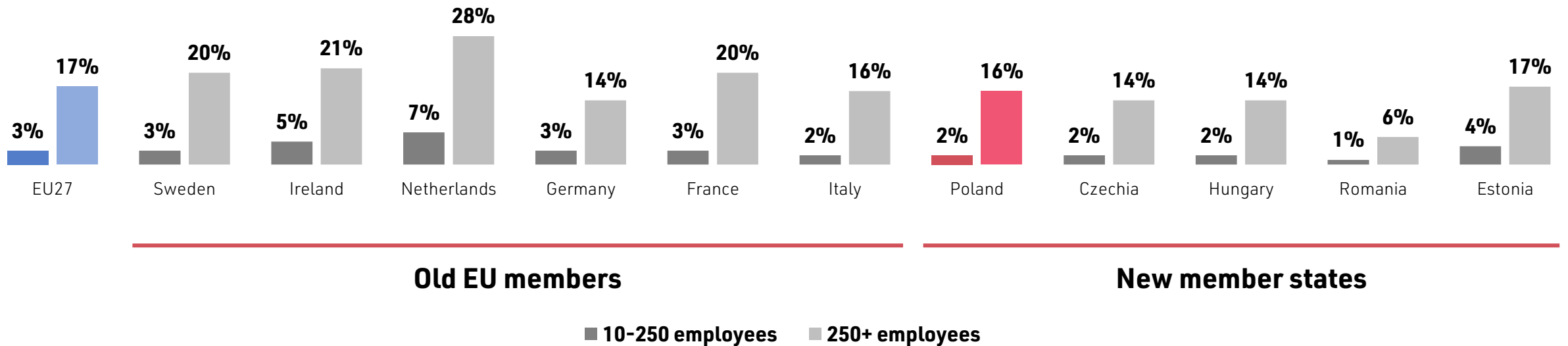


Ewa Drozd
Enterprise Commercial
Lead, Board Member,
Microsoft Poland

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.

- **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.**

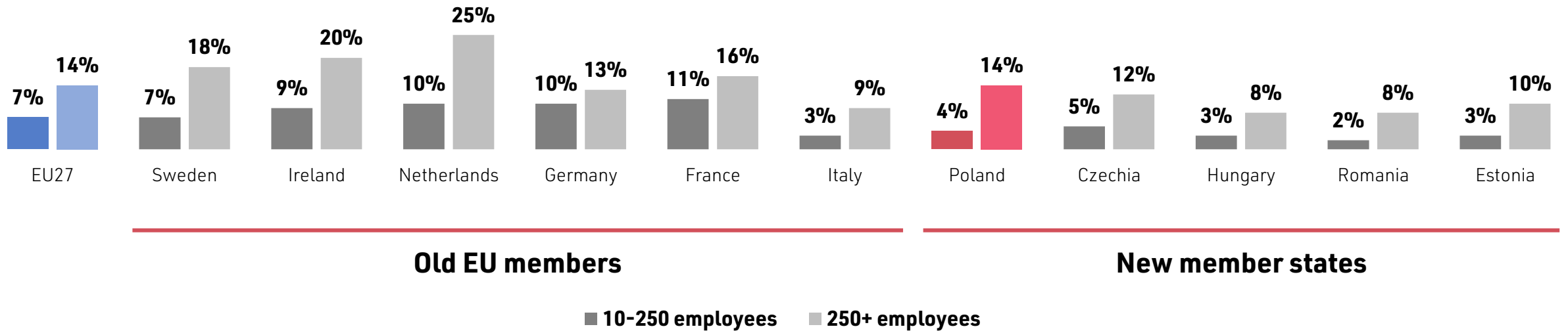
Companies that analyze big data from smart devices or sensors



Source: Eurostat ICT panel, data for 2020, December

- 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.

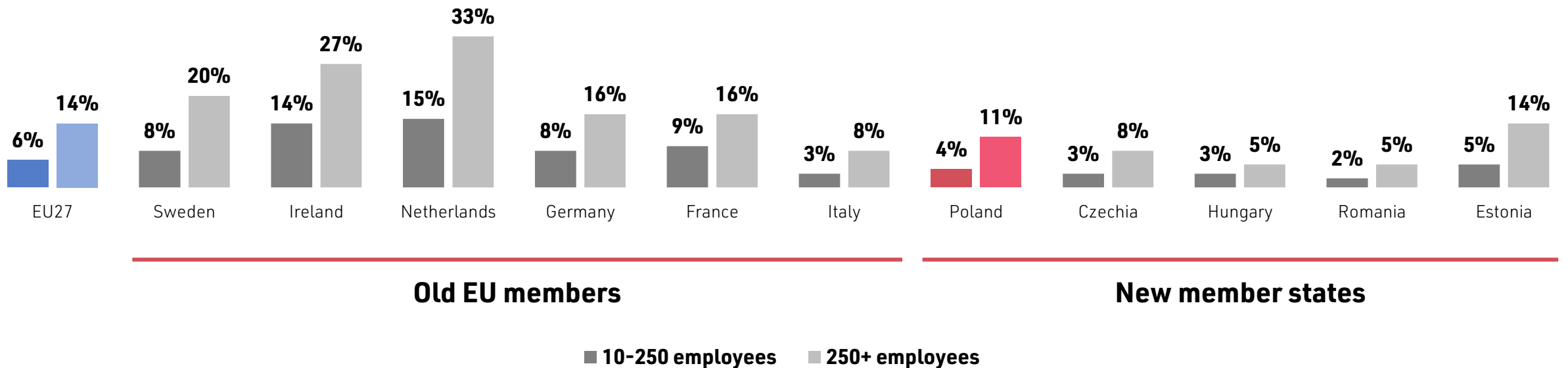
Companies that analyze big data from geolocation of portable devices



Source: Eurostat ICT panel, data for 2020, December

- 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



Source: Eurostat ICT panel, data for 2020, December

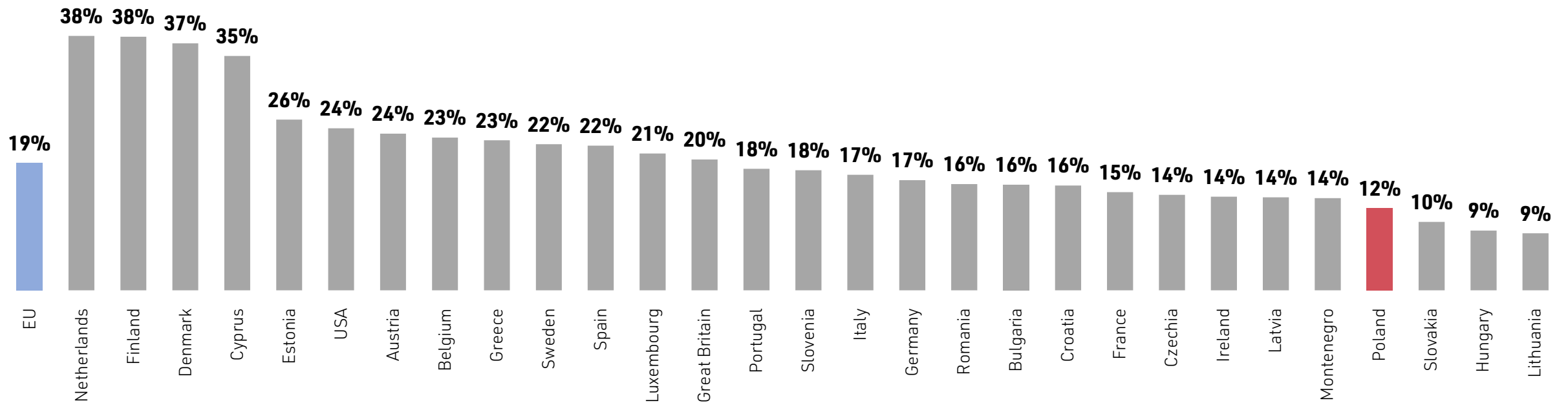


Ignacy Święcicki
Digital Economy Team
Leader,
Polish Economic Institute

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



Source: Cathles, Nayyar & Rückert (2020) „Digital technologies and firm performance: Evidence from Europe”, EIB Working Papers

► Insights



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

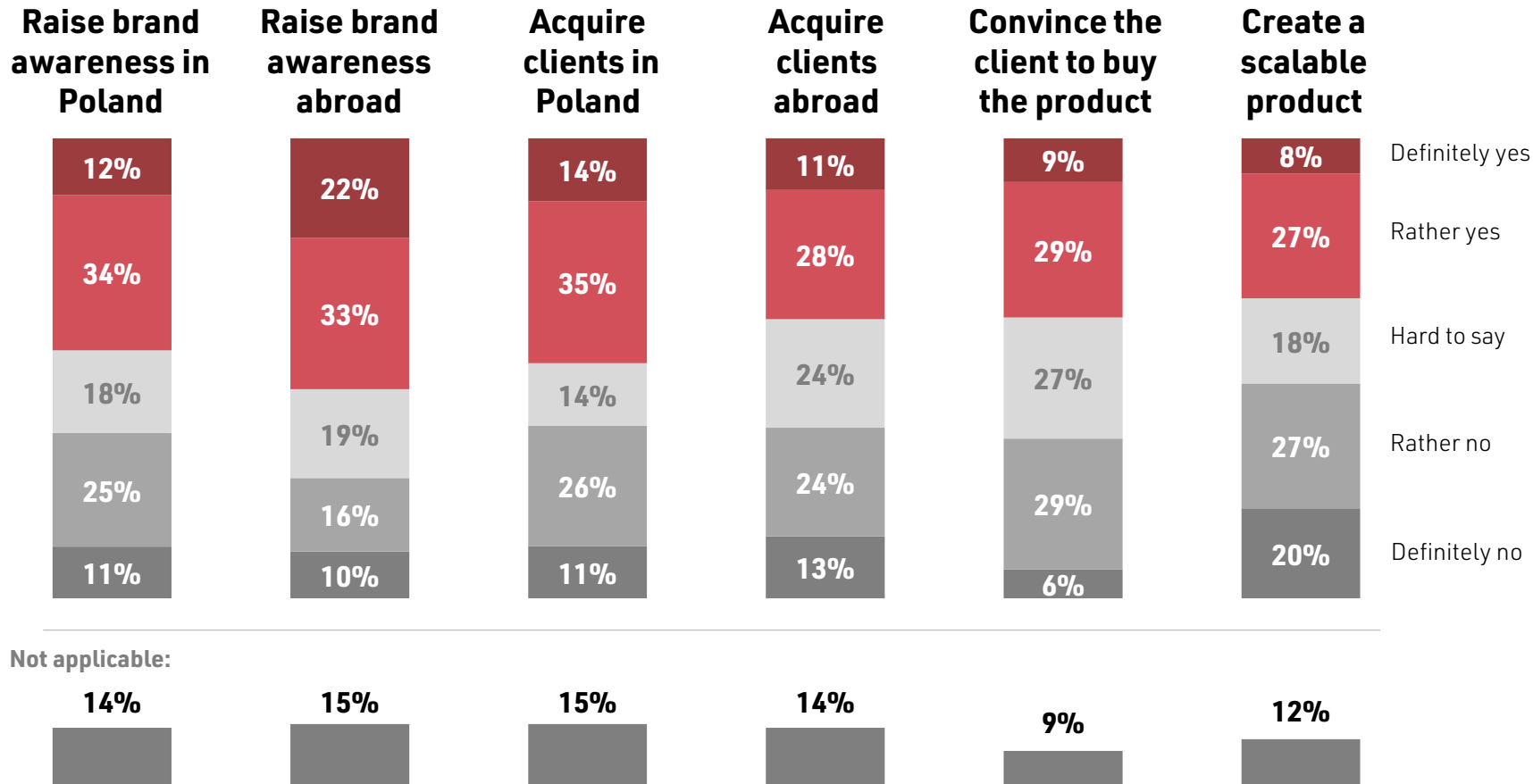
The data on the use of AI solutions in companies around the world are most often different and difficult to use for comparisons. Artificial intelligence is a new, very young field of technology. Researchers who study it use heterogeneous terminology and ask companies ambiguous questions. In addition,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



#12. Challenges for Polish AI Companies

Is it difficult for your organization to...?



- 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

► Insights



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 from 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 Chodarczewicz,
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.

► Insights



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 build 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.



Marek Zieliński
Co-Founder, CTO,
10 Senses

The results show that the biggest problem for AI companies in terms of sales and marketing is raising brand awareness either in Poland or abroad. Initiatives like the Map of Polish AI or AIPoland, that are aimed at promoting the Polish AI ecosystems are indeed needed. And as the results show what's even more important is to do it on our own yard.

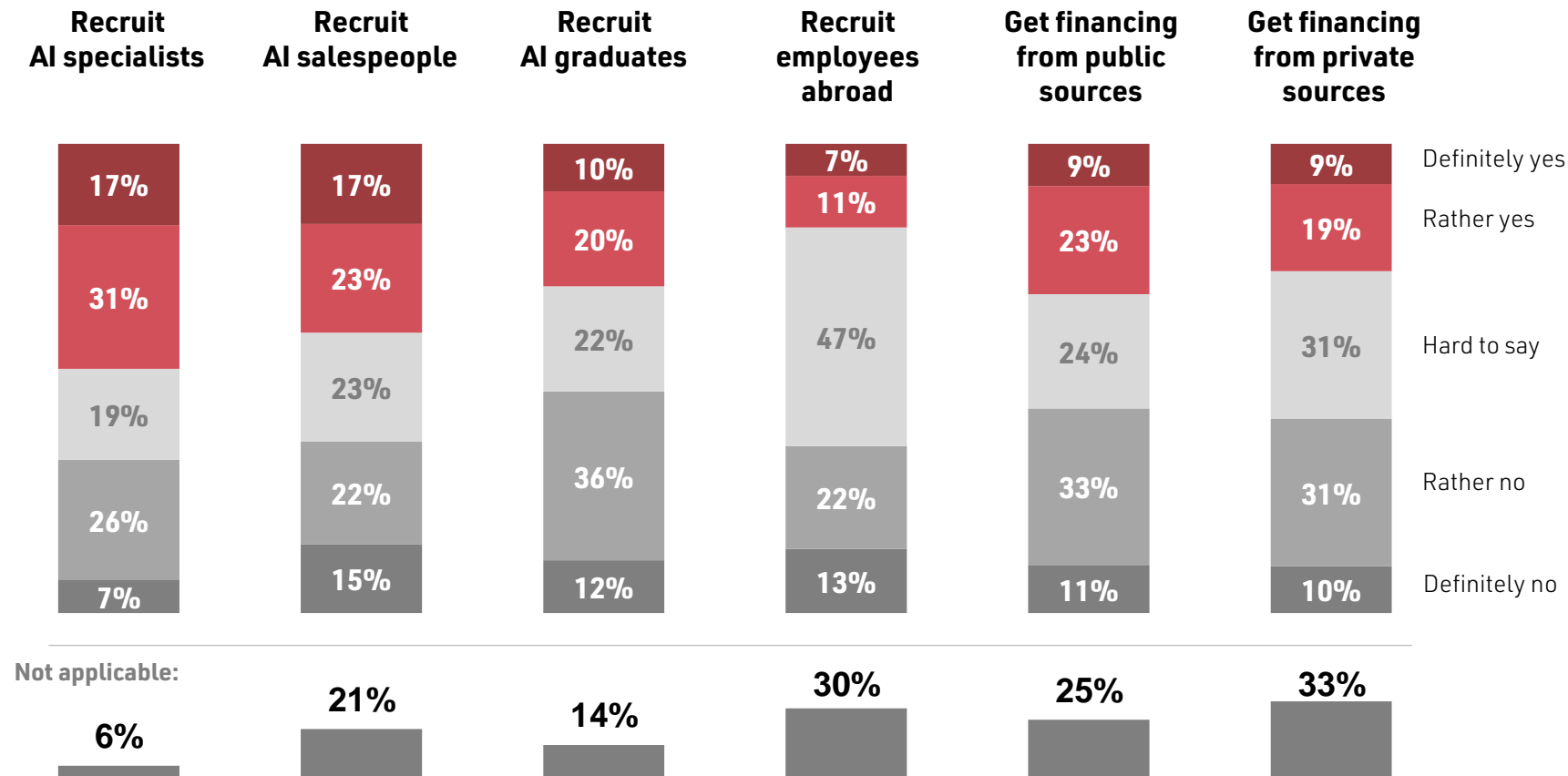
If we look below at the survey results in operations then will see that the biggest reported pain point is recruiting AI specialist. In this regard initiatives like AI Tech aimed at creating specialized workforce are definitely worth mentioning. Hopefully the AI Tech program will combine both worlds of traditional academia and the fast paced MOOC world that is the base of the AI progress recently.



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...?



- 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

► **Insights**



Rafał Albin
Chief Marketing and
Operations Officer, Board
member,
Microsoft Poland

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.

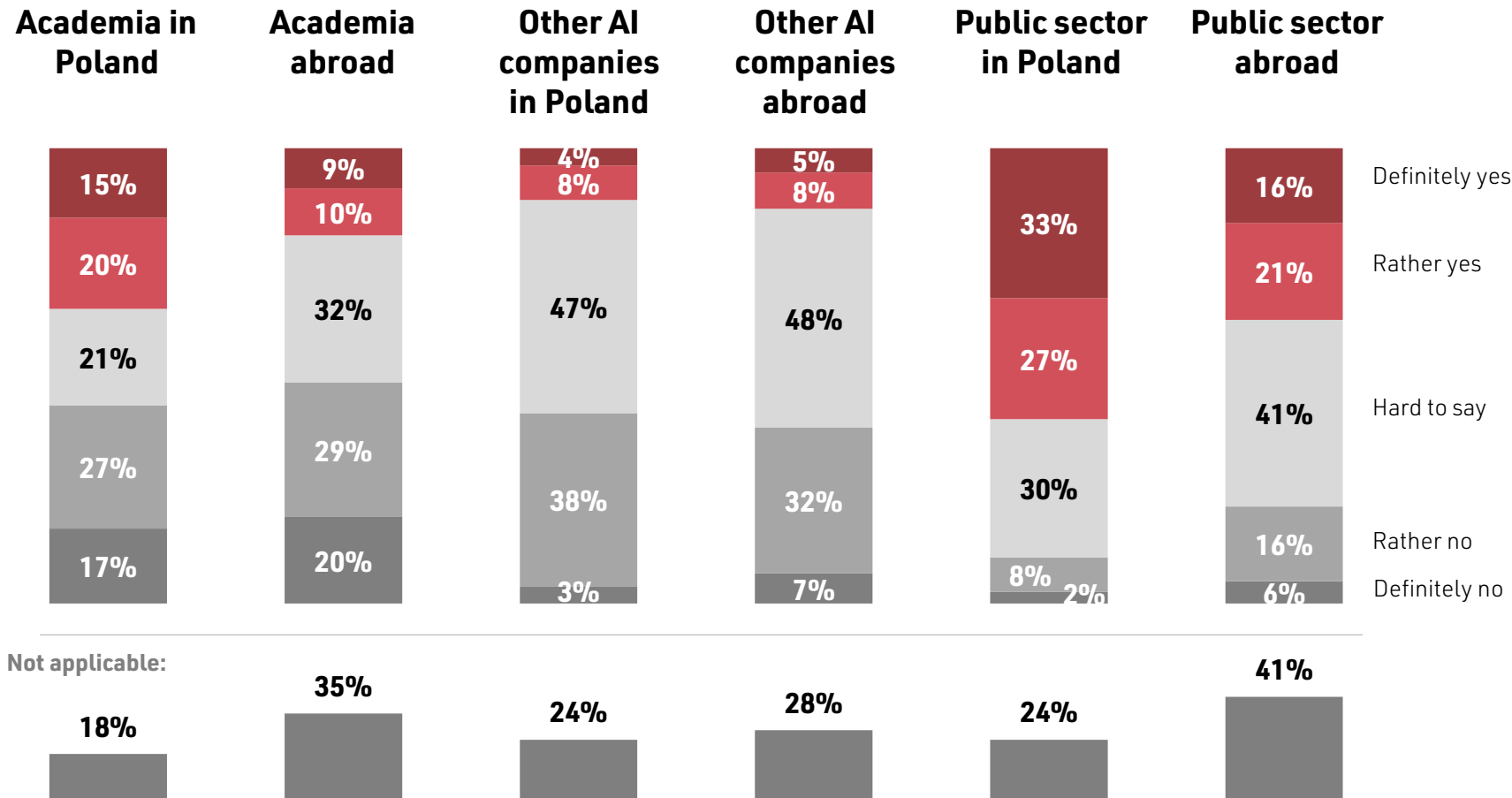
On the other hand, the answer to the difficulties in obtaining graduates may be close cooperation with the education sector at the academic level. Properly implemented technologies and training programs that show how to use them allow students to already use the right tools to prepare for the challenges 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.



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.

Is it difficult for your organization to cooperate with...?



- **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



Piotr Mieczkowski
Managing Director,
Digital Poland Foundation

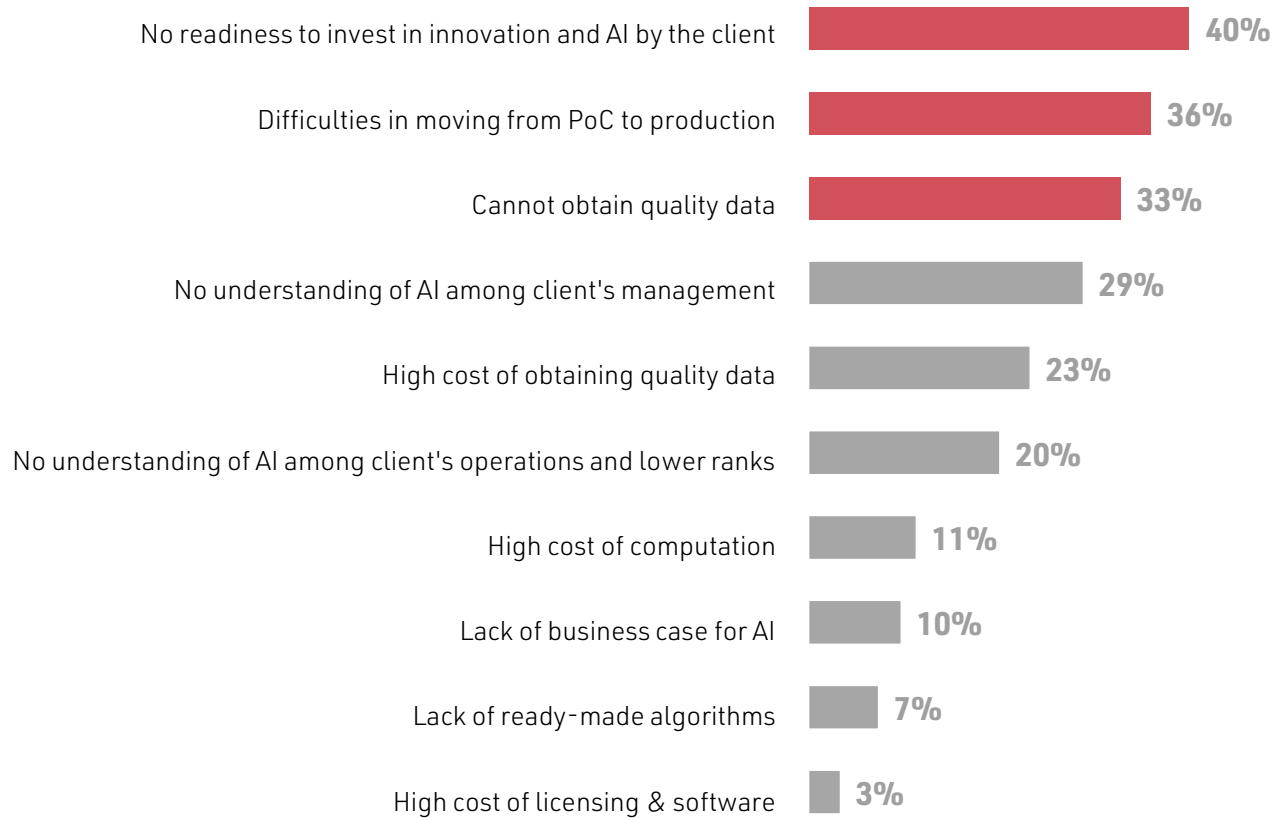
Two things struck me strongly when I began to analyze the results of the survey on the quality of collaboration.

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.

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



- **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.**

► **Insights**



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.



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.

► Insights



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.

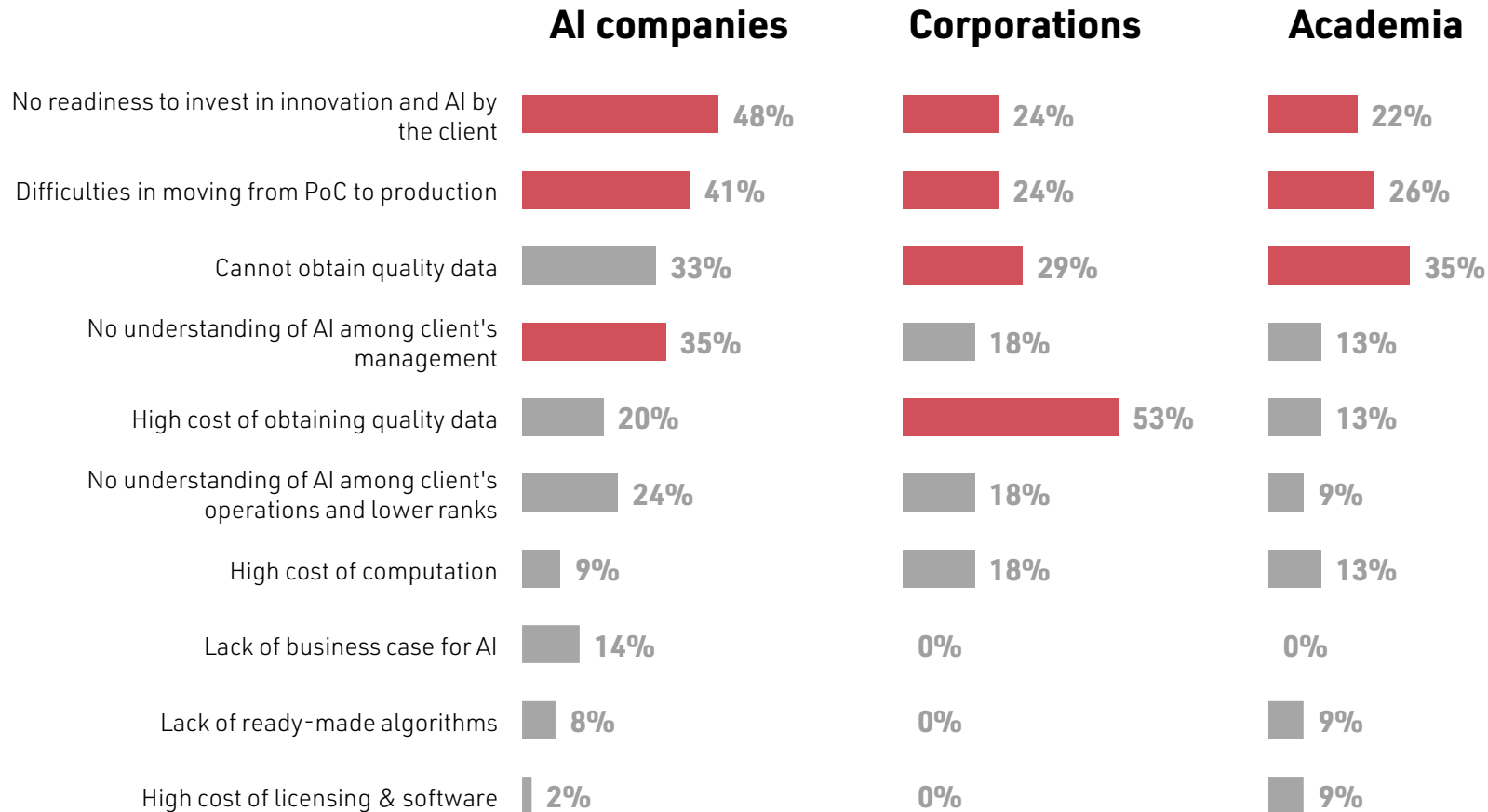
From my perspective, the biggest limitation of AI development in Poland are: the number of domain experts available on the market, insufficient focus on finalizing AI initiatives with implementations, and insufficient activities attracting foreign investors, including companies from the big tech sector. 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.

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



- **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%).**

Sample: AI companies, corporations & academic teams



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.



#13. AI Policy & AI Ecosystem Development

- 1 Beginning of the work on AI strategy** [Apr 2018] Visegrad 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

- **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 competitiveness 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

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

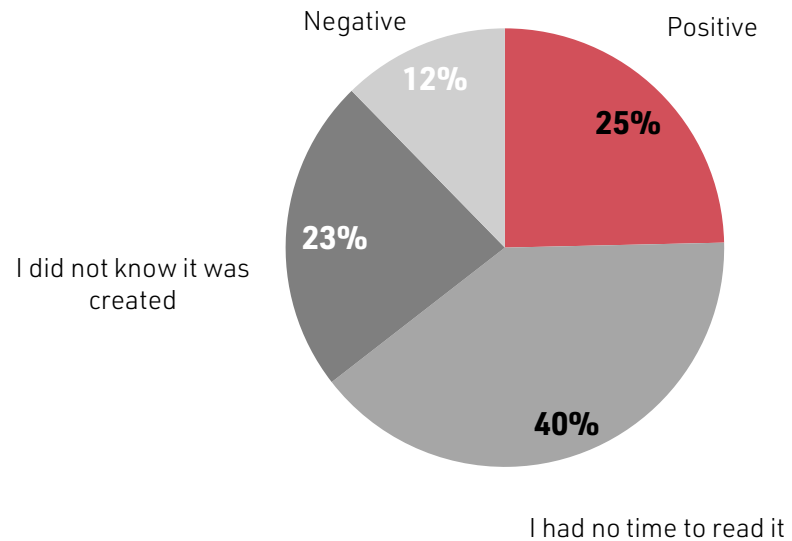
4

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

5

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

How do you rate Poland's AI policy?



- **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.**

► **Insights**



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. Government 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.

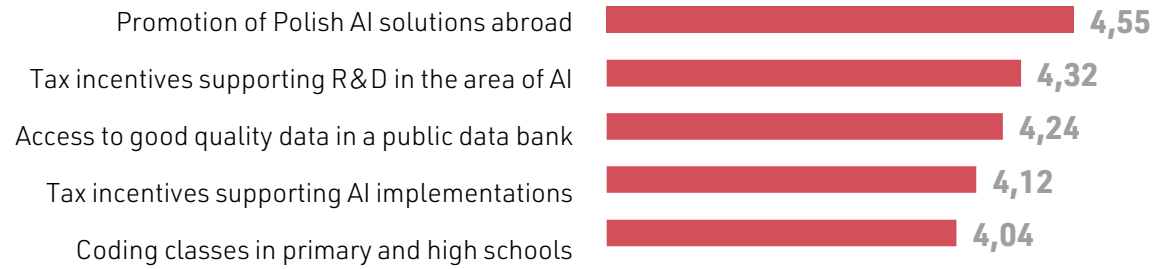
The last very important thing is accountability. The strategy should be well communicated and should also be translated to English to help bring in AI experts and scientist to Poland. The tasks should be clearly assigned to specific entities. This way it is clear what can be required of whom.

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.

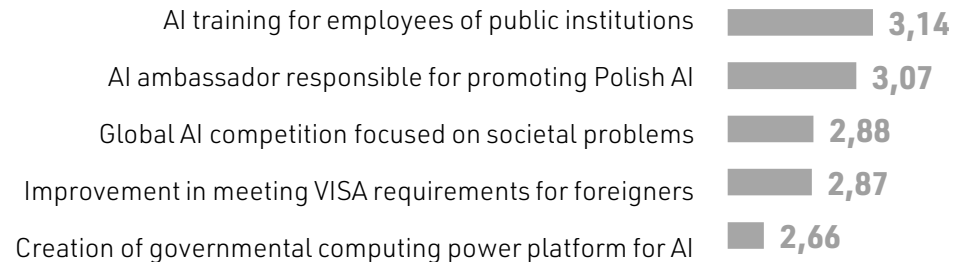
We asked a series of 35 questions about activities that could support the development of AI in Poland. Statements were rated on a scale from 1 to 5 (from unimportant to the most important). Answers were collected from the whole AI Polish ecosystem and later anonymized. On the next several pages we presents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

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

TOP 5



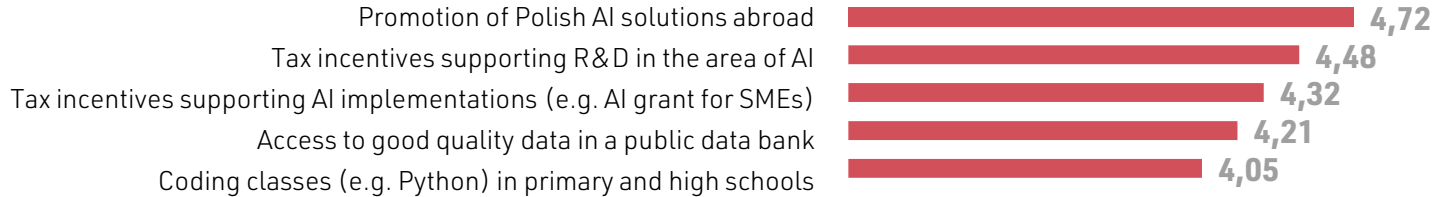
BOTTOM 5



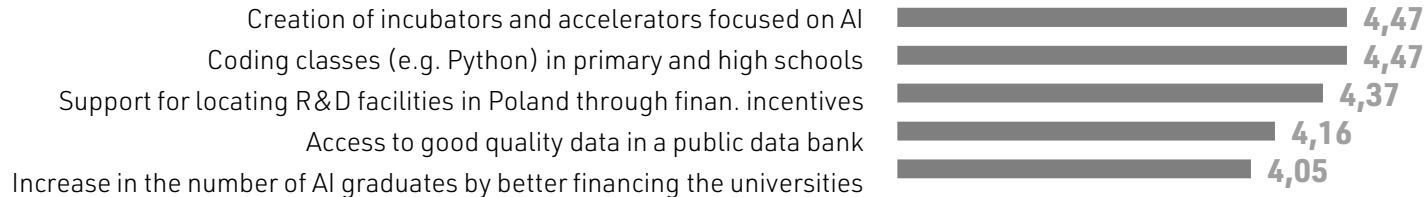
- **The activity most desired is promotion of Polish AI companies (average of 4,55). Followed by tax incentives for R&D (4,32) and access to quality public data (4,24).**
- **On the other hand, respondents are most critical of creating a public computing platform for AI (2,66), improving VISA requirements (2,87) or creating a global AI competition (2,88).**

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

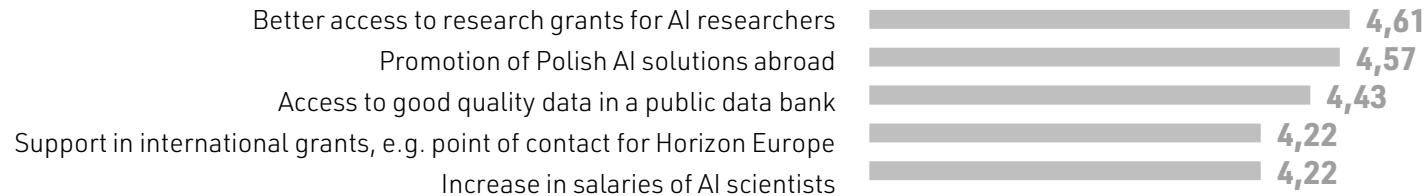
AI companies



Corporations



Academia



- 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.



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.

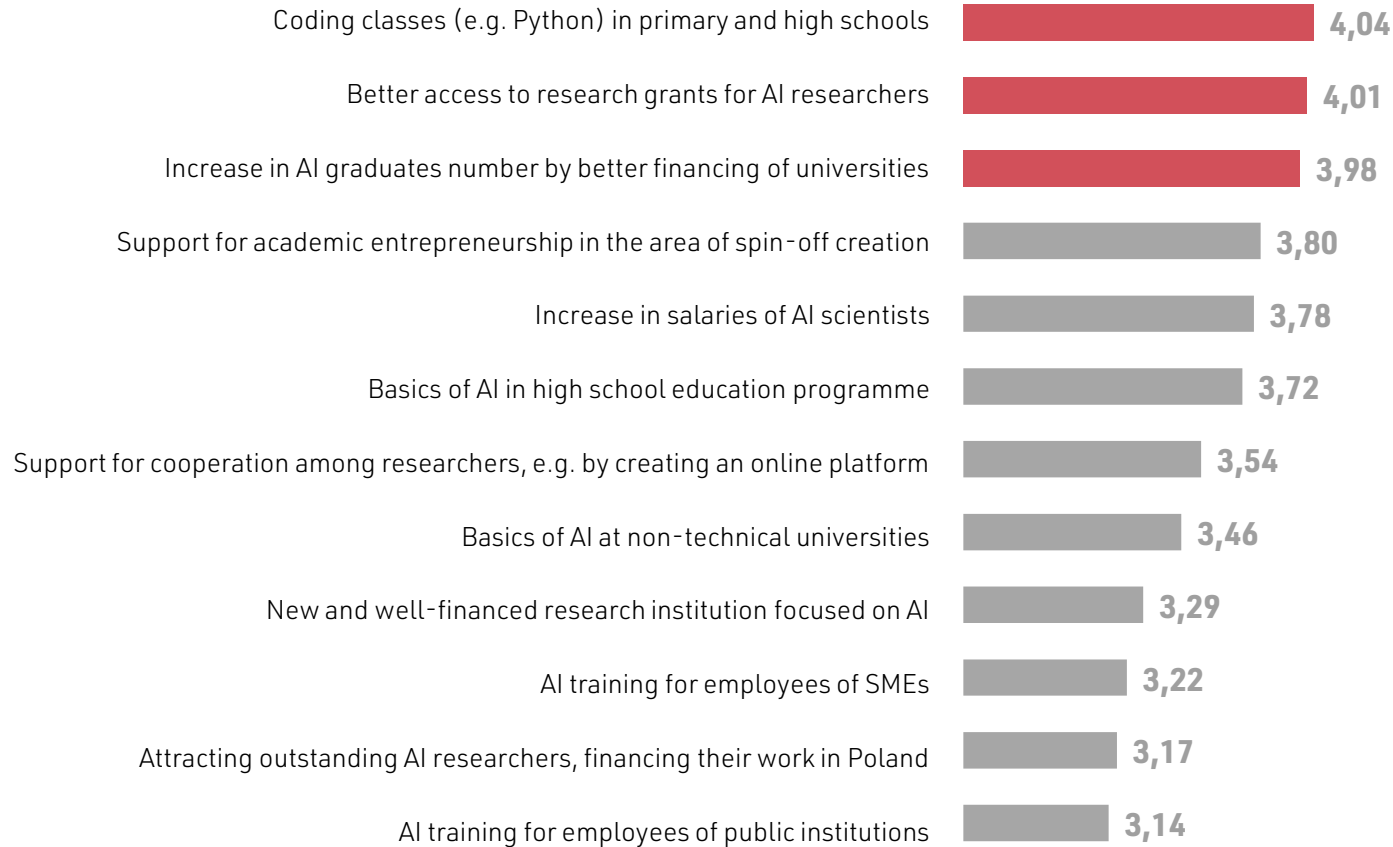
Allegro and the European Tech Alliance (the EUTA) I have the honour to be the Chair of is an active player in this debate. As the Alliance brings together Europe's digital champions and scaleups we stand ready to share our views and expertise on AI and Machine Learning with Polish and EU policy-makers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

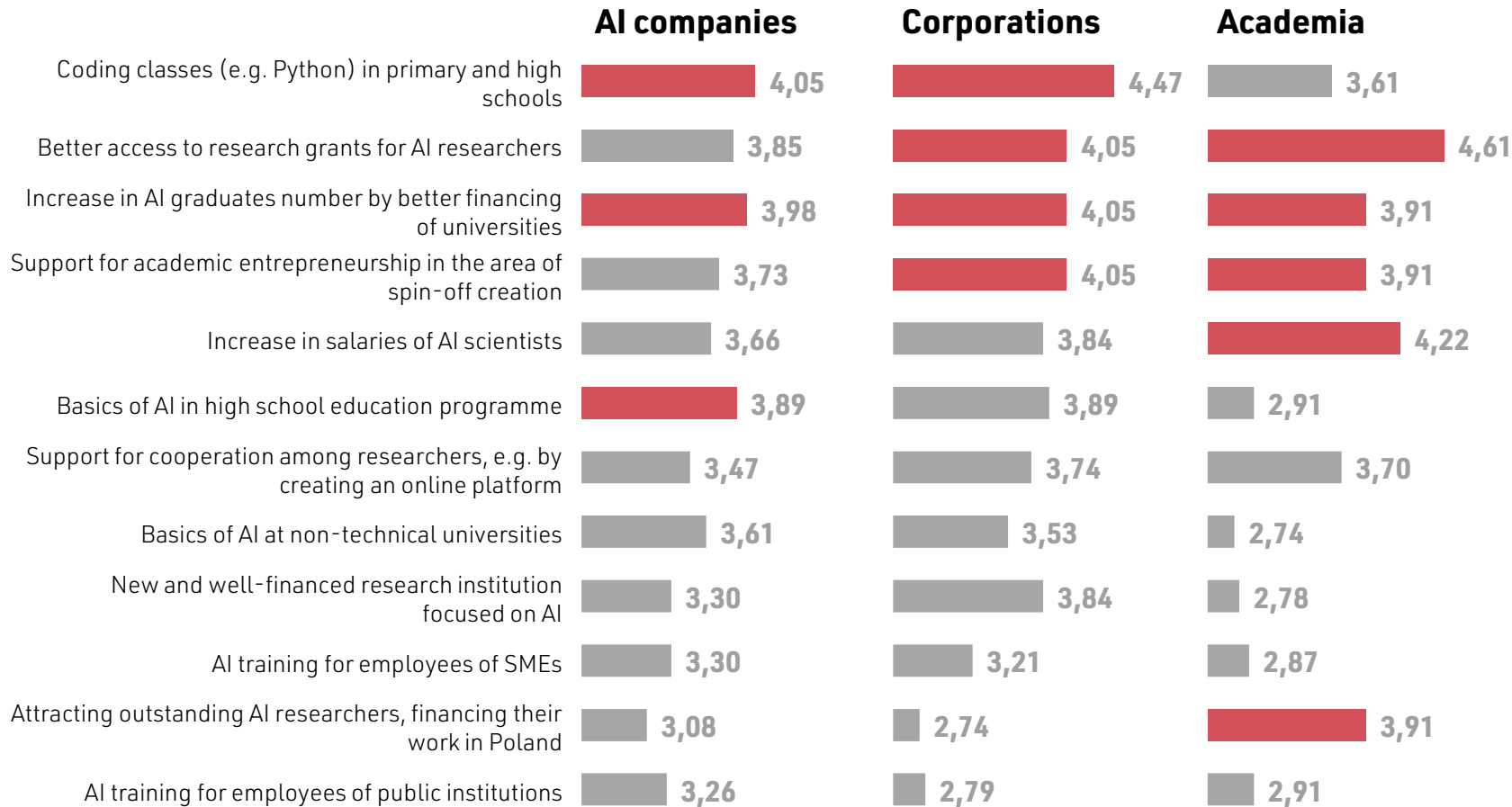
What should be primarily done to make Poland a hub for AI in Europe?



- **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

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



- 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



Łukasz Borowiecki
CEO, 10 Senses
AI Expert, Digital
Poland Foundation

Polish universities train some of the best IT graduates in the world. Polish IT specialists are in top 5 in various rankings such as HackerRank, Google Code Jam or The International Olympiad in Informatics. However, when it comes to scientific output our academic institutions underperform. For this reason Polish universities fare poorly in various international rankings. Our academic institutions train great graduates but are still not sufficiently competitive in terms of doing science.

Artificial intelligence and data science in general is a field where science is highly interlinked with practical business applications. Places which have experienced a boom in AI in recent years are the ones where strong scientific institutions operate. That is the case of Toronto or London. For this reason in order to develop the AI ecosystem in Poland it is crucial to strengthen the research output of Polish universities.

In practical terms, however, it means investment in academic research teams. Modern science is being done in teams. It is a place where PhD students and postdocs work on daily basis on specific research problems. By doing so they become experts. We cannot expect private companies to educate experts – companies work on practical problems which generate cash or are necessary for their day-to-day operations. If we want Poland to be not just a country full of coding companies but one where innovative startups are created then we need to invest in academic research teams. We also emphasise this in the recommendations section of this report.



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



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.

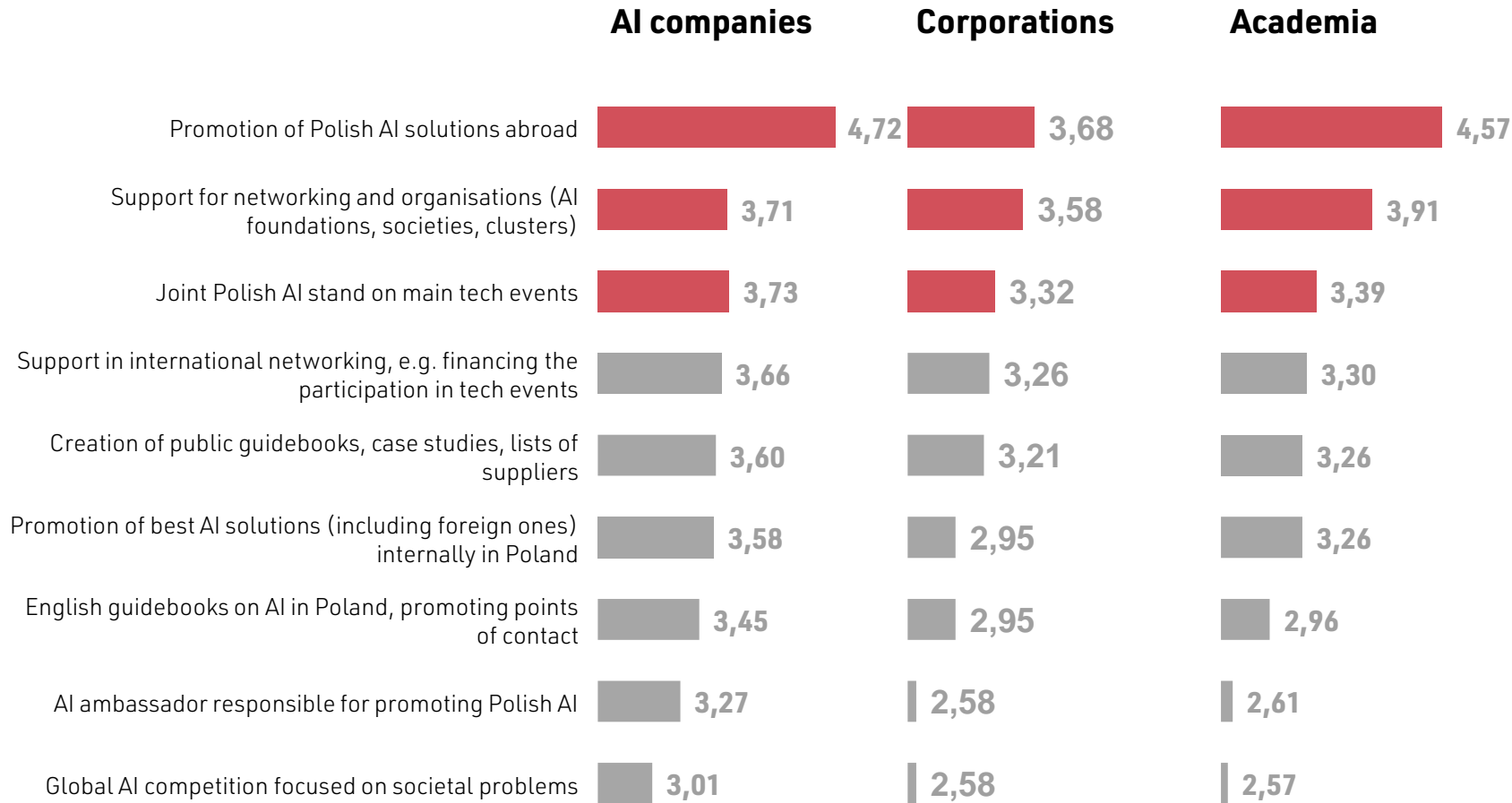
The quantitative needs of the market can only be satisfied under the condition of radical qualitative changes in academia. Inevitable, ground-breaking and global changes in the social structure of the work, taking place thanks to the AI technology saturation, call for a new approach to education system 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.

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



- **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 ambassador and a global competition focused on societal problems.**

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



- **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



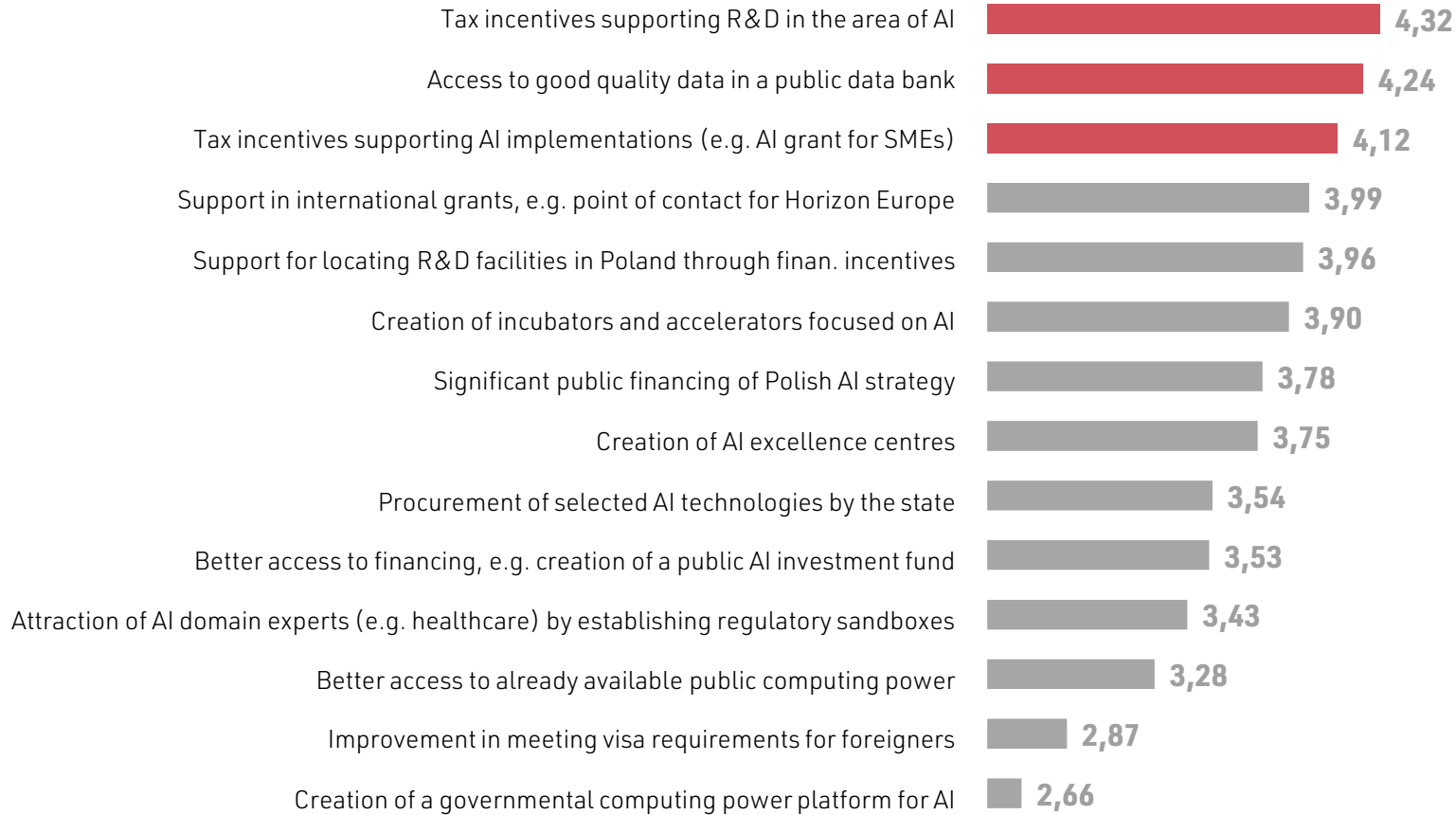
Kamil Rocki, PhD
Software Engineer, Brain-
Machine Interfaces,
Neuralink Corp.

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.

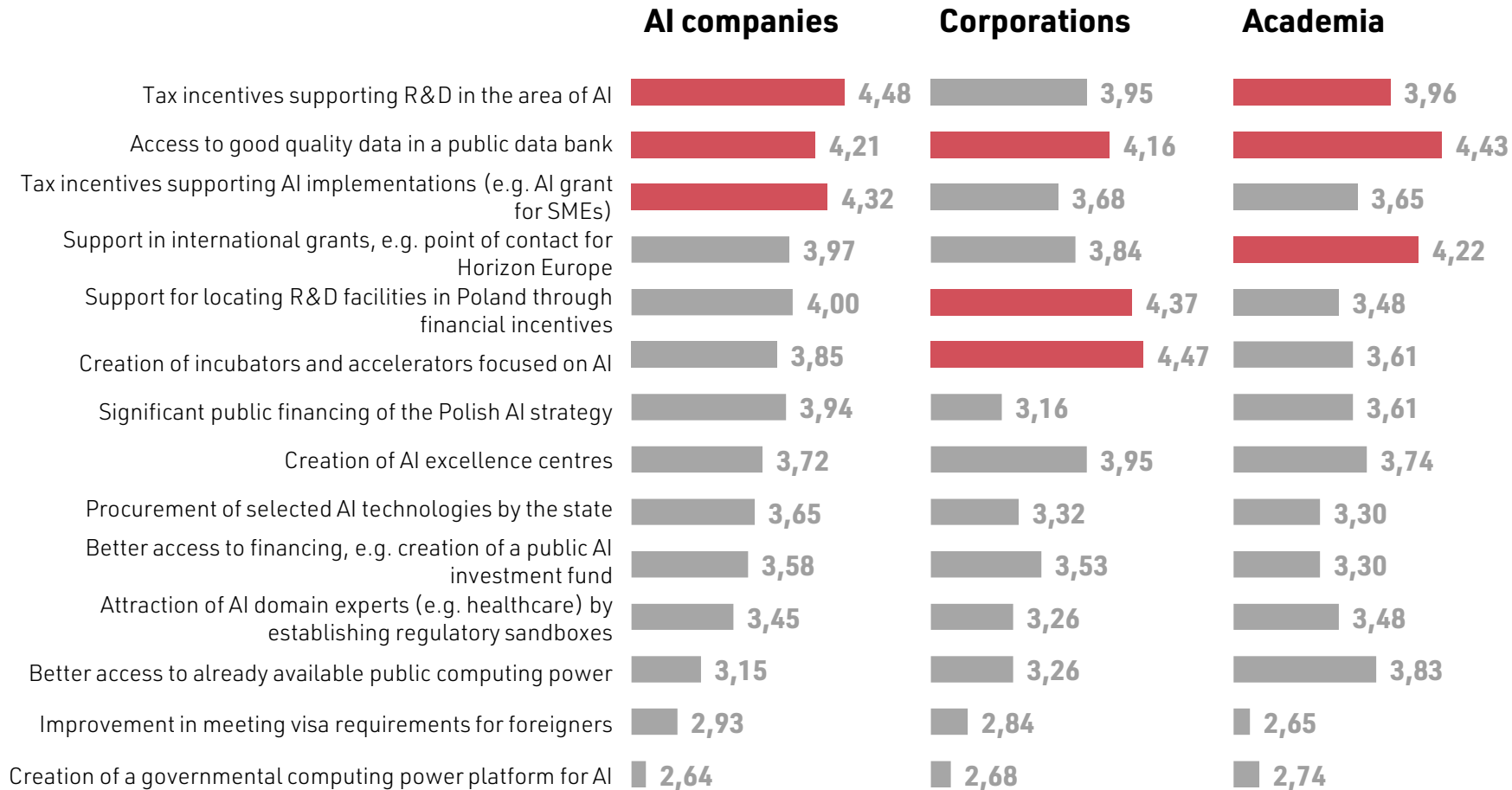
Students in Poland should not have to find part-time jobs to complete their Ph.D. courses. Universities should fund scholars well enough to support them as well as equip the labs and be competitive. Moreover, being competitive in terms of resources is going to bring even more talent to Poland. To promote 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 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).

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



- 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



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.

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.



#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, Salesmanago, 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, Ringier 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

► #15. Polish AI Ecosystem and Why to Invest in Poland / Leading Polish AI Companies



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

▶ #15. Polish AI Ecosystem and Why to Invest in Poland / Examples of Leading AI R&D, GDS, SDC Centres in Poland



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
ING Tech Poland



TomTom



Ocado Group



OLX Group



Atos



Nvidia



T-Mobile



Bosh



ByteDance



Pearson OKI



Revolut



Nielsen IQ



Ringier Axel
Springer Tech



Schneider
Electric



BCG
Gamma



► #15. Polish AI Ecosystem and Why to Invest in Poland / Institutions Supporting the Development of AI



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 society.



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

► #15. Polish AI Ecosystem and Why to Invest in Poland / **Scientific Societies**

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, Wrocław 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.**



► #15. Polish AI Ecosystem and Why to Invest in Poland / **Scientific and Professional Conferences**



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.



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.



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.



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.



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.



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.



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.



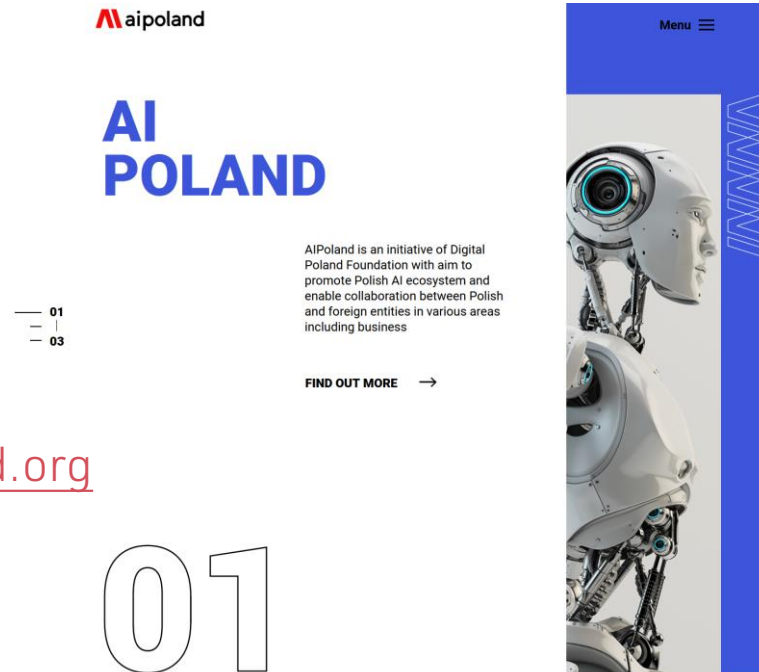
Data Science Summit

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.

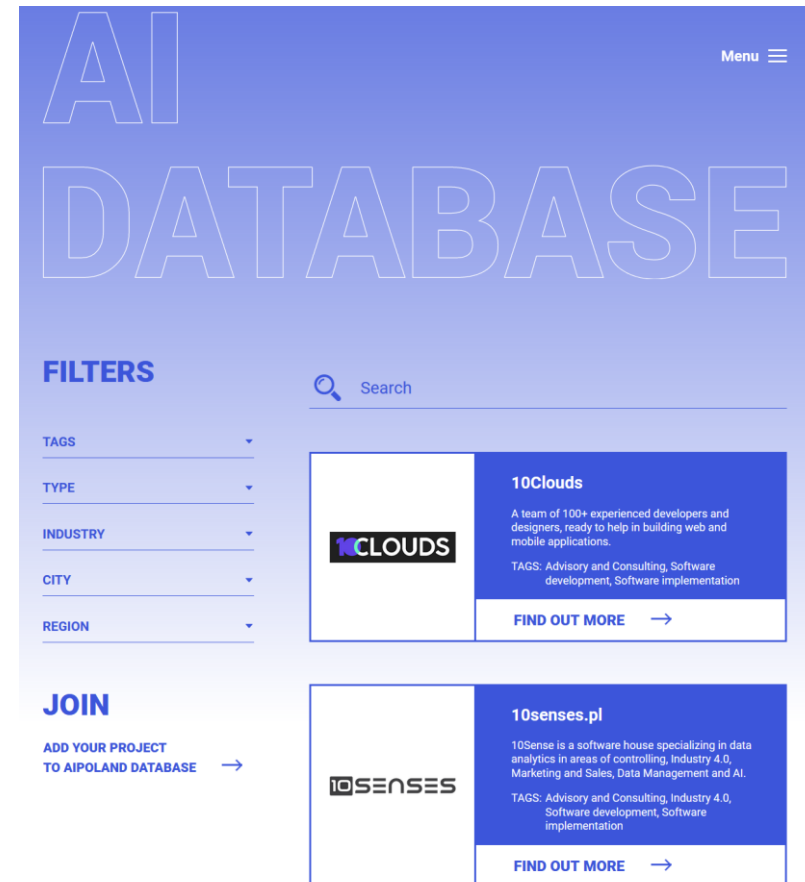
► #15. Polish AI Ecosystem and Why to Invest in Poland / **Want to see the entire Polish AI ecosystem? Visit aipoland.org**

AI Poland 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.



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 Northern 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.

► #15. Polish AI Ecosystem and Why to Invest in Poland / Recommendations of AI Leaders Who Have Presence in Poland



Mariusz Mielczarek
Head of Public Policy CEE
Amazon in Poland

“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.



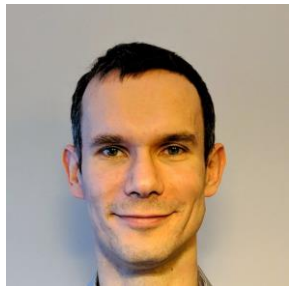
Paweł Skruch,
Associate prof.
Artificial Intelligence
Manager
Aptiv in Poland

“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.



Victor Canseco
General Manager Data
Platforms Group
Intel 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.



Piotr Lewalski
Site Leader
Nvidia 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.



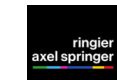
Adam Roś
Vice President
Samsung R&D
Institute in Poland

“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.



Aleksander Kutela
Vice President
Ringier Axel Springer
Polska

“Ringier Axel Springer has decided to build one of its key global AI and data science centres in Poland. This choice was mainly motivated by the availability of talented engineering specialists





#16. Authors of the Report

► #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](mailto:piotr.mieczkowski@digitalpoland.org)



#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!

logos of selected entities only

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

digitalswitzerland



digital-liechtenstein.li

digitalpoland



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

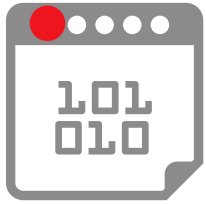
08
Strong media coverage

09
**Strategic Founders
bold initiatives**

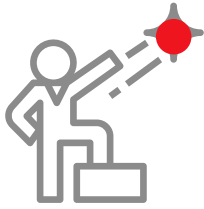
10
**Founders'
and Partners' support**



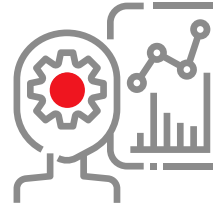
Example of Our Cross-industries Initiatives



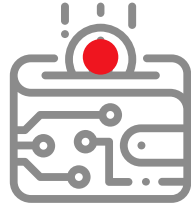
Digital Festival



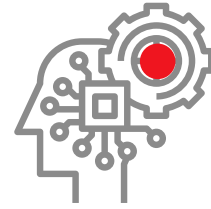
Digital Shapers



Digital Policies



FinTech incubator

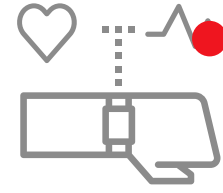


AI Hub

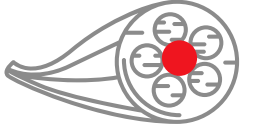
 aipoland



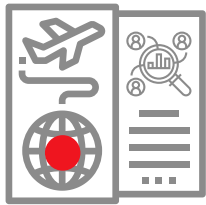
Smart Cities & buildings



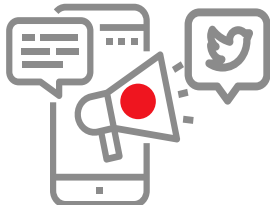
eHealth



Digital Connectivity (5G, Fiber)



Study Tours



Digital Marketing Hub



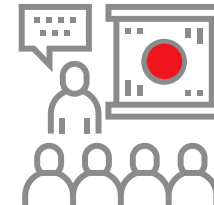
Digital CEO



Startup Ecosystem



Digital Fitness



Digital Summit



Poland as a R&D Hub



Digital education





#18. About AI Poland

AI HUB | aipoland | Our experience

Support of key policy-makers



Think Tank | AI Research



AI Academy for managers



Support of key AI policy documents



Support of Polish AI Roadmap



Roundtables | Digital Policies



Map of Polish AI



01

E-learning

Witaj na internetowym kursie „Elements of AI”!

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

Wybierz kraj: Polko

Rozpocznij kurs

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



AI Poland 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.

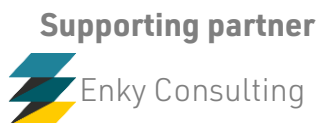
An interactive, updated Map of Polish AI 2021 will be presented on our website after May 16, 2021. Don't forget to visit us!

AI POLAND

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

FIND OUT MORE →

01
03



01



AI DATABASE

Menu ☰

FILTERS

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- TAGS
- TYPE
- INDUSTRY
- CITY
- REGION

JOIN

ADD YOUR PROJECT TO AIPOLAND DATABASE →

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

FIND OUT MORE →

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

FIND OUT MORE →

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@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**.

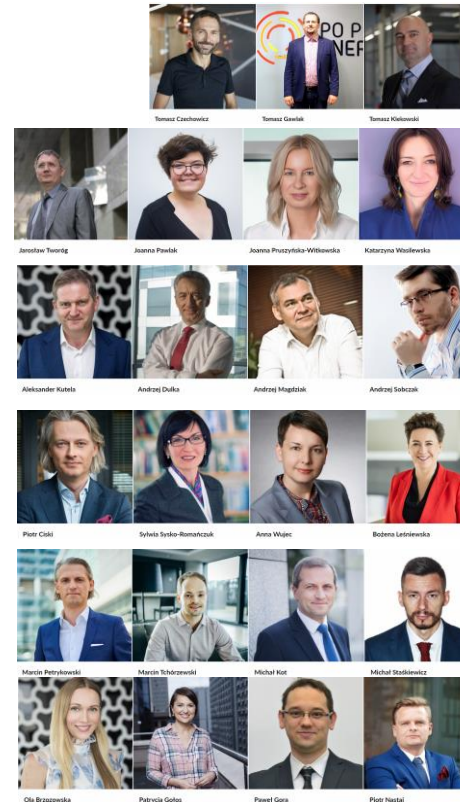
"**Elements of AI**" is a series of free online courses created by Reaktor and the University of Helsinki. The Polish version of the training is the result of cooperation between the **University of Helsinki, Reaktor, the European Commission, Digital Poland Foundation** and **Jagiellonian University**. 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.

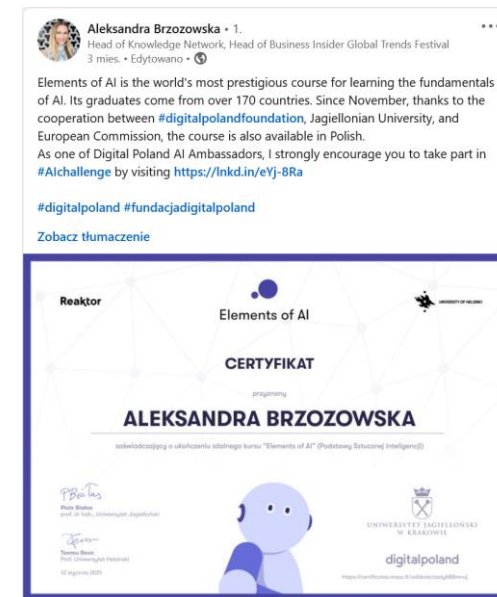
You too can join the people who know the basics of AI. All you have to do is **take the course and then share the certificate of completion on social media with the hashtag AIChallenge!**

[Link to course in Polish](#)

Ambassadors



#AIChallenge | Social media





#19. About 10 Senses



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



3rd edition | 1-10.10.2021

#GoDigital

Take full advantage of what a rapidly changing world has to offer. Gain knowledge of new technologies and digital skills.

www.digitalfestival.pl

Organizer **digitalpoland**



A night cityscape with a glowing red and orange network overlay. The network consists of interconnected nodes and lines, resembling a molecular structure or a data network, set against a dark background with city lights.

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