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Central European Public Administration Review is a scientific peer-reviewed journal that publishes original articles, devoted to the development and analysis of public administration and governance. We are mostly interested in articles on integrative and multidisciplinary research on the field that includes related scientific disciplines, such as law, economics and management as well as political, organisational and information sciences. The journal's goal is to cover mostly central European space, in not only geographical but mainly contextual sense by supporting administrative reforms in accordance with European principles.

Central European Public Administration Review was launched in 2018 by Faculty of Public Administration, University of Ljubljana. Its first title "Administration", launched in 2003, was later changed to "International Public Administration Review". In 2018, it was revised again to address predominantly central European administrative space.

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Budget Punctuations in Czech Local Government

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ABSTRACT

Purpose: This paper aims to identify which phases of the budgetary process are, according to the predictions of punctuated equilibrium theory, more prone to punctuations; to determine the factors influencing the occurrence of punctuations in these phases; and to test these assumptions using Czech regional data from 2005 to 2023.

Design/methodology/approach: The study utilises data on Czech regional current expenditure from 2005 to 2023, disaggregated into 113 functional budget lines. A two-sample Z-test is employed to determine whether the number of large annual changes in a functional budget line differs across the approved, amended, and executed budgets. A binary logit model is applied to assess whether external shocks, electoral changes, or budget complexity increase the likelihood of punctuations in the different budget phases.

Findings: The analysis reveals that punctuations occur more frequently in budget allocation than in actual spending, and that greater complexity in the budgeting process leads to an increased number of punctuations. The number of punctuations rose during the rebudgeting phase in response to the COVID-19 outbreak in 2020 and the influx of Ukrainian refugees in 2022. Elections and changes in government leadership were found to have no significant impact.

Academic contribution to the field: This paper offers a novel application of punctuated equilibrium theory by linking it to the distinct phases of local government budgeting. It traces the evolution of punctuations across the stages of approved, amended, and executed budgets, and evaluates the influence of external shocks. The study demonstrates the theory's

adaptability in analysing the effects of unprecedented events on public policy and budgeting.

Originality/significance/value: The research recognises the differentiation between local government budgeting phases in terms of institutional costs and exogenous shocks affecting decision-making and implementation. This segmentation of the budgetary process makes a significant contribution to both the theoretical understanding and practical application of the punctuated equilibrium theory.

Keywords: budgetary process, Czech Republic, local government, punctuated equilibrium theory, rebudgeting

Proračunske diskontinuitete v češki lokalni samoupravi

POVZETEK

Namen: avtorja si prizadevata ugotoviti, katere faze proračunskega procesa so po napovedih teorije prekinjenega ravnotežja bolj podvržene diskontinuitetam; določiti dejavnike, ki vplivajo na pojav diskontinuitet v teh fazah; ter te predpostavke preveriti na podatkih čeških regij za obdobje 2005–2023.

Načrt/metodologija/pristop: študija uporablja podatke o tekočih izdatkih čeških regij za obdobje 2005–2023, razčlenjene na 113 funkcionalnih proračunskih postavk. Za ugotavljanje, ali se število velikih letnih sprememb v posamezni funkcionalni postavki razlikuje med sprejetim, spremenjenim (rebalansiranim) in realiziranim proračunom, je uporabljen Z-test za dva vzorca. Za oceno, ali zunanji pretresi, volilne spremembe ali kompleksnost proračuna povečajo verjetnost diskontinuitet v različnih proračunskih fazah, je uporabljen binarni logitni model.

Ugotovitve: analiza razkrije, da se diskontinuitete pogosteje pojavljajo pri proračunskih alokacijah kot pri dejanski porabi ter da večja kompleksnost proračunskega procesa vodi v večje število diskontinuitet. Število diskontinuitet se je v fazi rebalansa povečalo kot odziv na izbruh covid-19 leta 2020 in prihod ukrajinskih beguncev leta 2022. Volitve in spremembe v vodstvu vlade niso imele pomembnega (statistično značilnega) vpliva.

Akademski prispevek k področju: članek ponuja novo aplikacijo teorije prekinjenega ravnotežja, saj jo povezuje z različnimi fazami proračunskega procesa v lokalni samoupravi. Sledi razvoju diskontinuitet skozi faze sprejetih, spremenjenih in realiziranih proračunov ter ocenjuje vpliv zunanjih pretresov. Študija pokaže prilagodljivost teorije pri analizi učinkov dogodkov brez primere na javne politike in proračun.

Izvirnost/pomen/vrednost: raziskava prepoznava razlikovanje med fazami lokalnega proračunskega procesa glede institucionalnih stroškov in eksogenih pretresov, ki vplivajo na odločanje in izvedbo. Ta segmentacija proračunskega procesa je pomemben prispevek tako k teoretičnemu razumevanju kot tudi k praktični uporabi teorije prekinjenega ravnotežja.

Ključne besede: proračunski proces, Češka republika, lokalna samouprava, teorija prekinjenega ravnotežja, rebalans proračuna

JEL: H70, H72

1 Introduction

The theory of punctuated equilibrium explains long-term empirical observations of budgetary behavior, showing that periods of relative stability or minor changes (so-called increments) are interrupted by more sizable changes (so-called punctuations) (True et al., 1999). Although the pattern, predicted by the punctuated equilibrium theory, was confirmed in every study examining public budgets (True et al., 2007), little attention was paid so far to the different phases of the budget cycle, when the budget is first approved by the legislative body, then goes under numerous budget amendments (rebudgeting) and faces impossibility or unwillingness to spend fully the budget allocation, ultimately leading to substantial differences between the approved, amended, and executed budgets (Dougherty et al., 2003).

The purpose of the paper is to determine what phases of the budgetary process are according to the predictions of the punctuated equilibrium theory more prone to punctuations, which factors determine the occurrence of punctuations in the different budget phases, and to test these assumptions using Czech regional data from 2005 to 2023.

We take advantage of the availability of detailed budget data in all three budget phases for the 13 Czech regions and use data on the Czech regional current expenditure from 2005 to 2023 disaggregated into 113 functional budget lines. The two-sample Z-Test is used to determine if the number of large annual changes in a functional budget line differs in the approved, amended, and executed budgets. A binary logit model is used to test whether external shocks, electoral change or budget complexity make policymakers more likely to adopt punctuations in the different budget phases.

The use of the punctuated equilibrium theory framework allowed us to expand the analysis of resource allocation in the public sector from merely analyzing final budget data to including the decision-making process that precedes these final outcomes as well. The decision-making process involves many participants and responds to a variety of rules, characteristics of the internal and external environment, and various impulses. The punctuated equilibrium theory provides predictions about how all these variables can affect the final allocation, and its verification in different contexts generally brings a better understanding of the decision-making processes in the allocation of public funds.

We see the contribution of our paper as twofold: in identifying the impact of additional budgetary changes during the fiscal year and in using unique data on the second tier of local government from a country in Central and Eastern Europe with fragmented public administration. To our knowledge, our study is one of the few studies (e.g., Sebők and Berki, 2017, Sebők and Berki, 2018, Wordlizek, 2021 or Pernica and Zdražil, 2022) testing the hypotheses of the punctuated equilibrium theory in the Central and Eastern Europe.

The paper begins with an introduction to punctuated equilibrium theory and its predictions regarding punctuations in various phases of the budget process. Five hypotheses are proposed to be tested. This is followed by an overview of the characteristics of Czech regions and the local government budget process. Subsequently, the data, variables, and methods used to test the hypotheses are described. Finally, the results are presented and discussed.

2 Punctuated Equilibrium Theory of Budgeting

Punctuated equilibrium theory offers an agenda-based model of budgeting when the boundedly rational process of human decision-making and disaggregated political institutions cause budgets to change only incrementally until a radical change occurs (True et al., 2007). Baumgarten and Jones proposed the theory for the very first time in 1993 and in the next two decades, they thoroughly developed, explained, and tested it with several coauthors.

When decision makers incrementally adjust this year's budget from a starting point of last year's budget, the annual changes within a given spending category have a normal distribution. This is, however, not the situation we observe in the real world, where decision-makers prioritize information and their subsequent actions and which leads to non-Gaussian dynamics (Jones et al., 2009). The distribution of annual budget changes is leptokurtic, with a high central tendency and fat-tails (Jordan, 2003).

Policymaking institutions are generally sticky and do not allow continuous adjustment to the environment. Jones et al. (2003) mark this as institutional friction. Friction results from either elevated decision costs or disproportionate information processing. The more friction an institution imposes on its ability to adapt to changes in the environment, the more punctuated is the institution's process of change (Park and Sapotichne, 2020).

Institutional friction is influenced by institutional costs, which include decision and transaction costs (Jones et al., 2003, and Jones and Baumgartner, 2005). Decision costs are incurred by actors that try to get to an agreement, such as bargaining costs or institutionally imposed costs, e.g., voting rule which requires that majority of all regional council representatives approve the budget, not just majority of representatives present at the meeting.

Transaction costs are incurred after the actors reach an agreement, e.g., costs to complete the transaction or costs of compliance with the agreement. Decision costs severely outweigh the transaction costs (Jones et al., 2003).

What are the institutional costs during the different phases of the budget cycle and how do they impact the occurrence of budget punctuations?

True et al. (2007) claim that punctuations occur at all levels of policymaking, all levels of the budget, and during all time periods. They expect that hierarchy will produce inequality in the transmission of punctuations from one level to another and by comparing the outputs of diverse institutional ar-

rangements. Jones et al. (2003) confirm that the kurtosis is higher for budget authority than budget outlays, meaning that the institutional costs hence the institutional friction are higher earlier in the budget process, leading to more punctuations in the budget debate and approval phase.

Decisions about how scarce resources are allocated to various social and economic needs take place throughout the entire process. The budget is primarily a political tool that reflects the preferences of individual participants in the process, and the resulting budget depends on whose preferences prevail (Wildavsky, 1992).

Before the beginning of the given budget year, the draft budget is prepared, debated, and approved by the legislative body. This phase lasts several months, many participants are involved, and getting an agreement may be quite costly, leading to more punctuations.

During the budget year, the executive body manages the affairs according to the approved budget. The approved budget is continuously adjusted through budget amendments (rebudgeting). The amended budget is the initially approved budget plus all budget amendments and fully reflects political will regarding the budget allocation.

The key player in this budget execution phase is the executive body, compared to the legislative body decisive in the first phase. The decision-making should be more flexible due to the composition of the executive body (there are only representatives from the leading party or bound by a coalition agreement) and likely higher professionalism of the representatives (especially in local governments members of the assemblies are involved in the administration only part-time). Therefore, theoretical expectations are:

H1: Approved budget has more punctuations than the amended budget.

Budget execution may or may not equal the amended budget and reflects impossibility, unwillingness, or intention not to spend the entire budget appropriation. Budget execution also brings some flexibility to the budgetary process (Raudla and Douglas, 2021).

In the execution phase, professional management plays an important role. This makes this phase quite flexible and thus less punctuated as suggested by Park and Sapotichne (2020) who confirmed a decreasing effect of bureaucracy on punctuated policy processes in Michigan cities. After the end of the budget year, the final account is compiled, audited, and approved by the legislative body. Therefore, it is expected that:

H2: Actual spending has fewer punctuations than the approved budget.

Budgets react to both endogenous and exogenous forces, which may include changing levels of public attention, striking, or compelling new information (True et al., 2007). Cavalieri (2025) expects that crisis moments produce budget punctuations as the urgency of the situation significantly reduces the time available for bargaining processes. The derived hypothesis is the following:

H3 Exogenous shocks lead to more punctuations.

Major policy changes are often associated with turnover in the composition of the decision-making body (True et al., 2007) or with electoral replacement. Kwak (2017) confirmed that the change in party control of the governorship in US states increased the number of budget punctuations. Consequently, the following hypothesis predicts that:

H4 The electoral change leads to more punctuations.

In the case of complex issues policymakers must consider more information and deal with less agreement about the priorities, which leads to the dynamic of policy change characterized by punctuated equilibrium theory (Epp and Baumgartner, 2017). Therefore, the more complex a policy area is, the greater the likelihood of extreme spending changes.

In the case of the budget and budgetary process, complexity is related to comprehensiveness, i.e., all operations of the given government unit are included and treated the same way (Premchand, 1983), which means that all operations are part of a single budget or that there is a single decision-making process for all operations. This allows for the following hypothesis:

H5 Complexity in the budgetary process leads to more punctuations.

We test these hypotheses using the Czech regional budget data to explore the difference between local government budgeting phases and the impact of exogenous shocks, electoral change or budget complexity when reaching and implementing a decision.

3 Czech Regions and Local Government Budgeting and Rebudgeting

After 1989, the Czech Republic transitioned from a centralized system towards a decentralized system of self-governing subnational governments. It has a two-tier subnational system with 6,254 municipalities, 13 regions, and the capital city of Prague, which has unique dual status as both a region and a municipality. The establishment of regions was legislated in 2000 and came into force in 2001. The first elections for regional assemblies took place in 2000 and since then have taken place every four years in the first half of October. In 2003, the competencies of the regions were significantly expanded in connection with the public administration reform and the abolition of district offices.

The regional assembly is an elected body. The regional committee represents the region's executive body and is composed of the president, vice presidents, and other members elected by and from within the regional assembly. The regional office is led by a director and presents a highly professional public office with four to seven hundred employees.

Regions exercise simultaneously the so-called own responsibility, which is exercised by the region and its bodies on its behalf, and delegated responsibility, which is performed on behalf of the state and the state is legally responsible for the performance of the delegated power. The Czech regions are responsible for the delivery of many key services. Their main spending categories include education, transportation, social services, healthcare, culture, and administration (Janský and Kolář, 2024). They are also responsible for the management of their property (Bečica, 2015), the development of their territory, regional economic development, and environmental protection (OECD, 2020).

Two thirds of regional revenue are earmarked grants and transfers; most of them are passing through transfers from the state budget to all the schools in the territory of the region and social care facilities. About 30% of revenue comes from the shared income and value-added tax. The shares of the individual regions have been stipulated by law since 2005 and roughly followed the estimated level of costs associated with delivering delegated services and functions. The individual regions cannot influence the volume of shared tax revenue they receive, so these revenues resemble more unconditional block grants than taxes (Blöchliger and Petzold, 2009). There is a debate to replace the fixed share by a formula now that would better reflect the needs of individual regions.

Czech legislation provides a general framework for the local government's budgetary process, including budget amendments, information disclosure, and roles that different subjects play in the budgetary process. Regions use detailed and binding economic and functional classifications of revenues and expenditures, which are uniform for all public budgets. The key parameters are summarized in Table 1.

The regional budget is prepared and debated for several months by both elected and professional regional officials, heads of regional organizations, and other relevant subjects (Memeti and Kreci, 2016). The regional assembly approves by most of all representatives the budget in a public meeting after the budget proposal is available online for at least 15 days. If the budget is not approved by the end of the previous year, special rules (the so-called budget provisory) are applied. Budget provisory is very rare in the regions' case.

The authority to implement budget amendments is divided between the regional assembly and the regional committee when the assembly decides on the extent of delegation of the authority to the committee. This decision is taken annually as part of the budget approval process. Four regions approve unlimited delegations, five define precise limits, usually limited by a specific amount (CZK 2 or 5 million, which allows approval of majority of amendments needed), and four define the scope of the power to make amendments, such as a specific list of operations. Only one region (South Bohemia) also delegates powers to the regional president and deputy in case of using reserves and other necessary measures. There were no changes in the extent of delegation between 2019 and 2022.

Table 1: Local governments budgetary process

Fiscal year

The fiscal year is given by law and is equal to the calendar year for all public budgets.

Single budget

The annual budget contains both current and capital operations.

Balanced budget requirement

The budget should be prepared as balanced. A deficit is allowed only if it can be covered by surplus from previous years or repayable resources, guaranteed by contract. Local governments are subject to debt regulation.

Budget classification

The uniform economic and functional budget classification applies to all public budgets.

Accounting standard

Budgetary documents and reports use cash accounting. Next to it accrual accounting and the double entry system are required for all local governments.

Multi-annual outlook

It is compiled mandatory and contains aggregated data on revenues, expenditures, debts, financial resources, and needs for a period of two to five years.

Budget preparation

The preparation of the budget draft must reflect the relationship with other public budgets. The draft budget must be available to the public before approval. Citizens can submit their comments in writing or orally at the council session.

Budget approval

The budget is approved by the regional council, i.e., the majority of all council members.

Budget amendments

Amendments are obligatory in the event of any changes in financial relations with other public budgets, at the legal level of control, or in the case of a danger of a deficit increase.

Year-end report

The year-end report includes budget reports, accounting statements, and information on the management of all local government organizations.

Audit

Audit of financial and legal compliance is obligatory for all local governments. In the case of regions, it is provided by the Ministry of Finance or private auditors, in the case of municipalities by regions or private auditors.

Financial reporting

Local governments submit monthly budget reports and quarterly accounting statements to the Ministry of Finance in a uniform format. These reports are publicly available through the application Monitor.

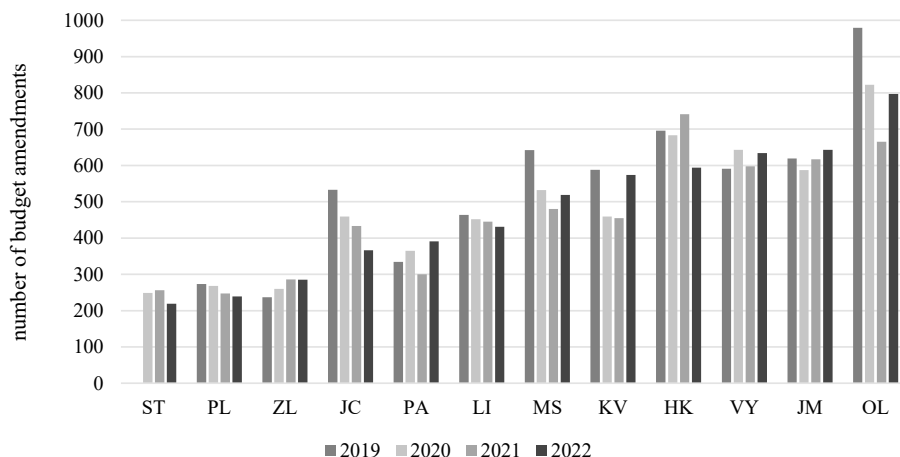
Information disclosure

Local governments publish on the Internet the budget and year-end report 15 days before their approval, and the approved budget, year-end report, and budget amendments within 30 days after their approval.

Source: Budgetary rules for local governments (250/2000 Coll.), Law on the Regions (129/2000 Coll.), Budget classification (412/2021 Coll.)

Rebudgeting is a consequence of specific organizational cultures, as the praxis among local governments differs (Anessi-Pessina et al., 2012) and the Covid-19 pandemic was expected to bring an unprecedented magnitude of rebudgeting (Anessi-Pesina et al., 2020). This expectation was not confirmed in the case of the Czech regions as all the regions showed only minor variability in both the number (Figure 1) and magnitude (Figure 2) of budget amendments over the period 2019-2022.

Figure 1: Number of budget amendments (12 regions, 2019-2022)



Source: authors, based on data provided by the regions on their respective webpages

Note that abbreviations represent the names of individual regions:

HK = Královéhradecký, JC = Jihočeský, JM = Jihomoravský, KV = Karlovarský,
LI = Liberecký, MS = Moravskoslezský, OL = Olomoucký, PA = Pardubický,
PL = Plzeňský, VY = Kraj Vysočina, ZL = Zlínský; Ústecký kraj is not shown as it uses an incomparable numbering system, i.e., it approved between 18 and 21 amendments between 2020 and 2022; data for Středočeský kraj (ST) for 2019 are not available due to changes in the reporting system.

Despite the information disclosure mandate on budget amendments (in force since 2017), rebudgeting is much less transparent than budgeting. It comprises several (many) minor amendments which are difficult to monitor and control both for the council members and the public (Anessi-Pessina et al., 2012). This is further strengthened in the Czech case by delegating the authority from the legislative to the executive body, which decides in closed meetings. Rebudgeting is, to a great extent, an informal and elusive process (Alesani, 2012). Rebudgeting complements the initial budget formulation (Anessi-Pessina et al., 2012) and can significantly change the initial budget (Anessi-Pessina et al., 2013).

Different regions use different budgeting practices allowed by law, which differ in comprehensiveness. Comprehensiveness is a basic principle in public budgeting and requires that all resources are allocated through the same process (Tommasi, 2013) and rebudgeting may violate this principle (Lauth, 2002). The level of comprehensiveness is related to the way expected trans-

fers are or are not included in the approved budget. Figure 2 shows the magnitude of rebudgeting, i.e. (amended – approved expenditure)/amended expenditure.

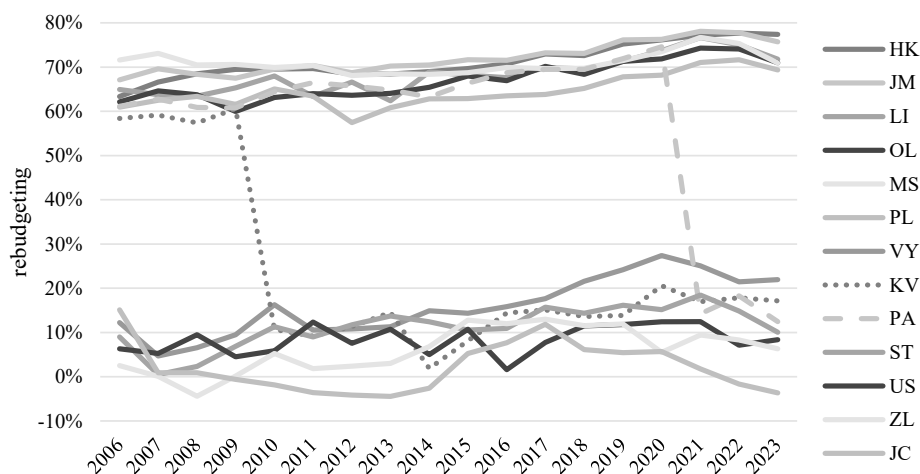
Here we can observe two clusters: The low cluster with eight regions in 2023, where the rebudgeting of current expenditure is below 30%, and the high cluster with five regions, where the rebudgeting is between 70 and 80%. Two regions did move from the high cluster to the low one: Karlovarský kraj (KV) in 2010 and Pardubický kraj (PA) in 2021.

A more detailed analysis shows that the primary reason for both the volume of rebudgeting and differences among the regions is related to how the approved budget deals with transfers from the central level.

Regions in the low cluster estimate expected transfers based on the current budget year and information provided in the state budget proposal for the next year. These estimates are approved in the budget, as well as expenditure financed from these transfers. Rebudgeting thus concerns only a small fraction of both transfers and related expenditures.

Regions in the high cluster do not budget for current transfers, and most or all transfers are included in the budget as rebudgeting in the first months of the year. Thus, the volume of rebudgeting of both transfers and the matching expenditure is above 70%.

Figure 2: Magnitude of rebudgeting of current expenditure (13 regions, 2006-2023)



Source: authors, based on data from Monitor

Note: HK = Královehradecký, JC = Jihočeský, JM = Jihomoravský, KV = Karlovarský, LI = Liberecký, MS = Moravskoslezský, OL = Olomoucký, PA = Pardubický, PL = Plzeňský, ST = Středočeský, US = Ústecký, VY = Kraj Vysočina, ZL = Zlínský; the legend is ordered according to rebudgeting in 2023
Rebudgeting = (amended – approved expenditure)/amended expenditure

While the regions in the low cluster comply with the principle of complexity and the budget debate concerns the full budget, the regions in the high cluster debate do not. Division of the decision-making into two periods – the allocation of own resources before budget approval and the allocation of transfers during rebudgeting – limits the complexity of the first period.

4 Data and Methods

The center of our attention is budget punctuation in current expenditure, i.e. a large annual change in a functional budget line in approved (B_PUN), amended (A_PUN), and executed (E_PUN) regional budgets.

The percentage change for each functional line is calculated as

$$change_t = \frac{budget_t - budget_{t-1}}{budget_{t-1}} \quad (1),$$

where the budget is either approved (B), amended (A), or executed (E).

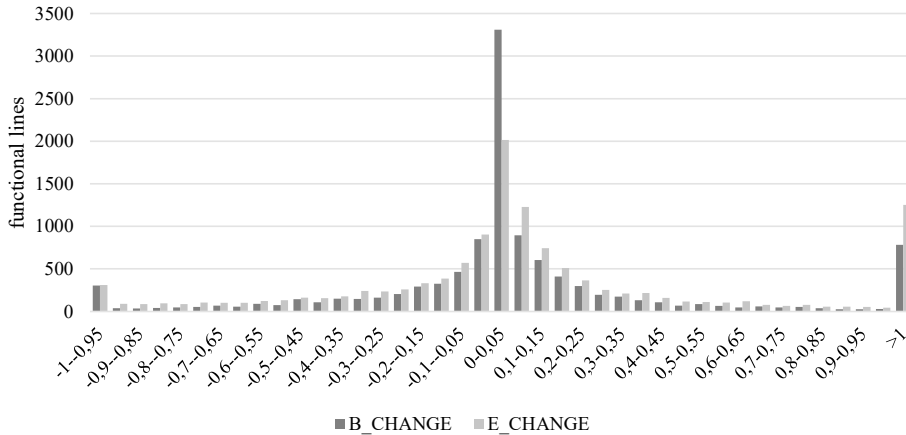
Functional line represents current expenditure for a given function. Current expenditure corresponds to the highest aggregation of economic classification, i.e., class 5, and to define a function we use the second lowest level of functional classification, e.g., 311x Preschool and elementary education, 312x Secondary education, 313x Institutional educational facilities, etc.

In total, our analysis includes 113 different functional lines, in the case of the individual regions there are between 33 and 59 functional lines in the approved budget, 42 and 68 lines in the amended budget, and 40 and 64 lines in the actual execution (Figure 3). Data on 13 regional budgets come from Monitor, a data portal provided by the Ministry of Finance. We use annual data for the period 2005 to 2023. The Monitor includes budget data using detailed economic and functional classifications. Both classifications use a 4-level coding system. Data for approved and amended budgets and for actual execution are provided.

To set threshold values, we follow Jordan (2003), i.e., a percentage decrease of more than 25 percent or a percentage increase of more than 35 is a punctuation. Budget punctuation is a discrete variable that can take a value 1 in the case of punctuation or 0 in the case of incremental change.

Similarly, to Kovari (2016), we observe functional lines with zero values in some years, which makes it impossible to calculate a percentage change due to a zero denominator ($budget_{t-1}$) in the percentage change formula (1). In that case, if $budget_{t-1}$ does not equal zero, this change is labelled as punctuation.

Figure 3: Distribution of budget changes in approved and amended budget (2005-2023)



Source: authors, based on data from Monitor

Note: B_CHANGE is the annual change in the approved budget and E_CHANGE is the annual change in the executed budget, both calculated using formula (1)

To test H1 (Approved budget has more punctuations than the amended budget) and H2 (Actual spending has less punctuations than approved budget) we compare if the share of budget punctuations in functional budget lines differs in the approved (B_PUN), amended (A_PUN), and executed (E_PUN) regional budgets. We use the two-sample Z-Test to determine if the meaning of two variables are equal.

To test H3 (Exogenous shocks lead to more punctuations), H4 (Electoral change leads to more punctuations) and H5 (Complexity in the budgetary process leads to more punctuations) we use the binary logit model for the estimation of factors influencing the dependent variable. The dependent variable is a discrete one and therefore this model is appropriate in this case. It is based on the maximum likelihood principle.

We estimate this equation:

$$PUNC = f(COVID, UKR, ELECT1, PERSON, PARTY, ELECT, COMP, C) + \varepsilon \quad (2)$$

where PUNC is punctuation in a functional line in a given budget process phase, COVID and UKR capture exogenous shock to test H3, ELECT1, PERSON, PARTY and ELECT represent electoral change to test H4 and COMP characterizes budget process complexity to test H5. C is a vector of control variables.

A similar approach was used by Robinson et al. (2007) to analyze the effects of organizational size and centralization on the budgetary process, by Flink (2017) to examine the impact of organizational performance and teacher turnover, and by Sebők and Berki (2017) to investigate factors influencing Hungarian state budget punctuations.

Czech regions play an important role in emergency management when they, among others, coordinate the delivery of health care services, provision for public health safety, emergency accommodation, and drinking water and food supply (Vilášek and Fus, 2023) so they have played a crucial role during the two recent unforeseen and unprecedented events: the COVID-19 pandemic starting in 2020 and the refugee wave after Russia invaded Ukraine in February 2022. To test H3 (Exogenous shocks lead to more punctuations), we introduce variables COVID and UKR. Both are dummy variables and are equal to 1 in the years 2020 and 2022, respectively.

Elections and their results, i.e., change in the party control of the assembly, are exogenous forces that may cause a change in the decision design and lead to a major change in choice (True et al., 2007). To test H4 (Electoral change leads to more punctuations), we introduce a set of dummy variables indicating the first post-election year (ELECT1), change in the party of the regional president (PARTY), and change of the regional president (PERSON). Data on regional presidents and their party affiliation come from the webpages of the individual regions.

According to the literature on political business cycle, governments strategically time policies following the electoral cycle to maximize their re-election chances (Nordhaus, 1975). Therefore, major reforms do not take place late in the election cycle, e.g., austerity reforms (Strobl et al., 2021), tax reforms (David and Sever, 2024), or welfare reforms (Wenzelburger et al., 2020). Consequently, there will likely be less punctuations in the election year. We introduce the dummy variable ELECT to test this assumption.

To test the impact of decision complexity or budget process comprehensiveness (H5) we introduce a dummy variable COMP, which reflects the region's praxis when budgeting transfers. Hence, COMP = 1 if the approved budget of the region is comprehensive, i.e., it includes transfers, COMP = 0 otherwise.

Additional control variables characterize the individual functional budget lines regarding their volume and their changes over the budget cycle. Volume of the functional line in the different budget phases - budgeted spending (B), spending in the amended budget (A) and actual or executed spending (E) - is expressed in millions CZK. Changes in the functional lines over the budget cycle are expressed as ratios when rebudgeting (REB) is amended to approved budget and execution (EXE) is actual to amended spending.

Table 2 provides detailed specification of all the variables and Table 3 shows the major descriptive statistics.

Table 2: List of variables

Variable	Description
B_PUNC	Dummy B_PUNC=0 if the approved budget annual change is between -0.25 and 0.35, B_PUNC=1 otherwise
A_PUNC	Dummy A_PUNC=0 if the amended budget annual change is between -0.25 and 0.35, A_PUNC=1 otherwise
E_PUNC	Dummy E_PUNC=0 if the actual spending budget annual change is between -0.25 and 0.35, E_PUNC=1 otherwise
REB	Rebudgeting = amended budget/approved budget
EXE	Execution = actual spending/amended budget
B	Budgeted spending in millions CZK
E	Actual spending in millions CZK
A	Amended budget spending in millions CZK
COVID	Dummy COVID=1 in the year 2020, COVID=0 otherwise
UKR	Dummy UKR=1 in the year 2022, UKR=0 otherwise
ELECT	Dummy ELECT=1 in the years of election, i.e., 2008, 2012, 2016, and 2020, ELECT=0 otherwise
ELECT1	Dummy ELECT1=1 in the first year after the election, ELECT=0 otherwise
PERSON	Dummy PERSON=1 in the first year after the regional president has changed, i.e., his/her first complete budget year, PERSON=0 otherwise
PARTY	Dummy PARTY=1 in the first year after the party of the regional president has changed, i.e., his/her first complete budget year, PARTY=0 otherwise
COMP	Dummy COMP =1 if the region includes transfers into the approved budget, COMP =0 otherwise

Source: authors

Table 3: Descriptive statistics

	average	median	min	max	st. dev.	skewness	kurtosis
B_CHANGE	1.34	0	-1	3,333	41.233	62.632	4,465.6
A_CHANGE	4.07	0.0304	-1	11,495	133	64.948	4,952.7
E_CHANGE	6.03	0.0269	-1	18,121	209.96	66.637	5,131.5
B_PUNC	0.46	0	0	1	0.4982	0.1709	-2.0
A_PUNC	0.44	0	0	1	0.4959	0.2587	-1.9
E_PUNC	0.42	0	0	1	0.4935	0.3263	-1.9
REB	16.43	1.14	0	14,056	213.75	51.768	3,149.2
EXE	0.83	0.97	0	2.5235	0.26501	-1.8344	2.6
B	130.74	5.11	0	17,986	578.97	12.514	238.3
A	233.69	12.37	0	18,975	832.71	8.4155	106.3
E	226.09	9.75	0	18,973	830.02	8.4926	107.9
COVID	0.06	0	0	1	0.2308	3.8445	12.8
UK	0.06	0	0	1	0.2292	3.8769	13.0
ELECT	0.22	0	0	1	0.4159	1.3344	-0.2
ELECT1	0.22	0	0	1	0.4154	1.3399	-0.2
PERSON	0.18	0	0	1	0.3808	1.7017	0.9
PARTY	0.14	0	0	1	0.3521	2.0172	2.1
COMP	0.46	0	0	1	0.4981	0.1741	-2.0

Source: authors

The description of the budgeting and rebudgeting process in 13 Czech regions is based on review of the valid legislation and information provided by the individual regions. We have approached the heads of the economic or similar departments with an e-mail request for budget guidelines (May 2023). The rest of the needed information (list of budget changes, delegation of responsibility from council to commission, or date of budget approval) was provided on the respective web pages or e-mail requests.

5 Results

The share of punctuations differs in the different budget phases. The highest (46%) is in the case of the approved budget, the punctuations in the amended and executed budgets are present in 39% and 39,8% of the functional lines, respectively. The two-sample Z-Test confirmed statistically significant differ-

ences between the approved and amended and approved and executed budget, but no significant difference between the amended and executed budget. The high number of punctuations is related to the further complexity of decision-making caused by the intergovernmental relationships (Meza, 2022).

The above-presented results confirm both H1 (Approved budget has more punctuations than the amended budget) and H2 (Actual spending has less punctuations than approved budget) and are in line with the predictions of the punctuated equilibrium theory. Punctuations are more common if the institutional, mostly the decision costs are high: approved budget is a result of demanding political negotiations and finding a coalition agreement for a single vote. This hinders smooth, incremental changes with a normal distribution and leads to many punctuations. The amended and executed budgets are adjusted through many small decisions which are more flexible and result in fewer punctuations. During the budget year, many of the originally approved punctuations do not materialize.

Results of the binary logit models show factors that influence the occurrence of budget punctuations in the different phases of the budget process (Table 4).

The approved budget is a result of budget preparation and debate that took place in the last months of the previous year. Punctuations in the approved budget B_PUNC are more common in regions with comprehensive budgeting COMP and less common in the election years ELECT.

The role of the volume of current expenditure in a functional line is negative, i.e., functional lines, with a small volume of current expenditure, experience punctuations more often than functional areas with a higher volume. This relationship is confirmed in all the models and variables budgeted spending B, amended spending A, and executed spending E. A similar situation was observed by Klase et al. (2001) in the case of West Virginia cities when extra money went into smaller departments during the within-year budget adjustments.

Punctuations in the amended budget A_PUNC are strongly positively influenced by the existence of the punctuations in the approved budget B_PUNC. The impact of the comprehensiveness of the budgeting approval is a little weaker than in the case of the approved budget, but still positive and significant. Both unexpected situations – Covid-19 and the Ukrainian refugee wave – led to significant growth of punctuations in the amended budget. The magnitude of rebudgeting, expressed as an amended budget to an approved budget, did not have a significant effect on the existence of punctuation.

Table 4: Results of the binary logit models

Dependent variable	B_PUNC	A_PUNC	E_PUNC_B_PUNC	E_PUNC_A_PUNC
Const	0.1507***	-1.0440***	0.9236***	
	(0.000)	(0.0461)	(0.0879)	
COVID	x	0.2024**	0.3222***	
		(0.0981)	(0.0036)	
UKR	x	0.1660*		
		(0.0979)		
ELECT	-0.1174**		-0.1291**	
	(0.0137)		(0.0364)	
COMP	0.1803***	0.1179***	0.0813*	
	(0.000)	(0.0445)	(0.0755)	
B_PUNC	x	1.5440***	1.2678***	x
		(0.0468)	(0.000)	
A_PUNC	x	x	x	3.6584***
				(0.0651)
EXE	x	x	-2.1531***	-2.1276***
			(0.000)	(0.0458)
B	-0.0053***	x	x	x
	(0.0000)			
A	x	-0.0023***	x	x
		(0.0000)		
E	x	x	-0.0023***	-0.0017***
			(0.0000)	(0.0000)
N	10772	10730	10653	12014
McFadden R2	0.0873	0.1752	0.2090	0.4906
Log-likelihood	-6783.693	-5912.323	-5651.394	-4158.695
Overall predicted cases	7314	7765	7752	10521
	(67.9%)	(72.4%)	(72.8%)	(87.6%)
Likelihood ratio statistics	1298.87***	2511.71**	2987.16**	8010.82**

Source: authors

Note: * denotes 90%, ** 95 % and *** 99% of statistical significance respectively, standard error in parenthesis; x denotes variables that were not included in the model, blank spaces show variables that were not statistically significant, variables REB, ELECT1, PARTY, and PERSON were not statistically significant in any model and, therefore are not shown

There are two models estimating E_PUNC, one uses as the starting point the approved budget E_PUNC_B_PUNC and the other uses amended budget E_PUNC_A_PUNC.

Punctuations in the executed budget E_PUNC are again strongly positively influenced by the existence of the punctuations in the approved budget B_PUN. There is a positive influence of the complexity of the budget approval COMP and Covid-19 and a negative of the election year ELECT. Compared to the punctuations in the amended budget A_PUNC we can observe the significant impact of the election year ELECT but not the refugee wave UKR.

The difference between amended and executed budget is caused by the execution of the spending (executed spending to amended spending) and its role is strongly negative. If the amended budget is fully spent EXE = 1. The more remains unspent, the smaller is EXE. EXE's statistically significant negative impact on E_PUNC means that underspending leads to more punctuation. If we consider budget execution EXE as a component of performance, i.e., underspending is a sign of low performance, then this negative relationship between execution EXE and punctuations in the executed budget E_PUNC is in line with the findings of Flink (2017), who found that low levels of performance are associated with non-incremental (punctual) changes.

The last model E_PUNC_A_PUNC shows a very strong and positive relationship between punctuations in executed and amended budgets and again negative impact of budget execution EXE. None of the other factors is significant.

While the results shown in Table 4 confirm H3 (Exogenous shocks lead to more punctuations) and H5 (Complexity in the budgetary process leads to more punctuations) they do not give any support for H4 (Electoral change leads to more punctuations).

Regarding H3, extraordinary situations experienced in 2020 (COVID) and 2022 (Ukrainian refugee wave UKR) led to more punctuations in amended and/or executed budgets. Our finding on the impact of Covid-19 is stronger than suggested by Cavelleri (2025) in the case of European countries.

Despite the expectations from the literature (Jones et al., 2009 and Kwak, 2017) we did not confirm H4. None of the variables (ELECT1, PARTY, PERSON) which capture the changes in the government were significant. Restraint to changes before election was on the other hand a significant factor lowering the number of punctuated budget changes in approved and executed budgets.

We found strong support for H5 in all budget phases. The difference in the praxis among the regions regarding the complexity of the budgeting process has a sizable impact on the occurrence of punctuations. It is in line with the predictions of the punctuated equilibrium theory: complex decision-making is limited by disproportionated information processing and is more prone to punctuations.

6 Discussion and Conclusions

The punctuated equilibrium theory explains the pattern of annual budget changes we observe almost universally and worldwide. It proves the ability of organizations to hold steady policies as well as being able to adapt to changed needs at the same time. Existing literature offers limited research that links directly the punctuated equilibrium theory to financial management practices (Xiao et al., 2020). Our research addresses this issue and offers a novel integration of these findings with detailed knowledge of the budget process and its major phases in a local government setting.

Punctuations in the current expenditures are present in all the budgeting phases, however, during the rebudgeting and execution phase their number declines. This is supported by the confirmed hypotheses H1 (Approved budget has more punctuations than the amended budget) and H2 (Actual spending has less punctuations than approved budget). It corresponds to the estimated institutional costs associated with the different budget phases, existing procedural rules and the roles politicians and professional bureaucrats have during the different budget phases.

While policy change is more likely to occur in case of exogenous shocks and turnover in the composition of the decision-making body, our analysis using Czech regional data did confirm only the former one. Czech regions responded during their rebudgeting phase to two unexpected events which occurred in February: the COVID-19 pandemic starting in 2020 and the refugee wave after Russia invaded Ukraine in 2022. And this response manifested itself in a higher number of budget line punctuations. Here we can confirm H3 - Exogenous shocks lead to more punctuations.

Unlike theoretical predictions and results from other countries, changes in the political leadership did not have any impact on budget punctuations in any budget phase. Neither change in the person of the regional president, leading party or starting a new election term did lead to substantial policy change. The election year is manifested by less punctuations in approved budget and budget execution confirming the expectation that significant policy change rarely takes place at the end of the budget cycle. H4 - Electoral change leads to more punctuations was not confirmed.

Czech regions use a different approach when including intergovernmental transfers into the approved budget. This praxis influences the complexity and comprehensiveness of the budget and budget process and has a significant impact on budget punctuations in all budgeting phases. Comprehensiveness of the public budget process leads to more friction and limiting comprehensiveness may ease the decision-making process. H5 – Complexity leads to more punctuations was confirmed.

Presented results are limited by the applied definition of budget punctuation, i.e., a percentage decrease of more than 25 percent or a percentage increase of more than 35 percent is a punctuation. Sectoral analysis, reflect-

ing the high heterogeneity among the 113 analyzed functional budget lines, could consider the complex intergovernmental setting where Czech regions operate and bring more insight into the factors influencing policy change at this local government level.

Our findings confirm again that budget institutions influence budget outcomes. Therefore, it calls for further research. Do changes in budgeting comprehensiveness take place over time and what is their impact? Do other budget process rules or practices influence the budget behavior as predicted by the punctuated equilibrium theory as well?

Decisions leading to policy change, expressed as budget punctuation, occur more often in the case of higher institutional friction. Institutional friction stems from higher decision costs or disproportionate information processing. Our analysis showed that declining decision costs during the budget process led to less budget punctuations in the latter phases of the budgetary process. The impact of disproportionate information processing manifested itself in reaction to a crisis and complexity or comprehensiveness of the budget approval. No impact of the change in political leadership was observed.

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Advancing the Legal Competences of Public Officials through the Administrative Consultation Platform: A Conceptual and Empirical Approach

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ABSTRACT

Purpose: This article examines the development of the legal competences of public officials within the Slovenian public administration who use the Administrative Consultation Platform (ACP) when conducting procedures under the General Administrative Procedure Act (GAPA). The ACP is an open-access legal clinic that serves as a supplementary source for

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interpreting procedural rules. To this end, a conceptual framework delineating legal competences for public officials was developed to assess how the use of the ACP affects the development of their acquired legal competences for the purposes of conducting administrative procedures. Based on this framework, a structural model was created to enable empirical testing of the impact of public officials' affinity for the ACP and the frequency of its use on the development of their technical-legal and entrepreneurial-relational competences.

Design/methodology/approach: The theoretical component employs normative, doctrinal, and comparative research methods to study legal competence models in the existing literature. The empirical component includes statistical analysis of data collected using a questionnaire measuring the technical-legal and entrepreneurial-relational competences of public officials who use the ACP, combined with an axiological-deontological evaluation of the results. Structural equation modelling was used to verify how affinity for the ACP and the frequency of its use when conducting administrative procedures affect the development of their legal competences.

Findings: The empirical study conducted in spring 2025 involved 112 public officials who conducted administrative procedures in administrative bodies and used the ACP between 2023 and 2025. The results indicate that the use of the ACP contributed significantly to the development of public officials' legal competences, particularly relational competences, such as the ability to communicate effectively and respectfully with parties involved in the administrative procedure, and entrepreneurial competences, especially the ability to uphold core ethical principles (e.g., integrity) and proactively seek solutions that balance the public interest with parties' rights. However, they developed technical-legal competences—such as legal reasoning for resolving procedural issues, understanding of the GAPA, and data protection regulation—to a lesser, though still not negligible, degree.

Academic contribution to the field: The article focuses on relatively under-explored aspects of public officials' legal competences. The conceptual framework represents an original contribution, complementing existing research on legal competences in a narrower context, while in a broader context it can be categorised as dealing with the subjects of administrative law and public administration. The empirical study advances scientific understanding of the impact of public officials' affinity for the ACP and the frequency of its use on the development of their legal competences, providing key feedback for ACP stakeholders.

Research/practical/social implications: The conceptual framework of legal competences serves as the foundation for further scholarly examination of the legal competences possessed by public officials and functions as a baseline for the systematic upgrading of the ACP to continue fostering the development of public officials' legal competences while they use it. From a societal perspective, this article contributes to raising awareness of the critical importance of cultivating legal competences and of the effective utilisation of the ACP as an instrument for more participatory and problem-solving-oriented administrative decision-making processes.

Originality/significance/value: The article offers an original contribution by (1) establishing a conceptual framework that advances the study of legal competences among public officials who use the ACP when conducting administrative procedures, and (2) demonstrating the pivotal role of

the ACP as a repository of accumulated collective knowledge, which aids public officials in developing their legal competences and facilitates the networking of stakeholders engaged in addressing administrative law challenges. The findings provide guidelines for enhancing the effectiveness of public officials and for fulfilling the objectives and principles of Good Governance in modern public administration.

Keywords: public officials, legal competences, Administrative Consultation Platform, legal clinic, administrative procedural law

Nadgradnja pravnih kompetenc javnih uslužbencev prek Upravne svetovalnice: konceptualni in empirični pristop

POVZETEK

Namen: članek preučuje razvoj pravnih kompetenc uradnih oseb v slovenski javni upravi, ki pri vodenju postopkov po Zakonu o splošnem upravnem postopku (ZUP) uporabljajo Upravno svetovalnico (US). US je odprtodostopna pravna klinika, ki je dopolnilni vir za razlago procesnih pravil. V ta namen je bil razvit konceptualni okvir pravnih kompetenc uradnih oseb, s katerim se ocenjuje, kako uporaba US vpliva na razvoj njihovih pridobljenih pravnih kompetenc za potrebe vodenja upravnih postopkov. Na podlagi tega okvirja je bil oblikovan strukturni model, ki omogoča empirično preverjanje vpliva naklonjenosti uradnih osebdo US in pogostosti njene uporabe na razvoj njihovih tehnično-pravnih ter podjetniško-odnosnih kompetenc.

Zasnova/metodologija/pristop: teoretični del uporablja normativne, doktrinarne in primerjalne raziskovalne metode za proučevanje modelov pravnih kompetenc v literaturi. Empirični del vključuje statistično analizo podatkov, zbranih z vprašalnikom za merjenje tehnično-pravnih in podjetniško-odnosnih kompetenc uradnih oseb, ki uporabljajo US, v kombinaciji z aksiološko-deontološko oceno rezultatov. Za preverjanje, kako naklonjenost US in pogostost njene uporabe pri vodenju upravnih postopkov vplivata na razvoj njihovih pravnih kompetenc, je bilo uporabljeno modeliranje strukturnih enačb.

Ugotovitve: empirična raziskava, izvedena spomladi 2025, je zajela 112 uradnih oseb, ki so v obdobju 2023–2025 vodili upravne postopke v upravnih organih in uporabljali US. Rezultati kažejo, da je uporaba US pomembno pripomogla k razvoju pravnih kompetenc uradnih oseb, zlasti odnosnih kompetenc, kot so zmožnost učinkovitega in spoštljivega komuniciranja s strankami v postopku, ter podjetniških kompetenc, predvsem zmožnosti spoštovanja temeljnih etičnih načel (na primer integritete) in proaktivnega iskanja rešitev ob upoštevanju ravnostja med javnim interesom in pravicami strank. Tehnično-pravne kompetence – kot so sposobnost pravnega argumentiranja, rešitev procesnih problemov, razumevanje ZUP in predpisov o varstvu podatkov – so se razvijale v manjši, toda kljub temu ne zanemarljivi meri.

Akademski prispevek k področju: članek se osredotoča na razmeroma premalo raziskane vidike pravnih kompetenc uradnih oseb. Konceptualni okvir je izviren prispevek, ki dopolnjuje obstoječe raziskave o pravnih kompetencah v ožjem kontekstu, v širšem pa ga je mogoče uvrstiti med tematike upravnega prava in javne uprave. Empirična raziskava pogloblja

znanstveno razumevanje vpliva naklonjenosti do US in pogostosti njene uporabe na razvoj pravnih kompetenc uradnih oseb ter zagotavlja ključno povratno informacijo deležnikom US.

Raziskovalne/praktične/družbene implikacije: konceptualni okvir pravnih kompetenc je temelj za nadaljnje znanstveno proučevanje pravnih kompetenc uradnih oseb in izhodišče za sistematično nadgrajevanje US, da bo tudi v prihodnje spodbujala razvoj pravnih kompetenc uporabnikov. Z družbenega vidika članek pripomore k dvigu zavedanja o ključnem pomenu razvoja pravnih kompetenc in učinkovite uporabe US kot orodja za bolj participativne in k reševanju problemov usmerjene upravne postopke.

Izvirnost/pomembnost/vrednost: članek ponuja izviren prispevek z (1.) vzpostavitvijo konceptualnega okvira, ki pripomore k preučevanju pravnih kompetenc uradnih oseb, ki pri vodenju upravnih postopkov uporabljajo US, ter (2.) prikazom osrednje vloge US kot vira akumuliranega kolektivnega znanja, ki uradnim osebam pomaga razvijati pravne kompetence in olajšuje medsebojno povezovanje deležnikov na področju upravnopravnih dilem. Ugotovitve ponujajo smernice za krepitev delovanja uradnih oseb ter za uresničevanja ciljev in načel dobrega upravljanja v sodobni javni upravi.

Ključne besede: javni uslužbenci, pravne kompetence, Upravna svetovalnica, pravna klinika, upravni procesno pravo

JEL: K40, J24, M53, H83

1 Introduction

In contemporary society, administrative procedures constitute a cornerstone of public officials' work with clients within administrative authorities, given that administrative relationships regulate relations between governing bodies and individual citizens (Galetta and Ziller, 2024). Pursuant to the General Administrative Procedure Act (GAPA; Official Gazette of the Republic of Slovenia, No. 80/99, 1 October 1999, as amended), administrative bodies in Slovenia address several million administrative matters annually. Accordingly, it is imperative that public officials who conduct these procedures are professionally trained (Kovač, 2024; Kovač and Jerovšek, 2024) and possess well-developed relevant legal and other competences (Hamilton and Bilonis, 2022; Carrel, 2019). Public officials acquire said legal competences primarily during education in accredited academic programmes (Kovač and Stare, 2014), and further refine them through continuous professional development, including access to and use of the Administrative Consultation Platform (ACP) (Kovač et al., 2023).

The ACP is a joint initiative of the Faculty of Public Administration (FPA UL) and the Ministry of Public Administration (MPA), specifically designed to provide principled interpretations of issues arising in administrative procedural law and administrative practice, particularly concerning the application of the GAPA. Established in 2009 as a research project addressing complex administrative procedure-related challenges encountered in administrative practice

(Kovač and Stare, 2014), the ACP experienced partial suspension in 2014 and was reinstated in 2022 in response to substantial demand, with new inquiries accepted since spring 2023 (Kovač et al., 2023). Following its overhaul, the ACP is defined as a research and pedagogical project under the governance of the FPA UL and the MPA, supervised by mentors from the faculty and officials from administrative bodies. It provides principled explanations of dilemmas concerning the application of the GAPA in individual situations. The project interprets the provisions of sector-specific regulations and the GAPA with due consideration of the fundamental principles of public administration. The ACP gathers and addresses dilemmas in the implementation of the GAPA across various administrative authorities and fields. Since 2009, the ACP has made available over 1,200 documented cases, with approximately 120 views and 300 daily user interactions recorded in the 2023–2025 period. Access to the platform's comprehensive repository – comprising published questions and answers, alongside the facility to submit new queries – is provided free of charge to users. Three-quarters of ACP users are public officials who conduct administrative procedures across various administrative domains (e.g., foreigners, taxation, construction, social affairs, data protection). In this context, the question arises regarding the nature of the legal competences possessed by public officials conducting administrative procedures, and the extent to which their affinity for and frequency of use of the affect the development of their legal competences.

The purpose of this study is to examine how the use of the ACP affects the development of legal competences among public officials conducting administrative procedures within Slovenian public administration, while also understanding how the perceived performance and effort expectancy of the ACP, social influence, and facilitating conditions impact the frequency of ACP use. The objectives of the paper are: (1) to develop a conceptual framework of the legal competences of public officials conducting administrative procedures; (2) to investigate the acquired legal competences of public officials as ACP users; and (3) to analyse the extent to which public officials' affinity for and frequency of use of the ACP contribute to the development of their legal competences. The following research question was formulated: How does the use of the ACP affect the acquisition and development of legal competences among public officials conducting administrative procedures within the Slovenian public administration? In line with the research question, the following hypotheses are posited:

H1: The acceptance of the ACP (measured through performance expectancy, effort expectancy, social influence, facilitating conditions) among public officials influences the frequency of ACP use in the conduct of administrative procedures.

H2: The frequency of ACP use among public officials conducting administrative procedures affects the development of their legal competences.

The remainder of the paper is structured as follows. Section 2 elaborates on the concept of legal competences, the findings of studies concerning the sig-

nificance of legal competence development for students and legal professionals (Finch and Fafinski, 2020; Isaacs et al., 2016; Hamilton, 2014; Shultz and Zedeck, 2011), and legal competence models (Hamilton and Bilonis, 2022; Carrel, 2021; Carrel, 2019; Mak, 2017). To this end, normative, doctrinal, and comparative research methods were employed. Section 3 outlines the methodological design in three subsections, namely the conceptual framework of legal competences, data collection and sampling, and the reliability and validity of the measurement model. The results of the empirical study are presented in Section 4, followed by discussion and recommendations in Section 5, and concluding remarks in Section 6. The core contribution of this study is the developed conceptual framework of legal competences for public officials, specifically tailored for the empirical investigation of their technical-legal, entrepreneurial, and relational competences essential for conducting administrative procedures. The conceptual framework concurrently serves as the groundwork for the structural model to empirically test the influence of public officials' affinity for the ACP and the frequency of its use on the development of these three dimensions of legal competences. This research constitutes a foundation for further studies and measures aimed at acquiring and fostering the appropriate legal competences among public officials.

2 Literature Review

2.1 Legal Competences of Public Officials

Competences encompass all those skills, abilities, and attitudes of employees that are essential for the successful execution of work tasks in general (Schaffar, 2021; Kruyen and Van Genugten, 2020; Arzenšek et al., 2019), including within public administration (Džinić and Manojlović, 2018), as they have an important effect on whether the established objectives are achieved (Buzeti and Stare, 2010). The study of competences using competence models, which represent an organisational framework for defining the competences, tasks, and responsibilities of employees to ensure effective work and performance evaluation subject to the strategic goals of the organisation (Mikhridinova et al., 2024), began in the latter half of the 20th century (Sommerman et al., 2025). In line with public administration reforms, various competences of public officials have been prioritised (Kruyen and Van Genugten, 2020). In traditional public administration, the competences of public officials comprised professional knowledge and technical skills, whereas during the New Public Management era, competences highlighting the importance of efficiency and effectiveness in public administration came to the fore (Kruyen and Van Genugten, 2020). With the implementation of Good Governance (Kovač, 2018) and influenced by social changes, digitalisation, and artificial intelligence, contemporary public administration has become complex (Galetta and Ziller, 2024), thereby increasingly accentuating those competences with which public officials effectively address individual and societal challenges (Vitello et al., 2021; Schneider, 2019).

When conducting administrative procedures, public officials must demonstrate appropriate professional qualifications, as evidenced by fulfilling the statutory requirements under Article 31 of the General Administrative Procedure Act (GAPA), which include: (1) *employment within the competent authority* (knowledge, attitudes); (2) *relevant education* (knowledge, skills); (3) *state professional examination in administrative procedure* (knowledge, skills, attitudes); (4) *authorisation* (knowledge, attitudes); and (5) *impartiality* (knowledge, attitudes) (Kovač and Jerovšek, 2024). However, since public officials decide on the rights, obligations, or legal interests of individuals, legal entities, or other parties when conducting administrative procedures, it is of paramount importance that their acquired legal competences are adequately developed. Legal competences are those that enable public officials, within the scope of legal regulations, to effect changes to their own or others' legal status through legal acts within the legal system (Villa-Rosas and Spaak, 2023). Typically, these encompass legal knowledge, skills, and abilities that empower public officials to actively and responsibly participate in societal development. Public officials achieve this by respecting the rule of law, exercising rights and obligations, and cooperating with state authorities and other key societal actors (Korotun and Bogdanova, 2020).

Existing research (Hamilton and Bilonis, 2022; Finch and Fafinski, 2020; Carrel, 2019; Gerkman and Cornett, 2016; Hamilton, 2014; Shultz and Zedeck, 2011) mostly examines the legal competences acquired by law students during their education and those further developed by practising lawyers through their professional work. However, very few studies directly address the development of legal competences among public officials after the completion of their formal education, particularly at the intersection of legal and administrative domains. For example, Kovač and Stare (2014) examined the general competences of students and graduates of public administration who participated in the ACP, while the Tuning project (Krogt and Reichard, 2012) is recognised as a key initiative for public administration. There is, however, no research that focuses specifically on those already employed in public administration and their legal and other relevant competences, which is a significant research gap in the study of legal competences among public officials. Given the substantive similarities in the work of public officials when conducting administrative procedures, especially regarding the interpretation and application of (procedural) law, the following section employs doctrinal analysis and synthesis to examine the legal competences of law students and practising lawyers (Bedner et al., 2020; Finch and Fafinski, 2020; Gerkman and Cornett, 2016; Isaacs et al., 2016; Hamilton, 2014; Kovač and Stare, 2014; Shultz and Zedeck, 2011) alongside existing legal competence models (Hamilton and Bilonis, 2022; Carrel, 2021; Carrel, 2019; Mak, 2017). These studies provide the basis for developing a conceptual framework of legal competences tailored to public officials using the ACP and for the further empirical examination of their legal competences.

2.2 Legal Competences and Legal Competence Models

According to analyses by various authors (Bedner et al., 2020; Finch and Fafinski, 2020; Gerkman and Cornett, 2016; Isaacs et al., 2016; Hamilton, 2014; Kovač and Stare, 2014; Shultz and Zedeck, 2011), law students must develop appropriate competences during their studies that then form the basis for further enhancement and deepening throughout their professional careers, enabling them to be fully competent in their respective fields.

Shultz and Zedeck (2011), in collaboration with alumni, students, professors, clients, and judges, identified 26 of the most important legal competences required during law studies and legal practice. These competences – e.g., analysis and reasoning, creativity, problem solving, practical judgment, legal research, writing, speaking, listening, organising and managing, negotiation skills, networking and business development, and stress management – are crucial in practice, as they contribute to employees' work performance.

Similarly, Hamilton (2014), drawing from a range of sources (Consulting Group – BTI, 2013; Survey of Newly Licensed Lawyers – NCBE, 2012; Association of Corporate Counsel – ACC, 2009), concluded that students aspiring to work as lawyers, especially in client-facing roles, should possess well-developed *technical-legal competences* (e.g., knowledge of doctrinal law, legal analysis, written and oral communication) as well as *other competences* (e.g., integrity, honesty, good judgment, problem solving, work ethic, dedication to client service, responsiveness to clients, seeking feedback). These competences should be acquired during their studies to such a degree that graduates already meet employer expectations upon entering the labour market, and they are then further developed during professional practice. However, Gerkman and Cornett (2016) found that law graduates often do not adequately develop certain legal competences (e.g., integrity, work ethic, resilience) which employers regard as essential and expect young lawyers to demonstrate in professional settings. To address this, they developed within the *Whole Lawyer* conceptual framework a set of the most important legal competences categorised for the short term as *professional competencies* (professionalism, emotional and interpersonal intelligence, communication) and *characteristics*, and for the longer term or throughout a legal career as *legal skills* (transactional practice, litigation practice, legal thinking and application, workload management) and *professional competencies* (professional development, workload management, and collaboration with others).

Law graduates are expected to master several categories of legal competences, such as *sources of law* (e.g., understanding legislation, locating and applying legislation and case law), *academic legal skills* (e.g., writing, referencing/avoiding plagiarism, answering problem questions), and *practical legal skills* (e.g., presentation skills, mooted, and negotiation skills) (Finch and Fafinski, 2020). Similarly, Bedner et al. (2020) categorised the legal competences and associated legal skills of law graduates – who are expected to become lawyers, judges, or public officials – into two groups. Group 1, *general skills* (e.g., critical thinking, juridical analytical skills) and *primary legal skills*

(e.g., case analysis, legal reasoning), provide law graduates with the foundation for the development of legal thinking. Whereas Group 2, *secondary legal skills* (e.g., legal writing, constructing legal arguments, legal drafting, and contract drafting), equip them with the ability to apply acquired knowledge in concrete legal practices.

The importance of developing legal competences among law students has also been emphasised in the Tuning pilot project, aimed at harmonising educational programmes in Europe for the field of public administration following the implementation of the Bologna process (Krogt and Reichard, 2012). Slovenia participated in the TuCAHEA task group within this project (Isaacs et al., 2016). Within this context, law students and graduates are expected to demonstrate, in addition to their general legal knowledge (e.g., regulatory and legal governance of social relations; legal and state development of the society; drafting and implementation of legislation), the legal knowledge of societal norms, legal forms of organisations, state functions, and specific legal fields (e.g., administrative law, civil law), alongside appropriately developed legal competences. The TuCAHEA project used the input from academics, employers, students, and graduates to classify 30 *general competences* and 20 *subject-specific competences* according to the importance of developing the respective competences during law studies. Among the most important general competences were the ability to apply knowledge in practice, autonomous learning, and the use of logic and critical thinking to solve problems. The most important elements among subject-specific competences were knowledge of current norms, statutes, and regulations as well as other sources of law, knowledge of and ability to apply national and international instruments to protect and promote human rights, skills to draw up legal documents and the like.

Following the Tuning project, Kovač and Stare (2014) examined the general competences of postgraduate public administration students at the Faculty of Public Administration in Ljubljana participating in the ACP. They found that the ACP contributed to students' development of the ability to apply knowledge in practical situations, deepen knowledge and understanding of the subject area and profession, demonstrate determination and perseverance in tasks and responsibilities, among other competences. According to them, the ACP is pivotal in developing these student competences, although they also highlighted the need to boost ties with employers and expand cooperation with various administrative bodies – a measure introduced during the ACP overhaul in 2022 (Kovač et al., 2023), although the results of this were not yet measured by the time of the present study.

For the purposes of the systematic study of the legal competences of students and legal professionals, a number of authors have developed various legal competence models, notably the *T-shaped Lawyer* (Carrel, 2021; Carrel, 2019; Mak, 2017), the *Delta Lawyer Competency Model* (Carrel, 2019), and the *Foundational Competences Model* (Hamilton and Bilonis, 2022). Using any of these models, organisations – including administrative bodies – can analyse

the level of development of legal competences acquired by law students and practitioners in their client-facing work (Hamilton and Bilionis, 2022). This approach is also applicable to graduates of law-related programmes, such as public administration, since this field is inherently bound to act in line with legal rules and principles due to its authoritative intervention into individuals' legal status (Stare and Pečarič, 2021).

According to the *T-shaped Lawyer* model (Carrel, 2021; Carrel, 2019; Mak, 2017), law students and legal professionals – including lawyers, judges, and academics – adapt to societal changes, digitalisation, and globalisation by acquiring appropriate legal knowledge alongside capabilities such as data analytics, technology use, and project management. This model delineates three distinct but overlapping lawyer profiles: 1) *the lawyer-statesman*, a traditional lawyer who emphasises the rule of law and justice, acting for the public good with moral integrity, sound judgment, and the ability to apply broad legal knowledge in practice; 2) the *rational legal professional* reflects the new public management influence, prioritising economic values (e.g., efficiency, effectiveness, transparency); this profile specializes in legal fields (e.g., commercial law, criminal law) while also mastering other disciplines (e.g., management, psychology) and is able to adapt to an organisation's goals and ethical frameworks; and 3) the *t-shaped lawyer* epitomises the modern 21st-century lawyer who responds to social changes, possesses relevant legal knowledge, is client-focused, demonstrates highly developed social and relational competences (e.g., empathy), interdisciplinary competences (e.g., sustainability, social justice), is technologically proficient, and acts in accordance with personal ethical standards (Mak, 2017). These profiles primarily describe lawyers, judges, and legal scholars, as law students are still developing these characteristics.

However, Carrel (2019) critiqued the model as being deficient for insufficiently promoting the development of traditional legal competences among law students and professionals within organisations. She proposed an enhancement through the *Delta Model of Lawyer Competence* (Delta Model), according to which graduates and lawyers systematically develop their legal competences when performing client-facing work and while effectively solving legal problems. The Delta Model exists in multiple iterations, simplified and adapted over time in response to societal changes. This article summarises the original triangular version, which categorises legal competences as follows: *legal knowledge and skills* (legal analysis, legal judgment, legal research) enabling lawyers to understand client's problems; *personal effectiveness skills (PES)* (e.g., emotional intelligence, relationship management, communication); and *process, data and technology* (technology and social media, data analytics, data security), covering the business and operational aspects of legal service delivery.

Consistent with the Delta Model, Hamilton and Bilionis (2022) developed the *Foundational Competences Model* aimed at enhancing law students' legal competences for academic success and lawyers' competences in delivering client services and career advancement. Their model also depicts legal competenc-

es as a triangle divided into three categories. At the core are foundational legal competences (responsible conduct and trust-building in client dealings), which influence the growth of other competences (e.g., social responsibility). The triangle's base includes *traditional technical competencies* – those emphasized by law schools and expected by employers and clients. On the left are *client-centred relational skills* and *problem-solving competences*, fostering client focus, while the right side emphasizes *ownership of professional development (initiative-taking) of essential competences*, emphasising continuous professional growth.

Existing legal competence models are not fully adequate to identify the necessary legal competences among public officials participating in the ACP, as they primarily target the educational phase or perspectives of lawyers, employers, and clients, and are developed within academic and professional milieus. Due to the absence of directed research in this domain and given the substantial role overlap between lawyers and officials, it was necessary to develop an adapted conceptual framework that would consider the specific legal competences of public officials whose work focuses on conducting administrative procedures.

3 Methodological Outline of the Theoretical Legal Competences Model and Its Empirical Verification

3.1 Designing a Conceptual Framework of Public Officials' Legal Competences

The conceptual framework of legal competences for public officials developed here is based on the three-dimensional structure of the Foundational Competences Model (Hamilton and Bilionis, 2022), which itself was based on the Delta Model (Carrel, 2019), comprising the *technical-legal*, *entrepreneurial*, and *relational* dimensions. It encompasses a set of specific legal competences that can be empirically examined by taking a comprehensive view of the professional, ethical, and socially responsible conduct of legal practitioners. Another foundational approach in the conceptual framework is derived from the TuCAHEA project under the Tuning initiative (Isaacs et al., 2016), which systematically defines *general competences* and *subject-specific competences*. This approach is employed due to its recognition and established use in implementing Bologna Process higher education programmes within the field of public administration. Additionally, it has been utilised by other authors to study student competences (cf. Kovač and Stare, 2014), and for its content as it covers a broad range of legal competences relevant to the ACP. The Foundational Competences Model and the Tuning/TuCAHEA framework together serve as the essential groundwork for the conceptual framework, since the former synthesises existing empirical studies in the field of law, while the latter specifies the particularities of legal competences within legal and public administration education. Although originally developed to enhance higher education in law and public administration, they are adapted in the conceptu-

al framework to define the legal competences of public officials that are critical for the effective discharge of their administrative duties, such as conducting administrative procedures, which substantively and functionally lie at the intersection of law and public administration. Therefore, it is vital for public officials to develop these competences through lifelong learning. Within the conceptual framework, competences irrelevant to conducting administrative procedures (e.g., ability to innovate, teamwork/collaboration, conscientiousness/attention to detail, grit/resilience) are excluded, whereas others (e.g., use of necessary technology for information retrieval in juridical practice and work ethic) are adjusted in accordance with the requirements of Article 31 of the General Administrative Procedure Act (GAPA).

Table 1 illustrates the conceptual framework of legal competences for public officials, structured across three dimensions and competences, where *subject-specific competences* are contained within the 1) technical-legal dimension, and *general competences* form parts of the 2) entrepreneurial and 3) relational dimensions.

The conceptual framework of legal competences for public officials presented in Table 1 provides a structured and comparable overview of diverse research underpinning, offering a more comprehensive understanding of the complexity of public officials' work. Based on this framework, propositions were developed for the empirical study of legal competences (for example, the legal competence is *understanding of administrative procedures*, and the corresponding proposition to investigate is *to understand the GAPA and sector-specific procedures*).

Table 1: Conceptual framework of legal competences for public officials

Legal Competences of Public Officials			
Competence model	Technical-legal dimension	Entrepreneurial dimension	Relational dimension
Tuning/ TuCAHEA	<i>Subject-specific competences:</i> • Knowledge of current norms, statutes, regulations and other sources of law. • Capacity to apply a legal rule to a particular legal case. • Understanding of administrative procedures. • Skills to draw up legal documents. • Ability to understand professionally and explain legal norms in the process of their application. • Ability to produce effective written or oral legal decisions and advice. • Capacity to identify the legal interests of the parties. • Capacity to use the technology necessary for information searches in juridical practice. • Ability to apply knowledge in practice. • Ability to use logic and critical thinking for solving problems. • Knowledge of the professional field.	<i>General competences:</i> • Ability to learn. • Ability to communicate in official, state, and foreign languages. • Ability to prevent and resolve conflicts.	<i>General competences:</i> • Ability to learn. • Ability to communicate in official, state, and foreign languages. • Ability to prevent and resolve conflicts.
Foundational Competences Model	• Knowledge of doctrinal law in the basic subject areas. • Legal analysis. • Legal research. • Written/oral communication in the legal context. • Legal judgment. • Knowledge of the law-of-lawyering, responsibilities to clients and the legal system.	• Work ethic. • Organisation and management of legal work. • An entrepreneurial mindset to serve clients.	• Superior client focus, responsiveness to the client. • Exceptional understanding of the client's context/business. • Client-tailored communication. • Creative problem solving/ good professional judgment synthesising all the competences.

Source: Based on Hamilton and Bilionis (2022); Tuning TUCAHEA (2012-2016)

3.2 Data Collection and Sampling for the Empirical Analysis through an Online Survey

In order to investigate the legal competences acquired through the use of the ACP by public officials who conduct administrative procedures in Slovenian public administration, and to understand the extent to which their attitude toward and frequency of ACP use contribute to the development of their legal competences, we employed a self-designed survey questionnaire. The questionnaire was developed on the basis of our conceptual framework of legal competences, as presented in Section 3.1. Both the questionnaire and framework draw upon the *Foundational Competences Model* (Hamilton and Bilionis, 2022) and the *Tuning/TuCAHEA* approach (Isaac et al., 2016). At the same time, they account for the specific intersection of law, public administration, and the ACP, while deliberately excluding formal educational aspects. Instead, the focus is placed on career-long training and adaptation to the specific professional demands faced by public officials responsible for conducting administrative procedures.

The questionnaire was structured into several sections. The first part focused on measuring legal competences, followed by items assessing respondents' attitudes and dispositions toward the use of the ACP. In addition, demographic data were collected to enable an analysis of the state and development of individual (and group) legal competences against reference benchmarks across multiple indicators. The questionnaire comprised 32 items, organised into several thematic sections. The first section measured technical-legal competences (7 items), including understanding of the GAPA and sector-specific procedures, knowledge of administrative case law on procedural rules, analytical thinking when solving administrative problems, legal reasoning when solving procedural problems, application of general rules to specific cases, and awareness of the fact that the processing of personal data is regulated by law and that digital content is protected by copyright law. The second section, entrepreneurial dimension (3 items), assessed adherence to fundamental ethical principles (integrity, impartiality, confidentiality) when performing duties or conducting administrative procedures, the accuracy in conducting administrative procedures, and proactive solution-seeking while balancing the public interest and the rights of the parties. The third section, relational competences (5 items), evaluated the effectiveness and respectfulness of communication with participants in the administrative procedure and with parties, a parties-centred focus, recognition of parties' legal interests in individual cases, and the ability to learn.

For the purposes of data collection, the questionnaire was transformed into an online survey using the open-source application 1KA (One Click Survey; www.1ka.si). Data were collected between March and April 2025. The target population consisted of 226 public officials employed in Slovenian public administration who conduct administrative procedures and who, between 2023 and 2025, had submitted at least one question to the ACP and received an answer as active users of the platform. Respondents participated on a voluntary

basis through self-selection, employing a non-probability sampling approach. Out of the 226 invited public officials, 112 completed the survey in full, yielding a 49.6% response rate, which is sufficient to allow extrapolation of the results and support valid conclusions. To uphold the integrity of the research process, special attention was devoted to ensuring the anonymity of the respondents' data.

The collected demographic indicators show that 74% of respondents were women, with approximately 57% from Generation X (born between 1965 and 1980), with around 17% older and the remainder younger. This distribution broadly reflects the composition of employees in the Slovenian public administration (Kovač and Stare, 2014). Age distribution also aligns with national data: in 2023 only 8% of central administration employees were aged 18–34, while 29% were aged 55 or older (OECD, 2025). Taken together, these comparisons support the representativeness of our sample and uphold the legitimacy of the inferences. In line with formal entry requirements, the vast majority of respondents hold a university degree, with 21% possessing a postgraduate qualification. Among them, 37% are law graduates, while 35% hold a degree from the Faculty of Public Administration, forming a relatively homogeneous group whose legal competences were, to a large extent, acquired through formal education prior to employment. This provides a solid basis for assessing which competences have subsequently been developed through the use of the ACP. Despite this common background, respondents are currently distributed across a variety of administrative domains: nearly 30% across multiple policy areas, about 19% in environment, construction, and agriculture, 17% in inspection services, 13% in internal affairs, and 6% in social affairs.

Further on, to assess the extent to which public officials' attitudes towards and frequency of use of the ACP contribute to the development of their legal competences, the questionnaire incorporated the Unified Theory of Acceptance and Use of Technology (UTAUT) developed by Venkatesh et al. (2003). The UTAUT synthesises insights from eight earlier technology acceptance models and identifies four core determinants of technology adoption: performance expectancy, effort expectancy, social influence, and facilitating conditions. These constructs have consistently demonstrated strong explanatory power for predicting both behavioural intention and actual system use, accounting for up to 70% of variance in intention and around 50% in use (Venkatesh et al., 2003). In this study, each construct was operationalised with four items measuring respondents' perceptions of the ACP's usefulness, ease of use, organisational and peer influence, and the availability of institutional support. Additionally, one item assessed the frequency of ACP use to browse existing cases, with response categories ranging from "daily" to "never".

The use of the UTAUT was particularly well suited to this research context for two reasons. First, the ACP represents a digital tool, available to public officials from the Slovenian public administration, for which adoption and consistent use are not guaranteed despite the potential for gaining legal competency. And secondly, the UTAUT has been successfully applied in com-

parable contexts where public officials' or employees' acceptance of various e-government tools was examined, thereby providing a validated lens to measure attitudes and usage behaviour (Salah et al., 2025; Zeebaree et al., 2022). These studies confirm the UTAUT's robustness and transferability to public administration settings, reinforcing its suitability for examining how ACP acceptance and usage contribute to the development of legal competences among Slovenian public officials.

All items in the questionnaire were formulated as statements. Respondents expressed their agreement using a 5-point Likert scale: 1 – Strongly disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, 5 – Strongly agree, with the option to select "I do not have enough information". For competences, a separate 5-point scale was used to indicate the extent of competence development as a result of ACP usage (not at all, slightly, moderately, considerably, fully developed). The Likert scaling method is a widely recognised approach for measuring responses, and is also widespread in public administration research (Croasmun and Ostrom, 2011).

3.3 Measurement Model Reliability and Validity

Data analysis involved both descriptive and inferential statistical methods. Summary statistics such as means and standard deviations were used to provide an overview of the variables. Structural equation modelling (SEM) was used to test hypothesised relationships among latent constructs. Descriptive analyses were performed in IBM SPSS 29, and SEM was conducted using IBM SPSS AMOS 29.0 (Arbuckle, 2021). Prior to evaluating the measurement model, an exploratory factor analysis (EFA) was conducted specifically on the items measuring legal competences, as this scale was newly developed for the purposes of this study and had not been previously validated.

The EFA indicated that legal competences are best represented by two underlying factors. The analysis revealed that the theoretically proposed dimensions of *entrepreneurial* and *relational competences*, did not emerge as distinct factors. Instead, the items intended initially for these two dimensions were grouped into one coherent factor. This factor reflects a broader competence related to professional responsibility and interpersonal conduct within administrative procedures. Considering the content of these items (e.g., respect for ethical principles, accuracy in procedural actions, respectful communication, balancing public and individual interests), this factor was labelled *entrepreneurial-relational competences*. The second factor included items measuring legal reasoning and procedural expertise, such as understanding procedural law, applying general rules to specific cases, and analytical reasoning; hence, this factor was labelled technical-legal competences. Two items, to reason legally when solving procedural problems and to focus on the parties, cross loaded on both factors, suggesting that these competences are not exclusively tied to the dimensions mentioned above but instead reflect an integration of both. Consequently, these two items were excluded from further analysis.

Following the EFA, a confirmatory factor analysis (CFA) was conducted to test the fit of the proposed (theoretical) model and evaluate its reliability and validity. The model fit indices suggest that the model provides an acceptable representation of the observed data – the chi-square statistic was statistically significant ($\chi^2 = 646.71$, $df = 335$, $p < .001$). However, the chi-square to degrees of freedom ratio ($\chi^2/df = 1.93$) was below the recommended threshold of 3, indicating a good fit between the model and the observed data. Incremental fit indices further supported the adequacy of the model (CFI = .867, IFI = .870, TLI = .838), since the values are close to or exceed the conventional cutoff of .85 for acceptable fit (Hu and Bentler, 1999). Although slightly above the ideal threshold of .08, the RMSEA (.092) remains within the range of reasonable error of approximation. The hypothesis of close fit could not be confirmed (PCLOSE = .000). Parsimony-adjusted indices indicated a reasonably efficient model given its complexity (PNFI = .630, PCFI = .715).

To evaluate the reliability and validity of the constructs used in the study, we calculated the Cronbach's alpha, composite reliability (CR), and average variance extracted (AVE) for each construct. As shown in Table 3, all constructs demonstrated good internal consistency, with Cronbach's α values ranging from 0.772 to 0.937, and CR values exceeding the recommended threshold of 0.70 (Hair et al., 2010).

Table 2: Reliability and validity of the measurement model

		M	SD	Cronbach's α	CR	AVE	1	2	3	4	5
1	Performance expectancy	4.36	.64	.857	.878	.646	-				
2	Effort expectancy	4.41	.66	.929	.933	.779	.608	-			
3	Social influence	3.19	.95	.899	.902	.701	.442	.372	-		
4	Facilitating conditions	4.20	.62	.772	.793	.570	.561	.599	.290	-	
5	Technical-legal competences	3.88	.58	.883	.859	.605	.396	.305	.241	.279	-
6	Entrepreneurial-relational legal competences	4.11	.72	.937	.942	.645	.506	.279	.201	.344	.729

Note. M = Mean; SD = Standard Deviation; α = Cronbach's Alpha; CR = Composite Reliability; AVE = Average Variance Extracted. The lower triangle presents correlations among latent factors.

Source: Own (2025)

The AVE values are above the 0.50 threshold for all constructs, indicating convergent validity. Discriminant validity was assessed using the Fornell and Larcker (1981) criterion, which compares the square root of each construct's AVE with its correlations to other constructs. The square root of the AVE for each construct (represented on the diagonal) was greater than its correlations with other constructs.

4 Results of the Empirical Study on the Legal Competences of Public Officials Related to the ACP

The results of the study indicate that the respondents generally agree that using the ACP has contributed to the development of key legal competences, such as understanding procedural rules and the protection of personal data. The use of the ACP has positively impacted the development of competences related to the application of rules and analytical thinking in legal tasks. Ethical principles, task precision, and proactive problem solving were strongly impacted by the use of the ACP. ACP use also helped to develop competences from the relational dimension, including effective communication with participants and focusing on client needs. Further, regarding the UTAUT part, the survey revealed a high agreement on items measuring performance expectancy which suggests that the respondents believe the ACP improves task efficiency and correctness, and is useful in task performance. The respondents reported that the ACP is easy to use, with a significant percentage (89.8%) reporting that they were able to quickly learn how to use it. The high ratings for ease of use and understanding of the tool point to a user-friendly experience. The low average agreement on items measuring social influence indicates that co-workers play a relatively minor role in users' decisions to use the ACP. The respondents have the necessary material resources and knowledge to use the ACP, but seem to lack proper internal support when facing difficulties, although they receive support from ACP administrator when needed. A total of 59.8% of the respondents are regular users of the ACP, using it at least once a month.

Table 3: Descriptive statistics for items

		M	SD	%
Performance expectancy				
PE1	The ACP is useful for performing tasks.	4.61	.607	97.2%
PE2	Using the ACP enables me to complete tasks faster.	4.22	.777	80.6%
PE3	Using the ACP allows me to perform tasks more accurately.	4.38	.733	88.9%
PE4	By using the ACP, I have improved my task performance abilities.	4.28	.807	83.3%
Effort expectancy				
EE1	The ACP is easy to use.	4.36	.767	89.8%
EE2	Using the ACP is understandable.	4.46	.676	91.7%
EE3	It is not difficult to become proficient in using the ACP.	4.42	.750	88.0%
EE4	I quickly learn how to use the ACP.	4.42	.725	89.8%
Social influence				
SI1	My colleagues are of the opinion that I should use the ACP when conducting administrative procedures.	3.27	1.065	44.3%
SI2	My colleagues expect me to use the ACP when conducting administrative procedures.	2.89	1.081	29.2%

SI3	My superiors expect me to use the ACP when conducting administrative procedures.	2.93	1.173	33.0%
SI4	My superiors are in favour of me using the ACP.	3.65	1.015	55.7%
Facilitating conditions				
FC1	I have all necessary equipment and resources to use the ACP.	4.42	.688	94.3%
FC2	I know how to use the content of the ACP effectively.	4.30	.733	87.7%
FC3	If I encounter problems using the ACP, I can turn to a colleague at work for help.	3.32	1.143	49.1%
FC4	If I encounter problems using the ACP, I can contact the ACP administrator at the FPA UL.	3.88	.825	67.0%
Frequency of use				
FREQ	Frequency of using the ACP for browsing existing cases.	3.80	.890	59.8%
Technical-legal dimension				
OTPK1	To understand the GAPA and sector-specific procedures.	3.92	.590	85.6%
OTPK2	To be familiar with administrative case law on procedural rules.	3.67	.679	65.8%
OTPK3	To think analytically when solving administrative problems.	3.87	.788	75.0%
OTPK4	To reason legally when solving procedural problems.	3.88	.871	81.3%
OTPK5	To apply general legal rules to specific cases.	3.96	.709	80.4%
OTPK6	To be aware that the processing of personal data is regulated by law.	4.14	.994	80.4%
OTPK7	To be aware that digital content is protected by copyright law.	3.99	.704	72.3%
Entrepreneurial dimension				
PM1	To respect fundamental ethical principles (integrity, impartiality, confidentiality) when performing duties or conducting administrative procedures.	4.13	.969	83.9%
PM2	To perform actions accurately when conducting administrative procedures.	3.84	.954	91.1%
PM3	To proactively seek solutions while balancing the public interest and the rights of the parties.	4.17	.889	79.5%
Relational dimension				
OD1	To communicate effectively with the parties involved in the administrative procedure.	4.26	.720	73.2%
OD2	To communicate respectfully with the parties involved.	4.12	.836	78.6%
OD3	To focus on the parties involved.	3.96	.750	83.0%
OD4	Identify the legal interests of the parties in individual cases.	4.00	.783	77.5%
OD5	Ability to learn.	4.22	.744	87.4%

Note. M = Mean; SD = Standard Deviation; % = Proportion of respondents who selected “agree” or “completely agree” on UTAUT items, proportion of those who reported using the ACP regularly (at least monthly), and proportion of those who indicated that ACP use had a “significant” or “very significant” impact on their development of legal competences.

Source: Own (2025)

The use of the ACP was associated with substantial improvements in technical-legal and entrepreneurial-relational competences among public officials responsible for administrative procedures.

Specifically, the most pronounced gain in the technical-legal competences concerned legal reasoning for resolving procedural problems, where the mean score increased from 3.47 to 4.07. Before using the ACP, 47.9% of public officials reported this competence as developed to a large extent or fully; after the ACP, this share rose to 87.7%. Understanding of the GAPA and sector-specific regulations also improved, with the mean rising from 3.59 to 3.97. Although more than half of public officials (54.8%) already reported this competence as largely or fully developed, the 87.5% figure after using the ACP indicates a significant improvement. Application of general rules to individual cases strengthened as well ($M = 4.05$), with 83.6% reporting substantial or complete development, compared to 58.9% at baseline. Awareness of data-protection regulation was already very high before ACP ($M = 4.21$; 79.5% largely or fully developed, including 42.5% fully developed), yet still improved for 86.3% of public officials. Awareness that digital content is protected by copyright increased from a mean of 3.74 to 3.95, with 57.5% reporting high competence before using the ACP and 76.8% afterwards. Analytical thinking improved from 3.45 to 3.85, with the proportion reporting strong competence rising from 50.7% to 75.3%. Knowledge of administrative case law was comparatively the weakest competence, however, the mean rose from 3.23 to 3.71, and the share with high competence increased from 42.5% to 68.0%.

Under entrepreneurial competences, accuracy in conducting administrative procedures reached the highest overall level, rising from 3.99 to 4.32. While 74.0% already reported strong competence before using the ACP, almost all officials (94.5%) improved further. Ethical conduct and confidentiality started at a high level ($M = 4.27$; 86.3% reporting strong competence) and improved for 87.7% of officials. Proactivity in finding solutions was initially less developed ($M = 3.73$; 54.8% at baseline), but rose to 4.05, with four in five respondents (80.9%) reporting a significant improvement.

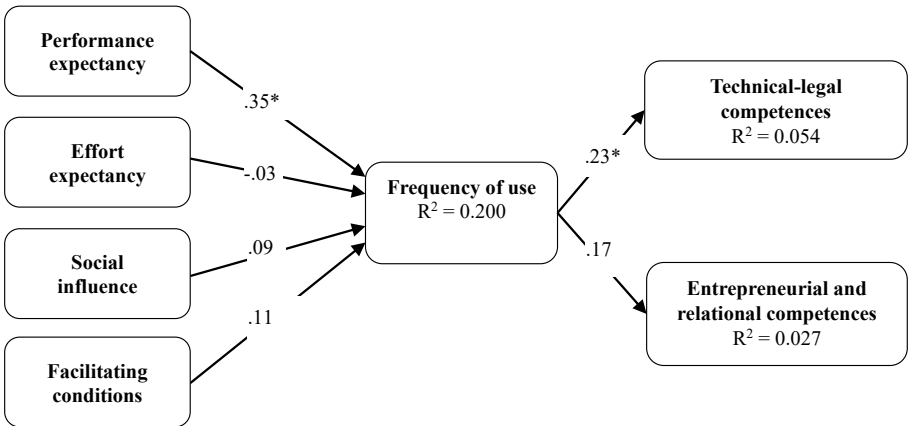
Using the ACP also lead to an improvement in relational competences, whereby recognition of parties' legal interests specifically improved from 3.79 to 4.11, with the share of officials reporting high competence increasing from 63.0% to 86.1%. Effective communication with participants, initially rated at 3.85, rose to 4.03, with improvements reported by 79.5% of respondents. Client orientation, already developed in 78.1% of respondents, was further improved to 89.0%. Respectful communication began at an especially high level ($M = 4.38$; 83.6% largely or fully developed), so overall change was limited, although 87.7% still reported some improvement, and more than half (52.1%) reported full development. The ability to learn was already present in 80.8% of officials and was further enhanced in nearly all cases (93.2%).

Overall, the findings confirm that ACP use makes a significant contribution to legal competence development among public officials. The strongest development was observed in five key areas: accuracy in conducting procedures,

ability to learn, legal reasoning in addressing procedural issues, application of general rules to specific cases, and proactive problem solving. Effective communication with participants also exceeded the threshold of strong competence development. These results highlight the ACP as not only a tool for supporting legal expertise, but also as a mechanism that strengthens the broader professional competences that are crucial for quality public service delivery.

Furthermore, the hypothesised relationships among UTAUT constructs, the frequency of using the ACP, and the perceived development of legal competences as a result of ACP use were tested with structural equation modelling (see Figure 1). The model assessed the acceptance of the ACP measured through predictive power of performance expectancy, effort expectancy, social influence and facilitating conditions on the frequency of use (H1), and subsequently, the effect of frequency of use on the perceived development of legal competences (H2).

Figure 1: The structural model



Note. $* = p < 0.05$.

Source: Own (2025)

The model explained 20% of the variance in usage frequency, 5.4% in technical-legal competences, and 2.7% in entrepreneurial-relational competences, suggesting an overall weak explanatory power. While the statistical explanatory power of the model is modest, the results still provide meaningful insights. They show that the most important factor driving public officials to use the ACP regularly is their belief that it is useful for their work. In other words, if public officials clearly see practical benefits, they are more motivated to integrate the ACP into their daily procedures. More frequent use, in turn, is associated with stronger development of technical-legal competences, while the effects on broader entrepreneurial-relational competences are weaker. This pattern suggests that the ACP is most effective as a tool for strengthening core technical-legal competences, but its potential to support

entrepreneurial-relational competences development may depend on additional organisational or contextual factors.

5 Discussion and Recommendations

In modern public administration, conducting administrative procedures under the General Administrative Procedure Act (GAPA) requires public officials to not only be professionally trained (Kovač and Jerovšek, 2024; Džinić, 2018), but to also possess appropriately developed competences (Sommerman et al., 2025; Kruyen and Van Genugten, 2020; Schneider, 2019). Among these, legal competences are of central importance, as they demonstrate the officials' professional competence in their work (Schaffar, 2021).

Public administration, grounded in the doctrine of Good Governance, is a vital part of contemporary society, contributing to its development and addressing social and individual challenges. Within this framework and the concept of Good Administration, public officials hold a key role in contemporary and complex public administration (Galetta and Ziller, 2024), where conducting administrative procedures is a core task (Pečarič and Stare, 2021). Public officials may conduct administrative procedures if they fulfil formal education and other requirements under Article 31 of the GAPA (Kovač and Jerovšek, 2024). However, effective and professional conduct of administrative procedures requires them to also possess a variety of skills and abilities, which in turn need to be continuously further developed. This guarantees professional administrative services and contributes to the stable and sound functioning of public administration (Vitello et al., 2021; Arzenšek et al., 2019). Administrative procedures increasingly serve as a critical mechanism in this regard in modern society where the role of authority in administrative relations (Galetta and Ziller, 2024) is defined by procedural law and relevant problem-solving-oriented conduct of administrative procedures. Due to the rapidly changing environment, substantive law and classical work organisation no longer meet the needs of participative public governance (Kovač, 2018).

As the complexity of administrative procedures grows, so does the importance of appropriate competences for the public officials conducting these procedures. According to various authors (Villa-Rosas and Spaak, 2023; Korotun and Bogdanova, 2020), public officials who conduct procedures and decide on the rights, obligations, and legal benefits of parties are expected to have acquired and properly developed legal competences. These competences extend beyond administrative-legal expertise to others such as legal analysis, written and oral communication, and legal judgment, gained through legal and public administration studies (Finch and Fafinski, 2020; Isaac et al., 2016; Kovač and Stare, 2014). They continue to develop these competences on the job and through use of the ACP. The ACP, as a pedagogical and research project of the FPA UL and the MPA, serves as a knowledge repository, providing stakeholders with generic and frequently usable expert responses to concrete administrative legal dilemmas in line with the proper application of the GAPA and the Decree on Administrative Operations (Official Gazette

of the Republic of Slovenia [Uradni list RS], Nos. 9/18, 14/20, 167/20, 172/21, 68/22, 89/22, 135/22, 77/23, and 24/24) as well as other regulations. The ACP facilitates networking among diverse stakeholders, with a key role played by academic staff from the FPA UL, the MPA, and experts from administrative bodies as it enables users (such as parties, citizens, companies, NGOs, and civil servants) to identify practical administrative law issues, contributing to their improved functioning and, consequently, societal benefit (Novak et al., 2025; Kovač, 2024).

Numerous authors (Bedner et al., 2020; Hamilton, 2014; Shultz and Zedeck, 2011) emphasise that lawyers and public officials must build up their legal competences as this enhances their work efficiency. Others (Hamilton and Bilionis, 2022; Carrel, 2021; Carrel, 2019; Mak, 2017), who examined legal competences through competency models, argue that such individuals are therefore more competent in their work. In this context, it can be concluded that legal competences are crucial specifically for the work of public officials. However, a review of existing research on legal competences shows that such studies are nearly non-existent, with only one exception (cf. Kovač and Stare, 2014). Thus, for the empirical part of the study of ACP use and the development of legal competences among public officials, it was necessary to design a conceptual framework of legal competences. This framework served as the basis for a structural model based on the (UTAUT), which was then used in the study to examine how public officials' attitudes toward the ACP and the frequency of its use influence the development of their technical-legal and entrepreneurial-relational competences.

The results of the study, as presented in Figure 1 and obtained from 112 public officials between 2023 and 2025, indicate that performance expectancy has a statistically significant positive effect on the frequency of ACP use ($\beta = 0.349$, $p = .012$). Respondents who perceive the ACP as useful tend to use it more often. In contrast, effort expectancy, social influence, and facilitating conditions do not appear to significantly impact the frequency of ACP use ($p > .05$). Therefore, H1 is partially accepted. It can thus be assumed that supervisors and colleagues did not significantly influence respondents' frequency of ACP use, nor did they expect its use in the conduct of administrative procedures. However, the respondents confirmed that they perceived ACP as useful in their work, which gave rise to the possible conclusion that they used it voluntarily when conducting administrative procedures. Additionally, facilitating conditions (e.g., availability of equipment, access to resources, or the capacity to use the ACP) did not affect usage frequency; when encountering problems with the ACP, respondents typically contacted the ACP administrator at the FPA UL.

The results also show that the frequency of use significantly predicted technical-legal competences ($\beta = 0.232$, $p = .023$). Regular use of the ACP was associated with greater self-reported development of technical-legal competences. The effect on entrepreneurial-relational competences was positive but marginally non-significant ($\beta = 0.165$, $p = .094$). Consequently, H2 is

accepted. It was hypothesised that the development and enhancement of legal competences through ACP use is indirectly influenced by performance expectancy, effort expectancy, social influence, and facilitating conditions, as mediated by frequency of use. Specifically, it was assumed that better acceptance of the ACP leads to more frequent use, which in turn supports the development and enhancement of legal competences. The findings suggest that only performance expectancy has a statistically significant positive effect on the frequency of ACP use. Furthermore, frequency of use positively influences the development of technical-legal competences, but not the entrepreneurial-relational legal competences. Although public officials developed entrepreneurial and relational competencies most strongly through the use of the ACP, these advances cannot be explained by ACP acceptance. The development of entrepreneurial and relational competencies appears to be influenced by factors outside the scope of the current model.

Descriptive statistics (Table 3) indicate that the use of ACP contributed most strongly to the development of relational competences, particularly the ability to communicate effectively and respectfully with the parties involved in the administrative procedure. Additionally, public officials reported improvement in entrepreneurial competences, especially in their ability to uphold core ethical principles (such as integrity, impartiality, and confidentiality) and to proactively seek solutions that balance the public interest with the rights of the parties. These competences help improve the public officials' dialogue with the parties involved in administrative procedures, enabling the establishment of relevant facts and the harmonisation of interests among all stakeholders. In this way, both public officials and participants are proactively involved throughout the entire administrative process. Similarly, the development of entrepreneurial and relational competences is emphasised by several authors (Hamilton and Bilonis, 2022; Finch and Fafinski, 2020; Carrel, 2021; Carrel, 2019; Shultz and Zedeck, 2011) who identify these as essential for legal professionals working with clients, as understanding, empathy, and more effective communication aid in resolving legal issues and building trustworthy client relationships. The technical-legal competences (e.g. legal reasoning for resolving procedural problems, understanding of the GAPA and sector-specific procedures, application of general rules to individual cases) were developed to a lesser extent as a result of ACP use; however, the extent was in no way negligible. This suggests that public officials already possess adequate legal knowledge (i.e., familiarity with fundamental principles of the GAPA) and understand general elements and structures of administrative procedural law, which they apply to solving concrete administrative procedural problems in practice. Several authors (Bedner et al., 2020; Isaac et al., 2016; Hamilton, 2014) stress that it is crucial for students to acquire technical-legal competences (e.g., knowledge of doctrinal law, legal analysis, legislation comprehension, knowledge of current norms, statutes, and regulations) during their studies, as these form the foundation for their professional work. It is noteworthy that Gerkman and Cornett (2016) found that some students and employees may not have adequately developed legal competences, which could affect the quality and results of their work (Mak, 2017).

This article thus answers the research question, confirming that ACP use influences the acquisition and development of technical-legal, entrepreneurial, and relational competences among public officials. The results offer relevant insights, demonstrating that the ACP is a crucial resource supporting officials in advancing their legal competences and thereby facilitating more effective resolution of administrative-legal dilemmas.

Theoretical and practical implications, limitations and suggestions for future research: This study has several important theoretical and practical implications. The central theoretical implications are the conceptual framework of legal competences of public officials and the structural model, which advance the theory of public officials' legal competences. From a practical perspective, they open possibilities for various studies on legal competences subject to the factors posited by the UTAUT across different ACP users (e.g., students and the parties involved). The findings indicate that the ACP plays a dual role: it aids in resolving administrative-legal dilemmas and enables more participatory and problem-solving-oriented administrative decision-making.

Although our study offers useful insights, certain limitations should be acknowledged. First, since previous authors (Hamilton and Bilionis, 2022; Carrel, 2021; Bedner et al., 2020; Finch and Fafinski, 2020; Isaac et al., 2016; Hamilton, 2014, etc.) investigated the legal competences of law students and lawyers, the legal competences of public officials in our conceptual framework and structural model were interpreted subjectively. Second, the conceptual framework and structural model were only empirically tested on a specific sample of ACP users – public officials conducting administrative procedures – but not on other ACP users (e.g., the parties involved, students, and other members of the public), preventing us from drawing direct generalisations about the results. Third, the results are interpretatively adapted to existing studies on public officials' legal competences, and since legal competences are socially and individually conditioned they may change over time, limiting the long-term relevance of the conceptual framework and structural model.

A number of improvements are proposed based on this work, including the future broadening of research on the impact of ACP use on the development of legal competences among other ACP users. Employing mixed methods in the broadened study would provide data that would broaden the results and aid their comparative analysis as well as the critical evaluation of ACP's role in legal competence development. Furthermore, it would be advantageous to upgrade the ACP with artificial intelligence tools and a tutorial (educational video) about its use and about the impact on users' legal competence development. Generally, this would help ACP users better understand the foundational principles and rights laid down by administrative procedural law, especially as administrative procedures become increasingly complex. Additionally, it would be appropriate to introduce ACP's usefulness to law and public administration students, who are still developing legal competences during their studies, as well as to newly employed public officials who do not yet meet all professional requirements under Article 31 of the GAPPA (e.g.,

those who have not yet passed the professional examination in the administrative procedure). Organising training on ACP use for public officials wishing to advance their legal knowledge and strengthen their existing legal competences would also be beneficial.

6 Conclusion

In modern public administration, public officials must possess adequately developed legal competences to address complex societal challenges and conduct administrative procedures effectively. Administrative procedures in Slovenian public administration represent a critical legal interface between the parties involved; therefore, it is essential that public officials master their technical and entrepreneurial-relational legal competences as well as continuously develop them in their work. The ACP, a joint pedagogical-research project of the FPA UL and the MPA, plays a significant role in this context, and supports the development of administrative law and equality before the law through interpretative application of GAPA principles. It represents a synergistic form of collaborative governance and serves as a tool for public officials to develop their legal competences, thereby fostering participatory and problem-solving-oriented administrative decision-making and contributing to sustainable societal development.

The central contributions of this article are the development of a conceptual framework of legal competences and a structural model. Using these, a study conducted in spring 2025 with public officials from Slovenian administrative bodies showed that, by using the ACP between 2023 and 2025, public officials developed their entrepreneurial and relational competences to a significant extent, and to some extent their technical-legal competences, too. It was also found that both the positive attitude of public officials toward the ACP and the frequency of its use contribute to the development of all three groups of legal competences. This in turn indicates that public officials recognise the importance of the ACP, perceiving it as a quick-to-learn and easy-to-use tool as well as beneficial in their work or in conducting administrative procedures.

The importance of developing legal competences using the ACP should continue to be highlighted, for example, by expanding research on the influence of ACP use on the development of legal competences among its other users (e.g., students, the parties involved, and other members of the public), demonstrating ACP's utility through organised training of students and public officials, and introducing innovations (e.g., AI tools) to the ACP. By developing legal competences more effectively, public officials resolve administrative procedures more efficiently, which is crucial in practice for all the parties involved and, in a broader sense, for achieving the goals and principles of modern public administration.

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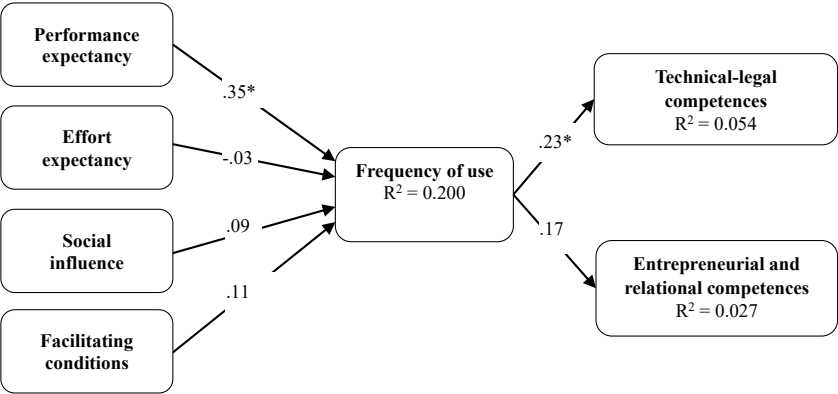
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Appendix 1: Questionnaire

Competence pillar	Legal Competences	To what extent did you have this competence developed before using the ACP?					To what extent, in your opinion, is this competence developed today due to the use of the ACP?				
		1 – None	2 – Low	3 – Moderate	4 – Much	5 – Completely	1 – None	2 – Low	3 – Moderate	4 – Much	5 – Completely
Technical-legal competences	To understand the GAPA and sector-specific procedures.										
	To be familiar with administrative case law on procedural rules.										
	To think analytically when solving administrative problems.										
	To reason legally when solving procedural problems.										
	To apply general legal rules to specific cases.										
Entrepreneurial competences	To be aware that the processing of personal data is regulated by law.										
	To be aware that digital content is protected by copyright law.										
	To respect fundamental ethical principles (integrity, impartiality, confidentiality) when performing duties or conducting administrative procedures.										
	To perform actions accurately when conducting administrative procedures.										
	To proactively seek solutions while balancing the public interest and the rights of the parties.										
Relational competences	To communicate effectively with participants in the administrative procedure.										
	To communicate respectfully with parties.										
	To communicate respectfully with parties.										
	Identify the legal interests of the parties in individual cases.										
	Ability to learn.										

Appendix 2: Structural (UTAUT) Model



Triple Helix Model and Artificial Intelligence in Public Administration

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ABSTRACT

Although the Triple Helix model has been widely analysed in the context of innovation ecosystems, its contribution to fostering the adoption of artificial intelligence (AI) within public administration remains insufficiently explored. This study addresses this research gap by examining how interactions among universities, industry, and government facilitate AI integration into digital governance across selected EU countries.

Purposes: The main research objectives are to: (a) assess the digital maturity of the selected EU countries; (b) evaluate how Triple Helix interactions shape AI adoption in public administration; (c) analyse the interrelationships among the three actors within the context of AI governance; and (d) explore the connections between each country's AI strategy and its broader governance mechanisms.

Design/Methodology/Approach: The research combines both quantitative and qualitative methods, utilizing data from AI Watch, the European Commission, Eurostat, Oxford Insights, and the OECD.

Findings: The findings reveal significant disparities among the selected EU member states and identify critical factors that either facilitate or constrain AI integration within public administration, offering new insights into the evolving role of the Triple Helix model in the era of algorithmic governance.

Practical Implications: The results are particularly relevant for public sector decision-makers, researchers in governance and innovation studies, and policymakers seeking sustainable models for digital transformation and collaborative innovation.

Originality/Value: This research presents the first cross-national empirical study linking Triple Helix dynamics to AI-driven innovation in the public sector, incorporating a range of indicators. The originality of this research lies in its conceptual integration of the Triple Helix framework with the transformative capacities of artificial intelligence in reconfiguring public governance and innovation dynamics within a few EU countries.

Keywords: *Triple Helix model, artificial intelligence, public administration, innovation ecosystems, European Union, comparative analysis, digital transformation, digital governance.*

Model trojne vijačnice in umetna inteligenca v javni upravi

POVZETEK

Čeprav je model trojne vijačnice široko analiziran v kontekstu inovacijskih ekosistemov, je njegov prispevek k spodbujanju uvajanja umetne inteligence (UI) v javni upravi premalo raziskan. Ta študija zapolnjuje raziskovalno vrzel z analizo, kako interakcije med univerzami, industrijo in vlado pospešujejo vključevanje UI v digitalno upravljanje v izbranih državah EU.

Nameni: glavni raziskovalni cilji so: (a) oceniti digitalno zrelost izbranih držav EU; (b) ovrednotiti, kako interakcije v okviru trojne vijačnice oblikujejo sprejemanje UI v javni upravi; (c) analizirati medsebojna razmerja med tremi akterji v kontekstu upravljanja UI; ter (d) raziskati povezave med nacionalno strategijo za UI posamezne države in njenimi širšimi mehanizmi upravljanja.

Načrt/metodologija/pristop: raziskava združuje kvantitativne in kvalitativne metode ter uporablja podatke AI Watch, Evropske komisije, Eurostata, Oxford Insights in Organizacije za gospodarsko sodelovanje in razvoj (OECD).

Ugotovitve: rezultati razkrivajo pomembne razlike med izbranimi državami članicami EU in opredeljujejo ključne dejavnike, ki bodisi omogočajo bodisi omejujejo vključevanje UI v javno upravo, pri čemer ponujajo nove vpoglede v razvijajočo se vlogo modela trojne vijačnice v dobi algoritmičnega upravljanja.

Praktične implikacije: rezultati so posebej relevantni za odločevalce v javnem sektorju, raziskovalce s področja upravljanja in inovacijskih študij ter za oblikovalce politik, ki iščejo trajnostne modele za digitalno preobrazbo in sodelovalne inovacije.

Izvirnost/vrednost: gre za prvo čeznacionalno empirično študijo, ki povezuje dinamiko trojne vijačnice z inovacijami, ki jih poganja UI, v javnem sektorju ob upoštevanju niza kazalnikov. Izvirnost raziskave je v konceptualni integraciji okvira trojne vijačnice s preoblikovalnimi zmožnostmi umetne inteligence pri preoblikovanju javnega upravljanja in inovacijskih dinamik v nekaterih državah EU.

Ključne besede: *model trojne vijačnice, umetna inteligenca, javna uprava, inovacijski ekosistemi, Evropska unija, primerjalna analiza, digitalna preobrazba, digitalno upravljanje.*

JEL: O33, O38, R53, R58.

1 Introduction

In the era of the knowledge-based economy and intelligent artificial technologies, innovation is no longer the exclusive result of university research or private investments, but of a strategic interaction between several institutional actors. In recent years, the European Union has placed a strong emphasis on the ethical and strategic adoption of Artificial Intelligence (AI) across public sectors. According to the *European Commission's Coordinated Plan on Artificial Intelligence (2021)* and the *EU AI Act (2024)*, member states are encouraged to integrate AI to improve administrative efficiency, transparency, and citizen-centred services. However, the level of AI adoption remains uneven across member states, with significant disparities in digital readiness, data governance, and institutional capacities.

The Triple Helix model is increasingly recognized as both an explanatory and operational framework for analyzing collaborative innovation processes (Etzkowitz, 2003a, p. 298; Etzkowitz, 2003b, p. 305). Within the European Union, this approach has been embedded in various regional and national initiatives, supported by structural funds and programs such as Horizon Europe. Originally proposed by Etzkowitz and Leydesdorff (1995a, p.29), the Triple Helix model offers a conceptual and practical foundation for fostering innovation through dynamic and systemic interactions among universities, industry, and government. This article analyzes the application of the Triple Helix model in different European Union member states, with a focus on good practices, public policies, governance structures, and economic and social results in the context of the accelerated growth of the integration of digital technologies and artificial intelligence (Nyathani, 2023, p. 3). Case studies from EU Member States illustrate different stages of maturity of innovation ecosystems and offer relevant lessons for future European policies (Grilli and Pedota, 2024, p. 242). The Triple Helix model is becoming increasingly relevant in the context of the adoption of artificial intelligence (AI) technologies in public administration (Reis et al. 2019, p. 132). AI requires both academic expertise (universities and research institutes), applied technological solutions (industry, business), and institutional capacity for integration and regulation (government through central, regional, and local administrative authorities). Success stories from some European countries (Neumann et al., 2024, p. 121) are instructive in this regard. Estonia has developed and implemented the KrattAI project, in which the government collaborates with universities and the IT industry to create AI-based digital assistants for public administration. In Finland, the AI4Cities project brings together local authorities, universities, and companies to develop sustainable urban AI solutions. In France, the Paris-Saclay AI Hub project is an initiative where cutting-edge research, AI startups and public policies focused on digital ethics intersect.

The Triple Helix model has proven effective in stimulating innovation in EU countries with mature infrastructure and coherent public policies (Etzkowitz, 2008, p. 149). To replicate its success across the Union, it is necessary to adapt models to the regional context, strengthen institutional capacity, and encour-

age cross-sectoral collaboration. The future of European innovation depends on the ability of actors in the three spheres to act in an integrated and adaptive manner in a competitive global context (Parent-Rochelleau and Parker, 2022, p. 14). The EU supports these directions through initiatives such as the Green Deal, Horizon Europe and the EIT (European Institute of Innovation and Technology), promoting responsible and sustainable innovation. The Triple Helix model provides the institutional and cultural infrastructure necessary for the integration of AI in public administration. It is not a technological model, but it is becoming essential for the collaborative governance of emerging technologies, including artificial intelligence.

This study focuses on a few EU member states, Estonia, Finland, Germany, France, and Romania, as representative cases that reflect varying levels of AI maturity and digital governance. Estonia and Finland are recognized for their advanced e-government infrastructures, while Germany and France illustrate large-scale administrative systems adapting to AI regulation and ethical governance. Romania represents a developing context, highlighting structural and institutional barriers to AI adoption. The comparative selection included in this research enables a nuanced understanding of the Triple Helix dynamics across different levels of AI readiness within the EU. From this perspective, this research aims to identify, analyze, and categorize selected EU member states according to specific variables derived from the Triple Helix model, within the broader context of developing and integrating diverse AI applications in public interest services. Although the principles of the Triple Helix model are formally embedded in European innovation strategies, their practical implementation differs considerably across Member States. To standardize innovative performance and strengthen knowledge and technology ecosystems across the European Union, a differentiated but coherent approach is needed at the level of public policies. While the literature on AI in the public sector has expanded rapidly, most studies focus on technological capabilities, ethics, or citizen trust (e.g., Janssen et al., 2020; Zuiderwijk et al., 2022). However, limited attention has been given to the institutional and collaborative mechanisms that enable or constrain AI innovation in public administration — particularly through the *Triple Helix framework* (interaction between government, academia, and industry). This paper seeks to bridge this gap by examining the functioning of the Triple Helix model in the context of AI adoption within selected EU public administrations, as well as the structural conditions that enable effective governance and innovation. The analysis conducted provides a coherent foundation of data and insights on the selected EU countries, categorized according to specific variables of the Triple Helix model, in the broader context of the rapid expansion of artificial intelligence across administrative and related domains. In the EU literature, the role of AI in public administrations is rapidly growing, being the subject of interesting empirical and conceptual studies, which are selectively presented in the next section of the paper.

This paper contributes to the literature, offering both theoretical insights for innovation governance and practical implications for the implementation of the EU AI Act and related digital public policies.

This work is organized into four interrelated sections. The first section provides a comprehensive review of key concepts and scholarly studies on the Triple Helix model, emphasizing its relevance to the application of artificial intelligence in public administrations across EU member states. The second section details the research methodology, including the study's objectives, research questions, hypotheses, and principal variables, as well as the analytical framework employed to systematically investigate the topic. The third section presents the research findings alongside a correlative analysis, highlighting patterns and insights derived from the data. Finally, the fourth section offers the main conclusions and underscores the study's contributions to advancing knowledge in the field of public governance and AI implementation.

2 Literature Review About the Triple Helix Model in the EU Member States

The Triple Helix model, developed by Henry Etzkowitz and Loet Leydesdorff (2001, p. 24), conceptualizes the interactions between university, industry, and government as pillars of innovation in a knowledge-based economy and artificial intelligence. In the EU, the Quadruple/Quintuple Helix extensions have added the sphere of civil society and the environment, strengthening a systemic framework for digitalization and AI (Androniceanu and Georgescu, 2023; Androniceanu et al., 2022). Our research aims to analyze the synergy between the Triple Helix and AI in European public administration, as reflected in the specialized literature. Henry Etzkowitz and Loet Leydesdorff (2001, p. 24, 1995b, p. 115; 1999, p. 117) laid the foundations of the model in 1995, emphasizing the hybrid role of universities, regulated by market and governance dynamics. Leydesdorff (2009, p. 381) extends the model, emphasizing the new evolution in knowledge-based economies. Elias Carayannis and Campbell (2009, p. 221) formulated the Quadruple/Quintuple Helix, including civil society and the environment in the innovation process. Research on these topics continues at an accelerated pace in the context of the large-scale penetration of artificial intelligence tools in public administration in EU countries and in other areas that provide public services (Makridakis, 2017, p. 52). Thus, an intensification of interdisciplinary approaches is observed in research in the last decade. Other researchers explore AI for the public sector, emphasizing the essential role of cross-sectoral collaboration (university–industry–government), but also the managerial and technological challenges that accompany such initiatives. Straub, Morgan, Bright and Margetts (2022, p. 162) propose an integrated framework for government AI through multiple dimensions: operational fitness, epistemic alignment, and normative divergence. JRC (Joint Research Centre, 2024) identified and analyzed the adoption of AI in public administration through an analysis of 574 managers based on the following main dimensions: leadership, technical-ethical skills, and governance. There is a par-

ticular interest in analyzing the synergy of the main actors in the Triple Helix model with new applications of artificial intelligence that can greatly support the cooperation between the main actors of the Triple Helix model, as universities generate knowledge, companies develop AI solutions, and the government adopts/regulates everything needed in a Triple Helix structure. Michalec et al. (2024, p. 62) show that administrative centers led by mixed teams can reduce institutional barriers. Research within the JRC has highlighted the role of AI in facilitating data interoperability through ontologies and taxonomies in European public administration. AI GOV (Straub et al., 2022, p. 163) introduces procedural, structural, and relational practices at strategic and tactical levels, which can be coordinated through Triple Helix nodes.

JRC (2024) recommends developing ethical and legal skills in AI governance (Rodgers et al., 2024, p. 25). In 2023, Tangi and his team at JRC produced a large study demonstrating the added value of AI in interoperability, supported by government-university-industry collaboration. The European Commission, through the Futurium programme (European Commission, 2023) describes concrete uses such as AI assistants for employees (HR, procurement, reporting), highlighting investments in governance and innovation culture (Etzkowitz and Carvalho de Mello, 2004, p. 162). Consequently, there is a solid body of literature exploring the interaction between AI and public administration in the context of the Triple Helix model, from theoretical perspectives (Etkowitz and Leydesdorff, 1999, p. 118), to applied cases and EU frameworks (JRC, 2024). This convergence provides an integrated framework for innovation, governance and skills, but the challenge of transforming this potential into real impact on public services and democratic trust remains. The literature (Votto et al., 2021, p. 14; Etzkowitz and Klofsten, 2005, p. 246) contains detailed case study examples from various EU member states, illustrating how the Triple Helix model is applied in public administration, in the context of artificial intelligence (Kruger and Steyn, 2025, p. 28). For example, during the pandemic, in Spain, a group of experts coordinated by Pierra Riccio created a multi-disciplinary center using anonymized mobility data and public surveys for epidemiological predictions and resource allocation based on the Triple Helix model and AI applications (Riccio et al., 2022, p. 7). The Triple Helix model in Spain had as main actors the regional government, the University of Alicante and the telecom companies: Telefonica and Vodafone. Another example of the application of the Triple Helix Model is identified in Denmark in the municipality of Gladsaxe. AI applications used are the internal Chatbot "GladGPT" (ChatGPT-4), launched in 2023, for employee support. In 2017, the algorithm for detecting vulnerable families was discontinued due to transparency and bias issues. The Lüneburg district and the federal states in Germany have examples of implementing a variety of chatbots to reduce direct interaction between the administration and citizens, but the results are varied (Gill et al., 2024, p. 21; Strohmeier, 2020, p. 352). Other researchers emphasize the importance of AI strategies at the state (Bundesländer) level: competencies, regulations, and different approaches from one state to another. Other experimental examples are identified in the Czech Republic between the Ministry of the Interior and universities, using various AI ap-

plications for the analysis of databases from population registers, security, and e-government. In Poland, there is a high Government AI Readiness Index (62.5%), with a progressive growth trend until 2027. The Triple Helix model consists of collaborations between the state, research institutions, and private companies specialized in ICT, focusing on chatbots, predictive analysis, and smart cities. Applied research and successful implementations of the Triple Helix model also exist in Norway in the municipality of Trondheim, where a study was conducted in approximately 200 public institutions, and 19 interviews were organized. The study analyzed the early adoption of AI, with risks of discrimination and political pressure. In Italy, the PRISMA project was carried out (2016): an interoperable cloud platform for citizen engagement (Catania and Siracusa municipalities) - Triple Helix models between local governments, universities, and the IT industry. AIDA is an AI system based on deep learning for crime prevention and collaboration between academia, police, and the public sector. In Belgium and Latvia, AI innovations in administration based on the Triple Helix model were carried out. In Belgium, several experimental research studies were conducted, and projects were implemented. One of the successful research areas was Knowledge management with generative AI (smart regulation). Another was Job matching (Jobnet). As can be seen, the Triple Helix Model in the context generated by AI in public administration in the public sector in EU countries is confirmed, but the risks of discrimination and cultural barriers represent major challenges (Ranga and Etzkowitz, 2013, p. 247). Theoretical frameworks (Nosratabadi et al., 2019, p. 18; Rodgers et al., 2024, p. 27.) and studies from different countries (Estonia, Italy, Germany, Spain, etc.) show that success comes from ethical policies, human involvement, and adaptive organizational culture, but also from massive investments in infrastructure and in the training of human resources and citizens culture (Lorincova et al., 2024, p. 19; Michalec, 2024, p. 64). Dvorský (2025, p. 98) emphasizes the importance of using AI in risk management. Expert recommendations include piloted approaches, rigorous training, and transparency and accountability mechanisms (Stachová et al., 2024). AI transforms HR in the public sector – from recruitment, performance appraisal, to professional development and planning, emphasizing the efficiency and personalization of new models, but warns of the risks of bias, transparency, and confidentiality (Mwita and Kitole, 2025). Nosratabadi et al., 2022, p. 23) present a systematic approach (“Employee Lifecycle Management”), highlighting the use of algorithms (Random Forest, SVM, Neural Networks) at all stages of the employee life cycle – recruitment, retention, and off-boarding. Rodgers et al. (2023) address “ethical decision-making” in HR, emphasizing the integration of responsible AI to eliminate bias. The Springer (2025) study from Tanzania shows that the success of AI implementation in HR requires technological infrastructure and organizational capital. The study draws attention to organizational culture and the fact that AI acceptance requires managerial involvement, cultural alignment and dedicated task forces.

Through the #KrattAI initiative, Estonia is developing virtual robots to guide staff and citizens. The “job matching” system has been extended to public HR, suggesting positions in line with users’ profiles. The Jobnet system uses

machine learning to match candidates to open positions in public administration (Garg et al., 2022, p. 607). A JRC comparative study conducted in Italy and Germany (N=1411) shows that human supervision does not prevent discrimination in AI decisions. A “fair AI” can reduce gender bias, but remains influenced by the prejudices of the assessor. Discrimination remains a problem: even algorithms designed for fairness can be influenced by the actions of human assessors (Meshram, 2023, p. 329; Androniceanu, M., 2024, p. 91; Androniceanu, M., 2025, p. 110). Rigid or bureaucratic institutional culture reduces AI adoption. Solutions: task force, “skunk works” require training and early involvement of institutional leadership (Malin et al., 2023, p. 8). Adopting AI requires clear rules, transparency, and trained personnel who can override automated decisions, as recommended by various researchers (Alaa, 2023, p. 348; De Alwis et al., 2022, p.190; Rahman and Audin, 2020, p. 259). Relevant empirical studies to discover the implications of the Triple Helix model and AI applications are identified in the literature (Wirtz, 2018, p. 609). Some of the relevant ones are presented below. In Sweden, an empirical analysis was carried out in public administration with HR analytics. The research that was carried out was based on national, regional, and local data obtained through semi-structured interviews for 51 respondents, all middle-level managers in the Swedish public sector. As the results presented in the paper “Reasons for HR analytics adoption in public sector organisations” show, organisations currently use only descriptive HR analytics (dashboards, reports), but intend to evolve towards predictive analytics. The identified determining factors were: internal pressure for efficiency, the need to quantify HR indicators, and data availability (Androniceanu, 2025, p. 82; Androniceanu, 2024, p. 110).

The main challenges are: limited technological capacity, lack of skills, and conservative organisational culture. The research showed that success depends on data infrastructure, technical skills, and strategic direction, including the qualitative involvement of HR and non-HR actors. The main advantages and challenges of the penetration of artificial intelligence in human resource management in public institutions, identified by Mwita and Kitole in the work published in 2025, are presented in Table 1.

The findings reported by Mwita and Kitole (2025, p. 12) highlight the potential risks of decision-making errors associated with the use of automated artificial intelligence systems in human resource management within public institutions, as illustrated in Figure 1.

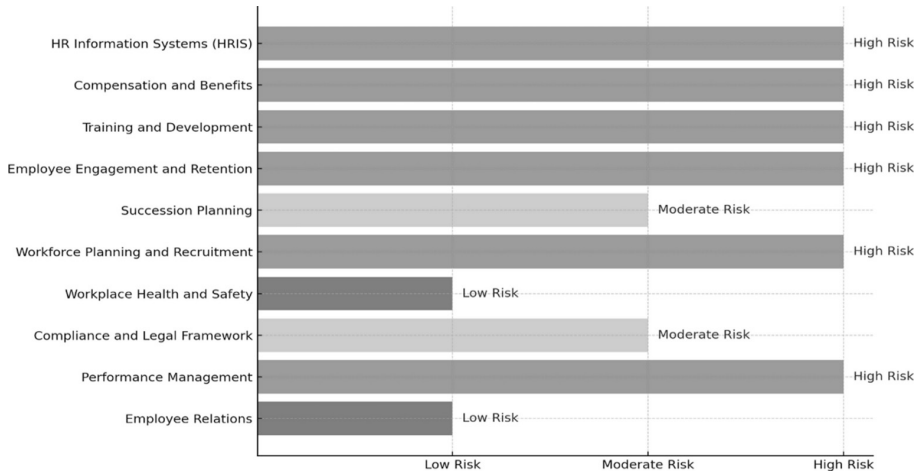
Table 1: Potential benefits and challenges of artificial intelligence in human resource management in public institutions

HRM Component	AI Benefits	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Workforce Planning and Recruitment	AI automates candidate screening to identify the best fit efficiently	87 (40%)	65 (30%)	43 (20%)	17 (8%)	5 (2%)
	AI enhances onboarding with personalized training modules for new hires	85 (39%)	67 (31%)	42 (19%)	18 (8%)	5 (2%)
Performance Management	AI generates actionable insights through continuous performance tracking	78 (36%)	70 (32%)	43 (20%)	19 (9%)	7 (3%)
	AI improves feedback accuracy with unbiased data analysis	80 (37%)	68 (31%)	44 (20%)	18 (8%)	7 (3%)
Training and Development	AI customizes employee training to address individual skill gaps	81 (37%)	74 (34%)	41 (19%)	15 (7%)	6 (3%)
	AI identifies future skill requirements for strategic upskilling	83 (38%)	70 (32%)	43 (20%)	15 (7%)	6 (3%)
Compensation and Benefits	AI uses predictive analytics to design competitive salary structures	83 (38%)	72 (33%)	39 (18%)	17 (8%)	6 (3%)
	AI simplifies benefit administration by automating complex processes	80 (37%)	73 (34%)	41 (19%)	17 (8%)	6 (3%)
Employee Relations	AI monitors employee sentiment to detect early signs of dissatisfaction	74 (34%)	69 (32%)	50 (23%)	19 (9%)	5 (2%)
	AI recommends proactive conflict resolution strategies	76 (35%)	67 (31%)	51 (24%)	18 (8%)	5 (2%)
Compliance and Legal Framework	AI ensures adherence to regulatory changes with real-time alerts	76 (35%)	73 (34%)	42 (19%)	20 (9%)	6 (3%)
	AI reduces human errors in compliance documentation and auditing	78 (36%)	71 (33%)	43 (20%)	19 (9%)	6 (3%)

HRM Component	AI Benefits	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Workplace Health and Safety	AI tracks workplace conditions to predict and prevent safety risks	79 (36%)	68 (31%)	44 (20%)	19 (9%)	7 (3%)
	AI facilitates wellness programs by monitoring employee health metrics	81 (37%)	69 (32%)	43 (20%)	17 (8%)	7 (3%)
HR Information Systems (HRIS)	AI streamlines data management and automates repetitive tasks in HR	85 (39%)	71 (33%)	41 (19%)	14 (6%)	6 (3%)
	AI provides predictive analytics for strategic workforce planning	82 (38%)	72 (33%)	42 (19%)	15 (7%)	6 (3%)
Succession Planning	AI identifies potential leaders through performance data analysis	84 (39%)	69 (32%)	44 (20%)	16 (7%)	4 (2%)
	AI maps career pathways to ensure seamless succession transitions	83 (38%)	68 (31%)	45 (21%)	17 (8%)	4 (2%)
Employee Engagement and Retention	AI predicts attrition risks by analysing engagement trends	82 (38%)	72 (33%)	43 (20%)	16 (7%)	4 (2%)
	AI designs personalized retention strategies using employee data insights	83 (38%)	71 (33%)	44 (20%)	15 (7%)	4 (2%)

Source: Mwita, K. M. and Kitole, F. A. (2025). Potential benefits and challenges of artificial intelligence in human resource management in public institutions. *Discover Global Society*, 3(35), pp. 1–19.

Figure 1: Risks Associated with AI in Human Resource Management



Source: Mwita, K. M., Kitole, F. A. (2025). Potential benefits and challenges of artificial intelligence in human resource management in public institutions. *Discover Global Society*, 3(35), pp. 1–19.

Another example of relevant empirical research conducted in the Swedish public administration is about AI systems integrated in the Swedish Public Employment Service (PES). The study was conducted in 2024 and the main results were published in the same year (Berman et al., 2024, p. 9). The theoretical framework of the research was based on Institutional Theory, Resource-Based View, and Ambidexterity. Case analysis was used as the method, with an emphasis on transparency, interpretability and stakeholder involvement. The results show that AI is effective in supporting decisions (assessment of assistance applicants), but transparency and stakeholder participation are suboptimal, which requires constant audits. Another study was conducted in 2021 in Germany by Kern and his team (Kern et al., 2021). The study was conducted on the German employment service, and the analysis of administrative data for profiling the unemployed. The methodology consisted of a comparative evaluation of predictive models with a focus on accuracy and equity. The results of the study highlighted the existence of performing models, but differentiated in the classification of policies, which can generate inequities, requiring a rigorous audit before the implementation of the system. Interesting experimental research was conducted in the Netherlands (Alon Barkat and Busuioc, 2021, p. 539) on the interaction between human resources and AI in public administration. Extended and diversified results were published three years later (Alon-Barkat and Busuioc, 2023, p. 157). The methods used were controlled psychological experiments with public decision-makers. The Triple Helix model provides a solid theoretical framework for understanding AI-based public innovation ecosystems in public administration. However, to translate the potential into real outcomes – such as improved decisions and citizen trust – robust research, cross-sectoral skills, and transparent and accountable governance are needed. The research underlying this paper con-

tributes to a classification of the selected EU countries and to an analysis of the state of implementation of the three pillars of the Triple Helix model in EU governance processes, in the context of artificial intelligence.

In summary, the existing literature demonstrates that the integration of the Triple Helix model with artificial intelligence in public administration remains an emerging yet up-and-coming field. While substantial progress has been made in conceptualizing collaborative frameworks among government, academia, and industry, empirical evidence on effective implementation and long-term outcomes is still limited. Cross-country analyses, particularly within the EU, reveal varying levels of maturity in AI governance and innovation ecosystems. Consequently, further research is needed to explore how the Triple Helix model can foster responsible, transparent, and ethically grounded AI adoption in public governance, contributing to both administrative efficiency and democratic accountability.

3 Research Methodology

According to the specialized literature, the variables for the Triple Helix model are specific to the three main actors: the academic environment providing knowledge, research and innovation, the business environment (industry) providing smart solutions and technologies in the context of public-private partnerships and the government/public administration, which develops public policies, provides total or partial financing and is the beneficiary of research and innovation. This study adopts a comparative, mixed-method research design to explore the relationship between Artificial Intelligence (AI) adoption in public administration and the Triple Helix model of innovation across selected EU member states. The study focuses on a few EU member states. This design enables comparative insights rather than exhaustive coverage, aligning with the study's aim to analyze structural and institutional determinants of AI adoption in public administration. This purposive sampling enables a comparative analysis of the Triple Helix dynamics and institutional factors influencing AI adoption in different administrative and policy environments, rather than aiming for exhaustive coverage of all EU states. The study employs a purposive sampling approach. A few EU countries were selected to reflect a diversity of AI maturity levels, administrative capacities, and geographical contexts within the European Union. The selection was based on three main criteria: (1) diversity in AI maturity and digital governance levels; (2) institutional and geographical representation of both Western/Northern and Central/Eastern Europe; and (3) availability and comparability of data from official EU and OECD databases. This balanced selection allows for cross-country comparison of institutional drivers and constraints affecting AI adoption in public administration.

Quantitative indicators were compiled, corresponding to the implementation of the *EU Coordinated Plan on Artificial Intelligence (2021 Review)* and the *Digital Europe Programme*. Data were obtained from Eurostat, the OECD, and the European Commission's Digital Economy and Society Index (DESI) and Oxford

Insights. To ensure cross-country comparability, all variables were normalized using min–max scaling (0–1 range). Missing data (less than 5% of the total) were addressed through linear interpolation based on available time series. The empirical analysis proceeds in descriptive statistics and Pearson correlation coefficients were used to identify preliminary associations between AI adoption and the Triple Helix dimensions. All variables were standardized (z-scores), and multicollinearity was tested using the Variance Inflation Factor ($VIF < 3$). Model assumptions regarding normality, homoscedasticity, and independence were verified before interpretation. This transparent methodological framework ensures replicability and provides a robust foundation for interpreting the institutional mechanisms underlying AI adoption in selected EU public administrations through the lens of the Triple Helix model.

Within the framework of this research, the following aspects are analyzed: (1) the degree of digital maturity of the selected EU states; (2) the intensity of the Triple Helix model; (3) the proportion of ICT graduates and the degree of integration of AI in public administration; (4) collaborative framework between university, industry and government and the AI integration in public administration; (5) ITC infrastructure supporting the TH model and the integration of AI in public administration (6) the national AI and governance strategy.

The objectives of the research are: (1) to analyse the degree of digital maturity of the states included in the pilot study; (2) to identify the impact of the Triple Helix Model (university-industry-government collaboration) on the assimilation and integration of AI in public administration; (3) to identify the main correlations between the three actors in the context of artificial intelligence; (4) to discover the main correlations between the TH maturity and the ICT infrastructure; (5) to find out the relations between the AI national strategies, government strategies and the degree of AI implementation in the public administration of the selected EU state.

The main questions answered by the research are: (1) What is the relationship between the intensity of the Triple Helix collaboration and the degree of digitalization and integration of AI in public administration? (2) Are there significant differences between the selected EU states in terms of implementing AI strategies in the public sector? (3) Is there a collaborative frame for supporting innovation and AI integration? How do the national AI strategies of the selected EU countries influence the success of AI implementation in administration?

The main research hypotheses (H) are the following:

- H1. A country's digital maturity level (DESI) mediates the relationship between the Triple Helix and the success of AI implementation in public administration.
- H2. Countries with strong Triple Helix (TH) have a higher intensity of UIG (universities, innovation, and government) collaborations.
- H3. Countries with higher proportions of ICT graduates tend to report greater levels of AI adoption.

- H4. A well-developed collaborative framework between universities, industry, and government is closely associated with increased innovation activity and AI integration.
- H5. There is a positive correlation between TH maturity, innovation activity and infrastructure.
- H6. Even if states have an artificial intelligence strategy for public administration, the real impact is different.

The main quantitative variables used in the first stage of the research are: (1) Number of AI projects in public administration; (2) DESI index – digital public services; (3) Percentage of civil servants trained in AI; (4) Percentage of AI integration in public administration; (5) Existence of a public AI strategy; (6) Triple Helix maturity level. A special category of subsidiary research variables was added to uncover the relationships between the national AI strategies of the selected countries and their governance. This subcategory of variables includes: the level of integration of AI in the governance process; public investments and partnerships with private sector organizations for the implementation of AI applications in the governance process; and the degree of adoption and integration of AI in the public sector.

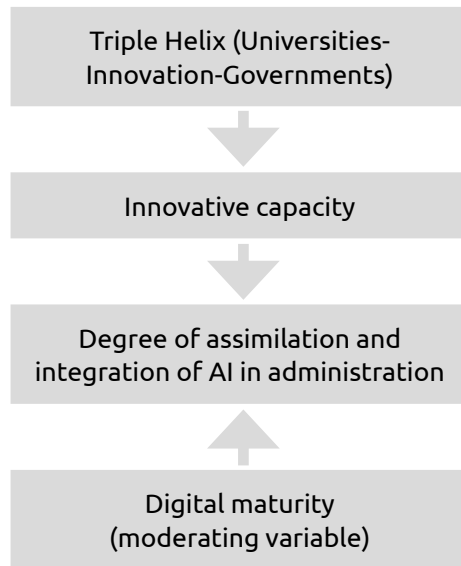
The main research variables used for the comparative analysis are presented in Table 2.

Table 2: The main research variables

Research variables	Type	Measurement level
Number of AI projects in the administration, public-private partnership	Quantitative	Absolute (number)
Index – services publicly available digital	Quantitative	Index (0-100)
Percent officially trained in AI	Quantitative	Percent
Percentage of integration of AI in public administration	Quantitative	Percent
The existence of a public AI strategy	Qualitative	Nominal (Yes/No)
Triple Helix Maturity Level	Qualitative	Ordinal (low/medium/high)

The research model is represented in Figure 2.

Figure 2: The correlational research model



Source: authors.

4 Discussions of the Research Results

The first parameter analyzed is the digital maturity of the selected EU states, which is measured with DESI. This index includes four relevant sub-dimensions: (1) human capital, which measures the digital skills of the population, including the number of IT specialists and the degree of internet use; (2) connectivity, which measures digital infrastructure, such as broadband network coverage and internet speed; (3) Digital technology integration, which measures how companies integrate digital technologies into their activities, including e-commerce; and (4) Digital public services, which measures the degree of digitalization of public services, such as e-government.

The analysis combines descriptive statistics and correlation analysis to examine the relationship between AI adoption in public administration and the three dimensions of the Triple Helix model. Correlation coefficients were first used to identify bivariate relationships among the indicators. Based on the data presented in Table 3, the Pearson correlation between DESI, the global DESI indicator for the year 2024, and the Government AI Readiness Index (Oxford Insights, 2024) for a few EU countries was determined.

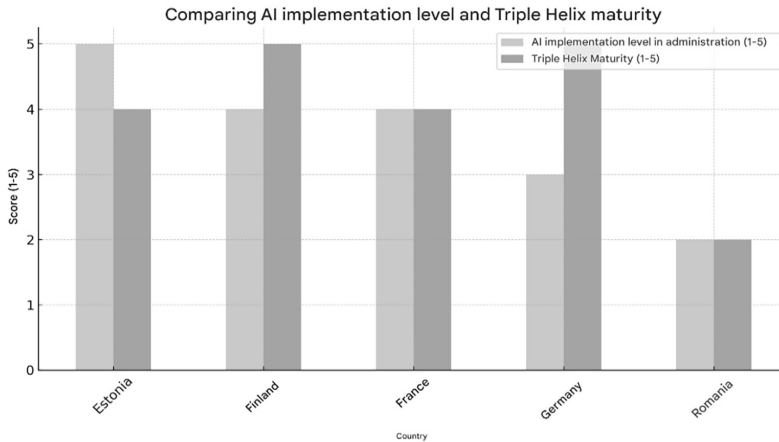
Table 3: DESI and the AI Score of the selected EU member states

Country	Score DESI (%)	Score AI (%)
Estonia	91.0	72.0
Finland	89.0	70.0
France	86.0	68.0
Germany	85.0	65.0
Romania	65.0	50.0

Sources: European Union, 2022 and Oxford Insights, 2023

The Pearson correlation coefficient calculation between DESI (European Union, 2022) and AI scores for the five countries is 0.98, indicating a very strong and positive correlation between these indicators. The correlation coefficient of 0.98 suggests that countries with higher DESI scores also tend to have higher AI scores, indicating a strong link between overall digitalization and the use of AI technologies. Estonia stands out with high scores on both DESI and AI, being a successful example of integrating digital technologies and AI. Romania has lower scores on both indicators, suggesting the need for more effective investments and public policies in the field of digitalization and AI development. The comparative analysis reinforces the fact that digital maturity (DESI) and AI in public administration are fundamental in mediating the effects of the Triple Helix on the assimilation and integration of AI in the public sector. The results show a clear positive correlation: countries with a higher DESI index have a significantly higher AI adoption. These results confirm hypothesis 1. Countries with solid ecosystems in these areas position themselves at the forefront of the EU, and the others have major potential if they invest strategically. Countries with a low DESI (Romania) have weak AI adoption. The bar chart in Figure 3 illustrates a comparative analysis of the level of AI implementation in public administration and the maturity of the Triple Helix model—representing university-industry-government collaboration—across five European countries: Estonia, Finland, France, Germany, and Romania. The data reveal notable differences in how these two dimensions correlate within each national context. Estonia emerges as a frontrunner in terms of AI implementation, achieving the highest possible score, while its Triple Helix maturity is slightly lower (4). This suggests that the country’s advanced digital governance infrastructure and strong political commitment to innovation may compensate for a moderately developed collaborative ecosystem.

Figure 3: The relationships between the AI implementation and the Triple Helix maturity



Source: authors.

In contrast, Finland and Germany display a reverse trend: both countries have achieved maximum maturity in their Triple Helix systems (5), but their AI implementation in administration remains at 4. This may indicate that despite robust collaboration among universities, industries, and governments, translating such systemic strengths into administrative AI adoption requires additional strategic alignment or regulatory innovation. France demonstrates equilibrium, with identical scores (4) for both AI implementation and Triple Helix maturity, reflecting a balanced relationship between ecosystem collaboration and technological integration. Romania, however, lags significantly behind, scoring only 2 in both categories. This parallel low performance highlights systemic weaknesses in both administrative innovation and collaborative capacity, suggesting that foundational reforms are necessary to foster both ecosystem maturity and technological uptake.

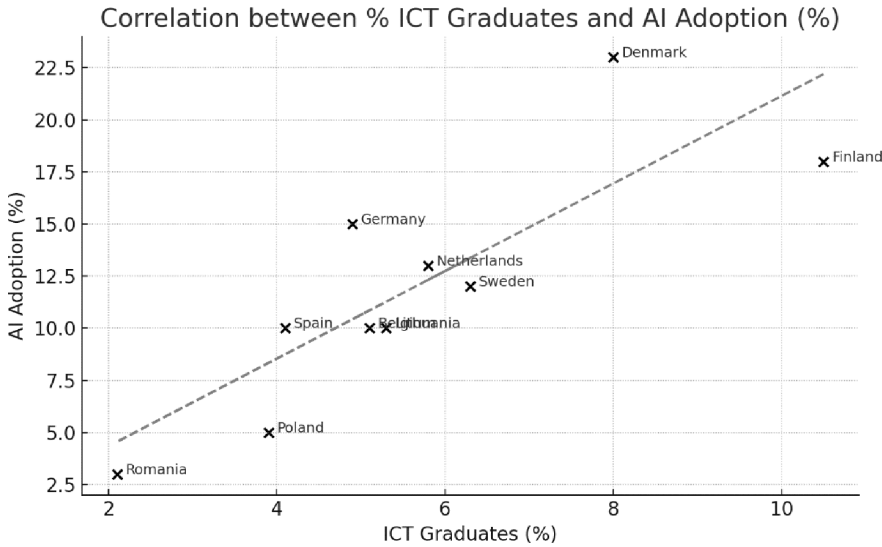
Overall, the comparison highlights a complex interplay between AI adoption and the maturity of collaborative ecosystems. While a high level of Triple Helix maturity appears conducive to technological implementation in some countries, it does not guarantee rapid AI integration in public administration. Conversely, Estonia's performance suggests that strong political will and a digital-first strategy can accelerate AI implementation even when ecosystem maturity is relatively moderate. These findings underscore the need for nuanced policy approaches tailored to each country's unique innovation landscape.

The second parameter is the Triple Helix (TH) intensity – proxies. It is determined based on ICT graduates and partnerships between public institutions and private sector organizations. At the level of the EU and according to DESI, Estonia leads in % ICT graduates (~11%) by 2022, while Italy, Belgium, and Cyprus have a process of less than 3%. The DESI-DII comparison shows that Germany, Finland, and the Netherlands have consolidated multi-sector ecosystems. We find out that countries with strong TH (e.g., Finland, the Nether-

lands, Germany) have a higher intensity of UIG (universities, innovation, and government) collaborations. These results partially confirm Hypothesis 2.

The graph in Figure 4 (% ICT graduates vs. AI adoption) confirms a moderate correlation: more ICT graduates usually mean a higher capacity to implement AI. However, there are exceptions (Spain has high AI adoption even with an average ICT percentage).

Figure 4: The correlation between the ICT graduates and the AI implementation within the sampled member states



Source: authors.

The scatterplot illustrates the correlation between the percentage of ICT graduates and the level of AI adoption across selected European countries. A positive relationship is evident, as indicated by the upward-sloping trendline: countries with higher proportions of ICT graduates tend to report greater levels of AI adoption. These results confirm hypothesis 3.

Finland and Denmark stand out as clear leaders. Finland, with over 10% ICT graduates, achieves an AI adoption rate of approximately 18%, while Denmark surpasses 22% AI adoption with around 8% ICT graduates. These outliers suggest that while a strong ICT educational base is critical, other factors such as innovation policies, RandD investment, and digital infrastructure also play significant roles in facilitating AI integration.

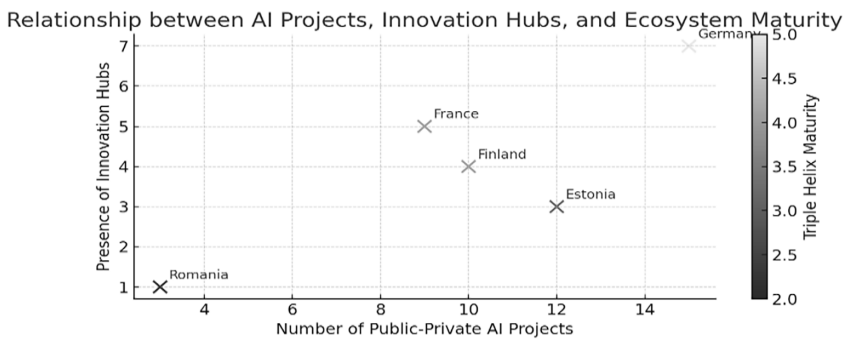
In contrast, Romania and Poland are positioned in the lower left quadrant of the chart, reflecting both a limited percentage of ICT graduates (below 4%) and low AI adoption rates (below 5%). This clustering suggests structural challenges in developing a skilled workforce and integrating advanced technologies.

Germany's performance is noteworthy: with a relatively moderate proportion of ICT graduates (about 5%), it achieves a comparatively high AI adoption rate (~15%). This deviation from the trendline indicates the potential influence of non-educational factors such as industrial capacity, public-private partnerships, and strong innovation ecosystems.

Overall, while the data support the hypothesis of a positive correlation between ICT education and AI uptake, the dispersion of data points around the trendline implies that ICT graduate rates alone are insufficient predictors of AI adoption. A comprehensive approach encompassing education, policy, infrastructure, and ecosystem development is likely necessary to drive AI integration at scale.

The third parameter is the degree of assimilation and integration of AI in public administrations in selected EU countries. According to AIWatch data (JRC, 2022, p. 126), in most EU countries, AI is used for multi-sector collaborations, governance processes, and interoperability. High levels of integration and use of AI applications in the public sector are in Denmark (24%), Portugal (17%), Finland (16%), in contrast to Romania/Poland/Hungary (~3%). These results indicate a strong correlation between digital maturity, the intensity of Triple Helix collaborations, and AI integration. The scatterplot presented in Figure 5 illustrates the relationship between the number of public-private AI projects, the presence of innovation hubs, and the maturity of the innovation ecosystem, measured through the Triple Helix model within a few selected EU countries.

Figure 5: The main relationships between the research variables



Source: authors.

Germany emerges as the most advanced ecosystem, with the highest number of AI projects (15), the strongest presence of innovation hubs (7), and the highest Triple Helix maturity (5). This suggests that a well-developed collaborative framework between universities, industry, and government is closely associated with increased innovation activity and AI integration. These results conform to Hypothesis 4.

Countries with clear artificial intelligence strategies in the public sector have higher adherence to government AI projects and significant budget allocations. France and Finland occupy intermediate positions, with a moderate number of AI projects (9–10) and innovation hubs (4–5), alongside relatively high ecosystem maturity (4–5). Estonia, despite having a comparable number of AI projects (12), demonstrates a lower presence of innovation hubs (3), which may limit the diffusion and scaling of innovation outcomes beyond specific sectors. Romania is an outlier, characterized by the lowest values on all three dimensions: minimal public-private AI projects (3), limited presence of innovation hubs (1), and low ecosystem maturity (2). This underscores significant structural gaps that could hinder its capacity to leverage AI for socio-economic development. Overall, the data suggest a positive correlation between Triple Helix maturity and both innovation activity and infrastructure. These results conform to Hypothesis 5.

The fourth parameter analyzed is national AI strategies and governance. For this purpose, in Table 4, relevant data for the 6 countries were collected based on the most recent official reports and EU sources (AI Watch, Oxford Insights, European Commission and OECD).

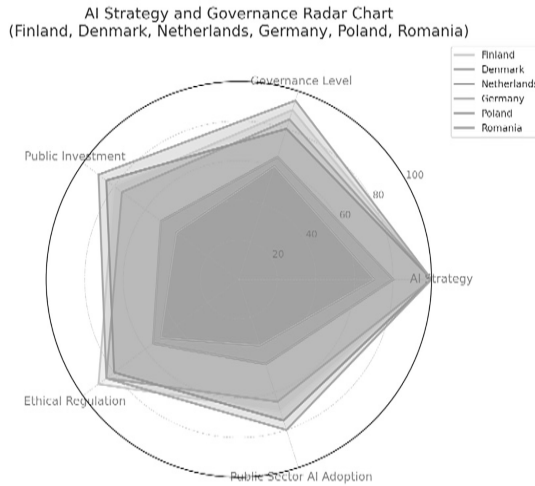
Table 4: The key research variable for measuring the relationship between AI governmental strategy and governance

Country	AI Strategy (Y/N)	Governance Level	Public Investment (€/capita)	Ethical Regulation	Public Sector AI Adoption and Integration
Finland	100	90	80	90	70
Denmark	100	85	75	85	65
Netherlands	100	80	85	80	75
Germany	100	95	90	85	80
Poland	80	65	50	55	45
Romania	70	60	40	50	35

Notes: Values are normalized based on recent reporting and estimates to allow for clear comparisons.

Sources: European Commission, 2022a,b; Oxford Insights, 2022 and OECD, 2022

Analysis of AI Strategies and Governance in selected EU countries is presented in Figure 6 based on a representative research variable. This radar chart provides a comparative overview of six EU member states—Finland, Denmark, the Netherlands, Germany, Poland, and Romania—regarding their Artificial Intelligence (AI) strategies and governance.

Figure 6: The relationship between AI Strategy and governance

Source: authors.

The chart visualizes five key indicators: the existence of a national AI strategy, governance level, public investment per capita, ethical regulation, and AI adoption within the public sector. The key findings are presented and analyzed below. Finland, Denmark, the Netherlands, and Germany show a strong presence of national AI strategies (all scored 100), reflecting early and comprehensive government commitment to AI development. These countries also score highly in governance and ethical regulation, indicating robust institutional frameworks and alignment with EU ethical guidelines. Germany leads in public investment per capita, followed closely by the Netherlands and Finland, suggesting prioritization of AI research and infrastructure. Poland and Romania exhibit considerably lower investment levels, highlighting disparities in resource allocation within the EU. While ethical regulations are generally strong in northern and western countries, Poland and Romania lag behind. This gap may affect the responsible deployment of AI systems and trust in public AI applications. Similarly, public sector adoption rates are significantly lower in Poland and Romania, potentially due to infrastructural or legislative limitations. The differences underscore the need for targeted support and harmonization efforts by the EU to bridge gaps in AI governance and investment. These results prove hypothesis 6, meaning that all analysed states have AI strategies, but the impact on public administration is different. Enhanced collaboration could foster equitable AI advancements across member states, reducing digital divides. EU countries such as Germany, Finland, France, Italy, and Spain have AI strategies that include the use of AI in public services. Finland already has a working group to adapt national legislation to the AI Act. Tables 4, 5, and 6 contain comparisons between the main EU countries included in the research.

Table 5. Comparative approach of the selected EU states from the research parameters perspective

Country	DESI (2022)	ICT graduates %	Public sector AI strategies	Observations
Finland	69.6	high (~>10%)	Yes (legal working group)	digital champion, robust TH
Denmark	69.3	high	Yes	AI in e- government + governance
Netherlands	67.4	high	Yes	Advanced digital ecosystem
Germany	52.9	medium-high	Yes	AI standardization, active TH
Poland	40.6	reduced (~3.5%)	Yes	Average digital shelter, modest TH
Romania	30.6	low (<3%)	Yes	DIGITIZATION weak, fragile TH

Source: authors.

Table no. 5 presents a comparative analysis of the main indicators that reflect the main components considered in this research.

Based on the results of this research, 3 typologies of approaches to the Triple Helix model in the context of artificial intelligence can be identified. These are:

- Leaders: Scandinavia – Finland, Denmark – TH, DESI, solid AI strategies → high AI integration.
- Followers: Germany, Netherlands, France – moderate AI integration, but with infrastructure and strategies ready.
- Challenged: Poland, Romania – although they have AI strategies, modest digitalization, and innovation ecosystems reduce the impact of AI in administration.

For policymakers, this study highlights the importance of multi-sectoral collaboration in implementing the EU AI Act; for scholars, it proposes a conceptual framework linking AI governance to the Triple Helix innovation model. The adoption of artificial intelligence (AI) in public administration presents both significant opportunities and challenges for governance. From a policy perspective, AI can enhance efficiency, streamline decision-making processes, and improve service delivery. However, successful implementation requires robust data governance frameworks, clear regulatory guidelines, and active collaboration between government, industry, and academia, consistent with the Triple Helix model. Comparative insights from Estonia, Finland, France, Germany, and Romania highlight diverse approaches: Estonia and

Finland exemplify advanced digital governance infrastructures, while Germany and France emphasize stringent data protection and ethical oversight. Romania, still developing its digital governance capabilities, can benefit from adopting best practices from these countries. Ultimately, responsible AI integration in public governance demands a balance between technological innovation, ethical standards, and public accountability to foster trust and equitable service delivery.

Table 6. The main research comparative indicators

Country	DESI (2022)	% ICT graduates (2022)	Adoption and integration AI (%)	AI strategies in public admin.	Observation
Finland	69.6	~11 (high)	16		Mature ecosystem
Denmark	69.3	~8	24		Government AI leader
Netherlands	67.4	~7	~12		Stable, TH collaborations
Sweden	65.2	~6	~12		Advanced TH, AI e-government
Germany	52.9	~5	~10		Industrial complex
Belgium	50.3	~3	~10		Medium TH
Spain	60.8	~5	~15		Good digital public services
Poland	40.5	~4	~5		Digital on the rise
Romania	30.6	~2	<5		Low digital
Lithuania	52.7	~5	~5		Average digital maturity

Note: AI adoption values in the public sector are estimated from AI-Watch data on companies.

Source: authors.

4.1 Limitations and Further Research

The study has several limitations that should be acknowledged. First, the sample is limited to almost ten European Union countries, which, while selected to provide regional and institutional diversity, may reduce the generalizability of the findings across the broader EU or other global contexts. Second, the analysis is based on data from 2018–2023, a period that captures recent developments in AI adoption and digital governance but may not reflect longer-term trends or policy shifts occurring outside this timeframe.

Future research could address these limitations by expanding the sample to include additional EU member states or non-European countries, enhancing the comparative perspective and robustness of findings. Longitudinal studies covering longer timeframes could also provide insights into the evolution of

AI adoption and the impact of governance innovations over time. Additionally, future work could explore more granular or sector-specific analyses, examining the effects of AI adoption on particular public administration functions or policy areas.

5 Conclusions

This study investigates the relationship between the Triple Helix model (university–industry–government collaboration) and the assimilation of artificial intelligence (AI) in public administration across selected European Union (EU) member states. The findings highlight distinct cluster patterns among selected EU countries, reflecting varying degrees of Triple Helix collaboration, digital maturity, and AI integration in public administration. The study offers valuable insights into how multi-actor ecosystems can accelerate AI-driven public sector innovation, and it proposes policy recommendations to strengthen cross-sector collaboration for digital governance. This study advances the understanding of how university–industry–government collaboration (Triple Helix) shapes the assimilation of artificial intelligence (AI) within public administration across EU member states. The empirical findings confirm that countries with higher levels of Triple Helix intensity exhibit significantly greater integration of AI applications in public governance processes. The analysis also highlights the mediating effect of digital maturity (measured by DESI) in amplifying the benefits of collaborative innovation ecosystems.

The comparative correlation analysis reveals structural disparities across EU countries, with a clear divide between digitally mature states fostering cross-sectoral innovation and lagging countries constrained by weak institutional capacities, limited public-private partnerships, and insufficient ethical governance frameworks.

Theoretically, the study contributes to extending the Triple Helix model to the domain of AI-driven public sector innovation, offering a novel perspective on how collaborative ecosystems accelerate digital transformation. Practically, the findings suggest that policymakers should strengthen multi-actor governance mechanisms, integrate ethical AI frameworks into digital strategies, and invest in public sector capabilities to leverage AI for citizen-centric innovation.

This study underscores the transformative potential of integrating the Triple Helix Model with Artificial Intelligence to advance innovation, efficiency, and responsiveness in public administration. By aligning the collaborative capacities of academia, industry, and government with data-driven decision-making and intelligent systems, public institutions can transition toward more adaptive and evidence-based governance models. The research contributes to the theoretical enrichment of innovation governance and provides practical implications for policymakers aiming to harness AI responsibly within the public sector.

This paper emphasizes the added value and originality of combining the Triple Helix model with Artificial Intelligence as a framework for reimagining

innovation and governance in public administration. Conceptually, the study advances the field by linking collaborative innovation theory with emerging models of AI governance, providing a fresh perspective on how knowledge co-creation among academia, industry, and government can be strengthened through the use of intelligent technologies.

From a practical standpoint, the findings provide actionable insights for policymakers and institutional leaders seeking to foster data-driven, transparent, and citizen-oriented governance. Overall, the research enriches the academic discourse on digital transformation in the public sector and opens new directions for empirical investigation into the long-term societal impacts of AI-enabled collaboration.

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Country Attractiveness for Conducting Clinical Trials – A Literature Review

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ABSTRACT

Purpose: Clinical trials are a big business worldwide, bringing benefits to patients and the healthcare systems of the countries that attract them. However, despite the extremely high scientific interest in clinical research in the medical literature, there is very little economic literature on clinical research and, in particular, on the factors that influence a country's attractiveness for clinical research. The purpose of this paper is to provide a review of this literature and the main approaches and findings used.

Approach: For this paper, the WoS CC database was first searched and papers on clinical trials published in 2015 or later were analyzed, with a focus on papers from the research area of business economics and public administration. Subsequently, an overview of the most important published papers on the study of the attractiveness of countries is then provided, and the methodological principles and results of the analyzed papers are explained.

Findings: A review of the literature shows that there are few studies investigating the attractiveness of countries for clinical research. Furthermore, the published papers are often small and examine individual cases or small samples of countries. However, the most important factors identified are the speed, reliability and efficiency of the hospital system and

the predictability of regulations. The cost of research in each country, although not unimportant, is secondary to the key factors highlighted.

Practical Implications: Clinical trials are of great importance for human health. However, they are also important for economic reasons but are underrepresented in the scientific literature dealing with them. This paper provides researchers with a framework for future scientific research. However, as it focuses on the study of the attractiveness of clinical trials, it is also useful for regulators and policy makers to gain a better understanding of this field.

Originality/Value: This paper offers an overview of an important but neglected scientific field and, by systematizing and interpreting the research and its results, enables further development and facilitates future research.

Keywords: clinical trials, country attractiveness, factors, costs, regulation

Privlačnost držav za izvajanje kliničnih raziskav – pregled literature

POVZETEK

Namen: klinične raziskave so velik posel po vsem svetu, saj prinašajo koristi pacientom in zdravstvenim sistemom držav, ki jih pritegnejo. Kljub izjemno velikemu znanstvenemu interesu za klinične raziskave v medicinski literaturi pa je ekonomske literature o kliničnih raziskavah, zlasti o dejavnikih, ki vplivajo na privlačnost države za klinične raziskave, zelo malo. Namen tega članka je podati pregled te literature ter glavnih pristopov in ugotovitev.

Pristop: najprej je bila preiskana baza podatkov WoS CC, analizirani pa so bili članki o kliničnih raziskavah, objavljeni leta 2015 ali pozneje, s poudarkom na delih iz raziskovalnih področij poslovne ekonomije in javne uprave. Nato je podan pregled najpomembnejših objavljenih člankov o preučevanju privlačnosti držav, pojasnjena pa so tudi metodološka izhodišča in rezultati analiziranih del.

Ugotovitve: pregled literature kaže, da je malo študij, ki bi preučevale privlačnost držav za klinične raziskave. Poleg tega objavljeni članki pogosto niso obsežni in obravnavajo posamezne primere ali majhne vzorce držav. Kljub temu so kot najpomembnejši dejavniki prepoznani hitrost, zanesljivost in učinkovitost bolnišničnega sistema ter predvidljivost predpisov. Stroški raziskav v posamezni državi – čeprav niso nepomembni – imajo sekundarno vlogo v primerjavi s poudarjenimi ključnimi dejavniki.

Praktične implikacije: klinične raziskave so zelo pomembne za zdravje ljudi. Pomembne so tudi z ekonomskega vidika, vendar so v znanstveni literaturi, ki jih proučuje, podzastopane. Ta članek raziskovalcem nudi okvir za nadaljnje znanstveno raziskovanje. Ker se osredotoča na preučevanje privlačnosti kliničnih raziskav, je koristen tudi za regulatorje in oblikovalce politik pri boljšem razumevanju tega področja.

Izvirnost/vrednost: članek ponuja pregled pomembnega, vendar zapostavljenega znanstvenega področja ter z njegovo sistemizacijo in interpretacijo raziskav ter rezultatov omogoča nadaljnji razvoj in olajša prihodnje raziskave.

Ključne besede: klinične raziskave, privlačnost držav, dejavniki, stroški, regulativa

JEL: I11, I18, M10

1 Introduction

Clinical trials are scientific research trials conducted to assess and demonstrate the safety and efficacy of a new drug, treatment option or a medical device, or to demonstrate their efficacy for an indication previously not approved for. Kramer and Schulman (2012) define clinical trials as *a means of gathering information about medical products or services*. Alvarenga and Martins (2010) mention the biblical story of the king Nebuchadnezzar's order for keeping a strict diet of meat and wine as the first document controlled clinical trial – where the prophet Daniel established the control arm by adhering to a diet of only pulse and water, and eventually showing that him and his friends became prettier and better-fed than the others.

Clinical trials are conducted in four phases, different in their aims and the study sample involved - the number of patients that the drug is investigated on. Phase I and II clinical trials enroll a smaller number of patients, and their aim is to provide initial safety data and to determine the target dose ensuring therapeutic effect. Phase IV trials aren't mandatory and aren't always conducted for every drug. Apart from further demonstrating safety and efficacy, phase III trials demonstrate equivalence or superiority of the investigational medicinal product (IMP) compared to other previously available treatment options. Those trials are conducted on a larger number of patients which make a statistically significant sample – depending on the study design, this can range from several hundred to more than 20.000 patients. After the successful completion of a phase III trial, the clinical trial sponsor can request marketing authorization for the IMP from regulatory agencies.

According to a report by Fortune Business Insides, the global clinical trials market is estimated to be worth USD 60.94 billion in 2024. According to the same source, phase III trials account for 46.8% of this amount, which is close to the usual estimate of nearly 50% of total clinical trial spending. Not only because of the big share of phase III trials in the market size, but also due to the fact that phase III clinical trials require the inclusion of the highest number of patients among all the mandatory phases of clinical trials and are most often conducted in multiple countries, phase III clinical trials are of primary interest for this paper.

Clinical trials are therefore a highly valuable and multi-beneficial activity worldwide, not only for patients, but also for healthcare systems and the scientific community. They give patients access to experimental, often more effective therapies that would otherwise not be available, improving health outcomes and quality of care. In addition, participation in industry-funded clinical trials can lead to significant cost reductions in conventional therapies, a phenomenon known as “cost avoidance” – i.e. the avoidance of costs for regular drugs and diagnostics that would otherwise be necessary.

Clinical trials also bring significant economic benefits to healthcare organizations. For example, according to research (Walter et al., 2020), for every euro invested in industry-supported trials in Austria, an economic multiplier of 1.95

was generated and new full-time jobs were created. In addition to these effects, participation in clinical trials promotes the professional development of medical staff, improves the scientific monitoring of clinical practice and establishes high research and ethical rules, which ultimately increases the quality of healthcare and the efficiency of the healthcare system. Some further specificity of the clinical trials industry is provided by work (Amato et al., 2017) which shows that global investments in biomedical research and development increased by 18.4% between 2007 and 2012, while during the same period the investment levels in North America and Europe remained the same or decreased. They also state that the number of human trials worldwide rose from 12,018 to 234,321 between 2004 and 2016, and that the share of clinical trials in the European Union decreased by 15% from 2009 to 2015, i.e. that the EU is lagging. Given this, the clinical trials industry is a global industry that brings a range of advantages and economic benefits to the countries where these trials are conducted. Since the economic literature on clinical trials is very scarce, there is a need for further research. The economic and regulatory benefits and challenges of clinical research for public health systems should not be overlooked. This paper therefore provides an overview of the scientific literature on this topic, which does not originate from the field of health, but from the fields of economics and business.

2 Overview of the Economic Importance of Clinical Trials

Clinical research and investment in the development of new medicines in general are not only of enormous value to human health but also generate significant costs for the companies that carry them out, while at the same time bringing considerable economic benefits to patients, hospitals and public health systems. Varmaghani et al. (2020) emphasize the economic importance of developing new pharmaceutical products: the development process from molecule creation to market approval takes 10 to 15 or more years, the approval rate for drugs entering the clinical trial phase is less than 12% and conducting phase I–IV clinical trials accounts for 75% of total development costs. The total cost of clinical trials for new drugs up to their market launch is estimated at USD 266 to 802 million. Furthermore, they find that between 2006 and 2010, the Turkish state was able to save almost USD 311,096,130 through medicines that were provided free of charge to patients as part of clinical trials and that would otherwise have been paid for by the national healthcare system. D'Ambrosio et al. (2020) present the results of their study on the treatment of oncology patients over a period of four weeks, in which 126 patients were treated free of charge as part of 34 clinical trials. The cost of standard therapy for these patients in clinical practice would have amounted to €517,658 over this period, which corresponds to a saving of €5,487 per patient over four weeks. Walter et al. (2020) state that 116.22 million euros invested in industry-funded clinical trials in Austria in 2018 generated an added value of 144.2 million euros, and that treatments worth 100 million euros were funded by clinical trials in Austria each year. This study shows that industry-funded clinical trials not only contribute to the advancement of

healthcare, medical care and science, but also have a positive effect on the economy as a whole. Kaló et al. (2014) outline the impact of clinical trials on the Hungarian economy, citing a direct effect of 0.163 contribution to Hungarian GDP and an additional indirect contribution of 0.033% of GDP due to savings in the healthcare system resulting from not having to pay for treatments that would otherwise be covered.

Table 1 shows the number of phase III clinical trials conducted in selected countries in the five-year period from 2015 to 2019. The data source used was the Citeline Trialtrave business intelligence system due to its more complete data than the US FDA's ClinicalTrials.gov database (Stergiopoulos et al, 2019), and a filter was applied to show only the number of clinical trials funded or commissioned by the pharmaceutical industry – in other words, all trials whose sponsor or funder was a government agency, academic organization or similar entity were excluded. The reason for not including non-industry sponsors is that they do not make their decisions on the choice of country in which to conduct a trial based on commercial or economic considerations. Instead, their decisions are based on other factors, such as existing collaborations with academic institutions in other countries, countries that are members of the academic consortium conducting the study, etc.

Table 1: Number of phase III clinical trials, commissioned by the pharmaceutical industry (2015–2019)

Country	Number of trials	Average no. of patients per site per month	Country population (millions)	No. of clinical trials per million inhabitants
United States	2525	5.72	339.9	7.43
Germany	1440	4.64	83.2	17.29
Spain	1339	0.34	47.6	28.18
Canada	1324	4.84	38.7	34.14
United Kingdom	1304	4.84	67.7	19.25
Italy	1221	0.45	58.9	20.74
France	1198	0.57	64.7	18.50
Poland	1170	0.53	41.0	28.52
Belgium	933	0.56	11.8	79.84
Russia	914	0.37	144.4	6.33
Australia	910	0.38	26.4	34.42
Hungary	871	0.39	10.1	85.76

Czech Republic	825	0.36	10.5	78.61
Netherlands	748	0.59	17.6	42.46
South Korea	741	0.26	51.8	14.31
Israel	664	0.25	9.8	72.37
Austria	574	0.51	8.9	64.07
Taiwan, China	572	0.35	23.9	23.91
Ukraine	538	0.37	36.7	14.64
Bulgaria	535	0.35	6.7	80.00
Romania	512	0.32	19.9	25.74
Turkey	512	0.27	85.8	5.97
Sweden	504	0.42	10.6	47.49
Denmark	492	0.50	5.9	83.24
Switzerland	397	0.38	8.8	45.13
China	387	0.21	1425.7	0.27
Greece	378	0.26	10.3	36.55
Portugal	367	0.23	10.2	35.81
Slovakia	317	0.37	5.7	54.70
Finland	315	18.63	5.54	56.80
Serbia	315	0.30	7.1	44.06
Ireland	284	0.24	5.1	56.16
Lithuania	242	0.42	2.7	89.02
Norway	233	0.30	5.5	42.56
Croatia	218	0.34	4.00	54.38
Latvia	212	0.49	1.8	115.83
Estonia	209	0.52	1.3	158.00
India	208	0.39	1428.6	0.15
Slovenia	89	0.33	2.1	41.99

Source: authors' calculation by using Trialtrave business intelligence system, owned by Citeline, Worldometer and estimate based on the 2022 revision of UN data.

The middle column shows the coefficient representing each country's efficiency in participating in clinical trials based on the average number of patients enrolled per trial site (i.e. a single hospital or outpatient clinic under the supervision of a principal investigator) per month.

The speed of implementation and completion of a clinical trial depends primarily on how quickly suitable patients are enrolled at the participating trial sites in the countries involved in the study. Intuitively, one might conclude that countries with large populations contribute the most to the number of patients enrolled in clinical trials and, consequently, the most clinical trials are conducted in those countries. However, the column "Number of clinical trials per million inhabitants" in Table 1 reveals a discrepancy between countries: certain countries with larger populations and higher average number of patients per trial site per month have a lower number of clinical trials per million inhabitants than other countries with smaller populations and the same patient enrollment factor (for example, Germany, with a population of 83.2 millions and a patient enrollment factor of 4.64, has fewer clinical trials per million inhabitants (17.29) than Italy, with a population of 58.8 million and a patient enrollment factor of 0.45, and 20.74 trials per million inhabitants). In addition, there are countries with approximately the same population in which the number of clinical trials per million inhabitants differs considerably. An example of this is Denmark and Finland: Denmark, with a population of 5.9 million and a patient recruitment factor of only 0.5, has 83.24 clinical trials per million inhabitants, while Finland, with a population of 5.5 million and a very high patient recruitment factor of 18.63, has only 56.8 clinical trials per million inhabitants.

3 Literature Review

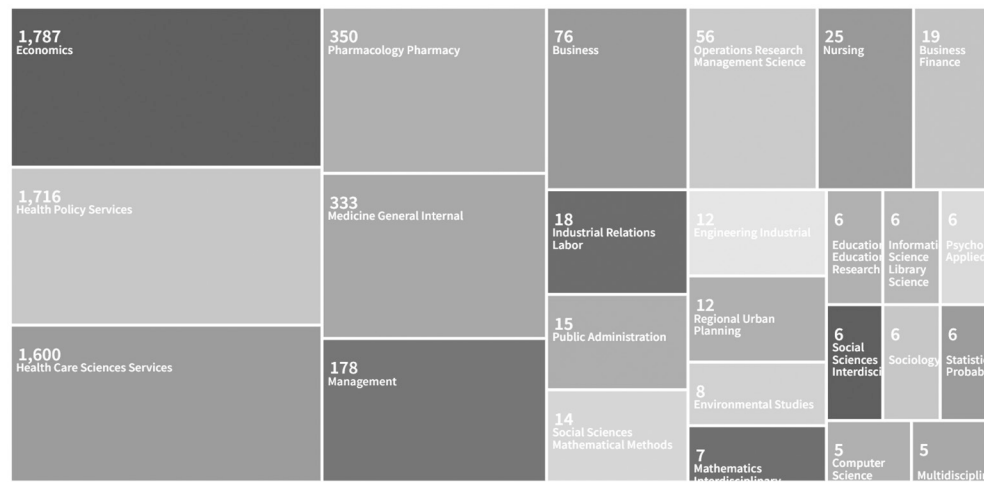
Due to its great economic importance – both in terms of market size and the large number of jobs in the industry – the clinical trials industry is an interesting and promising research topic, yet still relatively under-researched from an economic perspective. The following two figures show the number of scientific papers published since 2015 on Web of Science whose topic is clinical trials.

Figure 1: The number of papers on the topic of clinical trials in Web of Science 2015–2025.



Source: Web of Science

Figure 2: The number of papers on the topic of clinical trials in the research areas of business economics and public administration Web of Science 2015–2025.

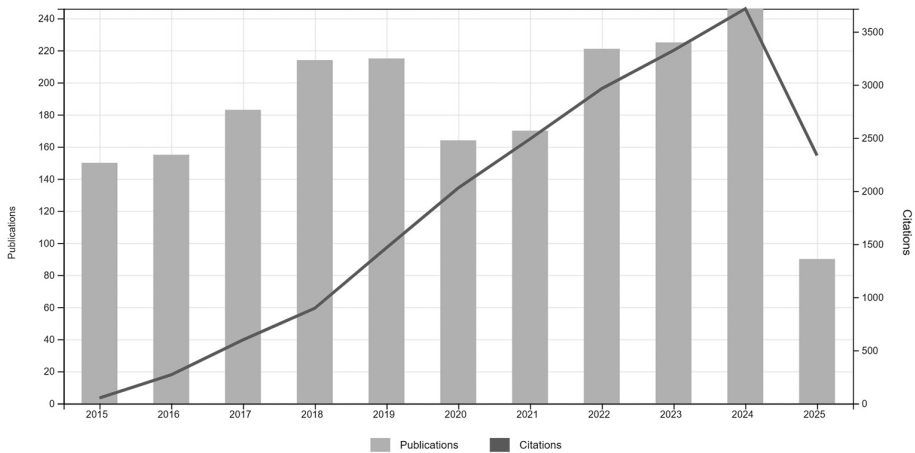


Source: Web of Science

Figure 1 shows the tree-map of published papers in the last ten years in the Web of Science Core Collection (WoS CC) in all subject areas on the specified topic. Although the total number of published papers is enormous and more than half a million (582,495), it is understandable that these are mainly on medical topics. However, when the search is narrowed down to the research areas of business economics and public administration (Figure 2), the total number of all types of research papers is only 2033, of which only 15 are in

the area of public administration. This shows that clinical trials are severely neglected in public administration and even in economics, which is difficult to understand given the importance of this sector in these areas. Even though the number of published papers is very modest, the number of citations of these papers is increasing rapidly (Figure 3), which shows the importance of the topic. The analysis of keywords for clinical trial in business economics and public administration carried out with VOSviewer shows (Figure 4) that country attractiveness, decision factors, etc. are underrepresented even in this research area.

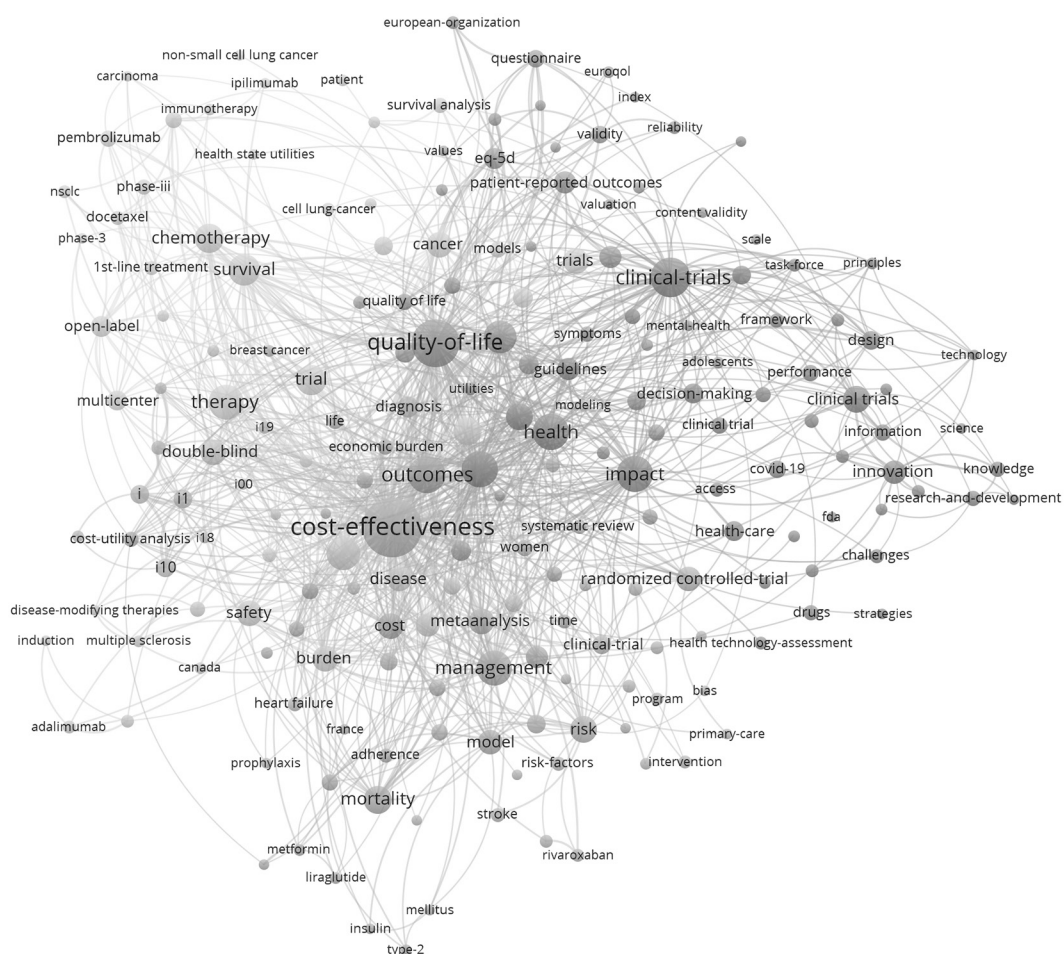
Figure 3: Papers on the topic of clinical trials in the area of business economics and public administration – times cited and publications over time.



Source: Web of Science

Due to the importance of the topic, the following part of the paper provides an overview of the relevant literature, which is limited to the very small number of studies that analyze the attractiveness of countries for clinical research. The overview is neither limited to specific databases nor to the publication period analyzed above, and is divided into several research clusters based on the focus of the individual contributions.

Figure 4: Keyword analysis of papers on the topic of clinical trials in the research areas of business economics and public administration Web of Science 2015–2025.



Source: created by the authors based on the data from the WoS CC database and using VOSviewer.

3.1 Attractiveness of Host Countries

According to Lee (2016), the concept of country attractiveness is used to measure the characteristics of a particular country in relation to its markets. He explains that the concept of country attractiveness can be defined as the relative importance of individual advantages and the perceived ability of the country to provide these individual advantages. Lee notes that empirical research indicates that a country's attractiveness is simultaneously influenced by several factors, including tangible factors such as market size, market growth potential, level of economic development (or per capita income), and market openness in the context of the political and institutional environment.

The same author points out that a country's attractiveness for foreign investment can be positively influenced by improving socio-political stability to reduce the risk of foreign investment, improving the level of human development (e.g., providing services that affect the quality of life, a well-educated workforce, socio-cultural conditions such as education, healthcare, culture, etc.), managing the overall investment climate, and reducing the perception of bribery and corruption by business entities.

Avetisyan (2020) lists market capacity, population size, degree of economic openness, inflation, taxes, exchange rate stability, etc. as factors for attracting foreign direct investment, on which most authors agree. He notes that institutional instability has a negative impact on foreign investment. He argues that the experience of several countries has shown that the effective functioning of political and economic regulatory institutions has a greater impact than a number of macroeconomic indicators. As negative factors identified in numerous studies, he cites non-transparent regulatory policies, the dominance of state ownership and the lack of an investor protection system, a weak rule of law and violations of economic freedoms. According to Avetisyan, when analyzing these factors, it was found that the political stability factor is statistically more significant than the inflation rate.

The few papers that have explored the factors that contribute to the attractiveness of countries for conducting clinical trials generally support the proposition that investments flow to countries with greater socio-political stability, transparency, education levels and quality, etc. Murthy et al. (2015) conducted an analysis of data from the online clinical trials registry ClinicalTrials.gov and classified trials as conducted in either low-income or high-income countries based on the location of the countries in which they were conducted. In their research, they find that clinical trials (i.e. industry-funded trials, excluding academic and other clinical trials funded by other sources such as public funding, etc.) are traditionally conducted in high-income countries (wealthy countries), as this is where the infrastructure for conducting such trials is developed and where most pharmaceutical companies are based.

However, Murthy and colleagues point out that this trend has changed in recent decades and that clinical trials are increasingly being conducted outside wealthy countries, resulting in the number of countries where clinical trials are conducted doubling between 1995 and 2005. By analyzing data available on the US FDA's online registry (ClinicalTrials.gov), they found that more than a quarter of clinical trials are conducted in non-wealthy countries, while most are conducted in both wealthy and non-wealthy countries. Glass et al. (2016) note that clinical trials are cheaper to conduct in countries such as India and South America compared to North America and Western Europe, and that patient recruitment is also faster and cheaper there. The same authors believe that the search for so-called treatment-naïve patients, i.e. patients who have not previously received treatment for their diseases, is a motivation for conducting clinical trials in non-wealthy countries. Due to poorer healthcare provision compared to wealthy countries, these countries may have larger pools

of untreated patients who are more suitable for participation in clinical trials, and both patients and physicians are more motivated to participate as participation in a clinical trial offers free healthcare and access to the latest therapeutic options. Murthy et al. (2015) find that among non-wealthy geographic regions, the largest proportion of clinical trials are found in non-Western Europe and Asia. They further note that investigative centers in these countries enroll more subjects than trials conducted only in wealthy countries, indicating that non-wealthy countries contribute significantly to the speed and objectives of trials. Although they also cite the lower costs in these countries as a likely factor, they support the thesis that the motivation for including non-wealthy countries in clinical trials and their attractiveness lies in the ease of recruitment of treatment-naïve patients with chronic diseases. Even if other studies indicate that the costs of trials do not play a (major) role in decision-making, the speed of conducting and completing clinical trials is certainly a key factor. The reason for this is the patent protection of the investigational product, which expires 20 years after the patent application and includes the period in which the clinical trials are conducted. Faster recruitment of patients to achieve the required statistical sample therefore contributes directly to a faster completion of the study and the start of commercial use of the investigational product. Glickman et al. (2009) highlight that the pharmaceutical industry benefits from the cost reductions due to globalization by conducting some activities in countries with relative advantages where there is a large population for clinical trials and sales in addition to cheaper labor, mentioning in particular South America and India.

Moscicka et al. (2013) present the specific characteristics of Central and Eastern European countries in their paper and highlight the reasons for the growing demand for these countries: centralized healthcare systems with a small number of specialized centers serving a large number of patients; well-trained physicians and nurses; both public and private healthcare facilities have access to treatment-naïve patients (unlike in Western European countries where this is becoming increasingly difficult); existing systems of vertical patient referral in these countries, resulting in minimal competition for patients between medical centers; and the availability of lifelong medical records for patients, allowing for low rates of failed screenings and early withdrawal of patients from studies. They also point out that the migration rate in this region is much lower compared to Western Europe, which allows for better long-term follow-up of participants. Other factors that contribute to the attractiveness of the region include good technical equipment with modern diagnostic devices and the medical, pharmaceutical or scientific education of clinical trials staff. Croatia and Serbia are cited as examples of countries where approval to start a clinical trial takes longer than in other countries, namely five to six months. They conclude that the quality of clinical trial conduct in Central and Eastern European countries does not lag behind the quality in Western European countries.

3.2 Factors Influencing the Decision on the Choice of Country

Silva et al. (2016) state that when selecting a country, trial sponsors should consider: the country's capacity to provide clinical evidence, investigator qualifications, number of patients with access to advanced medical care, communication capacity in terms of access to computers and the internet, intellectual property protection and market orientation. They also emphasize that the complex relationships between pharmaceutical companies and public institutions, as well as companies' attitudes toward the rules on compensation and payments in a given country, the degree of involvement of investigators in setting these rules, and general data on the country's market and healthcare system (population, gross domestic product per capita, healthcare expenditure per capita) may influence the decision on the location of a clinical trial. Silva et al. (2016) also note in their review that when selecting countries, their ethnic groups, epidemiological status of the disease, medical practice and geographical proximity must be considered and emphasize that not taking into account differences between countries may result in the need for a larger sample size and longer research duration.

Ippoliti (2013) conducted an econometric analysis of the economic efficiency of clinical trial assessment procedures in 29 European countries and their competitiveness in the human trials market, using panel data from 2004 to 2007. Based on this research, he finds that a country's population is statistically significant for competitiveness. He concludes that this suggests that trials are conducted more frequently where there are more potential patients in need of treatment. The same applies to the number of doctors: a higher number of doctors in a particular country has a positive effect on the decision of pharmaceutical companies to include that country. He also emphasizes that there is a positive correlation between the efficiency of the approval system for studies and investment in pharmaceuticals.

Gerhring et al. (2013) conducted an anonymous online survey on attitudes towards clinical trials in Europe (SAT-EU), in which the factors influencing the selection of trial sites in Europe were assessed. They highlight the negative impact of administrative burden on the competitiveness of clinical trials. They emphasize the critical importance of the speed with which feasibility data is collected and the speed with which a clinical trial is initiated. They believe that the track record of trial sites and the ability to quickly and effectively access all relevant information for sponsors and clinical trial organizers is of great importance. An eye-opening study based on an analysis of specific clinical trial sites (Dilts and Sandler, 2006) has identified an unusually high number of steps involved in the decision to initiate a clinical trial. A large proportion of these steps were found to be non-value adding and had no impact on the safety of the trial or the drug. The authors suggest that, following the example of other industries, removing such administrative hurdles could significantly speed up the process and improve patient care without compromising the integrity of the trial or patient safety.

Górecka and Szatucka (2013) highlight the existence of several market selection models in the literature and state that international market selection is usually considered as a sequential process where less attractive markets are gradually eliminated at each stage, eventually leading to the selection of a potential target market. They note that a systematic approach to international market selection is crucial, as this decision-making requires processing a large amount of information from many different and complex markets. The criteria for evaluating countries must be defined before the screening phase, as they ultimately have a direct impact on the screening results. They also emphasize that a number of criteria is proposed in the literature that can be used and measured, but there is no consensus on them and their selection depends on which criteria each author believes are most appropriate for a particular situation. These criteria are directly related to the objectives of a company's international expansion and vary depending on the type of market entry and what the company specifically wants to achieve in the target market.

Górecka and Szatucka (2013) further emphasize that while there are numerous indicators in the literature to measure the criteria for selecting foreign markets, there is no consensus on a standardized variable that would make this process less subjective. They also emphasize the lack of agreement on the relative weight or importance of individual criteria – some studies suggest assigning equal weight to all criteria, while others suggest that certain criteria may be more important than others. They note that the literature on international marketing identifies two main approaches for determining target markets during the initial selection of countries: grouping and ranking. The grouping method categorizes countries into groups based on the similarity of their commercial, economic, political and cultural dimensions, which helps to identify possible synergies between these markets. This approach assumes that companies prefer to enter countries from the same group (cluster) in which they already operate successfully. The ranking method ranks countries according to their attractiveness for market entry and evaluates them based on one or more criteria. This approach provides decision-makers with an aggregated measure of market attractiveness. The authors emphasize that although both methods are recognized as important tools for analyzing a large number of countries with heterogeneous markets, they should only be used in the preliminary phase of market assessment.

Bordet et al. (2015) analyzed the state of the clinical trials market in France and drew conclusions on the areas that need to be improved in order to increase the country's competitiveness. They conclude that France's productivity is perceived negatively in the eyes of the clinical trials industry compared to other countries. Negative factors cited include high costs, slow patient recruitment and a high proportion of trial sites closing without a single patient being enrolled. After the lengthy and costly approval process to start a clinical trial and the logistical challenge of starting the trial at each individual site, the closure of a trial site without patient recruitment is a worst case scenario for any trial sponsor. In their paper, Bordet and colleagues analyzed the findings of the French Strategic Council for the Health Industries (Conseil Stratégique

des Industries de Santé – CSIS), which established a public-private partnership to improve participation in clinical trials and proposed measures to reduce the time needed to sign contracts, enroll 80% or more of the planned number of patients in at least 80% of sites, and close fewer than 15% of sites without enrolled patients. They conclude that the results of the studies on the effectiveness of these measures show that it is possible to increase the country's attractiveness for industry-sponsored clinical trials.

Alemayehu et al. (2018) conducted a study by reviewing literature indexed in PubMed, Embase, CINAHL and Web of Science as well as the WHO Global Health Library, searching for keywords such as barriers, challenges, clinical trials and developing countries. The focus of their research is on the barriers to conducting clinical trials in developing countries. The most common barriers cited were lack of financial and human resources, barriers in ethical and regulatory approval systems, an underdeveloped research environment, operational barriers and competition from potential clinical trial investigators, e.g. lack of time and other priorities due to their other assignments. Based on a systematic review of the literature and internal communications from the European Clinical Research Infrastructure Network (ECRIN) related to the ECRIN-IA project from 2013 to 2017, Djurisic et al. (2017) cite insufficient knowledge of clinical trials and trial methodology, excessive monitoring, restrictive data protection laws and lack of transparency, complex regulatory requirements and inadequate infrastructure as barriers. They also mention lack of funding as a barrier, but this refers to academic and public clinical trials, not industry-funded ones, which are not the subject of this paper. Carvalho et al. (2021) present their view on the state of the clinical trials industry in Portugal. They highlight clinical trial organizational units as key to the success of clinical trials, as they believe they enable adequate feasibility studies, recruitment and retention of participants. As key factors for the success of clinical trials and also as competitive factors for strengthening clinical trials in Portugal, they mention the motivation and awareness of the trial teams, combined with a high level of reliability and good relationships between healthcare professionals and trial participants.

Based on eleven semi-structured interviews with employees of multinational pharmaceutical companies in Denmark who are involved in decisions on the awarding of clinical trials, Dombernowsky et al. (2017) describe the decision-making process for country selection. The headquarters of the trial sponsors – pharmaceutical companies – make the decision in collaboration with Contract Research Organizations (CROs – companies that organize and supervise the conduct of clinical trials for the sponsor) and their subsidiaries in individual countries. For fully outsourced trials, the decisions are made by the CROs, while in other cases the sponsor's head office makes the decisions. The sponsor's subsidiaries provide the head office with data on their country, the feasibility of a specific trial, the availability of human, organizational and technical resources, the track record and the availability of so-called key opinion leaders. For this study, the decision-makers on country allocation were interviewed. The results show that all respondents consider timely patient

recruitment to be one of the most important factors by which headquarters evaluate the performance of their subsidiaries, followed by the quality of the data obtained. It has been shown that smaller countries must continually demonstrate their success in patient recruitment to be included in new clinical trials, as smaller countries are not automatically selected by sponsors. In contrast, larger countries are often included in clinical trials regardless of their previous success in patient recruitment, due to other factors such as the potential for post-approval drug sales. An example of this is the United States, which, according to data from another study cited by Dombernowsky et al.(2017), recruited only two-thirds as many patients compared to other countries, but still participated in a very large number of clinical trials. The number of patients enrolled per month and per trial center is considered a measurable indicator of a country's success. Another factor is the speed with which a trial can be operationally initiated – in other words, a shorter time to obtain approval and sign contracts with individual healthcare facilities means a faster start to patient recruitment and more time for recruitment. The same study has shown that a lack or absence of investigator experience in conducting clinical trials does not necessarily mean that such sites will be rejected for participation. The reason for this is that the trial sponsor can compensate for this lack by providing more resources for training and monitoring the conduct of the trial.

Benisheva et al. (2023) conducted a study by reviewing legal documents, EU regulations and directives, and publications and reports on local and EU requirements for conducting clinical trials and analyzing statistical data from the EU Clinical Trials Register for Bulgaria, Hungary, Poland, Romania, and Slovakia on the total number of clinical trials conducted in these countries, Romania and Slovakia on the total number of completed and ongoing phase I-III interventional clinical trials, the prevalence of trials in rare disease diagnoses, the distribution of completed trials by phase and the number of completed and ongoing trials in the European Economic Area countries and all EU Member States from 2012 to 2022. Based on their research findings, they conclude that the number of clinical trials in a particular country does not correspond to the country's population size, but that other factors play a role in the choice of country, such as the reliability and predictability of regulatory timelines, a large number of medical personnel per capita, experienced medical personnel willing to conduct clinical trials, experienced CRO personnel, large potential for patient recruitment, competitive costs per patient, low patient dropout rates and satisfactory results in regulatory inspections.

Jeong et al. (2017) compared elements from nine representative countries with the US and used multiple linear regression to analyze factors associated with the distribution of trial sites. Through their research on characteristics and related factors in the context of globalization of clinical trials, they present a predictive model for the distribution of clinical trials that includes the following indices: EFI (Economic Freedom Index), HEC (Health Expenditure per Capita), HCI (Human Capital Index) and IPRI (Intellectual Property Rights Index). They find that the distribution of clinical trials can be satisfactorily ex-

plained by factors related to healthcare system infrastructure (HEC), a free market and low bureaucracy (EFI), access to higher education (HCI) and intellectual property rights (IPRI). They also point out that the literature mentions that the cost of clinical trials per country also has an influence, which may partially explain the determination of trial locations, but this data was not included in their research, and further studies are needed to explain other factors that influence the allocation of clinical trials by country.

3.3 The Influence of Costs

In relation to the cost of clinical trials by country and its influence on the selection of countries to conduct trials, research findings show contradictory results. Jeong et al. (2017) find that cost reduction is one of the main reasons why sponsors choose developing countries to conduct trials in countries such as China, India and South America. Gehring et al. (2015) found in their analysis that a favorable pool of suitable patients, speed of approval and online availability of trial site information are much more important than costs and government subsidies. Dombernowsky et al. (2017) also conclude that the costs of allocating clinical trials by country is less important. They refer to a 2009 report in which a survey of 362 clinical trial stakeholders found that 80% of respondents would prefer to meet patient recruitment targets 10% faster than reduce costs by 20%. A study conducted by Goehring et al. (2013) also found that the costs of conducting clinical trials was significantly less important compared to factors such as an appropriate patient pool, speed of the approval process and the existence of disease management networks.

Dombernowsky et al. (2019) also note that cost is less important than other factors in the selection of trial sites, but that it can still play an important role in the selection of countries. However, they note that the research findings suggest that cost is more important when the sponsor's headquarters evaluates the efficiency of CROs – i.e. external partners – than when it evaluates the performance of its own subsidiaries. Although research findings are not consistent regarding the importance of the cost level in a given country for enrollment in clinical trials, the inclusion of less wealthy countries can most likely be explained by their comparative advantages over wealthy countries, leading to faster recruitment of the required number of patients, as also stated by Bordet et al. (2015). On the same topic, Gehring et al. (2013) state that the impact of direct costs is limited and that indirect or hidden costs, such as the loss of time due to slow bureaucracy, slow patient recruitment or poor overall efficiency of trial sites, have a significant negative impact.

Although there is evidence that cost is not the decisive factor when selecting a country to conduct clinical trials, the costs of the entire process are very high and by no means negligible. Kramer and Schulman (2012) point out that regardless of the factors driving up the cost of developing new medicines, the impact of rising costs is clear: Higher research costs result in fewer new medical products coming to market, less knowledge about the products that do come to market, and less research on public health issues.

3.4 The Influence of Regulations

Gerhring et al. (2013) point out that the negative impact of a suboptimal regulatory environment does not necessarily have a negative impact on investigator selection – provided the investigator is known and visible, has proven competencies, information about their research center is easily accessible and they are able to enroll the required patients in the trial. Efficiency in terms of speed of patient recruitment takes precedence over the weight of negative factors in the regulatory and institutional environment.

Bansal (2012) highlights the following difficulties in conducting clinical trials globally from a US regulatory perspective: properly obtained and truly informed consent from subjects, differences in medical practice and standard of care, acceptance of data from other countries due to (non)compliance with US Food and Drug Administration (FDA) regulations, and ethnic factors due to different genetic profiles.

Pharmaceutical companies apply for patent protection for a newly discovered drug with the relevant regulatory authorities before starting clinical trials. In the USA (FDA, n.d.) and in the EU (Garattini and Finazzi 2022), the duration of drug patent protection is 20 years. The possibility of obtaining a patent for their discovery triggered a hunger for innovation in the pharmaceutical industry (Nedelcheva, 2019). The goal of clinical trial sponsors is to complete all three phases of clinical trials as quickly as possible in order to be able to start marketing the drug and exploiting it commercially. This means that the longer clinical trials take to complete, the shorter the period for exclusive commercial use. Once patent protection expires, generic manufacturers are free to start producing the drug without paying royalties. Investigating the causes of these discrepancies is the basic idea of this research: to identify the factors that make some countries more attractive than others for conducting clinical trials. In the context of speed of approval, Silva et al. (2016) cite the example of China, which has succeeded in reducing the time required for the approval of clinical trials by centralizing the regulatory authority and reducing conflicting regulations between the central and local levels of government.

In another paper, Gehring et al. (2015), based on data from the same SAT-EU study using Italy as an example, also point out that the regulatory environment influences sponsors' decisions on where to conduct their trials. Their research identified three areas that are critical to a country's competitiveness: the availability of information needed for clinical trials, the predictability and speed of clinical trial approvals by ethics committees and regulatory authorities, and the availability of necessary equipment. The issue of equipment availability highlighted in this paper is a somewhat surprising factor, as in multinational clinical trials sponsors generally assume that they will need to provide at least some (if not most) of the equipment for the trial sites. At first glance, this appears to be merely a logistical challenge, but it can also be interpreted as a lack of capacity to conduct clinical trials and is indeed an unfavorable factor in this context – even if its importance is questionable and unproven. In relation to the predictability and speed of the clinical trial approval process, the

authors note that the approval process and subsequent contracting with trial sites is so lengthy and demanding that by the time a clinical trial is launched in Italy, international clinical trials may have already reached their statistical sample and completed patient recruitment. As a conclusion and recommendations to improve Italy's competitiveness, as possible improvement models they mention the harmonization of national approval systems (at the level of ethics committees and the healthcare institutions themselves), including the improvement of procedures for contracting with healthcare institutions to bring them in line with the clinical trial approval process, and increasing the visibility of centers of excellence, i.e. making information about trial sites available on the Internet.

3.5 Further Observations on the Criteria for Clinical Trials

Strüver and Ibeneme (2021) examined the status of clinical trials in Nigeria and South Africa based on data from the ClinicalTrials.gov registry, the Pan African Clinical Trials Registry, the National Health Research Database from South Africa and the Nigeria Clinical Trials Registry and analyzed the data using descriptive statistics and trend analysis. They conclude that clinical trial sponsors do not appear to prioritize diseases that are prevalent in a particular country, such as plague in Nigeria, for which there is a large pool of patients. They conclude that sponsors do not select countries according to local health needs, but according to their own business priorities. They also highlight that sponsors appear to have a greater interest in non-communicable diseases, which can be considered international diseases. By analyzing a random sample of 5% of clinical trials registered in the WHO International Clinical Trials Registry Platform as interventional trials in the active patient recruitment phase, Viergever et al. (2013) came to the similar conclusions – they state that their research indicates that the correlation between disease incidence and the global distribution of clinical trials is low, and that clinical trials are much more common in higher income countries than in lower income countries.

4 Results and Discussion

Locating clinical research in a particular country, region or hospital has almost no negative consequences, while the positive effects are numerous and easy to understand. The economic impact of clinical trials on national healthcare systems is multifaceted:

- Patients receive free access to the most innovative therapies
- Treatment in clinical trials is free for both patients and the healthcare system
- Physician-investigators involved in clinical trials receive an additional source of income
- Some of the money goes directly to national healthcare systems in the form of a direct contribution to clinical trial budgets

- Part of the money flows indirectly into the national budget and the public healthcare system in the form of taxes, contributions and other fees

Based on an overview of the clinical trials market, it is clear that the success of countries in attracting this form of foreign investment varies widely. This paper analyzes some of the key studies that attempt to highlight the reasons why some countries are more successful than others in attracting clinical research, i.e. the factors that influence the decision of companies to conduct clinical research.

This research shows that the attractiveness of a country for conducting clinical trials is based on its ability to offer important economic, legal and infrastructural advantages that encourage investment in clinical research. The most important factors that make it attractive include political stability, a well-developed and accessible healthcare and research infrastructure, a high level of education, especially of medical personnel, and a transparent administrative system with a low level of corruption. All of this creates a favorable environment for pharmaceutical companies looking for efficient and reliable conditions for conducting clinical trials.

We found it particularly interesting that, according to some studies, Central and Eastern European countries have become competitive destinations over the last decade. Their attractiveness is enhanced by the existence of centralized healthcare systems with several large clinical centers, which enables the rapid recruitment of large numbers of patients. In addition, the availability of so-called “treatment-naïve” patients, i.e. patients who have not yet been treated for certain diseases, makes these countries suitable for testing the efficacy of new therapies. High-quality and experienced medical staff, modern diagnostic equipment and a stable population with low out-migration also increase the opportunities for long-term follow-up of test subjects, which is crucial for the success of many clinical studies. As the public healthcare systems of the most successful CEE countries are similar to those of other countries in this region, it is possible that other countries will become more receptive to such studies in the future.

In developing countries, especially in Asia and South America, more and more clinical trials are being conducted. The main reasons for this are the large number of patients available and the significantly lower costs compared to developed countries, which makes this region attractive to pharmaceutical companies seeking efficiency and cost rationalization as part of their global research strategies.

Previous studies have shown that pharmaceutical companies use a number of quantitative and qualitative criteria when selecting a country to conduct clinical trials. One of the most important is the size of the population, as a larger number of potential subjects increases the likelihood of successful and rapid recruitment. Similarly, a larger number of available physicians has a positive impact on the trial sponsor’s decision, as this is an indication of the healthcare system’s ability to support complex research activities.

One of the most important criteria is the speed of patient recruitment, as time is a limited resource in the context of the duration of patent protection. In addition, the efficiency of study initiation, i.e. the speed with which regulatory approvals are obtained and contracts are signed with research sites is often a decisive factor in the choice of a target country. Research sponsors value countries and sites that are known for fast and reliable procedures, and the existence of “key opinion leaders” – experts with international reputation who can contribute to the credibility and visibility of the study and, eventually, the drug once it is placed on the market – carries additional weight in the decision-making process.

Other important factors are the availability of digital infrastructures, the level of protection of intellectual property, the transparency of the regulatory system and the quality and reliability of the data collected. All of these elements combine to form the perception of the country as a professional and predictable destination for investment in clinical trials.

Interestingly, and somewhat counter-intuitively, a growing body of research suggests that cost alone is not the deciding factor in country choice. The overall cost of clinical trials is extremely high, but research shows that factors that directly impact the speed and success of trials (such as the ability to recruit patients quickly, the efficiency of regulatory procedures and the high quality of data collected) are increasingly being prioritized.

Although cost per patient may play a role, especially when assessing the efficiency of external partners such as CROs, it has less weight in the context of internal decisions by pharmaceutical companies on the allocation of trials to their own subsidiaries. Considering that the total cost of developing a new drug can be as high as USD 800 million, the priority is usually on speeding-up the process rather than maximizing savings. This confirms that, although costs are not negligible, strategic and operational factors carry greater weight in decision-making in the long term. This is particularly evident from the fact that when pharmaceutical companies enter Phase III of clinical research, patent protection already begins, so the speed and reliability of the trial process are of crucial importance. In this context, indirect costs – such as delays in study approval, slow administrative procedures or poor organizational infrastructure – can have a much more negative impact on the success of a trial than direct financial costs alone. For trial sponsors, time becomes a key currency, as a longer trial duration shortens the time available for exclusive commercialization of the drug before patent protection expires.

The country's regulatory framework is one of the key elements in the decision-making process for conducting clinical trials. Although an unfavorable regulatory environment does not automatically disqualify a country – especially if there are experienced and visible researchers – the speed and predictability of regulatory procedures still have a major impact on the attractiveness of the country. Studies show that lengthy approval processes and complex administrative requirements can significantly slow the start of patient recruitment, reducing the overall effectiveness of trials and increasing time to market.

In addition to the speed of approval, the availability of information about research sites and the existence of clear guidelines and procedures also play an important role. A lack of equipment or resources at the trial site can further delay the start of a trial, while the predictability of the approval process reduces risk and increases sponsor confidence. Even if regulation itself is not the only decisive factor, it largely shapes the perception of the country as a reliable and efficient partner in the global clinical research chain.

5 Conclusions

This research shows that the most important factors in attracting clinical trials in a country are economic, legal and infrastructural advantages that enable research to be carried out quickly, efficiently and reliably. These include, above all, political stability, a well-developed and accessible healthcare and research infrastructure, a high level of training for medical staff and a transparent and effective regulatory system with a low level of corruption. In this context, time becomes the key factor: the speed of patient recruitment and study approval plays a decisive role, while direct costs are less important than operational efficiency and data quality.

Central and Eastern European countries have proven to be particularly competitive due to their centralized healthcare systems, large numbers of patients, including those not previously treated, and highly qualified medical staff. Although more and more trials are also being moved to Asian and South American countries due to lower costs, the location decision is increasingly based on the country's overall ability to support the rapid and reliable conduct of trials. The key message is that the quality of organization, speed of administration and predictability of regulations are often more important than price alone – as delays and bureaucratic obstacles can cause more harm than high financial costs.

Given that clinical trials are a big business, and that countries have or should have an interest in attracting them for a number of reasons, this research is particularly useful for authorities and regulators. But it is also important for decision makers at the hospital and clinical system level to focus on the attraction factors for clinical trials.

It should be noted that not only is there little economic literature on clinical trials, but most of the work referred to in this review is non-empirical, such as commentaries, review articles or studies that are not comprehensive and are based on individual cases or on small samples of countries. Therefore, the factors influencing clinical trial decisions still need to be investigated and analyzed.

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Implementation of the SMART Concept within the Framework of the 2030 Agenda in the NUTS 3 Regions of the Slovak Republic

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ABSTRACT

Purpose: The main objective of this study is to assess the level of implementation of a selected element of the SMART concept within the context of the 2030 Agenda goals across individual NUTS 3 regions of the Slovak Republic, using various analytical methods. The study specifically focuses on the development and evaluation of the indicator "*employment in research, development and high-tech*," which represents a crucial component of SMART concept implementation from the labour market perspective.

Methodology/Approach: To fulfil the study's objective, in addition to analysing development trends using available statistical data, the shift-share analysis method will be applied. This method enables the identification and comparison of regional employment growth or decline in the research, development and high-tech sector in relation to national

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development trends in the given sector. Another method employed is the analysis of the sector through the lens of the so called “export base theory,” which examines its export potential. Through this approach, it is possible to identify the strength of representation and the influence of a given sector in the labour market on the region’s economy.

Findings: The research findings indicate that job creation in the research, development and high-tech sector does indeed reflect the implementation of the SMART concept, and in most regions, positive employment growth trends have been recorded. Despite support for employment in this sector in the Slovak Republic, only two regions—Bratislava and Košice—demonstrate a capacity to significantly contribute to the economic and social growth and competitiveness of the region by supporting this sector.

Practical Implications: The study concludes by offering several options for discussing how to support the creation of space for expanding this sector or other soft sectors in the regions. This would enable regions to generate greater added value than they currently do, as the prevailing dominance of manufacturing offers limited potential for sustainable development.

Originality/Value: The value of the study lies in the findings derived from the application of a wider range of research methods focused on examining the level of regional development (shift-share analysis and export base theory). The study identifies the results of the current level of implementation of the SMART concept in regions in terms of labour market transformation, and offers a perspective on further possibilities for supporting regions in this transformation. The focus is on smart and sustainable sectors that will drive the economies of regions and the country as a whole.

Keywords: research and development, employment, innovation, competitiveness, region, SMART concept

Implementácia konceptu SMART v okviri Agende 2030 v regióch NUTS 3 Slovenskej republiky

POVZETEK

Namen: glavni cilj te študije je oceniti raven uresničevanja izbranega elementa koncepta SMART v kontekstu ciljev Agende 2030 v posameznih regijah NUTS 3 Slovenske republike z uporabo različnih analitičnih metod. Študija se posebej osredotoča na razvoj in vrednotenje kazalnika »zaposlenost v raziskavah, razvoju in visokih tehnologijah«, ki je ključna komponenta uresničevanja koncepta SMART z vidika trga dela.

Metodologija/pristop: za doseg cilja študije bo poleg analize razvojnih trendov na podlagi statističnih podatkov, ki so na voljo, uporabljena tudi metoda *shift-share* analize. Ta metoda omogoča prepoznavanje in primerjavo regionalne rasti ali upada zaposlenosti v sektorju raziskav, razvoja in visokih tehnologij glede na nacionalne razvojne trende v navedenem sektorju. Uporabljena je tudi analiza sektorja skozi prizmo tako imenovane teorije izvozne baze, ki preučuje njegov izvozni potencial. Tak pristop omogoča prepoznavanje stopnje zastopanosti in vpliva danega sektorja na trg dela in gospodarstvo regije.

Ugotovitve: rezultati raziskave kažejo, da ustvarjanje delovnih mest v sektorju raziskav, razvoja in visokih tehnologij dejansko odraža uresničevanje koncepta SMART, pri čemer je bilo v večini regij zabeleženih pozitivnih trendov rasti zaposlenosti. Kljub podpori zaposlovanju v tem sektorju v Slovaški republiki pa le dve regiji – Bratislava in Košice – izkazujeta sposobnost, da s podporo temu sektorju bistveno prispevata k gospodarski in socialni rasti ter konkurenčnosti regije.

Praktične implikacije: študija zaključuje z več možnostmi za razpravo o tem, kako podpreti ustvarjanje prostora za širitev tega sektorja ali drugih tako imenovanih mehkih sektorjev v regijah. To bi regijam omogočilo ustvarjanje večje dodane vrednosti, kot jo ustvarjajo trenutno, saj prevlada predelovalnih dejavnosti ponuja omejen potencial za trajnostni razvoj.

Izvirnost/vrednost: vrednost študije izhaja iz spoznanj, ki temeljijo na uporabi širšega nabora raziskovalnih metod, osredinjenih na preučevanje ravni regionalnega razvoja (analiza *shift-share* in teorija izvozne baze). Študija opredeljuje rezultate trenutne ravni uresničevanja koncepta SMART v regijah z vidika transformacije trga dela ter ponuja pogled na nadaljnje možnosti za podporo regijam v tej transformaciji. Osredotoča se na pametne in trajnostne sektorje, ki bodo poganjali gospodarstva regij in države kot celote.

Ključne besede: raziskave in razvoj, zaposlenost, inovacije, konkurenčnost, regija, koncept SMART

JEL: O32, J21, O31, F43, R11, R58

1 Introduction

Approaches to implementing the SMART concept differ significantly across global regions. In Europe, the emphasis is largely on sustainability and enhancing everyday quality of life. By contrast, in countries such as the United States and many parts of Asia, the focus tends to be more on building technical infrastructure and advancing the digital economy, with sustainability often viewed as a secondary concern. In regions such as Africa and Latin America, the challenge remains how to apply the SMART concept in ways that meaningfully address the practical, day-to-day needs of cities and communities. Since 2015, the global 2030 Agenda framework has guided the sustainability efforts of United Nations member states, aiming to address a wide spectrum of societal challenges. In the context of accelerating digitalization and mounting social pressures, sustainability is no longer discussed solely in environmental terms. It has become increasingly linked with broader areas of public life, including the research, development, and high-tech sectors, where innovation plays a central role in shaping effective solutions to complex problems. Innovation has the potential to simplify and optimize systems across all areas of society, including public administrative processes (da Silva Martins et al., 2024; Eberhard et al., 2017; Rasvanis, 2024).

Innovation is the cornerstone of regional development. To foster genuine innovation, state and regional authorities must do more than merely introduce

new technologies. The key to success lies in supporting the innovators themselves businesses and universities where job creation and increasing employment help establish an environment conducive to creative work, new technologies, and innovation. The role of public administration should be to ensure a future-oriented policy that continuously stimulates local employment in sectors with long-term potential, not only for sustainability but also for economic stability. Regions face numerous challenges in the process of smart transformation. Agenda 2030 motivates countries and regions to secure a high quality of life for all stakeholders in a sustainable way, with an emphasis on the adoption of new technologies. There are many successful cases where the integration of smart solutions into regional and urban life has contributed not only to sustainability but also, for example, to improvements in mobility, energy consumption, waste management, public governance, public safety, education, and culture. However, such innovations are often introduced and implemented by foreign rather than domestic companies, i.e., companies that do not significantly contribute to national GDP or employment. (Brodny and Tutak, 2023; Surana et al., 2020).

Scientific development and innovation promote sustainable development (Tu, 2023), especially when effectively integrated into public policies and strategic decisions of public administration. In this context, it is the natural role of government to systematically support the development of science and research and to create favorable conditions for the labour market development in these areas (Smaldone et al., 2022). Today's knowledge-based society needs highly qualified professionals outside the academic environment (Hanatkova et al., 2022). These experts are able to link scientific knowledge with practical solutions, thereby helping to increase efficiency, transparency, and innovation in public administration, industry, healthcare, energy and digital technologies. Employment in science and research thus takes on strategic importance not only as a tool for economic growth, but also as a pillar of sustainable development, social inclusion, and technological sovereignty. This strengthens its contribution to the innovative capacity of regions and to the achievement of the Agenda 2030 goals (European Commission, 2020; "Národná stratégia výskumu, vývoja a inovácií 2030," 2023; Portefaix, 2025).

Due to the lack of specific studies, especially in the context of the Slovak Republic and the EU, we decided to examine the issue in greater depth and chose to study a selected indicator that has significant potential in the region, not only in relation to the ongoing smart transformation, but also in achieving the social goals of Agenda 2030.

This study focuses on assessing the level of implementation of selected elements of the SMART concept in the context of the 2030 Agenda goals in individual NUTS 3 regions of the Slovak Republic using various analytical methods (shift-share analysis, export base theory). These methods provide a deeper understanding of structural changes in the labour market and help identify the relative competitiveness and potential of the sector for regional development. The study focuses in particular on assessing and evaluating the in-

indicator “employment in science, research, development, and high-tech,” i.e., a sector that is one of the main producers of innovation, which is a prerequisite for the smart transformation and competitiveness of regions. Supporting employment in innovation-producing sectors is one of the most appropriate indicators for assessing the smart transformation of regions from a labour market perspective. By monitoring the development trends of this indicator, we are able to propose solutions for public administration institutions that are competent in the area of regional transformation and also supporting the creation of new jobs in regions. This indicator, its comprehensive analysis, and the subsequent proposal for improvement measures are also linked to several goals of Agenda 2030, specifically:

- Goal 8 Decent work and economic growth, which includes the sub-goal of promoting employment in research, development, and high-tech sectors, creating jobs with higher added value that bring innovation and contribute to the sustainable growth of regions.
- Goal 9 Industry, Innovation and Infrastructure, which includes the idea of smart transformation.

The study consists of several parts, with the introductory part devoted to assessing current trends in the area under investigation through an analysis of scientific articles and professional publications, in which the authors define the issue in question at both the theoretical and analytical levels. The next part of the study will consist of defining the methodological approach. The analytical part of the study will consist of obtaining and analyzing input statistical data and processing it using software. The analytical part of the study includes performing calculations and interpreting the results using graphs and tables. The conclusion of the study will be devoted to identifying the knowledge gained and discussing the importance of science, research, and high-tech in implementing the SMART concept and fulfilling the goals of Agenda 2030 in regions and cities, as well as the possibilities for further research on this issue.

1.1 Background of the Study

The concept of SMART was introduced within the framework of European regional policy to support sustainable development. It has since become so widely embedded in European regional policy that it appears in all major long-term regional development strategies (Rauhut and Humer, 2020).

Since its foundation, the EU’s regional policy has primarily aimed at fostering solidarity, reducing regional disparities, achieving sustainability, and continuously improving the quality of life in the regions through technological progress. Accordingly, the EU has long anchored its key development strategies in supporting research, development, innovation, and smart specialization. (Foray, 2025).

Interest in supporting education, science, research, and development stems primarily from the fact that European countries recognize their responsibil-

ity for climate change and its impact on various spheres of social life. They are aware of the extent to which the activities of sectors essential to human existence—such as agriculture, mining, energy, and manufacturing—contribute to land and environmental degradation. Therefore, the EU consistently strives to enhance the efficiency of these sectors to ensure their sustainability and their capacity to serve future generations (“Horizon Europe strategic plan 2025-2027,” 2024).

To achieve its objectives, the EU has long based its key strategies on the concept of “smart.” Within the Europe 2020 development strategy for the 2014–2020 programming period, the aim was to foster “smart, sustainable, and inclusive growth.” In pursuing smart growth, the strategy emphasized increasing investment in science, research and development, knowledge, innovation, and digital technologies, as well as raising overall employment across the population (Figueiredo and Figueiredo, 2024).

In the 2021–2027 programming period, the EU’s main priority is to make Europe “smarter, greener and low-carbon, more connected, more social, and closer to its citizens.” The aim is to build on the achievements of the previous period and to continue supporting digital transformation, strengthening business competitiveness, increasing employment in future-oriented sectors, promoting green and smart transformation, advancing climate and environmental initiatives, fostering more ecological agriculture, facilitating the transition to renewable energy sources, and ultimately achieving carbon neutrality (“COMMUNICATION FROM THE COMMISSION EUROPE 2020 A strategy for smart, sustainable and inclusive growth,” 2020).

However, it is not only European countries that are placing emphasis on protecting the environment and improving the overall quality of life. UN member states are also addressing these issues. The Agenda 2030 strategy, adopted at the UN summit in 2015, has significantly contributed to the effort to address global challenges such as climate change, poverty, hunger, quality of education, and unequal opportunities in the labour market. It sets ambitious goals for development in the field of societal sustainability. The scope of the program is defined by 17 Sustainable Development Goals (SDGs), which are to be achieved by 2030. The UN’s objectives within the program are as follows:

1. No Poverty
2. Zero Hunger
3. Good Health and Well-being
4. Quality Education
5. Gender Equality
6. Clean Water and Sanitation
7. Affordable and Clean Energy
8. Decent Work and Economic Growth
9. Industry, Innovation and Infrastructure
10. Reduced Inequalities
11. Sustainable Cities and Communities

12. Responsible Consumption and Production
13. Climate Action
14. Life Below Water
15. Life on Land
16. Peace, Justice and Strong Institutions
17. Partnerships for the Goals (GUIDE TO SDG INTERACTIONS: FROM SCIENCE TO IMPLEMENTATION," 2020; "The 2030 AGENDA FOR SUSTAINABLE DEVELOPMENT," 2015; Sachs et al., 2021).

Similar to the EU's objectives, the goals of Agenda 2030 are grounded in the transformation of countries, regions, and cities, fostering the adoption of state-of-the-art technologies designed to simplify and improve the quality of life. However, innovations in rapidly evolving technologies necessitate adaptation to the current needs of society, particularly in the labour market. These innovations are contributing to a reduced demand for human labor in many sectors of the economy, as technological solutions increasingly replace traditional work (Filippi et al., 2023).

Continuous technological development generates demand for labor in high-tech, science, research, and development, while simultaneously reducing employment in commerce, services, and manufacturing and processing industries, where workers can often be effectively replaced by technology (Hötte et al., 2023).

An important part of both Agenda 2030 and EU strategies—such as Cohesion Policy, Horizon Europe, and the EIT Strategic Innovation Agenda—is the support of job creation in science, research and development, and high-tech sectors. These sectors are particularly significant due to their capacity to drive innovation and sustainability. They also generate high incomes, thereby contributing to healthy economic development at the national and regional level, as well as to a higher standard of living (Ferraro et al., 2023; Filippi et al., 2023).

The term SMART is inextricably linked with innovation and advanced technologies. As such, this framework serves as a global roadmap for the implementation of a broad spectrum of technologies and innovations aimed at streamlining processes in areas such as public safety, administration, communication, transportation, the economy and labour market, environmental protection, and the overall quality of life. In recent years, the SMART concept has garnered significant scholarly attention. This rising interest is largely driven by the rapid evolution of digital technologies, including novel software applications, multimedia tools, and other innovations that address contemporary challenges across various fields of science and research (Kumar Das, 2024).

Among the most transformative innovations of the past decade is artificial intelligence (AI). Within the context of SMART implementation in regional and local development, AI has proven to be a breakthrough technology, enabling municipalities and regions to:

- analyse traffic data to improve the regulation of traffic flow, parking, and public transport scheduling;

- identify opportunities for reducing energy consumption and achieving cost savings;
- optimise waste management strategies, including sorting and collection schedules;
- detect local infrastructure issues and predict risks such as floods, fires, and other hazards (Dias et al., 2023).

The SMART concept, along with related technological innovations, is increasingly recognised as a strategic instrument for enhancing regional competitiveness from both economic and social development perspectives. It represents a transformative approach to addressing territorial challenges and fostering balanced, sustainable growth (Kalsoom et al., 2025; Kruse, 2024).

While the integration of SMART principles in public administration, health-care, manufacturing, logistics, and resource management presents new opportunities, it also introduces certain risks. It profoundly influences regional life by reshaping needs and preferences, which may lead to both positive and negative externalities such as shifts in labour market dynamics, workforce shortages in certain sectors, and subsequent disruptions in the supply of specific goods and services (Sutriadi, 2017).

Nevertheless, numerous studies suggest that the adoption of SMART solutions in less developed regions is critical to reducing regional disparities and promoting competitiveness (Billones et al., 2021).

The term SMART region has thus evolved as an extension of the SMART city concept, promoting a more holistic and sustainable planning approach at the regional level. The overarching goal is to integrate advanced technologies into daily life to streamline operations not only in mobility, environmental management, and social services, but also in public finance, education, health-care, and the labour market (Billones et al., 2021; Peráček and Kaššaj, 2025). A territorial unit that strategically implements smart solutions has the potential to achieve significant economic growth and enhance its regional competitiveness (Sutriadi, 2017).

The concept of the SMART region must also be linked to the pursuit of sustainable development, rooted in the continuous development of human capital and regional potential. This approach fosters territorial cohesion by promoting the effective utilisation of endogenous resources. Implementing innovative strategies facilitates the development of economic sectors, reinforces regional identity, safeguards cultural and historical assets, supports urban planning, and ultimately increases the region's attractiveness (Rachmawati et al., 2024).

The fundamental objective of every SMART region is to achieve smart specialisation a strategy aimed at stimulating socio-economic transformation by focusing on areas of competitive advantage. Smart regional transformation entails the formulation and execution of tailored solutions adapted to the specific needs of regions, cities, or municipalities. These efforts are support-

ed by national and European level policies through financial, institutional, and legislative instruments. The strategic use of such support in conjunction with the SMART concept offers significant opportunities for improving efficiency and sustainability. However, it is essential to align this approach with other key development strategies to ensure coherence and long-term success (Zlámal, 2019).

1.2 Implementation of the SMART Concept within the Framework of the 2030 Agenda

Several studies have addressed the implementation of smart transformation with the aim of achieving sustainability and improving residents' quality of life.

For example, Destefanis and Ur Rehman (2023) examine the impact of support measures for science, research, and development on employment in individual NUTS 2 regions of the EU. The results of the panel regression analysis clearly confirm that investment in science, research, and high-tech not only increases employment but also generates positive externalities in the form of high innovation activity and a strong, competitive economy.

Wirkierman et al., (2021) also assessed the level of support for employment in science, research, and high-tech in individual regions. They concluded that regions with the most significant support for science, research, and high-tech had the best labour market outcomes, high employment rates (not only in science, research, and high-tech, but also in related service industries), and a positive impact on the economy.

Moretti and Thulin (2013; 2022), using calculations based on export base theory in the US and Sweden, found that support for highly skilled jobs and high value-added industries has significant export potential. In addition to generating high incomes and stimulating regional economies, such support also creates jobs in sectors linked to the satisfaction of human needs, particularly in trade and services. Not only this study but also other research clearly points to the importance of locating high-tech companies in regions, as they have strong potential to become the driving force of the entire region or city—especially when the goal is to build a smart and sustainable territory. The role of the state and regional governments should therefore be to support these companies (Runlin and Feng, 2024; Hechi et al., 2024; Lawrance et al., 2023).

Significant findings were presented in the study by Rigby et al., (2022), which assesses the impact of smart specialisation principles on the economic development of cities and regions within the European Union. The authors analysed the evolution of the technological capabilities of European cities from 1980 to 2015, focusing on how cities and regions have developed technology and infrastructure over time. The research identified those cities and regions that experienced the most significant technological advancements, which ultimately translated into improved economic performance. According to the study, the German regions showing the most notable technological progress and economic improvement during the analysed period were Bavaria and

Baden-Württemberg. Other regions that demonstrated strong technological advancement with a positive impact on economic development include the Finnish region of Uusimaa, the Swedish region of Stockholm län, and the French region of Île-de-France. The Italian region of Lombardy, and the Spanish region of Catalonia, were also highlighted. The authors conclude that these regions significantly diversified their technological focus toward more complex domains and achieved above-average growth in both innovation and economic productivity. This rapid transformation was largely driven by the efficient use of existing potential and the promotion of employment in sectors that integrate innovation and new technologies into everyday life.

The 2017 study *Smart Specialization in the US Context*, similar to the work by Rigby et al. (2022), identified economically successful regions in the United States that achieved growth through the adoption of the smart specialization concept in the labour market. The study focuses on how regions leverage their potential and capabilities to develop and implement innovations for economic growth. The authors confirm that high-tech enterprises and research institutions are among the key drivers of innovation and new technologies. Therefore, creating new job opportunities and harnessing the potential of human capital in this area is essential. According to the study, the most successful SMART regions and cities include Albany in New York State, Austin in Texas, and Silicon Valley in California (Wessner and Howell, 2017).

These findings are supported by the study *Smart City Implementation in Indonesian Regions: A Legal and Empirical Review*, whose authors emphasize the importance of innovation and the need for cooperation between national, regional, and local governments. Using secondary analysis methods, the study critically evaluates key documents and activities implemented to date. It concludes with a recommendation to promote employment in innovation-related sectors and to enhance support for SMART concept implementation through legislative measures, financial incentives, and strengthened collaboration between stakeholders at the city, regional, and national levels (Syah et al., 2024).

Evidence from the study by (Adenle et al., 2023), shows that the richest countries, which dominate global research and development, have strengthened their economies. In contrast, low- and middle-income countries accounted for about 70 researchers per million inhabitants, compared to more than 3,500 per million in high-income countries. According to the authors, the global community should therefore encourage partnerships and transformative capacity development in science, research, and training. Specifically, national governments should support the creation of opportunities for industrial sectors by promoting scientific research and development for innovative economies and by building their capacities through education and training policies.

In addition to promoting employment in education and high-tech industries, and emphasizing the need for cooperation across different levels of territorial governance, a 2023 study by experts from the University of Wisconsin Park-side highlights the importance of civic community participation in introducing innovation into the development of cities and regions. Within their method-

ology, the authors expand the traditional “triple helix” model collaboration between academia, business, and the public sector into a “quadruple helix” model, which also includes the citizen community. This broader approach recognizes civic participation as a crucial element in implementing innovation at the regional and urban levels (Banerjee et al., 2023).

Hunady et al., (2018) in their paper “The Link Between Human Resources in Science and Technology and Regional Economic Development in the EU”, investigate the relationship between employment in science and technology and the regional economic development of NUTS 2 regions in the EU using regression and correlation analysis. The results clearly demonstrate a positive impact of increasing the number of employees in science and high-tech sectors on economic growth.

European Union countries are showing common progress in reducing unemployment (SDG 8: Decent Work and Economic Growth). One area of employment that is developing positively is research and development. Growth in the number of workers in this sector was recorded in all ten European regions studied by Pop and Stamos, (2023), (SDG 9: Industry, Innovation and Infrastructure). This points to the growing importance of innovation and the knowledge economy. However, as the varying degrees of change among countries indicate, success in addressing this issue differs significantly.

Baculakova and Harakalova (2017), confirmed a positive relationship between the level of public investment in research and development and employment growth. They concluded that a 1% increase in spending leads to a measurable increase in jobs. This effect is evident not only in the academic and technological sectors but also in related areas such as the creative industries, where average wages are also rising. The effect is particularly pronounced in high-tech sectors, which serve as key drivers of innovation and technological progress.

Mao (2024), examined the mechanisms of tax incentives and investment in research and development for employment absorption in this context. His results show that investment in research and development, operating profit margin, and remuneration have a significantly positive impact on employment absorption. According to Halaskova et al., (2024), this is most evident in countries classified as moderate innovators and emerging innovators. In these groups, they confirmed the positive impact of research and development expenditure on GDP per capita and employment in knowledge-intensive service sectors. Employment in science and research is also indirectly influenced by investment in these fields, as confirmed by Díaz et al., (2024), who demonstrated a positive impact on employment.

In addition, a higher proportion of scientists and engineers in the population correlates positively with the creation of new companies, especially in high-tech sectors. However, employment in high-tech sectors has a negative impact on entrepreneurial activity. This is mainly attributed to the concentration of talent and resources in large companies, which reduces the motivation to establish new businesses Skica, et al., (2025). Halaskova, et al., (2024), also

point out that youth unemployment can be reduced by employing young people in research and development at universities.

These findings highlight the complex and multi-layered effects of investment in research and development on employment, economic growth, and the development of individual sectors. They are particularly relevant in high-tech sectors in countries with developing innovation potential. It is therefore important to consider the regional dimension of innovation.

Samara et al, (2022), address the impact of high-tech on regional development by modelling innovation systems. The study employs regression and correlation analysis along with selected mathematical models based on the system dynamics approach to simulate various scenarios of digital technology development in regions. The model was applied to two Greek regions Western Macedonia and Central Macedonia which differ in their levels of development. The results indicate a positive impact of smart technologies on regional development in the studied areas. The authors also provide several recommendations, including the further promotion and development of digital skills and infrastructure, support for employment in key innovation and technology sectors, and enhanced education across diverse population groups. They strongly emphasize the importance of considering regional specificities and using forecasting and planning tools tailored to regional development.

This scientific portfolio includes scientific studies focused on the SMART concept within the context of the 2030 Agenda. These studies aim to analyse labour market indicators and regional economic growth. A valuable contribution to this field is the study by Keungoui et al., (2024), which applies a method for measuring regional specialisation and development potential. This helps identify the key factors contributing to the successful implementation of innovations, which are undoubtedly a driving force behind regional economic growth.

Corrocher et al. (2024) explore the complex relationship between innovation and the labour market. Their study examines the impacts of technological advances on employment, skills, and wages. Using export base theory, they identify regions where innovation-intensive industries have the greatest impact on economic growth and competitiveness.

Even smaller regions can be innovation leaders if they focus on specialization. Employment in the research and development sector is often supported through international research networks and projects (Cristani, 2024). Cross-border cooperation initiatives create favorable conditions for the development of an innovative environment and the sharing of expertise (Dušek, 2024). Mutambik et al., (2024), further argue that smart cities are more efficient and have more opportunities to ensure their growth. Pessina (2025) takes a similar approach, emphasizing that employment in science and research is a key factor in the ecological and technological transformation of regions.

Research on the SMART concept's implementation in relation to the 2030 Agenda is also addressed in the study *"Smart cities and attracting knowledge*

workers: Which cities attract highly educated workers in the 21st century?" This study investigates how smart cities attract skilled professionals. Using shift-share analysis to assess structural changes in the labour market, the authors identified trends in sectors employing highly skilled workers and pinpointed factors influencing regional employment growth in the knowledge economy. The results show that implementing technological innovations significantly attracts skilled workers. Furthermore, the study concludes that the steady increase in knowledge economy employment contributes to regional economic growth, development, and the creation of new job opportunities (Betz et al., 2016).

Based on a comprehensive analysis of scientific studies, we have concluded that many experts are paying attention to the issue of smart transformation of regions and cities in the context of achieving the goals of Agenda 2030. Several experts are deeply involved in the implementation of the SMART concept in practice and in examining how it contributes to the competitiveness and sustainability of regions and cities. A large number of studies focus on specific solutions and the implementation of specific activities to build smart regions and cities.

However, it can be said that there is a lack of studies that examine the issue in greater depth, i.e., by examining the impact of specific indicators of smart transformation on the development and sustainability of regions. Given the importance of employment in regional development, we have decided to focus on examining development trends and the strength of employment in the sector of the future, namely employment in science, research, and high-tech. This is a sector with strong economic and innovation potential, as well as potential for building smart infrastructure and sustainability.

Very few experts are paying attention to researching the impact of employment support in such a future-oriented sector as science, research, and high-tech. Most of these studies come from the American continent, such as those by Betz et al., (2016); Moretti and Thulin, (2022).

2 Methods

The main objective of this study is to assess the level of implementation of a selected element of the SMART concept within the context of the 2030 Agenda goals across individual NUTS 3 regions of the Slovak Republic using various analytical methods. The study specifically focuses on the development and evaluation of the indicator *"employment in research, development and high-tech,"* which represents a key driver of innovation and a crucial component of SMART concept implementation from the labour market perspective.

The indicator *"employment in research, development, and high-tech"* is one of the key elements aimed at achieving the objective of supporting innovative ecosystems within the SMART concept. Monitoring the development trends of this indicator is also essential for assessing the fulfilment of one of the 2030 Agenda goals:

- Goal 8 Decent work and economic growth, which includes the sub-goal of promoting employment in research, development, and high-tech sectors, creating jobs with higher added value that bring innovation and contribute to the sustainable growth of regions.
- Goal 9 Industry, Innovation and Infrastructure, which includes the idea of smart transformation.

After a thorough review of the available literature, we identified a lack of relevant research outputs not only within the EU but also in Slovakia, where no study of this type currently exists. This gap motivated us to examine the issue in greater depth by focusing on a specific indicator whose regional position has significant potential, both in relation to the ongoing trend of smart transformation and to the achievement of the social goals outlined in Agenda 2030. As the Slovak Republic has recently begun to make progress in promoting employment in science, research, and high-tech primarily due to EU financial support we consider it important to highlight this development and, at the same time, emphasize the potential of such support for the future of regions, particularly in terms of innovation, competitiveness, and socio-economic development. Therefore, employment in science, research, and innovation should be supported more intensively by both state and regional governments.

The methods of this research are inspired by those employed in the studies of Betz et al. (2016); Keungoui et al. (2024); Moretti and Thulin (2022). These methods appear to be appropriate for the stated objective, particularly given their ability to identify the position of a sector within a region in relation to both national and regional employment. Using them, it is possible to identify regions where the sector has the potential to generate additional jobs. In this study, we also apply these methods for our own analytical purposes. This research is based on secondary data obtained from the Slovak Republic's statistical database, DataCube. Our research was based on data available for the period 2015–2023, as Agenda 2030 was adopted in 2015.

To fulfill the main objective of this study, it is essential to formulate the following research question: *“Does the development of employment in research, development and high-tech sectors significantly affect the competitiveness of NUTS 3 regions in the Slovak Republic?”*

To answer this research question, it is necessary to establish several additional research sub-questions:

1. “Is there a statistically significant difference in the development of employment in the research, development and high-tech sectors between the NUTS 3 regions in the Slovak Republic?”
2. “Does the research, development, and high-tech sector significantly contribute to regional competitiveness and economic growth only in the Bratislava region?”

To assess the level of implementation of the SMART concept in the NUTS 3 regions of the Slovak Republic, the following analytical methods will be applied: analysis of development trends based on available statistical data on employment in the research, development, and high-tech sectors; comparison and synthesis of the data; shift-share analysis of structural changes in the labour market; and labour market analysis using export base theory.

1. The general methods of scientific research applied include analysis (used for the in-depth examination of theoretical and empirical data by breaking them down into smaller and more transparent units), comparison (used to identify common features across data), and synthesis (applied to integrate partial data into final units for subsequent evaluation, interpretation, and the formulation of conclusions) (Markechová, 2011).
2. Shift-share analysis is a method of spatial analysis of structural changes in the labour market. It allows the competitive position of regions to be extracted from the national economic context, thereby revealing either the development dynamics or, conversely, the lagging of a selected sector of the national economy in a given region compared to the national average over a specific time period. In our case, the analysed sector will be employment in the research, development and innovation sector, over the time period from 2015 to 2023.

This method is based on data on sectoral employment in the regions and the gross value added of the sector.

$$G_i = e_{io} ((E_t/E_o) - 1) + e_{io} ((E_{it}/E_{io}) - (E_t/E_o)) + e_{io} ((e_{it}/e_{io}) - (E_{it}/E_{io})) \quad (1)$$

Where:

G_i = regional employment growth in sector i

e_{io} = regional employment in sector i at the beginning of the reference period

e_{it} = regional employment in sector i at the end of the reference period

E_{io} = national employment in sector i at the beginning of the reference period

E_{it} = national employment in sector i at the end of the reference period

E_o = national employment at the beginning of the reference period

E_t = national employment at the end of the reference period

The application of this method will make it possible to assess the level of competitiveness of individual regions in a given sector, as well as the extent to which one of the objectives of the SMART concept has been implemented namely, supporting employment in the field of research, development and high-tech in the NUTS 3 regions of the Slovak Republic. In conducting the analysis of structural changes in the labour market, we rely on statistical data on employment in the research, development and high-tech sector, which represents innovation, as well as on regional and national employment data for the period 2015–2023.

3. Export base theory is a method used to identify the potential of a given sector to contribute to regional value creation through stronger economic

growth. One of the tools used in this context is Izard's location quotient (L_q), which reflects the competitiveness of given sector in a region.

$$L_q = \frac{\frac{x_{ij}}{x_j}}{\frac{x_i}{x}} \quad (2)$$

Where:

X_{ij} = number of people employed in industry i in region j

X = number of people employed in the country

X_j = number of people employed in the region

X_i = number of employees in industry i

Local employment (X_{ij}) refers to the difference between actual employment in the sector in the region and basic (local) employment, also known as **employment surplus**. It is represented by workers who produce "exportable" outputs beyond the borders of the region. This indicator is calculated only in regions where the value of the **Izard location quotient is greater than or equal to 1**.

$$X_{ijl} = X_{ij} / L_{(q)} \quad (3)$$

Where:

X_{ij} = number of employees in industry i in region j

L_q = Izard's localization quotient

The employment multiplier (M_z) explains how much an industry contributes to job creation in a region.

$$M_z = 1 + \sum_{i=1}^n \frac{x_{ij} - \frac{x_{ij}}{L_q}}{x_{ij}} \quad (4)$$

Where:

X_{ij} = number of employees in industry i in region j

L_q = Izard's localization quotient

(Belajová and Fáziková, 2005).

4. Testing hypotheses to answer the research question:

Wilcoxon matched pairs test is a nonparametric statistical method designed to compare two paired samples.

$$W = \min(W^+, W^-) \quad (5)$$

Where:

W^+ = sum of the orders of positive differences

W^- = sum of the orders of negative differences

(Markechová, 2011).

3 Results

Given the broad scope of the Agenda 2030 goals, we analyze the level of smart transformation in NUTS 3 regions, that is, the extent of SMART concept implementation, through the indicator *“employment in science, research, and high-tech.”* This indicator is not only a prerequisite for enhancing the economic and innovation potential of regions, but also a necessary condition for regions to become smart and thereby improve the quality of life for all stakeholders.

As noted earlier, studies of this kind absent not only in the Slovak Republic but also across the EU. This gap provides potential for future research, particularly through expanding the analysis to other European regions that lag in smart transformation or exhibit low employment in science, research, and high-tech sectors. The present study is based on data from the period 2015–2023, corresponding to the post-adoption phase of the Agenda 2030 program launched in 2015.

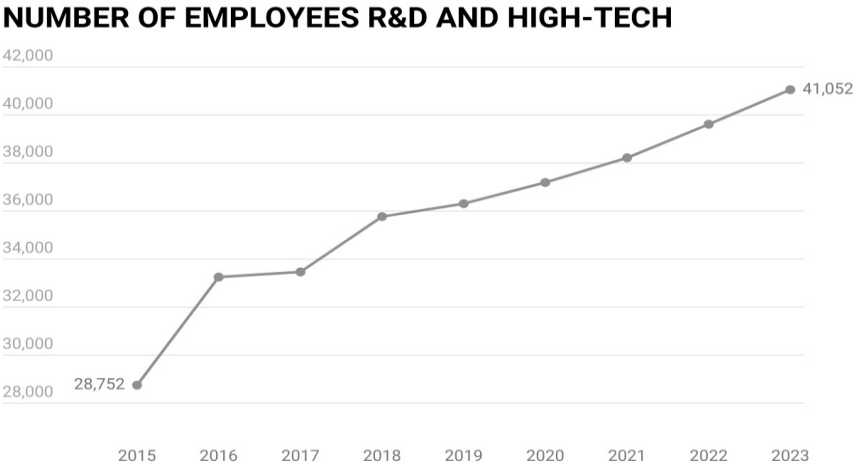
In the 2014–2020 programming period, EUR 2.67 billion was allocated from EU funds to support science, research, and innovation (HORIZON 2020, Operational Programme Research and Innovation, Slovak Investment Holding). However, given that the Slovak Republic has long been among the countries with a low absorption capacity for EU financial support, only about EUR 1.1 billion — roughly 80% of the total — was successfully utilized (*“Horizon Europe strategic plan 2025-2027,”* 2024; *“Operational Programme Research and Innovation 2014 - 2020,”* n.d.; *“Slovak Investment Holding,”* 2023).

Our focus on employment in this sector stems primarily from the relatively weak support for the smart transformation of regions and the limited implementation of the SMART concept. Compared to other European regions, support for this sector has long been insufficient. The Slovak Republic, along with most of its regions, lags significantly behind in fostering science, research, and innovation, as well as in adopting specific elements that contribute to smart regions serving all stakeholders. According to the innovation score, Slovakia ranks 24th among the 27 EU member states (*“European Innovation Scoreboard 2025 Country profile Slovakia,”* 2025).

Figure 1 demonstrates the development of employment in the research, development and high-tech sector in the Slovak Republic over the period 2015–2023. During the analysed timeframe, employment in this sector exhibited a consistently increasing trend. Between 2015 and 2023, the number of individuals employed in the research, development and high-tech sector grew by approximately 12,300.

This increase suggests that either new enterprises have been established in various regions of the Slovak Republic or existing ones have expanded their workforce in this sector. Such a trend is not only significant for the country's future economic growth and development but is also of crucial importance in the context of implementing the SMART concept and achieving the objectives of the 2030 Agenda.

Figure 1: Number of employees in R&D and high-tech



Source: ("Zamestnanosť v odvetví vedy, výskumu high-tech," 2025)

Figure 2 offers a comparative view of the development of employment in the research, development and high-tech sector in individual NUTS 3 regions in the Slovak Republic. Over the 2015 to 2023 reference period, the highest number of employees was recorded in the Bratislava region. It is essential to note that there is a significant gap in the number of workers in the research, development and high-tech sector between the Bratislava Region and other regions. Regional differences not only in employment in science, research, and high-tech, but also in the level of smart transformation and overall regional development are particularly pronounced between the Bratislava region and the other NUTS 3 regions. This is mainly because the Bratislava region is classified as an OECD metropolitan region, concentrating most innovative companies as well as the majority of research and educational institutions.

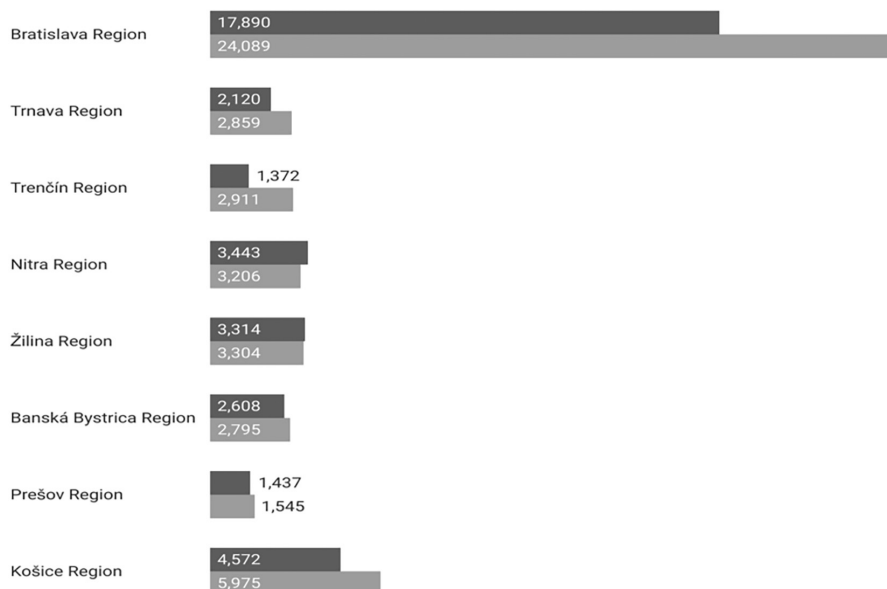
In the comparison of 2015 and 2023, it can be stated that the most significant increase in the number of employees in the given sector, with the exception of the Bratislava Region, occurred in the Trenčín Region and the Prešov Region during the period under review. However, there was also a small decrease in the number of the workforce in the research, development and high-tech sector during the period under review, namely in the Nitra region and the Žilina region. This phenomenon may have been caused by organizational changes within companies, as the decline is only marginal. Nevertheless, an analysis of the available statistical data allows us to conclude that, during the period under review, employment in the science, research, and high-tech sector developed favorably. This trend is a positive signal for smart transformation, as well as for the economy and competitiveness of the region.

When examining labour market sector dynamics in terms of growth intensity, particular attention should be given to structural change analyses (shift-share analysis). These analyses provide a comprehensive perspective not only on

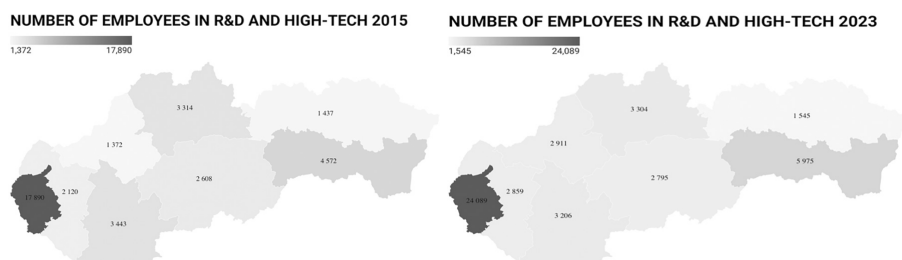
sectoral employment trends but also on the pace of development and regional competitiveness. Consequently, they allow for the identification of both development trajectories in selected labour market sectors and potential labour shortages or demand in specific sectors and regions.

Figure 2: (a) Number of employees in R&D and high-tech 2015; (b) Number of employees in R&D and high-tech 2023

NUMBER OF EMPLOYEES R&D AND HIGH-TECH 2015 AND 2023



Created with Datawrapper



Source: ("Zamestnanosť v odvetví vedy, výskumu high-tech," 2025 www.datacube.statistics.sk)

Table 1 provides an overview of the results of the shift-share analysis of structural changes in the labour market across individual NUTS 3 regions of the Slovak Republic, specifically in the research, development, and high-tech sector. The shift-share analysis enables the identification of whether the average change in employment in a given sector within a region exceeded the

average national change in that sector. In this context, the highest regional employment growth rates in the research, development, and high-tech sector between 2015 and 2023 were recorded in the Bratislava Region (0.008) and the Trenčín Region (0.008), outperforming both the national average and other regions. This indicates that these two regions experienced faster employment growth in the sector compared to the national level.

Conversely, negative values were observed in the Nitra Region (-0.007), the Žilina Region (-0.005), the Banská Bystrica Region (-0.003), and the Prešov Region (-0.002). Even in regions where employment increased in absolute terms, the growth rate lagged behind the national average. Moreover, the negative shift-share values were considerably more pronounced in regions that experienced an actual decline in employment within the sector.

The overall conclusion of the shift-share analysis is that the Bratislava and Trenčín Regions have most effectively leveraged their conditions to advance one of the key objectives of the SMART concept promoting and creating jobs in research, development, and high-tech. However, the situation in several other regions remains concerning. If the Slovak NUTS 3 regions were compared with those in other EU Member States, the results would likely be even more unfavourable.

These findings highlight an urgent need to strengthen support for employment in this sector, which is among the most promising for fostering future economic growth and competitiveness particularly in light of the expected decline in labour demand within Slovakia's traditionally dominant industrial sector due to ongoing digitisation and automation.

Table 1: Values of the Shift-share analysis

Region	Values of the Shift-share analysis
Bratislava Region	0.008
Trnava Region	0.001
Trenčín Region	0.008
Nitra Region	- 0.007
Žilina Region	- 0.005
Banská Bystrica Region	- 0.003
Prešov Region	- 0.002
Košice Region	0.001

Source: Author's own calculation based on statistical data
(www.datacube.statistics.sk)

Table 2 presents the results of calculations based on Izard's location quotient, the values of which indicate whether the research, development and high-tech sector is competitive in terms of the region's economic development. The period under review spans from 2015 to 2023.

Table 2: Values Izard's location quotient

Region	L_q2015	L_q2023
Bratislava Region	3.94	3.43
Trnava Region	0.51	0.57
Trenčín Region	0.32	0.58
Nitra Region	0.73	0.53
Žilina Region	0.68	0.45
Banská Bystrica Region	0.61	0.63
Prešov Region	0.28	0.24
Košice Region	0.89	1.00

Source: Author's own calculation based on statistical data
(www.datacube.statistics.sk)

If the value of Izard's location quotient is less than 1, the sector in the region cannot be considered competitive for economic growth. This indicates that the sector's output does not exceed regional boundaries (i.e. it is a non-exporting sector), or that the sector's share of employment in the region is lower than the national average. Conversely, if the value of the quotient is greater than 1, the sector can be considered competitive, meaning it generates output beyond the region's borders (export-oriented sector) or has a higher employment share compared to the national level. The results of the Izard location quotient calculations show that, at the beginning of the analysed period, the research, development and high-tech sector was competitive and contributed significantly to regional economic growth only in the Bratislava Region. By 2023, this sector had also become competitive and a driver of economic growth in the Košice Region. A comparison of the Izard location quotient values for the Bratislava and Košice Regions reveals that, despite an increase in the number of workers in the research, development and high-tech sector in the Bratislava Region, the overall competitiveness of the sector declined. The fact that only two regions in Slovakia have been identified as having potential in science, research, and high-tech is primarily attributable to the concentration of businesses and universities in the country's two largest cities. A decrease in quotient values was also recorded in the Nitra and Žilina Regions, where there was an actual decline in the workforce employed in the research, development and high-tech sector during the monitored period.

Table 3 presents the results of local employment calculations for regions in which the research, development and high-tech sector was competitive in the reference years 2015 and 2023, based on the Izard location quotient.

Table 3: Values of local employment

Region	LE 2015	LE 2023
Bratislava Region	4541	7023
Košice Region	-	5975

Source: Author's own calculation based on statistical data
(www.datacube.statistics.sk)

In 2015, the Bratislava Region was the only region where the research, development and high-tech sector was classified as an exporting, i.e., competitive sector. The total number of workers in this sector in the Bratislava Region that year was 17,890. Of these, 4,541 were employed in export-oriented activities, contributing directly to the region's economic growth. By 2023, two Slovak regions had a competitive research, development and high-tech sector: the Bratislava Region and the Košice Region. In Bratislava, the total number of workers in the sector had increased to 24,089, with 7,023 employed in export oriented roles supporting regional economic growth. In the Košice Region, local employment in the sector was recorded at 5,975 workers the same as the total number of employees in the sector in that region. Since the value of the Izard location quotient for Košice in 2023 was exactly 1, this indicates that, although the sector does not yet generate export value, it is still considered competitive and holds potential for future economic growth.

The increase in employment in this sector is primarily attributable to the concentration of scientific and research institutions, high-tech companies, and universities in Slovakia's two largest cities, Bratislava and Košice. In the regional capitals of other NUTS 3 regions, such institutions and companies are less prevalent. However, if Slovakia's current industry is transformed into a smart and inclusive one in line with Agenda 2030, it is likely that other regions will also become more competitive. Such a transformation could help mitigate demographic challenges, particularly the outmigration of young and educated people to central cities.

Table 4 shows the extent to which competitive export industries contribute to the creation of additional jobs in the region.

Table 4: Values of local employment

Region	LE 2015	LE 2023
Bratislava Region	17 890. 93	24 089. 71
Košice Region	-	5 975. 02

Source: Author's own calculation based on statistical data
(www.datacube.statistics.sk)

In 2015, the research, development and high-tech sector in the Bratislava Region contributed to the creation of 17,890.93 jobs. By 2023, the number of people employed in this sector had increased to 24,089.71. In 2023, significantly higher employment in the sector was also recorded in the Košice Region, where more than 5,975 jobs were created in the regional labour market. This contributed not only to strengthening the regional economy, but also to enhancing competitiveness in the implementation of the SMART concept and selected objectives of the 2030 Agenda. The results of the above calculations clearly highlight the need to focus on supporting job creation in the research, development and high-tech sector, as innovation is one of the key prerequisites for future regional development. Making a region or city "SMART" cannot rely solely on imported innovations. Rapid technological advancement compels us to consider the inevitable transformation in labour market demands.

To achieve sustainable economic development, we must also respond to the already significant changes in labour needs within the manufacturing and processing industries. A decline in demand for industrial labour could pose serious economic challenges in many regions. Therefore, achieving sustainable economic and social development requires not only external innovations but also those generated within the region itself, which can ensure greater adaptability in the labour market.

However, for regional innovation to thrive, a supportive environment must be established, along with systemic support from the state across all spheres of social life. Innovations can emerge from any sector from foundational areas such as education, public administration, and healthcare, to fields like tourism, which hold versatile future development potential for the labour market in the Slovak Republic. However, it is essential that individual actors including the state, regional governments, universities, research institutions, and innovative companies join forces and form consortia aimed at creating new jobs and generating innovative technologies. These should not only simplify public administration and improve the daily lives of citizens but also enhance economic competitiveness and sustainability.

4 Discussion

Several problems arise in the process of smart transformation, or the gradual implementation of the SMART concept through support for employment in science, research, and high-tech in the NUTS 3 regions of the Slovak Republic:

- There is low state support and a lack of cooperation between institutions responsible for science, research, and education at both national and regional levels and other entities such as universities and high-tech companies. Moreover, Slovakia lacks innovation clusters and consortia.

Targeted policy instruments such as research grants, innovation vouchers, tax incentives for high-tech enterprises, and start-up incubation programs could significantly stimulate regional employment in knowledge-based industries. Evidence from EU innovation leaders demonstrates that well-designed support schemes encourage the growth of spin-offs from universities and research institutions, which are key drivers of regional employment.

- Most of the funding for the development of science, research, and innovation in Slovakia comes from EU resources, complemented by the mandatory national co-financing set for EU member states.
- Links between regional and local authorities and key businesses and universities in science, research, and innovation remain weak.
- The Bratislava region, as an OECD metropolitan region and the country's capital area with the highest concentration of science, research, and high-tech institutions, employs incomparably more workers in this sector than other regions.
- Despite the presence of several car manufacturers in the Žilina (Kia), Nitra (Jaguar Land Rover), Trnava (STELLANTIS – Citroën, Opel), and Bratislava (Volkswagen) regions, the vast majority of employees in these companies are not part of the high-tech sector but belong to the manufacturing and processing industries, which were not included in our study. Our focus is on highly qualified professionals such as developers, analysts, specialists in various fields of cybernetics, and scientists. Industry in its current form is not regarded by Agenda 2030 or several recognized studies as a sector with higher added value, nor as one sustainable in line with Agenda 2030 goals ("European Innovation Scoreboard 2025 Country Profile Slovakia," 2025; Hickel et al., 2020; Pavlínek, 2012). The Agenda 2030 program aims to make industry inclusive, sustainable, and innovative, but under Slovakia's current conditions, this cannot be regarded as such. However, if smart transformation of regions is achieved including the transformation of industry it will be possible to foster economic competitiveness and sustainable growth even in economically less developed regions in Slovakia ("European Innovation Scoreboard 2025 Country profile Slovakia," 2025; Pavlínek, 2012; Vokoun, 2024).

The results of our analyses confirm that employment in the research, development and high-tech sector holds significant potential for sustainable eco-

conomic growth and development. However, in the NUTS 3 regions of the Slovak Republic, employment growth in this sector remains highly uneven even after nearly a decade. This persistent disparity ultimately threatens both the competitiveness and the long-term sustainability of regional development. The shortage of qualified professionals in high-tech fields, digital skills, and applied research continues to be one of the main constraints. In particular, regions outside Bratislava often lack sufficient numbers of doctoral graduates, ICT specialists, and R&D project managers, which reduces their ability to absorb investment and expand employment in high-tech sectors.

The differences in employment levels and the pace of employment development in the research, development and high-tech sector clearly indicate that fostering a strong innovation-driven economy and promoting sustainable growth are not yet priorities across all regions of Slovakia. Currently, the majority of the Slovak workforce is employed in the service and industrial sectors. With rapid technological advancement and shifts in labour market demand, a significant portion of jobs in these sectors is expected to disappear. Therefore, labour market and employment policies should focus on designing objectives and measures aimed at promoting employment in knowledge-based sectors, including tourism, as these are closely interconnected with various soft segments of the national economy.

The results of the analysis of structural changes in the labour market indicate a positive and more pronounced growth in the number of workers in this key sector for the future in only two of the monitored regions Bratislava and Trenčín. However, despite the relatively rapid employment growth in the research, development and high-tech sector, the Trenčín Region still does not reach a competitive level. Other regions show only negligible growth or even a slight decline in employment in the sector during the observed period, which presents a considerable challenge to efforts aimed at introducing innovation and implementing the SMART concept through the labour market. This situation requires targeted approaches and support measures. Given the low level of regional specialisation in the research, development and high-tech sector, the lack of alignment in regional development strategies also becomes apparent. Despite the risks associated with automation and digitalisation, many strategies still focus the future structure of the labour market on the automotive industry. Instead, regional development policies should prioritise diversification towards sectors such as biotechnology, renewable energy, creative industries, and digital services, all of which offer higher added value and greater employment resilience in line with Agenda 2030 goals.

At the same time, it is necessary to acknowledge that current political, financial, legislative, and other instruments do not sufficiently or effectively support smart regional specialisation. With the exception of the Bratislava Region, Slovak regions have not succeeded in creating adequate conditions for the development of the knowledge economy, despite a generally positive national trend in the number of workers employed in research, development and high-tech sectors.

Nevertheless, the issues addressed in this study are broad in scope and offer potential for further research. Such research, however, requires the continuous updating of statistical data, as this study is based on data covering the 2015–2023 period. We also see potential for further research in expanding the study to include other sectors that represent the future of the labor market, not only in terms of sustainability but also competitiveness. However, at present, the main limitation lies in the insufficient comprehensiveness of the available statistical data.

For a deeper elaboration and contribution to the subject, it will be important:

- Undertake repeated, in-depth, and multi-faceted analyses of regional differences in the labour market, especially in knowledge economy sectors, as it is necessary to investigate the factors hindering the implementation of SMART concept elements in the labour market space. These analyses should be linked to other regional data, particularly in the areas of education, infrastructure development, migration, and investment development (Hechi et al., 2024).
- Compare the conducted analyses and obtained results with those from other EU regions. This involves reflecting on the knowledge gained through foreign studies and examples of good practices from countries with the highest share of the workforce in knowledge economy sectors, as well as studying the development strategies and mechanisms that advanced regions have adopted to support the knowledge economy. Relevant examples of good practice may be drawn from regions such as Uusimaa (Finland), Baden-Württemberg (Germany), Stockholm län (Sweden), Île-de-France (France), as well as Emilia-Romagna (Italy) and Catalonia (Spain) (Rigby et al., 2022).
- Create a space for communication and discussion among regional development and labour market experts, representatives of the knowledge economy sector (including high-tech enterprises and research institutions), and policy decision-makers at both national and local levels. The goal is to establish a supportive financial and legislative environment for promoting knowledge economy sectors within regional labour markets (Rigby et al., 2022).
- Emphasise participatory models in line with the *quadruple helix* principle in the development of employment strategies. In addition to the public, private, and education/research sectors, it is desirable to involve citizens in planning and implementing the SMART concept, as well as in expanding employment capacities in the knowledge economy sectors. This requires systematic investment in life-long learning, reskilling programmes for workers displaced by automation, and the creation of attractive career pathways for young graduates to remain in their home regions rather than migrating abroad. Targeted scholarships, mentorship programmes, and regional talent retention schemes could help address these gaps. These individuals must be motivated and educated to fill future jobs in these sectors. Since knowledge economy industries place a high premium on a skill-

led workforce, it is essential to incorporate these requirements effectively into key education strategy documents (Banerjee et al., 2023).

- Beyond the national-level concept of labour market support for knowledge-based industries, it is recommended to develop tailored political-economic strategies for individual regions, as each possesses distinct development potential. These strategies must be adapted to the existing infrastructure, human capital, and other regional conditions to ensure economic competitiveness and sustainability. The involvement of all actors localised within the regions will be crucial, as effective outcomes can only be achieved through collaborative dialogue (Zlámál, 2019).

Other commonly recognised measures to support employment in the research, development and high-tech sector or the knowledge economy sector more broadly include:

- Strengthening financial, legislative, and consultative state support for existing innovation centres and clusters in the regions, as well as creating appropriate conditions for the establishment of new clusters.
- By 2030, increase public and private investment in research and development to at least 2% of total GDP, in line with the EU average expenditure on science and research, which currently stands at 2.22%. Achieving this threshold would not only align Slovakia with the EU average but also create thousands of new jobs in research, development, and knowledge-intensive services, particularly in regions currently lagging behind. A consistent increase in R&D expenditure has been shown to correlate with long-term growth in high-skilled employment across OECD countries (OECD, 2025).
- Establishing bilateral agreements to connect Slovak innovation centres and enterprises with foreign counterparts, particularly for the purpose of exchanging experience and fostering cooperation in the development and implementation of innovations.
- Enhancing the attractiveness of ongoing activities mainly those supported by EU project funding such as cooperation between universities, the private sector, and public administration; SMART mobility and energy projects; or initiatives aimed at attracting talent to the regions – is essential. In the context of Slovakia's managing authorities, it is crucial to create a favourable environment that reduces administrative and bureaucratic burdens, focuses on results achieved, and adheres to the principle of value for money to ensure high quality, efficiency, and long-term sustainability.

Furthermore, Slovakia should increase its participation in calls that facilitate cooperation on knowledge economy, science, research, and innovation projects with institutions from other EU Member States, going beyond those limited to the national context.

In order for individual regions of the Slovak Republic to move closer to achieving sustainable economic and social development by 2030, and to successfully deliver and implement innovation, it will be essential to intensively de-

velop their own innovation capacities. Such capacity building typically begins within smaller communities, which can subsequently expand their influence to a broader area. In this context, it is crucial that Slovak regions create an environment that enables them to leverage their strengths and potential to establish sustainable and smart local governments that utilise technology to address everyday challenges and improve the quality of life for residents and entrepreneurs, who represent the driving force of each regional economy. Such an environment enhances the capacity of regions to attract investors, retain highly skilled professionals, and stimulate the creation of knowledge-intensive jobs. In practice, this means not only strengthening the high-tech sector itself, but also expanding employment opportunities in related areas such as digital infrastructure management, smart mobility, renewable energy solutions, and data-driven public services. Overall, the findings highlight the urgent need for Slovakia to strengthen its knowledge economy capacities across all regions, as this remains the cornerstone for achieving both regional competitiveness and sustainable development in line with Agenda 2030.

5 Conclusion

The main objective of this study is to assess the level of implementation of a selected element of the SMART concept within the context of the 2030 Agenda goals across individual NUTS 3 regions of the Slovak Republic using various analytical methods.

In order to fulfil this objective, the following research question was formulated:

“Does the development of employment in the research, development and high-tech sector significantly affect the competitiveness of NUTS 3 regions in the Slovak Republic?”

To address this research question, the following hypotheses were formulated and tested:

Table 5. Wilcoxon Signed-Rank test

Q: Is there a statistically significant difference in the development of employment in the research, development and high-tech sector between the NUTS 3 regions in the Slovak Republic?

H₀: There is no statistically significant difference in the development of employment in the research, development and high-tech sector between NUTS 3 regions in the Slovak Republic.

H₁: There is a statistically significant difference in the development of employment in the research, development and high-tech sector between NUTS 3 regions in the Slovak Republic.

Parameter	Value
p-value	0.07813
W test (W-, W+)	5, (5, 31)
Effect size (r)	0.6228
Significance level (α)	0.05

Source: Author's own calculation

The test results do not provide sufficient evidence to reject the null hypothesis (H₀) at the 5% significance level ($p > \alpha$), indicating a substantial but statistically non-significant difference in employment in the research, development and high-tech sector between 2015 and 2023. It can be concluded that, although the number of people employed in this sector increased considerably, the change was not statistically significant. At the national level, the increase appears relatively substantial, but regional development trends remained largely unchanged, with the exception of the Trenčín Region. Most NUTS 3 regions, except Nitra and Žilina, recorded positive trends in employment in the research, development and high-tech sector, suggesting a regional effort to foster conditions for new jobs in the knowledge economy and innovation sectors. A striking disparity persists between the Bratislava Region and the rest of the Slovak Republic, which may intensify in the future and challenge the country's ability to effectively implement the SMART concept in line with the 2030 Agenda labour market objectives.

Table 6: Wilcoxon Signed-Rank test

<i>Q: Does the research, development, and high-tech sector significantly contribute to regional competitiveness and economic growth only in the Bratislava region?</i>	
<i>H0: There is no statistically significant difference in the share of the research, development and high-tech sector in economic growth between the Bratislava Region and other regions.</i>	
<i>H1: There is a statistically significant difference in the share of the research, development and high-tech sector in economic growth between the Bratislava Region and other regions.</i>	
Parameter	Value
p-value	0.485
W test (W-, W+)	0.500316
Effect size (r)	0.13
Significance level (α)	0.05

Source: Author's own calculation

The test results do not provide sufficient evidence to reject the null hypothesis (H0) at the 5% significance level ($p > \alpha$), indicating that the difference in the share of the research, development and high-tech sector in economic growth between the Bratislava Region and other Slovak regions is not statistically significant. Nevertheless, the analysed data suggest that only in the Bratislava Region is this sector represented by a workforce that generates exportable outputs and contributes substantially to regional economic growth and job creation. The multi-faceted analyses conducted for the 2015–2023 period also indicate that the research, development and high-tech sector shows signs of competitiveness in the Košice Region. However, in terms of workforce growth or decline, the sector remains relatively stagnant, pointing to a lack of systemic support.

These findings underline the urgent need to foster job creation in the research, development and high-tech sector, as it holds significant potential for the labour market of the future, sustainable economic development, and overall quality of life. The study concludes that employment development in this sector influences both regional and national competitiveness, particularly in the context of SMART concept implementation in line with the 2030 Agenda. Given the rapid digitalisation of the labour market and changing workforce skill requirements, it is crucial to strengthen support mechanisms and strategies aimed at generating new employment opportunities in cities and regions, especially in science, research, and innovation.

In order to create new job opportunities in science, research, and high-tech, we consider the following to be important:

- On the part of the state – establishing a long-term framework for financing science, research, and innovation, modernizing tax incentives for innovative companies, and providing systematic support for talent through education and retraining.
- On the part of regional governments – updating the smart specialization strategies of RIS3 regions, building clusters, innovation hubs (or laboratories), and consortia in cooperation with other regions, with support from the state, universities, innovative enterprises, and industrial actors. These initiatives should create space for programs aimed at retaining talent and graduates in the region.

During the course of the study, we encountered a number of limitations, particularly those relating to the regional delimitation of territories when examining indicators such as employment in science, research, and high-tech sectors, as overlaps between functional urban areas can significantly distort the results. We also identified limitations in the form of inconsistent statistical data, since in the industrial sector—especially the automotive industry—there are workers who may be considered highly skilled high-tech employees. Another limitation of the study lies in the narrow selection of indicators applied in the chosen methods (focused mainly on employment in the science, research, and high-tech sectors). On the other hand, this limitation opens opportunities for expanding the research in the future. Such research offers the possibility to examine and compare the competitiveness of several sustainable industries of the future, which could help regions effectively develop their potential for competitiveness and sustainable economic growth.

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Environmental Policy Implementation: Can We Reduce Failures Without Changing Objectives?

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ABSTRACT

Purpose: To demonstrate the necessity of reverse mapping in the implementation process of environmental policy.

Design/Methodology/Approach: A representative survey (of the adult population of Bulgaria) on pro-environmental behaviour and public attitudes towards relevant policies; data analysis conducted through ANOVA and factor analysis.

Findings: There is a gap between public approval of ecological goals and support for concrete measures. Preferences regarding policy tools depend on their perceived beneficial or harmful impact on the material situation of individuals. No more than 30% of citizens are willing to pay for ecological improvements.

Practical Implications: Individual preferences should be monitored throughout the process of environmental policy implementation and used as evidence to inform changes in policy development.

Originality/Value: The notion that individual preferences regarding policy tools are significant in the implementation of environmental policy; the composite indicator of pro-environmental behaviour.

Keywords: *policy tools, environmental policy implementation, implementation models, individual preferences regarding environmental policy tools, backward mapping implementation.*

Izvajanje okoljske politike: ali lahko zmanjšamo neuspehe, ne da bi spremenili cilje?

POVZETEK

Namen: prikazati nujnost vzratnega mapiranja v procesu izvajanja okoljske politike.

Načrt/metodologija/pristop: reprezentativna anketa (med odraslim prebivalstvom Bolgarije) o prookoljskem vedenju in javnih stališčih do ustreznih politik; analiza podatkov z ANOVA in faktorsko analizo.

Ugotovitve: obstaja razkorak med javnim odobravanjem okoljskih ciljev in podporo konkretnim ukrepom. Preference glede političnih orodij so odvisne od tega, ali se zaznava, da pozitivno ali negativno vplivajo na materialni položaj posameznikov. Plačevati za okoljske izboljšave je pripravljenih največ 30 odstotkov državljanov.

Praktične implikacije: posameznikove preference je treba spremljati skozi celoten proces izvajanja okoljske politike in jih uporabiti kot dokazila za usmerjanje sprememb v oblikovanju politik.

Izvirnost/vrednost: opozorilo, da so preference posameznikov glede političnih orodij pomembne pri izvajanju okoljske politike; sestavljeni kazalnik prookoljskega vedenja.

Ključne besede: *orodja politike; implementacija okoljske politike; modeli implementacije; preference posameznikov glede orodij okoljske politike; implementacija z vzratnim mapiranjem.*

JEL: D78, Q56, H83

1 Introduction

Environmental policy is probably the only area in which the administration and experts are more important than politicians, not because they have more powers, but because implementation is more important for achieving the desired results compared to policy formulation. The tools that can effectively stimulate people's pro-environmental behavior can be found within the framework of the implementation process. The likelihood of this happening at the macro-political level of governance is small for at least two reasons. On the one hand, this probability is limited due to the specificity of ecosys-

tems, local environmental problems, and public relations regarding their solution. On the other hand, the volatility of human behavior, which is difficult to predict due to the influence of unconscious and irrational factors, leads to unpredictability of reactions to the measures taken and to the need for these measures to be constantly adjusted and even supplemented. This turns the administration from a „politicians’ headquarters“ into an active initiator of specific tools for achieving policy goals. Moreover, due to the horizontal nature of sustainability goals, seeking compliance with them is part of the administration’s commitments, regardless of the sector in which it operates.

There are at least two reasons the implementation of environmental policy is more important than goal setting. One is related to the policy essence, and the other relates to the development process.

The long-dominant traditional model assumes a rational and coherent link between problems and policy in which optimal tools are prescribed to solve policy issues, regardless of the individual preferences to policy tools. The increasingly current behavior perspective, however, focuses on the effects of individual-level perceptions of policy tools. However, research on citizens’ potential preferences for policy tools is limited. This deficit encourages the perception of instrument choice as an expert-technical endeavor, especially with regard to policies where there is no clear political dividing line. In such an approach, the question of why the outcomes of certain policies is very limited, despite relative clarity and/or agreement on key objectives, remains open. In this context, the present study considers environmental policy as particularly relevant for the study of preferences for policy tools.

Almost 60 years after the Club of Rome Report, which gave the first impetus to the environmental policy, the results of its implementation remain questionable. Even after the 2015 Paris Agreement on climate change, which in some way changes the traditional approach by recognizing the need to limit certain human activities, skepticism that policies will actually deliver results still exists (Laitos and Okulski, 2017). Despite some individual improvements in selected indicators and specific locations, the overall decline in environmental quality continues with unwavering strength, and no country has achieved environmental sustainability (Howes et al., 2017).

It seems that environmental goals are, in general, commonly shared. Proof of this is the process outlined after 1992 by the successive Rio Earth Summits. This process led to the adoption in 2015 of the 17 Sustainable Development Goals (United Nations, 2015), adopted by the Governments of all Member States of the international organization (193 in total). Of course, a particularity of these goals is their weak specification, and it is difficult to dispute the statement that if we describe people’s goals at a high level of abstraction – “to have a good life” – then almost everything is a means to achieve these goals (Alemanno and Sibony, 2015).

Environmental policy follows two alternative approaches to solving identified problems: technological innovation and consumption change. In some

ways, the two approaches are interconnected. It is expected, and even seems logical, that technological change will increase the sustainability of production consumption, so that the economy will not only pollute and/or deplete natural resources. This approach clearly has its limitations. Electric motors, for instance, pollute less, but their production involves the use of many more resources. In addition, the issue of their disposal seems, at least for now, insoluble and extremely harmful to the natural environment. In general, the history of technology shows that many discoveries that are the basis of modern life have caused and continue to cause intractable environmental problems.

The second approach, which is consumer-oriented, seems even more contradictory. Even when not explicitly identified, changing behavior has long been at the heart of environmental programs (Bujold et al., 2020). However, the shift of pollution sources from production processes to consumption processes makes pro-environmental behavior of citizens essential for reducing pollution (Carducci et al., 2021). Modern consumer culture, which is strongly influenced by marketing rather than actual needs, has a beneficial impact on economic growth, but at the same time, a detrimental impact on the environment. The paradox here is that this also applies to products that meet certain environmental standards – they are more on the trajectory of consumerism than of environmental consumption.

Environmental policy can hardly achieve a significant effect without eliminating the reasons for the problems for which it is undertaken. When human activities are oriented primarily towards maximizing individual benefit, consideration for nature remains in the background. A society in which the benefit pursuit is the main factor of individual behavior can probably protect natural resources through policies if there is no contradiction between these two goals, and they are naturally achieved simultaneously. For the moment, however, this seems impossible - ecology is either expensive, or leads to a reduction in jobs, or makes it difficult for individuals. This, in most cases, leads to a refusal of either production, consumption, or ecology.

Despite the logical contradictions in the approaches to environmental policy, there is no reason to believe that it has become an occasion for new political cleavage. The thesis that achieving real results related to sustainability requires limiting economic growth (Asara et al., 2015) remains, at least for now, marginal in the policy debate. On the contrary, the big question is how to maintain the pace of economic growth and restore the ecological balance at the same time.

Within a simplistic vision of policy objectives, there is a focus on the efficient use of resources to achieve ecological goals, without much attention to the demand or behavioral characteristics of audiences (Shafir, 2012). Thus, policymaking is typically seen as an activity focused on the calibration of policy tools – such as the size of sanctions or incentives – rather than on considerations of the nature of the instruments and mechanisms themselves (Capano et al., 2019).

Beyond the contradictory approaches of the environmental policy, the process of its formation and implementation contains additional pitfalls. Environmental policy flows from top to bottom – from institutions to citizens and from the supranational through the State to the local level of governance. Although citizens are directly affected by environmental pollution, they, except in isolated cases, do not feel it directly. The individual's commitment to the environment is more of a cultural and informational origin than a material one, related to immediate needs. Not only at the beginning of the global process to sustainability but also now, the initiators of environmental policies are international expert circles and networks. In most cases, specific policies arise from global or international agreements, turn into national strategies and environmental laws, and then into regional programs and local plans. This largely seems logical. In the conditions of free trade, which turns countries into "race to the bottom" of regulations and active policies, independent environmental policy at the state level of governance would be a factor with adverse consequences for competitiveness. Therefore, international agreements on environmental policy, which in a sense set limits to the global "race to the bottom," are the incentives for measures taken at other levels of governance.

This article develops only one aspect of environmental policy implementation – the adaptation of policy to the preferences of affected individuals and the specific tools for their implementation. It seems to us that in such a task, there is a significant potential for improving the results of measures related to sustainability. At the same time, this issue cannot be solved in advance and in principle because of the strong dependence of human behavior on random factors. The first part of the article justifies the idea of implementation as a process that can improve performance, including by reformulating the tools. In the second part, based on the Bulgarian case, one of the main challenges facing the implementation of environmental policy is examined – the preferences of affected citizens regarding policy tools. On this basis, conclusions are drawn on how the administration can improve the relevant ecosystem through its own behavior.

2 Implementations as a Choice of Tools

In the theory, the issue of policy implementation is not new. As early as the 1970s, Jeffrey Pressman and Aaron Wildavsky opened this research field, proving that this stage of the policy process can significantly worsen the policy effect (Pressman and Wildavsky, 1984). The two authors study the policy process in a federal state, focusing on the transition from decisions at the central level to the actions of local authorities. They prove that a policy decision can be rendered ineffective by passing through the so-called implementation chain. The main claim is that the more agents are involved in the chain, the greater the probability of unsuccessful implementation.

The subject of Pressman and Wildavsky's study is the implementation of a federal job creation program in Auckland. Although the program is designed

and funded at the federal level, its implementation passes through several different agents: administrative agents or structures that allocate resources, local authorities that adapt the program to the local context, implementing organizations or institutions that directly implement the program and provide services, and finally – the final beneficiaries. The eventual failure of otherwise well-designed policies, according to Pressman and Wildavsky, can be caused by the presence of a series of approval points, the complexity of the actions, the relationships between the individual agents, etc.

The implementation chain of Pressman and Wildavsky is vertical. They study the transition and development of policies from the federal to the state level of governance. This fact is a reason to believe that their statements are not applicable in the conditions of unitary countries, where implementation is primarily horizontal coordination between various governmental and non-governmental agencies and organizations. The difference between the vertical implementation chain and the process of horizontal coordination is significant. In the first process, the relative freedom of each governmental level, the so-called discretion, is much more pronounced due to the presence of empowered, self-governing, independent, politically constituted communities. The vertical implementation chain does not replace horizontal coordination – they occur simultaneously. In the case of federal states, as well as in the case of more cultural than economic phenomena, such as environmental policy, the vertical implementation chain has a leading importance due to the lack of hierarchy between the main participants in it.

Pressman and Wildavsky's idea of implementation, however, contains several starting points for the present study. On the one hand, they prove that this stage does not imply only the implementation of the decision taken at the higher level, but is a creative process oriented towards maximizing the result. Accordingly, the result is a consequence of many factors, which, among other things, also relate to the relative freedom of each individual agent to make choices and solve problems. On the other hand, Pressman and Wildavsky defend the thesis that implementation is not technical, but, like formulation and decision-making, is a political process, during which the choice of policies or specific measures to achieve collective goals is exposed to the pressure of political or private interests. On the other hand, the failure of policies is also possible due to the last link in the implementation chain – the end-users of public services.

To determine the relative importance of the so-called implementation pitfalls, Howes et al. (Howes et al., 2017) use a categorization from other studies (Althaus et al., 2017; Kamieniecki and Kraft, 2012). According to the authors, these can be categorized as structural reasons, implementation traps, or problems with knowledge of the problem. The emphasis in our study is on the second group, which House et al. categorize as "implementation-related". We check the possibility of improving the effect of policies by controlling their quality.

We accept that the implementation is a process by which policy is converted into action (Barrett, 2004). The first question that this definition raises is who

is the main agent of the transformation of goals into actions. The second - given that the goal does not predetermine the action, what are the possible actions and what determines their choice. There is no agreement on both questions in the literature.

According to Pülzl and Treib (2007), research on implementation develops in three successive stages. The first, which began in the 1970s, raises the question of the potential gap between the common goal and the concrete actions for its implementation, the temporal and substantive difference between the law and the results of its application (Bardach, 1977). According to the same authors, this stage is rather pessimistic because it proves that policy intentions are not fully realized or are modified due to the complexity and sometimes unpredictability of the implementation process. The second and third stages are related to the analysis of implementation models. Research from this stage contrasts the top-down approach, in which a policy decision is implemented through the actions of a series of agencies, with the bottom-up approach, in which street level bureaucrats solve problems in a highly decentralized environment. Top-down theorists see policy designers as the central actors and concentrate their attention on factors that can be manipulated at the central level. Bottom-up theorists emphasize target groups and service deliverers, arguing policy really is made at the local level (Matland, 1995). The attempt to reconcile the two models leads to the identification of four paradigms that relate to the political-administrative relation and the degree of conflict within the implementation process. These four paradigms include low conflict-low ambiguity (administrative implementation), high conflict-low ambiguity (political implementation), high conflict-high ambiguity (symbolic implementation), and low conflict-high ambiguity (experimental implementation) (ibid.)

Our approach rejects the top-down approach without fully coinciding with the bottom-up approach. The reason is that our reasoning provides a different perspective on the understanding of implementation than the traditional one. The latter can improve the policy process by adapting specific measures to local specificities and, above all, to the attitudes and behavior of those affected. Such reasoning abstracts from the possible political-administrative conflict and considers the relative freedom of the administration to further develop political decisions. Such a perspective on the reasoning about implementation is related to the search for flexible forms of public governance that would allow for maximum consideration of the specificities of the place and time in which the policy is implemented. Matland (1995) summarizes the existence of three main criticisms of the top-downists: the interruption of the cyclical relationship and the failure to consider the lessons learned from previous implementations; the understanding of implementation as a purely administrative, technical process of implementation and the bias towards legal policy regulations. These three features of top-down approaches reject any possibility of policy being tailored to end-users. Accordingly, in this approach, outcome orientation, even if it exists, is sought solely based on theoretical considerations about what is "right" and "necessary."

The criticism of bottom-up approaches relates to the limited possibilities for political control and the overestimation of local autonomy and its resource provision to achieve public goals (*ibid.*). We claim that policy cannot be successful if the final links in the implementation chain cannot, for one reason or another, influence the policy design. This is not about their inclusion in the policy development, but about their active presence in the implementation process, when the policy needs to be adapted or even reformulated.

One of the first attempts to reconcile the two extreme models - Elmore's concept of forward and backward mapping, was developed back in the 1980s (Elmore, 1979). The idea of the model is that public authorities and target groups should jointly create the policy design. Forward mapping consists of specifying precise political goals, developing detailed "means-ends" schemes and specifying clear outcome criteria by which the policy is to be evaluated at each stage. Backward mapping consists of precisely specifying the behavior that needs to be changed at the lowest level, describing a set of operations that can ensure the change, and repeating the procedure upwards in steps until the central level is reached (*ibid.*). At first glance, this model contradicts efficiency, due to the slowness of the process. Therefore, its application in practice is most often limited to its first part - forward mapping with the participation of representatives of target groups. In the absence of reverse mapping, however, many issues become challenging – the changing attitudes of the affected parties over time and the emergence of new stakeholders; the possible lack of a clear and constant relationship between attitudes and behavior, as well as a mandatory connection between social group affiliation on the one hand and attitudes and behavior on the other. The lack of reverse mapping is a possible answer to the question of why "in many countries, effective shaping of public policies, programs, and projects let alone their implementation and monitoring, institutionalization, and evaluation, is one of the weakest points of public governance (Mencinger et al., 2017). In fact the implementation is not a one-way process at all (Sager et al., 2024). It is rather a process of interaction between independent agents incl. those affected by the policies – the end users of policy results. The failure of policies should be sought not only in the institutions but also in the preconceptions and behavioral stereotype of the end-users. For instance, when citizens are engaged, motivated, and willing to change their behavior, it is much easier for Governments to achieve their policy goals, in part because all citizens are joint participants in actions that have collective benefits. When citizens are excluded, antagonistic to Governments, and focused on their short-term interests, public policy becomes much more difficult to implement and the outcomes are poor (John, 2018).

The analysis of implementation, as well as of the policy process as a whole, concerns not only the question of "who is involved and what kind of interaction is there between the different agents", but also "what for does this interaction take place". In this sense, regardless of the implementation model (top-down, bottom-up or hybrid), this process is related to the choice of policy tools. And if the goal is abstract and can (at least in theory) be achieved in many ways,

the instrument is a concrete technique that changes individual behavior so that the overall goal is achieved. The choice of instrument is no less important than the choice of the goal, because the instrument must make people do something that they would not otherwise do (Schneider and Ingram, 1990).

This article focuses on the last part of the implementation chain. The question of how the end-user of public services can influence the success of policies is rarely a subject of research. In principle, both implementation and the entire chain are foreseen as a one-way process: from formulation at the political level, through implementation, where multiple state and/or territorial agencies participate, to the end-users. Each subsequent link in the implementation chain applies the decisions of the previous one, considering the specific context of its activity, and then makes decisions for its own activity, seeking efficiency. Since each link in the chain is relatively free in making decisions for its own activity, as well as because of the time distance between the formulation and the achievement of results, the risks of policy failure appear. A solution has been consistently sought in recent years within a logic of collaborative governance (Ansell et al., 2017), as well as shaping policy design through the participation of all stakeholders. The question that remains unanswered, however, is who represents the end-users and to what extent this representation is credible in terms of the future behavior of the affected individuals towards the instruments. The issue is further complicated because even if there is support in principle, the affected individual, whether a person or an organization, may not respond adequately to the instruments used, and thus create a risk to the achievement of the objectives. Overcoming or limiting this risk is usually sought in effective communication to present the measures to the affected individuals, especially in cases where they are unpopular or have a high social cost (Wenzelburger and Hörisch, 2016).

Institutions responsible for achieving common goals can change the behavior of individuals in the community through “stick, carrot, or sermon” (Bemelmans-Videc et al., 2011). This metaphor corresponds to the three ways in which the collective will, embodied in political power, can change individual behavior: coercion, incentives, and persuasion. It corresponds to the different resources that legitimate institutions use to influence individuals - power, public finances and information, as well as to the different techniques that public authorities in modern societies (and not only) use to achieve common goals - regulations, economic incentives, incl. taxes and fees, communication and exhortation. Despite the existence of multiple categorizations of tools (see e.g., Howlett, 2023), the above-mentioned study has had a significant impact on research in recent years, not only in the field of evaluation but in the theory of public policies in general (Olejniczak et al., 2025).

Knowledge on policy instruments and implementation patterns is brought together against the backdrop of current debates on behavioural science findings (Loer, Neher, 2024). In the last few decades, with the introduction of behavioral science into policy research, a new tool has emerged – nudges, which unconsciously change the architecture of individual behavioral choices

(Thaler and Sunstein, 2008; Klunin et al., 2024). Despite many criticisms of this approach, not coincidentally defined as libertarian paternalism (Sunstein, 2014) due to its “hidden” intervention, these tools are widely used and highly effective in certain areas of public management (Naru, 2024). Based on these criticisms, some similar categories, also inspired by behavioral science, have emerged, such as “Nudge plus” (Banerjee, 2021) or “Boosts” (Grune-Yanoff, and Hertwig, 2016). The goal of Nudge plus is not to use behavioral insights to create a one-time change, but to foster a state or environment where these interventions help establish a new equilibrium of self-reinforcing and beneficial behaviors that embed reflection as part of the nudge. With greater transparency, the agent becomes aware of his or her biases, which are systematically repeated with heuristics, i.e., they undergo perspective transformation (Banerjee, 2021). The common denominator behind Boosts policies is the idea of empowering people by expanding their competencies. Boosts are rationally based regulatory strategies designed to improve people’s ability to manage emotional reactions by overcoming biased thinking and undeliberate choices (Jolls and Sunstein, 2005). Thus, while classical nudges are considered bias-preserving, Boosts are considered bias-eliminating techniques (Di Porto and Rangone, 2015) aimed at improving people’s competence to exercise their freedom of choice.

In the broadest sense and based on whether policy tools guide or encourage appropriate behavior, they can be divided into “hard” and “soft” policy tools (Hood, 2007; Banerjee et al., 2021). Hard tools are those that guide people’s behavior through formulated rules and directives, and financial incentives such as fines, taxes, and subsidies. On the other hand, soft tools are those that seek to guide people’s behavior by providing additional information or by changing the information environment in which they make choices. Several studies have already examined public support specifically for these soft policy tools (Aghion et al., 2010; Banerjee et al., 2021).

Although implementation – the choice of a policy instrument – is a process in which multiple agents interact, exchanging expertise, influence, and often interests, the instrument must be able to achieve the goal in a specific situation. At this stage, we are not discussing the question of what the implementation model should be to choose the optimal instrument. The question is, rather, what the instrument should be to be determined as optimal. In this case, the question is not about the choice but about the evaluation.

Policies, and therefore instruments, achieve several goals simultaneously, and this is precisely the great challenge in their formulation. However, their main purpose is to change people’s behavior and to reconcile or replace their individualistic goals with common ones. Without this, no instrument can achieve results and therefore, its use becomes meaningless.

Instruments and goals are linked in the sense that the use of policy tools involves implicit or explicit assumptions and expectations about the effect that the implementation of the tools has on those affected by them. It is crucial for policy development that the behavior resulting from the use of instruments

in practice is what is expected. Whether these goals are purely social constructs with few empirical referents or reflect a more objective assessment of the actual behavior of the relevant groups of actors, this actual behavior is critical to the relationship between goals and instruments (Howlett, 2019).

The point is that no social technique acts directly. It is refracted through the attitudes, motivations and behavioral stereotypes of the affected individuals. In recent years, the application of behavioral science in public management has been mainly associated with the tools of nudge. However, it allows us not only to nudge, but also to establish and consider in advance that regulations work because people are interested in them, or because they inertially comply with the community and the authorities in it, or because the repressive or controlling apparatus in the community works well, etc. The reasons can be many. In any case, however, the effectiveness of the tools depends on the reactions of the individuals whose behavior is a prerequisite for achieving the goals. Ecological goals can be achieved and the tools chosen in connection with them can work if people are ready to reduce their consumption, or if they consume environmentally friendly products, or if they contribute to recycling, etc. Similarly, achieving sustainability goals depends on how economic agents organize the production process, what technologies they use, etc. Therefore, attitudes towards tools matter. Specific instruments may work where public attitudes are favorable and have no or minimal effect where this is not the case.

Existing research does not deny the relationship between policies and public attitudes. In most cases, however, the solution to the possible contradiction between policies and public attitudes is sought in the inclusion of stakeholders in the process of policy development and in collaborative governance (Emerson et al., 2012). The expectations are that the eventual contradictions will be overcome by finding a common point of view between the participants or by informing them. However, it is logical that citizens and their organizations can support the goals, and yet, in the process of implementing the instruments, adjust their behavior in such a way that the goals cannot be achieved.

Studies that prove the existence of certain preferences for policy tools are not often conducted. This is probably because the instrument is seen as a technique, the development of which is more a matter of expertise than of interests and attitudes. However, some significant connections between public attitudes and policy tools are already empirically proven.

For instance, Haselswerdt et al. (Haselswerdt et al., 2015) demonstrate that the way public policies are implemented has significant consequences for public attitudes towards them. The authors conducted a series of research experiments to test how citizens react to alternative instruments such as tax breaks and spending programs. Their study shows that citizens prefer tax breaks to direct subsidies, not in principle, but only because this is the current state of the measures taken. In cases where direct subsidies are applied or when no measures are taken at all, preferences for tax breaks decrease. The study also shows that ideology and political preferences also matter – conservatives prefer tax breaks to a much greater extent, but the same prefer-

ence prevails among liberals and is similarly influenced by the status quo. The authors conclude that the status quo of policy structures citizens' perceptions of the instruments.

Anna Wielicka-Regulska (Wielicka-Regulska, 2020) studies food consumption to establish the relationship between public attitudes and policy tools. Her preliminary hypothesis is that pro-environmental behavior (specifically consumption of local and/or seasonal products, consideration of the carbon footprint of food) is associated with favorable attitudes towards the implemented policy tools (green public procurement, higher VAT on unhealthy food, regulation allowing retailers to provide short-term food with a shelf life to charities as a tax-free donation, a levy on the amount discarded for distributors, a deposit for plastic bottles). The results of the study prove that the attitude towards the different instruments is not the same, and that while the acceptance of green public procurement and increased VAT is strongly expressed, this is not the case for the deposit for plastic bottles, as well as the penalty fee on discarded food. The author concludes that "we can also expect that after introducing a solution to the market, the degree of acceptance could significantly change, but it is still very important to know the factors which are most responsible for shaping attitudes and acceptance towards interventions stimulating sustainable food consumption" (Wielicka-Regulska, p. 447).

A recent study by Andersson and Almqvist (2022) aims to establish public preferences for nudges compared to traditional policy tools. The study is representative of the Swedish adult population and establishes public attitudes towards instruments from different policy areas. Based on the data obtained, the authors argue that, in general, information and subsidies are perceived more positively than other types of instruments – taxes, regulations, and nudges. According to them, the explanation is partly related to individualistic ideological views, support for political goals, as well as certain socio-demographic variables. The authors assume that the explanation can also be sought in the fact that the preferred instruments – information and subsidies – restrict individual freedom less and, to a limited extent, lead to direct material losses for individuals (Andersson and Almqvist, p. 22).

It would not be an exaggeration to note that current research on public preferences for policy tools is related to "nudges". Accordingly, they serve to support and affirm or, conversely, to reject an unconventional type of instrument. Regardless of their direct implications, these studies are of utmost importance because of the principal thesis that public preferences for policy tools matter. The study by Dominic H. Enste and Jennifer Potthoff (Enste and Potthoff, 2021) makes a significant contribution to the further development and argumentation of the above thesis. According to the cited authors, the development and communication of effective environmental policies require dividing the population into smaller units and identifying the full range of their environmental attitudes, behavioral patterns, requirements, and expectations. They use the concept of social milieu, which describe groups of people who are similar in terms of life, values, mentality, and lifestyle (Schip-

perges, 2019). Social milieu is simultaneously defined by attitudes and value orientations, social status, and generational affiliation. The authors conclude that changing human behavior to combat the climate change crisis requires an intervention that is different from traditional economic theory or a purely legal approach. Individual characteristics, cognitive boundaries, social factors, and group affiliation significantly influence the actions and decisions of individuals (Enste and Potthoff, 2021, p. 86). Therefore, the choice of policies must be accompanied by specific studies of public preferences, and the tools must be tailored to the characteristics of those they will affect.

3 Bulgarian Case: “Environmental Policy If We Don’t Pay For It And If It Is Not a Burden For Us”

The present study aims to establish the public preferences of citizens towards environmental policy tools. The traditional categorization of tools was used, according to which the behavior of individuals is influenced by prohibitions (regulations), incentives, or the dissemination of information. Due to the unconventional nature of the classic “Nudge” (Thaler and Sunstein, 2008), public attitudes towards it are established primarily through experiments and are difficult to include in standard questionnaires. However, some modified categories, also inspired by behavioral sciences, such as “Nudge plus” (Banerjee, 2021) or “Boosts” (Grune-Yanoff and Hertwig, 2016), can be classified as incentives or information dissemination techniques.

The research model was developed based on the following assumptions:

1. The environmental policy outcomes’ achievement depends on the pro-environmental characteristics of individual behavior.
2. The policy tools that transform goals into action aim to change the behavior of individuals so that they become possible. In a policy-driven society the prerequisite for the effectiveness of the process are individuals who respond relevantly to specific measures, changing their behavior in accordance with the common goals.
3. The behavior of individuals (whether person or organization) is multifactorial. There are connections and dependencies between the factors of behavior themselves. The reactions of individuals to policies depend on their preferences towards them, their attitudes, beliefs and convictions, as well as their socio-demographic characteristics.
4. Even in the presence of favorable attitudes towards policy tools, environmental behavior may remain unchanged due to the existence of more important incentives for individuals’ actions.
5. The relative strength of policy tools as a driver of behavior depends on trust in the institutions involved in policymaking, but not only. In many cases political affiliation can be much less important than others factors.

The present survey was conducted in the period 4-14 April 2024 among 1008 Bulgarian citizens aged 18 and over. The study is representative of the adult

population of Bulgaria. It is based on a nationally representative two-stage nested sample, implemented after preliminary stratification of the universe by administrative region (NUTS-3), settlements and size of the settlement, a random route of movement across the territory of the nest and selection of respondents starting with a starting address plus a step. The maximum permissible stochastic error is $\pm 3.1\%$. The registration method is a direct standardized interview.

One of the main hypotheses drafting the questionnaire is that environmental policy in Bulgaria has not led – at least so far – to a significant spread of pro-environmental individual behavior. Taking steps towards the development of behavioral models, a number of researchers are striving for a comprehensive review of the models and variables of behavior – Hines et al. (Hines et al., 1987), Stern (Stern, 2000), Kollmuss and Agyeman (Kollmuss and Agyeman, 2002), etc. Two dominant approaches have been used to study environmental behavior, one focused on impact and the second on intention. Intention refers to behaviors that contribute to environmental sustainability and emphasizes the outcome of the behavior. Impact-oriented makes assumptions based on motivations, rather than focusing on the outcome of the behaviors. The New Environmental Paradigm is considered the “gold standard” for measuring attitudes (Dunlap et al., 2000) and is a widely used and well-validated measure designed to assess an individual’s belief system about nature. Stern (Stern, 2000) adopts an intention-oriented approach to understanding pro-environmental behavior as actor-defined behavior with the intention of changing the environment. Stern distinguishes three types of behavior: environmental citizenship, political support, and personal behavior. Environmental citizenship behavior includes actions such as joining environmental groups and environmental activism. Political support includes accepting government decisions that aim to protect the environment, including raising taxes and prices. The final category of behavior is personal behavior, which includes “the purchase, use, and disposal of personal and household products that have an impact on the environment” (Stern, 2000).

One of the most important classifications of consumer actions, also used in this study, is that of Kaiser et al. They identified 65 self-reported environmental indicators in six groups: energy conservation, mobility and transportation, waste reduction, consumerism, recycling, and social behaviors towards environmental protection (Kaiser et al. 2003).

Based on numerous meta-analyses, Kurisu (2015) makes several useful classifications of various pro-environmental actions (behaviors). Subgroups of environmental behavior are energy efficiency at home; waste and recycling; water consumption; energy saving; personal transportation; purchasing green products; environmental activism. Possible reasons for environmental/non-environmental behavior are summarized as knowledge; norms; environment (infrastructure); perceived impact (utility); cost/benefit balance; abilities; habits; real opportunity. Some of them are defined as intrapersonal, and others as contextual. The leading variables in many studies can be divided into psycho-

logical (control, responsibility); cognitive (knowledge); demographic (gender, age, education, income, place of residence) (Kurusu, 2015).

For the study purpose, a composite indicator of pro-environmental behavior was created that covers a large part of the known pro-environmental practices. Similar to the measurement of environmental perception, there is no scientific consensus on which instrument to use to measure pro-environmental behavior. The number of behaviors used to measure pro-environmental behavior varies greatly across studies (from 3 to over 50 different behaviors), leading to a wide heterogeneity in the results. Behaviors can be attributed to different behavioral clusters (e.g., water/energy saving, political action, etc.). Going a step further, some studies group behaviors into composite coefficients (Binder and Blankenberg, 2017; Schmitt et al., 2018) to capture the relevant behavior more adequately. Although Kaiser (1998) notes that the use of composite scores to measure pro-environmental behavior is controversial because it assumes that aggregation across different types of behavior will capture relevant aspects of a particular type of environmental behavior and involves different ways of aggregating behavior into a composite variable, the goals of the present study suggest precisely such an approach. In many studies, authors combine different developed scales or create completely new ones (Mónus, 2020).

Based on the detailed review of the available data and empirical studies, three aggregate indicators were created for this study. The aggregate indicator for pro-environmental behavior is composed of 21 specific behavioral actions, which we believe cover the groups of behaviors identified in the literature - preference for seasonal, locally grown food; reading product labels given their potential harm to health; striving to reduce waste; participating in environmental campaigns; recycling; efforts for energy efficiency; using a car, etc. The aggregate indicator for awareness of environmental problems is composed of 8 specific perceptions of real problems – air pollution; water pollution; soil pollution; climate change; the extinction of some animal and plant species; depletion of natural resources; natural disasters; epidemics. The aggregate indicator for knowledge includes the declared level of 2 actions - the purposeful pursuit of self-education about environmental problems; and reading articles and watching shows; and 6 self-reported levels of familiarity with specific categories and groups of practices - the zero-waste concept; green energy sources; environmental standards; eco-labels for appliances; the harms of the production of most goods that are purchased.

The design of the questions focused on closed-answer questions with both 2 and 5 degrees of answers. The main assumption behind such a design is that we need to quantify as much as possible the differences regarding environmental policy among respondents. Choosing among different degrees in the answers scale allows us to identify significant differences in the attitude between different groups of responders. Quantification helps us to draw clear conclusions by splitting significant from insignificant differences in the attitude. It was already mentioned that the number of participants and

the sample selection approach make the survey nationally representative. It means that the number of responses and the design of the questions allow us to use quantitative statistics like Cronbach's Alpha, Factor analysis, ANOVA, and Chi-square. These classic statistics are used because of their robustness and high accuracy. In terms of results interpretation, it is a bit of a conservative approach since there are different statistical methods available to be used but the main idea is to identify essential trends in data by using classical and highly reliable statistics. In other words, the classical design of the data analysis puts us on the safe side. With that respect, we use Cronbach's Alpha, Factor analysis, ANOVA, and Chi-square as methods for analyzing data from the nationally representative survey. The statistical analysis of the procedure follows six steps:

1. When we had preliminary clarity about which primary indicators form a composite indicator, then we only checked their internal consistency with Cronbach's Alpha.
2. When we did not have prior clarity on which primary indicators formed a composite indicator, we applied factor analysis. After the extraction of the factors, we checked the internal consistency of the primary indicators they consist of with Cronbach's Alpha.
3. After we established the composition of the composite indicators, we calculated average scores for each composite indicator.
4. We have grouped the average scores of composite indicators into five groups based on the mean plus/minus one standard deviation and plus/minus two standard deviations:
 - a. Very weak – below mean minus two standard deviations.
 - b. Weak – between mean minus two standard deviations and mean minus one standard deviation.
 - c. Moderate – between mean minus one standard deviation and mean plus one standard deviation.
 - d. Strong – between mean plus one standard deviation and mean plus two standard deviations.
 - e. Very strong – above mean plus two standard deviations.
5. We compared the average scores of different groups of respondents using ANOVA.
6. We examined relationships between grouped composite indicators using Chi-square.
7. ANOVA compares the means of three or more groups to determine whether there are any statistically significant differences between them. Analysis of variance is used to test the hypothesis that several means are equal. It tests the hypothesis that all group means are equal by analyzing the variance within groups and between groups. ANOVA helps determine whether observed differences in sample means are likely due to real effects or just random variation. If the p-value from ANOVA is below a certain

threshold (e.g., 0.05), it suggests that at least one group mean is significantly different from the others.

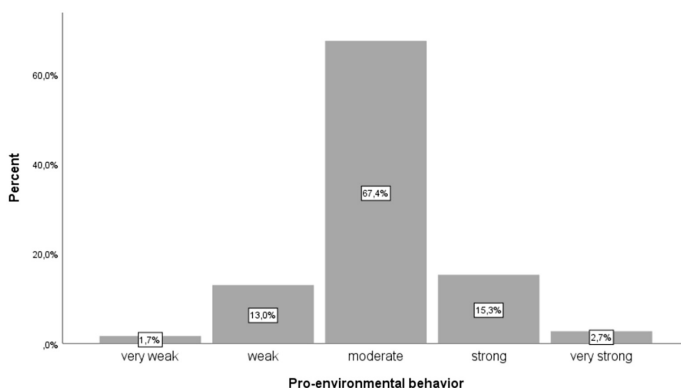
Factor analysis is a statistical method that attempts to identify underlying variables, or factors, that explain the pattern of correlations within a set of observed variables. Factor analysis is often used in data reduction to identify a small number of factors that explain most of the variance that is observed in a much larger number of manifest variables. Factor analysis is used to identify underlying relationships between observed variables. It reduces a large set of variables into fewer latent factors, which represent common patterns in the data. Each factor captures the shared variance among multiple variables, helping to explain correlations between them. Researchers often use it in psychology, marketing, and social sciences to uncover hidden dimensions like intelligence, customer preferences, or attitudes. The technique assumes that observed variables are influenced by both common factors and unique error components. Cronbach's Alpha is a measure of internal consistency. It is a score indicating the probability of two or more variables to measure a single underlying trait. In this survey, it is essential for estimating consistency between similar questions and is a benchmark for including them in the same composite indicator.

4 Results: Lack of Clustering in Preferences to Policy Tools

The results show a huge clustering of respondents' answers around the average values of the composite indicator for pro-environmental behavior.

67,4% of respondents have "moderate" pro-environmental behavior. The high levels on the scale – "strong" and "very strong" pro-environmental behavior, slightly exceed the corresponding low levels on the five-point scale of the composite indicator. Cronbach's alpha is 0.913, indicating excellent internal consistency. The percentages of the empirical distribution are close to the expected percentages of the normal (Gaussian) distribution, which are 2.3:13.6:68.3:13.6:2.3.

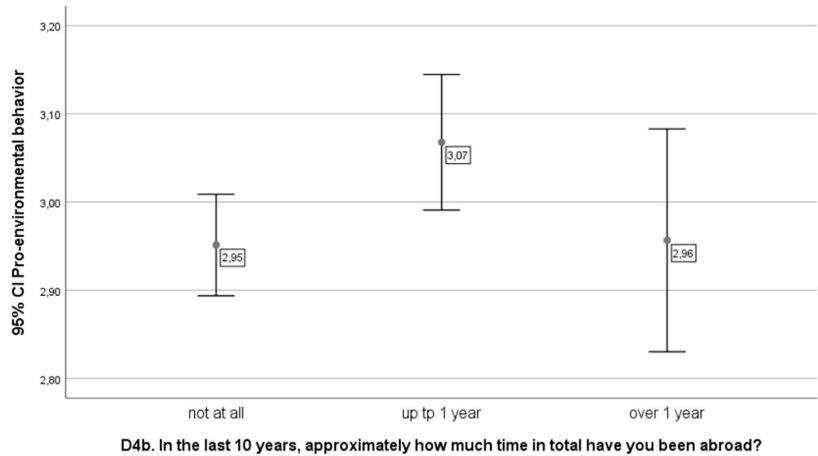
Figure 1. Pro-environmental behavior



Source: Own.

There is a statistically significant relationship between pro-environmental behavior and time spent abroad. ANOVA statistics show a significant difference ($p=0,048$) between pro-environmental attitudes among respondents with short stay abroad and those without experience abroad.

Figure 2. Mobility

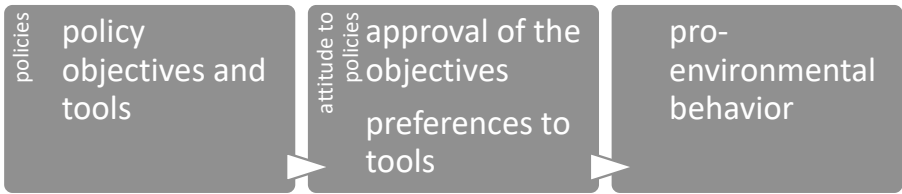


ANOVA					
Pro-environmental behavior					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2,405	2	1,203	3,051	,048
Within Groups	318,492	808	,394		
Total	320,897	810			

Source: Own.

There are many reasons for the relatively unfavorable picture of pro-environmental behavior. What interests us in this case is the influence of policies on environmental behavior. Our assumption is that if attitudes towards policies are unfavorable, then their influence on environmental behavior will be limited.

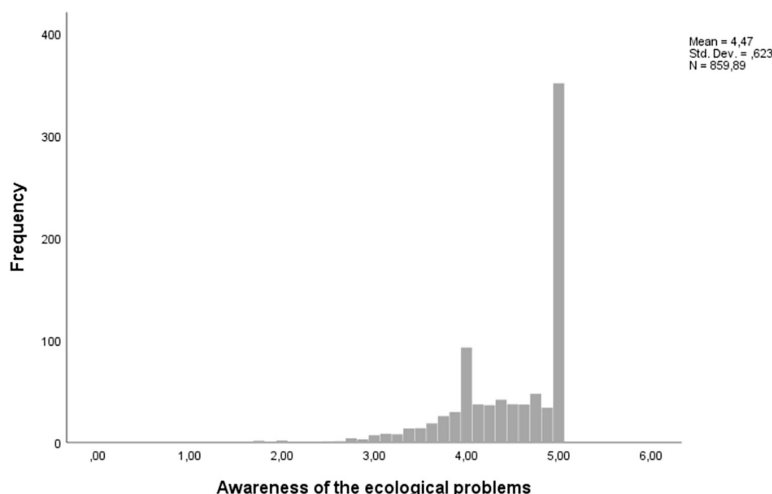
Figure 3. Research model



Source: Own.

The survey recorded an extremely high level of awareness of environmental problems. Between 55 and 65% of respondents believe that water, soil, air pollution, climate change, natural disasters, and epidemics are real problems. Slightly smaller are the share of respondents who believe that the disappearance of natural resources is a completely real problem (48.6%), as well as the disappearance of some animal and plant species (51.8%). Cronbach's alpha is 0.913, indicating excellent internal consistency.

Figure 4. Awareness of the ecological problems



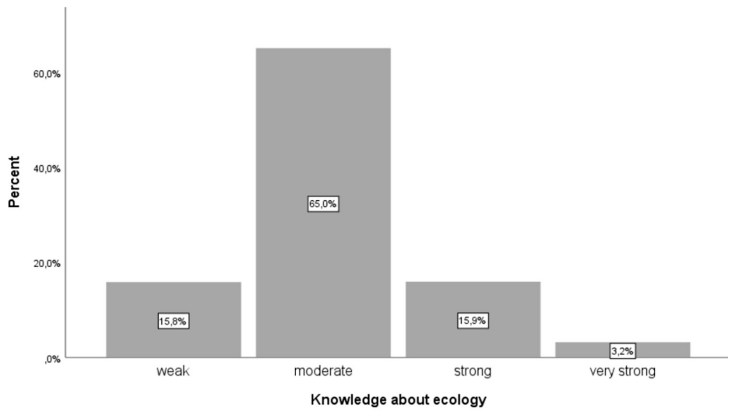
Source: Own.

The composite indicator, which includes awareness of all the above-mentioned types of environmental problems, shows a huge concentration at the highest level of the scale - the share of those who believe that environmental problems are not real is insignificant. The distribution is heavily skewed towards the right end of the scale. Very often, but not always, such extreme skewness indicates the presence of so-called social desirability bias. It is possible that respondents are indeed very aware of the ecological problems, but it is also possible that they have responded in a way that they know is expected of them.

Environmental awareness has both a cognitive component, based on knowledge, and an emotional component, based on perception. The study found a statistically significant relationship between environmental behavior and the degree of awareness of environmental problems - the higher the awareness, the higher the degree of pro-environmental behavior.

The problem is that despite this, moderate adherence to pro-environmental practices in everyday life prevails. In contrast to the high level of awareness of environmental problems, the level of knowledge about ecology is rather moderate. In this sense, the latter indicator corresponds to a much greater extent to the insufficient presence of environmental practices in everyday life.

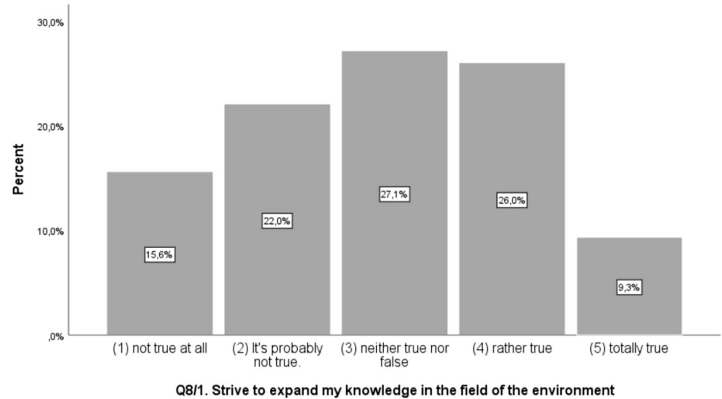
Figure 5. Knowledge about ecology



Source: Own.

Cronbach's alpha is 0.912, indicating excellent internal consistency. According to the overall knowledge indicator used in the study, 65% of citizens have a moderate level of knowledge about ecology, 16% have a strong level of knowledge, and 3% have a very strong level of knowledge. Since this is a self-assessment of knowledge, it is possible that this distribution simply reflects the high level of awareness of the problems.

Figure 6. Strive to expand knowledge



Source: Own.

In any case, the interest in environmental issues is present - 35% of the surveyed individuals express the opinion that they purposefully strive to expand their knowledge in the field of the environment. Environmental knowledge is generally considered a prerequisite for voluntary action (Frick et al., 2004). Although theoretically, knowledge seems to play a significant role in pro-environmental behavior, empirical evidence is inconclusive, as shown by some meta-analyses (Bamberg and Möser, 2007). Therefore, environmental knowl-

edge is considered a necessary but not sufficient condition for an individual's pro-environmental behavior (Kollmuss and Agyeman, 2002).

With a high awareness of environmental problems and moderate interest in knowledge about them, the insufficient environmental orientation of the daily behavior of individuals is more related to policies and attitudes towards them. Of course, the preferences for policy tools stated in the study reflect intuitive, unthinking, preliminary attitudes.

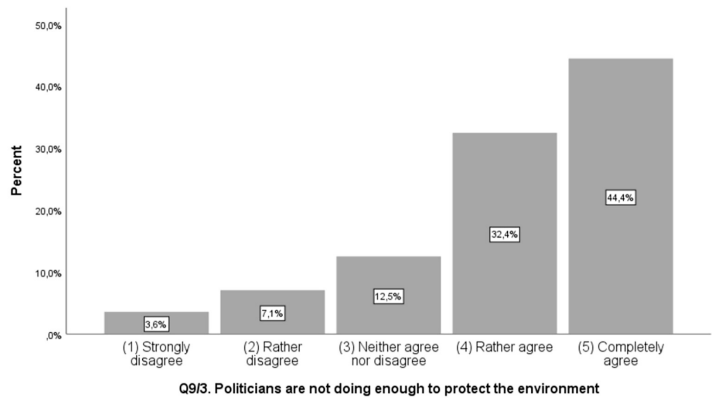
A significant part of adult Bulgarian citizens does not recognize their own responsibility for achieving environmental goals. Only slightly over 50% of them believe that environmental protection also depends on their own behavior. In practice, Bulgarian society is divided into two, almost equal parts: one believes that it should contribute to environmental protection, the other – does not see the connection between its own behavior and the achievement of green goals. Almost half of the Bulgarian population supports the statement that environmental protection is the duty of institutions, and it is not right to put emphasis on what individuals do.

Perceived control refers to individuals' perception of whether they can change or achieve a desired outcome through their actions or not. External focus attributes outcomes to external forces, while internal focus suggests that outcomes can be achieved through people's behavior. People with internal perceived control are more likely to take action (Johnson et al., 2004). Individuals with external perceived control cannot imagine environmental problems being solved without general government prescriptions and prohibitions (Kauder et al. 2018) – people tend to externalize responsibility and demand collective action. Denial of personal responsibility appears to be a major obstacle to pro-environmental behavior (Lorenzoni et al., 2007). The transfer of responsibility "outside" and the exoneration of one's behavior is also confirmed by the feeling that nothing depends on the individual citizen - 7 out of 10 people share the opinion that decisions on important issues in the country do not depend on them, but on a narrow circle of individuals, and 5 out of 10 respondents are convinced that the individual consumer cannot influence production and pollution.

The data show a significant tendency to shift responsibility for the state of the environment to institutions. At the same time, however, there is a huge distrust of politicians and environmental policies. Almost 80% of respondents believe that "politicians are not doing what they should", approximately the same share is of the opinion that certain people are getting rich from environmental protection measures.

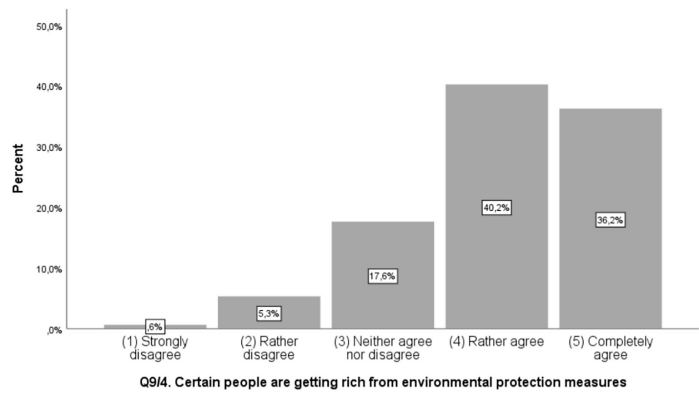
The current environmental policy also provokes distrust. According to the majority, it is necessary, but it is not effective and is not implemented properly, and it is "just another way for some people to get rich". There is a high level of skepticism towards the display of environmental concerns behind which other interests are hidden.

Figure 7. Evaluation of the activities of politicians



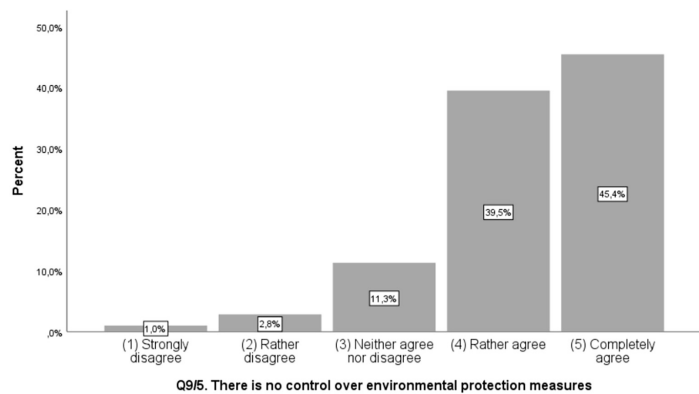
Source: Own.

Figure 8. Integrity assessment



Source: Own.

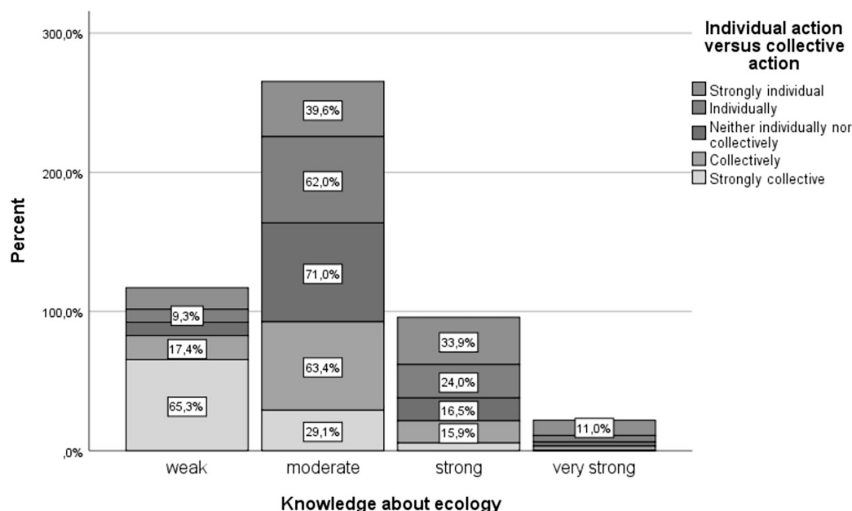
Figure 9. Evaluation of control effectiveness



Source: Own.

Given this mindset, the likelihood that citizens will not comply with measures stemming from unpopular politicians whose decisions fuel corrupt practices is enormous. The results of previous studies demonstrate that people with a high level of political support tend to comply with policies and accept institutional directives. An insufficient level of support, on the other hand, is an obstacle to the smooth implementation of environmental policy and it may end in failure (Wan et al., 2015).

Figure 10. Individual action versus collective action



Source: Own.

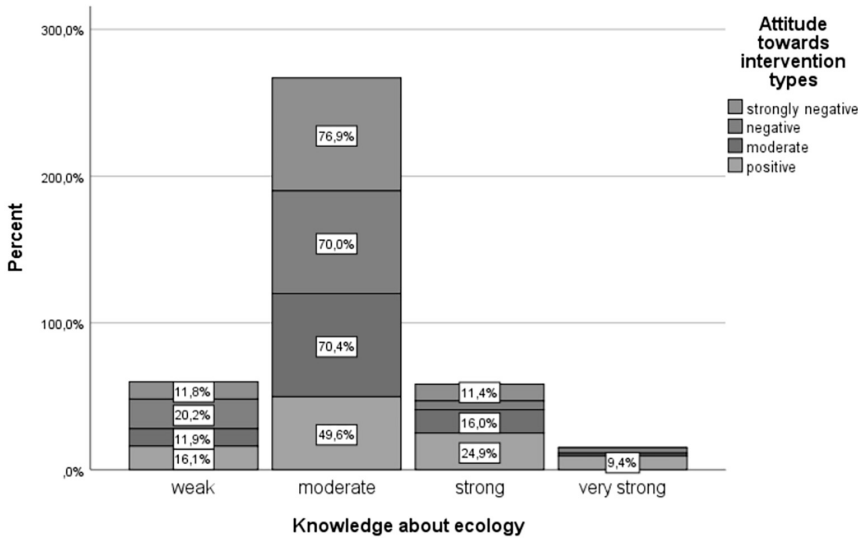
Chi-square = 69.95, $p = 0.000$, indicating the presence of a statistically significant relationship. The level of environmental knowledge is statistically significantly related to attitudes towards intervention types (Chi-square = 49.76, $p = 0.000$). The higher the knowledge, the more aware one is of the importance of own behavior in solving environmental problems. Similarly, the higher the environmental knowledge, the more support for soft approaches in environmental policy increases.

Environmental knowledge can be described as the amount of information that people have regarding environmental problems and their ability to understand and assess their impact on their surroundings (Blankenberg and Harm, 2019). According to older research, the possession of such environmental knowledge increases the likelihood of pro-environmental behavior (Hines et al., 1987).

The study does not register a significant difference between public preferences for different types of intervention: regulations and administrative control, negative and positive incentives, and dissemination of information about policies. Favorable public attitudes prevail in all four cases. At this level of policy instruments specification, citizens tend to express their support for environmental policies in general. The majority of respondents even believe that

control over the implementation of environmental measures is not sufficient, which, however, should not be perceived as a desire to strengthen coercive instruments, but only as a desire to comply with environmental measures.

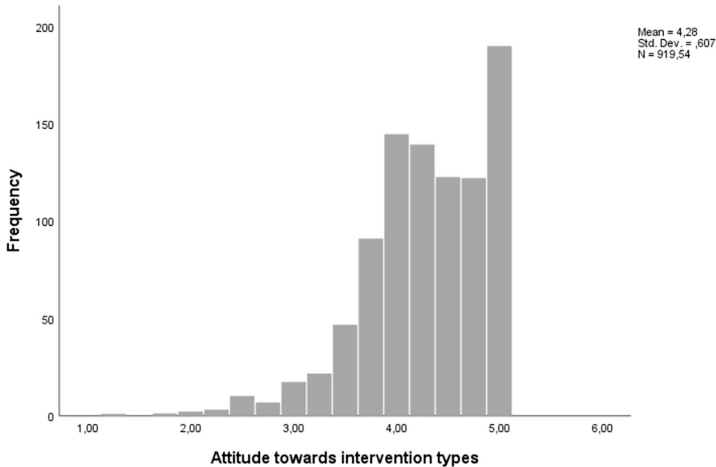
Figure 11. Environmental knowledge



Source: Own.

Although public preferences are favorable for all approaches to achieving environmental goals, the deviation from the meaning in the aggregate indicator of instrument preferences shows relatively greater support for soft tools related to information. Although the difference is small, support for soft tools is still higher among respondents with a higher level of environmental knowledge.

Figure 12. Attitude towards intervention types



Source: Own.

Cronbach's alpha is 0.659, indicating questionable internal consistency. At a more concrete level of policy tools specification the preferences of citizens become more specific. In this study, respondents stated their preferences for 15 different tools that are widespread in environmental policies in EU countries. Among the tested environmental protection alternatives, the proposals to introduce monetary incentives for citizens who return glass packaging receive the greatest support (approximately 8 out of 10 people completely or somewhat agree), followed by lower prices for lower electricity consumption, incentives for stores that allow you to return unwanted products, incentives for manufacturers that use recycling, and lower prices for lower water consumption. The proposals that are associated with paying a price/fine by citizens are the least approved, such as: paying more taxes and fees that go to environmental measures; higher taxes for citizens who do not recycle; paying a higher price for an environmentally friendly product; and fines for citizens who do not recycle

Through factor analysis, based on the combination of preferences declared by respondents, 5 subscales have been identified. The latter cannot be mechanically reduced to the "stick, carrot, and sermon". They differ in two more criteria: who they affect (an individual citizen or a specific economic organization) and whether the instrument is incentive or punitive.

The first subscale brings together four tools that, in the most general sense, can be defined as financial incentives that increase the income before taxes or disposable income of the affected individuals (both people and organizations). In this 1st factor includes both direct subsidies and tax reduction. These are positive financial incentives. Additional testing with Cronbach's Alpha showed a value of 0.806, indicating good internal consistency.

The second subscale includes taxes, prices or fines that punish citizens' behavior in case it is inconsistent with environmental goals. All four instruments in this 2nd factor included in are negative financial measures that "punish" citizens by reducing disposable income or increasing their expenses. Additional testing with Cronbach's Alpha showed a value of 0.879, indicating good internal consistency.

The third subscale combines negative financial tool aimed at organizations with behavior that is irrelevant to the environment. These instruments increase the costs or reduce the profits of economic entities. Additional testing with Cronbach's Alpha showed a value of 0.896, indicating good internal consistency.

The fourth subscale includes two tools. They reduce the costs of consumers with pro-environmental behavior. These are more of positive incentive tools for pro-environmental consumption. Additional testing with Cronbach's Alpha showed a value of 0.912, indicating excellent internal consistency.

The fifth subscale again includes two tools, which are united based on their punitive and/or prohibitive nature. These are sanctions, that can be direct prohibitions or fixed high prices of harmful products. Additional testing with

Cronbach's Alpha showed a value of 0.622, indicating questionable internal consistency.

The subscales are presented in order of respondents' preferences. The greatest support is for positive financial incentives (subscale 1), and the least - for sanctions (subscale 5). This result shows support for measures that are beneficial for the material state of individuals. If the policy tools harm it the support for them decrease.

Table 1. Main results of the study: public preferences towards policy tools

Tools	Subscales (factors)	In a statistically significant relationship with:
Introduce incentives for manufacturers who use recycled products	1 st Positive financial incentives for citizens	1. Education (F = 4.17, p = 0.016) 2. Socio-professional group (F = 3.37, p = 0.005) 3. Place of residence (F = 7.90, p = 0.000)
Introduce incentives for stores that allow to return unwanted products – clothing, batteries, etc.		
Introduce monetary incentives for citizens who buy second-hand electrical appliances		
To introduce monetary incentives for citizens who return glass packaging		
I'm willing to pay more taxes and fees that go specifically to environmental measures	2 nd Negative financial incentives for citizens	1. Gender (F = 14.06, p = 0.000) 2. Age group (F = 4.41, p = 0.001) 3. Education (F = 26.08, p = 0.000) 4. Socio-professional group (F = 4.28, p = 0.001) 5. Income group (F = 4.83, p = 0.000) 6. Place of residence (F = 8.18, p = 0.000)
I'm willing to pay a higher price for a more environmentally friendly product.		
Taxes should be higher for citizens who don't recycle		
Fine citizens who don't recycle		
Fine companies that don't recycle	3 rd Negative financial incentives for enterprises	1. Education (F = 5.26, p = 0.005) 2. Place of residence (F = 4.56, p = 0.004)
Taxes should be higher for companies that don't recycle		
Fine stores that don't have separate collection containers		
Introduce lower prices for lower water consumption	4 th Positive incentive for pro-environmental consumption	1. Gender (F = 9.36, p = 0.002) 2. Place of residence (F = 6.27, p = 0.000)
Introduce lower prices for lower electricity consumption		
Cars should be banned from entering downtown	5 th Sanctions	1. Gender (F = 18.21, p = 0.000) 2. Socio-professional group (F = 2.83, p = 0.015) 3. Place of residence (F = 4.09, p = 0.007)
Prices of plastic goods should be higher		

Source: Own.

The study does not establish a significant relationship between citizens' preferences and indicators of their socio-demographic situation: income group, age group, educational group, place of residence, gender, marital status, type of employment, international mobility. The preliminary hypothesis is that higher income groups, more educated, younger people and those groups that have lived abroad for a long time in the last three years have a different attitude towards environmental policy tools. This hypothesis is not confirmed by the data obtained. They show that the socio-demographic characteristics of the respondents do not structure attitudes towards environmental policy tools, except in isolated cases.

Men and women differ significantly in pro-environmental behavior (Eisler et al., 2003). Women show higher pro-environmental behavior than men (Longhi, 2013), report stronger pro-environmental attitudes (Zelezny et al., 2000) and are more willing to take pro-environmental actions (Stern et al., 1993). However, some studies find no or very small effects of gender (Blocker and Eckberg, 1997), which can be explained by the chosen behavior. In the present study, gender was statistically significantly associated with attitudes on three of the subscales: 5, 4 and 2. In the latter two subscales, the deviations from the mean in women were much larger.

Age is generally considered a key predictor of pro-environmental behavior, but the results of empirical studies are contradictory. On the one hand, young people are considered to behave less environmentally friendly than older people (Casaló and Escario, 2018), partly because the latter are more motivated by improving the quality of the environment for the next generation (Shen and Saijo, 2008). At the same time, younger people generally consider it less necessary to behave pro-environmentally, because they believe that technological progress will deal with future environmental problems (Benn, 2004). From the perspective of the present study, belonging to an age group only matters for the acceptance of financial tool that "punish" citizens for environmentally unfriendly behavior (2nd subscale). The group between 30-39 years old is more likely to accept this category of tools.

Higher levels of education and employment have been identified as positive predictors of pro-environmental behavior (Casaló and Escario, 2018). Education is generally expected to affect environmental concerns by increasing knowledge about environmental issues, but the analysis of concerns about global warming shows that education (treated as endogenous) has no effect on this type of concern (Chankrajang and Muttarak, 2017). In the field study, education is statistically significantly associated with three of the categories studied – positive incentives (1st subscale); negative financial incentive (2nd subscale) and financial sanctions for companies (3rd subscale). In all three categories, higher education is associated with a higher level of acceptance of the above categories.

Social group membership is statistically significantly associated with three of the identified subscales – 1st, 2nd and 5th. Managers and freelancers are most supportive of financial "penalties" on citizens. At the same time, the unem-

played group most strongly supports both types of incentives – for pro-environmental behavior (1st subscale) and for low consumption (5th subscales).

The amount of personal income is statistically significantly related to preferences for 2nd subscale – negative financial tools over citizens. The higher the income, the higher the support for these tools. Income in general has a controversial effect on pro-environmental behavior (Whitmarsh and O'Neill, 2010). Higher incomes are correlated with low individual pro-environmental behavior, and poorer people declare increased use of public transport and reduced heating costs (Longhi, 2013). However, most people are likely to engage in pro-environmental behavior if it is not costly (money, time, efforts and convenience) (Diekmann and Preisendorfer, 2003).

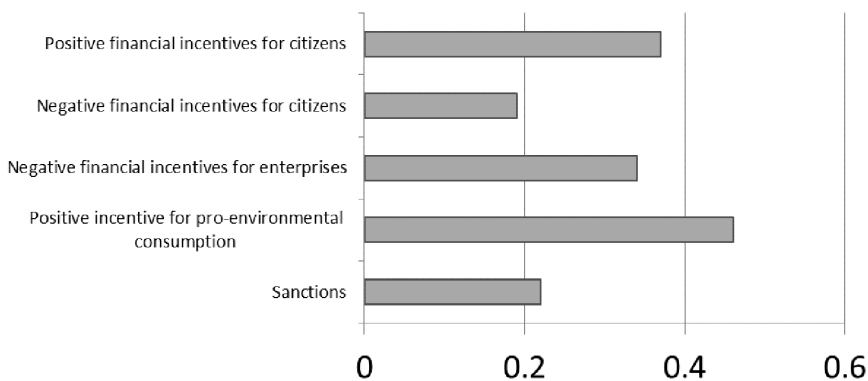
The place of residence is the only indicator that is in a statistically significant relationship with all five subscales. Support for positive incentives (1st subscale) is highest in the capital, for negative financial incentives for citizens (2nd) – in small towns; for negative financial stimuli on companies (3rd) – again in the capital; for stimuli for reduced consumption (4th) – in regional and small towns; for prohibitive and punitive measures (5th) – in the capital.

Around 30% of respondents hesitate to believe that they themselves should be fined if they do not implement individual sustainable practices. Around 35% of the respondents believe that the prices of plastic products could be higher. Approximately the same share of respondents declares their willingness to pay more for an ecological product. The remaining almost 70% oppose this perspective – to pay for an ecological policy.

The study establishes a very strong, statistically significant relationship between the composite indicator of ecological behavior and preferences for the tools. The higher the level of pro-environmental behavior, the stronger the preferences for sanctions (subscale 5th), negative financial incentives for companies (subscale 3rd) and negative financial tools or citizens (subscale 2nd). Pro-environmental behavior is related to all groups of tools, but its high levels are associated with preferences for sanctions.

The latter correlation can be interpreted as meaning that restrictive measures have a greater effect than incentives. This puts us in the difficult situation of interpreting a seemingly contradictory situation. People prefer incentives and would change their behavior to a greater extent because of them – as we have already shown, incentives are the most preferred approach among the tools studied. At the same time, people with pro-environmental behavior declare preferences for sanctions – perhaps this hides an unfavorable assessment of the policies followed, or distrust, even dissatisfaction with “other” citizens... Obviously, these are questions for other studies, but the contradiction between “incentives for me” and “sanctions for others” must be taken into account when formulating environmental (and not only) policy.

Figure 13. Correlation with pro-environmental behavior



Source: Own.

5 Conclusion

Since Pressman and Wildavski, hardly anyone doubts that implementation matters. This is especially true for environmental policy, where for many reasons the achievement of results seems difficult to achieve, despite the existing agreement on the goals.

The question, however, is what in the implementation needs to be changed to improve the process as a whole, so as to accelerate the achievement of the desired results. The theoretical review has led us, to use Elmer's term, to reverse mapping, i.e. to identify the necessary changes in the behavior of the individuals affected and to take concrete measures to accelerate this change. This reverse mapping presupposes a certain degree of discretion on the part of the administration engaged in the policy implementation, as well as sufficient capacity of this same administration to participate actively in shaping the policy design.

Research on citizens' preferences for environmental policy tools largely proves the above thesis.

1. They are contradictory and poorly structured, as a result of which, based on their establishment at a certain point in time, their future state cannot be predicted. This makes it necessary to monitor them in the process of implementation and to adapt the initial policy plan.
2. They are specific, which is why transferring knowledge about preferences for policy tools established in another political and cultural context is not a reliable basis for policy development.
3. Social group affiliation does not predict attitudes towards environmental policy tools.
4. Age group is not a predictor of preferences for environmental policy tools.

Only the expansion of the share of people for whom pro-environmental behavior is a commitment can make reverse mapping unnecessary. In Bulgaria, these people are about 30% and are willing to pay for ecology. There are not many, but it is a good start.

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Analysis of the Cost Efficiency of Public General Hospitals in Croatia

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ABSTRACT

Purpose: The Croatian population is rapidly ageing, and if current demographic trends continue, by 2050 one in three Croatians will be over the age of 65. This demographic shift implies that a smaller working-age population will need to support a growing number of elderly individuals, placing considerable strain on economic performance. Simultaneously, increasing demand for public health services has driven up public health-care expenditures, with general hospitals bearing the majority of accumulating unpaid obligations. In this context, assessing the cost efficiency of general hospitals becomes crucial in minimising resource wastage.

Design/Methodology/Approach: Cost efficiency is assessed by analysing how monetary inputs are converted into intermediate outputs. The cost efficiency of 19 Croatian general hospitals is analysed using the most common method—input-oriented Data Envelopment Analysis (DEA)—during the pre-pandemic years of 2015 and 2016, and the pandemic years of 2021 and 2022. One input is used (total expenditures and outlays of general hospitals, excluding investments in facilities) and three outputs (number of inpatient treatment days, beds/chairs occupancy rate in day hospitals, and number of outpatient services in polyclinic-consultative healthcare).

Findings: Cost efficiency scores range from 48% to 100%. On average, hospitals could have reduced expenditures by 7% in 2015, 14% in 2016 and 2021, and by 16% in 2022 while maintaining current output levels. During the COVID-19 pandemic, the overall cost efficiency of general hospitals declined. Pula-Pola and Varaždin consistently emerged as benchmark (most efficient) hospitals across all four years. In contrast, Vukovar underperformed, with cost efficiency scores below 70% throughout. For most hospitals, relative efficiency rankings remained stable over time—high performers before the pandemic continued to perform well afterward; low performers remained low. The data also indicate that larger hospitals, in terms of expenditures, generally demonstrate better cost efficiency.

Academic contribution to the field: This study contributes to the literature by measuring cost inefficiencies in general hospitals, which are often overlooked in international health economics research, particularly in Central and Eastern European countries. It identifies persistent benchmarks and inefficiencies, offering a data-driven foundation for policy reforms aimed at enhancing financial sustainability and operational efficiency in Croatia's healthcare system.

Research limitations: The model incorporates a limited set of variables due to data constraints. Including additional indicators, such as pharmaceutical expenditures or case-weighted inpatient discharges, could provide a more nuanced cost efficiency assessment. This limitation highlights the need for more comprehensive and standardised healthcare data collection in Croatia, especially from the Ministries of Health and Finance.

Practical implications: These findings may assist policymakers, as cost-efficient general hospitals are vital to economic and social prosperity. Benchmark general hospitals can serve as models, sharing best practices in cost management and resource use that could help improve cost efficiency across general hospitals. Less efficient general hospitals should be targeted for audits, managerial training, or support with budgeting and resource allocation. Furthermore, the study provides a foundation for enhancing national hospital performance monitoring systems and data reporting standards.

Originality/Value: This is the first study to calculate the cost efficiency of 19 Croatian general hospitals.

Keywords: cost efficiency, Croatia, Data Envelopment Analysis, health, public general hospitals

Analiza stroškovne učinkovitosti javnih splošnih bolnišnic na Hrvaškem

POVZETEK

Namen: Hrvaško prebivalstvo se hitro stara, in če se bodo sedanji demografski trendi nadaljevali, bo do leta 2050 vsak tretji Hrvat starejši od 65 let. Ta demografski premik pomeni, da bo moralo manjše delovno aktivno prebivalstvo podpirati čedalje več starejših, kar bo močno obremenilo gospodarsko uspešnost. Hkrati naraščajoče povpraševanje po javnih zdravstvenih storitvah povečuje javne izdatke za zdravstvo, pri čemer največji delež nakopičenih neporavnanih obveznosti nosijo splošne bolnišnice. V tem kontekstu postane ocenjevanje stroškovne učinkovitosti splošnih bolnišnic ključno za zmanjševanje razsipavanja virov.

Zasnova/metodologija/pristop: stroškovna učinkovitost je ocenjena z analizo, kako se denarni vložki pretvorijo v vmesne rezultate. Stroškovna učinkovitost 19 hrvaških splošnih bolnišnic je analizirana z najpogostejše uporabljeno metodo – vhodno usmerjeno analizo ovojnice podatkov (DEA) – v predpandemičnih letih 2015 in 2016 ter v pandemičnih letih 2021 in 2022. Uporabljen je en vhod (skupni izdatki in odhodki splošnih bolnišnic, brez naložb v objekte) in trije izhodi (število bolnišničnih oskrbnih dni, zasedenost postelj oziroma stolov v dnevni bolnišnicah ter število ambulantnih storitev v poliklinično-konzultativni dejavnosti).

Ugotovitve: ocene stroškovne učinkovitosti segajo od 48 % do 100 %. Povprečno bi bolnišnice lahko znižale izdatke za 7 % v letu 2015, za 14 % v letih 2016 in 2021 ter za 16 % v letu 2022, ne da bi zmanjšale obstoječe ravni izhodov. Med pandemijo covid-19 se je skupna stroškovna učinkovitost splošnih bolnišnic poslabšala. Bolnišnici Pula-Pola in Varaždin sta v vseh štirih letih dosledno izstopali kot referenčni (najučinkovitejši) enoti. Nasprotno pa je Vukovar dosegal slabše rezultate, s stroškovno učinkovitostjo pod 70 % v celotnem obdobju. Pri večini bolnišnic so relativne uvrstitve po učinkovitosti ostale stabilne skozi čas – visoko učinkovite pred pandemijo so ostale učinkovite tudi po njej; manj učinkovite so ostale nizko uvrščene. Podatki kažejo tudi, da večje bolnišnice, merjeno po izdatkih, praviloma dosegajo boljšo stroškovno učinkovitost.

Akademski prispevek k področju: študija prispeva k literaturi z merjenjem stroškovnih neučinkovitosti v splošnih bolnišnicah, ki jih mednarodne raziskave zdravstvene ekonomike pogosto spregledajo, zlasti v državah Srednje in Vzhodne Evrope. Identificira vztrajne referenčne primere in neučinkovitosti ter ponuja podatkovno podlago za politične reforme, usmerjene v izboljšanje finančne vzdržnosti in operativne učinkovitosti hrvaškega zdravstvenega sistema.

Omejitve raziskave: model vključuje omejen nabor spremenljivk zaradi podatkovnih omejitev. Vključitev dodatnih kazalnikov, kot so izdatki za zdravila ali po primerih uteženi akutni bolnišnični odpusti, bi lahko omogočila bolj niansirano oceno stroškovne učinkovitosti. Ta omejitev poudarja potrebo po celovitejšem in standardiziranem zbiranju zdravstvenih podatkov na Hrvaškem, zlasti s strani ministrstev za zdravstvo in finance.

Praktične implikacije: ugotovitve lahko pomagajo oblikovalcem politik, saj so stroškovno učinkovite splošne bolnišnice ključne za gospodarsko in socialno blaginjo. Referenčne bolnišnice so lahko vzor, delijo dobre prakse upravljanja stroškov in uporabe virov ter s tem pomagajo izboljšati stroškovno učinkovitost v celotnem sklopu splošnih bolnišnic. Manj učinkovite bolnišnice naj bodo cilj revizij, managerskega usposabljanja ali podpore pri proračunskem načrtovanju in načrtovanju virov. Poleg tega je študija podlaga za izboljšanje nacionalnih sistemov spremljanja uspešnosti bolnišnic in standardov poročanja podatkov.

Izvirnost/vrednost: gre za prvo študijo, ki je izračunala stroškovno učinkovitost 19 hrvaških splošnih bolnišnic.

Ključne besede: stroškovna učinkovitost, Hrvaška, analiza ovojnice podatkov (DEA), zdravje, javne splošne bolnišnice

JEL: H75, I18

1 Introduction

The Croatian public health system is struggling with financial stability due to two main factors. On the one hand, there is a growing demand for medical services driven by an aging population and the increasing need for expensive treatments and medications. On the other hand, limited public resources are available to support the healthcare system. As a result, the health system consistently faces budget deficits. Hospitals (especially general hospitals) are major contributors to these deficits. For instance, in 2022, 19 general hospitals accounted for around 45% of the deficit (total revenues and receipts minus total expenditures and outlays) of all healthcare institutions (MoF, 2025). Further, it must be emphasised that in 2021, 2022, and 2023, all general hospitals faced cumulative deficits, incurred during these years and/or in the periods before 2021 (MoF, 2025). A fiscal sustainability study by Šimović et al. (2021) found that hospitals account for the majority of healthcare debt, with 73% of debt older than 60 days, further indicating deep-rooted financial instability.

In 2022, Croatia's public health expenditure was in line with the EU average, with the EU and Croatia spending 7.7% of their GDP on health (Eurostat, 2025a). The major difference is that, on average, the EU spends (3.2% of GDP) on hospital services and (2.3% of GDP) on outpatient services, while Croatia spends more on hospital services (4.3% of GDP) and less on outpatient services (1.2% of GDP).

In terms of health outcomes, Croatia lags behind most EU countries. In 2023, life expectancy at birth in Croatia was 78.6 years, below the EU average of 81.5 years (Eurostat, 2025b). Additionally, Croatia's infant mortality rate was 4.1 deaths per 1,000 live births in 2022, which is higher than the EU average of 3.3 (Eurostat, 2025c).

Improving health outcomes in Croatia while containing costs requires greater efficiency. That is why one of the main goals of the Croatian National Health Development Plan for 2021 to 2027 is to improve the financial sustainability of the healthcare system. It is stipulated that there is a need to analyse the revenue and expenditure side of healthcare thoroughly and to define specific short-term and long-term steps to bring health financing into balance. The existing system of financing is sustainable neither in the short nor in the long term (Ministry of Health, 2021). There is inevitably a need to find new financing sources and improve cost efficiency of healthcare system.

We analysed the cost efficiency of 19 general hospitals in Croatia using an input-oriented DEA model with variable returns to scale. General hospital Sisak was excluded from the analysis due to the unavailability data for 2021 and 2022 because of the consequences of the earthquake. Also, general hospitals Nova Gradiška and Pakrac were excluded from the analysis due to the unavailability of data for 2015 and 2016. In this way, we want to find out which general hospitals could spend less on expenditures and outlays, maintaining the existing level of output. We calculate the cost efficiency, that is, the efficiency of the transformation of monetary input (total expenditures and outlays of

hospitals without investments in building facilities in euro) into intermediate outputs (number of days in hospital treatment for hospital (inpatient) health-care, beds/chairs occupancy rate in the day hospital, and number of services in polyclinic-consultative (outpatient) healthcare). To increase the robustness of the analysis and allow for a better understanding of the impact of the pandemic, the analysis includes two years before the pandemic (2015 and 2016), as well as two years during the pandemic (2021 and 2022). Including pre-pandemic years allows for a comparison of the performance of hospitals under normal and emergency circumstances and a more precise identification of changes and challenges in resource management during the COVID-19 pandemic, when hospitals were operating under special restrictions and reorganisation.

The paper is organised as follows. After the introduction, the literature review first defines cost efficiency; and then identifies the results and gaps in existing research on the efficiency of healthcare expenditures in Croatia and abroad. The third section discusses the data and methodology. The fourth section presents the results while the fifth presents the discussion. The paper ends with conclusions and recommendations for future research.

2 Literature Review

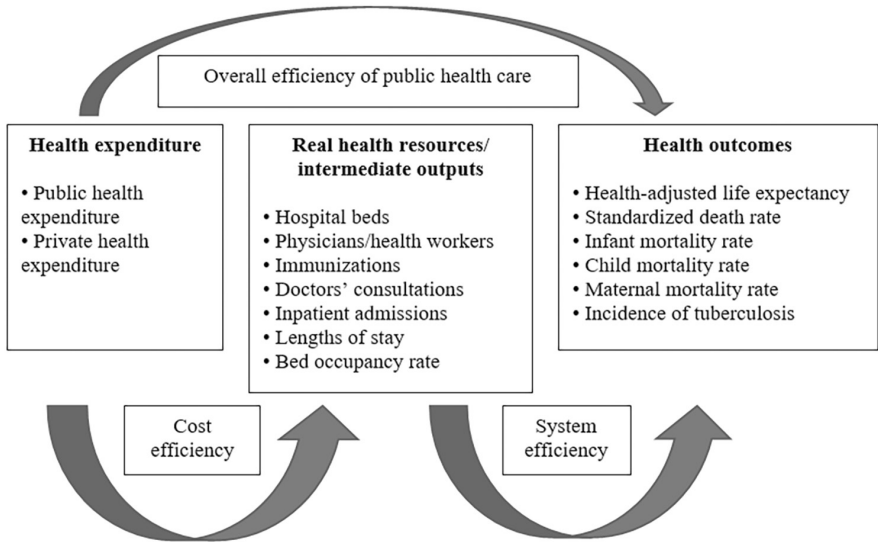
Public health efficiency is a key concept in evaluating health systems, focusing on how effectively governments utilise resources to achieve optimal health outcomes for their citizens. The goal is to ensure that resources are allocated rationally to achieve the best possible health outcomes within available financial constraints (Yi et al., 2020). Health outcomes reflect the core objectives that policymakers aim to achieve (in terms of mortality rates, standardised death rates from all causes per 1,000 people, life expectancy, etc.).

The overall efficiency of public healthcare expenditures measures the ratio of total health expenditures to the health outcomes achieved (Figure 1). Verhoeven et al. (2007) argue that overall efficiency can be divided into cost efficiency and system efficiency. Cost efficiency represents the efficiency of converting monetary inputs (total health expenditures) into intermediate outputs (e.g., the number of physicians, pharmacists, healthcare workers, hospital beds, and immunisation vaccines). System efficiency represents how well the intermediate outputs are used to achieve health outcomes (such as life expectancy).

Asbu et al. (2020), in their literature review on determinants of hospital efficiency, conclude that hospital efficiency is influenced by internal factors – elements that hospitals can directly manage and change – and external factors, which are outside a hospital's immediate control and require broader interventions at the health system or cross-sectoral level. Internal factors include size, specialisation, teaching status, case-mix index, bed occupancy rate, outpatient-to-inpatient ratio, etc. External factors include geographic location (related to demand for hospital services), competition, reimbursement system, provider incentives, etc. Linna et al. (2010) focused on how

well hospitals manage to achieve desired outcomes within a given budget, analysing hospital care in four Nordic countries on a sample of 184 hospitals. The study confirms that hospitals cannot directly influence the level of demand for health services, as they depend on patient referrals, and concludes that deviations in efficiency result from a combination of objective factors (e.g., patient structure) and subjective factors (e.g., management practices). The key takeaway from the literature review is that since hospital efficiency is affected by internal and external factors, there is no universal policy or magic formula that can broadly enhance performance across all hospitals (Asbu et al., 2020). However, we would also argue that the first step involves analysing the efficiency of hospitals to identify which ones are less efficient according to various criteria, followed by further analysis to pinpoint internal factors they could change – such as adjusting outpatient-to-inpatient ratios, staffing issues, or medication procurement practices – to improve the efficiency of less efficient hospitals. In that manner, Sheikhzadeh et al. (2012) studied the efficiency of hospitals in Iran, also using DEA, with a particular focus on input variables such as staffing and number of beds, and output variables such as patient discharges and outpatient visits. They concluded that there are significant inefficiencies in resource use and recommended targeted management interventions.

Figure 1. The efficiency relationship between health expenditure, resources/ outputs, and outcomes



Source: Adapted by authors from Verhoeven et al. (2007).

In this paper, we focus on the cost efficiency of 19 general hospitals, as defined by Verhoeven et al. (2007), which refers to the efficiency of converting monetary inputs into intermediate outputs. We decided not to investigate the overall efficiency of general hospitals since health outcomes data (e.g.,

life expectancy) are available only at the county level, where general hospitals operate. However, these health outcomes (e.g., life expectancy in one county) are influenced not only by the operations of general hospitals but also by other healthcare facilities in that county (such as healthcare centres, private and public hospitals, and health institutes) as well as behavioural and environmental factors beyond the control of the health system (such as diet, alcohol and tobacco consumption, the proportion of the population over 65 years of age).

We have focused exclusively on an analysis of general hospitals; Rabar (2010) focused on the efficiency of all hospitals in Croatia together, but the results of her research make it obvious that different types of hospitals should be divided into separate categories. She emphasised the importance of a categorical approach in calculating efficiency based on similarities between different types of hospitals. Accordingly, clinical, general and special hospitals should be analysed separately. Linna et al. (2010) also analysed the efficiency of hospitals in Finland using DEA, with a focus on cost effectiveness and resource allocation, highlighting the importance of distinguishing hospital types and the impact of patient structure on efficiency results.

Seven papers in Croatia analysed the efficiency of the whole healthcare system or the efficiency of hospitals using DEA methodology. However, cost efficiency, as defined by Verhoeven et al. (2007), was analysed only in two DEA studies regarding the efficiency of the whole Croatian health system (Buljan and Šimović, 2022; Jafarov and Gunnarsson, 2008). The other five studies that we found regarding the efficiency of hospitals in Croatia using DEA methodology did not analyse cost efficiency. In their analysis, they either did not use healthcare expenditures as inputs (Rabar, 2010, 2013; Blecich et al., 2024) or else did not use healthcare expenditures as the only inputs (Dukić Samaržija et al., 2018; Hodžić et al., 2019). Since we did not find any study on the cost efficiency of hospitals, this is the first time that the cost efficiency of 19 general hospitals is calculated in Croatia.

Jafarov and Gunnarsson (2008) evaluated the efficiency of social spending in Croatia and the EU-15, the EU-10, Cyprus, Malta, and OECD countries. They concluded that the inefficiency of the Croatian healthcare system primarily stems from high expenditures, as well as extended hospital stays, elevated drug costs, and minimal levels of private healthcare financing. Buljan and Šimović (2022) analyse the efficiency of the healthcare system in Croatia and compare it with other EU countries in the period 2013-2018. Croatia has the lowest overall efficiency in the EU, with a healthcare expenditure efficiency of only 57% in 2018. Although cost efficiency is high (100%), system efficiency is only 48%, which means that Croatia could achieve the same health outcomes with fewer resources.

Three studies on the efficiency of hospitals in Croatia highlight similar issues regarding resource allocation. Rabar (2010; 2013) and Blecich et al. (2024) find inefficiency due to the excess of beds and doctors in some hospitals. Hodžić et al. (2019) carried out research into the efficiency of healthcare ex-

penditures in Croatian counties for the period from 2010 to 2017, arguing that one of the main causes of inefficiency should be sought in better organisation of primary healthcare. Dukić Samaržija et al. (2018) analysed the efficiency of Croatian hospitals, focusing on 28 specific hospitals included in the DRG (Diagnostic-Related Groups) system for the classification of diabetes without comorbidities and complications. According to this study, the main source of inefficiency is the number of days spent in hospitals, which should be decreased. Another reason for inefficiency is also overspending on drugs and materials, which should also be reduced.

For measuring the efficiency of health services as an input variable, authors often use health expenditures, health expenditures per capita, or health expenditures as % GDP (Buljan and Šimović, 2022). There are several reasons in the literature why healthcare expenditures are used as an input variable. First, they represent costs that hospital management can control, which leads to more efficient financial management. The second reason is that expenditures are used to describe the economic burden. Expenditure analysis helps to assess government spending and shows where costs can be reduced, enabling higher efficiency (Jafarov and Gunnarsson, 2008; Slijepčević, 2019; Azreena et al., 2018; Yi et al., 2020; Wu, 2023; Hodžić et al., 2019).

Andrews and Emvalomatis (2024) note that measuring actual health outcomes is difficult due to limited data and high costs. As a result, researchers frequently rely on proxy indicators instead. Common outcome proxies include the number of inpatient episodes, outpatient visits, and the length of hospital stays. To better reflect both case complexity and severity in assessing healthcare output, studies commonly use inpatient days. This approach aims to capture the intensity of care and resource usage, with longer stays generally indicating more complex or severe cases. An excellent overview of variables and models used for efficiency measurement in healthcare can be found in Andrews and Emvalomatis (2024). They argue that there is a considerable variation in the use of inputs, outputs, and price variables in international studies, suggesting that the use of variables in healthcare productivity and efficiency literature rests on the balance between data availability and the research scope. In addition, Kruse et al. (2018) also conducted a systematic review of hospital efficiency studies at the EU level, identifying the wide range of used methodologies and variables, and highlighting the challenges of comparing efficiency across different healthcare systems. The output healthcare variables used in the previous cost efficiency DEA analysis of the Croatian healthcare system varied. Buljan and Šimović (2022) regarding the efficiency of the whole Croatian health system used the number of available hospital beds, the number of CT and MR scanners, and the number of doctors. Jafarov and Gunnarsson (2008) used the number of available hospital beds, the density of physicians, pharmacists, and healthcare workers, and the number of immunisation vaccines. As output, Dukić Samaržija et al. (2018) used the number of cases/discharges (a performance indicator that measures hospital activity relevant for DRG payments, given that it is an activity-based reimbursement system). Hodžić et al. (2019), used as outputs the number

of examinations, the number of patients per bed, and the vital index. Rabar (2010) used as outputs the number of hospital treatment cases and days of hospital treatment.

3 Data and Methodology

According to the Law on Health Care (2024), Croatia's healthcare system is structured into four levels: primary, secondary, and tertiary care, as well as health institutes. Primary healthcare is primarily provided through healthcare centres, where patients receive basic check-ups, consultations, and treatment for minor health issues. Secondary healthcare is offered through general and specialised hospitals and specialist consultations. General hospitals provide a broad range of services, including surgery, internal medicine, paediatrics, gynaecology and obstetrics, while ensuring patient accommodation and nutrition. Specialised hospitals focus on specific diseases or age groups, offering specialist consultations and hospital treatment, and also providing patient accommodation and nutrition. Specialist-consulting services involve complex medical procedures and diagnostic services, which are performed in policlinics, day hospitals, and healthcare centres (they do not include accommodation). Tertiary healthcare is delivered by clinics, clinical hospitals, and clinical hospital centres, which handle the most complex medical cases, offer a wide range of services, and often engage in higher education and scientific research. Health institutes include state health institutes (such as the Croatian Institute of Public Health and the Croatian Institute of Emergency Medicine), public health institutes of regional self-government units, and emergency medicine institutes of regional self-government units.

Until January 1, 2024, general hospitals were established by regional self-government units, such as the City of Zagreb or Split-Dalmatia County (with the exception of the general hospital in Vukovar, which was founded by the Republic of Croatia). However, starting January 1, 2024, the Republic of Croatia became the founder of all general hospitals, as outlined in the Law on Amendments to the Law on Health Care (2023).

Many authors use the deterministic non-parametric frontier method – Data Envelopment Analysis (DEA) to assess the cost efficiency of public hospitals (Andrews and Emvalomatis, 2024). By calculating the cost efficiency, it is possible to determine how well a hospital uses its resources to get the best possible health outputs/outcomes. Each hospital is a decision-making unit (DMU), i.e., the object under evaluation is a member of a group that produces comparable results using comparable inputs. DEA determines the efficiency limit of 1, limiting input from below and outputs from above.

Inefficient DMUs should aim for the efficiency limit, and every deviation from the frontier (efficiency score less than 1) is considered inefficient. DEA analysis, in addition to providing an evaluation of the efficiency of the observed units, also identifies examples of best practices that can serve as examples for improving inefficient units (Buljan and Šimović, 2022). Efficiency is meas-

ured by the ratio of output to input, where input represents the resources used in the production process, and output is the results that are achieved using these inputs. The advantages and, at the same time, the reasons for the popularity of the DEA method are that it enables the simultaneous analysis of a number of different inputs and outputs without prior assumptions about the functional form of their connection. Input and output data are used to form the efficiency frontier as a linear combination of the best units in the sample. The best units are those that achieve the highest output with a given input level or use the smallest combination of inputs to achieve a given output level. Then, efficiency indicators are calculated based on the distance of each individual unit from the efficiency frontier. Efficient units located at the efficiency frontier are assigned the highest indicator value of 1, while for other units located below the efficiency frontier, the indicator value is between 0 and 1. The efficiency indicator represents the room for efficiency improvement, i.e. the maximum value by which a unit could increase its outputs with given inputs or reduce its inputs with a constant output value. The efficiency indicators of the input-oriented DEA analysis show how much inputs could be reduced proportionally without compromising the achieved outputs.

The most commonly used models in the DEA analysis are (1) the Charnes, Cooper and Rhodes (1978) model, which assumes that the production function shows a constant return to scale (CCR model), and (2) the Banker, Charnes and Cooper (1984) model which assumes a variable return to scale (BCC model). For choosing the orientation of the model, one should take into account whether the unit has a greater influence on inputs or on outputs. Since healthcare decision makers have more control over inputs than outputs, we have chosen the input-oriented DEA model which is confirmed by international literature (Zubir et al., 2024). Variable return to scale assumes that a proportional increase in input results in a more or less proportional output increase. This BCC model has been chosen because the health sector operates in conditions of imperfect competition and has limited budgets and regulatory constraints (Buljan and Šimović, 2022).

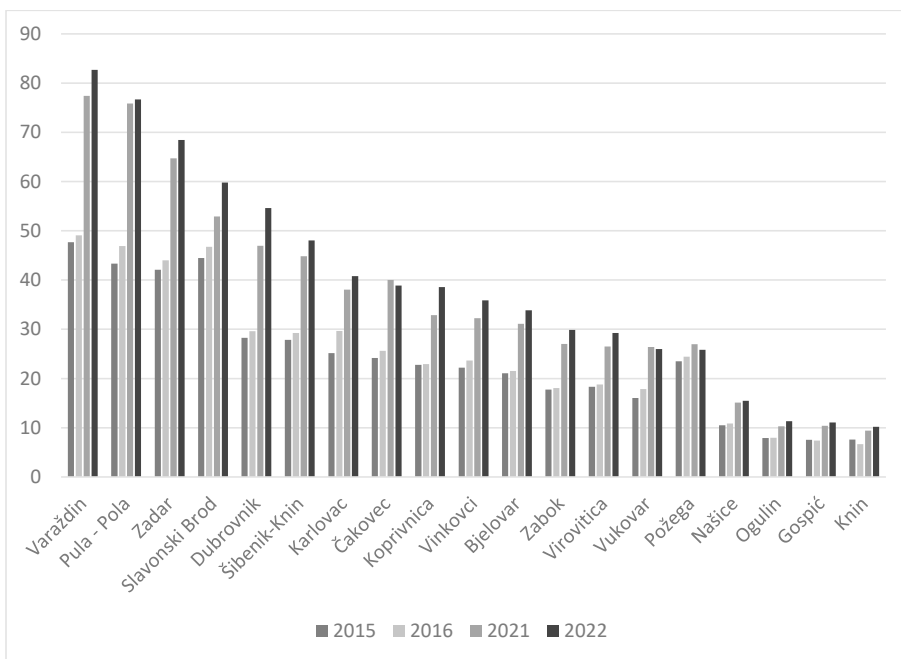
The formulation of the model is:

$$\begin{aligned} \max \theta &= \sum_{j=1}^m u_j y_{j0} + u_0 \\ \sum_{i=1}^s v_i x_{i0} &= 1 \\ \sum_{j=1}^m u_j y_{jk} - \sum_{i=1}^s v_i x_{ik} + u_0 &\leq 0 \\ v_i &\geq 0; u_j &\geq 0. \end{aligned}$$

The given model is used to obtain the value of efficiency θ_j , the optimal input v_i and the optimal output u_j .

Most important in the DEA analysis is the selection of inputs and outputs, which significantly influence the results. Thus, it is recommended that only fundamental inputs and outputs be used (Blecich et al., 2024). To calculate the cost efficiency of hospitals in Croatia, as outputs, we gathered data for four years – 2015, 2016, 2021 and 2022 – for 19 hospitals from the State Audit Office reports. Specifically, we used data from the Reports on the Completed Audit for 2016 (which includes data for 2015 and 2016), and Reports on the Completed Audit for 2022 (which includes data for 2021 and 2022). As an input variable, we used data for the 2015, 2016, 2021 and 2022 from the Ministry of Finance on total expenditures and outlays without investments in building facilities, calculated in mil. euro (Graph 1). Since, for e.g., the hospital in Bjelovar in 2021 spent around 20 mil. euro for construction objects, we excluded expenditures for investments in building facilities for all analysed hospitals. A similar input variable is used in many other research projects (e.g., Buljan and Šimović, 2022; Hodžić et al., 2019).

Graph 1. Total expenditures and outlays without investments in building facilities for 19 general hospitals, 2015, 2016, 2021, and 2022 (in mil. €)



Source: Authors.

Each general hospital performs three types of activities: hospital healthcare (where patients are treated and stay in the hospital for longer periods), day hospital (where patients come to the hospital for a day) and polyclinic-consultative healthcare (where patients come to the hospital to do consultative and diagnostic examinations). As output variables, we decided to use: the number of days in hospital treatments for hospital healthcare (as in e.g., Rabar, 2010;

Dukić Samaržija et al., 2018; Blecich et al., 2024), the average beds/chairs occupancy rate in day hospital (similarly to e.g., Hodžić et al., 2019), and the number of polyclinic-consultative services provided (similarly to e.g., Dukić Samaržija et al., 2018; Hodžić et al., 2019; Rabar, 2010). For outputs, we used data from Financial Audit Reports from the State Audit Office for general hospitals for 2015, 2016, 2021 and 2022, because that was the only source where we could find output variables for all three types of hospital activities. For more information about the variables used, see Table 1.

We did not include the number of beds or doctors in hospitals as an output indicator because Rabar (2010; 2013) and Blecich et al. (2024) find inefficiency due to excess of beds and doctors in some Croatian hospitals. Also, Imani et al. (2022) concluded that hospitals with higher bed numbers have lower efficiency than other hospitals. In addition, we do not think that a hospital is efficient if it has more beds, but for efficiency, it is more important that the existing beds are used. Thus, we use as output indicator the average bed occupancy rate in a hospital (like Azreena et al., 2018; Nwagbara et al., 2016; Vrabková and Lee, 2023; Yi et al., 2020).

Table 1. Definition of variables for each general hospital

Variable	Definition and measurement		Source
Input			
Expenditures	x_{ij}	Total expenditures and outlays without investments in building facilities. Based on data from a hospital's financial reports (in million €).	MoF (2025)
Outputs			
Days	y_{ij}	The number of days of hospital treatment in hospital healthcare (in 000).	State Audit Office (2018; 2024)
Beds	y_{2j}	The beds/chairs occupancy rate in the day hospital (in %).	
Services	y_{3j}	The number of services in polyclinic-consultative healthcare (in 000).	

Source: Authors.

4 Results

The correlation matrix for all variables in all years 2015, 2016, 2021 and 2022 are presented in Table 2, and it can be concluded that there is no high correlation between variables. To reduce computations and increase efficiency discrimination among DMUs, according to Sean et al. (2005), if there is a correlation between two variables higher than 0.9, one of the variables can be excluded. We tested the variable number of doctors and it was highly correlated with expenditures, thus for this reason, it is also excluded from the

analysis, even though it has been used in many research projects (e.g., Buljan and Šimović, 2022; Hodžić et al., 2019; Rabar, 2010). All data used are presented in Table A1 in the Appendix.

Table 2. Correlation matrix

	Expenditures	Days	Beds	Services
Expenditures	1			
Days	0.63	1		
Beds	0.48	0.34	1	
Services	0.73	0.58	0.45	1

Source: Authors.

The descriptive statistics is in Table 3 for all four years and reveal significant differences in all values of the variables. Hospital Varaždin has the highest total expenditures and outlays (82.7 mil. euro) and the highest number of days in treatment (275.2 th.). In contrast, hospital Pula-Pola has the highest number of services provided (2,945.8 th.), while hospital Slavonski Brod has the highest beds/chairs occupancy rate for day hospitals (239%). Hospital Knin reports the lowest expenditures and outlays (6.7 mil. euro) and the lowest number of services provided (146.2 th.). Finally, hospital Gospić has the lowest number of days in treatment (16.1 th.), while hospital Vukovar has the lowest beds/chairs occupancy rate in a day hospital (16%).

Table 3. Descriptive statistics for the variables of each general hospital

Variables	Minimum	Median	Mean	Maximum	Standard deviation
Input					
Expenditures	6.7	27.0	31.1	82.7	18.3
Outputs					
Days	16.1	68.3	75.2	275.2	49.1
Beds	15.8	83.6	85.7	238.6	37.6
Services	146.2	1,047.0	1,153.8	2,945.8	620.2

Source: Authors.

Analysis of cost and super efficiency conducted using the input-oriented DEA method with a variable return to scale for the years 2015, 2016, 2021 and 2022, are presented in Tables 4 and 5. In our study, the efficiency frontier includes hospitals that can achieve the best possible health outcomes with the least amount of resources (total expenditures and outlays). After calculating cost efficiency, we also calculate super efficiency to rank all cost efficient

general hospitals (score of 1). General hospitals with super efficiency infinity are the benchmarks.

Cost efficiency was higher in the COVID-19 pre-pandemic period than in the pandemic period (Tables 4 and 5). Like other authors we observe during pandemic cost efficiency decreased (e.g., Hamdollahzadeh et al., 2024). This was probably because hospitals were operating under special restrictions and re-organisation which increased costs in general hospitals. However, the level of cost efficiency did not change significantly during the observed period for most of the general hospitals analysed. General hospitals that were most efficient before the pandemic (Pula-Pola and Varaždin) continued to be the most efficient during the pandemic. Similarly, those general hospitals that were least efficient before the pandemic (like Dubrovnik and Vukovar) also remained the least efficient afterward. Comparing our results with the study by Blatnik et al. (2017), which analysed the technical, cost, and allocative efficiency of 12 Slovenian general hospitals from 2005 to 2014 using the DEA method, we observe a similar pattern. That study also emphasised that efficiency did not change significantly over the years: hospitals that were inefficient initially remained so for the next nine years, while efficient hospitals maintained their status.

According to our findings, cost efficiency among Croatian general hospitals varies considerably, with only 7 or 8 out of 19 general hospitals achieving full efficiency (score of 1) each year, while the remaining general hospitals are inefficient. On average, the efficiency score is 0.93 (or 93%) in 2015, 0.86 (or 86%) in both 2016 and 2021, and 0.84 (or 84%) in 2022, indicating that on average general hospitals could maintain the same output level while reducing their input by 7%, 14% or 16%, respectively. The cost efficiency of general hospitals ranges from 48% to 100%.

Our findings (see Figure 2, and Tables 4 and 5) show that the following hospitals were cost-efficient (cost efficiency = 1) in all analysed years: Knin, Našice, Pula-Pola, and Varaždin. Požega and Zadar were cost-efficient in 2022. Gospić was cost-efficient in 2015, 2016, and 2021; Šibenik-Knin in 2015 and 2021; Ogulin in 2015; Virovitica in 2015 and 2016; Zabok in 2016, 2021, and 2022; and Slavonski Brod in 2021 and 2022.

Table 4. Cost efficiency and super efficiency results and rankings for the 19 Croatian general hospitals, ranked by highest efficiency score in 2016

General hospital	2015			2016		
	Cost efficiency	Super efficiency	Rank	Cost efficiency	Super efficiency	Rank
Pula - Pola	1	Benchmark	1.	1	Benchmark	1.
Varaždin	1	Benchmark	1.	1	Benchmark	1.
Knin	1	1.2821	3.	1	1.5080	2.
Gospić	1	2.1439	2.	1	1.2724	3.
Zabok	0.9778	0.9778	9.	1	1.1520	4.
Virovitica	1	1.1146	4.	1	1.0481	5.
Našice	1	1.1092	6.	1	1.0363	6.
Ogulin	1	1.1135	5.	0.9756	0.9756	7.
Čakovec	0.9738	0.9738	10.	0.9045	0.9045	8.
Šibenik-Knin	1	1.0073	7.	0.8927	0.8927	9.
Bjelovar	0.8056	0.8056	15.	0.8778	0.8778	10.
Slavonski Brod	0.9406	0.9406	12.	0.8442	0.8442	11.
Vinkovci	0.9449	0.9449	11.	0.8417	0.8417	12.
Požega	0.9097	0.9097	13.	0.7421	0.7421	13.
Koprivnica	0.7248	0.7248	17.	0.7393	0.7393	14.
Zadar	0.8829	0.8829	14.	0.6389	0.6389	15.
Dubrovnik	0.9821	0.9821	8.	0.6325	0.6325	16.
Vukovar	0.6725	0.6725	18.	0.6282	0.6282	17.
Karlovac	0.7919	0.7919	16.	0.6212	0.6212	18.
Average	0.9267	-	-	0.8599	-	-

Source: Authors.

Table 5. Cost efficiency and super efficiency results and rankings for the 19 Croatian general hospitals, ranked by highest efficiency score in 2022

General hospital	2021			2022		
	Cost efficiency	Super efficiency	Rank	Cost efficiency	Super efficiency	Rank
Pula - Pola	1	Benchmark	1.	1	Benchmark	1.
Slavonski Brod	1	Benchmark	1.	1	Benchmark	1.
Varaždin	1	Benchmark	1.	1	Benchmark	1.
Zabok	1	1.8504	3.	1	1.9552	2.
Knin	1	1.7257	4.	1	1.8250	3.
Našice	1	1.1507	5.	1	1.1619	4.
Požega	0.6249	0.6249	14.	1	1.1503	5.
Zadar	0.8476	0.8476	9.	1	1.0005	6.
Čakovec	0.9212	0.9212	7.	0.9607	0.9607	7.
Gospić	1	1.9437	2.	0.9193	0.9193	8.
Ogulin	0.9455	0.9455	6.	0.9001	0.9001	9.
Karlovac	0.8647	0.8647	8.	0.7972	0.7972	10.
Virovitica	0.7828	0.7828	12.	0.7412	0.7412	11.
Vinkovci	0.7897	0.7897	11.	0.7118	0.7118	12.
Koprivnica	0.8029	0.8029	10.	0.7096	0.7096	13.
Bjelovar	0.7553	0.7553	13.	0.6779	0.6779	14.
Šibenik-Knin	1	Benchmark	1.	0.5664	0.5664	15.
Vukovar	0.4958	0.4958	16.	0.5397	0.5397	16.
Dubrovnik	0.5836	0.5836	15.	0.4810	0.4810	17.
Average	0.8639	-	-	0.8424	-	-

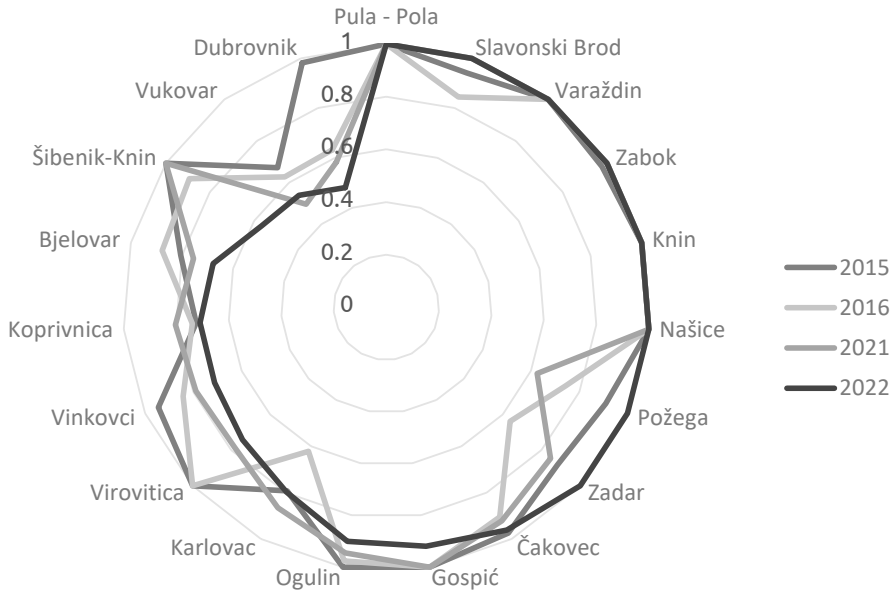
Source: Authors.

Notably, Gospić, Knin, Našice, and Ogulin consistently lie near the frontier's origin – indicating they operate with relatively low input and output levels (Table A1 in Appendix). Their proximity to the origin signals input minimisation, though it doesn't necessarily reflect optimal output quality or quantity. Rather, from an efficiency standpoint, these general hospitals are making effective use of limited resources.

In contrast, hospital Pula-Pola stands higher on the efficiency frontier, indicating that it is performing well relative to its peers – achieving relatively high outputs with its inputs. Similarly, hospital Varaždin is positioned very high and close to the efficiency frontier, indicating that it is also among the top performers in terms of converting inputs into outputs. However, it should be noted that this positioning reflects relative performance within the sample, not absolute optimisation. DEA evaluates a hospital's performance against other

hospitals rather than against a theoretical maximum (Jorge et al., 2006), i.e., efficiency is determined based on how well a hospital performs compared to its peers using the same set of resources.

Figure 2. Cost efficiency for 19 general hospitals in 2015, 2016, 2021 and 2022, ranked by highest efficiency score in 2022



Source: Authors.

Figure 2 also presents cost efficiency for 19 general hospitals. General hospitals mostly achieve the same (in)efficiency scores in all years, except for some. Hospitals Dubrovnik, Zadar, Karlovac, and Požega exhibit the most differences in inefficiency scores between the two years – 2015 and 2016. For example, the decrease in the efficiency of hospital Dubrovnik from 98% in 2015 to 63% in 2016 was due to an increase of 1.4 mil. euro of expenditures and outlays in 2016, and simultaneously a lower number of services and days in treatment while beds/chairs occupancy rate were higher. The decrease in the efficiency of hospital Zadar from 88% in 2015 to 64% in 2016 was due to an increase of 1.9 mil. euro of expenditures and outlays in 2016, and simultaneously a lower number of services and days in treatment, while beds/chairs occupancy rate were higher. Hospitals Šibenik-Knin, Požega, and Zadar exhibit the most differences in inefficiency scores between the two years – 2021 and 2022. For example, a decrease in cost efficiency of hospital Šibenik-Knin from 100% in 2021 to 57% 2022 occurred because expenditures and outlays increased by 3.2 mil. euro while days in treatment and the number of services declined (beds/chairs occupancy rate remained the same).

To rank all cost efficient general hospitals, we calculated super efficiency for observable years (Tables 4 and 5). General hospitals with super efficiency

score of infinity are unique in their characteristics, and there is no similar general hospital that could serve as a reference sample for them. Those hospitals are considered benchmark (best practice) general hospitals, and they all share rank 1. The benchmark hospitals operate at the frontier of efficiency, meaning they use the least amount of input to produce the most output. These benchmarks could serve as standards, showing how less efficient general hospitals can improve by mimicking their practices. Hospitals Pula-Pola and Varaždin were benchmark institutions in 2015 and 2016. In 2021 the benchmark institutions were Pula-Pola, Varaždin, Slavonski Brod, and Šibenik-Knin, while in 2022 only Pula-Pola, Varaždin, and Slavonski Brod were so rated. Hospital Pula-Pola had the highest number of services provided in 2015 and 2016, and Šibenik-Knin in 2021. Hospital Slavonski Brod had the highest beds/chairs occupancy rate in 2022, while hospital Varaždin recorded the highest expenditures and outlays in both 2021 and 2022, as well as the number of days in treatment throughout all observing years.

5 Discussion

This study adds to the literature by measuring cost inefficiencies in Croatian general hospitals. It identifies persistent benchmarks and inefficient general hospitals, offering a data-driven foundation for policy reforms aimed at enhancing financial sustainability in Croatia's healthcare system. It is important to notice that benchmark general hospitals (the most efficient ones) in each year are the largest general hospitals (in terms of expenditures) (except Slavonski Brod in 2015, Dubrovnik in 2021, and Zadar in 2021 and 2022) (Table A1 in Appendix). In addition, benchmark general hospitals on average in the analysed four years had much lower total due liabilities in total expenditures (12.4%) than low efficiency general hospitals (36.8%) (Table A1). This might be due to economies of scope and/or scale. Economies of scope refer to cost advantages gained by producing a variety of products using shared resources, while economies of scale refer to cost advantages gained by increasing production of a single product. Lindaas et al. (2025) show that general hospitals producing a diversified mix of services typically achieve greater cost efficiency through joint production of services (economies of scope). Furthermore, literature on hospital economies of scale confirms that larger hospitals – particularly those with 200-300 beds – often operate at an optimal scale, benefiting from cost efficiencies unavailable to smaller hospitals (Giancotti et al., 2017).

Interestingly on the other hand, some general hospitals reported the lowest expenditures (below 16 mil. euros), yet were still classified as efficient (cost efficiency = 1), but not as benchmark hospitals. Našice and Knin in all four years, Gospić in 2015, 2016 and 2021, and Ogulin in 2015. This may indicate effective resource management and operational efficiency in these facilities, despite limited financial resources. Smaller general hospitals could be more efficient due to simpler organisational structures and lower costs. Their limited scope of services enables more targeted resource allocation, resulting in reduced expenditures while still ensuring adequate service delivery.

However, smaller general hospitals often lack access to the latest technology, leading specialists, or the ability to perform complex interventions, so their efficiency should be assessed in relation to the scope and complexity of the services they provide. In Slovenia, DEA results showed that medium and relatively small general hospitals, such as Brežice and Trbovlje, consistently scored at or near full technical and cost efficiency, in contrast to large university hospitals which underperformed (Blatnik et al., 2017). In Slovakia, a regional DEA window analysis also suggested that regions with fewer beds and less advanced technological infrastructure often achieved higher health-care technical efficiency scores, implying that smaller-scale operations with simpler input structures can sometimes outperform more complex systems (Vaňková and Vrabková, 2022; Stefko et al., 2018).

The least efficient general hospital in all years of our analysis was Vukovar (cost efficiency score below 70%). Similarly, Dubrovnik had a cost efficiency score below 70% in all years except in 2015. According to Pecoraro et al. (2021), such differences can be a consequence of poor management, such as planning and local organisation of health. Thus, these two general hospitals should be prioritised as the best candidates for further cost efficiency analysis.

Looking at the broader picture, one of the most striking observations from this cost efficiency analysis is the recurrent deficit faced by all general hospitals in Croatia. This raises important questions about their financial sustainability. Similar problems exist in other Central and Eastern European (CEE) countries like Poland where in 2018 a majority of county hospitals (55.3%) reported a gross financial loss, and nearly half (48.5%) faced overdue liabilities (Dubas-Jakóbczyk et al., 2020).

How is it possible that almost all Croatian general hospitals continue to operate in deficit year after year; i.e. why general hospitals cannot cover their expenditures with their revenues and why do they create overdue liabilities? How to reduce deficits without compromising the achieved outputs? It is already mentioned that hospital efficiency is affected by internal and external factors and that there is no universal policy or magic formula that can broadly enhance performance across all hospitals (Asbu et al., 2020). However, the first step involves analysing the efficiency of hospitals to identify which ones are less efficient according to various criteria, followed by further analysis to pinpoint internal factors they could change – such as adjusting outpatient-to-inpatient ratios, staffing issues, or medication procurement practices – to improve the efficiency of less efficient hospitals.

Literature review points out that Croatian general hospitals face deficits because of problems relating to their revenues and expenditures. On the revenue side, the DRGs, which determine the pricing for services provided by general hospitals, appear to be set too low (Horvat, 2024). If the current DRG prices do not adequately cover the costs of services, they need to be reevaluated and increased. Insufficient reimbursement for the services rendered by general hospitals contributes to their financial struggles and inefficiencies. This is an external factor that influences hospital efficiency, which lies outside

a general hospital's immediate control and requires broader interventions at the health system or cross-sectoral level (responsibility of the Ministry of Health and Government). Research by Kalanj et al. (2021) confirmed that the introduction of DRG-based hospital financing in Croatia during 2009-2018 did not significantly improve hospital cost efficiency. Despite reductions in the average length of stay, number of beds, and hospitalisations, the average cost per DRG-weighted case increased by 17%. Research shows that many other CEE countries face significant financial challenges due to the debts accumulated by public hospitals, and one of the key contributing factors is the inadequate pricing of public hospital services, which is often set below the actual cost of providing care (Jovanović, 2020; Dubas-Jakóbczyk and Kozieł, 2020).

On the expenditure side, as already mentioned, less efficient general hospitals (such as Dubrovnik and Vukovar) should be prioritised for further analysis to identify specific causes of inefficiency. Some of these causes of inefficiency are elements that general hospitals can manage and change directly. For example, as the major share of general hospital expenditures and outlays is directed towards employee costs and materials, further research should be conducted to explore the impact of these expenditures and outlays on general hospital cost efficiency. In both 2021 and 2022, 19 general hospitals in Croatia allocated an average of around 60% of their total expenditures and outlays to employee costs and 20% to materials costs (e.g., medicines, food for patients, medical consumables) (MoF, 2025). For example, in 2021 and 2022 the general hospital in Dubrovnik spent more on material costs than the average for all general hospitals, and the general hospital Vukovar spent more on employee costs than the average for all general hospitals. Understanding the specific allocation of these costs can guide targeted interventions to reduce inefficiencies in the most impactful areas. Also, there may be an excess of doctors in certain hospitals, which contributes to higher personnel costs without necessarily improving service delivery, as argued by Rabar (2010; 2013) and Blečić et al. (2024). Additionally, some Croatian doctors may be splitting their working time between public and private healthcare sectors, reducing their effective working hours in public general hospitals. If this is the case, the system may need to consider policies similar to those in Slovenia, where doctors are prohibited from working in private hospitals while employed in the public sector. Alternatively, a system could be implemented to ensure that doctors are only compensated for the hours they spend working in public hospitals, thus preventing the misuse of public funds. The high expenditure on materials raises questions about potential inefficiencies in medication use. The same is argued by Jafarov and Gunnarsson (2008) and Đukić Samaržija et al. (2018). Are (expensive) medications being used unnecessarily? Bubaš (2022) analysed the Croatian hospital system from 2015 to 2022 and, on the example of clinical hospital centres, showed that almost all outstanding liabilities were attributed to material expenses, specifically, unpaid medicines and medical supplies. The State Audit Office (2024) argues that numerous general hospitals have problems with transparent tracking of medication consumption and public procurement practices. Inefficiencies in these areas could be a major contributor to the financial deficits experienced by general hospitals.

Similarly, Dubas-Jakóbczyk et al. (2020), argue that in Poland, the financial instability and indebtedness of public hospitals result from a complex interplay of external and internal factors. At the external level, contributing issues include insufficient funding mechanisms, inadequate tariff structures, weak governance of the hospital sector, oversized and inefficient infrastructure, centrally regulated salary increases for medical staff, and a lack of comprehensive health needs assessments. At the internal level, factors such as poor financial and managerial practices – particularly in cost containment, weak oversight by hospital owners, and aging infrastructure requiring capital investment – further exacerbate financial difficulties. The same authors point to significant variation in financial performance across hospitals, with both highly indebted and financially stable institutions coexisting, underscoring the importance of these individual, hospital-specific factors. A recent scoping review of hospital financial performance in Europe, Dubas-Jakóbczyk et al. (2025), also found that public hospitals in many CEE countries (including Croatia) consistently run deficits and accumulate debts, particularly for pharmaceutical and medical products and personnel costs. These deficits are often attributed to weak management accountability and lack of staff cost control. Taken together, these findings show that public hospitals across the region – not only in Croatia – frequently operate under chronic financial strain, accumulating arrears despite ongoing reform efforts.

Our study complements existing research from CEE, where public hospital inefficiencies, debts and overdue liabilities are a widespread concern, especially due to misalignment between service costs and reimbursement, and poor cost control in areas such as pharmaceuticals and staffing (e.g., Dubas-Jakóbczyk et al., 2025). However, unlike most previous studies, our analysis offers a detailed hospital-level comparison based on cost efficiency scores. This allows us to propose concrete, evidence-based strategies for cost optimisation and better alignment between resources and services for each general hospital. In doing so, our research contributes a novel, data-driven approach to understanding and improving hospital cost efficiency in Croatia and potentially in similar CEE health systems.

6 Conclusion

This study addresses a critical challenge facing Croatia's healthcare system, mounting financial obligations in general hospitals. The central question was whether cost efficiency of general hospitals – measured through input-oriented DEA – can reveal opportunities for reducing expenditures without compromising healthcare outputs.

This is the first time that the cost efficiency of 19 Croatian general hospitals has been calculated. Using the input-oriented BCC DEA model, we evaluated 19 general hospitals across two pre-pandemic years (2015-2016) and two pandemic years (2021-2022). Cost efficiency scores ranged from 48% to 100%. On average, the efficiency score is 0.93 (or 93%) in 2015, 0.86 (or 86%) in both 2016 and 2021, and 0.84 (or 84%) in 2022, indicating that on average general

hospitals could maintain the same output level while reducing their input by 7%, 14% or 16%, respectively. Though overall efficiency declined during COVID-19 – likely due to operational disruptions – individual hospital performance remained largely consistent. Pula-Pola and Varaždin emerged as persistent benchmarks, while Vukovar consistently scored below 70%. Moreover, larger hospitals – measured by total expenditures – consistently demonstrate higher cost efficiency when compared to their peers. Also, in the analysed four years benchmark general hospitals (with higher cost efficiency) on average had much lower total due liabilities in total expenditures (12.4%) than low efficiency general hospitals (36.8%).

Our study demonstrates that cost-efficiency assessment can pinpoint both high-performers and underperformers, offering a roadmap for targeted managerial and policy reforms. While no universal efficiency solution exists, because general hospital efficiency is influenced by internal and external factors, Croatia's general hospitals can benefit from data-driven identification of inefficient hospitals and strategic efforts to emulate top performers. By adopting practices from benchmark general hospitals, less efficient general hospitals could achieve substantial cost savings without reducing service levels. This aligns with national and international findings that emphasise the need for continuous performance monitoring and the dissemination of best practices for resource use and general hospital management.

Our research underscores the existence of cost inefficiencies within Croatia's general hospitals and highlights the potential for substantial cost savings. If a hospital has low cost efficiency, it may indicate operational issues. Thus, further analysis, especially in less efficient hospitals, can guide decisions like reallocating staff or reducing bed numbers. In the future, it would be very interesting to further analyse the least cost effective general hospital (Vukovar) and explore the impact of employees and materials costs on general hospital cost efficiency. It would also be interesting to find out why the largest general hospitals are usually the most cost efficient ones (benchmarks).

Our findings have direct implications for public administration and hospital governance. Based on the results, decision-makers in the health sector, such as the Ministry of Health, hospital founders, and financing bodies, could introduce regular performance monitoring, adjust hospital payment models (e.g., DRG pricing), analyse and improve staffing efficiency, and strengthen cost control in key spending categories like pharmaceuticals and materials. Additionally, more systematic use of financial and audit reports could support evidence-based management decisions. Recent research highlights that politicians and public managers in Croatia, including those in healthcare, often consult public sector financial reports; however, these are still underutilised as primary tools for decision-making (Barbieri et al., 2025). Greater reliance on such reports could support more effective management and cost efficiency in public hospitals. By applying these measures, public administration can support the long-term financial sustainability and operational efficiency of Croatian general hospitals.

The major limitation of this paper's analysis is that we used the inputs and outputs that were accessible to us, but other inputs and outputs might better reflect the efficiency of public general hospitals (e.g., pharmaceutical costs – how much medication has been spent in each general hospital or case-weighted inpatient discharges). Thus, this is only the first step in the cost efficiency analysis of Croatia's general hospitals. Unfortunately, from the currently available data, it was not possible to find out the structure of general hospitals' materials costs (how much was separately spent on medicines, food for patients, and medical consumables). Thus, there is a need for the Ministries of Health and Finance to produce more detailed data regarding the functioning of public general hospitals. Improving the availability and granularity of hospital-level data – especially on pharmaceutical and material costs – would not only enhance national performance monitoring, but also facilitate international benchmarking and research collaboration. This would enable comparative studies using harmonised indicators and DEA methodologies that could situate the Croatian general hospital's performance within an international framework.

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Appendix

Table A1. Data on used variables on 19 general hospitals in Croatia during years 2015, 2016, 2021 and 2022

General hospital	Year	Expenditures (in mil. €)	Due liabilities in total expenditures (in %)	Days (in 000)	Beds (in %)	Services (in 000)	Cost efficiency
<i>Benchmark – best practice</i>							
Varaždin	2016	49.1	20.7	275	105	1.382	1
Varaždin	2021	77.4	17.8	174	97	1.524	1
Varaždin	2022	82.7	17.7	184	129	1.737	1
Pula - Pola	2016	46.9	16.2	118	180	2.946	1
Varaždin	2015	47.7	15.2	273	126	1.692	1
Pula - Pola	2015	43.3	13.4	128	112	2.812	1
Pula - Pola	2021	75.9	10.2	74	130	2.149	1
Šibenik-Knin	2021	44.8	9.4	61	100	2.162	1
Pula - Pola	2022	76.7	5.7	92	121	2.283	1
Slavonski Brod	2021	52.9	5.4	92	168	1.160	1
Slavonski Brod	2022	59.8	5.1	92	239	1.313	1
<i>Efficient</i>							
Gospić	2015	7.5	15.9	20	91	311	1
Zabok	2022	29.9	9.4	64	148	1.702	1
Gospić	2021	10.4	9.7	19	120	327	1
Zabok	2021	27.0	11.0	62	144	1.513	1
Knin	2022	10.2	61.7	35	100	304	1
Knin	2021	9.4	61.1	34	82	237	1
Knin	2016	6.7	23.2	38	36	146	1
Knin	2015	7.6	18.2	36	55	309	1
Gospić	2016	7.4	17.6	20	67	416	1
Našice	2022	15.5	2.3	26	57	859	1
Zabok	2016	18.1	8.7	70	91	1.397	1
Našice	2021	15.1	5.7	27	59	825	1
Požega	2022	25.8	3.4	46	153	866	1
Virovitica	2015	18.3	15.6	62	100	1.028	1
Ogulin	2015	7.9	19.9	26	25	478	1
Našice	2015	10.5	14.9	36	47	698	1
Virovitica	2016	18.8	20.9	61	85	1.484	1
Našice	2016	10.9	19.5	34	45	777	1
Šibenik-Knin	2015	27.8	8.3	78	100	1.755	1
Zadar	2022	68.5	4.4	100	75	2.095	1

Analysis of the Cost Efficiency of Public General Hospitals in Croatia

General hospital	Year	Expenditures (in mil. €)	Due liabilities in total expenditures (in %)	Days (in 000)	Beds (in %)	Services (in 000)	Cost efficiency
<i>Near-efficient</i>							
Dubrovnik	2015	28.3	35.0	85	40	1.802	0.9821
Zabok	2015	17.7	7.9	63	74	1.013	0.9778
Ogulin	2016	8.0	15.4	26	63	274	0.9756
Čakovec	2015	24.2	7.9	95	100	1.210	0.9738
Čakovec	2022	38.9	6.0	88	100	1.099	0.9607
<i>Emerging</i>							
Ogulin	2021	10.3	3.0	18	38	274	0.9455
Vinkovci	2015	22.2	30.7	92	88	1.031	0.9449
Slavonski Brod	2015	44.5	15.2	158	100	2.359	0.9406
Čakovec	2021	40.0	6.7	89	100	851	0.9212
Gospić	2022	11.1	9.0	16	80	306	0.9193
Požega	2015	23.5	10.2	92	97	1.024	0.9097
Čakovec	2016	25.6	13.8	92	100	1.035	0.9045
Ogulin	2022	11.3	3.5	17	44	295	0.9001
Šibenik-Knin	2016	29.3	7.4	71	100	1.866	0.8927
Zadar	2015	42.1	11.1	122	61	2.292	0.8829
Bjelovar	2016	21.5	17.1	92	51	921	0.8778
Karlovac	2021	38.0	8.6	78	71	1.203	0.8647
Zadar	2021	64.7	9.5	105	71	1.814	0.8476
Slavonski Brod	2016	46.8	15.4	158	100	1.976	0.8442
Vinkovci	2016	23.7	37.6	87	88	1.170	0.8417
Bjelovar	2015	21.1	12.8	73	69	885	0.8056
Koprivnica	2021	32.9	9.0	68	50	693	0.8029
<i>Low efficiency</i>							
Karlovac	2022	40.8	7.0	75	79	1.298	0.7972
Karlovac	2015	25.2	1.1	90	59	1.018	0.7919
Vinkovci	2021	32.2	79.2	63	101	1.059	0.7897
Virovitica	2021	26.5	11.3	52	95	1.063	0.7828
Bjelovar	2021	31.1	39.2	59	71	1.014	0.7553
Požega	2016	24.4	23.2	80	82	928	0.7421
Virovitica	2022	29.3	8.1	53	100	1.063	0.7412
Koprivnica	2016	22.9	24.5	89	61	618	0.7393
Koprivnica	2015	22.8	19.9	87	45	654	0.7248
Vinkovci	2022	35.9	84.7	61	124	1.092	0.7118
Koprivnica	2022	38.6	5.6	69	56	811	0.7096
Bjelovar	2022	33.8	44.1	53	87	1.227	0.6779
Vukovar	2015	16.1	34.4	36	16	718	0.6725

General hospital	Year	Expenditures (in mil. €)	Due liabilities in total expenditures (in %)	Days (in 000)	Beds (in %)	Services (in 000)	Cost efficiency
Zadar	2016	44.0	17.2	120	71	1.578	0.6389
Dubrovnik	2016	29.6	45.3	83	52	1.154	0.6325
Vukovar	2016	17.9	34.9	34	27	809	0.6282
Požega	2021	27.0	5.9	44	100	796	0.6249
Karlovac	2016	29.7	0.2	86	75	1.009	0.6212
Dubrovnik	2021	46.9	84.9	64	77	1.438	0.5836
Šibenik-Knin	2022	48.1	9.9	57	100	1.547	0.5664
Vukovar	2022	26.0	20.5	34	46	656	0.5397
Vukovar	2021	26.4	164.2	23	37	616	0.4958
Dubrovnik	2022	54.6	80.2	59	80	1.438	0.4810

Source: Authors.

Fair Taxation of Inheritance?

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ABSTRACT

Purpose: The purpose of this article is to clarify the meaning and character of inheritance tax from a legal perspective. It is necessary to identify its role within the tax system and explore its connections to other taxes. Such an approach is the only way to substantiate arguments in favour of retaining inheritance tax. For the purposes of this paper, we assume that most countries in the European Union continue to levy inheritance tax, which must therefore be justified. A small number of states, on the other hand, have abolished this tax. The hypothesis we aim to confirm or disprove is that inheritance tax is a traditional levy firmly embedded within the tax systems of individual countries.

Design/Methodology/Approach: To achieve the aims of the paper, we follow the IMRaD methodology. Within the research section, it is necessary to characterise inheritance tax, identify its place within the tax system, and analyse the reasons behind its abolition in some jurisdictions. The research also includes an analytical-comparative component devoted to examining the individual structural elements of inheritance tax. This detailed analysis enables us to formulate a set of questions concerning the optimal and fair legal construction of the basic structural components of inheritance tax, which are addressed in the discussion section of the article. In the concluding section, we primarily determine whether the arguments for retaining or abolishing inheritance tax are more persuasive.

Findings: The hypothesis that inheritance tax is a traditional levy firmly embedded within the tax systems of individual countries is confirmed. Nevertheless, the decision to impose inheritance tax remains a purely political one. As is evident from the design of its structural components, the law and legal regulation can ensure that inheritance tax is implemented in a fair manner.

Academic Contribution to the Field: The research, which focuses on the fairness of inheritance tax from a legal perspective, is novel. Given that the decision to levy inheritance tax lies with political authorities, this paper offers options for designing the individual structural components of inheritance tax in consideration of other forms of taxation.

Research Implications/Limitations: This paper does not examine the fairness of taxation from political, sociological, or psychological perspectives. It does not consider the possibility that populism may serve as a strategic approach for introducing or abolishing inheritance tax. Furthermore, the research does not address the economic efficiency of inheritance taxation.

Originality/Value: The topic is highly original, as it addresses the legal regulation of inheritance taxation and the design of its individual structural components. The approach is applicable in all countries worldwide, regardless of whether they currently levy inheritance tax. It contributes to the discourse on inheritance taxation from a legal standpoint.

Keywords: inheritance tax, estate tax, gift tax, structural component of tax

Pošteno obdavčenje dediščine?

POVZETEK

Namen: namen članka je razjasniti pomen in naravo davka na dediščino z vidika prava. Njegovo vlogo je treba opredeliti v davčnem sistemu ter raziskati povezave z drugimi davki. Tak pristop je edini način, da utemeljimo argumente v korist ohranitvi davka na dediščino. V članku predpostavljamo, da večina držav v Evropski uniji še vedno ima davek na dediščino, zato ga je treba utemeljiti. Manjše število držav je ta davek odpravilo. Hipoteza, ki jo želimo potrditi ali ovreči, je, da je davek na dediščino tradicionalna dajatev, trdno umeščena v davčne sisteme posameznih držav.

Načrt/metodologija/pristop: za dosego ciljev prispevka sledimo metodologiji IMRaD. V raziskovalnem delu je treba opredeliti davek na dediščino, določiti njegov položaj v davčnem sistemu in analizirati razloge za njegovo odpravo v nekaterih jurisdikcijah. Raziskava vključuje tudi analitično-primerjalno komponento, namenjeno preučevanju posameznih strukturnih elementov davka na dediščino. Ta podrobna analiza nam omogoča oblikovati nabor vprašanj o optimalni in pravični pravni zasnovi osnovnih strukturnih sestavin davka na dediščino, na katera odgovarjamo v razpravljalnem delu članka. V sklepnem delu predvsem ugotovimo, ali so prepričljivejši argumenti za ohranitev ali za odpravo davka na dediščino.

Ugotovitve: hipoteza, da je davek na dediščino tradicionalna dajatev, trdno umeščena v davčne sisteme posameznih držav, je potrjena. Kljub temu odločitve o uvedbi tega davka ostaja izključno politična. Kot je razvidno iz zasnove njegovih strukturnih sestavin, lahko pravo in pravna ureditev zagotovita, da se davek na dediščino pobira na pravičen način.

Akademski prispevek k področju: raziskava, ki se osredotoča na pravičnost davka na dediščino s pravnega vidika, je novost. Ker je odločitev o uvedbi davka na dediščino v domeni političnih organov, članek ponuja možnosti za oblikovanje posameznih strukturnih sestavin tega davka ob upoštevanju drugih oblik obdavčitve.

Raziskovalne implikacije/omejitve: članek ne obravnava pravičnosti obdavčitve s političnega, sociološkega ali psihološkega vidika. Ne upošteva možnosti, da bi populizem lahko služil kot strateški pristop k uvedbi ali odpravi davka na dediščino. Poleg tega raziskava ne obravnava ekonomske učinkovitosti obdavčitve dediščine.

Izvirnost/vrednost: tema je zelo izvirna, saj obravnava pravno ureditev obdavčitve dediščine in zasnovo njenih posameznih strukturnih sestavin. Pristop je uporaben v vseh državah po svetu, ne glede na to, ali trenutno imajo davek na dediščino ali ne. Prispeva k razpravi o obdavčitvi dediščine z vidika prava.

Ključne besede: davek na dediščino, davek na zapuščino, davek na darila, strukturna sestavina davka

JEL: K34, K40

1 Introduction

The discussion about the fairness of taxation is never-ending. The reason is hidden in the fact that every person has a different perception of taxes: some people still believe that taxes are legal theft, while others pay taxes as they feel it is not only a legal obligation but also an ethical issue. Most of the population stays somewhere between these two poles. They are ready to pay taxes if they feel they are fair and they get adequate service from the state and/or local self-government units.

Fair taxation is not only connected to the absolute amount of every single tax being paid in every single tax period. The perception of tax fairness is primarily strongly connected to the mixture of taxes that taxpayers have to pay. In other words, it is not easy to explain why the recurrent property should be collected if the tax is paid from the net income after the taxation (by income taxes); many people see property tax as a second taxation of their income. The inheritance tax is then viewed even more negatively: the heir receives the property acquired by the deceased, obtained from income already taxed once. This problem comes to the fore, especially in the case of family property inherited from close relatives.

The purpose of this article is then to clarify the meaning and the character of inheritance tax from the legal point of view. It is necessary to identify its role in the tax system and find connections to other taxes. Such an approach is the only way to defend the arguments for retaining the inheritance tax. For the purpose of this paper, we really assume that most countries in the European Union still levy the inheritance tax, which must be justified. A small number of states, on the other hand, abolished this tax. The hypothesis we will confirm or disprove is that the inheritance tax is a traditional tax firmly anchored in the tax systems of individual countries.

To reach the aims of the paper, we follow the IMRaD methodology. Within the research part, it is necessary to characterize the inheritance tax and to

define its sub-categories. It is also needed to identify the place of inheritance tax in the tax system (tax mix) and to point out the connections between the inheritance tax and other taxes, mainly income taxes (such as personal income tax and corporate income tax) and other property taxes (gift tax, property transfer tax, taxes on acquisition of property, general wealth tax, and recurrent property tax). Later, we will analyse the reasons for abolishing the inheritance tax in countries where such a tax was abolished in recent decades. The Research must also include an analytical-comparative part devoted to individual structural components of the inheritance tax. The detailed analysis, in combination with the partial comparison between the European States, will allow us to create a set of questions asking for the optimal and fair legal construction of basic structural components of the inheritance tax, such as the person of taxpayer, the tax base construction, the type of tax rate/rates, the corrective elements, the tax administration and collection. These questions are to be answered in the discussion part of the article. Special attention will be paid to the relations between the inheritance tax and other taxes with regard to fairness in taxation and efficient tax administration. In the concluding section, we then synthesize the knowledge gained, summarize the results, and determine whether the arguments for retaining or abolishing the inheritance tax prevail.

Unfortunately, the current legal literature focusing on inheritance tax is limited. Even “the Bible” of the tax law – Thuronyi’s *Tax Law Design and Drafting* (Thuronyi, 1996) – does not include a specific chapter dealing with the inheritance tax. The inheritance tax is only mentioned in the chapter on the taxation of wealth (Rudnick and Gordon, 1996). The same applies to the chapter on wealth taxation by Boadway, Chamberlain and Emmerson (2010) or the wealth taxation study by OECD (2018). A legal regulation of the inheritance tax in OECD countries is analysed in the OECD’s *Tax Policy Studies – Inheritance Taxation in OECD Countries* (OECD, 2021). The inheritance tax was also studied in the general report and national reports of the EATLP 2025 congress (EATLP, 2025). From the economic, social, and political points of view, the number of scientific publications is much higher. They are focusing on intergenerational wealth mobility (Adermon, Lindahl and Waldenström, 2018; Bastani and Waldenström, 2021; Brunetti, 2006; Kopczuk, 2013; Wolff and Gittleman, 2014), effects of inheritance taxation on business (Burman, McClelland and Lu, 2018; Tsoutsoura, 2015), or the conflict between gift tax and inheritance tax (Bernheim, Lemke and Scholz, 2004; Joulfaian, 2004; Joulfaian, 2005; Poterba, 2001). Some papers are more general, i.e., Kopczuk (2009), some discuss specific issues in detail. E.g., Elinder, Erixson and Ohlsson (2012) examined the impact of inheritances on heirs’ labor and capital income, while Farhi and Werning (2010) offer progressive estate taxation.

2 Research

2.1 Inheritance Tax Characteristics

Inheritance tax, along with the closely related gift tax and property transfer tax/tax on the acquisition of property, constitutes a traditional category of (property) transfer taxes that has historically played a significant role in the tax systems of many countries. These taxes are linked to a change in ownership and are levied on a new owner's acquisition, transfer, or succession of property.

Systematically, the inheritance tax and the gift tax belong to the group of taxes on capital transfers. When assessing these taxes, it is essential to distinguish whether the transfer of ownership occurs during the owner's lifetime or upon their death. Inheritance tax applies when an heir acquires both movable and immovable property from a deceased owner (*mortis causa*). Inheritance involves the acquisition of property without consideration, thereby increasing the total wealth of the heir. In contrast, gift tax applies to gratuitous transfers of property between living individuals (*inter vivos*). Gift tax is levied not only on donations based on gift contracts but also on other gratuitous acquisitions of property resulting from legal acts. These may include, for example, debt forgiveness or the gratuitous assignment of a claim (Radvan, 2025).

A common feature of both inheritance and gift taxes is that they are imposed on gratuitous acquisitions of property and are classified as irregular taxes, since they are not collected on a regular periodic basis but only when a transfer occurs (Sobotovičová and Janoušková, 2018, 11).

Due to the close relationship between these taxes, they are often governed by a single legislative framework. Common rules typically apply to aspects such as valuation methods and the determination of tax exemptions. In some jurisdictions, property donated within a specific period before the deceased's death is included in the inheritance tax base (three years before death in Japan, or seven years in the United Kingdom) to ensure tax fairness, particularly in systems employing progressive tax rates.

Another example of the interrelation between these taxes involves generation-skipping. The generation-skipping generally means lower rates for close relatives and higher rates for distant relatives and unrelated persons (Adermon, Lindahl and Waldenström, 2018; Bastani and Waldenström, 2021; Brunetti, 2006; Kopczuk, 2013; Wolff and Gittleman, 2014). However, the generation-skipping principle can also be reflected in situations when a person inherits property and subsequently gifts it to their descendant within a certain period. In that case, the amount of gift tax may be reduced by the amount of inheritance tax already paid. In some cases, tax rates themselves may be coordinated, such that gift tax rates are set at double the rate of inheritance tax (Radvan, 2025).

It is important to distinguish between inheritance tax and estate tax, as they differ in terms of what is subject to taxation. While inheritance refers to the

property transferred to a specific heir, the estate encompasses all property bequeathed by the deceased (Sobotovičová and Janoušková, 2018, 71). Estate tax is levied on the total value of the deceased person's estate before its distribution among beneficiaries. The tax base is therefore the aggregate value of the estate, and the tax liability is borne jointly and severally by the heirs, or it is settled by the estate administrator (Sheposh, 2025; Radvan, 2025). In contrast, inheritance tax is imposed on the individual share received by each heir, meaning that each person pays tax separately based on their portion of the inherited property. In systems with a progressive tax rate, it is generally assumed that the total amount collected through the estate tax will exceed the sum of inheritance tax payments collected individually from each heir. From this perspective, inheritance tax is considered an *in personam* tax, while estate tax qualifies as an *in rem* tax. In the context of tax fairness, inheritance tax should ideally be cumulative, meaning that all inheritances received by the same taxpayer during their lifetime would be aggregated to determine their tax liability. However, this method of calculating the tax base would entail significant administrative complexity (Kubátová, 2006, p. 255; Radvan, 2025).

This paper uses the term "inheritance tax" in the broader sense, including the estate tax. If some parts of the text deal specifically with the estate tax, the term "estate tax" is used.

2.2 Classification of Inheritance Tax in the Tax System

Inheritance tax is a specific form of taxation on the transfer of property that occurs as a result of the death of the deceased. Alongside gift tax and estate tax, it belongs to the category of so-called capital transfer taxes. These taxes are not subject to a regular tax period, as they apply to a one-off transfer of property between entities. However, this does not prevent a single taxpayer from paying this tax multiple times, depending on how often they become an heir or a donee. A common characteristic of these taxes is the gratuitous nature of the transfer, whereby, unlike the real estate transfer tax, the new owner does not provide any consideration for the property received (Kubátová, 2006, p. 255; Radvan, 2025). The other elements of the relation between the inheritance tax and the gift tax are explained above.

Inheritance and gift taxes also incorporate elements of personal taxation. A typical example is the application of a progressive rate for multiple gifts, where the tax liability is determined based on the total value of gifts received by a single recipient (Kubátová, 2006, p. 255). The acquisition of property through inheritance or gift leads to an increase in the total value of the taxpayer's assets and can thus be considered a form of income. For this reason, it is necessary to regulate the relationship between capital transfer taxes and income taxes to avoid double taxation. When inheritance and gift taxes are levied, inheritances and gifts should be exempt from income tax. Conversely, if no capital transfer taxes are imposed, inheritances and gifts are generally subject to income tax unless specific exemptions are provided under income tax legislation (Radvan, 2025).

2.3 Reasons for Abolishing the Inheritance Tax

Inheritance tax is traditionally classified as a property tax with a long history. It is one of the oldest tax institutions, which, in the past, together with gift tax, represented a significant source of public revenue. Since the beginning of the 20th century, however, their share of total tax revenues has gradually declined. It is their low yield that is the key factor contributing to the reduction or complete abolition of these taxes in several countries. According to recent data, capital transfer taxes typically account for less than 0.2% of GDP in OECD countries (Radvan, 2025). However, the share of inheritance and gift taxes in total tax revenue varies considerably across OECD countries. In the absence of uniform legislation at the European Union level, each country regulates this area independently. Different approaches to the taxation of property transfers consequently lead to significant variations in the revenue generated from these taxes (Sobotovičová and Janoušková, 2018, 14). Among the countries with the highest revenues from inheritance and gift taxes are France and Belgium, where high yields result from a modern approach to determining the tax base (Radvan, 2025).

Over the past decades, several countries, including the Czech Republic, Slovakia, and Austria, have moved to abolish the inheritance tax entirely (Radvan, 2025). The most frequently cited reason for this decision is the low yield of inheritance tax. If its average yield is around 0.2% of GDP, this share must be even lower in many countries. Moreover, its collection is administratively demanding, and the unfavorable ratio between revenues and the costs of administration has led many countries to conclude that this tax is uneconomical and ineffective.

A typical example is the Czech Republic, where inheritance and gift taxes were abolished on 1 January 2014. It was primarily due to exemptions granted to close relatives, which rendered the tax revenue almost negligible. According to tax administration data, the revenue collected was so low that, to the costs of administration, tax collection proved uneconomical.

Slovakia applied a similar approach in 2004, when the inheritance tax was abolished as part of a tax reform. Prior to 2004, the inheritance tax rate in Slovakia was progressive, based on the value of the property and the relationship between the deceased and the heir. According to the explanatory memorandum to Act No. 554/2003 Z. z., on the tax on the transfer and transition of real estate, this taxation system proved to be both unfair and ineffective (Národná Rada SR, 2023).

Another fundamental objection to inheritance tax is the risk of double taxation. Critics argue that property subject to inheritance tax was typically acquired from income that had already been taxed. Thus, its re-taxation contradicts the principle of tax fairness (Kubátová, 2006, p. 246). Consequently, inheritance tax is generally unpopular among taxpayers. Some opinions even describe it as a so-called deterrent tax, as it may discourage individuals from

the long-term accumulation of assets and their potential growth across future generations (Radvan, 2025).

Opponents of inheritance tax also commonly argue that it unfairly penalizes individuals who have saved and limited their own consumption during their lifetime to accumulate wealth for their descendants (Sobotovičová and Janoušková, 2018, p. 70). The issue of abolishing inheritance tax is often a subject of political debate, largely because society perceives this tax as unfair. Furthermore, the tax impacts heirs at a particularly sensitive time in their lives, which further diminishes its popularity among taxpayers. As a result, the abolition of inheritance tax is frequently a politically popular move.

2.4 Structural Components of the Inheritance Tax

The following part of the paper deals with selected structural components of the inheritance tax: the taxpayer and the object of taxation, the tax base and the tax rate, and the corrective elements. The tax administration aspects, including the tax collection and the budget destination, are also partially included.

The person of the taxpayer and the object of taxation are strongly connected issues. In fact, the decision of whether to collect the estate tax or the inheritance tax is based on the national civil law traditions and the legal system. While the Anglo-American system is based on the estate administrator (trustee), who is responsible for the administration of the estate until the estate shares are transferred to the heirs, the continental legal system prefers to transfer inheritance shares to heirs shortly after the deceased's death. The taxation follows the civil law regulation: the estate tax is paid by the trustee, while heirs are responsible for the inheritance tax. Assuming that the inheritance tax rate is usually progressive, the inheritance tax should be more beneficial for the taxpayers, especially if there are more heirs.

In most cases, the heir liable for inheritance tax is a natural person, but it is not impossible for a legal entity to become the heir. The method of acquiring the inheritance, i.e., based on the deceased's will or by law, respectively, or a combination of both methods, has no influence on the determination of the taxpayer. Under no circumstances shall joint and several liability apply to taxpayers in relation to inheritance tax.

As the inheritance can also be perceived as an income, the heir is liable in fact to two taxes: a specific inheritance tax, and a general income tax (usually personal income tax, in the case of legal entities, corporate income tax). The legislator should be aware of these consequences and prepare legal regulations to avoid double taxation on income from inheritances.

National regulations usually set several inheritance tax groups depending on the relationship between the deceased and the heir. These tax groups do not necessarily copy the inheritance groups as defined by civil law. The closer the relationship is, the lower the inheritance tax rate will be. Increasing tax-free allowances or even complete exemption cannot be ruled out either.

The object of the estate tax is the property left by the deceased. In contrast, the inheritance tax is levied on property acquired by the heir by inheritance on the deceased's date of death (mainly on the basis of a specific authority – court, notary – decision). In this case, property refers to immovable property and movable property, which, in addition to movable items, also includes securities, cash in any currency and form (including non-cash forms, i.e., deposits in accounts, etc.), receivables (monetary and non-monetary), property rights (e.g., copyrights and similar rights), and all other property values.

The division of assets into movable and immovable property affects the collection of tax and the rules of how to avoid double taxation (OECD, 2025). In the case of real estate located abroad, tax is not usually collected, whereas tax is always collected on real estate located in the country that collects the inheritance tax, regardless of the nationality or residence of the deceased. In the case of movable property, if the deceased was a citizen of the country that collects the inheritance tax at the time of death and had permanent residence there, tax is levied on all of their movable property regardless of where it is located (domestically or abroad). If such a person did not have permanent residence in the country that collects the inheritance tax but was still a citizen of this country, tax is levied only on their movable property located in this country. The same procedure would apply to a foreigner; tax would be levied only on their movable property located in the country that collects the tax. This system is apparently the most common (it is used both in Europe and outside Europe, e.g., in Hong Kong and Singapore – Rudnick and Gordon, 1996, p. 325). The above rules should be considered general rules, and in specific cases, it is always necessary to refer to the relevant international double taxation treaty, which takes precedence in application according to the *lex specialis derogat legi generali* principle.

Inheritance taxes are characterized by an extensive list of exemptions. For greater clarity, it is advisable to divide them into personal exemptions and material exemptions. Concerning personal exemptions, the most frequent are the thresholds for close relatives of the deceased and persons living in the same household. The closer the family relationship is, the higher the threshold is. Specific thresholds are mostly set for individual inheritance groups. In some cases, only widows and widowers and children are exempt from paying the tax. In these cases, the heir is not often even required to file a tax return, in which they would have to prove their entitlement to the exemption.

The other personal exemptions are connected to charitable and other public benefit purposes; the acquisitions of property by universities, research institutions, churches, NGOs, public benefit corporations, foundations, etc., are also exempt from inheritance tax.

The most frequent material exemptions are connected to pension insurance of the deceased or specific deceased's claims for compensation. In some countries (e.g., Belgium – Bourgeois, De Raedt, Richelle Graulich and Desmyttere, 2025; France – Beltrame and Quilici, 2025; Germany – Desens, 2025), exemptions are available to support family businesses. Other states (e.g., Bel-

gium – Bourgeois, De Raedt, Richelle Graulich and Desmyttere, 2025; France – Beltrame and Quilici, 2025; Germany – Desens, 2025; Ireland – Matikonis, 2025; Poland – Prejs, 2025; Spain – Varona Alabern, 2025; Singapore – Rudnick and Gordon, 1996) allow exemptions for residential property. The exemption might be conditioned: e.g., the Polish housing relief concerns residential property up to 110 m², and the acquired person must reside in the property and not sell it for at least five years (Prejs, 2025). Other exemptions are applied to support agricultural production (e.g., France – Beltrame and Quilici, 2025; Ireland – Matikonis, 2025; Serbia – Ilić Popov and Cvjetković Ivetić, 2025; Slovenia – Štemberger Brizani and Kovač, 2025).

In order to determine the inheritance tax liability, it is necessary to correctly calculate the tax base and assign the appropriate tax rate to it. The estate tax base is the value of the property; in the case of the inheritance tax, the value of the property acquired by each heir (as determined in the inheritance proceedings). The value is reduced by any proven debts of the deceased, reasonable costs associated with the deceased's funeral (funeral expenses), and other items such as administrative costs, including the remuneration of the estate administrator, court and administrative fees, bank charges, costs related to the valuation of the property, etc. The value itself can be set specifically for the inheritance procedures, including tax proceedings. However, if the value-based system is being used for the recurrent property tax, it is reasonable to use this value for the immovable property. The same statement applies to any movable property where the price is evident from any public register.

In most countries, the inheritance tax rate is slidingly progressive: the amount of tax payable by each heir depends on their relationship to the deceased and the value of the acquired property. It is therefore directly proportional to the value of the property. However, e.g., in the US, a fixed tax rate is used, which is even increased in the case of so-called generation-skipping transfers.

If inheritance tax is payable, the heirs are required to file an inheritance tax return. In contrast, in common law countries, a single estate tax return is filed by the estate administrator. When assessing tax, the tax office primarily relies on the tax return but may also use other available evidence (the inheritance file from the court or notary's office). If the taxpayer fails to file a tax return within the statutory deadline or fails to cooperate with the tax office, the tax office may assess the tax without the taxpayer's cooperation, as it has all the necessary information for its decision in the inheritance file. The assessed tax is communicated to the taxpayer, and the due date is also specified.

In almost all countries that collect any form of inheritance tax, the tax revenue belongs to the state (central) budget.

3 Discussion

Based on the research and analysis of the structural components of the inheritance tax, several questions appeared concerning the optimal and fair legal

construction of the inheritance tax generally and basic structural components specifically.

3.1 What is the (Legal) Sense of the Inheritance Tax?

Inheritance tax is a frequently debated topic; despite numerous arguments supporting its abolition, there are also many voices advocating for its retention. The purpose of the inheritance tax cannot be evaluated solely from an economic perspective, as its social functions must also be considered, including aspects such as social justice, equal opportunities, and limiting the concentration of wealth.

Inheritance and gifts can contribute significantly to wealth inequality among individuals, as recipients typically have no control over these factors. Acquiring wealth in this manner may lead to undeserved advantages that undermine the fundamental principle of equal opportunity. It is generally assumed that individuals with comparable incomes will have similar economic standing, but inheritance can cause substantial disparities in wealth without any merit on the part of the recipient, who did not have to sacrifice time or effort to acquire the assets.

Some proponents of stricter inheritance tax regulation argue that high-value inheritances may foster economic passivity, where recipients lose motivation to work because they are not required to generate their own income. Consequently, inheritance taxation is often advocated as a tool to level the playing field and enhance equality of opportunity (Sobotovičová and Janoušková, 2018, p. 70).

It is also assumed that inheritance tax can influence the economic behavior of heirs. A higher tax burden reduces the net value of the acquired property, which can incentivize increased labor participation and higher savings rates (OECD, 2021, p. 58).

From the perspective of tax fairness, it is legitimate for inheritances and gifts, as forms of gratuitous income, to be subject to taxation, since heirs or donees acquire them without direct effort or merit (Radvan, 2025). Some opinions even hold that inheritance should be taxed at a higher rate than income earned through one's own labor, as the tax system should primarily reward individual effort and productivity (OECD, 2021, p. 42).

Inheritance tax serves a redistributive function, as the untaxed transfer of large amounts of wealth across generations could lead to the concentration of wealth within a narrow segment of the population. Taxing these transfers helps mitigate intergenerational inequality.

Certain countries apply inheritance tax to encourage the preservation of wealth within families. In such legal frameworks, the inheritance tax rate is lower for transfers between direct family members, while transfers outside the family are generally taxed at higher rates.

An equally important argument for maintaining the inheritance tax is its fiscal significance at the local level. Although its share of total public revenue is relatively low in international comparison, in some countries, the inheritance tax remains an important source of income for municipal and regional budgets (Sobotovičová and Janoušková, 2018, p. 7).

For inheritance tax to be perceived as fair, its corrective elements must meet basic quality criteria. The most important structural element is the threshold value, which is linked to inheritance tax groups, as discussed in more detail below.

3.2 What is the Role of the Inheritance Tax in the Tax System?

This question aims to clarify the relationship between the inheritance tax and other taxes. The closest is the relation to other property transfer taxes, mainly the gift tax (Bernheim, Lemke and Scholz, 2004; Joulfaian, 2004; Joulfaian, 2005; Poterba, 2001) and the property transfer tax. If the country collects all three types of taxes, the taxpayers may speculate on the timing of transfers. Gift taxes usually have higher tax rates, lower thresholds, or other disadvantages compared to the inheritance tax, so the idea might be not to transfer the property during the lifetime. The property transfer tax thus comes into consideration. Moreover, the property transfer tax may have an even lower tax rate than other transfer taxes, especially in the case of high property values. However, specifically in the transfer within the family, the contracting parties may tend to undervalue the property to decrease the tax base. A solution may be found, for example, in the Belgian regulation, considering acquisitions based on another legal title than the transfer due to death (e.g., a contract, including a gift) as a legacy, i.e., subject to the inheritance tax De Raedt, Richelle Graulich and Desmyttere, 2025).

The other conflict of the inheritance tax is with the income taxes. From both the legal and economic aspects, inheritance is income and, therefore, is liable to personal or corporate income tax. The legislator must be aware of this possible double taxation, and the exemption of inheritance from income taxation must be secured.

3.3 Estate Tax or Inheritance Tax?

As stated above, the object of the estate tax is the property left by the deceased. In contrast, the inheritance tax is levied on property acquired by the heir by inheritance on the deceased's date of death. In fact, the decision of whether to collect the estate tax or the inheritance tax is predetermined by the civil law traditions and regulations.

3.4 How to Set the Inheritance Tax Groups?

The assignment to the inheritance tax groups is essential due to the thresholds and the tax rates being applied. Because of the principle of uniform terminology in law, it would be reasonable to define the inheritance tax groups

in the same way as the inheritance groups for the purposes of civil law (inheritance law). Such a solution contributes to the clarity of the legal system and the consistency in legal terminology. The sub-question is connected to the status of the divorced spouse; also, in this case, the inclusion of the divorced husband/wife/partner should be the same in tax and civil law regulations.

An exception to the rule of consistency in legal terminology could be widows and widowers. The inheritance tax could benefit them more, on the presumption that the inherited property was community property in which the spouses participated jointly. Another reason might be the desire to leave the surviving spouse sufficient assets to provide for subsequent independent living.

3.5 Is it Necessary to Measure the Value of the Inheritance Specifically for the Inheritance Tax?

Generally, it is not necessary to measure the value of the inheritance specifically for the inheritance tax. The value of the estate or the inheritance (property acquired by each heir) is usually previously determined in the inheritance (civil law) proceedings. In doing so, it is even suggested that the values used for other tax purposes can be used to set the value of the inheritance (e.g., the value of the immovable property used for the recurrent property tax). Of course, for inheritance tax purposes, the value should be reduced by debts, funeral expenses, and other administrative costs, so that the inheritance tax base expresses the net income of the heirs.

3.6 Progressive or Linear Tax Rate?

The research shows that almost all countries that collect the inheritance tax prefer the progressive tax rate (Farhi and Werning, 2010). Even if the linear tax rate is used, the progressivity in taxation is secured by the thresholds. The other widely spread phenomenon is the generation-skipping, i.e., lower rates for close relatives and higher rates for distant relatives and unrelated persons (Adermon, Lindahl and Waldenström, 2018; Bastani and Waldenström, 2021; Brunetti, 2006; Kopczuk, 2013; Wolff and Gittleman, 2014). The progressivity in inheritance taxation, however, means certain demands on the legislator. Primarily, the absolute tax rate must not be extremely high, representing a choking effect of the inheritance tax. Also, legislators must be aware of other taxes connected with the transfers of property (property transfer tax, gift tax) in the rate design so that taxpayers are not forced to speculate on various forms of wealth transfer during their lifetime. Extremely high taxation of property can also lead to the creation of specific legal entities, such as donations, foundations, or trusts, to optimize tax duties. The taxation of transfers to and out of these entities should then also be taken into account when setting the tax rates (Burman, McClelland and Lu, 2018; Tsoutsoura, 2015).

3.7 How to Deal with Repeated Inheritance?

A repeated inheritance means that the heir dies soon after acquiring the inheritance, or even before the inheritance proceedings are completed. It means that the same inheritance would be taxed twice in a short period of time, which is manifestly unfair. Only a limited number of countries (e.g., the US, Japan, and Hong Kong) offer solutions from partial exemption to a single assessment, while in Portugal, the tax rate can be halved if there is a second or further inheritance of the same property within five years (Rudnick and Gordon, 1996, p. 318; do Rosário Anjos, 2025).

3.8 What Corrective Elements are Necessary?

The most essential corrective element in the inheritance tax construction is the threshold. Thresholds are very strongly connected to the inheritance tax groups: the closer the relationship between the deceased and the heir is, the higher the threshold is. Many countries apply full exemption for direct relatives in the first inheritance tax group, usually consisting of spouses and children, sometimes also other persons living in the shared household. The reasons are primarily the intergenerational wealth mobility (Adermon, Lindahl and Waldenström, 2018; Bastani and Waldenström, 2021; Brunetti, 2006; Kopczuk, 2013; Wolff and Gittleman, 2014), and, in the case of family business, also the effects of inheritance taxation on business (Burman, McClelland and Lu, 2018; Tsoutsoura, 2015). The other reasons, connected mainly to spouses, might be the presumption that the inherited property was gained jointly by the partners, or the desire to leave the surviving spouse adequate financial sources for subsequent independent living.

The full exemption for the direct relatives can also be limited to children only. The reason is the so-called generation-skipping transfer, i.e., a situation when the taxpayer avoids taxation by leaving property to heirs two or more generations distant. The emphasis on the maintenance of minor children may also be reflected in the determination of the age of the children in relation to the amount of the exemption. The other limitation could be the only exemption in a spouse's lifetime to prevent situations where a young woman/man marries older men/women several times in her/his life in order to inherit their wealth. Interestingly, historical Luxembourg's wealth tax law only allowed the acquisition of certain assets by inheritance between spouses to be exempted if there are children born of the marriage (Rudnick and Gordon, 1996, p. 317).

Concerning material exemptions, many of the reasons mentioned above also argue for partial or full exemption of primary residences. Support for agriculture can be reflected in the exemption of agricultural land.

It should also be added that there is a possibility to combine several corrective elements, such as the full exemption (i.e., the threshold) and a lower tax rate.

3.9 Is it Necessary to File the Inheritance Tax Return?

On the assumption that inheritance courts, notaries, trustees, etc., exercise in some sense a delegated public administration and that the complete information about the deceased, heirs, property and its value, etc., is available online, there is no need to file the inheritance tax return. The tax office can get all the necessary information on its own, without the taxpayer's cooperation. Such a solution aims to reduce administrative costs and save time for the taxpayer. Of course, all the general principles of effective collaboration between the tax office and the taxpayer must be followed in the tax procedure.

3.10 How to Secure Inheritance Tax Payments?

The inheritance tax is, by its very nature, a tax *in rem*, which means the taxpayer does not necessarily have the means to pay for it. From these perspectives, the estate tax seems to be more effective, especially if the trustee, as a taxpayer, has an adequate time to exchange assets for funds. Nevertheless, for both estate and inheritance taxes, general instruments preventing non-payment of taxes are available. The most common instruments, regulated in the general tax codes, are the postponement of tax payments and the payment of tax in instalments. The more beneficial conditions for these tools (more extended period, lower or no additional fees or interests, etc.) can also be explicitly set for the property transfer taxes, including the inheritance tax. The other securing institute is a surety: in the case of the estate tax, the heir(s) are the sureties, while in the case of the inheritance tax, the trustee or the other heirs can guarantee the tax payments.

4 Conclusion

Fairness, as a fundamental principle of the tax system, is a key criterion for assessing the legitimacy of any tax, and this issue is particularly sensitive in the case of inheritance tax. While the fiscal significance of this tax is relatively limited in most countries, the rationale for its retention often lies in considerations of fairness. The following section, therefore, focuses on the different dimensions of tax fairness to inheritance tax and outlines the conditions under which it can be perceived as a legitimate and equitable component of the tax system.

Tax theory primarily distinguishes between horizontal and vertical fairness. Horizontal fairness assumes that individuals with the same level of income or wealth should bear a similar tax burden. In other words, people in comparable financial situations should not be disadvantaged from a tax perspective simply because one acquired their wealth through personal labor, while the other did so through inheritance or a gift. According to this principle, taxpayers with similar ability to pay should not be subject to different tax rates (Nováková, 2007, p. 23). From this perspective, inheritance tax can be viewed as a tool to equalize conditions between recipients of inherited wealth and individuals who generate capital through their efforts (OECD, 2021, p. 43).

Inheritance tax can also promote the principle of vertical equity, which is based on the premise that individuals with higher incomes or greater wealth should bear a larger tax burden than those who are economically less advantaged. To achieve this objective, a progressive tax rate is commonly applied, ensuring that entities acquiring a greater volume of assets through inheritance are subject to higher tax liabilities (OECD, 2021, p. 43).

Inheritance often represents a significant increase in the total wealth of the heir, and progressive taxation can help reduce wealth inequalities within society. The transfer of wealth between generations without taxation tends to concentrate wealth and distort equal opportunities for future generations. Such an approach can lead to the emergence of a wealth elite whose economic standing reflects their privileged family background rather than their efforts. Inheritance tax can mitigate this effect and contribute to a more level playing field for subsequent generations (OECD, 2021, p. 43).

The hypothesis of this paper, stating that the inheritance tax is a traditional tax firmly anchored in the tax systems of individual countries, was confirmed. Nevertheless, the decision of whether to collect any inheritance tax or not is solely political. If politicians are brave enough to continue to levy or renew the inheritance tax, they must explain it to the taxpayers – the voters. For inheritance tax to be perceived as fair by taxpayers, it must be structured to reflect the taxpayer's actual economic situation accurately. An important mechanism in this regard is not only the application of a progressive tax rate but also the introduction of tax-free thresholds, which protect small inheritances from disproportionate taxation. As is evident from the other design of the inheritance tax structural components mentioned above, the law and legal regulation can make a fair inheritance tax happen.

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From Co-Creation to Circular Cities: Exploring Living Labs in EU Governance Frameworks – A Literature Review

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ABSTRACT

Purpose: This paper provides a comprehensive and integrative literature review of how Living Labs (LLs) are conceptualised, implemented, and evaluated within the European Union's governance frameworks. It aims to trace the evolution of LLs beyond their original innovation rhetoric and to assess their actual contributions to co-creation, participatory governance, and circular transitions.

Design/Methodology/Approach: Using a PRISMA-compliant systematic literature review methodology, the study screened 403 peer-reviewed publications from the Web of Science Core Collection. Following the application of rigorous inclusion criteria, 77 eligible studies were analysed. A co-occurrence analysis of 360 keywords was conducted using VOSviewer to identify ten thematic clusters that structure the field. The findings are discussed across four dimensions: institutional anchoring, collaborative learning, socio-economic transition, and methodological consolidation.

Findings: The review reveals that LLs function as hybrid governance infrastructures that foster innovation only when they are embedded in stable institutional settings and aligned with multi-level governance systems. While many LLs claim inclusivity, their actual transformative capacity is often constrained by power asymmetries, weak institutionalisation, and methodological fragmentation. Nevertheless, high-performing LLs demonstrate significant value in facilitating systemic learning, promoting circular practices, and enabling democratic experimentation.

Practical Implications: The findings emphasise the need for standardised evaluation frameworks, long-term funding mechanisms, and stronger in-

stitutional pathways for LL outcomes to inform policy. Policymakers and practitioners are urged to move beyond pilotism and adopt LLs as embedded tools of governance.

Originality/Value: Unlike previous studies that focused narrowly on sectoral applications or isolated urban experiments, this review is the first to systematically map the evolution of Living Labs across four governance-oriented dimensions: collaborative anchoring, democratic learning, circular innovation, and methodological evaluation. By linking these dimensions to the structural conditions of institutional consolidation within EU public policy frameworks, the article provides a novel conceptual synthesis that bridges fragmented scholarship. It advances the field by offering an integrated perspective that captures the multifunctional role of Living Labs as infrastructures for systemic governance innovation.

Keywords: co-creation, European Union, Living Labs, participatory governance, public policy, urban experimentation

Od soustvarjanja do krožnih mest: raziskovanje živih laboratorijev v okvirih upravljanja EU – pregled literature

POVZETEK

Namen: članek ponuja celovit in integrativen pregled literature o tem, kako so živi laboratoriji konceptualizirani, izvajani in vrednoteni znotraj upravljaljskih okvirov Evropske unije. Cilj je slediti razvoju živih laboratorijev onkraj izvorne inovacijske retorike ter oceniti njihove dejanske prispevke k soustvarjanju, participativnemu upravljanju in krožnim prehodom.

Načrt/metodologija/pristop: z uporabo sistematične metodologije pregleda literature v skladu s PRISMA je študija pregledala 403 recenzirane publikacije iz zbirke Web of Science Core Collection. Po uporabi strogih vključitvenih meril je bilo analiziranih 77 ustreznih študij. S programom VOSviewer je bila izvedena analiza sopojavljanja 360 ključnih besed za identifikacijo desetih tematskih grozdov, ki strukturirajo področje. Ugotovitve so obravnavane skozi štiri razsežnosti: institucionalna vpetost, sodelovalno učenje, družbeno-ekonomski prehod in metodološka konsolidacija.

Ugotovitve: pregled razkriva, da živi laboratoriji delujejo kot hibridne upravljaljske infrastrukture, ki spodbujajo inovacije le, kadar so umeščeni v stabilna institucionalna okolja in usklajeni z večnivojskimi sistemi upravljanja. Čeprav številni živi laboratoriji deklarirajo inkluzivnost, je njihova dejanska transformativna zmožnost pogosto omejena zaradi asimetrij moči, šibke institucionalizacije in metodološke razdrobljenosti. Kljub temu visoko uspešni živi laboratoriji izkazujejo pomembno vrednost pri pospeševanju sistemskega učenja, spodbujanju krožnih praks in omogočanju demokratičnega eksperimentiranja.

Praktične implikacije: ugotovitve poudarjajo potrebo po standardiziranih okvirih za vrednotenje, mehanizmih dolgoročnega financiranja ter močnejših institucionalnih poteh, po katerih bi rezultati živih laboratorijev informirali javne politike. Odločevalci in praktiki naj presežejo »pilotizem« (pretirano zanašanje na pilotne projekte) in žive laboratorije sprejmejo kot vgrajena orodja upravljanja.

Izvirnost/vrednost: drugače kot pretekle študije, ki so se ozko osredotočale na sektorske uporabe ali osamljene urbane eksperimente, je ta

pregled prvi, ki sistematično mapira razvoj živih laboratorijev skozi štiri na upravljanje usmerjene razsežnosti: sodelovalno vpetost, demokratično učenje, krožne inovacije in metodološko vrednotenje. S povezovanjem teh razsežnosti s strukturnimi pogoji institucionalne konsolidacije znotraj okvirov javnih politik EU članek ponuja novo konceptualno sintezo, ki premošča razdrobljeno znanstveno produkcijo. Področje nadgradi z integriranim vidikom, ki zajame večfunkcijsko vlogo živih laboratorijev kot infrastruktur za sistemske inovacije upravljanja.

Ključne besede: soustvarjanje, Evropska unija, živi laboratoriji, participativno upravljanje, javne politike, urbano eksperimentiranje

JEL: H83, R58, O35

1 Introduction

Over the past two decades, Living Labs (LL) have become a significant reference point in discussions about innovation, participation, and public policy transformation within the European Union. Initially conceptualized as collaborative spaces for user-centred experimentation, Living Labs have gradually evolved into instruments for addressing complex societal challenges through real-world co-creation processes (Bulkeley et al., 2016; Voytenko et al., 2016; Westerlund et al., 2018). Their appeal lies in the capacity to bring together diverse stakeholders – public authorities, citizens, researchers, and businesses – to test and develop context-sensitive solutions that respond to local and regional needs.

Despite their growing diffusion across Europe, the conceptualization and implementation of Living Labs remain highly heterogeneous. While some LLs are embedded in strategic urban governance frameworks (Bifulco et al., 2017; Bradley et al., 2022), others function as short-term pilot projects with limited institutional anchoring or long-term impact (Mukhtar-Landgren, 2021; Muur and Karo, 2023). Moreover, literature often treats Living Labs as a catch-all term, encompassing a wide variety of practices that differ significantly in methodology, purpose, and degree of citizen involvement. This ambiguity has created challenges for both academic inquiry and policy learning, highlighting the need for a systematic synthesis of the knowledge produced to date (Arias et al., 2025; Wehrmann et al., 2023).

In particular, the growing relevance of Living Labs within EU policy frameworks – especially in areas such as sustainability, circular economy, digital transformation, and participatory governance – calls for a deeper understanding of their functions, impact, and the institutional structures that support their implementation. Existing studies often examine particular sectors, cities, or individual cases, but frequently fail to synthesize these findings within a broader theoretical or comparative framework (Backhaus and John, 2025; Bhatta et al., 2025b; Broekema et al., 2023). As a result, the field lacks a consolidated view of how Living Labs contribute to public sector innovation, what thematic patterns structure current research, and where conceptual or empirical gaps persist.

Unlike previous studies that focused narrowly on sectoral or city-specific applications, this review is the first to systematically trace the evolution of Living Labs across four distinct governance dimensions – collaborative anchoring, democratic learning, circular innovation, and methodological evaluation – while also identifying the structural conditions that enable or inhibit their institutional consolidation within EU public policy frameworks.

This literature review examines how Living Labs are positioned as tools for co-creation and experimental governance within the EU. By synthesizing peer-reviewed research, the study highlights four key dimensions. First, it explores how Living Labs foster collaborative governance by engaging diverse stakeholders in shared decision-making. Second, it analyzes their role in promoting learning processes that support institutional adaptation and innovation (Eneqvist et al., 2022). Third, it considers their contribution to circular and socio-economic transitions, aligning local action with broader sustainability goals (Arciniegas et al., 2019; Bouzarovski et al., 2023). Finally, it reviews emerging methodological frameworks that enhance the evaluation and integration of Living Labs into public policy (Furlan et al., 2024; Zingraff-Hamed et al., 2020). Together, these insights clarify the potential and limits of Living Labs as instruments of systemic transformation in EU governance.

This article aims to provide a structured and integrative overview of how Living Labs have been studied in the context of public policy and governance within the European Union. To guide the analysis, the following three research questions were formulated:

RQ1: *How are Living Labs integrated into EU governance and public policy innovation frameworks, and what roles are they assigned within these processes?*

RQ2: *What forms of co-creation and stakeholder engagement are highlighted in the literature, and how do these practices shape the functioning of Living Labs?*

RQ3: *What conceptual clusters and recurring themes emerge in the academic discourse on Living Labs, particularly in relation to their governance structures, implementation challenges, and policy impact?*

By addressing these questions, the article offers a coherent overview of how Living Labs are defined, implemented, and interpreted within EU policy and governance frameworks. It clarifies the ways in which Living Labs are used - as platforms for innovation, as mechanisms for stakeholder participation, and as tools for institutional change. The review also highlights the variety of co-creation practices described in the literature, distinguishing between inclusive, collaborative models and more limited or symbolic approaches. In addition, it identifies common challenges - such as weak institutional integration, unequal power dynamics, and difficulties in evaluating long-term impact. Rather than compiling isolated findings, the article builds an integrated framework that helps researchers and policymakers better understand the potential and limitations of Living Labs and provides a foundation for more systematic future research and practice.

To position this contribution within the broader state of the art, it is necessary to clarify how Living Labs are defined in this study and which conceptual models provide the analytical anchors for our review.

We adopt a governance-oriented definition of Living Labs as real-world, multi-stakeholder infrastructures that organize iterative cycles of co-creation to inform and adjust public decision-making (Westerlund, Leminen and Habib, 2018; Scholl and Kemp, 2016). Two conceptual anchors structure our approach. The first is provided by platform- and function-based typologies, which differentiate product-, service-, process-, and policy-oriented labs and emphasize the contrast between technology-driven and policy-oriented experiments (Westerlund et al., 2018; Scholl and Kemp, 2016). The second anchor stems from transition-oriented taxonomies that classify labs according to their role in exploring, shaping, or institutionalizing systemic change (McCrory et al., 2020; 2022). Building on these perspectives, our review advances the state of the art by systematically mapping ten keyword co-occurrence clusters into four governance dimensions—institutional anchoring, collaborative learning, circular transition, and methodological consolidation—thus offering a novel synthesis that clarifies how Living Labs function as infrastructures for governance innovation in the EU context.

2 Methodology

2.1 Methodological Design

This study follows a systematic literature review (SLR) approach designed to synthesize existing knowledge on the use of Living Labs in public policy innovation and experimental governance within the European Union. The review was conducted according to the PRISMA 2020 (Haddaway et al., 2022) guidelines (Preferred Reporting Items for Systematic Reviews and Meta-Analyses), ensuring methodological transparency, replicability, and academic rigor.

2.2 Inclusion and Exclusion Criteria

To ensure consistency and relevance, only peer-reviewed articles and proceedings papers published between 2008 and 2025 were considered. These documents had to be written in English, Spanish, French, Portuguese, and accessible through Open Access, allowing for full-text analysis. The studies were required to explicitly address Living Labs (including terms such as “urban living labs” or “territorial living labs”) and to link these to at least one core theme: public policy, governance, co-creation, policy experimentation, public sector innovation, or regional development. All studies had to be situated within the geographical boundaries of the European Union or refer specifically to EU institutions or programs.

Publications that did not meet these criteria were excluded. Book chapters ($n = 15$) and early access articles ($n = 8$) were removed due to lack of definitive peer-review status at the time of screening. Additionally, thematic exclu-

sion was applied based on Web of Science categories. Technical fields such as Computer Science, Engineering, Medical Informatics, and Telecommunications were filtered out, as they do not address the participatory, institutional, or governance dimensions that are central to the Living Lab concept. Conversely, thematic categories relevant to governance, sustainability, policy design, urban planning, and social innovation were retained. After applying these criteria, 193 eligible studies remained.

2.3 Data Source and Database Selection

The literature search was performed exclusively in the Web of Science Core Collection. This database was selected for its comprehensive coverage of high-impact peer-reviewed journals and its robust filtering tools that enable precise refinement by discipline, publication type, and geographic focus. Web of Science is particularly suited for interdisciplinary research combining political science, sustainability, urban studies, and innovation policy - disciplines at the heart of the Living Lab framework.

2.4. Search Strategy

The search strategy employed a structured Boolean logic to combine thematic, conceptual, and geographical dimensions. The final query was:

TS = ("living lab" OR "urban living lab*" OR "territorial living lab*")*

AND

TS = ("public polic" OR "policy innovation" OR "governance" OR "policy experimentation" OR "co-creation" OR "public sector innovation" OR "regional development")*

AND

ALL = ("European Union" OR "EU" OR "European Commission" OR "Austria" OR "Belgium" OR "Bulgaria" OR "Croatia" OR "Cyprus" OR "Czech Republic" OR "Denmark" OR "Estonia" OR "Finland" OR "France" OR "Germany" OR "Greece" OR "Hungary" OR "Ireland" OR "Italy" OR "Latvia" OR "Lithuania" OR "Luxembourg" OR "Malta" OR "Netherlands" OR "Poland" OR "Portugal" OR "Romania" OR "Slovakia" OR "Slovenia" OR "Spain" OR "Sweden")

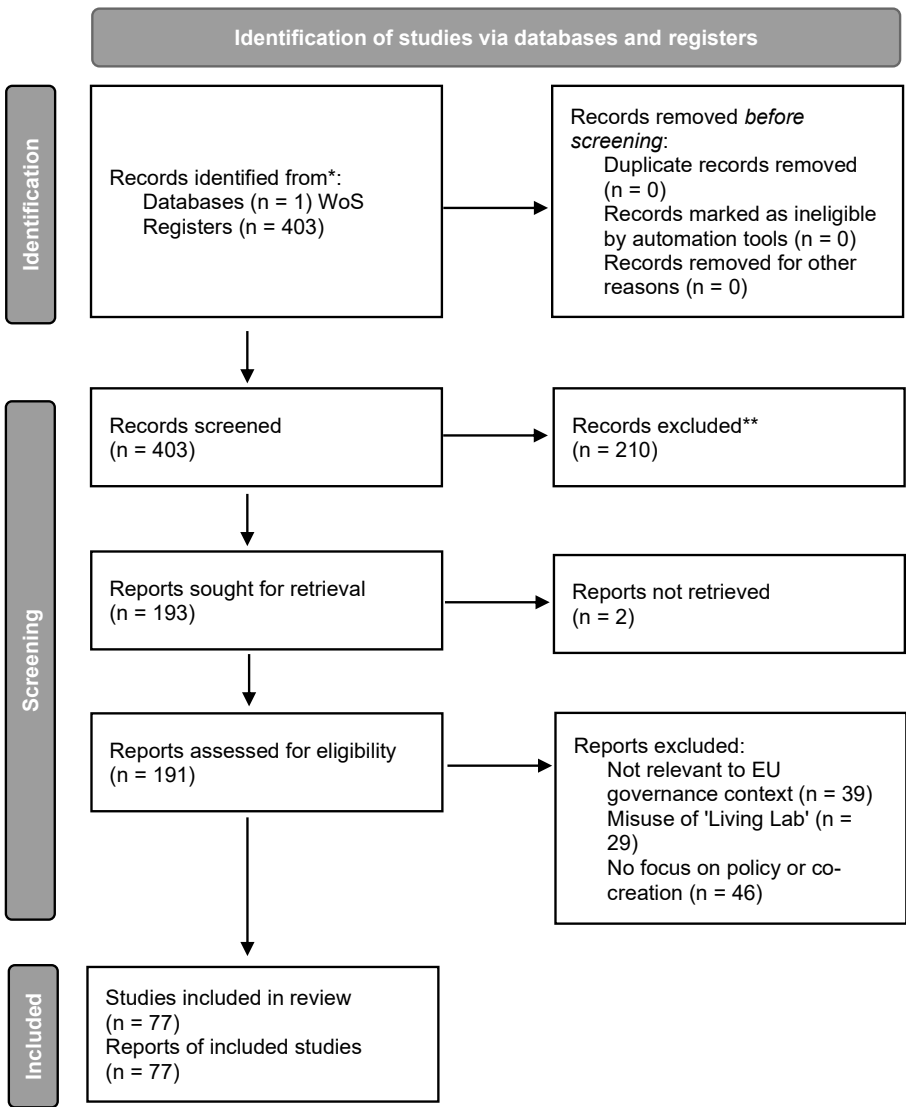
This formulation ensured thematic relevance (Living Labs and public governance), conceptual focus (innovation, co-creation, experimentation), and geographical delimitation (EU-specific cases).

2.5 Study Selection Process

The initial search in the Web of Science database identified 403 records. No duplicates or automation-based exclusions were necessary. All titles and abstracts were manually screened, leading to the exclusion of 210 studies that were either unrelated to the EU context, misused the term "Living Lab," or

lacked a focus on policy or co-creation. From the 193 full-text articles selected for eligibility assessment, 2 could not be retrieved. Of the remaining 191, a further 114 were excluded for similar reasons, resulting in a final selection of 77 studies that met all inclusion criteria. The stages of this selection process are detailed in Figure 1.

Figure 1. PRISMA flow diagram illustrating the selection process of studies on Living Labs within the EU context

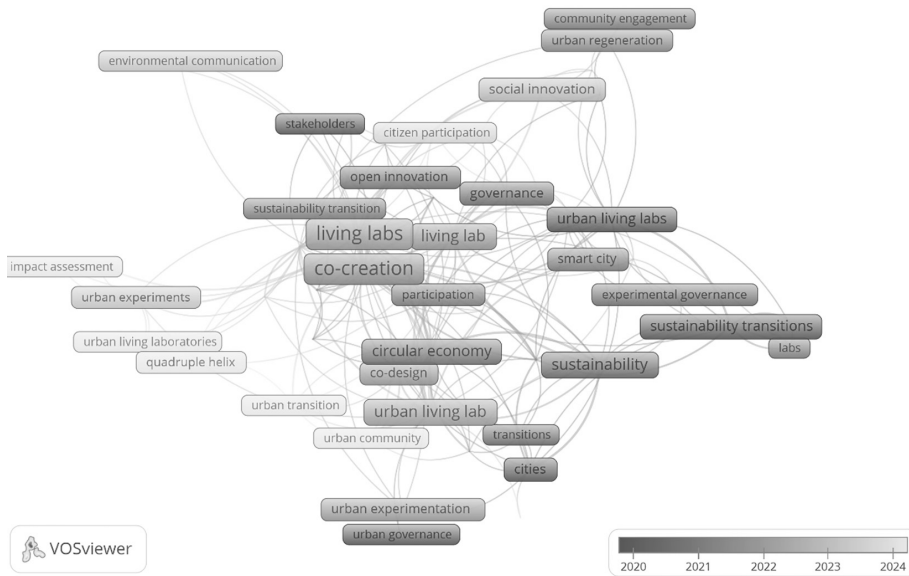


Source: Authors' own elaboration.

2.6 Keyword Co-occurrence and Cluster Analysis

To deepen the understanding of conceptual patterns emerging from the selected studies, a co-occurrence analysis of author keywords was conducted using VOSviewer. From the 77 retained articles, a total of 360 unique keywords were extracted. Applying a minimum occurrence threshold of two, 56 keywords met the criteria and were included in the analysis. The resulting semantic network, illustrated in Figure 2, identified ten thematic clusters that offer a structured analytical framework for organizing the literature and understanding the key conceptual dimensions of Living Lab research.

Figure 2. Keyword co-occurrence network generated with VOSviewer, illustrating ten thematic clusters that structure the conceptual landscape of Living Lab research



Source: Authors' own elaboration.

The co-occurrence analysis of keywords reveals ten interconnected thematic clusters that map the conceptual landscape of Living Lab research. At the core lies the urban and institutional embedding of Living Labs, where concepts such as collaboration, governance, and sustainability reflect their role as experimental platforms within smart cities and public innovation ecosystems. This is closely linked to their function as adaptive governance tools anchored in municipal structures. A second thematic dimension emphasizes learning and scaling processes, where frameworks such as impact assessment, the quadruple helix, and urban experiments highlight the iterative nature of knowledge co-production and policy refinement. In parallel, Living Labs emerge as catalysts for economic and social innovation, promoting circular economies, co-design, and urban transitions that respond to local development challenges. Reinforcing their participatory nature, another cluster points to democrat-

ic governance practices, with terms like citizen participation and stakeholder engagement underlining their inclusiveness and legitimacy. The spatial dimension is further elaborated through place-based experimentation, as Living Labs adapt to community needs and urban regeneration efforts. Additional clusters explore their institutional architecture, particularly the role of collaborative and multi-level governance in coordinating diverse actors and sustaining innovation. A transdisciplinary perspective complements this, recognizing Living Labs as hybrid spaces that merge pragmatic intervention with systemic learning across disciplines. Methodological concerns are also evident, with emphasis on tools such as interpretive structural modelling and structured experimentation to guide participatory processes and policy evaluation. Finally, a distinctive cluster emphasizes the role of Living Labs in connecting scientific research with societal needs through citizen science and inclusive forms of knowledge co-production. Altogether, these clusters portray Living Labs as complex, context-sensitive instruments for innovation, capable of simultaneously addressing urban challenges, fostering societal engagement, and reshaping governance through co-creative, evidence-based practices.

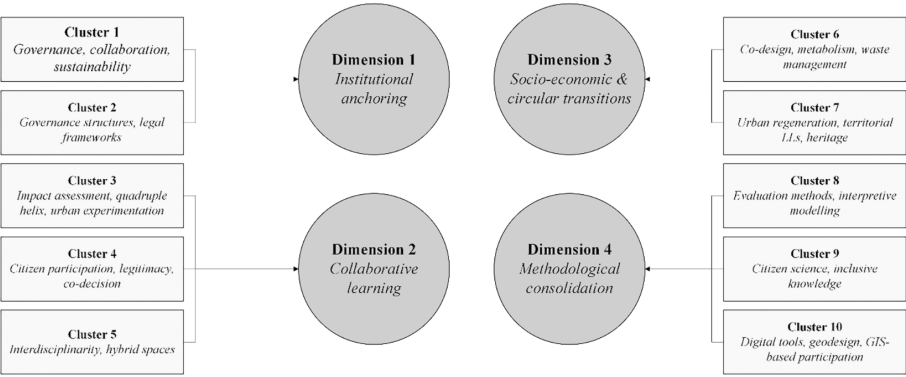
2.7 From Keyword Clusters to Governance Dimensions

To move from descriptive co-occurrence clusters to an interpretive governance framework, a structured sense-making procedure was applied. The ten clusters generated through VOSviewer (Figure 2) were first reviewed independently by two coders with expertise in governance and policy analysis. Each cluster was provisionally assigned to one of four overarching mechanisms identified in the state-of-the-art literature: (i) institutional anchoring (Westerlund, Leminen, and Habib, 2018; Scholl and Kemp, 2016), (ii) collaborative learning (McCrory et al., 2020; Bhatta, Vreugdenhil, and Slinger, 2025a), (iii) socio-economic and circular transitions (Amenta et al., 2019; Obersteg et al., 2020), and (iv) methodological consolidation (Broekema, Bulder, and Horlings, 2023; Sarabi et al., 2021).

In the second step, coders compared and reconciled their classifications through iterative discussion, producing a consensual mapping of the ten clusters into four governance dimensions. This process ensured that no empirical content was lost: all ten clusters are presented descriptively in the Results section, while their aggregation into four dimensions forms the analytical lens developed in the Analysis section. This procedure follows best practices in systematic reviews, where inductive clustering is combined with deductive theoretical anchoring to enhance transparency and comparability across studies. This approach allowed us to move beyond descriptive mapping and to generate an integrated governance-oriented framework, which constitutes the main conceptual contribution of this review.

The outcome of this procedure is summarized in Figure 3, which visualizes the mapping of the ten keyword clusters into four governance-oriented dimensions.

Figure 3. Mapping of the ten keyword clusters into four governance-oriented dimensions of Living Lab research in EU contexts



Source: Authors' own elaboration.

3 Results

The keyword co-occurrence analysis of the 77 eligible studies generated a semantic network of ten thematic clusters, each representing a distinct but interconnected strand of Living Lab scholarship within the European Union. These clusters reveal how the literature has evolved from localized case studies toward a complex research landscape structured around governance, learning, circularity, participation, methodological sophistication, and digital innovation.

The first cluster highlights the institutional embedding of Living Labs in smart-city governance frameworks. Keywords such as governance, collaboration, and sustainability dominate this group, reflecting how municipal structures integrate experimental methods into urban policy-making. Early studies in cities such as Amsterdam, Helsinki, and Barcelona demonstrated that policy impact depends less on technological novelty and more on the density of cross-sectoral collaboration (Bulkeley et al., 2016; Bifulco et al., 2017; Voytenko et al., 2016). These findings underline the centrality of institutional anchoring in ensuring that Living Labs transcend isolated pilot status.

A second cluster emphasizes learning and scaling processes, with keywords including impact assessment, quadruple helix, and urban experimentation. This stream of literature conceptualizes Living Labs as arenas for iterative knowledge co-production and organizational learning. Frameworks such as the Living Lab Learning Framework (Bhatta et al., 2025a) illustrate how capacities are built across individual, organizational, and systemic levels, while follow-up studies identify pathways through which experimental insights become embedded into policy structures (Bhatta et al., 2025b; Fuglsang and Hansen, 2022).

The third cluster captures the role of Living Labs in circular economy transitions. Terms such as co-design, metabolism, and waste management domi-

nate this group, underscoring the relevance of LLs as catalysts of systemic innovation in urban sustainability. Projects such as REPAiR and related initiatives in Hamburg and Ghent show how participatory experimentation can translate European waste directives into neighborhood-specific planning scenarios and policy indicators (Amenta et al., 2019; Obersteg et al., 2020; Acke et al., 2020).

A fourth cluster is oriented toward democratic governance and stakeholder participation. Keywords such as citizen participation, legitimacy, and co-decision point to the political dimension of Living Labs as sites of power redistribution and democratic renewal. Studies stress that LLs can only achieve legitimacy when participation is inclusive and when decision-making authority is effectively shared with citizens (Eneqvist et al., 2022; Campos and Marin-Gonzalez, 2023).

The fifth cluster focuses on place-based experimentation and territorial anchoring, where the spatial dimension of LLs shapes both design and outcomes. Literature on urban regeneration and territorial living labs highlights how local identities, cultural heritage, and rural–urban linkages condition experimental trajectories and policy uptake (Falanga and Nunes, 2021; Oedl-Wieser et al., 2020). This perspective situates Living Labs as embedded infrastructures that mediate between place-specific needs and broader policy frameworks.

The sixth cluster examines collaborative and multi-level governance architectures, reflecting how institutional design and legal frameworks determine the sustainability of Living Labs. Here, the focus is on coordination mechanisms, contractual arrangements, and risk allocation between municipalities, private actors, and civil society. Research shows that the degree of legal formalization and political oversight directly influences both legitimacy and long-term viability (Voorwinden et al., 2023; Mukhtar-Landgren, 2021).

The seventh cluster identifies the transdisciplinary character of Living Labs, with keywords such as co-production, interdisciplinarity, and hybrid spaces. These studies conceptualize LLs as knowledge infrastructures that connect academic, civic, and professional perspectives, producing both pragmatic interventions and systemic learning (Brons et al., 2022; Kalinauskaite et al., 2021). The emphasis lies on LLs as hybrid arenas where knowledge integration fosters transformative capacity.

The eighth cluster addresses methodological innovation and evaluation frameworks. Literature in this group advances tools such as interpretive structural modelling, structured experimentation, and narrative analysis to assess co-creation processes and outcomes. Rather than focusing solely on outputs, these approaches evaluate the quality of interactions, learning dynamics, and governance transformations enabled by LLs (Sarabi et al., 2021; Broekema et al., 2023).

The ninth cluster explores citizen science and inclusive knowledge production, extending the participatory scope of Living Labs into environmental monitoring and civic epistemologies. By incorporating citizens as co-research-

ers, these initiatives democratize data production and expand legitimacy in governance processes (Slingerland and Overdiek, 2023).

Finally, the tenth cluster highlights the role of digital and geodesign toolkits in hybridizing spatial simulation with participatory dialogue. These studies emphasize how GIS-based visualization and digital negotiation platforms accelerate consensus-building and translate abstract scenarios into actionable policies (Arciniegas et al., 2019; Furlan et al., 2024).

Taken together, these ten clusters provide a comprehensive map of the conceptual terrain of Living Lab research in the EU context. They illustrate the field's diversity, ranging from institutional and participatory perspectives to circular transitions, methodological refinement, and digital innovation. This descriptive mapping lays the empirical foundation for the subsequent analysis, where the clusters are aggregated into four overarching governance dimensions that clarify how Living Labs function as infrastructures for experimental governance and policy innovation.

The ten clusters reported above constitute the descriptive outcomes of the co-occurrence analysis (Results). In the next section (Analysis), we interpret these clusters through the two state-of-the-art anchors, integrating case evidence to derive four governance-oriented dimensions: institutional anchoring (A), collaborative learning (B), socio-economic/circular transitions (C), and methodological consolidation (D).

4 Analysis

4.1 Collaborative Governance and the Urban-Institutional Anchoring of Living Labs

Initially emerging in Northern Europe as arenas for user-centred innovation, Living Labs (LLs) rapidly evolved into instruments for smart-city governance and evidence-based policymaking. This transformation, driven by municipal actors, reflects the integration of experimental methods into urban administrative routines (Bulkeley et al., 2016; Munteanu et al., 2024; Voytenko et al., 2016). Comparative studies in Amsterdam, Helsinki, and Barcelona have demonstrated that the policy impact of LLs depends less on the novelty of technologies and more on the density and quality of cross-sectoral collaboration (Bifulco et al., 2017), indicating the centrality of institutional embedding.

Nevertheless, as the concept proliferated across Europe, its meaning became diluted. Arias et al. (2025), analysing 95 cases, found that only 15% conformed to the canonical criteria of co-creation, testing, knowledge exchange, and real-life experimentation. Nearly half operated in controlled environments that marginalised citizen agency, illustrating a "semantic drift" that enables conventional testbeds or showcase pilots to adopt the LL label without participatory substance (Wehrmann et al., 2023).

This dilution is often associated with imbalances of power within LL configurations. Backhaus and John (2025) identify three archetypes - optimizers, tailors, and co-creators – highlighting that only the latter meaningfully redistribute decision-making authority beyond technical experts. In the CLEVER Cities programme, nine Urban Living Labs (ULLs) in London, Milan, and Hamburg progressed through three stages - partnership formation, governance modelling, and institutional consolidation – allowing for a gradual expansion of citizen influence over agenda-setting (Bradley et al., 2022). Trust-building, as shown in South Thamesmead, required intermediaries and “safe contact points” before residents transitioned from consultation to co-decision-making (Bradley and Mahmoud, 2024). However, the Swedish cases of Stockholm and Göteborg reveal an ongoing tension between the demand for quick, visible outcomes and the slower deliberative processes that confer democratic legitimacy; in the absence of strong political oversight, such labs risk bypassing public scrutiny (Eneqvist et al., 2022).

The relevance of LLs is especially pronounced when they are designed to address social justice issues. Energy-justice laboratories in Manchester, Metsovo, and Nyírbátor demonstrate that the success of energy retrofitting projects depended not merely on technical fixes, but on “intermediation of justice” by facilitators who aligned technical interventions with residents’ rights and recognition (Bouzarovski et al., 2023). A similar conclusion emerges from Campos and Marin-Gonzalez (2023), who show that LLs incorporating Responsible Innovation principles – anticipation, reflexivity, inclusiveness, and responsiveness - are better equipped to prevent socio-technical conflicts.

The territorial and spatial anchoring of Living Labs significantly shapes their ability to influence policy outcomes. In Hamburg-Altona, a circular economy LL managed to translate European waste directives into neighbourhood-specific planning scenarios, but only by aligning its experimental outputs with statutory governance frameworks through coordinated multi-level mechanisms (Obersteg et al., 2020). Similarly, Ghent’s bio-waste LL succeeded in promoting behavioural change and redefining performance metrics, yet this impact materialised only after its outcomes were formally validated within the Flemish Vision 2050 strategy (Acke et al., 2020). These cases highlight an important condition for the effectiveness of LLs: their integration into established institutional structures that can absorb and legitimise innovation. Indeed, as Stan and Tasente (2023) argue, the capacity of public actors to foster transparency and engage meaningfully with citizens through digital communication is contingent upon the extent to which such practices are supported by stable governance arrangements and embedded routines. This reinforces the view that LLs yield sustainable impact not merely through experimentation, but through their alignment with broader systems of accountability and decision-making.

Empirical validation of these patterns is offered by Dignum et al. (2020), who conducted a meta-analysis of 520 urban experiments across Europe. Their findings confirm that factors such as network density, existing intersectoral collaborations, and supportive political climates play an essential role in de-

termining whether LLs deliver incremental improvements or support more transformative change.

Transnational, peri-urban, and rural–urban configurations introduce further complexity. The REPAiR labs in Naples and Amsterdam exemplify how district-level territorial anchoring and community identity can enhance adherence to circular economy principles (Amenta et al., 2019). By contrast, Madrid’s seven ULLs, although aligned with the Spanish Urban Agenda, lacked both citizen engagement and political uptake, limiting their systemic impact (Diaz-Sarachaga and Sanchez-Canete, 2024). At the rural–urban interface, territorial LLs in Styrian municipalities highlight the importance of flexible horizontal coordination to avoid reinforcing centre–periphery hierarchies (Oedl-Wieser et al., 2020).

Beyond spatial and participatory dimensions, the legal-institutional infrastructure of LLs proves critical for their long-term sustainability. Voorwinden et al. (2023), analysing four smart-city LLs in Amsterdam, show how varying degrees of contractual formalisation shape risk allocation, stability, and the evolving role of municipalities – as both regulators and co-investors – raising dilemmas of compliance and legitimacy. This perspective is deepened by Llanccce et al. (2025), whose research on Rotterdam’s climate-resilient infrastructure identifies 19 governance factors – ranging from human capacity and finance to culture and communication – that determine whether pilot projects outlive their funding cycles. In Sweden, legal rigidity in smart-city initiatives has curtailed local autonomy and shifted LL experimentation toward technocratic goals (Mukhtar-Landgren, 2021). However, when municipalities assume active roles – as innovators or mediators – LLs are more likely to gain social legitimacy and upscaling potential (Mukhtar-Landgren et al., 2019).

Taken together, these findings underscore that the legitimacy and effectiveness of Living Labs rest on three foundational pillars: clear role allocation among actors, equitable power-sharing mechanisms, and robust institutional embedding. When these criteria are fulfilled, LLs can transcend their experimental status and act as constitutional devices that renegotiate the social contract of urban governance. In their absence, LLs risk reducing citizens to passive “beta-testers,” while innovation remains confined to peripheral demonstration zones.

4.2 Collaborative Learning, Democratic Legitimacy and Citizen Participation

Beyond their institutional anchoring, Living Labs (LLs) are increasingly conceptualized in the literature as educational arenas where actors acquire new skills, reframe problems, and co-produce shared imaginaries. Drawing from constructivist and transformative learning theories, Bhatta et al. (2025a) develop a Living Lab Learning Framework that categorizes learning by type (content, capacity, network), process (intentional vs. incidental), and level (individual, team, organizational). Applying this framework to a water governance

project, they trace improvements in systems thinking and policy deliberation. A follow-up study identifies seven post hoc learning pathways - from knowledge integration to institutional norm change - emerging from a climate adaptation lab (Bhatta et al., 2025b).

These theoretical insights are supported by empirical studies emphasizing the value of experiential learning and informal storytelling in co-creative nature-based LLs. Aniche et al. (2024) find that exposure to real-life contexts and openness to local narratives are key predictors of successful engagement. In Hamburg's CLEVER Lab, sustained participation across phases was facilitated by clearly defined institutional structures, credible local facilitators, and methods adapted to civic literacy levels (Arlati et al., 2021). Knowledge continuity also plays a pivotal role: in Turin's proGReg Lab, the long-term viability of green corridors depended on community ownership, leadership stability, and shared responsibility (Battisti et al., 2024). A comparative survey of public-sector LLs reveals that a balance of process learning, bounded experimentation, and genuine democratic engagement yields the most transformative results (Fuglsang and Hansen, 2022).

At the core of these dynamics lies trust. Dupont et al. (2019), using the Cocon Trust Matrix, show that transparency, reciprocity, and recognition of actors' contributions prevent superficial or tokenistic participation. Brons et al. (2022) distinguish between two complementary LL modes: embedded laboratories rooted in everyday routines (breadth) and reflective spaces that generate critical foresight (depth). Sequencing these dimensions supports equitable stakeholder engagement, particularly in food system transitions. Istanbul's Edible City projects further illustrate how informal environments, empathic facilitation, and flexible governance structures nurture creativity and strengthen ownership (Massari et al., 2023). Similar participatory mechanisms have been reported in coastal regions, where trust was built through shared environmental awareness and strong place-based identities (Aivaz and Vancea, 2009; Stan et al., 2021).

LLs do not only foster skill-building but also reshape collective meaning-making processes. Longitudinal research in Rotterdam's Carnisse neighborhood demonstrates how the Resilience Lab co-produced a renewed sense of place through symbolic reinterpretation, visionary storytelling, and reimagined human-environment relations (Frantzeskaki et al., 2018, 2019). In Lisbon, the ROCK Lab mobilized cultural heritage in marginalized districts, but only when memory work was institutionally anchored and aligned with social cohesion strategies (Falanga and Nunes, 2021). In Barcelona, the Library Living Lab transformed a conventional public library into a co-creation hub through challenge-action-return cycles, fostering civic empowerment (Vilarino et al., 2018). Similarly, dream-based visioning exercises in Swedish mobility labs enabled participants to resist path dependency by unlocking new aspirational frames (Ebbesson, 2022).

Yet inclusivity is far from guaranteed. The FIT4FOOD2030 project, which involved 25 LLs across Europe, exposed four persistent design dilemmas: rep-

resentation vs. deliberation, diversity vs. directionality, marginal vs. dominant actor dynamics, and challenges in defining participatory boundaries (Kok et al., 2021). Kalinauskaite et al. (2021) respond by proposing a transdisciplinary collaboration framework that emphasizes joint goal-setting, clearly defined roles, and iterative feedback loops to overcome fragmentation. In South-Eastern Europe, Belgrade's NbS Lab shows how multi-level translation between niche innovation, urban regimes, and political landscapes is essential for inclusive participation (Mitic-Radulovic and Lalovic, 2021). Similar tensions are reported in Catalonia's smart-city LLs, where citizens engage in slow "power banking" to rebalance institutional dominance (Nguyen et al., 2022). University-anchored LLs offer a promising alternative: the EPIC-WE hubs, for instance, integrate students, cultural institutions, and creative industries, simultaneously enhancing legitimacy and innovation (Norgard and Holflod, 2025).

Learning processes yield systemic impact only when integrated into formal policy cycles. Ehnert (2025) documents how Dresden's City of the Future lab reoriented public officials from top-down planners to facilitators of change, but only after learning outcomes were strategically embedded into municipal structures. Nordic experiments on autonomous buses underscore that process documentation, decision-maker engagement, and reflexive evaluation are key to scaling lessons beyond the pilot phase (Muur and Karo, 2023). This is echoed in platforms from Rotterdam, Leuven, and Malmö, which foster institutional change by aligning design, learning, and governance capacities (Rehm et al., 2021). These findings are further supported by evidence from consultations with students in urban planning and related disciplines, who associate hands-on, community-based learning with more active involvement in public life and increased trust in institutions (Stan et al., 2023). Additional insights from participatory urban planning reveal that meaningful citizen engagement emerges especially when public consultations enable the articulation of concerns related to green spaces, cultural identity, and procedural legitimacy - suggesting that democratic learning is most effective when institutions acknowledge and integrate community priorities into planning frameworks (Slave et al., 2023).

Conversely, in the absence of deeper institutional integration, Living Labs tend to result in limited learning outcomes. In the Swedish case studies, including the Uddevalla Living Lab, collaborative efforts generated individual-level insights but fell short of triggering broader organizational or systemic change, largely due to the disconnect between voluntary engagement and formal planning structures (Pettersson et al., 2018).

Institutional capacity proves essential. Freiburg's e-mobility lab required a mix of technological expertise, participatory facilitation, risk management, and reflexive learning; failure in any area stalled progress (Teko and Lah, 2022). In Allgäu, a tourism-focused LL relied on continuous feedback loops to balance resident needs with destination development strategies (Thees et al., 2020). Some labs even go beyond anthropocentric participation. Biodiversity sensing labs incorporate plants and animals as epistemic actors, broadening

both the scope and legitimacy of environmental monitoring (Slingerland and Overdiek, 2023). When there are no clear mechanisms to integrate outcomes into existing institutional structures, Living Labs risk remaining ethereal and temporary initiatives, lacking the capacity to generate concrete results or long-term sustainable change (Soeiro, 2021).

4.3 Socio-Economic Innovation, Circular Transitions and Rural–Urban Convergence

A third stream of research frames Living Labs (LLs) as key enablers of systemic transitions across critical sectors such as waste management, water, energy, mobility, and food. This perspective emphasizes the role of LLs not just as experimental zones, but as embedded infrastructures capable of guiding complex socio-technical change. The REPAiR project exemplifies this approach, integrating the Geodesign Decision Support Environment into regional labs that visualized the spatial impact of waste flows and facilitated the co-design of circular land-use scenarios (Arciniegas et al., 2019). The labs in Naples and Amsterdam, through cycles of co-exploration and co-governance, showed that meaningful collaboration between experts and citizens can generate enforceable strategies for regenerating degraded wastescapes (Amenta et al., 2019). Hamburg’s circular-economy lab highlighted the need for continuous multi-level negotiation to align land-use planning with resource metabolism (Obersteg et al., 2020), while Ghent’s bio-waste lab reframed policy indicators to reflect lifecycle thinking (Acke et al., 2020).

In response to crisis conditions, LLs have also demonstrated rapid prototyping capacities. The FURNISH project, developed during the COVID-19 lockdown, deployed mobile urban elements and used an iterative LOOP Scheme to monitor their spatial and social impacts (Aquilue et al., 2021). Berlin’s Sustainable Living Lab applied urban design thinking to co-create last-mile cycling logistics hubs, showing that early-stage end-user engagement reduces resistance to adoption (Alexandrakis, 2021). Similarly, Freiburg’s e-mobility labs conducted capacity-needs assessments to synchronise training programmes with infrastructural investments (Teko and Lah, 2022). Pilot initiatives such as Munich’s City2Share, Barcelona’s Superblocks, and Austria’s Digibus Koppl reveal five discursive strategies – from quick wins to momentum-building narratives – that justify project continuation even in the absence of immediate quantitative outcomes (Jung and Wentland, 2024).

The integration of participatory digital tools is another key strength. Participatory geodesign in Amsterdam, Hamburg, and Naples demonstrated how combining spatial simulation with stakeholder dialogue can yield strategies that balance ambition with feasibility (Furlan et al., 2024). In Greece, Karditsa’s regional energy lab successfully aligned spatial concepts, business models, and community alliances, reinforcing that integrated planning outperforms siloed sectoral approaches (Giannouli et al., 2018). In Lucca, food policy labs bridged rural–urban divides by envisioning peri-urban agricultural

parks, highlighting that systemic change depends on policy coherence and multi-scalar partnerships (Galli et al., 2024).

In this regard, agroecological LLs in Italy, the Netherlands, and the United Kingdom operate as transdisciplinary platforms for rethinking food systems. These labs facilitate sustained collaboration among farmers, researchers, NGOs, and local governments through participatory activities such as workshops, collaborative mapping, and knowledge-sharing processes. By connecting grassroots knowledge with scientific and policy frameworks, they foster context-specific, inclusive solutions aimed at ecological resilience and food sovereignty (Rastorgueva et al., 2025).

LLs have also been pivotal in the logistics sector. Gatta et al. (2017) combine desk research, participatory engagement, and simulation modelling to design urban freight policies that reflect behavioral, financial, and operational constraints. A comparative study of cycling innovation in four European cities identifies 16 recurring dilemmas - ranging from vision alignment to monitoring limitations - and concludes that reflexive governance and clear scale-up pathways are essential for LL success (van Waes et al., 2021). Nordic pilots with autonomous buses further show that technical viability is insufficient without institutional learning infrastructures (Muur and Karo, 2023), while studies of Swedish mobility interventions reveal that economic nudges often fail without supportive urban design (Sjoman et al., 2020).

Cultural and heritage-led labs introduce an additional dimension of socio-spatial justice. In Split, a regional LL reconciled post-pandemic tourism with sustainability by promoting low-volume, high-value cultural routes and treating heritage authenticity as a form of economic capital. A Mediterranean comparative analysis confirms that resilience in cultural LLs requires agenda co-definition among small operators, local authorities, and residents (Mandic et al., 2025). In Salerno, the "Hack the City" initiative gamified heritage revitalization through micro-interventions and co-created cultural indicators that localized the broader vision of the New European Bauhaus (Cerreta et al., 2021). Meanwhile, Bremen's biodiversity lab mainstreams more-than-human sensing by positioning plants and insects as co-researchers, thereby reframing urban ecosystem governance (Slingerland and Overdiek, 2023).

However, the question of scaling remains a persistent challenge. The Edible City Solutions initiative, across cities like Andernach, Berlin, Oslo, and Rotterdam, proposes five complementary scaling modes - scaling up, deep, wide, across, and soft - demonstrating that long-term success depends on policy integration and dedicated funding streams (Plassnig et al., 2022). Survey-based research in six European capitals shows that LLs with direct access to decision-making levers are significantly more impactful than peripheral demonstrators (Prendeville et al., 2018). A typology of institutional ecosystems for climate resilience identifies community-decentralized and hybrid-partnerial models as the most adaptive, provided financing strategies are diversified and context-responsive (Llancce et al., 2025). On the commercial side, Med-Tech Living Labs illustrate four collaboration archetypes - exploration, incuba-

tor, integrator, and impact – mapping the trajectory from research to market while underscoring the need for alignment between technological maturity and market demand (Saad and Agogue, 2024).

In sum, socio-economic perspectives position Living Labs as transitional nodes that translate circular, mobility, energy, and cultural aspirations into territorially grounded innovation trajectories. Their effectiveness depends on integrative design methodologies, multi-level governance alignment, adaptive financing mechanisms, and strategic pathways for upscaling. These findings are further supported by the recent techno-ecological model proposed by Kerboua et al., (2025), which demonstrates that transitioning from uncontrolled landfilling to energy recovery can reduce greenhouse gas emissions by up to 99.87%, while simultaneously generating electrical power.

4.4 Methodological Consolidation and Transdisciplinary Evaluation

The rapid proliferation of Living Labs (LLs) has prompted an equally urgent need for methodological consolidation. Responding to this, DeLosRios-White et al. (2020) propose the *Life-Cycle Co-Creation Process* - a cyclical framework encompassing five iterative phases: *Co-Explore*, *Co-Design*, *Co-Experiment*, *Co-Implement*, and *Co-Manage*. This model serves as a procedural blueprint for nature-based urban interventions. Complementing this, Broekema et al. (2023) advanced a process-oriented evaluation method that moves beyond output metrics by analysing narrative dynamics, actor configurations, and emergent learning. They caution that a “tick-box exercise” approach to co-creation risks undermining the legitimacy of EU-funded social innovation programmes.

To reduce conceptual ambiguity, several taxonomic efforts have emerged. McCrory et al. (2020) introduce a classification of four LL families - Living, Transition, Real-World, and Innovation Labs - subsequently extended into six functional modes ranging from Fix and Control to Explore and Shape (McCrory et al., 2022). Westerlund et al. (2018) offer a platform-based typology based on whether the lab focuses on products, services, processes, or policies, warning that unstructured diversity can lead to evaluative confusion. In a related vein, City-Lab research distinguishes policy-oriented labs from technology-driven ones, suggesting that success in the former should be measured through governance transformation rather than prototype adoption (Scholl and Kemp, 2016).

New analytical methodologies further refine the understanding of co-creation dynamics. Using Interpretive Structural Modelling (ISM), Sarabi et al. (2021) map causal hierarchies across 15 co-creation factors in nature-based LLs, identifying local learning and openness to informal contributions as systemic drivers. A systemic barrier model applied in Tampere, Eindhoven, and Genoa reveals that institutional capacity deficits are a key constraint in mainstreaming nature-based solutions. To avoid elite capture by technical actors, Zingraff-Hamed et al. (2020) introduce an actor-mapping framework that cat-

egorizes stakeholders into four distinct roles: initiators, facilitators, influencers, and beneficiaries.

Digital tools play a central role in today's hybrid LL methodologies. Geodesign exemplifies digital–dialogic hybridity by combining GIS-based visualization with stakeholder negotiation, accelerating consensus-building and enabling tangible planning outcomes (Arciniegas et al., 2019; Furlan et al., 2024). In higher education, digital platforms similarly function as infrastructural enablers of innovation and participation, facilitating institutional change and stakeholder engagement (Du et al., 2023).

In parallel, data collaboratives emerging from Dutch city deals illustrate how co-governed data sharing requires clear legal frameworks addressing privacy, access, and accountability (Ruijter, 2021). Expanding the epistemic toolkit, “more-than-human citizen sensing” incorporates plants and insects as legitimate contributors to urban knowledge systems (Slingerland and Overdiek, 2023). Within the cultural domain, the Play ReCH project combines gamification, participatory mapping, and design thinking to co-create locally validated monitoring indicators (Cerreeta et al., 2021).

However, methodological sophistication does not automatically translate into institutional uptake. University networks such as Italy's RUS demonstrate that campus-based LLs can model SDG-oriented governance, but only if their findings are integrated into strategic institutional planning (Marchigiani and Garofolo, 2023). Comparative research between Dutch and Indonesian LLs highlights that performance criteria - such as co-creation depth, public impact, and financial sustainability - must be calibrated to local contexts (Witteveen et al., 2023). These findings reinforce the need for digitally competent administrations capable of leveraging citizen feedback and social media platforms for policy learning and adaptive governance (Stan and Taseuțe, 2024).

In rural contexts, socio-ecological LLs require long-term institutional infrastructures beyond project-based cycles. The integration of Theory of Change workshops into groundwater governance initiatives across Italy, Greece, Tunisia, and Turkey has proven to be an effective model for institutional continuity (Ceseracciu et al., 2025). Moreover, transition typologies suggest that “empower-and-govern” and “explore-and-shape” models demand flexible funding schemes and iterative evaluation to avoid reabsorption by dominant regimes (McCrory et al., 2022).

Taken together, these methodological advances converge on three foundational pillars for the next generation of Living Labs: cyclical evaluation, explicit taxonomy, and hybrid digital–participatory toolkits. Standardizing these elements is essential to prevent semantic drift and ensure that LLs contribute verifiably to public sector innovation.

5 Discussion

The results of this review demonstrate that Living Labs in the European Union cannot be understood solely as experimental spaces or pilot projects; rather, they must be framed as dynamic infrastructures of governance that connect actors, resources, and institutional logics. In this sense, the four governance-oriented dimensions distilled from the co-occurrence analysis—institutional anchoring, collaborative learning, socio-economic and circular transitions, and methodological consolidation—advance the conceptual field by showing how Living Labs evolve beyond isolated initiatives and acquire systemic relevance.

From a theoretical perspective, these findings refine existing typologies. Previous studies distinguished between product-, service-, process- and policy-oriented labs (Westerlund et al., 2018; Scholl and Kemp, 2016) or classified them according to their role in transitions (McCrory et al., 2020; 2022). Our synthesis contributes by demonstrating that the *effectiveness* of these categories depends on governance conditions. For example, policy-oriented labs are impactful only when they are institutionally embedded, legally recognized, and supported by political accountability. Without such conditions, the promise of co-creation risks collapsing into what Wehrmann et al. (2023) call “semantic drift,” where the Living Lab label is applied without substantive participatory substance. Thus, this review does not merely reproduce existing classifications but reinterprets them through the lens of governance infrastructures.

The analysis also illuminates how Living Labs recalibrate democratic legitimacy. While inclusivity is frequently claimed, genuine participation remains uneven. Studies reviewed here indicate that trust-building, procedural fairness, and recognition of citizen agency are decisive for moving from consultation toward co-decision (Bradley et al., 2022; Campos and Marin-Gonzalez, 2023). These insights align with frameworks of responsible innovation, which stress anticipation, reflexivity, and responsiveness (Owen et al., 2013), but they extend them by emphasizing the institutional routines that enable trust to be embedded in governance systems. In this respect, Living Labs should not be seen as parallel arenas to formal policymaking, but as boundary infrastructures that strengthen democratic accountability within existing institutions.

The socio-economic and circular transitions dimension further clarifies the role of LLs in addressing systemic challenges. Projects such as REPAiR or CLEVER Cities demonstrate that Living Labs can translate abstract sustainability goals into territorial grounded strategies (Amenta et al., 2019; Obersteg et al., 2020). Yet, the evidence also reveals that circular pilots remain vulnerable when policy alignment and financing are absent. Here, our contribution to the state of the art lies in demonstrating that systemic impact arises not from the novelty of tools—be they GIS, geodesign, or participatory mapping—but from their integration into multi-level governance architectures that ensure continuity beyond project cycles.

Equally important is the recognition that methodological diversity, while often celebrated, has generated fragmentation. The clusters identified in this review show that evaluation approaches vary from interpretive modelling (Sarabi et al., 2021) to narrative analysis (Broekema et al., 2023), with little convergence. This lack of consolidation impedes comparative research and policy learning. By foregrounding methodological consolidation as a governance dimension, our review moves beyond descriptive cataloguing and calls for standardized reporting criteria that capture co-creation depth, learning outputs, and scale-up trajectories. Such criteria would help to preserve analytical clarity and prevent the Living Lab concept from becoming a diffuse metaphor.

Taken together, these findings have three implications. First, they reframe Living Labs as *evolving governance ecologies* rather than static models of innovation delivery. Their value lies not in isolated outputs, but in their ability to connect experimental practices to institutional norms, thereby shaping the capacity of public administrations to act under conditions of uncertainty and contestation. Second, they show that democratization within Living Labs is not automatic; it requires explicit mechanisms for redistributing power, establishing procedural fairness, and embedding trust. Third, they underscore that methodological rigour is a political issue: without standardized evaluation, Living Labs risk serving as symbolic showcases rather than engines of systemic change.

For practitioners, the discussion highlights several managerial lessons. Municipalities and funders should move beyond “pilotism” and ensure that Living Labs are structurally linked to decision-making routines. This requires legal frameworks (sandbox clauses, contractual clarity), long-term financing strategies, and dedicated roles for intermediaries who facilitate trust and translation. It also requires that scaling is planned as a multi-modal process—scaling up, deep, wide, across, and soft—so that experiments do not remain isolated but diffuse their impact across governance layers. Finally, digital tools should be deployed not merely for efficiency, but for democratization, ensuring that technological infrastructures expand rather than restrict participation.

In summary, this discussion positions Living Labs as infrastructures for governance innovation in the EU context. By linking our empirical clusters to established typologies and transition theories, we demonstrate how LLs contribute to recalibrating institutions, fostering democratic learning, and enabling systemic transitions. This interpretive framework advances the state of the art by moving beyond descriptive accounts and by proposing a governance-oriented model that clarifies both the promises and the limits of Living Labs in contemporary public administration.

6 Conclusion

The systematic review of Living Labs (LLs) within the European Union governance context reveals that their transformative potential cannot be assumed based on format alone. While Living Labs are frequently presented as inno-

vative arenas for co-creation and public experimentation, their actual impact depends on how deeply they are embedded in institutional structures, how effectively they distribute agency, and how consistently they facilitate long-term learning across governance layers.

What emerges most clearly is that LLs function not as standalone interventions, but as boundary infrastructures - interfaces through which institutions, citizens, and knowledge systems are reconfigured. Their contribution to public sector innovation stems from the extent to which they are integrated into formal decision-making routines, regulatory frameworks, and institutional memory. Labs that remain disconnected from these systems, even when methodologically sophisticated, tend to remain marginal or symbolic.

Participation within LLs remains a contested and uneven practice. Many initiatives claim inclusivity and co-creation yet fail to establish procedural mechanisms that shift the locus of decision-making beyond technical or administrative actors. Genuine collaboration is often undermined by tokenistic consultation formats and unaddressed power asymmetries. The review shows that only those configurations that explicitly enable shared ownership, iterative feedback, and the institutionalization of trust dynamics succeed in generating democratic legitimacy.

The spatial and territorial positioning of LLs significantly influences their effectiveness. Labs situated within well-connected governance ecosystems – with existing intersectoral partnerships and adaptive policy cultures - are more likely to evolve into catalysts for systemic change. In contrast, projects isolated from political uptake or implemented through rigid institutional logics frequently result in stalled innovation, regardless of their local relevance.

As LLs expand into peri-urban, rural, and transnational domains, the necessity of context-sensitive design becomes increasingly apparent. Flexible governance architectures and participatory tools that adapt to local conditions - notably through co-design, narrative-based engagement, and transdisciplinary mediation - are crucial to navigating the complexity of multi-scalar transitions. Where such tools are absent, LLs risk reproducing existing inequalities or reinforcing centre-periphery divides.

A major challenge lies in the methodological landscape of LL research itself. Although numerous frameworks and typologies exist, their adoption remains fragmented, and comparative insights are often impeded by the absence of standardized reporting criteria. Methodological consolidation is not merely a technical need - it is essential to ensure that the LL concept retains analytical clarity and evaluative integrity. Without this, the risk of conceptual inflation remains high, and so too the danger of policy misuse.

The hybrid character of LLs - spanning digital infrastructure, civic facilitation, and institutional experimentation - introduces both strengths and vulnerabilities. Digital tools can support transparency, dialogue, and scenario-building, but can also marginalize participants without technological access or fluency.

The effective governance of LLs thus requires not only technical sophistication, but sustained investment in civic literacy and epistemic pluralism.

From a theoretical standpoint, the review invites a shift in how LLs are framed - not as fixed models of innovation delivery, but as evolving governance ecologies. They should be assessed based on their capacity to recalibrate administrative norms, bridge fragmented knowledge regimes, and support adaptive institutions capable of responding to complexity and contestation. This repositioning situates LLs within broader trajectories of democratic governance renewal and sustainability transition.

The future relevance of Living Labs will depend on how convincingly they can be institutionalized without losing their experimental vitality; how meaningfully they can democratize the production of knowledge and policy; and how responsibly they can navigate the tensions between openness, accountability, and innovation. Only under such conditions can LLs serve not as symbolic containers, but as generative spaces where new forms of collective intelligence and governance take root.

7 Limitations and Future Research Directions

Despite its systematic scope, this review is constrained by several structural limitations inherent to the Living Lab literature. A major challenge stems from the lack of standardized methodologies for defining, documenting, and evaluating Living Labs across different institutional and territorial contexts. The heterogeneity of conceptual frameworks – often varying between technological, participatory, and policy-driven interpretations – complicates both comparative analysis and cumulative knowledge building. Furthermore, the absence of consistent reporting standards across case studies limits the ability to assess depth of co-creation, governance integration, or long-term policy impact. While the co-occurrence analysis provides a structured overview of thematic clusters, it does not substitute for a critical appraisal of the quality or replicability of individual studies. Future research should prioritize the development of harmonized evaluation metrics, longitudinal monitoring of LL outcomes, and cross-national typologies that account for local policy ecosystems. Advancing the field requires not only conceptual synthesis but also institutional mechanisms for methodological convergence.

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The Ombudsman as a Guardian of Good Governance: Insights from North Macedonia

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ABSTRACT

Purpose: The purpose of this paper is to present the role of the Ombudsman in upholding the principles of good governance when protecting and promoting the rights of citizens and other individuals within a democratic framework. The research focuses on the work of the Ombudsman in North Macedonia, examining its activities and its authority over public institutions when acting or failing to act.

Design/Methodology/Approach: The research methods applied include desk research, an analysis of documents and reports related to the institutional and legal set-up of the Ombudsman's office in North Macedonia, and content analysis. To understand the complexities of the Ombudsman's competencies within the Macedonian institutional set-up, a comparative analysis was conducted, covering examples from the EU and other global contexts. To clarify the findings, semi-structured interviews were conducted with relevant officials, including the Ombudsman of North Macedonia and its deputies.

Findings: The results of this research indicate that, although the Ombudsman is empowered to protect the human rights and freedoms of individuals or groups when they are violated by state authorities, its efforts to contribute towards the efficient and effective operation of public administration, and to promote the principles of good governance and the right to good administration in North Macedonia, are limited. However, this corresponds with the overall efficiency of the institution and its position within the legal and political system. In general, the institutional response to the Ombudsman's remarks is weak, as evidenced by missed hearings before the Government, delays in the adoption of its annual reports by Parliament, a lack of public debate, and insufficient implementation of follow-up measures addressing the Ombudsman's remarks. Furthermore, the Ombudsman institution does not enjoy full independence.

Practical Implications: The paper is based on research conducted in 2023/2024 and provides clear and structured recommendations for the

improvement of the Ombudsman's office in North Macedonia, aimed at achieving good governance standards. Due to its practical applicability, the recommendations can serve to improve the work of Ombudsman offices elsewhere in the region and beyond.

Originality/Value: This research highlights the role of the Ombudsman in fostering good governance and presents it as a necessary condition for establishing a robust system for the protection of individual rights. Often, the work of the Ombudsman is analysed through its *ex officio* interventions aimed at protecting rights when violated by state institutions. In this sense, the office intervenes with proposals, suggestions, and recommendations, acting as a guardian of individuals' rights in relation to public administration. This research presents another perspective on the Ombudsman's role—often neglected in public discourse—by offering a broader view of its function in upholding democratic standards and good governance principles.

Keywords: challenges, good governance, human rights, North Macedonia, ombudsman

Varuh človekovih pravic kot varuh dobrega upravljanja: spoznanja iz Severne Makedonije

POVZETEK

Namen: prispevek predstavi vlogo varuha človekovih pravic pri uveljavljanju načel dobrega upravljanja pri varstvu in spodbujanju pravic državljanov in drugih posameznikov v demokratičnem okviru. Raziskava se osredotoča na delo varuha v Severni Makedoniji ter preučuje njegove dejavnosti in pristojnosti nad javnimi institucijami pri njihovem delovanju ali opustitvi dolžnega ravnanja.

Zasnova/metodologija/pristop: uporabljene raziskovalne metode vključujejo preučevanje virov, analizo dokumentov in poročil, povezanih z institucionalno in pravno ureditvijo urada varuha v Severni Makedoniji, ter analizo vsebine. Za razumevanje kompleksnosti pristojnosti varuha znotraj makedonske institucionalne ureditve je bila izvedena primerjalna analiza, ki zajema primere iz EU in drugih svetovnih kontekstov. Za pojasnitev ugotovitev so bili opravljeni polstrukturirani intervjuji z relevantnimi uradniki, vključno z varuhom človekovih pravic Severne Makedonije in njegovimi namestniki.

Ugotovitve: rezultati raziskave kažejo, da je varuh sicer pooblaščen za varovanje človekovih pravic in svoboščin posameznikov ali skupin, kadar jih kršijo državni organi, vendar so njegova prizadevanja za prispevek k učinkovitemu in uspešnemu delovanju javne uprave ter za spodbujanje načel dobrega upravljanja in pravice do dobrega upravljanja v Severni Makedoniji omejena. To pa je v skladu s splošno učinkovitostjo institucije in njenim položajem v pravnem in političnem sistemu. Na splošno je institucionalni odziv na pripombe varuha šibek, kar se kaže v izpuščenih obravnavah pred vlado, zamudah pri sprejemanju njegovih letnih poročil v parlamentu, pomanjkanju javne razprave ter nezadostnem izvajanju naknadnih ukrepov za obravnavo varuhovih pripomb. Poleg tega institucija varuha ne uživa polne neodvisnosti.

Praktične posledice: prispevek temelji na raziskavi, opravljeni v letih 2023/2024, in podaja jasna in strukturirana priporočila za izboljšanje de-

lovanja urada varuha v Severni Makedoniji z namenom doseganja standardov dobrega upravljanja. Zaradi svoje praktične uporabnosti lahko priporočila prispevajo k izboljšanju dela uradov varuhov človekovih pravic drugje v regiji in širše.

Izvirnost/vrednost: raziskava poudarja vlogo varuha pri spodbujanju dobrega upravljanja in ga predstavlja kot nujni pogoj za vzpostavitev trdnega sistema varstva pravic posameznikov. Delo varuha je pogosto analizirano skozi njegove posege po uradni dolžnosti, usmerjene v zaščito pravic, kadar jih kršijo državni organi. V tem smislu urad posega s predlogi, pobudami in priporočili ter deluje kot varuh pravic posameznikov v razmerju do javne uprave. Ta raziskava ponuja še en, v javnem diskurzu pogosto zastavljen vidik varuhove vloge, saj nudi širši pogled na njegovo funkcijo pri uveljavljanju demokratičnih standardov in načel dobrega upravljanja.

Ključne besede: izzivi, dobro upravljanje, človekove pravice, Severna Makedonija, varuh človekovih pravic/ombudsman

JEL: K23 H83

1 Introduction

This paper aims to clarify the role of the Ombudsman in upholding the principles of good governance within the political system of North Macedonia. The research examines the work of the Ombudsman in general, focusing on its authority over public institutions and the services they provide to citizens. The Ombudsman is empowered to protect the human rights and freedoms of individuals or groups when violated by state authorities, intervening with proposals, suggestions, and recommendations. Through this role, the Ombudsman indirectly contributes to the efficient and effective operation of public administration, supports achieving democratic standards and promotes the principles of good governance.

As a case study, this research paper focuses on the Ombudsman work in North Macedonia. Being a transitional democracy striving for European Union (EU) membership, North Macedonia's Ombudsman faces several challenges within its public governance system. Despite its establishment as an independent body, the Ombudsman does not hold a prominent position within the political system although its prerogatives suggest it should. An enhanced role in this setup is essential for the Ombudsman to fulfil its core function: protecting human rights. However, institutional response to the Ombudsman's remarks remains weak, hearings before the Government regarding its reports are often evaded, its annual reports acceptance are delayed by the Parliament, and follow-up measures to keep public institutions accountable are lacking. Additionally, the Ombudsman as an institution lacks complete financial independence, affecting its functional independence. On the other hand, it does not maintain separate statistics on complaints against the administration and does not report inconsistencies in how institutional and governmental bodies respond to its remarks. Therefore, it is essential to strengthen the Ombuds-

man's position to ensure that it can demonstrate and maintain strong role in upholding the principles of good governance and protection of human rights. The paper aims to identify weaknesses in the current system while also highlighting best practices and providing recommendations for strengthening the Ombudsman's position. It also highlights the importance of aligning the Ombudsman's role with other non-governmental actors, such as CSOs and the media, to better achieve its objectives.

2 Methods

This paper is a result of research conducted in the period November 2023 – October 2024. It is a part of the project *Enhancement of Governance and Public Administration Reforms* funded by the National Endowment for Democracy (NED) and implemented by the Center for Change Management (CCM). The main aim of the project was to raise awareness among citizens to seek high professional standards, efficient institutions, and success in the operation of public administration. This research envisages the need to improve institutional accountability, encouraging citizens to be engaged and to demand responsibility from the administration for implementing the necessary reforms and applying the standards of good governance. Its particular focus was monitoring the work of the Ombudsman of the Republic of North Macedonia, considering the institutions' response towards citizens' requests and complaints.

The specific objective of the research was to understand the role of the Ombudsman in fulfilling the principles of good governance in North Macedonia, i.e. the protection and promotion of citizens' rights arising from that sphere. The assumed weaknesses in the work of the Ombudsman were that the annual reports issued by the Ombudsman do not focus on the relationship between citizens and the administration, but are narrowly focused on certain vulnerable groups, although its areas of activity are broad. Additionally, the Ombudsman's activity over the years has been modest, with a small number of initiatives and a small amount of information, i.e. the Ombudsman institution was not proactive enough.

The research methods were the content analysis based on the desk research findings (analysis of documents and reports), an analysis of the documents related to the institutional and legal set-up of the Ombudsman's office; the analysis of how the Ombudsman's reports are managed, as well as their content analysis, i.e. which aspects they cover and on which human rights are focused. Additionally, comparative analyses were conducted using EU and global examples to get valuable insights. To clarify the findings' semi-structured interviews were conducted with relevant officials, including the Ombudsman of North Macedonia and its deputies. Based on that the recommendations for improvement were created.

The undertaken research steps should answer the main research question, related to the clarification of the role, competencies, and the power of the Ombudsman in North Macedonia to promote good governance principles, and

with that support the reforms towards a more efficient and effective system of public administration.

3 Results

3.1 The Ombudsperson in Its Core

The protection of human rights and the elimination of their abuse are essential functions of democratic governments. The Ombudsman is an institution established to contribute to the fulfilment of these goals. The increased sensitivity to human rights, the challenges and problems faced by the judiciary, the expansion of the functions of the public administration, as well as the commitment to fulfilling values such as transparency, accountability, and citizen participation in public processes, are currently leading to the strengthening of the role of the Ombudsman and the increase of its function in society.

Historically, institutions or officials similar to the modern Ombudsman have been observed in the Roman, Chinese, Islamic, and Spanish systems (Reif, 2004). However, the country from which the institution of the Ombudsman originated is considered to be the Kingdom of Sweden. According to the scholarship, the King of Sweden, Charles XII, after his military defeat by Russia in 1709, took refuge in the Ottoman Empire. During this period, the King established an office that was to monitor the behaviour of the Swedish administration on his behalf, and this was the beginning of the emergence of the first modern institution of the Ombudsman (Stern, 2008). After Sweden, the institution of the Ombudsman was also established in Finland (1919), and then in Norway (1952), Denmark (1955), and West Germany (1956). Therefore, for a long historical period, the Ombudsman as an institution existed only in Northern European countries. In the early 1960s, the idea of an Ombudsman was also adopted by the Commonwealth countries, and this institution was founded first in New Zealand (in 1962), and then in other countries (Rowat, 1964). The collapse of totalitarian regimes in Portugal, Spain, and Greece, and the process of democratization in the countries of Central and Eastern Europe after the Cold War contributed to the acceptance of the idea of an Ombudsman in these regions as well, so it can be said that the Ombudsman institution contributed, i.e. was part of the democratization movements respectfully (Kucsko-Stadlmayer, 2008).

Apart from the need for democratization, one of the most important reasons that has encouraged the increase in the number of these institutions is the idea of a welfare state, which in the 1950s swept the whole world. Within the framework of these tendencies are also the ideas of establishing mechanisms for protecting the rights of citizens concerning public administration. The fact that the institution of the Ombudsman is easily accessible to citizens, it provides free assistance, and is relatively fast in comparison with the judicial system, has played a key role in the establishment of Ombudsman offices in many countries around the world (Rowat, 1964). As a result, Ombudsman institutions are considered as an alternative in situations in which

judicial procedures are unavailable, or simply unrealistic to implement (Reif, 2004). Additionally, the Ombudsman institution is inherently flexible, adaptable, and therefore acceptable to countries with different political and administrative cultures (Cheng, 1968). This contributes to the easy incorporation of Ombudsman institutions into different national contexts but is also a prerequisite for the existence of institutions that have diverse organizational structures. However, certain characteristics are common to this institution, i.e. the Ombudsman as an institution is: (1) legally established, (2) functionally autonomous, (3) outside the system of administration, (4) operationally independent of both the legislative and executive branches, (5) may have a certain specialty, (6) expert, (7) non-partisan, (8) universal, (9) citizen-oriented, (10) easily accessible and socially visible (Hill, 1974).

The name of the institution, its status, duties, powers, jurisdiction, and procedures vary between countries around the world. In Norway, the Netherlands, Australia, New Zealand, Ireland, Canada, and Malta, the original name of the institution – Ombudsman – is used. The institution is called the Parliamentary Commissioner for Administration in the United Kingdom and Sri Lanka; the Mediator of the Republic in Francophone countries such as France, Senegal, and Burkina Faso; and the Defender of the People in Spain, Argentina, Peru and Bolivia (Reif, 2004). In some countries, the institution of the Ombudsman is constitutionally established (Sweden, Norway, Spain, and the Netherlands), and in some, it is established by a law passed by the national parliament (France, Belgium, and the United Kingdom) (Kucsko-Stadlmayer, 2008). Comparatively, in most cases, the Ombudsman is appointed and dismissed by the parliament of the country. However, in the United Kingdom, the Ombudsman is appointed by the executive (or the King/Queen), in France by the Council of Ministers, while in some countries by the President of the State (Turkey, Kazakhstan, etc.). Regarding his/her dismissal, in some countries, the Ombudsman cannot be dismissed from the office before the end of his/her term of office (Austria). In many countries around the world the Ombudsman cannot be reappointed (France, Israel, and Azerbaijan). In some countries, there is no limit on the re-appointment of an Ombudsman (Sweden, Norway, and Finland), while in some countries the Ombudsman can only be appointed twice (Russia, Portugal, and Ireland) (Kucsko-Stadlmayer, 2008).

In terms of the functions of the institution, the classic function of the Ombudsman is to investigate citizens' complaints against the executive branch by acting on complaints or *ex officio*. However, in recent years, Ombudsmen around the world have been given new functions. Therefore, in addition to investigating complaints for the protection of human rights, these institutions are also gaining new roles in combating corruption, preventing abuse of power by elected and high-ranking public officials, eliminating conflicts of interest, preventing nepotism (Reif, 2004), or like in North Macedonia to monitor the principle of the equitable representation with the public administration. The powers (scope of control) of Ombudsman institutions are different in different countries and they are generally shaped by the aforementioned political and administrative traditions in the countries in which they are es-

tablished. For example, in Sweden, in addition to the central government and local authorities, the army and the judiciary are also under the control of the Ombudsman (Capozzola, 1968). In Norway, local self-government, ministerial decisions, court decisions, and the work of auditors are outside the Ombudsman's jurisdiction. Ombudsmen generally have the authority to investigate, request relevant documents, hear citizens, review the decisions of relevant public institutions, and create reports on them. However, the Ombudsman institution is not a judicial body and does not have the power to impose sanctions (Letowska, 1990).

In principle, no financial fees are required to file a complaint in front of the Ombudsman. Citizens can often communicate their complaints directly. However, in some countries such as the United Kingdom and France, a complaint cannot be submitted directly to the Ombudsman, and citizens can do so through a senator, or member of a Parliament (MP). With the exception of countries like the United Kingdom, Belgium, and Luxembourg, Ombudsmen have a general authority to act *ex officio*, as well as to conduct investigations upon the complaints (Kucsko-Stadlmayer, 2008).

3.2 The Ombudsman and the Principles of Good Governance

The importance of the Ombudsman is also reflected in the fact that currently, only a few countries in the world have not established such an institution (Zahid Sobaci and Hatipoğlu, 2023). In general, the role of the Ombudsman is to receive, investigate, and resolve complaints from citizens regarding the actions or inaction of the public administration. Therefore, in addition to parliamentary control and judicial review, the Ombudsman is a control mechanism of the public administration, i.e. of the executive branch. The Ombudsman is not a judicial body and cannot replace the role of the judicial authorities, but in a democratic state, it has a complementary role. To understand the role of the Ombudsman in promoting of the principles of the good governance it is necessary to clarify what is meant under the concept of good governance, and how the related standards can be effectuated.

3.2.1 The Concept of Good Governance

Good governance is the basis of democratic decision-making. It increases democracy and contributes towards social and economic development. Although there are numerous attempts to define the concept of good governance, for some theorists it is a complicated activity that does not have many practical consequences (Doornbos, 2001). However, to understand its essence, according to most authors, the concept of good governance should be divided into its constituent components (principles) (Gisselquist, 2012). Nevertheless, although there are many definitions of what constitutes good governance, they all share common elements.

The principle of transparency is one of them and is related to the openness of institutions, i.e. making information generated by institutions available to the public through various mechanisms. A way to achieve transparency is to

strengthen freedom of information, known as the right of access to public information – a right that provides the opportunity for citizens and other social entities to seek and receive information from the work of a certain institution that has the character of the public. This mechanism is a powerful (although usually underused) instrument for controlling the activities of the government and public administration. Another aspect of transparency is the proactive publication of information by institutions in a generalized manner, as well as the creation of electronic services for citizens. In addition to transparency, the principle of participation is extremely important for good governance. Through this principle, non-state actors have the opportunity to provide government actors and, in general, society with knowledge, different views, and attitudes. This ensures fairness in the processes, i.e. it contributes to decisions and policies being not only legal but also correct and appropriate, i.e. it ensures the democratic legitimacy of decisions. However, participation must be based on certain criteria that allow for the diversity and appropriateness of participants. The criteria must prevent bias, i.e. the articulation of vested interests. Therefore, they must guarantee impartiality and objectivity in the selection of participants (Shikova, 2022).

The principle of accountability is also important for good governance. It is a social relationship in which the actor feels obliged to explain and justify his behaviour to someone else (Bovens, 2005). One of the most important results of this democratic principle is the premise that those who exercise public powers must be responsible for how they use those powers since they exercise them towards the citizens, and in their name. Accountability gains greater significance if it is linked to the assumption of political responsibility by political leaders concerning their political programs (Peters, 2008). Access to information and transparency directly affect accountability and help the functioning of the above-described mechanisms that ensure it.

Good governance also encompasses the principle of effectiveness. It is the achievement of a result that corresponds to the goals set by the institution. Every institution has to act effectively, and this entails the need to act efficiently and economically. Applying the principle of effectiveness means that in performing its function, the public administration considers the available resources in relation to the goals it needs to achieve, and on this basis creates practically feasible alternatives for action. Before choosing one of them, the options need to be considered and the possible effects of the choice need to be explained (Cerrillo-i-Martínez, 2023).

There are also some traditional mechanisms for guaranteeing accountability such as elections and periodic audit reports related to public spending (Agere, 2000). But apart from them, the new accountability mechanisms that have emerged recently are more flexible and help to overcome the limitations of traditional mechanisms. Some of them are the introduction of the institution of the Ombudsman, the formation of decentralized power structures, the introduction of mechanisms for citizen participation in policy-making processes, the strengthened role of the media, as well as measures for strengthened internal administrative control.

3.2.2 The Ombudsman and Good Governance Principles

Through its activities, the Ombudsman improves the functioning of public administration and contributes to good governance. In this context, the Ombudsman institution helps to strengthen the efficiency, functionality, transparency, and accountability of public administration, educates the citizens, and this increases citizens' trust in public institutions. Therefore, the Ombudsman institution directly backs the achievement of democratic standards. This corresponds with focused investigation of the activities of public officials, external financial audit, various internal methods and mechanisms, as well as a strengthened role of the Ombudsman. This role of the Ombudsman arises from global trends, in which, in light of economic and other problems, the state is forced to respond to growing public expectations. Therefore, it is extremely important to balance the interests of the individuals and groups with the public interest, to connect them and accommodate them. Although the public servants should be dedicated to the public interest, that is not always the case, i.e. often, there are occasions in which public servants avoid or even refuse to do what is essentially expected of them, i.e. to decide, act, propose, defend, etc., or simply to be responsible. Therefore, in this social setting, the role of the Ombudsman gains importance. The Ombudsman as an institution influences and promotes the ethics, and responsibility of public servants, and through its acting towards complaints of human rights violations, it directly targets the unlawfulness, abuse of power, and unfair behaviour (Pliscoff, 2019).

Unclear administrative procedures additionally burdened with various bureaucratic manoeuvres can directly affect the protection of citizens' rights. As a result of past legacies, the administrative state was (and still is to some extent) highly bureaucratic, and hence, under the influence of EU integration processes, it can be observed that established concepts and related understandings are already changing. As a result, the state is becoming more service-oriented toward citizens and more aware that the services provided should be within the framework of legality and the principles of the rule of law (Leyland and Anthony, 2016). By failing to act or acting outside the established legal competencies, the rights of the citizen are affected, especially the rights of those who are marginalized and stigmatized by the majority community (such as homosexuals, transgender people, people with disabilities, and even in some cases women).

Although the duties, powers, and procedures of the Ombudsman vary from country to country, increased awareness of human rights has paved the way for the specification of international standards related to the structure and powers that the institution should have. In this regard, there are numerous regional and international initiatives, as well as international organizations that assist the standardization process. In addition to establishing standards for the structure and functioning of the Ombudsman, another issue is need to assess the effectiveness of the work of a particular institution (Zahid Sobaci and Hatipoğlu, 2023).

3.2.3 Classical vs. Human Rights Ombudsman in Upholding Good Governance Principles

In theory and practice, there is a division between classical and human rights ombudsmen, and those two models or a hybrid one can be found in most European countries, considering their role in promoting good governance by monitoring administrative behaviour and protecting and promoting human rights. The classical model is often in Scandinavian countries (to which competencies over jurisdiction to human rights are given in addition to their primary role in administrative justice), while the human rights Ombudsman and hybrid ones are typical for the countries that transitioned to democracy, mostly Eastern European countries. The Ombudsman institutions play a variety of roles in building good governance by monitoring the administrative activity in the country and in protecting and promoting human rights. Their acting can be observed by monitoring the “legality” of the public administration, embracing notions of equality, fairness, and good governance. Human rights monitoring is mainly considered an enlargement of the classical or initial role of the Ombudsman after functioning for a relatively long time (for example Sweden, Finland, Netherlands, etc.). On the other hand, when it comes to the younger democracies, the typical model is human rights, or hybrid model of the Ombudsman with priority in its human rights protection function. The efforts of the Ombudsman which follows the classical model, are more visible in the promotion of good governance in public administration, and its additional competencies in human rights contribute to monitoring of a state’s compliance with human rights obligations. In that sense, the direct use of human rights norms can be used to determine if the administrative conduct is in line with the laws. For instance, in the Netherlands, the Ombudsman uses human rights norms as “orientation criteria” in the assessment of the administrative conduct that is in question. The classical Ombudsman institution investigates administrative conduct if the administration violates the legal interests of the individual if the administration is not fulfilling specific obligations imposed by an administrative act, or in cases when the administration by its acting violates the principles of good administration and transparency. This example can be found in Greece where the institution is considered to be a human rights Ombudsman with classical ombudsman powers, but the majority of complaints are against poor administrative practices and not human rights protection (Reif, 2004).

The Human Rights Ombudsman, as an institution mainly occurred after the collapse of the Soviet Union and the beginnings of the democratization of Central and Eastern Europe. In their attempts to establish democracies, these countries started to redesign or create new institutions that would enhance the rule of law, overcome bureaucratic practices, and improve human rights records. Therefore, the countries established national human rights institutions, attempting in the same time, and within the same institution to address human rights protection and poor administration. Those institutions often have a predominated mandate and that is human rights protection. In essence that is misleading, since although the term “ombudsman” is

used, most of those institutions are close to the Human Rights Commission model, instead of institutions that have a mandate to protect administrative justice. There are theoreticians who argue that the role of the human rights Ombudsman is more important in the countries that went through the transition to democracy (the ones in Central and Eastern Europe, in comparison to the established democracies) since the Ombudsman can help in the development of democracy, strengthen the rule of law and influence the modernization of the state institutions. Through its acting it can draw attention to needed legislative changes, harmonization of the laws, reform of the structure and the institutions of the government, and change of the public authorities' practices (Bizjak, 2001).

Nevertheless, classical and hybrid Ombudsman institutions play a crucial role in fostering democratic accountability and development by functioning as both horizontal and vertical mechanisms of oversight within a democratic state. This dual role enables Ombudsmen to enhance the effectiveness of public administration while contributing to the broader objectives of good governance. The Ombudsman institutions are increasingly seen as instrumental in achieving good governance, which is often linked with public administration and human rights protection. In many countries, the executive branch has historically dominated governance, often at the expense of weaker legislative and judicial branches, prompting efforts to strengthen these institutions, particularly during democratic transitions or post-conflict reconstruction. These efforts frequently involve reforming the executive or administrative branches to address legacies of authoritarian rule, human rights violations, administrative inefficiency, corruption, and the absence of democratic norms. Establishing classical or hybrid Ombudsman institutions has become a common response, with the aim of enhancing accountability and promoting democratic governance. These institutions—especially hybrid ones with mandates in human rights protection, anti-corruption, or enforcement of leadership codes—function as mechanisms of horizontal accountability by independently investigating administrative conduct, recommending legal or policy reforms, reporting to legislatures and the public, and in some cases, initiating legal action. However, the effectiveness of an Ombudsman is closely tied to the quality of democracy in a given state; in states lacking democratic structures, Ombudsmen face significant operational challenges, and any regression in democratic governance can directly impair their ability to function. In a well-functioning democracy, Ombudsman institutions help ensure that the administrative branch remains accountable to the public and operates within legal and ethical boundaries (Reif, 2004).

For an Ombudsman institution to serve effectively as a mechanism of horizontal accountability, it must be structurally independent of the executive or administrative branch of government—a fundamental requirement—along with other factors that influence its overall effectiveness. Vertical accountability is often associated with the ability of citizens to hold leaders accountable through regular, free, and fair elections. However, the Ombudsman enhances this process by allowing individuals to file complaints about unlawful or unjust

administrative behaviour. In doing so, they subject government conduct to impartial review, potentially resulting in criticism or, where empowered, more substantial consequences. In that way, the Ombudsman reinforces democratic governance and positions it closely with the principles of good governance. By working to improve all the core elements such as transparency of public administration, the accountability of public authorities, public participation, and application of principles of fairness, the Ombudsmen institutions help in building good governance.

It is obvious that at some point, the Ombudsman as a concept and even as an institution was removed from its legal roots in the administrative law (Erkila, 2020). It expanded outside the Scandinavian context since it was mainly seen as a country milestone towards democratic accountability and good governance. After the collapse of totalitarianism, within the countries in Europe that established them, the institutions were modified and adjusted to the specific social, economic, cultural, and political contexts upon which the success of the institution depended. This novelty of the institution affected its legitimacy and public perception, considered to be even at some point "a legal transplant." Those issues have to be borne in mind when assessing the efficiency of a particular institution in protecting good governance principles. It is without doubt the institution's effectiveness will be limited if it is dependent on the executive. This could create a 'patron-client relationship', and in general will influence not only public perception but also well perception of the administrative institutions towards it. The effectiveness depends on the function that has been given to the institution, but on the other hand, it depends on the personality of the office holder. Lack of responsiveness of all public authorities and less proactivity in some cases led to the phenomenon of 'institutional hypocrisy', where the institution finds the reasons for ineffectiveness in a lack of resources, although in most cases the institution's effectiveness depends upon office holder authority, the public support that enjoys as well as the responsiveness of all public authorities towards the institution (Dragos, 2021).

As it is now, in younger democracies, the Ombudsman Institution's primary role appears to focus more on providing an additional layer of constitutional oversight rather than ensuring the implementation of good governance principles by the administration. However, its effectiveness must be understood within the broader context of the country's democratic tradition, whereas the institution is often seen more as symbolic affirmations of democratic values than as practical tools for enforcing accountability and administrative integrity (Balica, 2011). The mere establishment of the Ombudsman Institution, as outlined in the Constitution and its governing statute, has not automatically led to enhanced legal protection for citizens in their interactions with public authorities. Its effective implementation depends on time, the presence of a democratic framework, a supportive legal and political culture, as well as general level of democracy (Dragos, 2021).

There are certain theoretical debates accompanied with some empirical evidence, that are assessing the capacities of the Ombudsman institution in de-

veloping the norms of good administration (Dragos & Neamtu, 2017). Based on the powers that has, the Ombudsman institutions are classified as basic or classical model, the rule of law model, and the Ombudsman that follows the human rights model (Kucsko-Stadlmayer, 2008). If the standards of assessments are applied that take into consideration the legal norms, the good administration principles, and human rights (Remac, 2014), arguably only in the systems where the good administration is used as the main standard of assessment, the Ombudsmen can provide content, and the institution have more potential to materially develop the concept of good administration materially. The examples of their acting can include checklists for good administrative practice, the codes of good administrative behaviours, as well as taking initiatives to tackle the existing and systemic maladministration. On the other hand, other types of Ombudsmen will be limited in that regard, and can only apply the existing legal provisions within the initiated cases. Even in a sort of advanced model, this limitation can be observed in the case of the EU Ombudsman as well, where the institution is developer of norms of good administration predominately in the area of free access to information, but has a rather limited role as developer of norms of good administration through individual decisions. However, the power to apply and to present the principles understandably should not be underestimated in creating good administration norms, although legally this can be more seen as an interpretation, and giving meaning to the existing principles (Dragos & Neamtu, 2017).

3.2.4 EU Practices

Considering the EU practices, the European Administrative Space is a growing body of European administrative standards. The administrative convergence of the EU is also reflected through the general administrative procedures. One of the most recent initiatives is the codification of the EU administrative procedural law as Model Rules applicable to all procedures carried out by the EU institutions, bodies, offices, and agencies. In South-Eastern Europe, the ongoing reforms of the general administrative procedural acts are an interaction between the legalistic tradition and the political and managerial pressure for the rationalization of public administration. The general administrative procedure is one of the key components in the system of legal protection of citizens. This system is complex and consists of an interdependent set of legally regulated institutions, procedural protection in public administration, national and international judicial control over administrative acts and actions, judicial protection of constitutional rights (most often in constitutional courts), and among them protection through the Ombudsman. It guarantees of open access to the public information and protection of human rights and fundamental freedoms. All these efforts are in line with the right to good administration, part of the Charter of Fundamental Rights of the EU (2000), stipulated in Article 41. The right to good administration indicates that every person has the right to have his or her affairs handled impartially, fairly, and within a reasonable time by the institutions, bodies, offices, and agencies of the Union. This right includes (a) the right of every person to be heard, before any individual measure that would adversely affect him or her is taken; (b) the

right of every person to have access to his or her file, while respecting the legitimate interests of confidentiality and professional and business secrecy; (c) the obligation of the administration to give reasons for its decisions. Every person has the right to have the Union reimburse any damage caused by its institutions or by its servants in the performance of their duties, under the general principles common to the laws of the Member States. Every person may write to the institutions of the Union in one of the languages of the Treaties and must have an answer in the same language (European Union, 2000).

The European Code of Good Administrative Behaviour is a European Ombudsman's document, that in 2002 was approved by the European Parliament. The Code shares best practices and promotes – within the institutions and beyond – a harmonized European citizen-centered administrative culture that listens to and learns from, interactions with citizens, businesses, and stakeholders. The Code is a guide to practical steps towards greater effectiveness, transparency, and accountability of public administration. All European citizens and residents benefit from good administration. The European Code of Good Administrative Behaviour is a vital instrument for putting the principle of good administration into practice. It helps citizens understand and exercise their rights and promotes the public interest in an open, efficient, and independent European administration. Creating an agreed and harmonized service culture in the EU is increasingly challenging, and the institutions are becoming aware of the practical business case for a citizen-centered approach. The Code therefore concretises the concept of good administration and encourages administrations to reach the highest standards. It also acts to raise citizens' awareness of what administrative standards they have the right to expect and serves as a useful guide for civil servants in their relations with the public (European Code, 2002). Therefore, the Code strongly affirms the Ombudsman role in protecting good governance principles.

3.3 The Ombudsman in North Macedonia

The protection of citizens from the decisions of state bodies is a contemporary process and follows recent developments in which the citizen is perceived as the essence of the modern administrative state. Based on that position, the state has various duties and this encompasses the responsibility of administrative bodies, as well as legal remedies that are available to citizens faced with abuse of power. The direct impact on the protection of human rights can also be seen in the legal framework of North Macedonia regarding fundamental rights, which is largely in line with European standards. However, some mechanisms are not yet fully functional and they are a potential barrier to the full enjoyment of the granted rights. This particularly affects those whose rights are most often threatened and highlights the role of the Ombudsman as a guardian of citizens' rights concerning the public administration. The Ombudsman in North Macedonia is a human rights Ombudsman (*Народен правобранител*), and that role is predominant. The Ombudsman mainly deals with the complaints concerning the treatment of persons deprived of their liberty (e.g. detainees, prisoners, persons in psychiatric facilities), police con-

duct, property rights, social and economic rights, and unreasonable delays in obtaining decisions in court and administrative proceedings feature prominently. That differs from the classical Ombudsman's primary role is to investigate the complaints that consider that the administration of government was conducted in an illegal, unfair, or improper manner. Although appointed by the legislative, its nomination is done by the executive, making it a less independent institution, whereas both the executive and the legislative branches are not very responsive to the recommendations and reports of the Human Rights Ombudsman.

3.3.1 Legal Framework

According to the Constitution of the North Macedonia (North Macedonia) (1991) (article 77 and Constitutional amendment XI), and the Law on the Ombudsman (2003), the Ombudsman is an independent national institution with the authority to protect the human rights and freedoms of individuals or groups of citizens when they are violated by the state authorities. The Law on the Ombudsman stipulates the condition for election, dismissal, competences and way for working of the Ombudsman (Law on the Ombudsman 2003, article 1). The Ombudsman is elected for a term of eight years, with the right to one more election (Constitution of the Republic of North Macedonia, 1991, article 77). The election of the Ombudsman is upon so called *Badinter majority*, under which the Parliament elects the Ombudsman with a majority of votes from the total number of Members of Parliament, whereby there must be a majority of votes from the total number of Members of Parliament belonging to communities that are not in the majority in North Macedonia (Constitution of the Republic of North Macedonia, 1991, Constitutional amendment XI). Upon the Constitution and the Law, the Ombudsman is a body that protects the constitutional and legal rights of the citizens and any other individuals when they are violated with the acts and omissions of the bodies of the state administration and others institutions and bodies that have public authorities (Constitution of the Republic of North Macedonia, 1991, article 77; Law on the Ombudsman 2003, article 2). The Ombudsman's powers do not extend to the private sector or the judiciary, except in cases of unjustified delay in the court procedure or irresponsibility of the judicial services (Law on the Ombudsman 2003, article 12). In this sense, the Ombudsman has no legislative, executive, or judicial powers and is neither a prosecution body nor an inspection body. The Ombudsman is a control mechanism that intervenes with proposals, suggestions, recommendations, etc. Its role is ethical and moral and its activities are primarily aimed towards promoting and improving the efficient and effective operation of public administration, so the citizens and other individuals can exercise of their rights. The Ombudsman has an educational and advisory role as well (ombudsman.mk).

Summarized, the principles that underpin the work of the Ombudsman are independence, impartiality, professionalism, conscientiousness, objectivity, accountability, and urgency in terms of promoting, respecting, and protecting human rights and freedoms. The Ombudsman is independent in perform-

ing its function. It performs its competences according and within the frame of Constitution, law and international agreements that are ratified upon the Constitution. In its acting, the Ombudsman can call as well upon the principle of fairness (Law on the Ombudsman 2003, article 3). The Ombudsman of the Republic of North Macedonia received additional responsibility with the adoption of the Ohrid Framework Agreement in 2001. Namely, according to the Law and in practice the Ombudsman takes the measures for protection of the principles of non-discrimination and equitable and fair representation of the members of the communities in the bodies of the central power, the local - self-government unities and public institutions and services (Law on the Ombudsman 2003, article 2), i.e. in all state and local government bodies and public institutions.

Every person in communication with the Ombudsman can use one of the country official languages and its script, and the institution responds on the Macedonian language and its Cyrillic script as well as on the official language and script used by the one who submitted the appeal (Law on the Ombudsman 2003, article 15). The appeal should consist the data about the applicant, as well as the circumstances, facts and proves upon the appeal is based, however there is no mandatory form that need to be followed during the submission, neither process or tax fees (Law on the Ombudsman 2003, article 16).

The new draft Law on the Ombudsman (which is still not brought by the Parliament), among other things, it predicts full implementation of the Paris Principles,¹ and financial independence as the basis for the functioning of the institution (Draft Law for amend and supplement the Law on the Ombudsman, 2025; ombudsman.mk).

3.3.2 The Work of the Ombudsman

Through its activities, the Ombudsman indirectly improves the functioning of public administration and contributes to good governance. The Ombudsman acts towards achievement of democratic standards. It intervenes: when the acts and activities of administrative bodies and other bodies within the public sector violate the individual rights of citizens and non-citizens; when responsible persons or other civil servants have incorrectly adopted administrative acts, incorrectly applied the laws; when they violated administrative or other procedures; when they arbitrarily or incorrectly undertaken activities; and when they discriminated against people on any basis or behaved inhumanely. Considering its work the Ombudsman creates annual reports that are publicly presented and accepted in the Parliamentary session, and upon them, the

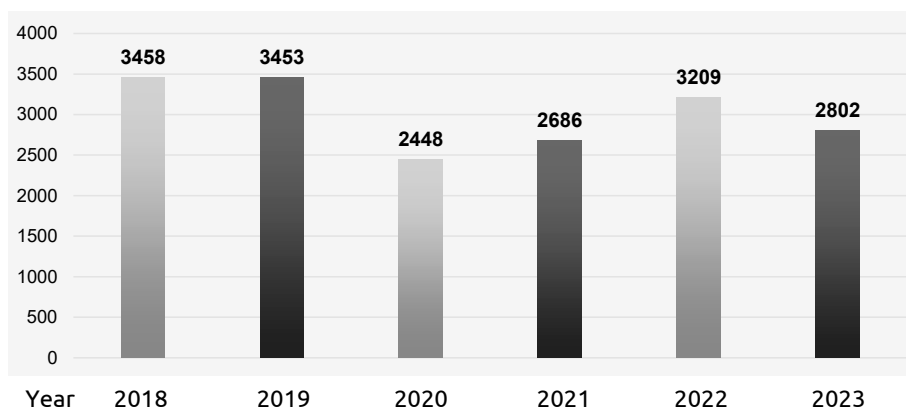
¹ The Paris Principles, adopted by the UN General Assembly in 1993 (Resolution A/RES/48/134), set out the following standards: Establishment under primary law or a constitution; Broad mandate to promote and protect human rights; Formal and functional independence; Pluralism, representing all aspects of society; Adequate resources and financial autonomy; Freedom to address any human rights issue; Annual report on the national human rights situation; Cooperation with national and international actors, including civil society. The accreditation process is essential as it demonstrates the credibility of the institution and ensures that these principles are applied in the national context, <<https://ennhri.org/about-nhris/un-paris-principles-and-accreditation/>>.

measures are created for the institutions to correct their behavior and improve human rights status.

If we analyze the Annual reports of the Ombudsman office work in North Macedonia, in the last five years, that are available to the public, we can observe many discrepancies.

Annually, approximately, in North Macedonia there are around 3000 complaints directed to the Ombudsman office, which is quite a lot for the country that has less than 2 million inhabitants.

Table 1: Number of the complains directed to the Ombudsman office per year.



Source: The Annual Report of the Ombudsman on the degree of granting, upholding, enhancement and protection of the human rights and freedoms, 2023.

The complaints that Ombudsman office receives annually, are the most numerous in the area of justice, followed by the complaints in labour relations, children's rights, penal – correctional and educational institutions.

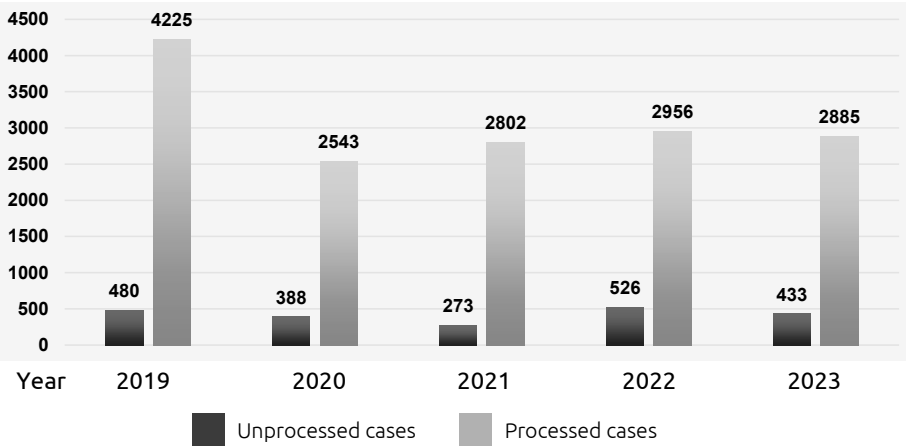
Table 2: The areas in which the complains are submitted per year.

	2018	2019	2020	2021	2022	2023
Judiciary	945	639	406	436	534	488
Labor relations	335	282	258	218	288	267
Children's rights	153	246	111	254	252	231
Penal – correctional inst.	247	267	166	162	206	166
Other	1778	2019	1507	1616	1929	1650
Total	3458	3453	2448	2686	3209	2802

Source: The Annual Report of the Ombudsman on the degree of granting, upholding, enhancement and protection of the human rights and freedoms, 2023.

Approximately 1/3 of the received cases are not processes in the ongoing year, meaning the office does not have sufficient capacities to proceed all the received complains annually.

Table 3: The number of the processed cases by the Ombudsman office vis a vis non processed cases per year.

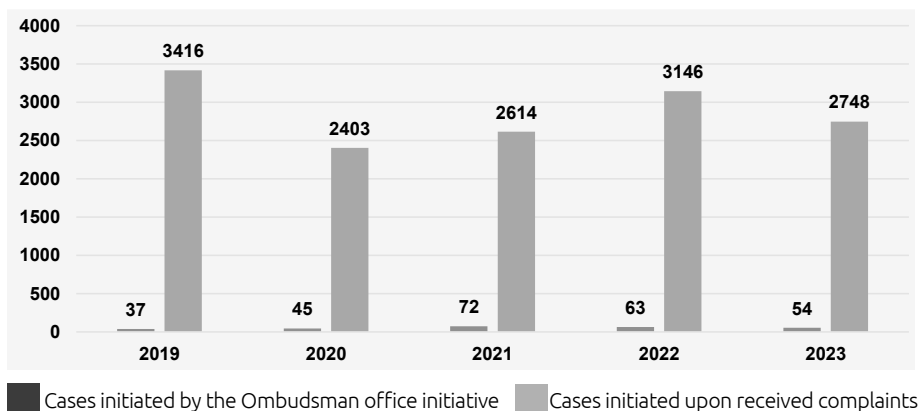


Source: Data from the Annual reports of the Ombudsman on the degree of granting, upholding, enhancement and protection of the human rights and freedoms, for years 2019–2023, compiled and processed by CCM.

Most of the cases are initiated upon individual complaints, or complains logged by the CSOs or group of citizens, and a very small number are initiated by the Ombudsman office. For example, in 2023, only 1,93% cases are formed by the Ombudsman office own initiative, i.e. upon “heard voice” (Annual Report, 2023). That can be accounted to the Ombudsman office lack in equipped personnel and understaffed, but as well as the restrictions that institution faces as a result of its semi-independent position within the political system and its codependence on the other institutions (for example Ministry of Finance approval over the Ombudsman institution budget, etc.). Additionally, still six out of ten Deputy Ombudspersons are not yet elected by the Parliament (European Commission, 2024).

When processed and directed towards the public institutions, at the first indication only in 20% of the institutions are acting and responding. This number increases as the Ombudsman office repeats its quests. The number of 20% corresponds only with response towards Ombudsman office, and does not indicates resolving of the cases, or acting upon Ombudsman remarks. This clearly shows that institutionally and practically, the Ombudsman office inquires do not have such a strong impact over the concerned institutions.

Table 4: Cases initiated by the Ombudsman own initiative *vis a vis* complains lodged by the other parties' complaints.

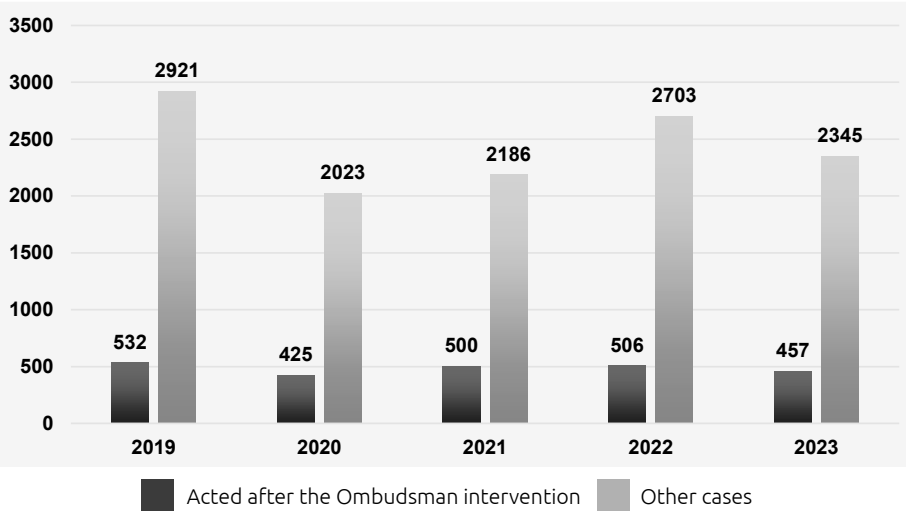


Source: data from the Annual reports of the Ombudsman on the degree of granting, upholding, enhancement and protection of the human rights and freedoms, for years 2019-2023, compiled and processed by CCM.

Based on the interviews conducted with the relevant officials, the institutions in the public sector are often reluctant towards Ombudsman office findings. Additionally, its annual reports that summarize office work in one calendar year reflecting the human rights situation in the country, are not seriously taken into account by the public sector. Often the Ombudsman's Annual Report is adopted late, at the last yearly session of the Parliament, and due to the short deadline, there is no debate in regards the implementation of the recommendations part of the previous annual report. According to the deputy Ombudsman, in the last two years, no measures have been adopted that need to be followed up, but only recommendations (Interview with Deputy Ombudsman Jovan Andonovski). Considering the implementation of the right to good administration and principles of good governance, the Ombudsman office does not keep separate statistics on complaints against the administration in respect of the legality, transparency, accountability, responsibility, conflict of interest, use of discretionary powers, etc., or at least they are not public. The reasons for this can be found in the challenges that the institution generally faces and its primary focus on the field on human rights protection instead of monitoring of the administrative conducts. As a result of its obviously weak position within the political system, according to the obtained insights, in general, only 50% of the institutions are responding to the Ombudsman's remarks; 30% of them react only after a second, or a third indication that they have not responded; and 15% of the institutions never respond to the Ombudsman inquiries. Considering the responses that Ombudsman receives, 40% of them are strictly formal, indicating that the remark was received and the institution will consider it, and 60% are content-wise. The ones that evade the most the Ombudsman remarks are the bodies that have special powers (Commissions, Agencies, etc.), as well as the prosecutor's offices, the Ministry of Internal Affairs, and the National Security Agency. How-

ever, after verification that there has been a violation of the law in respect to the human rights, the number of the institutions that are acting towards Ombudsman’s recommendations increases up to the 70% in total. When there is no response from the appropriate institution, the Ombudsman addresses the hierarchically higher authority, and in 2023, that happened 22 times. Although certain issues require a confrontation between the Ombudsman and the authority to which it relates, the Government does not organize such discussions. The institution authority is not called to explain its position, and the Government only relies to the given answer in written form. That does not mean that the answer is adequate, considers the Ombudsman in office Naser Ziberi (Interview with Ombudsman Naser Ziberi). In addition, the Ombudsman as an institution does not enjoy full independence but is dependent in respect of the personnel, finances, and facilities. The institution does not have a sufficient budget to fully exercise its powers, as well as to network within international and regional associations of Ombudsman (Sakam da kazam, 2016). The Macedonian Ombudsman cooperates with the European Ombudsman, but in the European Ombudsman Association is a member - observer, i.e. an institution with status B, precisely because of its dependent position.

Table 5: The cases upon the institutions acted after the Ombudsman intervention vis a vis the cases that haven’t been any actions even after the Ombudsman intervention per year.



Source: data from the Annual reports of the Ombudsman on the degree of granting, upholding, enhancement and protection of the human rights and freedoms, for years 2019-2023, compiled and processed by CCM.

4 Discussion

The Ombudsman in its acting supports the principle of good governance and helps to reach democratic standards. In protecting human rights, the Ombudsman’s office does not make binding decisions and impose sanctions;

however, it has strong, informal power that exceeds the formal limits and directly influences society. It is evident that in North Macedonia the Ombudsman's role in promoting good governance principles is not so prominent, and to take a step forward the institution itself should get a more notable place in the democratic system that has tendencies to join the EU. The standards should be in place, and aligned with EU standards, but even more, a strong emphasis should be given to their implementation. To begin with, the extent to which institutions cooperate with the Ombudsman's Office has to increase. Nonetheless, the cooperation is not a result of success but a level of institutional response towards the Ombudsman's remarks. It is without doubt that this is not in consideration of a formal, provisional response, but it is related to the response that systematically and coherently addressed the Ombudsman's remarks. That non responsiveness points towards low level of public accountability of the public authorities and the public administration. Besides the responsibility related to the institutional responsiveness to the Ombudsman remarks, the Ombudsman office needs to ensure a more systematic way for monitoring the implementation of its findings, as well as to measure implementation progress when addressing indicated shortcomings. That will increase the general transparency. Those aspects are important because in North Macedonia the citizens' right to good administration is supported by the legal framework, but its implementation remains highly questionable, and even it in North Macedonia is a human right Ombudsman, the right to good governance is as well a right that has to be protected. Considering the general remarks about the functioning of the administration, that right is constantly violated since the institutions are not proactively publishing public data, the administrative disputes are unreasonably delayed, the appeal procedures are complex and lengthy, and the procedural shortcomings are common (European Commission, 2023). Additionally, the debates in Parliament on Ombudsman reports are very limited, and there is need the Ombudsman findings and recommendations to be followed up more systematically and that can increase public scrutiny over the work of the authorities, as well over the work of the Ombudsman institution. All of that indicated above is pointing that so far there has been lack of developments and progress related to the citizens' rights to good administration (European Commission, 2024).

To improve this situation, the Ombudsman's role in general needs to be strengthened, and at the same time to be promoted as one of the mechanisms that should secure good governance principles and effectuate the right to good administration. Being the candidate country for EU membership, North Macedonia's public sector should raise up to certain standards (European Commission, 2024).

It is without doubt that the Ombudsman should fully implement legally given competencies. The most important power at the Ombudsman's disposal is the publication of its annual reports. These reports carry significant moral and political weight, which should lead to voluntary compliance by institutions towards Ombudsman's remarks. This activity creates pressure on public officeholders and public institutions and it increases their accountability

(Sobaci and Hatipoğlu, 2023). Given the scope of work and diversity of the Ombudsman activity, the aspect of good governance needs to be stressed whereas the special reports need to be created that investigate systemic deficiencies in the administrative system. Through this activity, the Ombudsman can contribute towards achieving good governance standards, a topic that is particularly relevant not only for the EU candidate countries but also for EU member states. Creating a common administrative space, in which EU citizens can protect their rights concerning the European administration precisely through the European Ombudsman, is proof of that (ComPact, 2023). Such a commitment in North Macedonia would not discredit the rest of the Ombudsman's work but it will strengthen it. In this way, a general overview of the administration's acting toward citizens' rights would be secured, and the rights related to the separate categories of citizens (prisoners, residents of psychiatric institutions, the elderly, children...) could be a part of separate, special reports that will promote the work of the Ombudsman as a human rights defender. Currently, the annual reports of the Office of the Ombudsman in North Macedonia have been focusing on the protection of the rights of numerous categories of citizens, but not on the general acting of the administration that violates those rights. The more focused approach will effectuate the principles of good governance and in the same time will secure more scrutiny over human rights protection. Additionally, following the European Code of Good Governance (European Code, 2002), the Ombudsman of North Macedonia can create a National Code of Good Governance, as a set of standards that citizens can expect from the administrative acting. The Ombudsman should also keep separate statistics on complaints against the administration regarding the right to good administration that in itself embodies the good governance principles (legality, transparency, accountability, responsibility, conflict of interest, discretionary powers, etc.). To secure its role as a promotor of good governance principles, the Ombudsman institution should create not only quantitative but qualitative reports related to the work of the administration that can be publicized periodically. To achieve this, cooperation with the European Ombudsman should be strengthened and the EU's good practices should be considered. In these endeavours, the Ombudsman should really on media support. The media and the civil society sector can help the institution to put pressure, influence public opinion, as well as to encourage citizen activism aimed at change (Sobaci and Hatipoğlu, 2023). The role of the Ombudsman is greater than simply handling complaints, and the institution should be focused more on raising public awareness about the general effectiveness and efficiency of the public administration (Interview with State Counselor in the Ombudsman's Office, Vaska Bajramovska Mustafa). Additionally, to achieve the above-mentioned standards, and towards the successful functioning of the Ombudsman institution in general, it is necessary to monitor the institutional implementation of the recommendations arising from it. This will put pressure on the administration and will strengthen responsibility and accountability in the implementation of these recommendations, which are again in the direction of good governance protection. These special efforts will help towards society democratization that in recent

years has been in decline (n.b. For instance, the latest democracy index points that the Republic of North Macedonia is ranked 68th out of 210 countries and territories in the world, as a partially free country in the exercise of civil liberties and rights, Freedom House, 2024).

The tendency towards EU membership and public administration reforms can help in those endeavours, but so far, the EU recommendations have not been addressed consistently, and the European Commission is repeating them yearly. The Commission is notifying the lack of Parliamentary consensus for adopting important laws related to public administration reform, as well as the laws that were supposed to improve the status of the Ombudsman's office. The debate in the Parliament on the reports of the Ombudsman continued to be very limited and the Commission pointed to the absence of progress in citizens' rights to good administration. This has to be further addressed as well as the need for the allocation of the necessary resources for the Ombudsman Office to be able to fulfil its mandate (European Commission, 2024). Apart from this, the financial independence of the institution has to be strengthened. In this line, it is important to mention that the State Audit Office recently identified systemic weaknesses, i.e. pointed out inconsistent and imprecise legal regulations that regulate the status, rights, and obligations of the Ombudsman's office employees, as well as the procedure for the election and appointment of the Ombudsman's deputies (State Audit Office, 2023). All of these recommendations are recurrent but there is no systematic response towards them yet.

Despite technical and legal challenges, in addition to responding to the citizens' complaints, the Ombudsman should also act on his own initiative and so far, the institution is not so notably proactive. The Ombudsman needs to maintain neutrality, but also to ensure due respect in society. For the Ombudsman to be successful, citizens need to believe that their complaints will have a result and that the actions taken by the institutions will be objective. The integrity of the Ombudsman contributes to increasing citizens' trust in the Ombudsman institution, as well as in the public institutions. Citizens should have a high awareness of the institution; they should be informed about the procedures before it and the institution should always be accessible. To increase the visibility of the institution and emphasize its practical work, in addition to legal requirements, modern technical solutions are undoubtedly needed.

All those factors affect the success of the institution but also point to weaknesses where action needs to be taken. To improve, continuous efforts are necessary to address the shortcomings that are continuously highlighted by current and former responsible persons of the Ombudsman office, as well as by the professional and general public. In North Macedonia, the Ombudsman's Office has good cooperation with the media and civil sector, but there is a need for even stronger cooperation. In addition to appropriate legal and technical solutions, for the effectiveness of the Ombudsman, it is essential to have high standards of democracy and civic awareness that are mutually interconnected.

5 Conclusion

This paper is based on research aimed at understanding the role of the Ombudsman in upholding the principles of good governance, specifically in protecting and promoting citizens' rights in a democratic framework. The research focused on the work of the Ombudsman in North Macedonia, examining its authority over public institutions and the services they provide to citizens. The Ombudsman is empowered to protect the human rights and freedoms of individuals or groups when they are violated by state authorities. It is a flexible and dynamic institution. Many countries around the world have established an Ombudsman institution at different levels of government (national, state, regional, and local), for different social groups (such as the disabled, children, women, and minorities) and in different sectors (such as universities, media, health services, etc.). However, it is difficult to say that the Ombudsman institution is very powerful and functions successfully in every country. For a powerful Ombudsman, some requirements need to be met, including maintaining the independence of the institution. A prerequisite for this is that the functioning of the Ombudsman institution is guaranteed by a constitution and laws, and this relates to the appointment of the Ombudsman and its conditions regarding the repeatability and duration of the mandate, and the resources that are at the institution's disposal.

The Ombudsman also contributes to the efficient and effective operation of public administration, helps achieve democratic standards, and promotes the principles of good governance. However, the Ombudsman in North Macedonia faces several challenges. It does not maintain separate statistics for complaints against the administration (upon the right to good administration), or if such statistics exist, they are not made public. There is also a weak response from the public institutions to the Ombudsman's remarks, including missed hearings before the Government, delayed adoption of annual reports by the Parliament, and absence of subsequent measures that should address the Ombudsman's remarks. Moreover, the Ombudsman institution does not enjoy complete independence. It is crucial to highlight the role of the Ombudsman in fostering good governance—a necessary condition for the protection of citizens' rights. Systematic monitoring of the achievement of standards in this area is essential.

There is no doubt that changes towards a modern Ombudsman institution are needed in North Macedonia not only for upholding human rights but also for democratization and protection and promotion of good governance principles. It is evident that the Ombudsman of North Macedonia is not operating at its full potential in contributing to administrative efficiency and the promotion of good governance principles. Its engagement in these areas can be characterized as moderate at best, and response of the public authorities towards its findings notably limited. This underperformance stems not only from systemic barriers—such as legal, institutional, and resource-related constraints—but also from internal shortcomings, including moderate to low level of self-initiative, i.e. an inclination toward passivity in addressing key governance challenges.

5.1 Recommendations for Improvement

Based on the conduct research and performed analysis, several recommendations can be envisaged. To strengthen the role and impact of the Ombudsman, there is need to modernize and reinforce both its internal methodology of working and its external influence over the system of governance. To begin with, the Ombudsman's Annual Report should be revised to reflect the principles of good governance—principles that are especially significant in the context of the European Union and its commitment to a shared administrative space. Therefore, a fresh approach to the structure and preparation of the Annual Reports is needed. Rather than compiling a single comprehensive report, the Ombudsman should consider separating findings into thematic reports, each dedicated to specific vulnerable groups—such as prisoners, individuals in psychiatric institutions, and elderly people, as well as compiling a special report that will deal with defects and flows of the administrative acting. This would allow for more detailed analyses and targeted policy responses. Equally important is the need for systematic monitoring of the implementation of the Ombudsman's recommendations. Public administration should not only be informed of these findings but held accountable for addressing them. This is a two-sided aspect, but for the general aspects of accountability, it is crucial that the Annual Report is reviewed in a timely manner—well before the final annual parliamentary session. Early review would enable substantive debate on the level of implementation of previous recommendations, allow space for the adoption of new measures based on the latest findings and keep the public institution accountable for their acting or omission to act. In that respect, both the Government and Parliament must assume responsibility for responding to the Ombudsman's reports. Their inaction, or failure to follow up on critical issues, should be subject to scrutiny. At the same time, the visibility of the Ombudsman must be increased. Citizens need to be more aware of the institution's protective role, and public administration should recognize it as a vital check on executive power. The introduction of a National Code of Good Administration—that can be modelled like the European Code—could serve as a practical tool to standardize administrative behaviour and improve service delivery. Education is also key. Both citizens and public servants should be informed about the Ombudsman's work and its importance in safeguarding rights. Public institutions, in turn, should become more proactive in engaging with the Ombudsman's office and acting on its guidance. Finally, to truly empower the Ombudsman, systemic barriers must be dismantled. This includes enacting legal reforms that solidify the office's authority, and ensuring its operational independence through adequate staffing, space, and financial resources. Legal and administrative reforms should not take place in isolation; they must be accompanied by improvements in the overall political climate and the strengthening of democratic values and practices. Only under such conditions can the Ombudsman effectively carry out its mandate to protect human rights and in the same time to promote good governance principles.

This article is a revised version of the monograph entitled “Народниот правобранител во заштита на правото на добра администрација” (The Ombudsman in the protection of the right to good administration), and a result of the project “Enhancement of Governance and Public Administration Reforms” funded by the National Endowment for Democracy (NED) and implemented by the Center for Change Management (CCM).

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Beyond the Speculation: Mapping the Real Impacts of Digitalization on the Slovenian Healthcare Business Model

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ABSTRACT

Purpose: The increasing digitalization of healthcare systems worldwide has been welcomed as a transformative force, yet its actual effects on healthcare business models remain underexplored. Moving beyond the speculation and overly optimistic expectations, this study examines the real impacts of digitalization on the Slovenian healthcare business model.

Methodology: A qualitative research approach was employed, combining a comprehensive literature review with semi-structured online surveys. The study surveyed 20 prominent experts responsible for managing national eHealth solutions in Slovenia. Content analysis was used to capture the perspectives of participating experts and systematically map the real impacts of digitalization on the Slovenian healthcare business model.

Findings: Results indicate that digitalization significantly impacts the healthcare business model by improving operational efficiency and care coordination, optimizing data accessibility and management, and enhancing patient engagement. However, due to structural and systemic challenges, the impacts of digitalization on the Slovenian healthcare business model remain relatively limited at this stage and largely depend on the effective alignment of technological advancements with health, business, organizational, and socio-economic factors.

Practical implications: The findings emphasize that digitalization in healthcare should not be regarded merely as a technological endeavour, but as a strategic driver of comprehensive healthcare and business transformation. For healthcare managers and policymakers, this means

investing not only in digital infrastructure but also in governance, organizational processes, business operations, and social dimensions. By doing so, they can maximize the benefits of digital solutions, reduce inefficiencies, and create a more sustainable, patient-centred healthcare system. The study may assist leaders to identify bottlenecks and prioritize actions that ensure digitalization can bring measurable improvements in service delivery and public health outcomes.

Originality: This research contributes novel insights by providing one of the few empirical analyses of digitalization's impacts on the Slovenian healthcare business model. Rather than relying on assumptions or normative expectations, it integrates the viewpoints of leading national eHealth experts and contextualizes them within broader structural and systemic framework. The study adds value by bridging the gap between global discourses on digital transformation and the realities of a small national healthcare system, thus offering lessons transferable to other countries facing similar challenges of scale, resources, and institutional inertia.

Keywords: business model, digitalization, healthcare system, impacts, qualitative research

Onkraj špekulacij: oris dejanskih vplivov digitalizacije na slovenski poslovni model zdravstvenega varstva

POVZETEK

Namen: čedalje večja digitalizacija zdravstvenih sistemov po svetu je dobrodošla kot preobrazbena sila, vendar so njeni dejanski učinki na poslovne modele v zdravstvu še vedno premalo raziskani. Članek presega špekulacije in pretirano optimistična pričakovanja ter preučuje resnične vplive digitalizacije na slovenski poslovni model zdravstvenega varstva.

Metodologija: uporabljen je bil kvalitativni raziskovalni pristop, ki je združil celovit pregled literature s polstrukturiranimi spletnimi anketami. Raziskava je zajela 20 vodilnih strokovnjakov, odgovornih za upravljanje nacionalnih rešitev eZdravja v Sloveniji. Za zajem pogledov sodelujočih strokovnjakov in sistematičen oris dejanskih vplivov digitalizacije na slovenski poslovni model zdravstvenega varstva je bila uporabljena analiza vsebine.

Ugotovitve: rezultati kažejo, da digitalizacija pomembno vpliva na poslovni model v zdravstvu z izboljšanjem operativne učinkovitosti in koordinacije oskrbe, optimizacijo dostopnosti do podatkov in upravljanja podatkov ter krepitvijo vključenosti pacientov. Vendar pa zaradi strukturnih in sistemskih izzivov učinki digitalizacije na slovenski poslovni model zdravstvenega varstva v tej fazi ostajajo razmeroma omejeni in pretežno odvisni od učinkovitega usklajevanja tehnološkega napredka z zdravstvenimi, poslovnimi, organizacijskimi in socioekonomskimi dejavniki.

Praktične implikacije: ugotovitve poudarjajo, da digitalizacije v zdravstvu ne moremo obravnavati zgolj kot tehnološkega podviga, temveč kot strateški vzvod celovite zdravstvene in poslovne transformacije. Za menedžerje v zdravstvu in oblikovalce politik to ne pomeni le vlaganja v digitalno infrastrukturo, temveč tudi v upravljanje, organizacijske procese, poslovno delovanje in socialne razsežnosti. Tako lahko maksimizirajo koristi digitalnih rešitev, zmanjšajo neučinkovitosti ter ustvarijo bolj trajnos-

ten in na pacienta osredinjen zdravstveni sistem. Študija lahko voditeljem pomaga pri prepoznavanju ozkih grl in določanju prednostnih nalog ukrepov, ki zagotavljajo, da digitalizacija prinese merljive izboljšave pri izvajanju storitev in zdravstvenih izidih na ravni javnega zdravja.

Izvirnost: raziskava prinaša nove vpoglede, saj je ena redkih empiričnih analiz vplivov digitalizacije na slovenski poslovni model zdravstvenega varstva. Namesto da bi se opirala na domneve ali normativna pričakovanja, vključuje poglede vodilnih nacionalnih strokovnjakov za eZdravje in jih umešča v širši strukturni in sistemski okvir. Študija pripomore k zapolnjevanju vrzeli med globalnimi diskurzi o digitalni preobrazbi in realnostmi majhnega nacionalnega zdravstvenega sistema ter tako ponuja lekcije, prenosljive tudi v druge države, ki se soočajo s podobnimi izzivi obsega, virov in institucionalne inercije.

Ključne besede: poslovni model, digitalizacija, zdravstveni sistem, vplivi, kvalitativna raziskava

JEL: I15, M15

1 Introduction

In recent years, the Slovenian healthcare system, much like other healthcare systems within the European Union (EU), has faced substantial structural challenges. These challenges are driven by objective circumstances and cannot be avoided in the foreseeable future, necessitating fundamental changes to the current healthcare setting. Healthcare reform has thus emerged as a societal imperative, requiring policymakers to adopt a more comprehensive and innovative approach in the years ahead. One of the key structural reforms needed to address these challenges effectively is the digitalization of the healthcare system. A robust and integrated health information system is envisioned to facilitate precise patient tracking, streamline treatment processes, manage costs, and enhance data accessibility. Such a system would enable efficient scheduling of medical appointments, coordination of waiting lists, tracking of completed medical procedures, and evaluations of their health outcomes and costs. Additionally, health information system could improve the efficiency and transparency of public healthcare in Slovenia and optimize the operational processes within healthcare institutions (MoH, 2022). Despite the undeniable potential and opportunities offered by digitalization, misleading and overly ambitious political slogans, unrealistic predictions by certain experts, and uncritical public debates have often led to inflated public expectations that digitalization will provide miraculous solutions to all the shortcomings of the healthcare sector.

However, while digitalization is not a panacea, it will undoubtedly have a profound and long-term impact on the entire healthcare system and its subsystems. This is supported by experiences from the most developed countries (Perianez et al., 2024; Wang and Xu, 2023; Majcherek et al., 2024). These experiences emphasize the importance of the healthcare system's business

model, which plays a pivotal role in the system's functioning and development (Schiavone, et al., 2021; Cosenz et al., 2024). A business model can be broadly defined as a framework of components, their roles, interconnections, and dependencies that, combined with information flows and business processes, create added value for both internal and external stakeholders (Osterwalder et al., 2005; Zott and Amit, 2024; Snihur and Markman, 2023). By outlining the structural and functional elements of an organization, the business model serves as a foundation for setting strategic goals, providing a logical operational framework for objective and data-driven business planning. The business model is sensitive to systemic changes, making it an effective tool for analysing and projecting the financial and operational implications of business policies or projects (Lanzolla and Markides, 2021; Westerveld et al., 2023). Given the rapid advancements in digitalization, which are becoming key drivers of structural and business changes in healthcare, this article explores the broader, often overlooked impacts of digitalization on the healthcare system's business model. Drawing on theoretical constructs, empirical cases, and online surveys with renowned experts from the field, this article addresses two primary research objectives: 1) exploring the concept of a business model and assessing the current state of the healthcare business model in Slovenia and 2) mapping the real impacts of digitalization on the Slovenian healthcare business model.

Following the introduction, the second section of the article reviews existing research and literature, offering insights into the concept of the business model and its role in contemporary organizational systems. The third section outlines the qualitative research design, detailing the methodological framework and content analysis procedures. The fourth section presents the research results, with a primary focus on the current state of the healthcare business model in Slovenia and the tangible impacts of digitalization on the healthcare business model. The fifth section engages in a critical discussion, addressing open questions related to business model digitalization and its role in implementing structural reforms within the healthcare system. Finally, the sixth section concludes with key findings and closing remarks.

2 Review of Previous Research in the Field

In recent years, the concept of the business model has garnered significant attention from professionals and academia (Aagaard and Nielsen, 2021; Ancillai et al., 2023; Leal Neto and Von Wyl, 2024). An expanding body of research underscores the need to examine critical success factors and mechanisms for creating added value. This trend reflects a broader recognition among organizations that their competitive edge and business success hinge on elements such as business expertise, innovation, human resources, business processes, service and product quality, and customer relationships – factors that are largely intangible (Miller et al., 2021; Wirtz et al., 2021; Mignon and Bankel, 2023).

As interest in business success factors has grown, so too has the exploration of the business model as a wide-ranging concept. Although the term has long

existed in economic theory to describe the “way of doing business”, its significance has expanded. In general terms, a business model can be defined as a framework of interconnected factors that shape an organization’s operations and underpin its success. This success may stem from the quality and uniqueness of products or services or from cost efficiencies that enable the achievement of long-term goals (Bigelow and Barney, 2021; Purnomo et al., 2022). Chesbrough and Rosenbloom (2002) trace the origins of the business model concept back to Chandler’s seminal work *Strategy and Structure* (1969), which analysed the factors distinguishing successful from unsuccessful companies. Chandler’s research highlighted mechanisms for creating added value, optimizing the transformation of resources into products and services, and building efficient value chains.

While most studies underscore the positive impact of business models, some researchers focus on the interplay between added value, business models, and strategy. They contend that the configuration of key business factors and the management of core strategic values, such as customer relationships, access to technology, and understanding customer needs, are more critical to an organization’s growth than inventing entirely new business models. These scholars argue that opportunities for added value lie in enhancing these strategic connections. Added value may come from solving systemic challenges, improving business performance, or reducing risks and costs (Bresciani et al., 2021; Mostaghel et al., 2022; Colovic, 2022). Achieving this often requires reconfiguring an organization’s core values, such as adopting new approaches to customer engagement, leveraging advanced information and communication technologies (ICTs), or gaining deeper insights into customer needs.

Despite the increasing interest from both practitioners and academics, the term business model remains elusive, with no universally accepted definition. The theoretical underpinnings of the concept remain ambiguous, and definitions vary widely, reflecting diverse research angles and interpretations. Recent research on business models spans a broad range of areas, including organizational dynamics, business processes and structures, value chains and networks, innovative and ICT-based approaches, corporate strategy and competitive advantage, entrepreneurship, sustainability, and ecosystem functions. Although these research domains often overlap and terminological ambiguities persist, the existing body of literature allows us to roughly distinguish three predominant directions in business model research (Sjödin et al., 2020; Vaska et al., 2021; Menter et al., 2024): 1) organizational changes and new organizational forms, 2) value creation, and 3) business model innovation and digitalization. The boundaries between the outlined research directions are fluid, making it challenging to chart the business model research thus far, identify and assess the prevailing topics, and forecast the research trends and priorities in the future. The fragmented and isolated study of business models from various perspectives hinders a thorough and critical evaluation of their potential impact on organizational systems. This fragmented approach often leads to a lack of motivation to transform outdated or inadequate business models, particularly within public sector organizations. As a result, these

organizations experience stagnation and fail to harness their full potential to deliver innovative products and services or meet the evolving and diverse needs of their users.

2.1 The Concept of a Business Model

Research often roughly defines a business model as a network of factors, their interrelationships, processes, and causal links that create added value. Studies generally argue that a comprehensive business model should identify the target users, articulate the organization's comparative advantages, specify the product and service offerings, and assess cash flow, projected profit, and associated risks (Trischler and Li-Ying, 2023). Some studies are even more comprehensive and provide a broader interpretation, describing a business model as an organizational framework designed to gather, connect, and communicate information about an organization's operations and activities (Verhagen et al., 2021).

In the late 1990s, the concept of a business model became closely associated with e-business and the emerging digital economy. The rise of the internet and the widespread digitalization of both private enterprises and the public sector gave birth to innovative business models, pushing e-business models into the spotlight (Bresciani et al., 2021; Ancillai et al., 2023). Since then, researchers and professionals have focused on understanding how digitalization and online business reshape organizational practices and influence business model components and their interrelationships. Successful business models often take inspiration from the banking and online retail sectors (Hanafizadeh and Marjaie, 2021; Palmié et al., 2022). Despite differences in structure, naming conventions, characteristics, and interrelationships, several core components consistently appear across most business model definitions, concepts, and depictions (Zott and Amit, 2024; Lanzolla and Markides, 2021; Wirtz et al., 2023; Lorenz et al., 2024; Menter et al., 2024; Mignon and Bankel, 2023; Miller et al., 2021; Westerveld et al., 2023; Trischler and Li-Ying, 2023). They are summarized in Table 1. These components provide a framework for understanding how business models can be utilized, adapted and optimized to meet contemporary challenges and opportunities, particularly in the context of digital transformation.

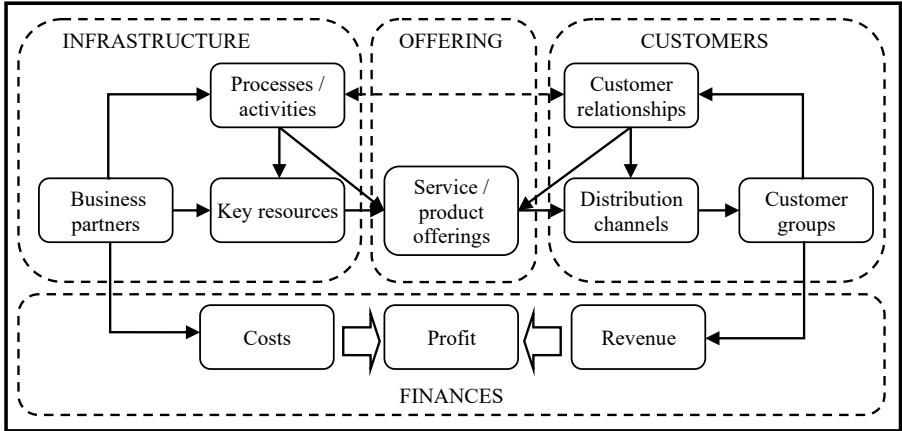
Table 1. Components of a generic business model

Component	Description
Service / product offering	Which customer desires and needs does the organization's service / product offering focus on?
Customer groups / market segmentation	How and to what extent does the organization satisfy customer desires, needs, and expectations overall or for specific market segments?
Business / communication distribution channels	Through which channels and how does the organization communicate with customers and offer its services / products?
Customer relationships / connections	What are the relationships with customers, how are they maintained, and what are the customers' expectations regarding these relationships / connections?
Business processes / activities / value configuration	Which key business processes / activities are carried out within the organization, and how do they contribute to creating added value?
Key resources / capabilities / capacities	What resources, and in what quantities, does the organization utilize in its operations, and how effectively are they used?
Business partners / partner network	To what extent do various partners contribute to the organization's operations, success and efficiency, and in what way?
Costs / expenses / expenditure	What is the cost structure for services / products and the organization's operational activities, and are these costs aligned with the organization's business plan?
Revenues / income	Which services/products offered by the organization are customers willing to pay for, how much, and in what manner?
Profit / added value / business performance	Does the organization's business performance reflect as an operational outcome in the form of profit/added value generated through the production and sale of products or the provision of services?

Source: Authors' compilation (different sources).

The illustration below presents an adapted version of Osterwalder and Pigneur’s (2010) business model ontology, a widely recognized and frequently applied framework for visualization and understanding business models and their components (Figure 1). Osterwalder and Pigneur (2010) developed the business model ontology as a structured framework for understanding, designing, and analysing business models. The ontology defines a business model as a conceptual tool that describes how an organization creates, delivers, and captures value. It consists of nine interrelated building blocks, which together form the well-known business model depiction. The business model ontology provides a shared language for managers, entrepreneurs, and researchers, making it easier to visualize and innovate business models systematically. It is widely used as a strategic management tool.

Figure 1. Business model ontology



Source: Adapted from Osterwalder and Pigneur, 2010.

This business model framework, although predominantly applied in the private sector, provides a comprehensive and transparent representation of the key factors and their interrelations that determine the success of an organizational system. As such, it will serve as a foundation for mapping the real impacts of digitalization on the healthcare business model in Slovenia.

3 Methods

The methodological framework is adapted to the interdisciplinary nature of the research problem and encompasses a comprehensive review of existing literature on the business model, synthesis of findings, and online surveys to map the impacts of digitalization on the Slovenian healthcare business model (Yin, 2017; Braun et al., 2021; Barroga et al., 2023). By addressing the technological, medical, and business dimensions of the Slovenian healthcare system, policymakers can better navigate the complexities of healthcare system operations and ensure long-term benefits for patients, healthcare providers, and society as a whole.

3.1 Research Design

This study employs a qualitative research design to analyse the impacts of digitalization on the Slovenian healthcare business model. Following a comprehensive review of existing literature on business models, the primary data collection method involved semi-structured online surveys with 20 prominent experts from the National Institute of Public Health who manage national eHealth solutions. These surveys were conducted between January and February 2025. The study's qualitative approach aligns with the complex and interdisciplinary nature of the research problem, which requires in-depth exploration of expert insights into digitalization and its ubiquitous impacts on the healthcare business model. The methodological framework follows a structured process: 1) designing the study and developing the survey protocol, 2) conducting the surveys, 3) transcribing and coding the survey data, 4) analysing the data using qualitative content analysis, 5) interpreting the findings, and 6) reporting the results. This approach is based on established methodologies for qualitative research and content analysis ensuring rigor and reliability in the research process (Shava et al., 2021; Yadav, 2022).

3.2 Sample

The sample for this study comprises 20 experts who hold leadership positions in the management of national eHealth solutions. These participants were purposefully selected based on their unparalleled expertise and extensive experience in digitalization initiatives, healthcare information systems, operations, and structure of the Slovenian healthcare system. The non-random, purposive sampling method ensures that participants possess the necessary knowledge to provide credible and insightful perspectives on the research topic. The selected experts represent a diverse group of individuals specialized in information technology, medicine, economy, organization, and public health. This diversity allows for a comprehensive examination of digitalization's effects on various components of the healthcare business model. Recruitment was guided by the principle of maximum variation sampling to capture a broad spectrum of views and experiences (Hennink and Kaiser, 2022). The sampling procedure achieved data saturation point, ensuring that no significant new information emerged during the final stages of data collection.

3.3 Data Collection and Analysis

The online surveys were conducted using a miscellaneous set of questions including open-ended questions and semi-structured format to maintain focus of the research and address both consistency and flexibility in exploring emerging themes. Open-ended questions within the survey protocol were designed to elicit detailed insights into participants' experiences, perceptions, and evaluations of digitalization initiatives within the Slovenian healthcare system. The survey questions presented below were applied:

1. How would you assess the current state of the healthcare business model in Slovenia? Is there a clearly defined business model within Slovenian healthcare system?
2. Can you identify and define the real impacts of digitalization on the business model? Provide detailed insights into how each of the business model components listed below is affected:
 - Infrastructure
 - Offering of healthcare services and products
 - Patient
 - Public health and public finance

Prior to conducting the online survey, participants were provided with a detailed explanation of the business model concept, including its components, interconnections, and relationships on the one hand, and its characteristics, functions, and objectives on the other. Before proceeding with the survey, any uncertainties or ambiguities raised by participants were clarified and resolved, ensuring that they were able to contribute to the study as effectively and reliably as possible. Each online survey took approximately 90 minutes to complete and was conducted with the participants' consent. To ensure data confidentiality and ethical compliance, all identifying information were anonymized.

The content analysis was conducted using MAXQDA Analytics Pro 2022 (version 22.4.1), a qualitative analysis software. This tool allows for systematic coding and categorization of the survey data, enabling the identification of patterns, themes, and relationships. The content analysis followed a typical multi-stage coding process: 1) initial reading: transcripts were reviewed to familiarize the researchers with the data and identify preliminary themes, 2) coding framework development: codes were derived both inductively from the survey data and deductively from the literature review, 3) thematic analysis: coded data was organized into overarching themes, reflecting the viewpoints and statements of the participating experts regarding the survey questions, and 4) validation: both coders independently analysed the data to ensure reliability and minimize bias. The coding framework comprised 9 primary codes, categorized into 2 main areas based on the survey questions (Figure 2). These codes reflect various issues and perspectives shared by participants regarding digitalization and the healthcare business model, their interplay, and the real impacts of digitalization on the Slovenian healthcare business model.

The software's analytic capabilities were used to generate visualizations, such as code diagrams and thematic maps, to support the interpretation of findings. The results were triangulated with existing literature to validate and contextualize the insights, ensuring robust conclusions (Im et al., 2023). By combining literature review and expert surveys with systematic content analysis, this study provides a nuanced understanding of digitalization's current impacts on the Slovenian healthcare business model. The findings aim to inform evidence-based strategies for aligning digital initiatives with systemic healthcare reforms.

Figure 2. Code system developed in content analysis software

Code System	Count
Code System	0
The current state of the healthcare BM in Slovenia	0
Poor collaboration among stakeholders and patient interaction	0
Limited technological capacity and coordination challenges	0
Slow development and lagging behind other sectors	0
Undefined BM, inadequate organization, inconsistent processes	0
Outdated operations and inefficient business practices	0
The real impacts of digitalization on the healthcare BM	0
Public health and public finance	0
Patient	0
Offering	0
Infrastructure	0
Sets	0

Source: Authors' research.

4 Results

One of the most important segments of strategic planning and mechanisms for achieving long-term organizational goals and satisfying stakeholder needs is the business model of the organization. A comprehensive and appropriately digitalized business model facilitates the effective transformation of organizational resources into high-quality products and services. It represents an integral link between the organization's strategic goals and the business processes required to achieve them.

4.1 The Impact of Digitalization on Organizational Systems and Healthcare Business Models

Research consistently highlights digitalization as a driving force behind changes and development in business models (Caputo et al., 2021; Broccardo et al., 2023). According to research thus far, the influences of digitalization on business models range from minimal ICT use to a complete redefinition of the business landscape. Studies in the field further emphasize the role of digitalization in adapting organizational processes, improving business efficiency within and between organizations, and enhancing interactions with the broader societal environment (Wang et al., 2023; Snihur and Markman, 2023). To date research generally indicates a strong positive correlation between comprehensive digitalization and business success, positioning digitalization as a critical factor for organizational management and value creation (Climent and Haftor, 2021; Reim et al., 2022). Lessons and experience reveal that the conversion of digital assets (e.g., infrastructure, technologies, and expertise) into strategic resources and further digitalization initiatives have

a significant impact on business performance, including improved products, processes, and communication efficiency (Gregori and Holzmann, 2020; As-trom et al., 2022). Nevertheless, it is important to keep in mind that business models are under constant pressure to evolve due to global trends, regulatory changes, shifting user behaviour, and, in particular, technological advances. In this context, successful digitalization depends on an organization's ability to continuously adapt its business model to volatile market conditions and remain relevant and effective in a dynamic environment.

Digitalization projects in healthcare focus on digitalizing clinical and business processes, as well as systematically collecting, analysing, and utilizing healthcare data. These initiatives are part of comprehensive healthcare reforms that began in developed countries during the 1980s. The goals are twofold: to improve the quality and timeliness of patient care and to provide robust support for decision-making, planning, and management at both institutional and system-wide levels. However, many digitalization projects have focused on isolated segments of healthcare operations, overlooking the broader business model as a critical success factor within the healthcare system. A well-designed, digitalized business model facilitates the effective transformation of organizational resources into high-quality healthcare services and serves as a bridge between strategic goals and the processes required to achieve them. Successful healthcare reforms depend not only on technological improvements but also on a deep understanding of business, organizational, policy, socio-economic, and other factors contained in the business model framework (Sibaliija et al., 2021). Understanding how digitalization affects the healthcare system's business model requires familiarity with the system's architecture and operations. However, due to the rapidly changing public health conditions and technological landscape, this understanding may not always be sufficient. The business model is inherently dynamic, as demonstrated by its complex structure and variety of its components. Therefore, healthcare organizations must continuously adapt their business models to keep pace with healthcare needs and demands on the population level, financial restrictions, regulatory changes, and digitalization advancements (Wirtz, 2023). However, while digitalization and technological innovation are essential, they do not guarantee public health or business success on their own. The healthcare system is a wide-ranging network of components, activities, interconnections, and dependencies that leverage information and resources to create health value for stakeholders. Such systems are intrinsically complicated, involving numerous stakeholders and multi-layered organizational structures. Achieving public health and business success thus require a well-planned business model, effective implementation, and careful strategic alignment of digitalization projects with healthcare system's operations and long-term goals.

The following paragraphs present summaries of the responses and perspectives shared by the participating experts regarding the survey questions.

4.2 The Current State of the Healthcare Business Model in Slovenia

The participants shared in-depth opinions and various arguments in response to the survey's introductory question about the current state of the healthcare business model in Slovenia. The existing healthcare business model in Slovenia is ill-defined and characterized by poor collaboration among stakeholders, leading to inefficiencies in decision-making, resource allocation, and service delivery. The undefined and often arbitrary business framework makes it challenging to establish clear guidelines and structures that ensure effectiveness, accountability, and long-term sustainability. Patient interaction remains weak, with limited engagement and communication, often resulting in a lack of patient-centred care and lower overall satisfaction. The current approach to business operations, which can hardly be considered a true business model, remains technologically incapacitated and underdeveloped. The digital infrastructure is often fragmented and outdated, posing significant challenges to achieving an effective digital transformation and better business and healthcare outcomes. The lack of investment in digital health infrastructure and workforce training further amplifies inefficiencies and hinders Slovenian healthcare system from achieving its desired transformational goals. The lack of coordination and agreement on financial matters between healthcare providers, policymakers, and insurers is evident in the frequent strikes of healthcare workers. This not only further complicates service delivery but also slows down progress in digital health initiatives. Compared to other sectors, the development of the Slovenian healthcare system business model has been slow, with a significant lag in adopting digital technologies and innovative operational strategies. The organization of work is often inadequate, characterized by rigid hierarchies and bureaucratic obstacles that hinder timely operations, responsiveness, and adaptability to evolving healthcare needs. Business processes are inconsistent and fragmented, resulting in duplication of efforts, increased administrative burdens, and inefficiencies in service delivery. The healthcare system generally operates on outdated principles that are misaligned with modern business paradigms, preventing it from leveraging best practices in digital innovation and healthcare management.

4.3 The Real Impacts of Digitalization on the Slovenian Healthcare Business Model

Digitalization is anticipated to significantly enhance the healthcare system's business model, provided it is implemented sensibly and effectively. Nevertheless, the potential long-term effects of digitalization on the healthcare business model, as outlined by the participating experts, remain somewhat uncertain and, for now, merely hypothetical. In this study, however, we focus primarily on the real and immediate impacts of digitalization on the healthcare business model.

At this relatively early stage, precisely identifying and assessing the long-term effects of digitalization remains challenging. However, we can reasonably

map its real and current impacts on the healthcare business model key components (although not precisely defined): infrastructure, offering, patients, and public health and public finance. The table below (Table 2) outlines the impacts of digitalization on each of these core components, illustrating how digital transformation is driving significant changes across the entire Slovenian healthcare system.

Despite the undeniable potential of digitalization, its real and current impacts on the healthcare business model remain relatively limited. There are undoubtedly many reasons for this. In collaboration with participating experts, we have identified some of the key factors. One of the primary reasons is likely the absence of a clearly defined business model within the Slovenian healthcare system that all stakeholders follow. Consequently, initiating the transformation of an entity that lacks both a formal and, in many respects, a material structure presents a significant challenge. Digitalizing such a vast and complex organizational system as healthcare is a demanding socio-technological project – one that requires a strategic approach, significant resources, time, expertise, and systemic support. However, Slovenia does not adequately meet any of these requirements. As a result, the business model of Slovenian healthcare largely follows the inertia of past periods, with only sporadic integration of otherwise successful and high-quality digital solutions. Yet, these solutions alone – without radical changes in other areas and systemic support – are insufficient to bring about deeper, more visible, and lasting improvements. Despite the growing importance and recognition of digitalization as a critical success factor, the healthcare system remains hesitant to implement more fundamental changes. This reluctance manifests in unwillingness to transform its business model and subsequently restructure business processes, communication channels, integrate comprehensive digital solutions, and align innovative technologies with strategic healthcare goals. As a result, the rigid organizational structure and the existing inflexible business model persist, hindering the healthcare system's ability to adapt to growing and diverse patient needs and the evolving broader environment.

Table 2. The real impacts of digitalization on the healthcare business model

Business model aspects	Impacts of digitalization
Infrastructure aspect	▪ Increased investment in digital technology – improved digital infrastructure at the national level and within healthcare providers. ▪ Automated exchange of a significant portion of healthcare data among public healthcare providers. ▪ Partially automated exchange of health, administrative, and financial data with regulators and government institutions. ▪ Standardization and simplification of digitalized processes (not all business processes). ▪ Enhanced oversight and monitoring of healthcare services provided by healthcare providers. ▪ Increased funding for ICT experts at healthcare providers, regulatory bodies, and government agencies. ▪ Greater investment in digital skills training for healthcare employees. ▪ Enabled monitoring of some performance indicators. ▪ Adoption of digital services by healthcare providers and patients. ▪ Digitalization is becoming an increasingly important factor in the socio-political context due to its developmental potential.
Offering aspect	▪ A transparent definition and list of available healthcare services and products are accessible online. ▪ Healthcare providers, along with their contact information and the healthcare services they offer, are available online. ▪ Certain segments of healthcare services and products are offered in digital form. ▪ Availability of eHealth services, including the Patient Portal, ePrescription, eAppointment, medical test results, health documents, certificates of sick leave, etc. ▪ Information about medications and treatments is available online.
Patient aspect	▪ Increased exchange and use of healthcare data for improved healthcare delivery. ▪ Partially redefined relationships between healthcare professionals and patients, including better control over personal data and treatment processes, improved communication, and better access to information. ▪ eHealth services on the Patient Portal (accessible 24/7). ▪ Reduced costs for patients due to eHealth services, including savings on time and transport expenses. ▪ Improved accessibility of certain healthcare services for disadvantaged patient groups. ▪ Increased digital literacy among patients.

Public health and public finance aspect	▪ Enhanced mechanisms for collecting and analysing data on health and financial efficiency and effectiveness of the health-care system, as well as non-health factors. ▪ Greater transparency in expenditure and income structures. ▪ More transparent overview of public health indicators. ▪ Improved evaluation of service and product pricing. ▪ Accessibility of certain indicators for managing healthcare providers and the overall healthcare system. ▪ Availability of certain indicators related to operational, human resources, and financial management aspects.
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Source: Authors' research.

Successful transformation requires an understanding of theoretical business model concepts relevant to the organization's context and a deep comprehension of operational processes, relationships, and interdependencies (Wirtz, 2020). It also necessitates recognizing the healthcare system's role within a broader society (Barnett et al., 2025). Given the complexity and specificity of healthcare as a public sector service, the transformation process must consider the broader context and ensure that business model components are aligned with socio-economic, policy, technological, organizational, public health, and financial factors and constraints (Lorenz et al., 2024). The future Slovenian healthcare system's business model needs to incorporate adaptations beyond Osterwalder and Pigneur's (2010) traditional business model ontology, widely used in the private sector. The healthcare system's public nature involves more factors, with modified functions and relationships reflecting the unique role of healthcare in modern societies and confirming the complexity of organizational systems in the public sector that generate public benefit. Public sector business models operate in a more diverse and restrictive environment than those in the private sector. In addition to core business model elements such as infrastructure, offering, customers, and finances, public healthcare must also consider public health and public finance factors. These elements typically shape strategic objectives, operational priorities, and guide healthcare system development and sustainability (Rosati et al., 2023). This is reflected in the numerous obstacles that impede the faster adoption of Slovenian eHealth solutions, which are generally well-developed and highly advanced. For comprehensive transformation of the current healthcare business model, digitalization must be given a more significant role. It should integrate the fragmented elements of the business model, enhancing healthcare services, two-way communication, and patient empowerment (Stanimirović and Stanimirović, 2025). Digitalization can improve the utilization of human, material and digital resources, optimize operation and processes, ensure transparency, and enable better oversight of expenditures and incomes (Gehde et al., 2022). Improved data transparency allows for enhanced financial oversight and supports cost-containment measures in public health financing. A comprehensive digitalization of the healthcare business model would enable the Slovenian healthcare system to seize opportunities for high-quality patient care, drive business and organizational restructuring, and support

long-term development. By leveraging accurate and reliable clinical, financial, and administrative data, digitalization could also streamline the management of healthcare organizations and the healthcare system as a whole.

5 Discussion

In modern organizational paradigms, the business model serves as a crucial tool for analysing operations, planning technological innovations, and guiding organizational transformation (Klos et al., 2021; Grego et al., 2024). Despite the growing interest from the professional and academic community in business models over the past two decades, compelling studies exploring the material impacts of digitalization on healthcare business models remain scarce. Existing research generally emphasizes the complex and multifaceted influence of digitalization on organizational business models, confirming that comprehensive digitalization is a crucial step in developing an effective business model (Ramori et al., 2021; Kraus et al., 2021), which is essential for enhancing patient care on one hand, and improving healthcare system efficiency on the other.

The research indicates that the real and current impacts of digitalization on the healthcare system's business model in Slovenia can be assessed from four key aspects: infrastructure, offering, patient, and public health and public finance. In these areas, digitalization demonstrates some very significant effects, although perhaps not as extensive or profound as one might expect or desire at this stage. Even more far-reaching effects of digitalization can be expected in the future, likely playing a pivotal role in shaping the transformation of the business model. However, the effective strategic transformation and development of a suitable business model for the Slovenian healthcare system depend not only on advancements in digital technologies but also on a deeper understanding of policy, business, organizational, socio-economic, and other critical factors (Heubeck, 2023; Bamel, 2023). While digitalization undoubtedly offers significant potential for development and positively impacts organizational business models, it is clear that it cannot, in isolation, drive an effective transformation of the healthcare system or improve its overall outcomes. The success of the healthcare system's operations and efficiency is heavily reliant on aligning digitalization with a wide range of systemic and organizational factors (Stanimirović and Stanimirović, 2025). Moreover, the business model must be adapted to meet the needs of patients, healthcare organizations, and the broader healthcare ecosystem (Oderanti, 2021). Therefore, the successful digitalization of the healthcare system's business model requires the involvement of numerous stakeholders and the balancing of often conflicting factors and interests within the healthcare system (Cosenz et al., 2024). This complexity makes implementation challenging but underscores the importance of careful planning and coordination in building a long-term, effective business model. Despite these challenges, digitalizing the business model represents a substantial opportunity for development (Perianez et al., 2024). When properly aligned with other systemic factors,

digitalized business models can integrate the fragmented elements of the healthcare system, enhance the utilization of organizational capabilities, and accelerate the transformation of resources into tangible value for patients and measurable public health benefits.

In the context of utilizing a properly digitalized business model for implementing structural reforms and achieving strategic goals within the healthcare system, it is essential to recognize that digitalization may improve productivity, boost business performance, and promote organizational innovation (Wirtz et al., 2023). The greatest benefits of an effectively digitalized business model are realized when investments in digital technology are combined with broader systemic measures and organizational changes. These include new strategic approaches, the reengineering of both business and healthcare processes, the adaptation of healthcare services and products, and the transformation of relationships between healthcare providers and patients (Cardinaal, et al., 2024). An appropriately digitalized business model must account for the unique characteristics of healthcare and facilitate better health outcomes and improved business results.

Accordingly, the digitalization of healthcare business models should not be viewed or evaluated solely as a technological advancement; it also constitutes a potential economic intervention in healthcare service delivery, establishing systemic mechanisms with significant implications for efficiency, cost-effectiveness, and the fiscal sustainability of healthcare systems (Lange, 2023). From a public economics perspective, successful digital transformation in healthcare carries significant strategic importance, as it can enhance allocative efficiency, optimize resource utilization, and support the long-term rationalization of public expenditure (Stanic et al., 2023).

The consistent and appropriate application of digital tools such as ePrescription, eAppointment, the Patient Portal, and centralized electronic health records can optimize the use of scarce healthcare resources by reducing administrative redundancies, minimizing medical errors, and streamlining clinical workflows, resulting in tangible operational efficiencies (Tagde et al., 2021). These digital tools may also improve scheduling, enhance patient treatment adherence, reduce unnecessary visits and avoidable hospitalizations, and limit the duplication of diagnostics, thereby directly contributing to efficiency gains and cost savings (Stanic et al., 2023). For example, automated appointment systems reduce waiting times and facilitate better alignment between the supply and demand of healthcare services, thereby improving public health outcomes and allocative efficiency.

Furthermore, digitalization introduces mechanisms for real-time monitoring of healthcare spending, predictive data analytics, and transparent reporting. These features support more effective workforce deployment, capacity planning, and evidence-based policy formulation (WHO, 2019). Such mechanisms directly address common inefficiencies linked to healthcare service inertia and fragmented budget planning. While investment in digital health infrastructure is initially capital-intensive, it frequently yields a high return

on investment over time by reducing expenditures, lowering administrative burdens, and enhancing preventive care, thus alleviating the strain on long-term healthcare budgets (Biggs et al., 2019). Consequently, digitalization should be regarded as a strategic investment in public sector productivity. As healthcare demands and expenditures rise due to demographic shifts and the increasing prevalence of chronic diseases, a digitally enabled healthcare system can promote better population health, greater resilience, and economic sustainability, thereby supporting broader objectives such as economic growth, fiscal consolidation, and efficient public service delivery (Olu et al., 2019). Accordingly, digitalization should be embedded within national long-term expenditure frameworks and healthcare reform agendas (Perianez et al., 2024). This integration enables the synchronization of digital investment cycles with budgetary planning, ensuring sustained funding and effective oversight. The adoption of key performance indicators related to cost savings, patient outcomes, and system responsiveness facilitates continuous assessment of return on investment and public spending efficiency (Willis et al., 2022). The findings reinforce the notion that digitalization constitutes a form of public capital investment with multifaceted returns – not only in financial terms but also in institutional resilience, transparency, and long-term adaptability of health systems.

In Slovenia, digitalization has already begun to generate these effects, though their full realization remains constrained by several factors, including fragmented approaches, uneven development, outdated policies and regulations, and inconsistent implementation practices. An evaluation conducted by the Ministry of Public Administration for the 2016–2018 period suggests that the implementation of eHealth solutions, specifically the ePrescription and eAppointment systems, contributed to substantial cost savings within the Slovenian healthcare system. The Ministry estimates the cumulative financial savings to be approximately EUR 40 million in this period (MPA, 2019).

5.1 Relevance Beyond the National Context: Potential Broader Implications of the Slovenian Case

While this study focuses on Slovenia, the findings hold valuable implications for similarly structured healthcare systems, particularly those across Central, Eastern, and Southern Europe, as well as other small to mid-sized, publicly funded health systems. The Slovenian public healthcare system reflects common characteristics such as centralized financing, hierarchical governance, and incremental digitalization (Albrecht et al., 2021), making it a relevant case study for broader international comparative analyses.

Challenges faced by Slovenia – fragmented digital architecture, limited inter-institutional coordination, constrained resources, and resistance to structural change – are similarly observed in numerous EU and OECD member states (Stanimirović, 2024; Bruthans et al., 2025). By detailing technological, institutional, and economic issues, this study offers a diagnostic framework that can inform policy evaluations, support strategic planning, and guide imple-

mentation efforts for healthcare digitalization initiatives beyond the national context. Accordingly, the systemic barriers and enablers identified herein may help shape digital transformation projects across the region. Slovenia's gradual integration of eHealth services aligns with broader strategies set forth by the World Health Organization and the EU, including the European Health Data Space initiative (WHO, 2021; European Commission, 2025). This alignment enables cross-national dialogue, collaborative initiatives, and knowledge transfer, particularly in areas such as interoperability standards, patient data exchange and governance, as well as information security. In this light, the Slovenian case, demonstrating both realized and potential impacts of digitalization in healthcare, could serve as a reference point for designing scalable, context-sensitive digital health policies in comparable regional settings.

5.2 Limitations of the Study and Future Research Directions

The research framework applied in this study has one clear methodological limitation. The Slovenian healthcare system does not have a formally defined business model, so all our assumptions about the structure of the Slovenian healthcare business model and how digitalization might impact it in the future are based on theoretical constructs and surveys with experts in the field of healthcare digitalization. Despite the validated information from literature and the unquestionable expertise and experience of the participating specialists, it is important to note that the potential impacts of digitalization on the transformation of the Slovenian healthcare business model have been conjectured without empirical corroboration in the real healthcare environment. On the other hand, some effects of digitalization on the healthcare business model have already materialized, and the transformative impacts of digitalization can now be assessed and monitored in terms of tangible results and improvements in the healthcare system's operations and outcomes. This was particularly evident during the COVID-19 pandemic, when digital solutions represented one of the few components of the healthcare system that continued to operate without significant disruption.

Therefore, the issues related to the projected impacts and implications of digitalization on the healthcare business model may raise some questions, and the research outcomes might be subject to debate. These concerns should be addressed in future studies aimed at a comprehensive analysis of the long-term impacts of digitalization on the healthcare system. Future research should include a detailed investigation of the direct effects and implications of digitalization on the healthcare business model, including simulations, modelling, and empirical testing in real-world healthcare settings. The focus of these studies should be on providing recommendations and operational guidelines for implementing proper digitalization procedures in countries striving to adapt their business model structures to rapid technological advancements, thereby contributing to increased efficiency of healthcare systems. Despite the methodological limitations outlined, the research reveals the complex dynamics between digitalization and healthcare, highlighting the critical importance of continuously adapting the operations of organizational

systems to broader social and technological changes. It has been shown that, in this regard, the public sector lags significantly behind the private sector.

6 Conclusions

Business practice demonstrates a clear correlation between digitalization and improved business model efficiency, sparking increased interest in how new technologies transform organizational models. This trend is particularly relevant to healthcare and other public sector subsystems, where digitalization can drive the effective integration of innovative technologies, process restructuring, and reorganization. This article explores these pressing issues, emphasizing the need for further multidisciplinary research into the intricate background of digitalization initiatives, business models, and healthcare systems. The study provides a comprehensive overview of business model concept, key components, and their functions. The research outlines the digitalization as one of the catalysts for the necessary transformation of the healthcare business model. It highlights the real impacts of digitalization and stresses that its full transformative potential can be realized only when all business model components, organizational frameworks, and (eco)systemic factors are successfully aligned. A thorough analysis of impacts of digitalization on healthcare business models requires understanding and consideration of broader context in which digitalization takes place and healthcare operates. Successful digitalization of healthcare business models, along with their adaptability and resilience, clearly depends on integrating these diverse elements. Ultimately, all the synergies created should strengthen the efficiency of the healthcare system, fostering sustainable, patient-centred development and contributing to improved public health.

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