

Research on the evaluation model for the impact of AI services

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Abstract

This study aims to propose a framework for evaluating the impact of artificial intelligence (AI) services, based on the concept of AI service impact. It also suggests a model for evaluating this impact and identifies relevant factors and measurement approaches for each item of the model. The study classifies the impact of AI services into five categories: ethics, safety and reliability, compliance, user rights, and environmental friendliness. It discusses these five categories from a broad perspective and provides 21 detailed factors for evaluating each category. In terms of ethics, the study introduces three additional factors—accessibility, openness, and fairness—to the ten items initially developed by KISDI. In the safety and reliability category, the study excludes factors such as dependability, policy, compliance, and awareness improvement as they can be better addressed from a technical perspective. The compliance category includes factors such as human rights protection, privacy protection, non-infringement, publicness, accountability, safety, transparency, policy compliance, and explainability. For the user rights category, the study excludes factors such as publicness, data management, policy compliance, awareness improvement, recoverability, openness, and accuracy. The environmental friendliness category encompasses diversity, publicness, dependability, transparency, awareness improvement, recoverability, and openness. This study lays the foundation for further related research and contributes to the establishment of relevant policies by establishing a model for evaluating the impact of AI services. Future research is required to assess the validity of the developed indicators and provide specific evaluation items for practical use, based on expert evaluations.

Keywords: *Artificial intelligence service, Service impact assessment, Analysis criteria, STEEP, Public aspect.*

1. INTRODUCTION

Artificial intelligence technology is rapidly advancing, and AI(Artificial Intelligence) integration into products and services across various industries is increasing, leading to significant socioeconomic implications of AI services [1, 2]. Consequently, it is necessary to prepare for potential issues and risks that may arise from AI services' societal impact and ripple effects. This involves establishing analytical criteria to assess the environmental changes caused by AI and the influence AI has in various fields, as well as implementing appropriate responses based on evaluations of AI's impact. As the level of AI technology and service development varies, AI impact assessment should evolve from one-time projects to sustained efforts and programs, even reaching institutionalization.

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This study aims to present the concept of the impact of AI services and provide a framework for evaluating the impact of AI service. Moreover, it emphasizes the significance of proposing a model for evaluating such impact. Based on each measurement criterion of this model, the study seeks to identify relevant factors and suggest measurement approaches.

2. LITERATURE

1.1 AI Service Impact

1.1.1 AI

The concept of AI refers to the development of computer systems that can perform tasks that typically require human intelligence, such as visual perception, speech recognition, decision-making, and language translation. AI systems can be trained with data and algorithms to perform these tasks and can be designed to mimic human cognitive processes such as learning and problem solving.

The goal of AI research is to create machines that can work and learn like humans, and the development of AI technologies has the potential to greatly impact many areas of our lives [3, 4, 5].

1.1.2 AI Service

The concept of AI services refers to the applications and products that utilize AI technologies to provide solutions and services to businesses, organizations, and individuals [6, 7].

AI services can take many forms, such as chat-bots, virtual assistants, predictive analytics, and image recognition, and they can be used to automate processes, improve efficiency, and enhance customer experiences.

AI services can be delivered through cloud computing, on-premise software, or mobile applications and can be customized to meet specific business requirements. The widespread adoption of AI services is driving the growth of the AI industry and transforming many industries across the world.

1.1.3 AI Service Impact

The concept of impact of artificial intelligence services refers to the effects or consequences that the implementation and use of AI technologies have on different aspects of society such as economy, culture, ethics, politics, and human behavior.

This impact can be both positive and negative [8, 9, 10], and it is important to consider and manage the consequences of AI to ensure its responsible and beneficial deployment [11, 12].

1.2 The legal aspect of the impact of AI services

From a legal perspective, the impact of artificial intelligence services can be significant and complex. Some potential legal issues such as liability, privacy, discrimination, Intellectual property, employment and labor are shown in table 1.

Table 1 .Considerations for the legal aspect of AI services

Classification	Contents
Liability	In cases where AI systems cause harm or make errors, it can be difficult to determine who is responsible.
Privacy	AI systems often collect, process, and store large amounts of personal data, which raises privacy concerns and the need for effective data protection laws.
Discrimination	AI algorithms may perpetuate or amplify existing biases, leading to discrimination against certain groups.
Intellectual Property	AI systems may generate new forms of intellectual property, such as original creative works, which raises questions about ownership and control.
Employment and Labor	The widespread adoption of AI may lead to job losses and changes in the labor market, and there may be legal implications for worker rights and protections.

Therefore, it is important to have clear and comprehensive legal frameworks in place to address the impact of AI services and ensure that they are used responsibly and ethically.

1.3. The impact of AI services from the perspective of influence

From an impact perspective, artificial intelligence services can have a range of effects on various aspects of society such as economic, cultural, ethical, political and human behavior. (see Table 2)

Table 2. Considerations for the impact aspect of AI services

Classification	Contents
Economic	AI can increase productivity and efficiency, but it can also lead to job displacement and require significant investments in new technologies and skills.
Cultural	AI can change the way we live and interact, and it can impact our values and beliefs.
Ethical	AI raises important ethical questions about accountability, bias, privacy, and the use of personal data.
Political	AI can be used for both good and evil, and it has the potential to impact power dynamics and contribute to social and geopolitical conflicts.
Human behavior:	AI can influence our behavior and decision-making, and it can raise questions about agency and responsibility.

It is important to carefully consider the impact of AI services and to ensure that they are developed and used in a responsible and ethical manner that benefits society as a whole.

1.4. The impact of AI services from the perspective of objectives

From a goal perspective, the purpose of artificial intelligence services can vary greatly depending on the specific application and the context in which it is used. Some common goals for AI services include the followings. (see Table 3)

Table 3. Considerations for the implementation objectives of artificial intelligence

Classification	Contents
Automation	AI can automate repetitive and time-consuming tasks, freeing up human time and resources for more strategic and creative activities.
Decision-making	AI can provide data-driven insights and recommendations to support human decision-making, such as in the areas of marketing, finance, and healthcare.
Customer experience	AI can enhance the customer experience by providing personalized and real-time support, such as through chatbots and virtual assistants.
Optimization	AI can optimize operations and processes, such as in supply chain management and resource allocation.
Innovation:	AI can drive innovation by enabling new and more efficient ways of solving problems and creating value.

The goal of AI services can range from increasing efficiency and productivity to improving people's lives, and it is important to carefully consider the intended outcomes and impacts of AI technologies.

1.5 Examples of evaluating the impact of AI services

When examining research on the evaluation of the impact of AI services conducted abroad, it is focused on the ethical aspects and risk factors of AI services. Currently, in Korea, various attempts are being made to establish the foundation for evaluating the impact of AI services, rather than applying it at a legal level. The country is actively conducting research on the National Artificial Intelligence Ethics Standards and Intelligent Information Society Ethics Guidelines, led by the government.

Countries like Canada, the United States, and Singapore have already begun examining the legal directions in this regard. In Europe, several projects are being undertaken within the EU, and relevant research is being conducted[13]. The following are some materials related to the evaluation of the impact of AI services

conducted abroad (see Table 4).

Table 4. Evaluation of the impact of overseas AI services

No	Case name (Publishing institution, Publication year)
1	AI Utilization Guidelines (The Conference toward AI Network Society, 2017)
2	Artificial Intelligence Impact Assessment (ECP, 2018)
3	Data Protection Impact Assessment (EU, 2018)
4	IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems (IEEE, 2018)
5	IEEE Wellbeing (IEEE, 2018)
6	Singapore AI Governance Framework (PDPC, 2018)
7	Ethically Aligned Design, Version 2 (IEEE, 2019)
8	U.S. AI Leadership: A Plan for Federal Engagement in Developing Technical Standards and Related Tools (U.S. Government, 2019)
9	Trusted AI Assessment List for Self-Assessment (AI HLEG, 2020)
10	IEEE 7010 within the SHERPA Project (IEEE, 2020)
11	Canada's AI and Data Impact Assessment (Government of Canada, 2022)
12	UNESCO Recommendation on the Ethics of Artificial Intelligence (UNESCO, 2021)
13	AI Risk Management Framework (NIST, 2022)
14	Ethics and Algorithm Toolkit (Beta) (Center for Government Cooperation, 2018)
15	Algorithmic Impact Assessment: A Practical Framework for Public Agencies' Accountability (Dillon Reisman et al., 2018)
16	Guidelines for Ethical AI in an Intelligent Information Society (Ministry of Science and ICT, 2019)
17	National AI Ethics Standards (Ministry of Science and ICT and Korea Information Society Development Institute, 2021)

The following are materials related to the impact of artificial intelligence being reviewed in Korea.

Table 5. Evaluation contents for the impact assessment of Korea AI services

No	Case name (Publishing institution, Publication year)
1	Guidelines for Ethical AI in an Intelligent Information Society (Ministry of Science and ICT, 2019)
2	National AI Ethics Standards (Ministry of Science and ICT and Korea Information Society Development Institute, 2021)
3	Principles for an Intelligent Information Society Centered on Users (Broadcasting and Telecommunications Commission, 2019)
4	National AI Ethics Standards (Ministry of Science and ICT, 2019)
5	Financial AI Guidelines (Financial Services Commission, 2021)
6	Environmental Impact Assessment (Ministry of Environment)
7	Personal Data Impact Assessment

3. INDICATORS FOR EVALUATING THE IMPACT OF AI SERVICES

3.1. Derivation of AI service evaluation indicators

In this study, the contents examined to create indicators for evaluating the impact of AI services can be classified into the following five categories, using the STEEP framework: Social, Technology, Politics, Economy, and Ecology. The identified limitations in current AI services were also classified, and these categories were linked to the provisions mentioned in Article 56 of the Basic Act on Intelligent Informationization in Korea. The classification perspective was also presented horizontally.

The domestic legal regulations regarding the impact assessment of AI are based on Article 56 of the Basic Act on Intelligent Information Society, which requires national and local governments to analyze the impact of the widespread use of intelligent information services on society, economy, culture, and people's daily lives, considering their significant influence on people's lives.

Please note that the translation has been adapted to maintain the intended meaning and may not be a literal translation.

Table 6. Deriving indicators for AI service impact assessment

Classification	1	2	3	4	5
STEEP	Social	Technology	Politics	Economy	Ecological
Limitations Perspective	Human Rights Violations	Technology Misuse	Personal Data Breach	Inadequate User Protection	Other
Article 56 of the Basic Act	Intelligent Information Society Ethics	Safety and Reliability	Privacy Protection and Information Security	Employment, Labor, Fair Trade, User Rights	Impact on Culture and Daily Life
Classification Perspective	Horizontal Perspective				
Development Institution	Korea Information Society Development Institute (KISDI)				
Actor Perspective	Service Providers/Users	Service Providers (Developers)	Stakeholders (Government Agencies)	Service Users	Stakeholders (Government Agencies)
Review Considerations	Is the service ethically impactful?	Is the service technologically impactful?	Is the service impactful from a legal and institutional perspective?	Is the service impactful in terms of user rights?	Is the service impactful environmentally?
Principles	Dignity of Individuals Public Interest of Society Multi-Purpose Nature of Technology		Principle of Legality		
Areas of Impact Assessment	Ethicality	Safety and Reliability	Legality	User Rights	Environmental Friendliness

3.2. Domains for evaluating the impact of AI services

Artificial Intelligence Service Evaluation Areas Derived from the Criteria Discussed:

Ethics refers to the standards for making appropriate decisions and actions in the development, use, management, and control of artificial intelligence systems. This includes aspects such as protection of individuals' personal information, fairness in decision-making, and reliability. Ethical regulations for AI systems are continuously revised in line with technological advancements, taking into account issues of social rights and responsibilities.

Safety and Reliability ensures the stable and trustworthy operation of artificial intelligence systems. Safety and reliability encompass factors such as accuracy, availability, and security of AI systems. High safety and reliability in AI systems provide users with reliable results and minimize potential harm through stable operation.

Legality relates to the extent to which the results provided by AI systems align with user expectations from a legal and regulatory perspective. Legality includes factors such as accuracy, reliability, and availability of AI systems. AI systems that demonstrate high legality provide users with accurate and reliable results, meeting their expectations. Additionally, such systems ensure efficient operation, saving users time and costs.

User Rights focuses on ensuring the rights and interests of users who utilize AI services. User rights involve aspects such as protection of personal information, appropriate use of personal data, and prevention of harm caused by intentional or negligent actions. AI systems with a high level of user rights protection guarantee users' rights and interests, offering trustworthy AI services.

Environmental Friendliness pertains to minimizing the impact on the environment throughout the development, operation, and disposal processes of AI systems. This includes considerations such as high energy consumption or proper waste management during disposal. Environmentally friendly AI systems reduce their environmental impact, contribute positively to the environment, and provide sustainable AI services.

Based on the selected criteria, the following measurement indicators were classified into the respective categories:

Table 7. The measurement indicators of AI Impact evaluation model

Factors/Items	Ethics	Safety and Reliability	Compliance	User Rights Protection	Environmental Friendliness
(1) Human rights protection	O	O	O	O	
(2) Privacy preservation	O	O	O	O	
(3) Respect for Diversity	O	O		O	O
(4) Non-infringement	O	O	O	O	
(5) Publicness	O	O	O		O
(6) Solidarity	O			O	O
(7) Data management	O	O			
(8) Accountability	O	O	O	O	O
(9) Safety	O	O	O	O	O
(10) Transparency	O	O	O	O	O
(11) Policy orientation			O		
(12) Compliance			O		
(13) Accessibility (information disparity)	O*	O		O	
(14) Educational aspect		O		O	
(15) Supervision		O		O	
(16) Awareness enhancement					O
(17) Restorability		O			O
(18) Openness	O*	O			O
(19) Fairness	O*	O		O	
(20) Explainability		O	O	O	
(21) Accuracy		O	O		

* For Ethics, the content developed by KISDI is supplemented by the author.

3.3 Evaluation Factors

3.3.1. Human rights protection

From the perspective of human rights protection, the development and utilization of artificial intelligence should respect the rights granted equally to all individuals and uphold various democratic values and the rights specified in international human rights law. Furthermore, the development and utilization of artificial intelligence must not infringe upon human rights and freedoms.

3.3.2. Privacy preservation

Privacy Preservation involves safeguarding individuals' privacy throughout the entire process of developing and utilizing artificial intelligence. Efforts should be made to minimize the misuse of personal information throughout the entire lifecycle of artificial intelligence.

3.3.3. Respect for Diversity

Respect for Diversity entails reflecting the diversity and representativeness of users in the development and utilization of artificial intelligence, minimizing biases and discrimination based on individual characteristics such as gender, age, disability, region, race, religion, and nationality. Commercialized artificial intelligence should be applied fairly to all individuals. Moreover, ensuring accessibility to artificial intelligence technologies and services for socially disadvantaged and vulnerable groups, and striving for equitable distribution of the benefits of artificial intelligence to all people, not just specific groups.

3.3.4. Non-infringement

In terms of Non-infringement, artificial intelligence should not be used with the intention of directly or indirectly causing harm to humans. Measures should be taken to address the risks and negative outcomes that can arise from artificial intelligence services.

3.3.5. Publicness

Artificial intelligence should be utilized not only for personal happiness but also for enhancing social publicness and serving the common good of humanity. Therefore, artificial intelligence should be used in a direction that leads to positive societal changes. To achieve this, comprehensive education should be conducted to maximize the benefits and minimize the drawbacks of artificial intelligence.

3.3.6. Solidarity

From the perspective of solidarity, it is necessary to maintain the relational solidarity among various groups and consider the future generations when utilizing artificial intelligence. Throughout the entire life cycle of artificial intelligence, it is important to ensure fair opportunities for diverse stakeholders to participate.[14] In particular, from an ethical standpoint, international cooperation should be sought to minimize negative factors and provide positive impacts through the utilization of artificial intelligence services.

3.3.7. Data management

In data management, individual data such as personal information should be utilized in accordance with their intended purposes and should not be used for purposes other than those intended. Additionally, data quality and risks should be managed throughout the entire process of data collection and utilization to minimize data biases.

3.3.8. Accountability

To ensure responsibility, efforts should be made to minimize potential harm by establishing accountable entities throughout the process of artificial intelligence development and utilization. Clear accountability should be assigned among AI designers, developers, service providers, and users..

3.3.9. Safety

To ensure safety, efforts should be made throughout the entire process of artificial intelligence development and utilization to prevent potential risks and guarantee safety. In the AI utilization process, there should be efforts to provide users with the capability to control its operations when clear errors or breaches occur.

3.3.10. Transparency

In order to ensure transparency, efforts should be made to enhance an appropriate level of transparency and explain ability in the utilization of artificial intelligence, taking into consideration the principles and trade-offs for fostering social trust. Moreover, when providing AI-based products or services, it is necessary to provide advance notice of the utilization details of AI and potential risks that may arise during the utilization process.

3.3.11. Policy orientation

In terms of policy orientation, it is essential to adhere to the action plans determined by the government or state in order to address public issues or achieve specific goals.

3.3.12. Compliance

In terms of compliance with laws and regulations, stakeholders involved in AI services must recognize their collective responsibility to ensure the proper functionality of AI services and uphold human-centered values, while adhering to relevant laws and contractual obligations. This can be linked to the principle of accountability in intelligent information services.

3.3.13. Accessibility (information disparity)

Accessibility to various information should be equitable, ensuring equal opportunities to access and utilize information and communication services through information and communication networks, regardless of economic, regional, physical, or social conditions. This can be explained in connection with the principle of non-discrimination in intelligent information services.

3.3.14. Educational aspect

Educational aspect should be made to provide an environment for fostering specialized personnel in artificial intelligence services for educational purposes.

3.3.15. Supervision

In terms of regulatory oversight, adequate levels of interaction and control should be provided in accordance with the provision of artificial intelligence services. Additionally, means and procedures for handling emergency situations and accepting risks associated with the services should be established.

3.3.16. Awareness enhancement

In terms of awareness enhancement, efforts should be made by governments, public organizations, etc., to promote citizen participation, digital literacy, AI ethics education, and media engagement in order to foster awareness and understanding of AI technology and the value of data.

3.3.17. Restorability

An environment should be created to adapt to and withstand the changes brought about by AI services.

3.3.18. Openness

The members of an intelligent information society should be able to participate in public user policy

processes without discrimination, and public entities should establish regular channels through which providers and users can effectively present their opinions. This can be linked to the key principles of intelligent information services, particularly the principle of participation.

3.3.19. Fairness

It is important to recognize that artificial intelligence services can potentially contribute to social and economic inequalities or disparities, and efforts should be made to minimize discriminatory elements at all stages of algorithm development and usage. This can be linked to the key principles of intelligent information services, particularly the principle of non-discrimination.

3.3.20. Explain ability

Explain ability means that when an artificial intelligence service has a significant impact on users, relevant information should be provided in a manner that users can understand, without infringing upon the legitimate interests of the company. In cases where user fundamental rights have been affected, the key factors used for prediction, recommendation, or decision-making should be explainable. This is related to the key principles of intelligent information services, particularly the principle of interpretability.

3.3.21. Accuracy

Artificial intelligence services should provide users with accurate information and make efforts to provide supporting evidence accordingly.

4. DISCUSSION ON THE MODEL FOR ASSESSING THE IMPACT OF AI SERVICES

4.1. Discussion

Various services utilizing artificial intelligence technology are emerging, contributing to positive societal development and aiming to ensure the provision of ethical and responsible AI services. To assess the impact of AI services and mitigate potential negative factors in the market, several research efforts are being conducted. Therefore, this study is significant in measuring and evaluating the influence of AI services in the market, with the intention of reducing and addressing negative aspects through prevention and intervention.

The five dimensions proposed in this study (Ethics, Safety and Trustworthiness, Compliance, User Rights, and Environmental Friendliness) are based on the ethical framework previously developed by KISDI (Korea Information Society Development Institute). Horizontal discussions on each dimension are conducted, and a set of 21 specific factors is presented for the evaluation of each dimension.

Regarding the Ethics dimension, Accessibility, Openness, and Fairness are added to the ten existing factors developed by KISDI.

For the Safety and Trustworthiness dimension, elements such as Interconnectivity, Policy Orientation, Compliance, and Enhancement of Awareness are excluded as they can be discussed under technical aspects.

The Compliance dimension includes factors such as Human Rights Protection, Privacy Protection, Non-Infringement, Public Interest, Responsibility, Safety, Transparency, Policy Orientation, Compliance, and Explain ability.

User Rights dimension excludes factors such as Public Interest, Data Management, Policy Orientation, Compliance, Enhancement of Awareness, Restorability, Openness, and Accuracy.

The Environmental Friendliness dimension covers Diversity, Public Interest, Interconnectivity, Transparency, Enhancement of Awareness, Restorability, and Openness.

4.2. Key Points and Limitations

This study addresses the impact of AI services and analyzes the metrics based on existing domestic and international literature. Therefore, it is significant in establishing a foundation for researching the impact of AI services. Additionally, this research can serve as a reference when establishing the institutional framework in Korea.

However, there are limitations to this study, which include the relatively insufficient process of incorporating opinions from various experts in the analysis. Continuous discussions and debates are necessary regarding this model. Some researchers may argue that the 21 factors may contain certain redundancies. Thus, it is important to gather sufficient input and examine the validity of the proposed items.

5. CONCLUSION

Artificial intelligence technology, coupled with the generation of big data from the Internet of Things and incredibly fast computing power, is progressively learning human cognitive abilities. As a result, AI plays diverse roles not only as a personal assistant but also in various business sectors, including corporate decision-making and customer management.

In light of the rapid proliferation of AI services in the market, it is crucial to assess their impact and create an environment that can mitigate any negative effects and provide effective responses.

This study categorizes the impact of AI services into five areas: ethics, safety and reliability, compliance, user rights, and environmental sustainability. These five domains are discussed from a horizontal perspective, and 21 specific factors are presented to evaluate each category. The evaluation process involves selecting appropriate factors from the 21 identified factors and developing corresponding metrics and items for assessment.

Regarding ethics, three additional factors, accessibility, openness, and fairness, are added to the ten existing factors developed by KISDI. For safety and reliability, factors such as interconnectivity, policy orientation, compliance, and perception enhancement are excluded as they fall under the realm of technical aspects. Compliance encompasses factors such as human rights protection, privacy preservation, prohibition of infringement, publicness, accountability, safety, transparency, policy orientation, compliance, and interpretability. User rights exclude factors such as publicness, data management, policy orientation, compliance, perception enhancement, restorability, openness, and accuracy. Environmental sustainability covers factors such as diversity, publicness, interconnectivity, transparency, perception enhancement, restorability, and openness.

This research aims to reduce and prevent negative factors in the provision of AI services through the measurement and evaluation process, thus supporting effective responses. It provides a foundation for assessing the impact of AI services and contributes to the establishment of related policies.

Future research should involve expert evaluation of the validity of the developed indicators based on discussions surrounding them. Additionally, it should propose specific evaluation items for practical application in real-world scenarios.

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REFERENCES

- [1] Yoo Soonduck. "A Study on the Method of Deriving AI Activation Policy," *Journal of the Korea Internet Broadcasting and Communication Society* 20, no. 5 (2020): 187-193.
- [2] Sowon Jeon, Jihee Lee, and Jongtae Lee. "A Study on User Acceptance Intention of AI Services: Focusing on Factors Influencing the Perception of Need for Conversational AI Services," *Journal of Technology Innovation* 22, no. 2 (2019): 242-264.
- [3] Misuraca, Gianluca, and Colin Van Noordt. "AI Watch-Artificial Intelligence in public services: Overview of the use and impact of AI in public services in the EU," *JRC Working Papers JRC120399* (2020).
- [4] Park Soo-ah, and Choi Se-jeong. "Factors Influencing Satisfaction with Artificial Intelligence Speakers and Continuous Usage Intention: Focusing on Functional and Emotional Factors," *Information Society and Media* 19, no. 3 (2018): 159-182.
- [5] Amazon Web Services(AWS) web site, 2022
- [6] sas web site, 2022
- [7] Changhwa Baek, Jaeho Choi, and Sungwook Lim. "Consideration and Suggestion of AI Service Characteristics and Quality Measurement Items," *J Korean Soc Qual Manag Vol* 46, no. 3 (2018): 677-694.
- [8] Van der Horst, Dan, and Saskia Vermeylen. "Spatial scale and social impacts of biofuel production." *Biomass and bioenergy* 35, no. 6 (2011): 2435-2443.
- [9] Jinyeol Kim. "Reviews on Policy 'Impact Assessment System' and Consumer Impact Assessment," *Consumer Policy Trends* 109 (2020): 1-25.
- [10] Nguyen, Tuyet-Mai, and Ashish Malik. "A two-wave cross-lagged study on AI service quality: The moderating effects of the job level and job role," *British Journal of Management* 33, no. 3 (2022): 1221-1237.
- [11] Naumov, Nikola. "The impact of robots, artificial intelligence, and service automation on service quality and service experience in hospitality," In *Robots, artificial intelligence, and service automation in travel, tourism and hospitality*. Emerald Publishing Limited, 2019.
- [12] Yoo, Soonduck, Jungihl Kim, and Kwangsun Ryu. "Using big data strategy for the development of the communication industry," In *International Conference on Web-Age Information Management*, pp. 349-359. Springer, Cham, 2014.
- [13] Hangyul Seo, Sangjun Nam and Seongjun Lee. (2019). Evaluating mobile communication service efficiency in OECD countries: using data envelope analysis methodology. *Journal of the Korean Society of Communications and Communications*, 44(2), 376-386.
- [14] Younghee Lee. "Social Control and Acceptance of Technology: The Politics of Technology Impact Assessment," *Economy and Society* (2007): 246-268.