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When Administrative Law Meets Process Engineering

BPMN Modelling, Automation and Interoperability in the Hungarian State Registry Systems

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Abstract: The paper examines the digitalisation of Hungary's public administration registries through an interdisciplinary legal IT lens. It traces the acceleration of records digitisation since the 2000s and identifies fragmentation across sectoral registers as the primary barrier to end-to-end digital services. Methodologically, we combine doctrinal legal analysis with process engineering, using BPMN to model priority procedures and test two questions, namely, 1. whether digitised procedures fit within current Hungarian register law, and 2. what are the challenges that hinder interoperability in both the legal and IT contexts? Our findings demonstrate that BPMN enables verifiable, executable specifications for normative procedures,

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supporting RPA and rule-based automated decisions. AI and expert systems can extend capabilities where explainability and override are ensured. The paper argues for a technology-neutral code of state registries and enforceable interoperability, i.e. shared identifiers, data contracts and auditability. We are also proposing improvements to risk management, such as addressing biases, ensuring authenticity and preventing model drift. These improvements will guide the transition to a human-centred, reliable digital administration.

Keywords: process modelling, BPMN, artificial intelligence, digital public records, automated decision making, interoperability

1. Introduction

Collecting and cataloguing data is a key aspect of public administration, and such data may be traced back, in effect, to the very beginning of recorded public administration, going back to some thousands of years. Public administration, encompassing the entirety of social life, covers both state actions and the management of everyday affairs. As these social phenomena are in constant change and transition, public administration must mimic those dynamics and constantly adapt to social, economic and technological changes. A key element of this adaptation is the efficient management of information, for which the system of keeping state registers serves as one of the most important tools and frameworks. As such, we do not consider the keeping of registers to be a separate sector of public administration; rather, it is, in our opinion, a type of activity that supports administrative management and governance, resulting in data sets, which provide the background for public administration decision-making, facilitating information gathering, data analysis, and the performance of administrative tasks.

These registers are essential and indispensable for any efficient and effective system of public administration, supporting both public governance and the interests of society as a whole by ensuring the reliability and transparency of data management. This is ever so in the era of digital public administration, where electronic data management and the integration of IT systems play a key role in enhanced efficiency and speed.

However, with this information revolution, the amount of data needed to be processed has increased considerably as well, and so, due to the large-scale digitalisation of this data, data management and the keeping of state records are facing novel challenges, both methodologically and systemically speaking. Although different legal regimes indeed have varying methods and scopes of data collection, in this study we are considering a particular regime, the digitalisation of Hungarian public records, and we are offering a critical analysis of the preliminary measures necessary for a viable reform.

In Hungary, the process of digitising records has intensified since the 2000s (Cseh & Czékmann, 2021), and as a result of the insufficient coordination and lack of centralised control, unrelated and even separate subsystems and sectoral data sets have been developed at different rates and within different legal and technological frameworks. Now, when the efficient digitisation of public administration demands its subsystems to

be able to communicate with one another, requiring algorithmic facilitation of data flow, there is an urgent need to reconsider the classic registration traditions.

In this study, we seek to answer why digitised government registries are unable to communicate with one another, and what obstacles Hungarian legislation must overcome to ultimately achieve the legal and technological interoperability of these registries. The research involved legal and IT experts who used legal and IT tools to examine databases and the legal regulations governing them.

2. Interdisciplinary methodology of research

2.1. Legal and IT languages combined

The primary goal of the research was to contribute to the digital transformation of major government registries. The vast majority of Hungarian government registries now operate in digital form, having transitioned from paper-based data storage and operations over the past few decades. However, this transition has occurred gradually and in a fragmented manner across different sectors, meaning it has been sporadic in terms of both regulation and technology. For instance, the Hungarian Parliament (Országgyűlés) mandated the full digitisation of civil registry records through Act I of 2010, originally setting a one-year deadline for its implementation. However, due to slower technical and organisational development, the law did not ultimately take effect until mid-2014. In contrast, the vehicle registry was already defined as an electronic registry a decade earlier, under Act LXXXIV of 1999. What is more, Act LXVI of 1992, which established the personal data and address registry, had already defined itself as an electronic (i.e. digitised) registry well in the mid-1990s.

This sector-specific variation in digitalisation has also led to significant regulatory and technological differences, which today, among other things, have a significant impact on the interoperability of specialised systems. For this reason, the research required a joint examination of the legal and IT issues of regulation. We employed a research methodology that is fundamentally based on collaboration between legal and IT researchers. As such, our interest lies in the research findings arising from the intersection of the interpretive domains of the two fields, namely the modelability of law and the resulting challenges in both disciplines. It is, thus, an interdisciplinary research by its very nature. Moreover, our study contributes to the long-standing process of research and thought examining the impact of technology on public administration and its development potential, ultimately in the interests of society in Hungary.

2.2. Why (these) records?

In Hungary, government registries are usually managed by sectoral authorities. Therefore, the government agency (usually a ministry) with jurisdiction over the relevant sector essentially bears the substantive legal responsibility for the registries. IdomSoft Zrt.,

established in the early 2010s from former ministerial bodies, was tasked with providing the technological environment and IT-based support for certain core state registries, among other things. These include the personal data and address registry, the vehicle registry, the passport and driving licence registries, and the criminal records registry.

This study is based on detailed research conducted on behalf of IdomSoft Zrt. Therefore, our analysis focused on the registries that the client identified as being most affected by the need for interoperability: the personal data and address registry, the civil registry, the driving licence registry and the vehicle registry.

The four registers examined are core government systems that affect society as a whole, and their digital development is expected to have significant social and economic consequences. The aim of this research is therefore to explore the potential for collaboration between these digitised registers and the conditions for modelling.

2.3. Methodology of the legal analysis

The paper applies a doctrinal legal methodology within an interdisciplinary research framework. Its legal analysis focuses on the normative structure of Hungarian public administration registries, examining the statutory bases, conceptual categories, guarantees, and procedural implications of state records within the evolving legal framework of administrative and digital governance.

Rather than viewing registry law as an isolated body of sectoral rules, the study interprets it as a legal infrastructure that underpins public administration. Particular attention is dedicated to legality, public authenticity, data disclosure, procedural safeguards and inter-registry cooperation. From a methodological perspective, the doctrinal inquiry is problem-oriented, assessing whether existing Hungarian legislation provides an adequate legal basis for the digital modelling of administrative procedures and whether it can be expressed in a form suitable for algorithmic interpretation.

This legal analysis is paired with process engineering and modelling. This is not intended as a substitute for legal reasoning but rather as an analytical instrument for testing the internal coherence, executability and regulatory completeness of legislation. The paper's legal method, therefore, combines conceptual analysis, statutory interpretation, and systemic evaluation with a functional examination of how legal norms operate when translated into digital administrative processes, automation and interoperable state registry systems.

2.4. Process-engineering protocol and validation criteria

The development of administrative systems is closely linked to the development of information and communication technologies. Process modelling tools widely used in engineering and business management, such as *Business Process Model and Notation* (BPMN), effectively support the precise description and analysis of administrative processes. This facilitates more informed decision-making and higher-quality service

delivery. In addition, they offer the possibility of recording legislation in a structured, digitally processable form, creating the basis for automated process control.

From an IT perspective, the modelling was carried out as a structured process-engineering protocol rather than as a merely illustrative diagramming exercise. First, the relevant legal provisions were decomposed into operational units: actors, triggering events, required data inputs, authoritative registers, procedural activities, decision points, deadlines, outputs and possible remedies. Second, these units were mapped to BPMN elements: start and end events, user tasks, service tasks, gateways, message events, data objects, pools and lanes. Third, the resulting models were checked against three criteria: syntactic validity, legal traceability and algorithmic interpretability. By syntactic validity, we mean that the BPMN model follows the notation rules and contains no dead ends, unresolved branches or missing termination points. Legal traceability means that each activity or gateway can be linked back to an identifiable legal rule or administrative requirement. And algorithmic interpretability means that the model contains sufficiently explicit conditions, data inputs, and decision rules to allow transformation into a rule-based workflow or executable decision-support specification.

Figure 1 summarises the modelling logic applied in the study. It shows how legal rules were translated into procedural elements and BPMN representations, and how the model was then used to distinguish between descriptive modelling, executable modelling and automated decision-making. The figure also highlights the main methodological boundary of the analysis: the capacity to model a process in BPMN does not in itself imply full legal or technical suitability for automation.

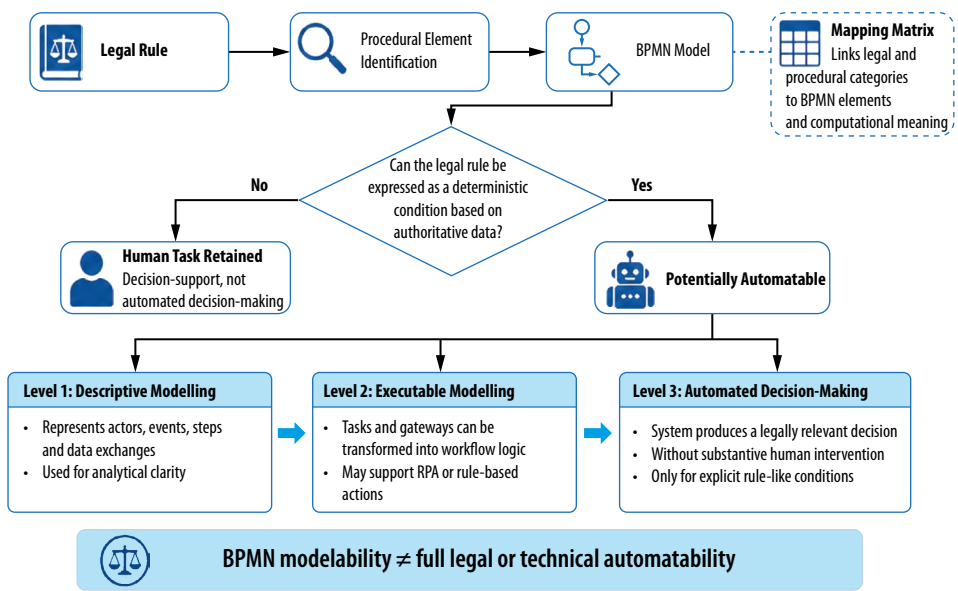

Figure 1
From legal rules to BPMN modelability and automation boundaries
Source: Compiled by the authors.

To make this logic more transparent, Table 1 presents a simplified mapping matrix linking typical legal or procedural categories to BPMN elements and their possible computational interpretation.

Table 1
Mapping legal norms to BPMN and computational elements

Legal/procedural category	BPMN element	IT interpretation	Validation criterion
Application submitted by citizen	Start event / message event	Process trigger	Is the input channel and timestamp identifiable?
Competent authority	Pool/lane	Responsible system or organisational actor	Is responsibility unambiguous?
Data request from public register	Service task / data object	API call or register query	Is the authoritative data source defined?
Legal condition	Exclusive gateway	Boolean rule / decision predicate	Is the condition formal and machine-checkable?
Discretionary assessment	User task / manual review	Human-in-the-loop decision	Is discretion legally required?
Notification / decision delivery	Message event / end event	Output generation and delivery	Is the communication channel auditable?
Appeal or legal remedy	Event subprocess	Exception path	Is the remedy path preserved?
Missing data / contradiction	Error event / exception flow	Data quality or legal inconsistency flag	Is the inconsistency logged and reviewable?

Source: Compiled by the authors.

Table 1 should be read as a concise mapping matrix that clarifies the modelling logic applied in the study. It shows how typical legal and procedural elements can be represented in BPMN and how their computational meaning can be assessed. This distinction is important because the mere representation of a procedural step in BPMN does not automatically make it suitable for automation. Where a legal rule can be expressed as a deterministic condition based on authoritative data, the corresponding BPMN gateway may be considered potentially suitable for automation. Where the legal rule requires evaluation, balancing, discretion, or proportionality, the model should retain a human task and should be classified as decision support rather than automated decision-making.

2.5. Research questions

One of the key questions of the study is how the system of public administration records can be integrated with modern information and communication technologies, and how they can be standardised to make public administration procedures more efficient.

Exploring this issue is important both from a theoretical and practical point of view, as recently digitisation and automated decision-making are among the fundamental challenges for public administration systems.

The study examined the systematic characteristics of administrative records, their legal and technological background, and how these systems could be integrated with the latest IT tools, with legal and IT researchers conducting the analysis. The study was based on two fundamental questions:

1. Is it possible to model digitised administrative processes within the current legal framework for Hungarian state records?
2. What are the challenges that hinder interoperability in both the legal and IT contexts?

The research is therefore interdisciplinary, bridging the gap between technological and legal regulatory platforms. Exploring the potential of developments in information and communication technology and artificial intelligence (AI) will have a significant influence on the future functioning of public administration.

3. First step: Laying the groundwork for a process-based interpretation of public records

The essence of public administration lies in its dynamic, activity-based components. It must therefore be understood as a kind of "action" or "operation", and as such, it is necessarily a process (Waldo, 1955, pp. 5–6; Varga, 2017, pp. 90–91). This constant dynamic movement presupposes that public administration has sufficient information to function correctly and efficiently, including information about its own internal workings and the surrounding domestic and international external reality.

For public administration bodies to function properly, they need systematic support in the form of information gathering and data management. They obtain this primarily from registers and official statistics, which are considered reliable sources of data. All of these perform a supplementary and supporting function in public administration. While registers primarily serve public administration, they have now developed a secondary purpose of serving the needs of society and the economy. These heterogeneous registers, statistics and other *ad hoc* data reporting systems thus form a unified system with the same purpose, which can also be regarded as an information infrastructure.

Registers can also be interpreted as constituting a fundamental unit, or "building block". It is evident that data derived from registers and procedural processes can function as a foundational element for the development of information technology. Consequently, this data can play a pivotal role in the identification and implementation of legal development trends. Needless to say, however, the legal environment is currently confronted with a series of challenges that have emerged in response to technological advancements. It is imperative for public administration to compete with these

technological solutions, and it is advisable to implement solutions that can benefit both the back and front office sides of public administration. Given the predominance of these technological solutions within the business sphere, it is pertinent to investigate the potential for the implementation of best practices in both public administration and the business sector. And it appears that the BPMN modelling standard can be classified as one of these best practices (Torres et al., 2010, pp. 114–120).

BPMN has been demonstrated to facilitate comprehension of the sequence of individual public administration processes, including procedures pertaining to registers. Furthermore, it has been shown to translate legislation into a "common language", from which subsequent technological solutions can be derived. In order to comprehend the modelling of registers using the BPMN method and to identify the nodes that arise in individual procedures, it is first necessary to address the systematic issues of registers.

Records are understood to be the systematic organisation and recording of information that is necessary for performing tasks in a way that can be explored (Horváth, 1999, p. 169). A register is defined as a static data set, namely a collection of information that has been gathered and recorded according to predetermined criteria. That is to say, it is a collection of systematised facts (Torma, 2005, p. 620). The dynamics of registers are determined by data movement, i.e. data entry, data modification, data deletion, data locking and data destruction. The disclosure of data does not result in a modification of the data content of the register; rather, it serves to create an imprint of the data's status or alterations over time, akin to the manner in which a photograph is created. This may manifest in the form of an official certificate, a court extract, or other special public document.[1]

Within the framework of state data management, the Hungarian legal scholarship distinguishes between two basic types of registers: 1. state registers containing data from individual administrative sectors, regulated by normative requirements and legal guarantees, and 2. administrative registers, which are not bound by legislation and are intended to support the internal functioning, economic, HR and other functions of the authorities (Budai et al., 2018, pp. 177–178). In our research, we examined the regulatory systems of the Hungarian state registers of personal data and addresses, birth records, motor vehicle registration and driving licence registration.

The most important feature of public registers is that they are established and maintained by a public authority on the basis of a law or a local government decree authorised by law.[2] Another important feature is that they are maintained by a public authority or a non-public authority authorised by the state.[3] With regard to the former, a more precise definition is that a legal entity under public law[4] may maintain a register, since not only the state or one of its bodies may maintain a register, but also local

[1] The court communicates the extract in the form of a decision. See Section 88 of Act CLXXXI of 2011 on the court registration of civil organisations and related procedural rules.

[2] For the legal basis see Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation) Article 6(1)(e). Less frequently, but still possible, decentralised registers may be made mandatory by law and maintained by local or regional authorities. Such registers also share the characteristics of state registers.

[3] Examples of the latter are the registers kept by public utilities.

[4] For the definition of legal personality under public law, see Patyi and Varga (2012) and Tamás (2014).

governments or atypical administrative institutions (such as public bodies or public institutions). Act CL of 2016 on General Public Administration Procedures (hereinafter: Procedure Act), and Act CCXXII of 2015 on Electronic Administration and the General Rules of Trust Services (hereinafter: eServices Act) both refer to "legally regulated public registers",[5] which form part of the state registers in our study.

In Hungarian legislation, significant reforms were introduced on 1 September 2024 with the repeal of the eServices Act Section 36 of Act CIII of 2023 on the digital state and certain rules for the provision of digital services (hereinafter: Digital Citizenship Act). Among the conceptual distinctions, it is also important to note that 'state registers' are not the same as 'official registers'. The latter are a narrower category within state registers, which the Procedure Act covers and works only in the framework of public procedures. However, there are state registers which, although established by law, are not covered by the Procedure Act, such as the company register or the register of civil organisations.

The main feature of state registers is that all their characteristics – in particular their scope, publicity and the person responsible for maintaining them, as well as special data protection provisions – are established by law. Similarly, the primary regulations that govern the provision of data from the register and the fulfilment of the obligation to provide information are also established by law.

The prevailing principles that govern public registers, in addition to the dominance of the principle of legality, are the principles of public credibility, accuracy, timeliness, expediency and completeness (Torma, 2005, pp. 620–622). The principle of public credibility is of particular interest, given that the status of public credibility remains an open question in public administration science to this day. State registers, which are regarded as credible in a public sphere, document (or, in some cases, create) the legal status of individuals and state interests. The content of these registers is subject to legal regulation and state interests. In such cases, registration serves as a foundation for safeguarding the legal status that has been attained. While there is an obligation to accept the registered data, the possibility of rebuttal exists. The refusal, modification or deletion of a registration is considered an official decision and may be appealed (Horváth, 1999, p. 173), but the registered data is presumed to be true until proven otherwise (Gerencsér & Berkes, 2014, p. 29).

The shortest answer to the question of what makes a register authentic is that it is stated in legislation, either implicitly or explicitly. For example, the law on the land register or the company register expressly mentions the public authenticity of the registers. In contrast, the law on the address register failed to do so for a long time and only stated public authenticity in its explanatory memorandum. Still, the presumption was also included in the law in this case. In such a manner, Gerencsér and Berkes (2014, p. 30) and Kisfaludi (2003, p. 8) argue, having their conclusion based on specific legal rules, that in many cases these rules only state that the regulated register is authentic, but no uniform concept can be defined with regard to its content.

The Constitutional Court has imposed a further substantive requirement on public credibility. According to Decision 15/1995 (III. 13.) AB, a public register must be open

[5] Section 36(2) of the Act, Section 20 of the eServices Act.

to the public, the data, registered rights or facts contained therein must be accessible, public authenticity may also function as a guarantee of constitutional rights, its essential content cannot be restricted and it must correspond to reality. But this is only valid to a limited extent, which is why it is possible to provide counter-evidence, yet for the sake of legal certainty, this can only be allowed for a limited period of time.[6] From the perspective of legal practice, a 2011 ruling by the Supreme Court[7] stated that "from the point of view of a register, public credibility means that the entry, modification and deletion of data that can be entered in the register modification and deletion of data that can be entered in the register may only be carried out by a body authorised to do so by law, in accordance with the procedural rules laid down in law and on the basis of documents specified in law, thereby guaranteeing the accuracy, completeness and reliability of the register".

The decision also stated that the rights and facts recorded in public registers can only be changed in court proceedings if proven otherwise. In practice, this means that public credibility has no real substantive requirements; it only means that no one has provided evidence to the contrary. Although justified from a legal point of view, this approach does not strengthen confidence in the registers at all, as public credibility is currently linked not to the factual content of the data, but to the legal context attached. In our opinion, in addition to the legal presumption, it would be necessary to provide guarantees for the security of the data as well, something utterly missing from the current regulation.

In conclusion, registers are of paramount importance and effectively serve as the "building blocks" of public administration. It is no exaggeration to say that the operation of the state would be inconceivable without registers. However, in order for registers to function efficiently and accurately, developments and improvements are essential. This necessity must be reflected in both legislation and the technological environment. A key consideration is whether individual administrative processes can be transferred to a model system, primarily used in the economic environment, which is capable of identifying points of intervention. On these points, an efficient, automated and, last but not least, customer-oriented administrative system can be built in the future through further development. Consequently, the *information and communication* technology (*ICT)* side of the developments must also be examined, that is to say, which methods will facilitate the implementation of effective automation in the future.

4. Second step: Modelling administrative processes from an ICT perspective

In our preceding analysis, we have endeavoured to outline such a technological framework for the research with which administrative (management) professionals are familiar and prone to use regularly. As such, we refrained from limiting the technological framework to tools used by the government alone, and, instead, sought proven process analysis methods employed by stakeholders and meeting recent ICT standards.

[6] Decision 15/1995. (III. 13.) AB, ABH 1995, 88, 90.
[7] Gfv.X.30.004/2011/9.

The development of information and communication systems entails corresponding advances in public services and government systems. In order to provide services, it is necessary to develop IT systems that comply with the processes laid down in legislation and to ensure standardised and secure access to various data sources (electronic data provision from registers). During the implementation of IT systems, five basic process activities of software development can be distinguished (Sommerville, 2016): 1. *specification* (identification and definition of functional and non-functional requirements, and their validation); 2. *design* (architectural, interface, component, data structure and algorithm design); 3. *implementation* (realisation of the designed system); 4. *verification* and *validation* (component, system, and functional tests to check whether the implemented system complies with the specification: whether the right system has been built and whether it has been built correctly); and finally, 5. *evolution* (ensuring the ongoing development and maintenance of the system).

Focusing on specification and design activities in the context of state registers requires examining how the legislation defining a given register can be formalised so that any implementation based on it meets expectations as closely as possible. Notably, planning can also have an impact on legislation: during formalisation and structured description, any inconsistencies, redundancies, or efficiency problems may become apparent at a stage when changes are still possible.

For IT systems, a structured design approach involves the use of process modelling tools. The modelling toolkit includes a notation system that can dynamically model not only the structure of the IT system being implemented, but also its behaviour.

The BPMN method we have decided to use originated in the work of the Business Process Management Initiative (BPMI.org), with contributions from several industry participants, including IBM, Oracle, SAP, Software AG and others. Following the merger of BPMI.org into the Object Management Group (OMG), the BPMN specification was published (version 1.0 in 2004, version 2.0 in 2011). The aim of creating BPMN was to develop an easy-to-understand notation system for all stakeholders in organisations and business life: business analysts (for initial process design), technical developers (for implementation and automatic generation of internal models), and business people (for monitoring and management).

The central element of BPMN modelling[8] is the organisational process diagram *(Business Process Diagram)*. The process diagram can be divided into *pools* and *lanes* according to the actors or functions involved in the process. Clearly distinguishable components in each lane describe the individual steps of the process:

- *Events:* "occurrences" in the process that affect its course. An event can be 1. a start event, which signals the start of the process; 2. an intermediate event, such as an incoming message or notification; 3. a closing event, which signals the end of the process.
- *Activities:* Components representing work, tasks or active steps in the process.

[8] For a detailed description in the documentation of a standard modelling tool see https://camunda.com/bpmn/reference

- *Gateway:* A component positioned at the divergence and convergence points of alternative or parallel paths in the process flow, determining which branch or branches the flow continues along and subsequently merging those paths. It can be exclusive, inclusive, parallel, or event-based.
- *Artefact:* elements used for annotation and grouping within the diagram.

However, the capacity to model a process in BPMN should not be equated with full legal or technical automation potential. A BPMN model can represent deterministic, discretionary and exception-based procedural elements alike. Therefore, in this study, the models were interpreted on three levels. The first is the descriptive modelling level, where the process is represented for analytical clarity. The second level is executable modelling, where tasks and gateways can be transformed into workflow logic or RPA-supported actions. Finally, the third level is automated decision-making, where the system produces a legally relevant decision without substantive human intervention.

Only those parts of the procedure that are based on explicit, rule-like conditions and authoritative register data can safely move from the first to the second or third level.

Although the context of business processes differs in many respects from that of public administration processes, their structure and building blocks are the same, so the same toolset can be used to describe public administration processes (with some adaptation). This is why the modelling structure, elements, tools and descriptions have spilt over from the business sphere (Corradini et al., 2015).

The uptake of information and communication technologies in public administration has been particularly evident in electronic communication with citizens, document management, and the development of administration back-end systems, as a result of which electronic administration is now feasible across an ever-growing range of areas. At the same time, the potential of information and communication technologies is far from being fully exploited. For information and communication technologies to support public administration more effectively than at present, legislators need to shift to a process-oriented approach when drafting regulations on types of administrative matters. One useful tool for a process-oriented approach is the use of BPMN diagrams.

With regard to administrative processes, a challenge is that some of them can be modelled in several ways (e.g. due to different levels of abstraction). This can cause problems when models are shared between organisations (or even within an organisation) and the task is, for example, to merge them. This problem can be managed by designing processes from reusable modules (sub-processes, elements). Legislation allows for this kind of abstraction, as similar situations in life must be resolved using similar procedures (processes). Even though the areas of specialised administration are different, many of their sub-processes (e.g. applications, summonses, notifications, rectification of deficiencies) can be described in a uniform manner.

At the same time, a significant part of administrative legislation is not currently prepared from a process perspective, and legislative drafting is not preceded by the careful planning and structuring of an operational model, which could result in a technical text describing a process or algorithm (Kregel et al., 2022). A more prominent role for the process approach in legislation would have numerous advantages: it would facilitate the

implementation of processes in information and communication systems, provide opportunities for process optimisation, and enable quantified performance measurement and more effective comparative control.

5. Technological challenges for public administration

Next to interdisciplinarity, outlined above, the rapid pace of digitalisation is forcing the legal system, and thus public administration, to keep pace with innovations and continuously integrate new technologies. All this poses serious challenges to which public administration must respond. In the following, we outline the key challenges that will determine the future direction of Hungarian public administration.

Among the primary factors, generational differences and attitudes towards technology deserve special attention. Public administration must simultaneously meet the expectations of the younger generation, who increasingly want to access public services via electronic platforms and online administrative systems, and the needs of the older generation, many of whom are less familiar with the use of digital tools (see e.g. Ofoma, 2024, p. 98). This difference may become an increasingly practical issue in the near future, especially in light of the introduction of digital citizenship. The question arises as to what proportion of each age group will register and become active users of the new system. This is a major administrative challenge worldwide, which so far only Estonia has successfully addressed, with 93% of the population already conducting their administrative affairs online (Halmos et al., 2023). In addition to intergenerational differences, strengthening the relationship between the state and the individual is also a key issue, as the acceptance and active use of digital services will only be possible if users' trust in the system is strengthened.

Beyond social aspects, technological development also plays a decisive role in the digitisation of public administration. Today, information and communication innovations emerge rapidly, with AI, automation, expert systems, and digital citizenship solutions being particularly noteworthy. It should be emphasised that Hungarian public administration is currently on the verge of a significant transformation: with the repeal of the eServices Act and the entry into force of the Digital Citizenship Act in 2024, the electronic public administration system and its tools will also change significantly.

In terms of chronological limitations, we must disclose that our study reflects developments as of March 2025, and we deliberately do not intend to meddle with the technological aspects of ICT challenges, as those would, in our opinion, constitute a separate and technical inquiry only loosely connected to the core arguments of this study. As such, in the subsequent analysis, we confine our attention to strictly speaking legal problems.

6. ICT challenges for legislation

In terms of legislative problems, it is paramount to acknowledge, right at the outset, the presence of deficiencies within the Hungarian legal system, which impede the effective

implementation of these novel solutions. A salient problem is the absence of a registration code and the issue of interoperability in relation to the harmonisation of registers.

A common feature of state registers is the absence of a common set of rules that would regulate the guarantee issues of register management in a general manner. There are no uniform regulations on data collection, storage or processing that would apply as general rules to the most diverse registers. Section 97 of the Procedure Act exclusively pertains to official registers, and even in this context, it merely establishes a legal presumption of public credibility among the legal guarantees. The section addresses procedural matters, including the finality of decisions. However, there is still no mention of the issues of data disclosure or confidentiality, and there are no general rules on cooperation between registers.

Sectoral registers thus remain isolated, incapable of cooperation, resulting in the utilisation of data being only partial. The absence of uniform regulations can be ascribed to the fact that state registers were established by specific pieces of legislation, namely, administrative and sectoral legislation. In each instance, the founding norm comprises the data set that the register is required to contain, in addition to the minimum set of procedural rules necessary for the operation of the register and data management. The deficiencies of the system may also be attributed to the varying degrees of sophistication of the normative backgrounds of the various registers. This demonstrates the significance of establishing a document code, as it would enable the harmonisation of the individual registers under a unified set of regulations, thereby facilitating data movement between registers, enhancing interoperability, and eliminating regulatory disparities between them. It is posited that this code of documents could encompass both general substantive and procedural rules relating to registers. Moreover, the document code would facilitate the task of law enforcement officials, as it would no longer be necessary for them to identify solutions to specific issues in individual sectoral laws. Instead, they would be able to locate the specific rules for each sector within the document code itself (Ilosvai, 2023, p. 71). However, this raises the need for not only legal but also technological harmonisation (Veszprémi, 2018a, pp. 71–72).

Another source of problems stems from shortcomings in interoperability. The capacity for registers to function collectively, that is to say, their interoperability, is emerging as a fundamental prerequisite for the effective and extensive provision of public services. However, it is crucial to note that this principle must be applied not only to registers but to all electronic services. The interoperability of e-government services is not only in the interest of the state, but also of the European Union. The European Commission has developed an 'interoperability maturity model' (IMM). Its aim is to provide Member States' public administrations with a tool for measuring their own level of interoperability maturity and for determining the priorities necessary for the next stage of development of the interoperability of e-government systems (including, for example, registers).[9]

In Hungary, the interoperability of electronic systems still needs significant development (Veszprémi, 2018b, p. 181). This is also supported by European indicators such as the *Digital Decade indicator* and the *eGovernment Benchmark*. Section 72 of the

[9] See https://ec.europa.eu/isa2/sites/isa/files/interoperability_maturity_model.pdf

eServices Act was the first to stipulate that registers containing address data must be able to work together. In order to achieve this goal, in the absence of a common platform, the law created a new register, the "central address register". In order for the personal data and address register and the real estate register to be able to interoperate with the water register or the mining register, or possibly with the register of licensed commercial service providers at the local level, both legal and IT developments are required. However, until adequate, mature interoperability is achieved, the previous[10] and the present Procedure Act and eServices Act have made a very important advance, as they state that data that is public or that must be included in a legally established public register cannot be requested from the customer. Section 5(1) of the Digital Citizenship Act establishes the general principle of interoperability, and it can be clearly inferred from this provision and Section 1(e) that the coordination of individual state registers will (may) be developed in order to implement Section 5. As a result, the provision of Section 5(2) of the Digital Citizenship Act, according to which users cannot be obliged to repeatedly provide data available in digital space, solves a long-standing problem in public administration. This provision transforms cooperation between registers into a legal obligation. Ultimately, it is expected that the obligation to cooperate will increase the level of interoperability.

7. Conclusion: What is next for e-government?

Hungary's registries have reached a turning point where decades of sectoral digitisation must be consolidated into a coherent, manageable and interoperable whole. Our analysis confirms that registries remain essential "building blocks" of government operations and service delivery. However, it is evident that their legal guarantees, technical interfaces, and operational practices have developed unevenly since the 2000s. In order to move forward, it is not sufficient to rely solely on technological advances; rather, there is a need for a meticulous integration of legal planning and system design. In practice, this means that legislation must consider both processes and technology, i.e. interoperability must become a fundamental requirement, and it must be ensured that automation and AI increase rather than undermine legality, transparency and trust.

The most important legal conclusion of the research is that a general, technology-neutral registration code appears to be necessary in Hungary. The contemporary situation is characterised by the fragmentation of sectoral norms, giving rise to deficiencies in credibility, access, data disclosure and cooperation obligations, which in turn impede the delivery of end-to-end digital services. The establishment of a codified baseline, encompassing the domains of data lifecycle, public authenticity, disclosure/confidentiality, verifiability and inter-registry cooperation, would serve to streamline the guarantees that are currently dispersed across a range of specific laws, aligning them with contemporary technical controls, including integrity protection, provenance and time stamping. The research has demonstrated that such legislation should be developed with process

[10] Act CXL of 2004 on the general rules of administrative authority procedures and services.

models in mind. BPMN-based models have the capacity to reveal inconsistencies and regulatory gaps, and can become effective monitoring and impact assessment tools. In the context of automated processes, it is imperative that the guarantees of fair procedure are explicitly delineated. This encompasses the necessity of substantiation, comprehensive logging, and the provision of a legal remedy and the opportunity for human review in instances where rights have been infringed.

Drawing upon the findings of research in the field of information technology, it is imperative to employ modelling techniques prior to the initiation of development projects. Furthermore, it is essential to ensure that secure and verifiable interoperability is prioritised as the default setting. Canonical BPMN models for high-volume procedural components – applications, notifications, deficiency correction and data validation – should be validated with legal owners and converted into executable rule sets. The concept of interoperability necessitates the utilisation of shared identifiers, common data contracts, event interfaces and hardened data-provision services between registers. These processes are supported by uniform authentication and authorisation mechanisms.

AI and expert systems can extend these gains, provided they are applied where they are most appropriate. The associated governance layer – including model risk classification, data set governance, bias and performance monitoring, logging and override mechanisms – must be defined in advance. Meanwhile, digital exclusion remains a significant constraint. The effectiveness of assisted digital channels and accessible design will be crucial in determining the outcome of reforms in terms of equitable distribution, especially as digital citizenship tools continue to develop.

Returning to the two research questions formulated in the introduction and methodology, the analysis allows for a differentiated answer rather than a simple affirmative or negative conclusion.

Regarding the first research question, the study came to the conclusion that digitised administrative processes can be modelled within the current Hungarian registry framework, but only if the model preserves the legal guarantees of competence, public authenticity, data protection, notification, reasoning and legal remedy. BPMN is suitable for representing these guarantees because it can express actors, events, decision points, data exchanges and exception paths. The modelling of personal identity card applications and the procedure for placing a motor vehicle into circulation confirms that BPMN can make the procedural structure visible and can identify those segments where workflow support, RPA or rule-based automation may be introduced without undermining legal safeguards.

Regarding the second research question, the study found that interoperability is constrained by a combination of fragmented legal authorisations, uneven sectoral regulation and heterogeneous technical architectures. From a legal perspective, the main obstacles are the lack of uniform rules on data sharing, public authenticity, responsibility for data quality, access rights and inter-registry cooperation. From an IT perspective, the key barriers are the absence of shared identifiers, common data models, standardised data contracts, stable interfaces, event-based communication and uniform logging and audit mechanisms. These obstacles are mutually reinforcing: even technically feasible data exchange cannot be implemented safely without a clear legal basis, while legally permitted cooperation remains ineffective if the underlying systems cannot communicate in a secure,

verifiable and semantically consistent manner. Therefore, interoperability should be understood not merely as a technical integration problem, but as a joint legal, organisational, semantic and technical design requirement.

The risk environment is clear. Over-automation of discretionary cases jeopardises fairness, fragmented authenticity guarantees undermine trust, and IT solutions must not undermine legitimate legal rules and norms. And so, success must be measured and not merely assumed.

It is the responsibility of experts to monitor direct processing rates, average decision-making times, the success of data exchange between registries, the elimination of duplicate data requests, the enforcement of legality and appeal rates. The ultimate success of legal planning and system design will be determined by user acceptance, which is to be broken down by demographic groups, in order to ascertain whether the services actually used by people are in line with the planning and design.

In summary, the transition from isolated digitisation to a reliable, explainable, citizen-centred digital state is contingent upon the recognition of records as a regulated digital infrastructure and legislation as a first-order requirement. By institutionalising process-oriented lawmaking, enforcing interoperability, and introducing automation and AI within a robust governance framework, Hungary can transform two decades of gradual development into a strategic, sustainable public administration architecture.

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