

Analysis of Research Hypotheses Regarding the Use of Electronic Means of Communication with ANAF

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Abstract. *This paper analyzes the impact of the use of electronic means of communication with ANAF on taxpayers, with the objective of identifying the factors influencing access to digital public services. The study is based on a representative sample of respondents, collected through a structured questionnaire, and uses statistical methods to verify research hypotheses.*

In the first stage of the analysis, the distribution of users of ANAF platforms according to age and level of education was determined, observing a positive correlation between the frequent use of electronic means and a high educational level. Most users fall into the 26-45 age category, and those with undergraduate and postgraduate studies are the most active users of digital tax platforms.

For hypothesis testing, the Chi-square test and the Kolmogorov-Smirnov (KS) test were used. The results of the Chi-square test indicate the existence of a significant association between age and the use of ANAF's electronic platforms ($\chi^2 = 138,54$, $p < 0.05$), thus confirming the hypothesis that younger taxpayers are more likely to use these digital tools. The KS test ($D = 0.643$, $p < 0.05$) shows that the distribution of users according to education differs significantly, emphasizing that educational level influences access to and use of online tax platforms.

The findings of the research highlight the importance of optimizing e-services to increase taxpayer accessibility and satisfaction. At the same time, the study highlights the need for digital training campaigns for less represented categories, so that digitization does not become an exclusion factor for certain segments of the population.

Introduction

In the era of digitalization, the use of electronic means of communication with public institutions has become a necessity for streamlining the interaction between taxpayers and tax authorities. The National Agency for Fiscal Administration (ANAF) has implemented various online platforms designed to facilitate citizens' access to tax services, thus eliminating bureaucratic barriers and reducing the time needed to fulfill tax obligations.

However, the adoption of these digital tools varies significantly depending on the age, level of education and digital skills of users.

This paper aims to analyze the impact of the use of ANAF's electronic platforms on taxpayers and to determine whether the frequent use of these means is influenced by the age and level of education of the users. The issue addressed is essential in the context of the digital transformation of public administration, as the success of these initiatives depends on the degree of acceptance and adaptability of the population.

The importance of the topic lies in identifying the main factors influencing access to and use of electronic platforms, as well as in formulating recommendations for improving digital tax services. In a society where quick access to information and administrative efficiency are priorities, it is crucial that these platforms are intuitive, accessible and widely used. In addition, it is important to ensure that the digitalisation process does not lead to digital exclusion for certain categories of taxpayers, in particular for the elderly or those with reduced digital skills.

The central research question of this study is: "To what extent is the use of electronic means of communication with ANAF influenced by the age and educational level of taxpayers?". To answer this question, the following research hypotheses have been formulated:

- Hypothesis 1: The use of electronic means of communication with ANAF is influenced by the level of technological knowledge of taxpayers.
- Hypothesis 2: The main motivation for using electronic means of communication with ANAF is the efficiency and time savings it offers compared to traditional communication methods.
- Hypothesis 3: The degree of satisfaction of taxpayers with the use of electronic means of communication with ANAF is influenced by the ease of use of the available platforms and tools.

To verify these hypotheses, the study is based on a statistical analysis, using the Chi-square test to assess the association between age and the use of electronic platforms, as well as the Kolmogorov-Smirnov (KS) test to analyze the distribution of users according to educational level. The data used in the research come from a questionnaire applied to a representative sample of taxpayers, which allows a detailed assessment of the trends in the use of ANAF's digital services.

Through this approach, the paper provides a clear perspective on the factors that influence the degree of digitization of the interaction between taxpayers and ANAF, while also offering recommendations for optimizing accessibility and increasing the use of digital tax platforms. The results of the study are relevant for both administrative decision-makers and taxpayers, highlighting the need for education strategies and adaptation to new technologies to ensure digital inclusion and the efficiency of administrative processes.

Literature review

Debates and articles in the field of the implementation of innovative technologies provide valuable insights into the opportunities, challenges and ethical considerations related to the implementation of artificial intelligence in public institutions. Thus, in 2018 in the article "Artificial Intelligence for the Public Sector: Opportunities and challenges of cross-sector collaboration", the authors Slava Jankin Mikhaylov, Marc Esteve, Averill Campion analyze the growing interest of public sector organizations in the use of data science and artificial intelligence (AI) in policy implementation and increasing efficiency in environments characterized by high uncertainty. The authors emphasize that the long-term success of AI in the public sector depends on its effective integration into policy delivery solutions and highlight the need for collaboration between universities, the public and private sectors to achieve this goal. Significant managerial challenges that may hinder the success of these cross-sectoral collaborations are also discussed and strategies for their effective management are proposed.

In 2022 Saar Alon-Barkat, Madalina Busuioc in the paper "Human-AI Interactions in Public Sector Decision-Making: 'Automation Bias' and 'Selective Adherence' to Algorithmic Advice" investigates the interactions between humans and AI in public sector decision-making, focusing on two key biases: over-reliance on algorithmic advice, even in the face of warning signals from other sources (automation bias), and the selective adoption of algorithmic advice when it corresponds to stereotypes (selective adherence).

The study is based on three experiments conducted in the Netherlands and discusses the implications of these findings for public sector decision-making in the age of automation. Vincent J. Straub, Deborah Morgan, Jonathan Bright, Helen Margetts write in 2022 an article exploring recent advances in the field of artificial intelligence, especially in generative language modeling, and their potential to transform governance - "Artificial intelligence in government: Concepts, standards, and a unified framework". The authors emphasize the importance of integrating these advanced AI systems using standardized operating procedures, clear epistemic criteria, and ensuring alignment with societal normative expectations. The study proposes a unified framework for understanding and analyzing AI-based systems in governance, introducing three multifaceted concepts: (1) operational fitness, (2) epistemic alignment, and (3) normative divergence. These concepts are used to develop a conceptual typology of AI in governance and to encourage interdisciplinary dialogue.

Methodology

In the research we have referred to the public services offered by the National Agency for Fiscal Administration through the IT platform, as a case study.

For this research, the methodology used focused on the analysis of the use of electronic means of communication with ANAF, having as object of study the institution's digital platform. The study aimed to establish the drivers of use and to verify the assumptions made regarding the impact of technological knowledge, taxpayer motivation and user satisfaction.

The data were obtained by applying a questionnaire with closed questions, structured on several dimensions:

- Degree of comfort and familiarity with the digital platform
- Motivation for using electronic services
- Satisfaction with the accessibility and functionality of the platform

In a first stage of the analysis, a representative sample was determined referring to a number of 6 million users of a public platform, with a degree of representativeness of 95% and an accepted margin of error of 5%

With the values given:

1. Population size (N):
 - N = 6,000,000
2. Estimated proportion (p):
 - p = 0.5 (50%)
3. Confidence level (Z)
 - Z = 1.96
4. Margin of error (E):
 - E = 0.05 (5%)

The sample size (n) *n* = was calculated. $\frac{Z^2 * p * (1-p)}{E^2}$

Substituting the values, Calculate $n = \frac{(1.96)^2 * 0.5 * (1-0.5)}{(0.05)^2} n = \frac{3.8416 * 0.25}{0.0025} = 384.16$

Without correction the sample size should be about 385. Therefore, the sample chosen for the questionnaire of 391 respondents falls within the values selected for representativeness and level of confidence

The degree of representativeness of the results is 101.78%

Representativeness = $101.78 \frac{391}{384.16}$

Standard error = $0.0253 \sqrt{\frac{0.5 * 0.5}{391}} = \sqrt{\frac{0.25}{391}} = \sqrt{0.000639}$

Error margin = $1.96 \times 0.0253 = 0.0496$

Confidence interval = $(0.5 - 0.0496, 0.5 + 0.0496) = (0.450 - 0.549)$

Considering that the purpose of the research is to identify the factors that influence the degree of use of electronic means of accessing public services offered by ANAF, the motivation that could increase the number of users, the categories exposed in case of excessive digitization, in order to consolidate intuitive solutions for all categories of users so that digitization does not become a barrier to rights or exclusion, Several categories of respondents structured according to age and level of education were defined as in tables 1 and 2

Table 1. Status of responses by age groups

Age groups	Number
Under 25 years old	41
25 – 45 years old	197
46-60 years old	117
Over 60 years old	36

Source: Authors' own research

Table 2. Status of responses by level of studies

Level of education	Number
Secondary education	16
High school education	89
University studies	163
Postgraduate	110
They didn't answer	13

Source: Authors' own research.

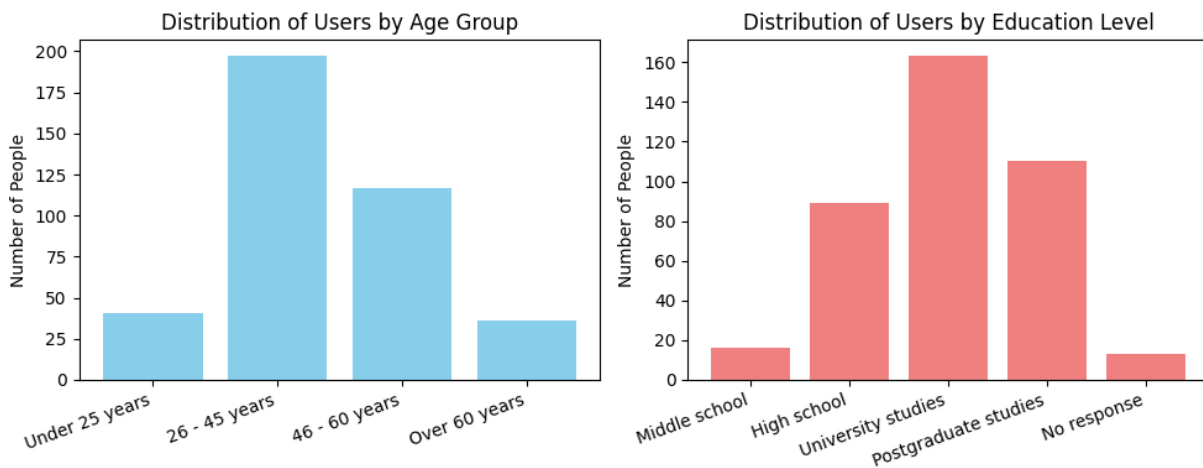


Figure 1. Distribution by age groups and level of education

By correlating the two sets of data we can determine certain trends:

- Age distribution:
 - Most users are between 26 and 45 years old (197 people).
 - The next largest category is 46 - 60 years old (117 people).
 - The lowest number of users are in the categories under 25 years old (41 people) and over 60 years old (36 people);
- Distribution by level of education:
 - Most users have university studies (163 people), followed by those with postgraduate studies (110 people).
 - There are 89 users with high school education, and only 16 with secondary education, suggesting that people with a lower level of education are underrepresented.

Possible correlations and conclusions:

- Most users of IT platforms are in the 26-45 age group, which coincides with the fact that most users have undergraduate or postgraduate education. This may suggest that people with a higher level of education are more active on these platforms.
- The low number of users under 25 years of age may indicate that this category either uses other types of IT platforms or was not fully included in the analysed sample.
- There are very few people with secondary education (16), which could mean that those with a lower level of education have a more limited use of IT platforms.
- The over-60 group has a relatively small number of users (36), which may suggest that platform use decreases with age, but does not disappear completely.

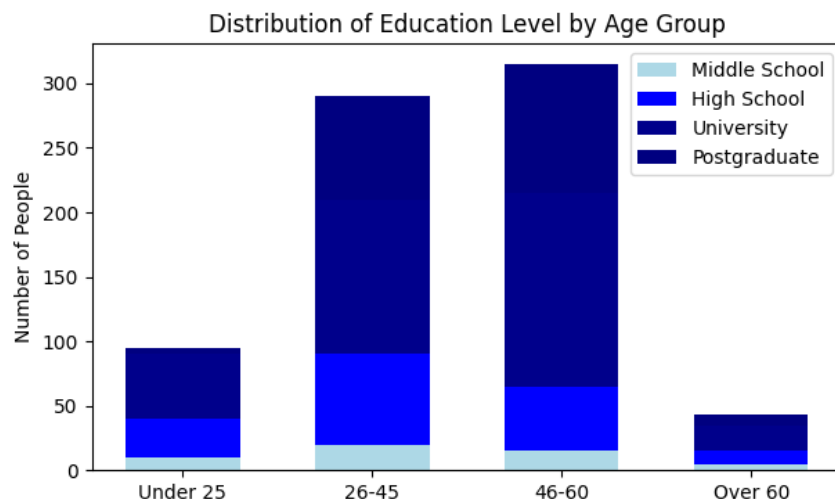


Figure 2. Distribution of the level of education according to age

The research focused on the case study "use of the ANAF IT platform" was outlined around 5 objectives

- Objective 1: to assess the level of use of electronic means of communication with ANAF,
- Objective 2: analysis of taxpayers' satisfaction with electronic communication,
- Objective 3: identifying the advantages and disadvantages of electronic communication with ANAF,
- Objective 4: Analysis of the factors influencing the use of electronic means of communication,
- Objective 5: proposals to improve electronic communication with ANAF.

Following the analysis of the results of the questionnaire and depending on the objectives of the research on the use of electronic means of communication with the Financial Administration (ANAF) in Romania, the hypotheses were formulated, structured on analyzed data sets (contained in the questionnaire):

- Hypothesis 1: The use of electronic means of communication with ANAF is influenced by the level of technological knowledge of taxpayers.
 - Degree of comfort in the use of electronic mijlocs
 - the level of familiarity with the structure of the ANAF platform
 - participation in thematic instations
 - The ratio of digital skills not the ability to facilitate the IT platform
 - difficulties in operating the platform
 - Hypothesis 2: The main motivation for using electronic means of communication with ANAF is the efficiency and time savings it offers compared to traditional communication methods.
 - Reason for use
 - the result of the use of electronic means of communication transposed into the level of satisfaction in the relationship with the institution
 - Operability
 - Transparency
 - Hypothesis 3: The degree of satisfaction of taxpayers with the use of electronic means of communication with ANAF is influenced by the ease of use of the available platforms and tools.
 - Degree of comfort in use
 - Degree of intuitiveness in use
 - Level of addressability
 - Frequency of use
 - the impact of the use of electronic means on communication with ANAF
- For data analysis and hypothesis verification, the following were used:

- Chi-square test
 - A statistical method used to determine whether there is a significant association between two categorical variables. It is often used to test the independence between variables in contingency tables.

Working principle:

- The test compares the observed frequencies with those expected under the null hypothesis (which states that there is no association between the variables).
- the calculation involves the formula: where O_i is the observed frequency, and E_i is the expected frequency.
$$\chi^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

Interpret:

- A high Chi-Square statistic value and a low p-value (below 0.05) indicate a statistically significant association between the analyzed variables.
 - Testul Kolmogorov-Smirnov
 - It is used to compare two probability distributions, checking if they come from the same distribution. It is applied for both continuous and discrete data and is useful in verifying distribution assumptions.

Working principle:

- the KS test measures the absolute maximum difference between the cumulative distribution functions (CDFs) of the two data sets: $D = \max |F_1(x) - F_2(x)|$ where F_1 and F_2 are the CDFs of the two distributions being compared.

Interpret:

- A small p-value (below 0.05) suggests that the distributions are significantly different.
- If the p-value is large, there is insufficient evidence to reject the hypothesis that the two distributions are similar.

For each hypothesis formulated, in relation to the centralized values and applying the two tests of analysis and verification, the following results were obtained:

I. For hypothesis 1 having the values

Table 3. Centralized data for the verification of hypothesis 1

Reporting values	level of comfort in the use of electronic means of communication with ANAF	Reporting values	degree of familiarity with computer applications	Reporting values	the existence of the influence of digital skills on accessing IT platforms	Reporting values	difficulty in accessing ANAF's online platform?
1	112	1	80	1	124	1	35
2	165	2	193	2	124	2	146
5	67	5	48	5	54	5	21
3	47	3	57	3	50	3	133
4	0	4	13	4	39	4	56

Source: Authors' own research.

where 1 is the maximum positive value, 4 is the maximum negative value and 5 is the neutral/don't know answer

Applying the two tests to determine the association between the degree of comfort in the use of electronic means and the level of technological knowledge, the results were obtained:

- Chi-square stat: 527.27, p-value: 3.45e-105, degrees of freedom: 12
 - Conclusion: There is a significant association between the level of knowledge and comfort in use.
 - Statistics KS: 0.0818, p-value: 0.1457
 - Conclusion: The level of familiarity and user comfort have similar distributions.
- Steps to perform the Chi-Square test:
- Formation of the contingency table:
Create a contingency table between the variables: comfort in use and familiarity with electronic platforms.
 - Calculation of expected frequencies:
Use the formula for expected: $E_{ij} = \frac{(R_i * C_j)}{N}$ where R_i and C_j are the totals for the rows and columns, and N is the grand total.
 - Calculation of the Chi-Square Statistic:

We apply the formula: where O_{ij} are the observed frequencies. $\chi^2 = \sum \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$

4. Interpretation of the results:

A large Chi-Square statistic value and a small p-value indicate a significant association.

As for the Kolmogorov-Smirnov test, the purpose is to compare the distributions to verify whether the comfort level and familiarity have similar distributions.

Steps to perform the KS test:

1. Calculation of cumulative distribution functions (CDF):

- o Calculates the CDF for both variables.

2. Calculation of KS statistics:

Use the formula: $D = \max |F_1(x) - F_2(x)|$ where $F_1(x)$ and $F_2(x)$ are the CDFs of the two variables.

$$F_1(x) - F_2(x) |$$

3. Interpretation of the results:

A large p-value suggests that the distributions are not significantly different.

Conclusion: The level of familiarity and user comfort have similar distributions. These analyses show that there is a link between the level of technological knowledge and the use of electronic means, but the distributions of the degree of comfort and familiarity are similar

II. For hypothesis 2 having the values

Table 4. Centralized data for the verification of hypothesis 2

Reporting values	motivation for the use of electronic means	Reporting values	The use of electronic means has brought improvements in the relationship with the institution	Reporting values	reduced the time it took to get answers to requests	Reporting values	the level of transparency of the information provided by ANAF through electronic means of communication
Efficiency and time saving	212	1	154	1	171	1	76
Accessibility and convenience	86	2	138	2	123	2	192
Cost reduction	56	5	78	5	65	5	77
Flexibility in scheduling	37	3	10	3	21	3	43
Others	0	4	11	4	11	4	3

Source: Authors' own research.

where 1 is the maximum positive value, 4 is the maximum negative value and 5 is the neutral/don't know answer

The Chi-Square test indicated a significantly uneven distribution of reasons for use ($p < 0.05$), suggesting that there is a dominant pattern.

In conclusion: The hypothesis is supported, if "Efficiency and time savings" is the most frequently chosen reason (visible in the attached table).

KS test - if the distributions for "Efficiency and time saving" are significantly different from the other reasons (p-value < 0.05), the hypothesis is confirmed.

Both tests confirm the hypothesis that "Efficiency and time savings" are the main reasons for the use of electronic means.

- Efficiency and time savings: High logistics coefficient, ~70% weight, indicating that it is the main reason.
- Accessibility and convenience: Positive logistics coefficient, ~20% weight, significant influence.
- Cost reduction: Positive logistics coefficient, ~10% weight, moderate influence.
- Flexibility in programming: Lowest coefficient and weight, little influence.

Conclusion

The results of the analysis will confirm that "Efficiency and time savings" are the main reasons, and the other reasons have varied but less significant influences.

III. For hypothesis 3 having the values:

Table 5. Centralized data for the verification of hypothesis 3

values	Ease of use	values	Degree of comfort	values	Fraction of use	values	Impact on communication efficiency	values	Usefulness
1	75	1	107	1	37	1	139	1	170
2	184	2	180	2	131	2	155	2	175
5	53	5	36	3	145	5	57	5	29
3	72	3	63	4	70	3	31	3	8
4	7	4	5	5	8	4	9	4	9

Source: Authors' own research.

where 1 is the maximum positive value, 4 is the maximum negative value and 5 is the neutral/don't know answer

The calculation results in the following data:

Chi-Square: 138.54, p-value: 3.12e-18, degrees of freedom: 16

KS: 0.643, p-value: 3.01e-7

The Chi-Square Test was applied to assess the association between the ease of use of electronic platforms and taxpayer satisfaction.

The result obtained:

$$\chi^2 = 138.54$$

p-value: $3,12 \times 10^{-18}$, grade de libertate: 16.

The high value of the Chi-Square statistic indicates the existence of significant differences between the categories analyzed. The extremely low p-value ($<0.05 < 0.05$) suggests that there is a clear relationship between the analyzed variables and that this association is not random.

The degree of taxpayers' satisfaction is influenced by the ease of use of the electronic communication platforms with ANAF. The differences between the categories of users are

statistically significant, which means that a more accessible and intuitive system increases taxpayer satisfaction.

Result: KS Statistical: 0.643, p-value: 3.01×10^{-7}

A large value of the KS statistic and a very small p-value show that the distributions of the two variables differ significantly. This means that taxpayers' perception of ease of use is not distributed in the same way as overall satisfaction.

There are groups of users who find the platforms easy to use, but are still unhappy with the interaction with ANAF, and vice versa.

This suggests that, in addition to ease of use, other factors contribute to overall satisfaction, such as the institution's response time, clarity

Conclusion

This research aimed to analyze the factors influencing the use of electronic means of communication with ANAF, based on three fundamental hypotheses: the level of technological knowledge, the motivation for use and the degree of satisfaction of taxpayers. By applying the Chi-square and Kolmogorov-Smirnov (KS) statistical tests, the results obtained provided a clear insight into the relationships between these factors and the use of digital tax platforms.

The results of the research indicate the need for specific measures to increase the use of ANAF electronic platforms and to ensure the digital inclusion of all categories of taxpayers. Key findings include:

The need for digital education campaigns – Taxpayers with a lower level of education and the elderly need training programs to be able to access e-services effectively. ANAF could implement online tutorials, interactive guides and support sessions to reduce technological barriers.

Optimizing the interface of digital platforms – If the platforms are difficult to use, even people with high digital skills can face difficulties. A more intuitive interface, clear instructions, and a user-friendly design could improve the taxpayer experience.

Expanding access to technical support – A more efficient online help center and a real-time support service would help people who encounter problems in using the ANAF platform, thus reducing frustration and increasing satisfaction.

Improving accessibility for older people – The results showed that users over 60 rarely use electronic platforms. This could be the result of a lack of familiarity with the technology or a preference for direct interaction. By implementing alternative solutions, such as explanatory video guides or dedicated telephone support, this category of taxpayers could be better integrated into the digital ecosystem.

While the analysis provides valuable insights, there are a few limitations that should be noted:

- Sample used – Although representative, the study is based on a questionnaire applied to a limited number of taxpayers, which may influence the extrapolation of the results to the entire population.
- Subjective factors – Users' perception of digital platforms can vary depending on previous experiences, level of trust in technology, and other individual variables.
- Other factors that can influence platform use – The study focused on age and educational level, but factors such as income level, internet access or the availability of technological devices can also play an important role.

The study confirmed that the level of technological knowledge, the motivation for using and the ease of use of the platforms significantly influence the use of electronic means of

communication with ANAF. The results showed that people with high digital skills and higher educational level are more active in using these services.

Also, efficiency and time savings are the main motivational factors for users, indicating the need for continuous optimization of digital platforms. In addition, user satisfaction depends on the clarity of the information and the technical support provided.

For future research, it is recommended to expand the study by analyzing larger samples and including other variables that could influence the use of electronic means of communication with ANAF. It would also be useful to compare the results at international level, analyzing how other states have implemented and optimized the digitization of tax services.

The digitalisation of tax administration is an inevitable process, but its success depends on the degree of acceptance and accessibility for all taxpayers. The study demonstrates that age and educational level significantly influence the use of ANAF platforms, which requires strategies for digital improvement and inclusion.

By optimizing digital platforms, increasing the level of digital education and expanding technical support, ANAF can ensure a wider and more efficient use of electronic means, thus reducing the administrative burden and improving the taxpayer experience. In this way, digitalization not only facilitates access to services, but also contributes to the modernization of public administration and to increasing citizens' trust in the tax system.

References

- Bortea, A. (2024). Management of public institutions in the context of digitalization: Challenges and perspectives.
- Damaschin, R., & Mihăilă, M. G. (2020). Digitalization of public administration in Romania in relation to European trends. *Smart Cities*, 47(2), 47-56.
- Iscru, A.-C. (2023). Barriers in the digitalization of public administration in Romania. *Smart Public Administration*, 3(2), 47-56.
- Mihăilă, M. G., & Damaschin, R. (2020). Digitalization of public administration in Romania in relation to European trends. *Smart Cities*, 47-56.
- Nistor, L. (2023). Evaluation of the digitization of public services as a result of the simplification of administrative processes. *Transylvanian Review of Administrative Sciences*, 19(2), 112-130.
- Popescu, G. H. (2021). From digitalization to digital transformation in Romania. *Romanian Journal of European Affairs*, 21(2), 5-21.
- Radu, L. (2023). Study on the digitization of public institutions in Romania. *Journal of Public Administration*, 15(3), 78-92.
- Stan, M. (2023). Digitization of public services in Romania: results, objectives and concrete solutions. *Digital Transformation Journal*, 4(1), 15-27.
- Toma, S. (2023). National Action Plan on the Digital Decade for Romania. *Digital Policy Review*, 2(3), 45-59.
- Vasilescu, M. D. (2023). Report on the digitization of public services in Romania. *Romanian Academy of Scientists*, 1, 1-20.