

IN THE WAKE OF ALGORITHMIC DECISION MAKING: MAPPING AI-RELATED ADVANCEMENTS IN THE HUNGARIAN PUBLIC SECTOR

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Abstract

Utilizing artificial intelligence (AI) is among the most substantial challenges of our time, raising numerous issues concerning work organization, technology implementation, legal and ethical issues. This is especially true in public administration when it comes to the systems that support the operation of public services. The paper begins with a review of the various uses of artificial intelligence in public administration (starting from the observation that in many cases the different issues of process automation and predictive algorithms-backed decision support systems are not clearly separated), followed by a discussion of the dilemmas and problems which must be dealt with. After drawing a theoretical framework, the research reviews the systems currently employed by the Hungarian public administration and those planned to be introduced in the near future. Finally, the authors evaluate different aspects of the widespread use of algorithmic decision making in the Hungarian public administration in the future, with special emphasis on the integration of AI-developments in public administration development policy documents, the organizational and legal components, and the potential general acceptance of such AI-based public services.

1. Introduction – artificial intelligence is gaining ground

Artificial intelligence (AI) can be defined as a general-purpose technology, and in recent years it showed a great effect on the everyday life of people and businesses. Implemented it in a prudent way, it holds the potential to improve the well-being of people, to contribute to positive sustainable global economic activity, to increase innovation and productivity, and it has been already deployed in many sectors ranging from production, finance and transport to healthcare and security [1]. Current datafication and digitalization trends can be observed also in public administration, as there are increased attempts to use massive amounts of data to improve governmental practices [14]. People who work in government and do business with public administration are coming up with more and more ways to use AI.

In 2018, the High Level Expert Group on Artificial Intelligence (AI HLEG)⁴ was formed by the European Commission in order to advice for the implementation of its Artificial Intelligence Strategy. The Expert Group developed the document *Policy and investment recommendations for trustworthy Artificial Intelligence* [9] in which they emphasized the crucial role the public sector can have in AI-related innovation and growth. The publication enumerates areas, focal points and actions how the public sector “as a platform”

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⁴ <https://ec.europa.eu/digital-single-market/en/high-level-expert-group-artificial-intelligence>

can fulfill this role, including providing more targeted and effective services for individuals and groups as a catalyst for innovation and growth.

Engstrom et al. underline that artificial intelligence has the potential to transform how government agencies do their work: they conclude that current rapid developments in AI can contribute to reduce the cost of core governance functions, improve the quality of decisions, and unleash the power of administrative data, thereby making government performance more efficient and effective. Their empirical research showed that the range of AI solutions in federal level government in the USA is diverse and spans the federal administrative state, as nearly half of the federal agencies studied (45%) have experimented with AI and related machine learning (ML) tools [7].

The first Automating Society Report (*Taking Stock of Automated Decision-Making in the EU*, which is using the term automated decision making (ADM) instead of ‘artificial intelligence’, defining ADM as “*algorithmically controlled, automated decision-making or decision support systems are procedures in which decisions are initially—partially or completely—delegated to another person or corporate entity, who then in turn use automatically executed decision-making models to perform an action.*”) was published in the beginning of 2019 [21], and in the introduction section of the second report (published at the end of 2020), the editor writes that ADM systems in Europe were mostly new, experimental, and unmapped when the first report came out, but the situation has changed rapidly as the deployment of ADM systems has vastly increased in just over a year. [3] As it is usually pictured in the literature dealing with the implementation of different technologies into public administration processes, the public sector has trailed behind the private sector in adopting AI, but governments are seeking to rapidly catch up [1].

Evaluating AI-related developments in public administration, as the mapping of such initiatives is just beginning, the number of such applications is constantly increasing, and many projects are in early or experimental stages. It is also unclear how effectively AI solutions are being adopted and used by government and whether they are having a social or economic impact. This paper examines the policy background, organization aspects, and maps AI-related initiatives as a first step towards assessing algorithmic decision-making in Hungarian public administration. The authors are completing their landscape review on the potential reception of automated public services among citizens.

2. Background – what is AI and why is it important (for public administration)

2.1. Artificial intelligence: wide range of definitions, meanings and emerging research areas

In the last few years, citizens and businesses have been increasingly encountering AI-based technologies and solutions in many areas of life, ranging from communication via social media and by email, to chatbots and digital assistants, to product recommendations and many more. Despite the fact the research field of AI can be originated back to the 1950’s, there is no uniform, widely used definition of artificial intelligence [20], and therefore many reports and recommendations begins with a working definition of AI. For example, the 2019 OECD Recommendation on Artificial Intelligence [23] declares that an “*AI system is a machine-based system that can, for a given set of human-defined objectives, make predictions, recommendations, or decisions influencing real or virtual environments. AI systems are designed to operate with varying levels of autonomy.*”

The probably most detailed definition was adopted by the High Level Expert Group on AI of the European Commission [9]: “*Artificial intelligence (AI) systems are software (and possibly also hardware) systems designed by humans that, given a complex goal, act in the physical or digital*

dimension by perceiving their environment through data acquisition, interpreting the collected structured or unstructured data, reasoning on the knowledge, or processing the information, derived from this data and deciding the best action(s) to take to achieve the given goal. AI systems can either use symbolic rules or learn a numeric model, and they can also adapt their behaviour by analysing how the environment is affected by their previous actions. As a scientific discipline, AI includes several approaches and techniques, such as machine learning (of which deep learning and reinforcement learning are specific examples), machine reasoning (which includes planning, scheduling, knowledge representation and reasoning, search, and optimization), and robotics (which includes control, perception, sensors and actuators, as well as the integration of all other techniques into cyber-physical systems)."

An AI Watch⁵ report demanded the development of a process to establish a reference AI definition [20], and its subsequent operationalization into a taxonomy and representative keywords. The authors of the report considered the cited definition proposed by the HLEG and their proposed operational definition (based on the review of 55 relevant documents) is composed by a concise taxonomy characterizing the core domains of the AI research field and transversal topics (*Figure 1.*); and a list of keywords representative of such taxonomy.

AI taxonomy		
	AI domain	AI subdomain
Core	Reasoning	Knowledge representation
		Automated reasoning
		Common sense reasoning
	Planning	Planning and Scheduling
		Searching
		Optimisation
	Learning	Machine learning
Communication	Natural language processing	
Perception	Computer vision	
	Audio processing	
Transversal	Integration and Interaction	Multi-agent systems
		Robotics and Automation
		Connected and Automated vehicles
	Services	AI Services
	Ethics and Philosophy	AI Ethics
Philosophy of AI		

Figure 1: A current AI taxonomy by Samioli et al. [20]

The broad definitions (and the rich set of AI keywords collected by the AI Watch report) show how diverse and multidimensional can be the application of artificial intelligence in the public sector, and it is also reflected in the scientific literature, essentially based around the term ‘algorithm’. Algorithms are at the center of AI-systems, as they can be seen as the “*encoded procedures for transforming input data into a desired output, based on specified calculations*” [11], or as Willson put it “*An algorithm is delegated a task or process and the way it is instantiated and engaged with in turn impacts upon those things, people and processes that it interacts with - with varying consequences*”. Gradual deployment of algorithms has sparked renewed interest across disciplines in how algorithms can be applied in the organization of public life, and it is resulted in the

⁵ https://knowledge4policy.ec.europa.eu/ai-watch_en

emergence of research field *algorithmic governance*, which is at the intersection of digitalization, datafication, and governance through technology [12].

Danaher et al. stress that algorithmic governance is a natural extension of a longer historical trend toward the mechanization of governance, as sociologists have been highlighting how the originations of the state are subjects to the very same modernizing ambitions as the industrial factories and businesses entities. This trend has led to a machine-like system of governance (with subdivided task and specialized roles in order to achieve as efficient operation as possible), which has always depended on the collection of data about the society and citizens and computers have been involved to automate some parts of different procedures or entire processes [6]. To a large extent, the application journey of AI in government fits well with the research tradition of eGovernment: the use of ICTs to improve government services and practices [14].

Establishing AI in government to assist with service delivery and decision-making comes also with risks and new obstacles. Although an algorithm may promise greater precision and efficiency in many fields, the same efficiency cannot be automatically replicated in the public service domain, where caseworkers must exercise discretion in applying complex legal frameworks affecting individual lives directly [15]. Pääkkönen et al. distinguish between two roles in which algorithms can bring power: automating or supporting human decision-making. *In the first case, where discretionary power is located at different stages of the development and maintenance of the algorithmic system, algorithms are used to replace humans* in certain tasks in programmatic and automated decision structures. In other cases (e.g. risk assessment models in court by judges), *algorithms serve as support systems that can guide or extend human actions while allowing an element of discretion*. The authors argue that algorithms enter into complex interactions with humans both in their supporting and replacing roles [18].

As Vogl et al. put it, there are basically two different approaches for designing algorithms: ‘top-down’ (in which the ruleset exhaustively defined for the algorithm) and ‘bottom up’ (in which the algorithm is given a learning rule and trained on large datasets in order to develop its own rules). The authors conclude that in recent years there have been major changes in the design of algorithms, and one of the most important changes is the shift from ‘top-down’ algorithms to ‘bottom-up’ (mainly AI-based) algorithms, which trend arises problems in terms of transparency and opacity of algorithmic governance systems [22]. Futó [10] examined the public and state administration decision support system landscape in Hungary and concluded that deduction-based expert systems, the classical version of artificial intelligence applications, can be more suitable for the public administration (instead of the newer, mainly (big) data-lead approaches), where the functioning of the institutions and their decisions are based largely on normative regulations.

2.2. Artificial intelligence in public service provision – wide range of use cases

The scope, goals and practices of public sector use of AI are really diverse. Based on their research among federal agencies in the USA, Engstrom et al. [7] highlighted five main areas of governance tasks where AI tools are already implemented (using a wide range of AI techniques, from machine learning to “deep learning” with natural language and image data):

- Enforcement, relates to the enforcement of existing regulation, such as those that identify or prioritize targets which require enforcement or inspections.
- Regulatory research, analysis and monitoring, refers to AI use cases which assist in the policy making processes, such as collecting, monitoring and analyzing data to augment policy-makers decision-making capabilities and make them more evidence based.

- Adjudication, which AI systems are used in order to assist or conduct the granting of benefits or the entitlement of rights to citizens.
- Public services and engagement: These AI solutions include those that are used to support the provision of services to the citizens and businesses or to facilitate communication with and participation of the general public are part of this category.
- Internal management: These AI use cases are used to assist in the management of the internal organization, such as human resources, procurement, ICT systems or other utilities.

The results of the first exploratory mapping of the use of AI in public services in the EU [14] show a wide variety of initiatives and efforts by Member States to adopt AI-enabled innovations. The report proposes a classification based on 10 application domains – called ‘AI typologies (*Table 1.*)’, align with the operational taxonomy proposed by the AI Watch and an earlier AI in government-specific taxonomy by Wirtz et al. [24], who also suggested 10 AI application areas, describing their value creation and functioning as well as specific public use cases.

1. Audio Processing	These AI applications are capable of detecting and recognizing sound, music and other audio inputs, including speech, thus enabling the recognition of voices and transcription of spoken words.
2. Chatbots, Intelligent Digital Assistants, Virtual Agents and Recommendation Systems	This AI typology includes virtualised assistants or online ‘bots’ currently used in not only to provide generic advice but also behaviour related recommendations to users
3. Cognitive Robotics, Process Automation and Connected and Automated Vehicles	The common trait of these AI technologies is process automation, which can be achieved through robotized hardware or software
4. Computer Vision and Identity Recognition	AI applications from this list category use some form of image, video or facial recognition to gain information on the external environment and/or the identity of specific persons or objects.
5. Expert and Rule-based Systems, Algorithmic Decision Making	The reason why these apparently distant AI developments are joined into a single application is their prevalent orientation to facilitate or fully automate decision making processes of potential relevance not only to the private but also to the public sector
6. AI-empowered Knowledge Management	The common element here is the underlying capacity of embedded AI to create a searchable collection of case descriptions, texts and other insights to be shared with experts for further analysis.
7. Machine Learning, Deep Learning	While almost all the other categories of AI use some form of Machine Learning, this residual category refers to AI solutions which are not suitable for the other classifications.
8. Natural Language Processing, Text Mining and Speech Analytics	These AI applications are capable of recognising and analysing speech, written text and communicate back.
9. Predictive Analytics, Simulation and Data Visualisation	These AI solutions learn from large datasets to identify patterns in the data that are consequently used to visualise, simulate or predict new configurations.
10. Security Analytics and Threat Intelligence	These refer to AI systems which are tasked with analysing and monitoring security information and to prevent or detect malicious activities.

Table 1: An AI typology, developed by Misuraca and van Noordt [14] on the basis of Wirtz et al. [24]

Based on the rapidly changing technology landscape, a taxonomy can serve more as an aid to further understanding new AI cases than a definitive list of imaginable use cases, therefore we applied this taxonomy during the mapping process as a guide.

3. Artificial intelligence in Hungarian public administration

To begin the mapping process, we turned to different methods and information sources. During a desk research phase, we examined the main policy documents and strategies to explore the extent to which AI is incorporated in public administration development plans. We also reviewed documents/information from the last programming period on public administration development projects, as well as planned developments, then we validated our findings with expert interviews from officials working in this field. Finally, we also consulted the database from the Good State Public Administration Opinion Survey, which gives us an idea of how these developments can be perceived among citizens.

3.1. Strategy and policy level – AI is on the rise

For the programming period 2014-2020, the main policy documents in this domain are The National Infocommunication Strategy 2014-2020 (NIS) (with four pillars, one of them is “digital state”) [17] and the *Public Administration and Public Service Development Strategy 2014-2020* [19]. Artificial intelligence is directly mentioned only once in the NIS (under the measure Encouragement and support of the R+D+I activity of the ICT sector), and has no direct mention in the public administration development document. The latter, however, is talking a lot about the benefits of digitization, and there are some isolated mentions of automated processes, both front- and back-office level, as a possibility.

A new strategy on this filed, the National Digitisation Strategy (NDS) is currently being prepared by the Ministry of Innovation and Technology as the successor to the National Information Communication Strategy. The Digital Success Programme⁶ initiated the establishment of the Hungarian Artificial Intelligence Coalition at the end of 2018. The members are including multinational and domestic businesses, universities, scientific workshops and professional and public administration organizations. The coalition contributed to the most important recent policy document in the domain, which is the national strategy on AI adopted, in the second half of 2020. The Hungary’s Artificial Intelligence Strategy 2020-2030 [13] proposes the following main groups of measures (Figure 2.):

- *Foundation pillars*, which aim is to prepare society to manage inevitable changes resulting from AI effectively and to fully exploit the advantages of the technology. It's divided into two sections: the AI value chain covers the internal conditions (ensuring access to public and private data, building both a community and researchers and an ecosystem supporting the use of the technology), while the AI frameworks provide the “external” conditions (human skills, availability of software and hardware, clear regulatory environment).
- *Focus areas*, which aim to strengthen the growth potential of the Hungarian economy and to improve its efficiency in a targeted and conscious manner through the use of available AI technologies, on the one hand; and the development of future technologies, on the other. The

⁶ <https://digitalisjoletprogram.hu/en>

strategy favours supporting specific sectors that could benefit most from AI-based applications.

- *Transformative programmes*, which do not include programmes in a traditional sense, but rather complex means-end schemes provided in a form that is readily comprehensible for society as a whole.

As Figure 2. shows that focus areas (State Administration – “Data-driven, service provider state”) and transformative programmes (automated administrative procedures in Hungarian) both includes state administration. The Strategy says the main aim is to facilitate electronic access to, and the digitalisation of, public services, with AI being one of the enabling technologies, which is in line with the current concept of public administration digitalization, focusing on integration and developing processes, the efficiency of which can be improved and where new channels can be provided with services more effectively. There are some concrete topics mentioned in the strategy, among others the introduction of control systems for use by law enforcement, the development of complex modelling systems to simulate decision-making situations and development of systems supporting the oversight of financial and taxation processes [13].

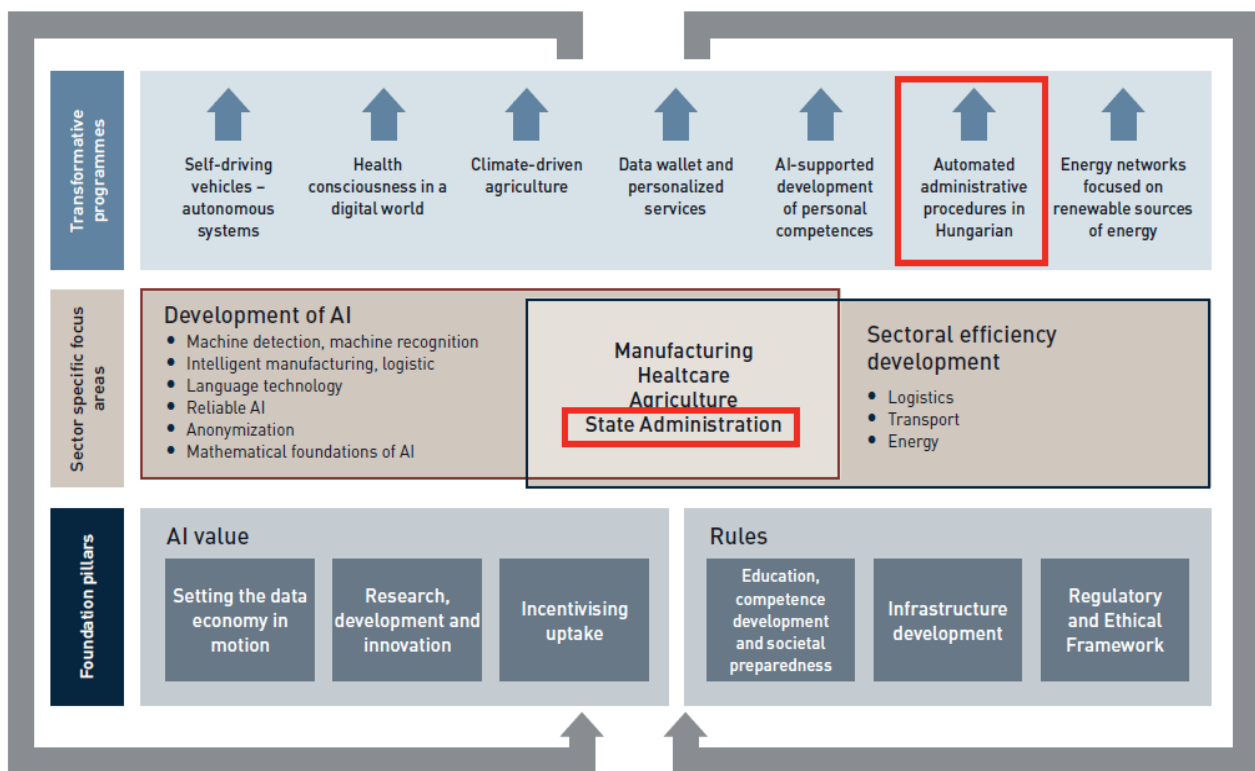


Figure 2: Measures of the Strategy and their relationship with each other (Public Administration related measures are indicated) [13]

Many developments and projects focusing on public administration digitalization are taking place under projects funded by the European Union, therefore it is important to mention the Public Administration and Civil Service Development Operational Programme (KÖFOP, with EUR 935 million funding), which aims to improve the services provided by the public authorities and the increase efficiency of public administration, in line with the cited strategy documents. Public administration digitization is also included in the draft of the Digital Renewal Operational Program (DIMOP), which at this stage of the planning process, can be considered as a continuation of the Public Administration and Civil Service Development Operational Programme (KÖFOP). If the

programme is accepted, there will be even more emphasis on digital transformation in this respect. According to the draft summary/structure published for public consultation⁷, the content of DIMOP would consist further digitization of public services, where the realisation of data-driven administration (process automation/automated decision making and the application of AI and robotics would play a central role) can be a priority. This would be supported with the extension of the Central Government Service Bus (KKSZB) interoperability platform.

3.2. Practical level – actual or planned use of AI in Hungarian public administration

Currently, the main responsible body for public administration digitization is the Ministry of Interior, which recently opted strongly to implement artificial intelligence-based solutions, with the dual aim of improving customer centricity as well as the efficiency of workflows.⁸ Another argument is that automated decision making could provide greater transparency and reduce the possibility of corruption.

We examined the content and scope of the projects which are founded under the umbrella of the Public Administration and Civil Service Development Operational Programme (KÖFOP), and two major project addition to the KÖFOP in the last year (however not yet under contract) reflect this trend:

- The placement of artificial intelligence supported customer service points (KIOSKs) at government offices (HUF 2.6 billion). KIOSKs are service points/terminals where certain cases/services can be handled fully automatically (for example, passport, identity card and certificate of good conduct requests), using various technologies and algorithms for identification (portrait-based or using the national eID card), speech recognition/ conversion and an AI-augmented procedure support application, connected with public registers. There are working examples of the terminals, out of which 400 will be installed in the project.
- Developing an Automated Public Administration Decision Making system (AKD) as a regulated electronic administration service (SZEÜSZ) (HUF 1 billion). In consequence of this project, an integrated service will be implemented, with which administrative steps between the opening and closing of a case can be carried out without human intervention, provided all the information necessary for the decision is available (in public registers). This model can be further developed and expanded, through which a public administration institution will be able to simplify and automate its own administrative processes by integrating this service.

We see some other references in projects running to automate case handling (e.g. EKEIDR project, which aims to extend a unified file and process management system to territorial administration, or an another project set up for the review and simplification of proceedings instituted by a public authority), which are involved in wider administrative burden reduction or workflow reengineering measures and basically the activities of these projects mainly target the automation of some part of the process or the evaluation of possible future automation.

In other areas, technology similar to that used for setting up KIOSKs has been considered or already implemented. One such area is the introduction of chatbots into the processes of the Governmental Hotline (1818)⁹ in 2021, the customer service provides information regarding public administration

⁷ <https://www.palyazat.gov.hu/digitalis-megujulas-operativ-program#>

⁸ <https://www.youtube.com/watch?v=XHVPqmsJrZk>

⁹ <https://1818.hu/home>

procedures, which would include portrait-based identification, speech recognition/conversion and automated case handling. Portrait-based identification is also used in relation to border control. It is also worth mentioning that the National Tax and Custom Administration, based on the enormous amount of data (7,5 petabyte) it collects (e.g. from a near real-time online cash register system), is implementing different artificial intelligence-based solutions, one of them is a fraud detection system [16].

One of the most important development principle we identified is the intention of integrating of AI-technologies into the system of regulated electronic administration service (SZEÜSZ). Regulated electronic administration services are IT building blocks that can be integrated into many services in the same way and in this way, complete digital procedures can be built from this building blocks. Hungary has been pursuing this centralized model of e-governement development since the first half of the last decade [2][4]. One analogue for the AI-related expansion of different SZEÜSZ' is the central identification solution, the Central Authentication Agent, which supports the use of different electronic identification and authentication services (Client Gate, national eID card, Partial Code Telephone Authentication). Different identification solutions (based on portraits/pictures or touchless fingerprint recognition) will be developed to be another building block for digital processes, as well as a customizable chatbot with speech and text recognition and processing capabilities.

Most of the developments are in pilot, testing or planning phase, and it is important to emphasize that in many cases, to achieve the fully automated case handling, regulatory changes are also necessary and under negotiations.

3.3. Citizen's perspective

In closing, it's worth taking a look at how customers approach the state's automation efforts. The empirical basis of this section is the Good State Public Administration Opinion Survey, which was carried out in Hungary in first half of 2020. The survey questions were tested on a representative sample for the adult (age 18+) Hungarian population. The sampling method was multistage, proportionally stratified probability sampling, while the database was also corrected ex post with matrix weighting procedure in respect to age, gender, region, settlement type and education. The survey provided the opportunity to gain a large representative database, with data about citizens' usage and experience of different areas of e-government services, their channel preferences and the obstacles they face while dealing with public administration procedures. One of the questions asked the respondents whether they try different ways of machine-assisted case handling (*Table 2*).

There are significant differences related to age and education: only 20-25% of the respondents and 18-29 refuse to try the listed methods, while the ration among respondents who are above 70 years of age is ranging between 80-90%. Respondents with no more than elementary education are less likely to try the new channels and methods, which is in line with earlier research [5] as they probably feel that they will not get enough support using the novel technics. Among internet users, the more frequently one uses the internet, the more likely they would try the automated/remotely supported way of the procedure. The numbers show that there is receptivity for automated case handling and for AI-assisted procedure handling, as approximately two thirds of the respondents would at least try these methods, but they certainly cannot work for everyone at the moment.

	By no means would I try it	I would only try it if I benefit from it (e.g. I can save time)	I would like to try it out
Using online chatbot for gathering information	37	38	25
Using video calls for complete procedures online	32	40	28
Using a terminal in customer services/physical one stop shops instead of interacting with a clerk	38	37	25
Using video calls at customer service/physical one stop shops	37	33	29

**Table 2: Preferences towards different AI-assisted methods for interacting with public administration
(Good State Public Administration Opinion Survey 2020)**

4. Conclusion

Reviewing the current policy documents and development projects and initiatives, we can conclude that there is a growing level of presence and importance of implementing artificial intelligence (and automation) into public administration, a trend which started around 2018. One of the main catalysts was the establishment of the Hungarian Artificial Intelligence Coalition at the end of 2018, but an important aspect could be the constant innovation pressure on the public sector to engage with state-of-the-art technologies already widely adopted in the private sector. Currently, the technologies and solutions used, tested or piloted by the Hungarian Public Administration (using the AI-typology from *Table 1.*): Audio Processing; Cognitive Robotics, Process Automation and Connected and Automated Vehicles; Chatbots, Intelligent Digital Assistants, Virtual Agents and Recommendation Systems, Computer Vision and Identity Recognition; Natural Language Processing, Text Mining and Speech Analytics. Some initiatives are combining almost all of these methods, while big-data or machine learning based solutions are not widely used. One explanation for this could be that artificial intelligence is seen as a possibility to extend the system of regulated electronic administrated services, which means that these solutions can be an integral, standardized part of digital procedures. The AKD project is aiming for fully automated processes, which can pave the way for an even more integrated approach, as currently we can state that present activities related to AI is determined by the “eGovernment rhetoric legacy” [14], or the translation of administrative procedures in digital format. Citizens appear to be receptive to (more) automated case handling and to AI assisted procedure handling, but in practice this receptivity can vary widely between different segments of the population and between different cases and services. The human or organizational aspect is equally relevant in terms of public administration bodies: besides the overcoming of existing legal barriers and fine-tuning regulations to make automated procedures possible, administration without human intervention must follow a different approach to responsibility and public administration management.

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