This is a draft chapter/article. The final version is available in "Research handbook on public management and artificial intelligence" edited by Yannis Charalabidis, Rony Medaglia and Colin van Noordt, published in 2024, Edward Elgar Publishing Ltd
https://doi.org/10.4337/9781802207347.00017

<a> Application of Artificial Intelligence by Poland's Public Administration

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Abstract: This chapter presents an overview and analysis of artificial intelligence-driven solutions created and implemented by or with the support of Poland's central public administration (PA). After discussing governance of AI-related issues, we analyze a set of examples of AI innovation to map the actors and their relations within the ecosystem, describe the field where innovation in AI for PA occurs, and highlight the potentialities and limitations of the current scenario. Moreover, we examine the dynamics among stakeholders in AI-driven innovation building for PA. We conducted an exploratory study of Poland's situation, assuming the capacity of this methodological strategy for the early examination of the topic and opening new avenues for further research. Thus, we followed the replication logic of Yin's case study. The interviews were approached inductively, to unveil the underlying elements that connect the practical development of AI projects with the institutional framework and the theoretical background.

Keywords: Artificial Intelligence, Public Administration, Innovation, Machine Learning, Emerging Technologies, Data Analytics, Public Services

[*] The work of David Duenas-Cid was funded with the project ELECTRUST (EU H2020 MSCA programme, grant agreement no. 101038055) and 'Dynamika (braku) zaufania w kreowaniu systemów głosowania internetowego' (Narodowe Centrum Nauki, OPUS-20 competition, grant agreement no. 2020/39/B/HS5/01661).

<b> 1. Introduction

X`x``This chapter presents an overview and analysis of artificial intelligence (AI)-driven solutions created and implemented by or with the support of the central public administration (PA) in Poland. We focus on GovTech Polska, a special unit within the Chancellery of the Prime Minister that acts as a hub for innovation in central public administration and in designing AI-based tools for other PA units. The development of solutions enabled by emerging technologies, such as AI, blockchain, or the Internet of Things (IoT), and the automation of services are drivers of innovative and sustainable change in organisations. Implementation of such technologies increases organisational flexibility, resilience, and fosters the production of social capital. However, in contrast to business, the PA's implementation of emerging technologies is generally slow and cumbersome. Thus, many civic-centric services lag behind in digitisation and digital transformation.

The type of adoption of emerging technologies also varies. Whereas business tends to take these technologies to scale and explore the newest technological trends, public administration (due to financial and human resource-related constraints) often focuses on pilot projects and is more hesitant to experiment with disruptive technologies.

Among emerging technologies, AI holds a special place. AI is a well-established and broad field of disciplines, including natural language processing, machine vision, machine learning, deep learning, or robotics. The term itself, however, is notoriously hard to define. We have defined AI as follows: 1) as a scientific discipline, where the term is applied to the development of systems endowed with intellectual processes characteristic of humans; and 2) as a field of implementation, where it is understood as the ability of a computer or computer-controlled

robot to perform tasks commonly performed by intelligent beings (Dobrev, 2005; Kok et al., 2009).

According to some studies, AI is an umbrella term that encompasses a range of disciplines (Schuett, 2019), like NLP or machine vision. However, other studies underline crucial differences between deep neural network architectures and different machine learning models (Ngiam et al., 2011). According to the second approach, a predictive model based on regression or a simple rule-based chatbot would not necessarily fit within the scope of AI.

According to our hypothesis, AI applications sponsored and/or driven by the public administration in Poland **can be classified as fitting under a very broad understanding of AI, covering advanced data analytics, supervised machine learning, and cloud-based solutions**. Rarely do they cover applications of neural networks and fail to meet the criteria of narrowly understood AI, conceived as learning neural nets-based architectures.

However, a more modest approach to implementing AI and funding AI-based projects does not mean that the innovation does not occur. A change in the direction of more digital citizen-service is observable. Nevertheless, the question is whether the innovations implemented by the PA in Poland fulfill the condition of being classified as AI-based projects and which stakeholders from public administration are most significant in their development and implementation. Moreover, we are looking at the impact of these projects on PA as a whole. What are the roles played by the different stakeholders while incubating tech-driven innovation? Thus, we propose analyzing a set of examples of AI innovation to respond to these questions, describe the field where innovation in AI for PA occurs, and highlight the potentialities and limitations of the current scenario. Moreover, we will examine the dynamics among stakeholders in AI-driven innovation building for PA. Here, we focus on whether we

can classify the current scenario of AI-driven innovation as a collaborative strategy or if its shape results from the lack of clear leadership.

<b> 2. Challenges and issues for developing AI systems in public administration

Public administration can be understood as "the part of the economy composed of public enterprise, including military, law enforcement, infrastructure, public transportation, healthcare and the work of elected officials" (Heady, 2001; Rhodes, 2000). Literature on the adoption of technological innovation in and by the public administration is quite vast and well developed. Still, when it comes to artificial intelligence, one can detect a shortage of publications (Campion et al., 2020). As van Noordt and Misuraca (2020, p. 15) state, *the use of AI in the public sector is still in its infancy; more research is needed to truly understand how systems are adopted by public sector organizations*. The potential of AI-based solutions in PA has raised both expectations and fears (Wang et al., 2020, pp. 1–2). Some researchers portray AI as human beings' best hope to prevent extinction; others describe it as a threat, even predicting that AI will cause Armageddon.

In terms of PA, AI is expected to increase government efficiency, improve the interaction between citizens and governments (Mehr, 2017), and contribute to the redesign of public services, simplifying them and increasing their value for citizens through personalization (Kuziemski & Misuraca, 2020). As Van Noord and Misuraca (2020) emphasize, AI should support more profound analysis of data, reduce repetitive tasks (Lima & Delen, 2020; Mehr, 2017), and facilitate the achievement of social development goals (Vinuesa et al., 2020).

Indeed, the adoption of AI technologies by PA is not exempt from challenges. Agarwal (2018) lists the following elements to consider when adopting AI: 1) ensuring a smooth transition to digital services including public and private stakeholders; 2) accommodating the transformation of the job market; 3) counteracting the potential decline of revenues derived from the transformation of the job market; 4) protecting consumers from potential biases in AI algorithms and ensuring equal treatment; and 5) ensuring privacy. Like Campion et al. (2020), Dwivedi et al. (2019) and Sun and Medaglia (2019) summarize seven categories of challenges: 1) social; 2) economic; 3) technological; 4) data related; 5) organizational and managerial; 6) ethical; and 7) political, legal, and policy-related.

Both approaches consider the organizational dimension and how the adoption of AI by the public sector relies on a collaborative process. The central position of PA in the provision of living conditions for the citizenry and the fact that it is often excluded from fundamental and applied research concerning AI (Sousa et al., 2019) makes it of utmost importance to understand how administrations can adopt and implement this technology (Campion et al., 2020). Similarly, the inherent transversal nature of AI brings along the need to create collaborative approaches, gathering different types of stakeholders, from legal experts dealing with the frame where AI is to be inserted (Scherer, 2015; Veale et al., 2018), to IT specialists covering the lack of know-how and technical expertise that characterizes PA (Agarwal, 2018; Holdren & Smith, 2016). PA's role, in this situation, is critical for making organizational decisions that will determine the further development of AI (Andrews, 2019). An excess of leadership by the PA can slow down the process and exclude stakeholders. But at the same time, a lack of involvement can entail losing control of the process by outsourcing (Agarwal, 2018) or failing to fulfill the needs and expectations of such developments.

The potential of multi-stakeholder collaboration in public sector innovation has already been analyzed and described (Bekkers & Tummers, 2018; de Vries et al., 2016) and, concerning AI use in the public sector, its positive effects (Desouza, 2018; Susar & Aquaro, 2019; van Noordt & Misuraca, 2020) and challenges (Desouza & Jacob, 2017) have been defined. On the positive side, a collaborative strategy can help improve the organizational antecedents (van Noordt & Misuraca, 2020) in which AI is to be implemented, such as increasing the amount of available resources, know-how, skills, or infrastructures. It can also help to enlarge the capacities of the technology allowing its interoperability (Desouza, 2018), potential decentralization (Montes & Goertzel, 2019), or ensuring that the regulations allow the full development of the projects in which different stakeholders are involved (Cath, 2018). Engaging and activating several partners enables benefiting from their potential and exponentially increasing the reach of the innovation. Amongst the challenges, we can highlight the integration of vast but typically fragmented quantities of data (Desouza & Jacob, 2017), the difficulties for the renovation of new organizational routines (Campion et al., 2020), and the need to create trust among stakeholders (Kankanhalli et al., 2019).

The development of a multi-stakeholder collaborative environment (especially in innovative and cross-cutting technologies) presents itself as a good framework for the development of distributed forms of governance, where the participants renegotiate their traditional roles and adopt different forms of relation to achieve their individual goals while contributing to the general-purpose set up by the leading partner, in this case, the PA. This collaborative governance frame is "[…] a type of governance in which public and private actors work collectively in distinctive ways, using processes, to establish laws and rules for the provision of public goods" (Ansell & Gash, 2008). The adoption of collaborative governance permits the

addition of new priorities by participating stakeholders (Carlsson & Sandström, 2008), amongst them sustainability issues or common activities pertaining to peer-production. In the case of sustainable development, AI technologies might have an important impact on the monitoring of environmental protection, creating a better and more efficient holistic energy cycle, or forecasting climate alterations (Sharma et al., 2020).

This perspective involves the adoption of Open Innovation (OI) strategies by all stakeholders in the field, in their search for flexibility and innovativeness (Kankanhalli et al., 2017). Open innovation can be defined as a distributed innovation process based on purposefully managed knowledge flows across organizational boundaries (Chesbrough & Bogers, 2014, p. 17). In AI, OI has been used in the energy sector showing how its use accelerate the implementation of AI by following a natural flow of expert knowledge outside of the company, allowing the implementation of solutions that otherwise would have been out of their reach due to, for example, costs or development complexity (J. J. Yun et al., 2019). Its use replaces the internal learning accumulation by the emergence of new knowledge, allowing more creative decision-making (J. Yun et al., 2016).

<b> 3. Regulatory and strategy considerations for AI development

<c> 3.1. In the context of European and Global trends

Poland is interesting case study. On the one hand Polish, policymakers are making a conscious effort to significantly accelerate technology adoption. On the other hand, compared to other EU Member States, Poland is technologically behind its peers which may decrease its future competitiveness.

According to a recent McKinsey (2021) report, Poland "lags behind European leaders in both the level of cloud adoption and the rate at which adoption is progressing." The country's level of cloud adoption is 14 times lower than that of the European Frontrunners and 1.5 times lower than the average for Central and Eastern Europe (CEE). The study adds that the "adoption is progressing at an annual rate of 23 percent, below the 25 percent rate of the European Frontrunners and the 24 percent for Europe's five largest economies." Even though the report limits itself to measuring cloud solutions adoption, the same can be said of other types of emerging technologies.

Nonetheless, the 2020s decade has brought an acceleration of the implementation of policies introducing AI solutions to PA. Since 2017, when Canada, Finland, Japan, and the UK created and pioneered some AI strategies, other countries followed suit. Many of them established special task forces and AI expert groups and created digital strategies feeding the development of AI algorithms. The US National AI Initiative Office coordinates the implementation of a national AI strategy and cooperation among government, industry, and academia. Other countries, like New Zealand, are focusing on the ethical aspects of AI by creating a Data Ethics Advisory Group. Even so, the path to follow in terms of regulating AI is still a subject of debate. In some cases, the interest centers on biases in AI systems, safety (e.g., autonomous cars), and data privacy, which pushes for the adoption of strict and binding rules. Yet, as of January 2022 these "hard laws" are in the minority. The European Commission started working in 2020 on a set of Trustworthy AI regulations and passed three resolutions on intellectual property, civil liability, and AI ethics. In 2021, the European Commission released the first version of the Artificial Intelligence Act, setting rules for AI systems based on their risk. By January 2022, this proposal was being considered by the European Parliament and Member states who are

seeking a compromise that would not inhibit the development of AI in the European Union region but ensure its safety and transparency.

These regulatory trends did not bypass Poland. In 2020 the Polish government released its "Policy for the Development of Artificial Intelligence in Poland 2020" as one of the first parts of its "Polish Productivity Strategy" and the "Efficient and Modern State 2030 Strategy" programs. The document is a strategy outline for the growth of AI from the business and science perspectives and includes short-, medium-, and long-term goals set at 2023, 2027, and post-2027 respectively. A special emphasis is put on the role of AI in society, companies, science, education, international cooperation, and the public sector. Yet, the document does not contain specific information on programs that would achieve the government's goals. Despite its lack of detail, this initiative sets the vision for the decade and, in light of the European Parliament's work on AI-specific policies, it is also an introduction to an effort aimed at recognizing AI as an indispensable segment of the country's growth. Thus, one can expect more legislative and regulatory documents to follow in the next few years.

However, the document also has limitations. For example, it does not refer to AI activity in defense and national security which may pose serious doubts about how the country handles AI solutions, such as lethal autonomous weapons. This may be particularly important as Poland is a NATO member directly exposed to hybrid and cyber conflicts because of its location on the Eastern flank. Moreover, the document was created without other similar initiatives, such as those by the European Union and UNESCO, in mind. That was because regulations and vision for AI development within countries is the area of rapid development and Poland was one of the first countries to implement such blueprints. However, once the ground for common

regulations in the European Union is established, Polish regulations will most probably need to be modified.

<c> 3.2 Poland's strategy for developing AI

In 2018 Poland accepted the "Statute on the National Cybersecurity System" as a direct implementation of the EU Network and Information Security directive proposed by the European Commission. The Statute specified the functionality of the national cybersecurity system in order to ensure uninterrupted delivery of key services and digital services as well as the high level of security of ICT. The system includes operators of key and sensitive sectors, such as energy and healthcare, digital service providers, public administration bodies, and telecommunication systems. Moreover, the document specifies the responsibilities within companies, institutions, and the country and sets the blueprint for the reporting of cybersecurity incidents. In addition, new education activities were created to raise awareness in society and the private sector.

Poland is in the initial stages of its development of a collaborative ecosystem for innovation in AI for PA. The country has not created the conditions conducive to economic growth based on new technologies (Prusak, 2017) and lacks programs dedicated to preparing AI for implementation in PA. Nevertheless, recently implemented programs are trying to foster interaction between state-owned companies and private stakeholders to develop AI technologies (Skop et al., 2021), mediated by GovTech Polska. This institution, reporting directly to the prime minister of Poland, aims to provide PA bodies with innovative digital services and helps to centralize the dispersion amongst ministries of programs promoting and facilitating the implementation of new technologies.

A flagship initiative, the GovTech competition platform connects administration with the private technology sector as follows. The administration proposes a set of challenges to be met, and start-ups and small companies apply for the funds offered to Proofs of Concept, followed by full implementations of the proposed solution. At a smaller scale (SMEs and academia), GovTech established the "E-Pionier" competition providing acceleration services from supervision of product implementation through technology consulting to funding projects. By January 2021, two complete editions had taken place, with 17 challenges solved. The proposed solutions, heavily reliant on the support of PA, transfer the financial costs of innovation to the donors following Mazzucato's (2011) guidelines, reducing risks for private stakeholders and linking the innovation to real problems. In parallel, it forces GovTech Polska to lead the AI innovation field, dealing with the growing network of agents and committing to implement the solutions.

Regarding the private sector, following the Polish Agency for Enterprise Development (Skowrońska & Tarnawa, 2021), 99.8% of the companies in Poland are SMEs, creating a difficult environment for medium-large scale innovation implementation. Previous research has already highlighted the lack of capacity of the Polish SME sector to conduct innovation and its dependence on the institutional system (Lewandowska & Stopa, 2019), and the role of Polish enterprises as innovation adopters, not as creators (Runiewicz-Wardyn, 2013, 2020).

The resulting scenario is characterized by fewer identifiable stakeholders, with public institutions the only ones with the capacity to develop AI for general purposes. The Polish government, aware of this situation, has repeatedly pledged its support for the doctrine proposed by Mazzucato (2011) that the state should lead innovation in technology because the private sector is neither willing nor able to invest in risky sectors. Innovation investments entail

risks that scare private investors and vendors due to a lack of certainty on its capacity to generate revenue. The state can cover such uncertainty by acting as a pioneer in innovative sectors. The GovTech Polska initiative fits this scenario, incentivizing innovation in technology for governance, leading the innovation of AI, and has already published a "Strategy on Artificial Intelligence" as a roadmap for its future development.

In general, the ecosystem built by many Polish institutions, especially GovTech and Polish Development Fund, closely follows the strategy of swarm intelligence, creating an environment that fosters innovation in AI. These institutions decided against implementing AI and related technological solutions by outsourcing the product development to software companies with strict guidelines on how the product should work. In contrast, they harnessed the advantages of collective intelligence, defined by Yun et al. (2019) as using the power of many people to solve a difficult problem as a group, by creating programs where open calls for solutions are available to anyone and only problems to be solved are stated. Moreover, crowdsourcing programs in the form of hackathons and more recently "climathons" (hackathons for climate-friendly technological solutions for Polish cities) involve the participation of public administration institutions. Together, these activities constitute two forms of collective intelligence described by Yun et al. (2019): flow-based (groups working on the same activities and problems) and dialogic (engagement in a dialog). Furthermore, these activities link AI and collective innovation. This included solutions aiming a better understanding of data about citizens and helping to implement more inclusive decision-making processes (e.g. a big data system created by the Ministry of Digitization for investigating the geographical diversity of digital competencies among Polish citizens).

<b> 4. Case Studies

<c> 4.1 Selection of Case Studies

Given this scenario, we opted for conducting an exploratory study of the Polish situation based on interviews with stakeholders, assuming the capacity of this methodological strategy for the early examination of the topic and opening avenues for further research. An initial overview of the institutional environment leading the development of AI for the Public Sector positioned GovTech Polska as a core actor in the AI development strategy. With that as our pivotal unit, we developed three case studies of related projects, based on companies or institutions that participated in GovTech funding competitions: the Ministry of Digitalization, Orlen, and Ministry of Health. We use the experience of these vendors in their interaction with GovTech Polska to evaluate the process and extract information for mapping the field. This methodological approach is common in the research in AI as seen in the work of Kuziemski and Misuraca (2020), and Van Noord and Misuraca (2020), both using a three-case study to compare international examples of AI adoption by PA, being the difference with our proposal the scale of the cases (international to national).

Following Yin's (2018) case study replication logic, we combined case studies that replicate the type of relation with GovTech Polska with others with contrasting connections with the same unit. For every case study, we conducted in-depth interviews and analysis of secondary data. The interviews were approached inductively, to reveal the underlying elements that connect the practical development of AI projects with the institutional framework and the theoretical background (Thomas, 2006).

<c> 4.2 Presenting the Case Studies

Hereafter we will present the results of our case studies, including the following information: 1) a description of the vendor providing the service; 2) the recipient of the innovation; 3) an

explanation of the motivation of the project; 4) a description of the problem; 5) the solution; 6) the role played by GovTech; 7) advantages and benefits, and 8) problems and limitations of the proposed solution. The information generates a discussion of a map of stakeholders, and follows a similar descriptive purpose to the model proposed by Kuziemski and Misuraca (2020), who focused on goals, drivers, barriers and risks. We focus on specific AI projects.

<d> 4.2.1. Datawise[1]

Datawise is a startup that specializes in the analysis, delivery, and integration of data and big data for a different clients from big corporations to SMEs. They offer customer segmentation services based on SIM card data, geomarketing, data merging using CRM systems, and data storing and analysis. They use AI in image data extraction and for prognosis-based tasks.

Recipient of the technology: Ministry of Digitization

Motivation: Financial, especially the possibility to of obtaining funding in the proof-of-concept stage. The challenge topic relates directly to the services provided by the vendor (e.g., geolocation and local context data extraction using big data), and its capacity to adjust those services to private companies and PA, so the public sector might easily become a potential client.

Description of the problem: The Ministry of Digitization aims to improve the digital skills and competencies of the citizens to increase their capacity to exploit the opportunities provided by the internet. To track and compare the evolution of these skills, a set of indicators is collected by all EU Member States. However, due to budget and time constraints, the statistics cannot

[1] http://www.datawise.pl/

scale down and cover Poland's internal geographical disparity, complicating the allocation of resources and projects in the areas and regions of Poland where they would be more needed.

Solution: Datawise proposed merging the available data published by the Ministry of Digitization with big data obtained from mobile network operators. This data registers, online behaviors, intensity, and type of websites visited by the customers, allow its geographical fragmentation. Combining these two datasets reveals the geographical diversity of digital competencies, e.g., the percentage of citizens using online banking services. The final solution consisted of a visual map (front end) and a model with data streams on the back end created using big data and statistical algorithms, allowing data to be updated annually.

Role of Govtech: Intermediation. They set up a ready-to-implement infrastructure for the cooperation between companies and beneficiaries — including contracts, negotiations, formalized contests — which significantly accelerates the process compared with independent management by each administrative unit. GovTech also provides flexible contracts adapted to the characteristics of the technology and industry, including legal foundations, so that companies providing solutions are more willing to participate. This standardization of the process by which cooperation is initialized constitutes one of Datawise's most significant advantages.

Advantages and benefits:

- Speed of process, professional cooperation, responsiveness
- Reduction of bureaucratic obstacles
- Capacity to use the competition as a self-promotion tool to build credibility among partners and potential clients

- Transparent and well-organized competition
- Access to valuable data
- Financial reward adequate to the complexity of the problem

Problems and limitations:

- Lack of final implementations even though a product has been created
- Lack of expressed reasons for not implementing the product

Graphic 1. Ministry of Digitization – Assessment on its involvement during collaboration

Source: self-creation, 2022

<d> 4.2.2. Veturai[2]

Veturai is a start-up that offers machine learning and big data solutions to various industries, including healthcare and manufacturing. Examples of AI projects include detecting objects and potential risks for autonomous vehicles, algorithmic trading, demand forecasting, and dynamic product pricing. Veturai provides services to private and public units. Some of the services are as follows:

- detection of overuse and outliers in systems
- satellite imagery analytics
- traffic optimization and simulation
- adaptive systems for intelligent traffic management

[2] https://veturai.com/

- urban planning
- social media analytics

Recipient of the technology: PKN Orlen[3]. PKN Orlen[4] is a Polish state-owned oil refiner and petrol retailer, with over 2850 fuel stations and 40 petrochemical products marketed to over 60 countries.

Motivation: Financial rewards and networking opportunities. It was an opportunity to create bonds with PA and state-owned companies and to identify their problems. It allows Orlen to trace a strategy of potential uses of AI solutions to respond to these problems. In this way, the company increases the knowledge of future trends and technologies that will be profitable in the medium-term. National and international contracts with PA provide start-ups with a reputation that can facilitate collaboration with other corporations (in this case, with the recipient of the solution, Orlen) and attract new clients.

Description of the problem: The creation of a model for object detection from camera images for security reasons.

Solution: Veturai will be responsible for piloting and implementing the automatic vehicle identification mechanism, which will support the transaction handling system through the ORLEN mobile application ("mFlota"). This functionality will simplify and automate the current way of verifying refueled vehicles. The system will be based on scanning specially designed holographic markers placed on the vehicle window. The machine learning algorithms (computer vision techniques) will verify the features of vehicles assigned to fleet cards.

[3] https://www.orlen.pl/pl
[4] https://www.orlen.pl/en/about-the-company/what-we-do

Role of GovTech: Laying the foundation for the future cooperation between the receiver of the technology (PA) and a technological company, including legal procedures, formalized every step of the contests, contracts adjusted to the characteristics of technical cooperation. GovTech's role is finished once the project is submitted. It does not participate in the election of the winners and remains neutral thereafter. Accordingly, the final contract between the start-up (Veturai) and Orlen, including budget details for its implementation, is negotiated without GovTech.

Advantages and benefits:

- Strong emphasis on anonymity during the contest— under no circumstances should the company's name be mentioned (e.g., in a presentation or the programming code). Even during in-person meetings, logos, names, or even hardware names should be anonymous. As start-ups admit, they found it one of GovTech's most positive practices.
- Easing risk-taking — since contests and the whole infrastructure was provided by GovTech, the public administration institutions did not feel pressure or a financial burden. Start-up admits that beneficiaries were more willing to take risks than if they would organize competition independently.
- Bureaucracy reduction.
- Positive attitude and willingness to cooperate by the beneficiary.
- The fact that GovTech organizes the contests makes the system more effective and resilient — no place for mistakes or corruption.

Problems and limitations:

- Lack of standardized procedures during technical dialogues: some companies require non-disclosure agreements before any consultation, while others do not. Some companies need start-ups to bring the prototype in this initial stage. It makes it difficult for technology providers to plan their work and deters them from further involvement.
- Significant delay between winning the contest and signing the contract.
- Limited understanding of technology by the beneficiaries: capabilities, opportunities, and ways of measuring the effectiveness of its implementation.
- Budgetary and legal constraints: Budget limits make it difficult to provide long-term solutions. After the successful implementation of a system, some public institutions want to invest in new products supplied by the same start-up/technological company. Still, they face the limitations that GovTech contests involve: the Polish Government Procurement Act limits the amount that a public institution can spend on a project.
- The contest should ensure that all the participants use the same datasets to train machine learning models when submitting the applications.
- Find fairer ways to assess the applications. For example, some companies use expensive hardware to train models, which are not necessarily more effective. Moreover, this hardware would not be used in practice (i.e., in public administration units) to run algorithms, so it does not make any sense to artificially achieve better results to qualify for the next stage. More emphasis should be put on the accuracy of the models and how the product fits its actual environment.

Graphic 2. Orlen – Assessment on its involvement during collaboration

Source: self-creation, 2022

<d> 4.2.3. Logicai.io[5]

Logicai.io is a young Polish software house focusing on statistical analysis and machine learning technologies. From the advisory role to the actual implementation, the company provides AI services, including data science, reinforcement learning, customer analytics, and computer vision. The company also offers workshops to educate enterprises and AI boot camps for teams and individuals. The company implemented, among others, prediction algorithms, recommendations for search engines, and employee scheduling optimization for clients such as Alior Bank, Dubai Police Force, Trivago, and Dior.

Recipient of the technology: Ministry of Health

Motivation: Promotion and scope of the contest. As a young company, its participation in competitions helps to promote the company's services in order to compete with more prominent organizations on deep-tech solutions. In addition, the challenge proposed in the contest matches with the services that Logicai provides. Unlike the previous cases, financial reasons did not play an important role as the company broke even after calculating all the costs of building a product.

Description of the problem: Financial fraud among the publicly funded health services billing: showing higher rates than the actual costs of the services provided (upcoding and unbundling) by suppliers who want to be paid more than the negotiated amount.

Solution: Logicai proposed an Abuse Detection Module: a set of tools consisting of a web application with ten ML fraud detection algorithms whose task is to spot patterns of potential

[5] https://logicai.io/

abuse and an exploratory module that enables browsing through available data to examine the information based on specific parameters set by the user.

Role of GovTech: Laying the foundation for the future cooperation between the recipient of the technology (PA) and a technological company, including legal procedures, formalizing every step of the contests, and contracts adjusted to the characteristics of technical cooperation. Yet, GovTech's role is finished once the project is submitted; the entity does not participate in the election of the winners and stays neutral thereafter. Accordingly, the final contract between the start-up and Ministry of Health, including budget details for its implementation, is negotiated without GovTech.

Advantages and benefits:

- Reduction of bureaucracy.
- High responsiveness, organization, and punctuality of the beneficiary's organizations.
- The open form of the contest is one of the key advantages in the eyes of start-ups, as it allows smaller companies to participate in similar conditions.
- The project's beneficiary is aware of the limitations, advantages, disadvantages, possibilities, and specifications of the implemented technology.
- The competition helped the company build its market position, promote itself and gain a reputation.

Problems and limitations:

- Limited amount of available data to build a product due to its high sensitivity
- Reduced budget for the project, meaning that it could not hire additional employees because they struggle with deadlines

- Financial rewards and other benefits do not outweigh the complexity of the task and are associated with the time necessary to dedicate

Graphic 3. Ministry of Health – Assessment on its involvement during collaboration

Source: self-creation, 2022

<b> 5. Mapping Poland's AI ecosystem

The information collected during the fieldwork allowed us to answer the questions posed in the introduction. When it comes to the roles played by the different stakeholders in the field of AI innovation in Poland we can enumerate the functions of agents in their area of influence:

- Funding: Entities that directly administer funds or assist in obtaining funds from European Union programs or creating special programs with the funds in the form of grants.
- Research and Education: Entities that contribute to increased knowledge of public administration's employees when it comes to new technologies and their usage.
- Creation of governmental programs aimed at supporting technical knowledge among society.
- Conducting research that directly or indirectly supports the government.
- Technology Implementation: Public entities that directly implement technologies within public administration.
- Ecosystem Building: Entities focusing on programs that promote innovation within public administration space, such as hackathons.

- Acceleration & Consulting Services: Entities that directly help private companies build and implement new technologies. Consulting can refer to business, funding, and technological space.

Based on these categories and using publicly available information and results of our fieldwork, we can map the organizations within the Polish Innovation Ecosystem. These include public entities controlled by the government and other innovation providers that work with governments (national and regional) and state-owned companies. Some of the entities, such as the National Research Institute, are placed in multiple categories because they create dedicated programs with different purposes. Graphic 4 depicts how different actors fit into and interact with distinctive fields.

Graphic 4. Map of Polish Innovation Ecosystem

Source: self-creation, 2022

When it comes to AI-driven innovations in public administration in Poland, the landscape became much brighter. Considering Poland's difficulties while joining the EU because of fewer funding opportunities and an underdeveloped business ecosystem, the sector has advanced rapidly. Also, most of the PA programs of the map are in their first or second edition. The tools, methods and market responses are still being carefully tested to detect possibilities for improvement. So, although the implementation has been far from perfect, it is still a crucial step forward for the country's building of a network of stakeholders and introducing AI.

Still, the focus of innovation in PA is not only on AI. There are many paths to a more efficient and effective PA and reducing it to the use of AI would limit the impact of digitization. Therefore, many programs include multiple technologies aiming to create an ecosystem of digital innovation, in which AI is just a valuable part. The value here lies in the interoperability of the different technologies to ensure the usefulness and capacity of integrating the innovations.

Whereas this scenario seems a logical outcome of the situation described, while analyzing how innovation in AI occurs, one can notice how the lack of a clear path of development makes it difficult to meet the expectations of PA. On the one hand, PA lacks the skills and competencies amongst its employees and decision-makers to fully benefit from AI implementation (or to understand the risks associated with certain technologies). In the case studies analyzed, it became clear that technology implementation is more effective if the organization already has the requisite skillset, and the civil servants are trained to cooperate with the private sector. Nevertheless, because PA is dealing with emerging technologies that are still in their infancy, particularly when it comes to their mainstream adoption, PA has a hard time navigating how best to invest in them. Finally, the accelerated transformation of the ecosystem (and the ever-faster innovation pace estimated for the following years) creates an urgent need for a sustainable political environment to ensure the stability of the development plans and the resource availability for fostering innovation. Innovation thrives when long-term vision and clear development plans are in place, and this scenario differs from the frequent institutional and leadership change that Poland has witnessed in recent years.

<b> 6. Limitations

The main limitation of this study is its introductory nature and innovativeness in the Polish context. The lack of previous studies describing the Polish reality and the innovativeness of the use of AI in PA challenges the creation of a solid theoretical foundation for the research. Even if contradictory, this is, at the same time, its added value: the current piece represents the first attempt to describing the Polish reality and, as such, has great value for the future of the research.

The ecosystem presented should therefore be taken as an introductory map of the institutional agents relevant to the development of AI (especially GovTech Polska) but does not cover all the possible agents at lower administrative levels. In addition, the map represents a fixed photography of a vivid and mutable reality whose validity is limited in time. Still, the data and its interpretation shed light on some of the main properties of the interaction between PA and providers of AI-related innovation.

Further research should consider using a narrower focus on the development and uses of AI frameworks in designated sectors like agriculture or citizen services, or expanding the research sample to find regularities and tendencies to for comparison. The further occurrence of GovTech Polska contests will certainly enlarge the availability of data easing the development of its analysis and adding new sectors to those described in the previous case studies.

<b> 7. Conclusions

The question we tried to answer is whether the current innovations implemented by the PA in Poland are significant in fulfilling the needs and expectations of the Public Administration itself. Our research aligns with the conclusions raised by Misuraca and Van Noordt (2020), who identify a gap between the transformative potential of AI, its adoption and use.

Automatization should be one stage in the improvement of public administration, but even though it is not difficult to implement solutions for automating decisions under administrative discretion, "general clauses or valuation standards" pose a real challenge. Similarly, Etscheid (2019) argues that "the constant increase of technical possibilities makes the automation of processes more and more attractive for the public administration, but not all administrative processes can be automated from a technical point of view." From thousands of administrative procedures, decision-makers must select those processes which they consider appropriate for partial or full automation. Taking this into account, we emphasize that even though many of the projects studied here do not fit exactly into a more purist approach to what AI is, and are focused on data analytics, they still affect PA's functioning and greatly contribute to building digital skills and competences across the whole ecosystem. We have also revealed the roles played by the different stakeholders while incubating tech-driven innovation. These roles seem to be robust, exchangeable, and adoptable by different agents. For instance, the funding role may be directed either towards serving the citizens or internally, towards enhancing the technological capabilities of the public administration. Similarly, the roles of a funding institution and the accelerator can be exchangeable.

The Polish ecosystem is still at in its infancy and the flexibility of different agents will presumably allow for its rapid growth and complexity. The diversity of actors already present in the current ecosystem depicts the potential for a collaborative environment in which the dialogue between the public and the private interests might contribute to the implementation of AI uses while developing their own goals. Public Administration, in turn, needs to jump into the "paradox of change" (Tilson et al., 2010), providing a sufficient level of stability (in terms of infrastructures, funds, and applicability of the technology) to ensure the evolution and dynamism of the ecosystem. Finally, in the next years we will experience a significant change

of landscape regarding the directions that AI implementation will take in all European Member States, among other elements, because of the upcoming AI Act. This regulation puts great emphasis on trustworthy and transparent AI incubation and enforces reporting whenever black-boxed deep learning systems are implemented in decision making in various crucial areas, like medical diagnosis or consumer banking. On one hand, this regulation can reshape how AI is being used in PA and redirect attention to simpler machine learning models, but on the other hand it can incentivize PA to use AI more frequently because of higher standards of application.

<b> 8. References

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