Center For Asia-Pacific Fiscal Affairs

Innovations in Public Finance in the Era of Digital Transformation

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Ⅰ. Introduction

□ The emergence of the digital transformation era highlights the importance of innovations in public finance. Various advanced technologies are playing a key role in enhancing the efficiency of public financial management, strengthening transparency, and improving the quality of services.

○ Globally, governments and public institutions are leveraging advanced technologies such as artificial intelligence (AI), blockchain, and big data to maximize the efficiency of management in the public finance sector, enabling faster and more accurate fiscal operations through automation and optimization of public finance systems.

□ This report aims to analyze the significance of digital transformation in the field of public finance and its impact on public financial management. It further seeks to identify key factors for successful digital transformation by examining major domestic and international policy cases.

○ Through this analysis, the report seeks to present a strategic direction for digital transformation, and derive policy implications for more efficient and transparent fiscal management. Ultimately, it aims to examine how digital transformation enhances transparency, efficiency, and inclusiveness in public financial management, and to explore ways to contribute to the advancement of fiscal governance.

□ This report examines various cases of advanced technology adoption in the field of public finance, both in Korea and abroad, and analyzes how these technologies are being applied within public financial systems.

○ This report outlines the definition of digital transformation and the major advanced technologies being introduced in the field of public financial management. It also identifies key success factors of digital transformation through an analysis of both Korea's and international policy cases.

○ Lastly, the report presents the future direction of public finance innovation in the digital era and offers policy implications for achieving more efficient and transparent fiscal operations.

II. An Overview of Digital Transformation in Public Finance

1. Digital Transformation of Public Finance[1)]

A. Definition

☐ The digital transformation of public finance refers to the efficient enhancement of government fiscal operations, budget management, and revenue-expenditure processes through the use of information and communication technology (ICT) and data analytics tools.

○ It is expected to contribute to an increase in transparency, maximize effectiveness in fiscal execution, and reduce corruption.

☐ Digital transformation can be categorized into three stages: digitization, digitalization, and digital transformation.

○ Digitization: Converting analog information into digital form

○ Digitalization: Improving existing processes through digital technologies

○ Digital Transformation: Creating new models through the integration of digital technologies[2)]

☐ There are three approaches to the digital transformation of public finance: function, technology, and governance and management.

○ Function refers to how digitalization supports, automates, and redesigns business processes.

- Although IT system models for fiscal activities vary by country, they share common core functions and design principles.

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1) IMF (2023)
2) Lee & Kim (2023)

- AI enables the rapid generation of reliable fiscal information, facilitating data-driven decision-making.

○ IT Architecture refers to the foundational technological characteristics, including cybersecurity.

- The reuse of technology through digital building blocks can prevent redundant tasks and minimize the waste of resources.[3)]

○ Governance and management refer to the legal and institutional dimensions.

- Robust data protection is essential to safeguard privacy and other user rights.
- Digitalization not only brings about process automation, but also involves cultural and mindset shifts. Therefore, an appropriate change management strategy is necessary to ensure success in the digital transformation of the public finance sector.

□ The digital transformation of public finance offers several advantages, including enhanced revenue collection, increased efficiency in government spending, strengthened fiscal transparency, and improved delivery systems for public services such as education and healthcare.

B. Applications

□ The digitalization of tax administration includes the use of e-filing, e-invoicing, and electronic fiscal devices.

○ E-filing is widely used in developed countries but has a relatively low adoption rate in developing nations.

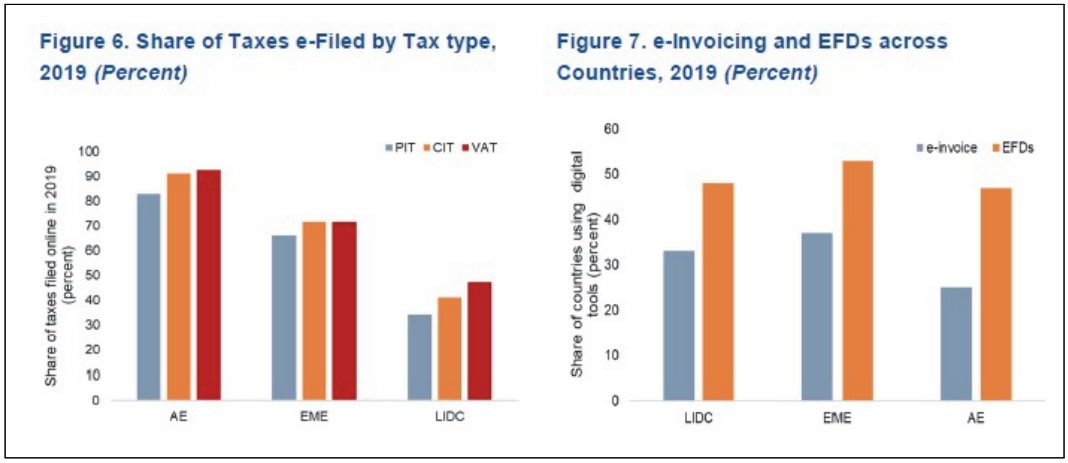
○ E-invoicing and electronic fiscal devices are more commonly implemented in emerging and developing countries than in advanced economies.

- These technologies facilitate the collection and tracking of transaction data, making the enforcement of value-added tax (VAT) and corporate income tax more effective.
- In Korea, the cash receipt system was introduced in 2005, contributing to a significant

3) Digital building blocks primarily refer to applications, platforms, and systems—often developed as open-source software—that can be reused and integrated to build larger, more complex systems.

increase in the tax capture rate—from 39.1% in 2004 to 88.6% in 2012, an annual growth of 5-7%.[4)]

[Figure Ⅱ-1] Utilization of E-Filing and E-Invoicing by Income Level across Countries



Note: CIT = Corporate Income Tax, PIT = Personal Income Tax, VAT = Value-Added Tax, EFD = Electronic Fiscal Device, AE = Advanced Economies, EME = Emerging Market Economies, LIDC = Low-Income Developing Countries

Source: IMF (2023), p. 12.

□ The digitalization of public expenditure involves the use of Financial Management Information Systems (FMIS), Treasury Single Account IT systems (TSA), e-procurement systems, and Public Investment Management Systems (PIMS).

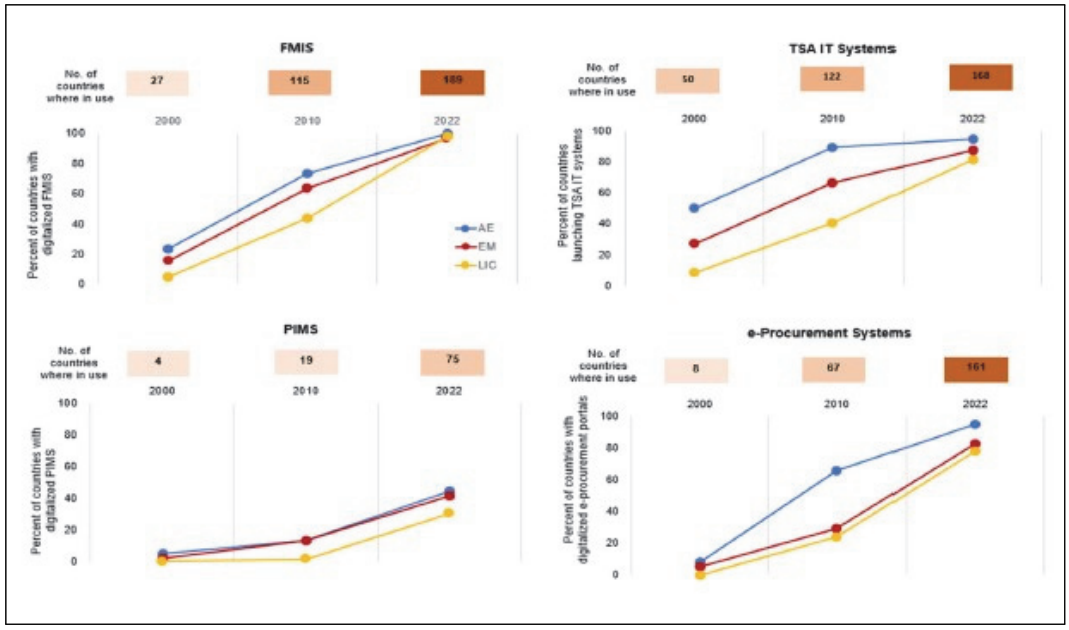
○ According to the World Bank's GovTech Maturity Index (2022)[5)], most countries had achieved significant digitalization by 2022 through FMIS, TSA IT systems, and e-procurement.

○ However, the development of Public Investment Management Systems (PIMS) has been relatively slow, with fewer than half of advanced economies and less than one-third of low-income countries having achieved digitalization in this area.

4) Lee (2016), p. 1371.

5) Calculated as a simple average of the scores of four components: The Core Government Systems Index, The Public Service Delivery Index, The Digital Citizen Engagement Index, and The GovTech Enablers Index (World Bank, 2022).

[Figure Ⅱ-2] Digitalization of Public Expenditure by Income Level across Countries



Note: FMIS = Financial Management Information System, TSA IT system = Treasury Single Account IT System, PIMS = Public Investment Management System, e-Procurement Systems = Electronic Procurement Systems, AE = Advanced Economies, EME = Emerging Market Economies, LIDC = Low-Income Developing Countries

Source: IMF (2023), p. 13.

C. Expected Outcomes

□ The digital transformation of the public finance sector is expected to contribute to increased revenue collection, enhanced fiscal transparency, and inclusive growth[6].

○ Revenue Collection

- The introduction of e-filing can increase revenue by up to 3% of GDP.
- The implementation of e-invoicing and electronic fiscal devices can raise revenues by approximately 0.7% and 0.5% of GDP, respectively.

6) IMF (2023)

○ Fiscal Transparency

- The automation of budget expenditures using digital technologies enhances budget transparency, as reflected in the Open Budget Index.
- The introduction of Public Investment Management Systems (PIMS) has systematized registration and management of capital investment projects, promoting fiscal transparency.

○ Inclusive Growth

- The adoption of digital payments and e-procurement can improve income distribution for women and the bottom 50% income group.

D. Digital Transformation Strategies for Public Finance[7)]

□ A national digital strategy is essential for sound digital transformation in public financial management, serving as a comprehensive plan that includes a vision and roadmap, overarching goals, policies, and the efficient use of resources.

○ To avoid a fragmented approach and duplication of effort, the national digital strategy should take into account four key elements: △ user needs, △ private sector engagement, △ risk mitigation, and △ inclusion.

- User-driven digitalization, facilitated through agile methodologies, enables governments to rapidly respond to the changing needs of citizens.
- Encouraging collaboration with the private sector supports the development, regulation, and adoption of digital technologies that account for social, ethical, and environmental impacts.
- Enacting privacy protection legislation, addressing systemic risks[8)], and providing civil servant training can help mitigate potential threats.
- Inclusion must be considered to ensure that digitalization policies benefit all people, particularly in the context of the digital divide.

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7) IMF (2023), pp. 19~20.

8) Among various systemic risks—such as those related to people, technology, and processes—particular attention must be paid to the human factor. According to Verizon (2022), 80% of data breaches typically result from unintentional employee errors.

○ Government strategies must be aligned with the current level of digital transformation in fiscal operations.

- Developing countries may have the opportunity to leapfrog from using basic public finance systems to adopting advanced digital technologies.

2. Digital Transformation of the Public Sector in Korea

□ With the purpose of enhancing the productivity, transparency, and democratic values of administrative agencies and improving the quality of life for citizens, the Korean government enacted the Act on Promotion of the Digitalization of Administrative Affairs, etc. for Creation of Electronic Government (hereinafter referred to as the Electronic Government Act) in 2001[9].

○ Since then, the Electronic Government Act has undergone multiple revisions to reflect evolving trends and societal demands.

- The 5th revision of the Electronic Government Act (enforced on July 29, 2014) and the 7th revision (enforced on December 9, 2021), respectively, established the legal basis for the development of a common big data infrastructure system and for the adoption and utilization of advanced technologies such as AI and cloud computing[10].

□ With the advancement of innovative digital technologies such as AI, big data, and cloud computing reaching an inflection point, we are entering an era of accelerated digitalization in which the ability to utilize these cutting-edge technologies plays a decisive role in national competitiveness.

□ In response to these trends and changes, the Korean government's new strategy is to promote a Digital Platform Government for administrative innovation. This is defined as "a government in which the public, businesses, and government entities collaboratively

9) Ministry of the Interior and Safety, Republic of Korea, "e-Government Laws and Institutional Frameworks", https://mois.go.kr/frt/sub/a06/b04/egovLawSystem/screen.do, accessed July 16, 2024.
10) Ibid.

solve societal problems and create new value through an integrated 'digital platform'[11]."

○ Representative technologies of the Digital Platform Government include process automation and AI.

○ The aim is to improve accuracy and speed in administrative tasks by reducing human error, ultimately enhancing the quality of administrative services provided by the government and thus increasing public satisfaction[12].

□ The Korean government has established various legal and institutional foundations to realize the Digital Platform Government.

○ The two main legal frameworks are the "Act on Promotion of the Provision and Use of Public Data" and the "Act on the Promotion of Data-Based Administration". In addition, the "Electronic Government Act" stipulates the principles, procedures, and implementation methods for the electronic processing of administrative affairs, thereby institutionalizing the enhancement of public value through the digitization of documents and the use of information and communication technology in administrative processes[13].

□ By advocating the Digital Platform Government, the Korean government has achieved outstanding results in international assessments conducted by organizations such as the UN and OECD, establishing itself as one of the world's leading digital governments in the global community[14].

○ Ranked 1st overall in the 2019 OECD Digital Government Index and 3rd overall in the 2022 E-Government Survey.

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11) The Presidential Committee on the Digital Platform Government Website, https://dpg.go.kr/DPG/contents/DPG03020000.do?schM=view&page=1&viewCount=9&id=&schBdcode=&schGroupCode=&id=20230530171501095647, accessed July 16, 2024.

12) Korea Institute of Public Administration (2023), p. 17.

13) The Presidential Committee on the Digital Platform Government Website, https://dpg.go.kr/DPG/contents/DPG03020000.do?schM=view&page=1&viewCount=9&id=&schBdcode=&schGroupCode=&id=20230530171501095647, accessed July 16, 2024.

14) Korea Institute of Public Administration (2023).

□ In the fiscal sector, digital transformation includes the development of financial information systems, subsidy management systems, e-procurement systems, and the National Tax Service's efforts to enhance taxpayer convenience and prevent tax evasion.

○ dBrain+: the Next-Generation digital budget and accounting system for the digitalization of budgeting and fiscal operations

○ e-Naradoum: the integrated subsidy management system for managing national subsidies and detecting fraudulent claims

○ The Next-Generation KONEPS (Korea ON-Line e-Procurement System): the digitalization of procurement operations

○ Business registration, pre-filled and auto-filled tax return services, and chatbot-based tax consultation provided by the National Tax Service

○ The establishment and application of the Korea Minting, Security Printing & ID Card Operating Corporation (KOMSCO)'s blockchain-based public trust platform

3. Key Technologies of Digital Transformation in Public Finance

A. Artificial Intelligence

□ Artificial Intelligence (AI) is a scientific technology that simulates human intellectual capabilities through computers. With the emergence of advanced algorithms, the widespread use of smartphones, and the development of networks leading to the accumulation of data, AI has seen rapid advancements in recent years.

○ AI is considered an innovative force that brings about broad structural changes in our industry and society, and is gaining attention as a key driver of the Fourth Industrial Revolution aimed at strengthening national competitiveness[15].

15) Korea Policy Briefing, https://www.korea.kr/special/policyCurationView.do?newsId=148868542#L1, accessed July 16, 2024.

□ There is no single globally adopted standard for classifying AI technologies, and numerous classification systems exist. However, commonly included technologies generally comprise machine learning, deep learning, natural language processing, generative models, text mining, speech recognition, voice analysis, simulation, data visualization, and image/video analysis[16].

○ (Machine Learning) Machine Learning (ML) refers to a technology that analyzes big data and makes predictions or decisions based on the results. It learns patterns from data through various learning methods such as supervised learning, unsupervised learning, and reinforcement learning.

○ (Natural Language Processing) Natural Language Processing (NLP) is a technology that enables computers to understand and interpret human language. It is used in various fields such as text mining, speech recognition, and translation, allowing for the analysis of various documents and facilitating communication between humans and computers.

○ (Computer Vision) Computer Vision is a technology that allows computers to understand and analyze images or videos. It includes image recognition, object detection, and video analysis, and is applied in various fields such as autonomous vehicles and medical image analysis.

○ (Deep Learning) Deep Learning is a type of machine learning based on artificial neural networks. It is a technology that learns complex patterns from large-scale data and performs better when trained on large volumes of high-quality data. As it learns from user behavior, its performance improves over time.

○ (Generative Models) Generative Models are models that generate new data based on given data. They are used in applications such as text generation, image creation, and music composition. Recently, large-scale language models like ChatGPT have made it possible to generate natural and coherent text.

16) Korea Institute of Public Administration (2023), p. 13.

B. Blockchain

□ Blockchain is a public digital ledger that records transaction data in blocks, which are sequentially linked in a chain over time and distributed across the computers of multiple participants. Blockchain operates on a decentralized network, eliminating the need for a central server[17].

□ A block can only be added through consensus among participants, and because each new block includes information from the previous one, it is difficult to alter or forge data, thereby ensuring its reliability.

○ All transaction records are shared among participants, and modifying a specific block affects all subsequent linked blocks, making it extremely difficult to arbitrarily alter once-recorded information[18].

C. Big Data

□ Big Data refers to large-scale data in various forms—such as text and images—that are generated at high velocity. It enables the utilization of previously hard-to-process unstructured data and allows for the rapid analysis of massive datasets to extract valuable information and patterns[19].

4. Literature Review

A. Digital Platform Government

□ *"Strategic Directions and Key Tasks for Implementing the Digital Platform Government under the New Administration"* (National Information Society Agency, 2022) examines the components of the "digital platform" and application cases of both the public and private

17) Seo & Jung (2018), pp. 288~289.
18) Kim (2018), pp. 104~105
19) Lee, et al. (2017), pp. 12-14.

sectors, and presents key success factors and strategic directions for implementing the Digital Platform Government.

○ For successful implementation of the Digital Platform Government, the report suggests that it is necessary to structure a data architecture that enables the effective integration and utilization of diverse data. It also highlights the importance of governance mechanisms such as a joint public-private committee.

□ *"Digital Platform Government Leading Innovation through Public-Private Collaboration"* (Go, 2022) introduces the concept of the Digital Platform Government as a solution for the digital transformation of public services, and outlines its objectives along with key priority tasks for its implementation.

○ Through the Digital Platform Government, a data-driven digital governance system should be established, enabling the government to enhance public convenience by recommending personalized services to citizens.

□ *"Standardization Trends and Implications for Building the Digital Platform Government"* (Lee & Kim, 2023) identifies key ICT technologies required for the realization of the Digital Platform Government and derives implications by examining standardization trends related to these technologies.

○ To implement the Digital Platform Government, it is necessary to ensure compatibility between existing and new technologies, as well as standardization across various platforms and datasets.

B. Digital Transformation in Public Finance

□ *"Application of AI in the Fiscal Sector and Its Implications"* (Park, 2023) examines the use of AI technologies in the public sector and its potential for expansion, and derives implications by analyzing domestic and international cases of AI application in the fiscal sector.

○ Countries such as the United States, Canada, and the United Kingdom are utilizing AI technologies in areas such as financial services, budget expenditures, and the detection of fraudulent claims. In contrast, the use of AI in Korea's fiscal sector is still in its early stages and requires further expansion.

□ *"Transforming Public Finance through GovTech"* (IMF, 2023) discusses how digitalization enhances public services such as public finance, education, and healthcare, and presents three stages of digitalization along with three core pillars for public finance initiatives.

○ It emphasizes that the digital transformation of public finance can improve the efficiency and transparency of public service delivery.

□ *"Artificial Intelligence and Public Finance"* (Woo, 2021) highlights that one of AI's key functions—classification—can facilitate the assessment of redundancy in budget planning, funds, and subsidy programs. It also stresses the need for the expansion of AI-related areas and the scale of fiscal expenditures in the future.

C. AI in the Public Sector

□ *"Application Strategies for Generative AI in the Public Sector"* (National Information Society Agency, 2023) examines the current use of generative AI in the public sector both domestically and internationally, and offers recommendations on key considerations for its implementation in the public domain.

○ It emphasizes the importance of identifying tasks suitable for generative AI based on its potential benefits and limitations, and highlights the need to establish appropriate security and personal data protection measures following its adoption.

□ *"Strategies for Expanding Public Services through AI Technologies"* (Bang, 2021) explores cases in which AI technologies—integrated with various ICT tools such as big data, chatbots, and extended reality—have been applied to public services, and offers key

recommendations for expanding AI-based public services.

○ It states that increasing government investments and focusing on talent development is essential in the AI sector, and stresses that the logical validity and ethical considerations surrounding the development and use of such services must be thoroughly reviewed before applying AI technologies to public services.

□ *"National Strategies for AI Adoption and Utilization in the Public Sector by Country"* (Korea Institute of Public Administration, 2024) reviews the AI strategies established by the United Kingdom, Australia, and the United States, and proposes policy ideas and alternatives that could be applied to the Korean context.

○ It highlights the need to establish a whole-of-government AI strategy, including guidelines on AI ethics and safety, and emphasizes efforts to resolve redundancies and complexities in governance to promote active AI utilization.

Ⅲ. Cases of Digital Innovation in the Public Finance Sector

1. Korean Cases in Digital Innovation

A. (dBrain+) Next Generation Digital Budget Accounting System

1) Background

□ In response to the growing need for more effective government budget and accounting management amid rapid social change, Korea introduced the Digital Budget and Accounting System (dBrain) in 2007. To address the limitations that emerged during its operation, the next-generation Digital Budget Accounting System (dBrain+) was launched in January 2022[20].

○ Prior to the introduction of the dBrain system, Korea's fiscal information systems were divided into the Financial Information Management System (FIMSys) for budget formulation and the National Financial Information System (NAFIS) for revenue, expenditure, and account settlement.

○ As a result, the two systems were operated by different ministries, lacking interoperability. This resulted in inefficient sharing of information, and thus measures were taken to integrate the systems for better national fiscal management[21].

○ Furthermore, there was a need to build an integrated fiscal information system to support innovations in fiscal institutions such as the National Fiscal Management Plan, accrual-based double-entry bookkeeping, performance-based management, and the top-down budgeting system[22].

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20) Song (2021), p. 1.
21) Lim (2012), p. 190.
22) Ibid.

□ Following the decision to establish an integrated fiscal information system at a Presidential Policy Agenda Meeting in 2004, the dBrain system was launched in 2007. It enabled the automation of fiscal operations, the development of systems for fiscal analysis, diagnostics, and forecasting, and laid the foundation for integrated national fiscal management.

□ However, aging infrastructure led to slower processing speeds, insufficient inter-ministerial connectivity, and the inability to adopt the latest information technologies (IT), causing ongoing inconvenience for users[23].

□ Therefore, the dBrain+ was launched to address these issues and incorporate new technologies for more efficient fiscal operations.

2) Implementation Process

□ (Implementation Process) The legal basis for the development of dBrain is mentioned in Paragraph (1) of Article 97-2 (Informatization of Financial Business) of the National Finance Act[24].

○ The development of the dBrain was one of the four major fiscal reform initiatives. It established a real-time management system for the entirety of national fiscal operations and enabled the sharing of key fiscal information accumulated within the system with the public, thereby facilitating more transparent and efficient national fiscal management[25].

23) Korea Fiscal Information Service, “2024 PEMNA On-site Visit Presentation Materials,” *Presentation Materials*, p. 4.
24) Statutes of the Republic of Korea Website, https://elaw.klri.re.kr/kor_service/lawView.do?hseq=67744&lang=KOR, accessed June 25, 2024.
25) Korea Ministry of Economy and Finance (January 20, 2022).

「National Finance Act」

「Article 97-2 (Informatization of Financial Business)」

(1) To ensure the smooth performance of finance-related affairs, the Minister of Economy and Finance may develop information and communications media, programs, etc. and require the heads of central government agencies to use them. In such cases, he or she shall in advance consult with the Board of Audit and Inspection on the development of information and communications media, programs, etc. concerning national accounting business.

(2) Notwithstanding paragraph (1), the heads of central government agencies may directly develop and use information and communications media, programs, etc. which handle finance-related business. In such cases, they shall in advance consult with the Minister of Economy and Finance and the Board of Audit and Inspection (limited to the development of information and communications media, programs, etc. concerning national accounting business).

(3) If the Minister of Economy and Finance deems it necessary for performing finance-related affairs through information and communications media, programs, etc. under paragraph (1), he or she may request the heads of relevant central government agencies, the heads of local governments, institutions falling under Article 9 (2) 2 and 3, and other relevant institutions to link electronic systems. In such cases, the heads of relevant central government agencies, etc. shall comply with such request unless there is a compelling reason not to do so. 〈Newly Inserted on Dec. 21, 2021〉

☐ Korea established a mid- to long-term development model for dBrain+ in 2013. Based on the results of a preliminary feasibility study conducted in 2015, budget was allocated, and the full-scale development of the dBrain+ system began in 2019.

☐ To establish dBrain+, the Project Implementation Team of the Korea Ministry of Economy and Finance (Korea MOEF) was launched in July 2019, and the system development project began in December of the same year.

□ dBrain+ was partially launched in May 2021 for use in the budget formulation process for fiscal year 2022, and later fully launched in January 2022. The system is currently in operation.

3) Key Functions and Roles

□ (Key Functions) dBrain+ consists of an Integrated Fiscal Information System, Fiscal Linkage, Fiscal Data System, and Business Support. It manages the full spectrum of fiscal operations, including government fiscal planning, budget formulation, fiscal execution, asset and liability management, accounting and settlement, and performance evaluation[26].

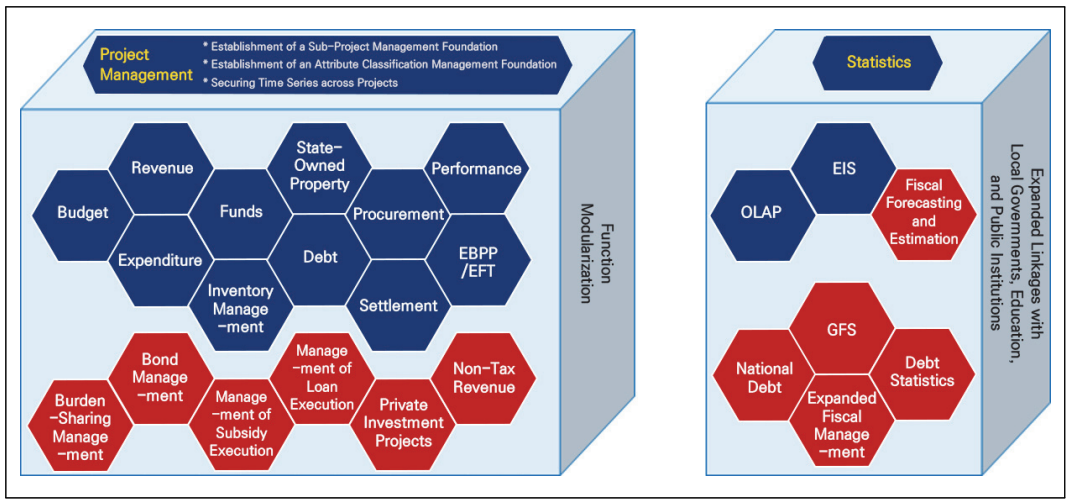
○ As of December 2023, dBrain+ is connected with 141 systems across 79 institutions, including the Public Procurement Service and the Bank of Korea, supporting real-time fiscal operations. It also enhances system usability through portals that provide national fiscal information and business support systems such as user training[27].

□ The main differences between dBrain and dBrain+ lie in the expansion of functions and support for data-driven policy decision-making.

○ (Expansion of Functions) The original dBrain system, which comprised 13 functional units, was expanded to include 11 new units such as burden-sharing management, Government Finance Statistics (GFS), and fiscal forecasting and estimation. As a result, a total of 24 fiscal functions were systematized, thereby addressing blind spots in fiscal management[28][29].

26) Korea Fiscal Information Service Website, https://www.fis.kr/ko/major_biz/dbrain_oper/main_func, accessed June 25, 2024.
27) Korea Fiscal Information Service Website, https://www.fis.kr/ko/major_biz/dbrain_oper/intro/status, accessed June 25, 2024.
28) Korea Fiscal Information Service, "2024 PEMNA On-site Visit Presentation Materials," *Presentation Materials*, p. 9.
29) Korea Ministry of Economy and Finance (January 20, 2022).

[Figure Ⅲ-1] Expansion of Functions in the Next-Generation Digital Budget and Accounting System



Source: Korea Ministry of Economy and Finance (January 20, 2022).

☐ (Support for Data-Driven Policy Decision-Making) The previous dBrain system, which was primarily designed for operational processing, lacked multidimensional analysis and diverse data visualization capabilities. It was also unable to perform an integrated analysis with economic, social, and administrative indicators from other ministries, limiting meaningful analytical outcomes. In contrast, dBrain+ enables such integration, allowing for value-added analysis and supporting data-driven policy decisions[30].

☐ Using the Korea Data Analysis Service (KODAS), an AI-based data analysis platform, dBrain+ can link fiscal data in real time with social, economic, and administrative indicators, as well as with private-sector data. The analysis results generated using AI technologies can then be utilized to inform policy decisions.

☐ In addition, the establishment of the Korea Risk Assessment & Horizon Scanning (KORAHS), a data-driven policy risk management system, enables the early detection of risk factors and supports proactive response measures.

30) Ibid

☐ The application of advanced information technologies (IT), such as big data, is expected to improve the efficiency of fiscal operations and enable swift monitoring of fiscal execution.

B. (e-Naradoum) National Subsidy Integrated Management System

1) Background

☐ As of 2024, national subsidies account for 16.6% of total government expenditures. Therefore, enhancing transparency and improving efficiency in the management of subsidies is essential[31].

○ The scale of national subsidies in Korea has more than doubled over the past decade, increasing from KRW 52.5 trillion in 2014 to KRW 109.1 trillion in 2024. This trend is expected to continue due to the expansion of welfare spending.

☐ The Integrated Management System for National Subsidies (e-Naradoum) was established to ensure that subsidies are used transparently and efficiently by automating and centrally managing the entire subsidy process, including the stages of allocation, execution, settlement, and post-management[32].

○ e-Naradoum was introduced to prevent the misuse of subsidy budgets funded by taxpayers by centrally managing subsidy-related information within the system and verifying eligibility for subprograms as well as supporting documents for expenditures.

○ Prior to the introduction of e-Naradoum, most tasks related to national subsidies were handled manually and operated under a “prepayment and post-settlement” system, which led to inefficiencies. The system aims to address these issues through electronic documentation and system-based settlement processes.

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31) Korea Fiscal Information Service Website, https://www.fis.kr/ko/major_biz/eNara_help_oper/government_subsidies, accessed October 2, 2024.

32) Integrated Subsidy Portal, https://www.bojo.go.kr/bojo.do#mark1, accessed October 2, 2024.

○ This system seeks to improve subsidy services by providing tailored information on subsidy programs to the public and transparently disclosing the operational status and performance of these programs.

2) Implementation Process

□ The e-Naradoum system development project is based on Article 26-2 (Establishment of Integrated Subsidy Management Network) of the Subsidy Management Act[33].

○ In December 2014, Korea formulated a comprehensive plan to address fraudulent claims of national subsidies and designated the establishment of e-Naradoum as a core initiative. Accordingly, in 2015, the Korea MOEF established the "Task Force for the Development of the Integrated Subsidy Management System" and formulated a Business Process Reengineering and Information Strategy Plan (BPR & ISP) for the development of e-Naradoum[34].

○ In December 2016, the Subsidy Management Act was passed by the National Assembly, and the e-Naradoum system was fully launched in 2017.

33) Statutes of the Republic of Korea Website, https://elaw.klri.re.kr/kor_service/lawView.do?hseq=66982&lang=KOR, accessed October2, 2024.

34) Integrated Subsidy Portal, https://www.bojo.go.kr/bojo.do#mark1, accessed October 2, 2024.

「Subsidy Management Act」

Article 26-2 (Establishment of Integrated Subsidy Management Network)

(1) The Minister of Economy and Finance and the heads of central government agencies shall establish an integrated subsidy management network (hereinafter referred to as the "integrated subsidy management network") to effectively implement subsidy programs and to prevent duplicate or erroneous payment of subsidies, and shall take necessary measures, such as the establishment of specific standards for the selection of subsidy programs and subsidy program operators, the implementation of subsidy programs, and the post management thereof. 〈Amended on Jul. 20, 2015; Jan. 28, 2016; Jan. 4, 2017〉

(2) The head of a central government agency (including the head of its affiliated government office who is delegated with the duties pursuant to Article 38; hereafter the same shall apply in this Article, and Articles 26-3 and 26-4), the head of a local government, a subsidy program operator or an indirect subsidy program operator shall perform duties concerning the management of subsidies, such as implementation and ex post facto management of the relevant subsidy programs or indirect subsidy programs through the integrated subsidy management network; provided, this shall not apply to subsidy programs or indirect subsidy programs related to national unification, security, etc., which are determined by the Minister of Economy and Finance as inappropriate to be performed through the integrated subsidy management network, in consultation with the head of the relevant central government agency. 〈Newly Inserted on Jan. 4, 2017〉

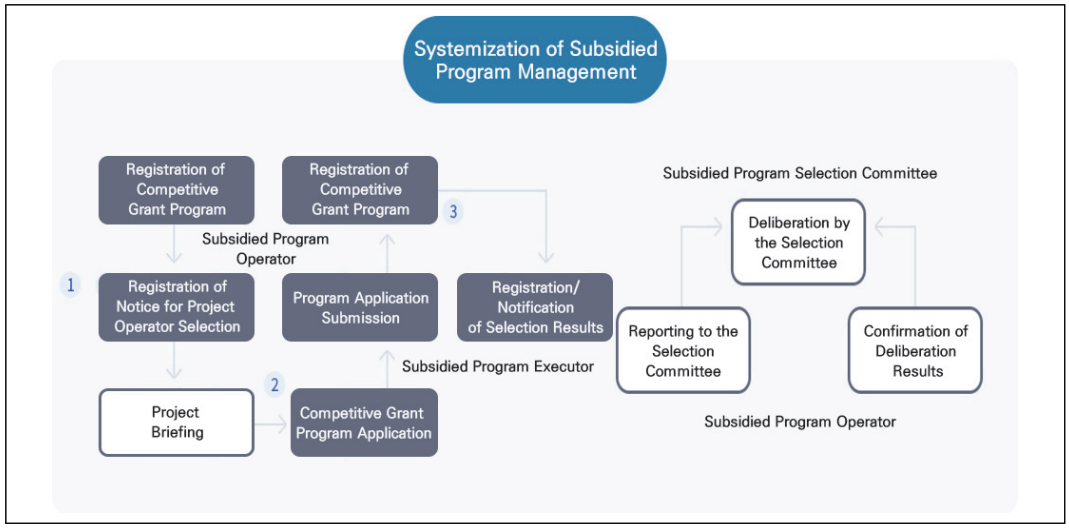
3) Key Functions and Roles

□ Systemization of the Entire Subsidy Management Process

○ The entire national subsidy programs process—ranging from program announcements, applications, eligibility verification, selection of beneficiaries, result notifications, execution management, to post-settlement—is now integrated within a single system, and is used by central government agencies, local governments, and private subsidized program operators[35].

35) Integrated Subsidy Portal, https://www.bojo.go.kr/bojo.do#mark2, accessed October 2, 2024.

[Figure Ⅲ-2] Systemization in the Management of Government Subsidies



Source: Korea Fiscal Information Service, https://www.fis.kr/ko/major_biz/eNara_help_oper/intro/main_func

○ The execution status can be more systematically managed across all stages from Central Government, Local Governments, Private Subsidized Program Operator to Final Implementation by designating a "sub-project[36]" as the execution management unit within each detailed project.

○ This enables the standardization of national subsidy program operations and enhances administrative efficiency and transparency.

□ Prevention of Duplicate and Fraudulent Claims of National Subsidies

○ Through information linkage with e-Naradoum, data on fraudulent claimants and disqualified operators—previously managed separately by each ministry—can now be shared across ministries, establishing an integrated, inter-ministerial management system for fraudulent claims. This allows the information to be shared during the selection of Subsidized Program Operators and preemptively restricts the participation of disqualified operators[37].

36) The actual project management unit that constitutes a detailed project (project) of a central government agency (Han, 2017).

37) National Subsidy Integrated Management System Division, Korea Ministry of Economy and Finance (2021).

- Once information on fraudulent claimants is registered in e-Naradoum, it becomes accessible to other ministries as well[38].

○ In addition, the introduction of e-Naradoum has reduced information asymmetry in the national subsidy delivery system[39], and made it possible to prevent duplicate and fraudulent claims by verifying each stage of the subsidy process.

- At the project selection stage, pre-qualification screening is conducted to prevent ineligible individuals from executing subsidy programs, and participants with a history of fraudulent claims can be excluded from program implementation[40].
- At the subsidy execution stage, funds are deposited in an integrated depository institution, ensuring that all disbursements occur in real time through the system, thereby preventing fraudulent claims in advance. Additionally, transaction evidence such as electronic tax invoices and credit card records is verified through linkages with the National Tax Service and financial institutions.
- In the post-execution stage, the system monitors assets acquired with subsidies in collaboration with institutions such as the Supreme Court and the National Tax Service to prevent the use for unintended purposes and to facilitate returns. Fraudulently claimed subsidies and corresponding interest can also be recovered and managed in connection with dBrain+[41].

○ By utilizing the Subsidy Fraud Detection System (SFDS[42]) within e-Naradoum, more than 50 fraud patterns have been developed and applied to regularly monitor signs of fraudulent activity. When a suspicious project is identified, the information is notified to the upper-level Subsidized Program Operator for self-inspection[43].

- In 2021, an AI-based intelligent fraud detection system was introduced, capable of

38) Ibid.
39) Cho & Roh (2022), p. 112.
40) Weon, et al., (2021), pp. 37-39.
41) Cho & Roh (2022), p. 114.
42) A system that collects various information on Subsidized Program Operators (beneficiaries), generates patterns such as transactions among family members, benefit claims by individuals who are deceased or have left the country, and canceled tax invoices, and detects corresponding disbursement cases to identify and flag high-risk programs (Korea Ministry of Economy and Finance (January 20, 2022)).
43) Cho & Roh (2022), p. 112.

identifying high-risk projects by learning from past cases of fraudulent claims. In 2023, this system identified 493 cases of fraudulent use of national subsidies amounting to approximately KRW 70 billion, involving issues such as budget misuse, duplicate salary payments, and transactions among family members[44].

- A hybrid model that combines traditional rule-based patterns with intelligent statistical modeling[45] has been piloted to validate its effectiveness and enhance the accuracy and efficiency of fraud detection[46].

○ After extracting suspicious projects using the fraud detection system, individual ministries or joint on-site inspections are conducted, and the results are registered in e-Naradoum[47].

□ Information Disclosure and Provision of Personalized Services

○ All open calls for national subsidy programs are disclosed, allowing users to search and apply according to project area, implementing agency, or region. Additionally, statistical information related to subsidy budgets and programs is made public to enhance transparency.

○ By utilizing subsidy program information categorized by life cycle, target group, region, and topic, individuals are provided with personalized information on eligible programs, along with functions to apply for and check their application status[48].

44) Korea Ministry of Economy and Finance (February 15, 2024).
45) Suspicious programs are identified by scoring the degree of similarity between actual past cases of fraudulent claims and projects monitored by *e-Naradoum.*
46) National Subsidy Integrated Management System Division, Korea Ministry of Economy and Finance (2021).
47) Korea Ministry of Economy and Finance (February 15, 2024).
48) Integrated Subsidy Portal, https://www.bojo.go.kr/bojo.do#mark2, accessed October 2, 2024.

C. Public Procurement Service's Development of The Next-Generation Korea ON-Line e-Procurement System (KONEPS)

1) Background

□ Public procurement refers to the purchase of goods, development, and services by the government and public institutions for public purposes. The Public Procurement Service, a central administrative agency under the Korea MOEF, is responsible for managing the purchase and supply of goods, development contracts, government property, and state-owned assets.

○ In 2023, Korea's total public procurement contract volume reached a record high of KRW 208.6 trillion, a 6.4% increase from the previous year. This accounted for 9.3% of the nation's GDP, demonstrating not only the significant scale of public procurement, but also its critical role in stimulating domestic demand and contributing to Korea's economic development[49].

□ To handle procurement tasks more efficiently and transparently, the Public Procurement Service established the Korea ON-Line e-Procurement System (KONEPS, also known as Nara Jangteo) in September 2002. This system digitizes the entire procurement process from bid announcements and contracts to payment disbursements[50].

○ The KONEPS is linked with over 220 institutions, enabling a one-stop processing system of the entire procurement workflow without the need to submit supporting documents. It serves as a single window for public procurement, used by all public institutions and procurement companies[51].

○ In addition, procurement companies are no longer required to visit public institutions in person, resulting in streamlined procedures, reduced transaction costs, enhanced transparency, and improved competitiveness for small and medium-sized enterprises[52].

49) Public Procurement Service (May 2, 2024).
50) Korea ON-Line e-Procurement System Website, https://www.g2b.go.kr/gov/koneps/pt/intro/intro_02.html, accessed December 16, 2024.
51) Ibid

○ In 2023, KONEPS recorded transaction volume of KRW 130.6 trillion, accounting for 62.6% of total public procurement. The figure continues to grow steadily, and the system is regarded as a core infrastructure for national fiscal expenditure[53].

□ However, the KONEPS, which was launched in 2002, has become outdated, leading to the emergence of the following issues and the need for improvements[54].

○ Having been in use for over 20 years without a full-scale overhaul, KONEPS is the oldest among major e-government systems. In 2020 alone, it experienced 120 system failures, with each incident affecting up to 1,000 bid announcements and 100,000 bidders[55].

○ The existing KONEPS is based on a legacy infrastructure that makes it difficult to apply new technologies such as big data, AI, and blockchain. Additionally, the abolition of the accredited certification system has created a need for the adoption of diverse authentication methods[56][57].

○ Due to the existence of 28 separate in-house procurement systems across public institutions, procurement companies face inconvenience from fragmented access points, and approximately KRW 30 billion is wasted annually on system maintenance costs[58][59].

□ The Next-Generation KONEPS Development Project is a full-scale overhaul of the existing KONEPS, a user-friendly platform utilizing digital technologies such as cloud computing, AI, and big data. The project began in June 2021, and is scheduled to launch on January 6, 2025[60].

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52) Korea ON-Line e-Procurement System Website, https://www.g2b.go.kr/gov/koneps/pt/intro/intro_05.html, accessed June 25, 2024.
53) Public Procurement Service (May 2, 2024).
54) Public Procurement Service (2024), pp. 97~107.
55) Ibid., p. 97.
56) Public Procurement Service (2023), p. 1.
57) Public Procurement Service (2024), p. 98.
58) Public Procurement Service (2023), p. 1.
59) Public Procurement Service (2024), p. 98.
60) Korea ON-Line e-Procurement System Website, https://www.g2b.go.kr/pt/e-support/fwdEsupportMain.do?supportUrl=/pt/notice/listNotice.do, accessed December 16, 2024.

Big Data

Big data refers to large-scale data in various forms—such as texts and images—that are generated at high frequency. It has enabled the utilization of unstructured data that was previously difficult to process and allows for a faster analysis of massive datasets to extract valuable information and patterns[61].

2) Implementation Process

□ The Next-Generation KONEPS Development Project is based on Articles 5, 12, and 14 of the Electronic Procurement Utilization and Promotion Act[62][63].

「Electronic Procurement Utilization and Promotion Act」

Article 5 (Electronic Processing of Procurement Services)

(1) The head of each procuring entity shall endeavor to process procurement services electronically by using or utilizing the Electronic Procurement System.

(2) The Administrator of the Public Procurement Service shall formulate policies for facilitating electronic procurement.

Article 12 (Establishment and Operation of the Electronic Procurement System)

(1) The Administrator of the Public Procurement Service shall establish the Electronic Procurement System so as to electronically process procurement services.

(2) The Administrator of the Public Procurement Service may request the head of a procuring entity or the head of any relevant institution to provide data or information necessary to establish and operate the Electronic Procurement System, as prescribed by Presidential Decree. The head of

61) Lee, et al. (2017), pp. 12-14.
62) Public Procurement Service (2024), pp. 98-99.
63) Statutes of the Republic of Korea Website, https://elaw.klri.re.kr/kor_service/lawView.do?hseq=55553&lang=KOR, accessed June 25, 2024.

an institution in receipt of a request for provision of data or information shall comply with such request, unless there is a compelling reason not to do so.

(3) The Administrator of the Public Procurement Service may determine and publicly notify standards for the establishment and operation of the Electronic Procurement System.

Article 14 (Establishment and Operation of Independent Electronic Procurement System)

(1) Where the head of a procuring entity intends to newly establish an independent Electronic Procurement System, the Minister of Economy and Finance may allow the head of a procuring entity, limited to one satisfying the requirements prescribed by the Presidential Decree, to establish and operate an independent Electronic Procurement System linked to the Electronic Procurement System. 〈Amended on Dec. 31, 2018〉

(2) Deleted. 〈Dec. 31, 2018〉

(3) Where the head of a procuring entity operating an existing independent Electronic Procurement System comes to fail to satisfy the requirements prescribed by the Presidential Decree, the Minister of Economy and Finance may demand him or her to switch over to the Electronic Procurement System under Article 12. 〈Newly Inserted on Dec. 31, 2018〉

(4) When establishing and operating an independent Electronic Procurement System, the head of a procuring entity shall apply the standards publicly notified under Article 12 (3) as much as possible. 〈Newly Inserted on Dec. 31, 2018〉

(5) The authority of the Minister of Economy and Finance pursuant to paragraphs (1) and (3) may be delegated to the Administrator of the Public Procurement Service, as prescribed by Presidential Decree. 〈Newly Inserted on Dec. 31, 2018〉

□ The KONEPS development project is based on Articles 5, 12, and 14 of the Electronic Procurement Utilization and Promotion Act.

○ (Expansion Phase) In 2006, the online shopping mall was revamped to establish an integrated shopping platform, and in 2010, a fingerprint recognition system was introduced for electronic bidding to enhance user convenience[64].

64) Korea ON-Line e-Procurement System Website, https://www.g2b.go.kr/gov/koneps/pt/intro/intro_

○ (Advancement Phase) In 2013, the e-Government Framework was applied to enhance system stability, significantly reduce user access time, and strengthen security and web accessibility[65].

□ The Next-Generation KONEPS Development Project was carried out in the following phases.

○ In 2018, an Information Strategy Planning (ISP) study was conducted to analyze the current system, identify areas for improvement, and design future goals for system development[66].

○ In 2019, the Electronic Procurement Utilization and Promotion Act was amended to provide a legal basis for the integration of in-house procurement systems, and the project passed a preliminary feasibility study, verifying its validity[67].

○ In 2020, an Information System Master Plan (ISMP) was developed to conduct a detailed analysis of business and technical requirements related to the project[68].

○ In June 2021, the SK C&C consortium was selected as the project operator through an open competitive bidding process, and in July, the Next-Generation KONEPS Task Force was established to oversee the project[69].

○ The analysis and design phase ended in 2022, and a full-scale development and unit test began in 2023[70].

□ The Next-Generation KONEPS was launched on January 6, 2025, costing a total of KRW 100 billion. It aims to unify the public procurement platform by integrating 25 in-house procurement systems that are currently operated separately by individual public institutions[71].

03.html, accessed December 16, 2024.

65) Korea IT Times, https://www.koreaittimes.com/news/articleView.html?idxno=2574, accessed December 16, 2024.

66) Public Procurement Service (February 25, 2024), p. 2.

67) Public Procurement Service (2024), pp. 99-100.

68) Public Procurement Service (February 25, 2024), p. 3.

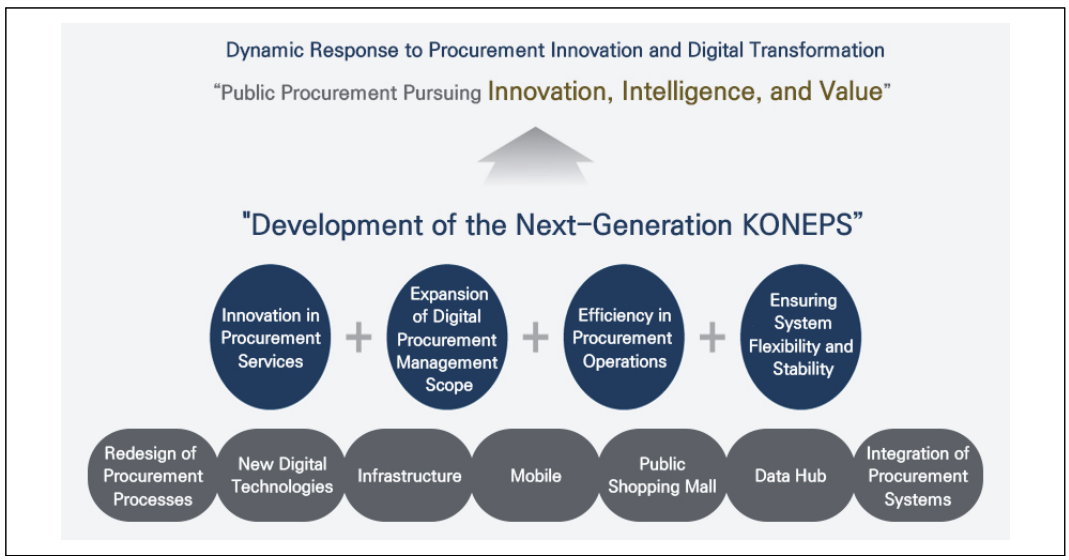
69) Public Procurement Service (July 6, 2021), pp. 1-2.

70) Public Procurement Service (2023), p. 1.

71) Public Procurement Service Website, https://www.pps.go.kr/kor/content.do?key=01297, accessed

○ The procurement process has been redesigned and integrated to enhance operational efficiency, and cutting-edge digital technologies such as AI, big data, and blockchain have been fully applied. A “Data Hub” has also been established to consolidate and manage various procurement datasets, thereby improving the usability of procurement data[72].

[Figure Ⅲ-3] Strategic Plan for the Next-Generation Korea ON-Line e-Procurement System



Source: Public Procurement Service Website, https://www.pps.go.kr/kor/content.do?key=01297

3) Key Functions and Roles

□ The KONEPS consists of four major functions: electronic bidding, electronic contracting, electronic payment, and an integrated shopping mall[73].

○ (Electronic Bidding) Handles the registration and viewing of bid announcements, application for bid participation by procurement companies, bidding submission, bid opening, and selection of successful bidders through qualification screening.

December 16, 2024.

72) Ibid.

73) Korea ON-line e-Procurement System Website, https://www.g2b.go.kr/gov/koneps/pt/intro/intro_02_02.html, accessed December 16, 2024.

○ (Electronic Contracting) Covers all tasks required for contract execution, including contract drafting and electronic signing, stamp tax payment, contract management, and modifications.

○ (Electronic Payment) Processes inspection, payment requests, and disbursement for products, services, and facilities in connection with major fiscal information systems.

○ (Integrated Shopping Mall) Allows procurement companies to register commercial goods or services online, enabling public institutions to purchase them directly from the online marketplace.

□ The following improvements will enhance the functions of the Next Generation KONEPS.

○ Redesigning of the outdated system infrastructure

- Cloud technology is introduced to enable swift resource allocation and reduce the number and size of electronic documents, thereby resolving frequent system failures caused by increased user activity and transaction volume[74].
- The system is redesigned into a highly intuitive user experience–based interface, with expanded support for non-face-to-face services and enhanced mobile accessibility to improve overall user convenience[75][76].

○ Introduction of new digital technologies

- Personalized services such as bid recommendations, bid information summaries, comparative analysis of similar bid notices, and probability of winning bids are provided using big data on bidding and machine learning[77].
- Key indicators such as joint supply arrangements, credit ratings, and delivery deadlines are analyzed through pattern analysis, machine learning, and regression analysis to proactively alert users to potential contract risks[78].
- Intelligent consultation services are offered by analyzing voice data from civil

74) Public Procurement Service (February 25, 2020), pp. 2-9.
75) Public Procurement Service (August 10, 2021), p. 2.
76) Public Procurement Service (April 20, 2021), p. 3.
77) Public Procurement Service (February 25, 2020), p. 7.
78) Ibid.

petitioners to generate appropriate responses[79].

- Useful and structured information is delivered to support decision-making through data visualization, keyword analysis, and image analysis using big data and AI[80].
- Blockchain technology is applied to prevent document forgery and tampering, and to enable reuse of repeatedly submitted documents, thereby improving user convenience[81].
- Designed with a bid rigging prevention algorithm, the system enables the use of multiple authentication methods, eliminating the need for in-person fingerprint verification previously required[82][83].

○ Integration of in-house electronic procurement systems

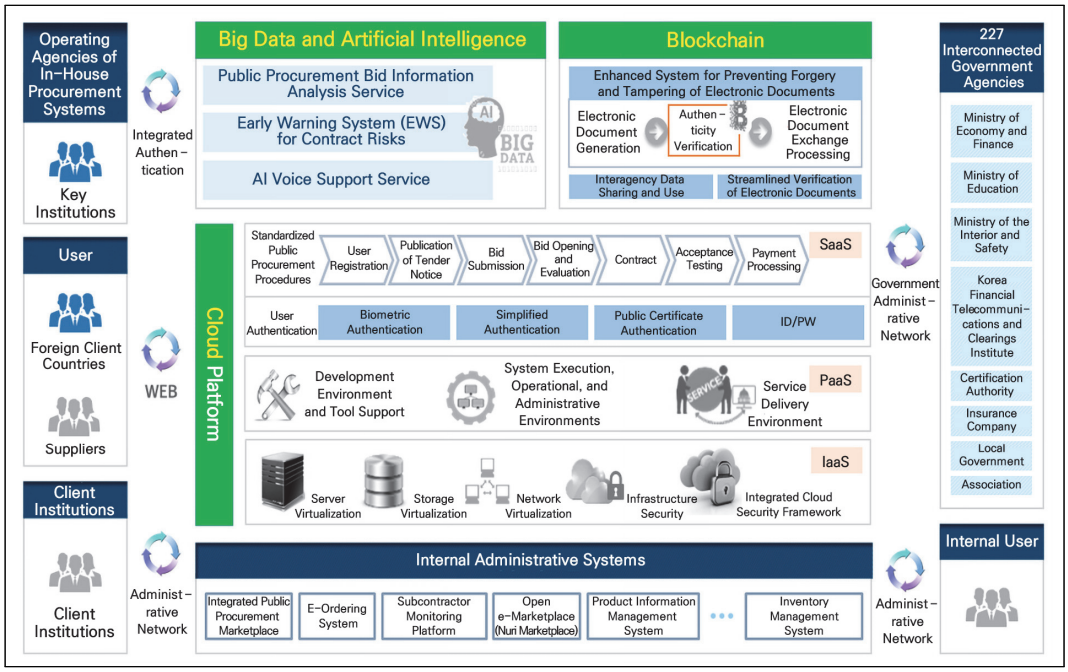
- By integrating separately operated procurement systems of various public institutions into KONEPS, the system alleviates user inconvenience and reduces operation and maintenance costs.

○ Enhancement of user convenience

- Instead of fingerprint security tokens, which were difficult to use and required in-person registration at the Public Procurement Service, users can now choose from various authentication methods such as accredited certificates and simple SNS-based authentication[84].
- A "Procurement Assistant" that provides real-time guidance and an AI chatbot that enables real-time inquiries have been introduced[85].

79) Ibid., p. 3.
80) Kim (October 18, 2023)
81) Public Procurement Service (February 25, 2020), p. 3.
82) Public Procurement Service (April 22, 2021), p. 4.
83) Kim (June 24, 2024)
84) Public Procurement Service Website, https://www.pps.go.kr/kor/bbs/view.do?bbsSn=2312040012&key=00638, accessed December 16, 2024.
85) Ibid.

[Figure Ⅲ-4] Target Model for the Development of the Next-Generation Korea ON-Line e-Procurement System



Source: Public Procurement Service Website (February 25, 2020), p. 6.

D. National Tax Service's Digital Tax Administration Using Big Data and AI

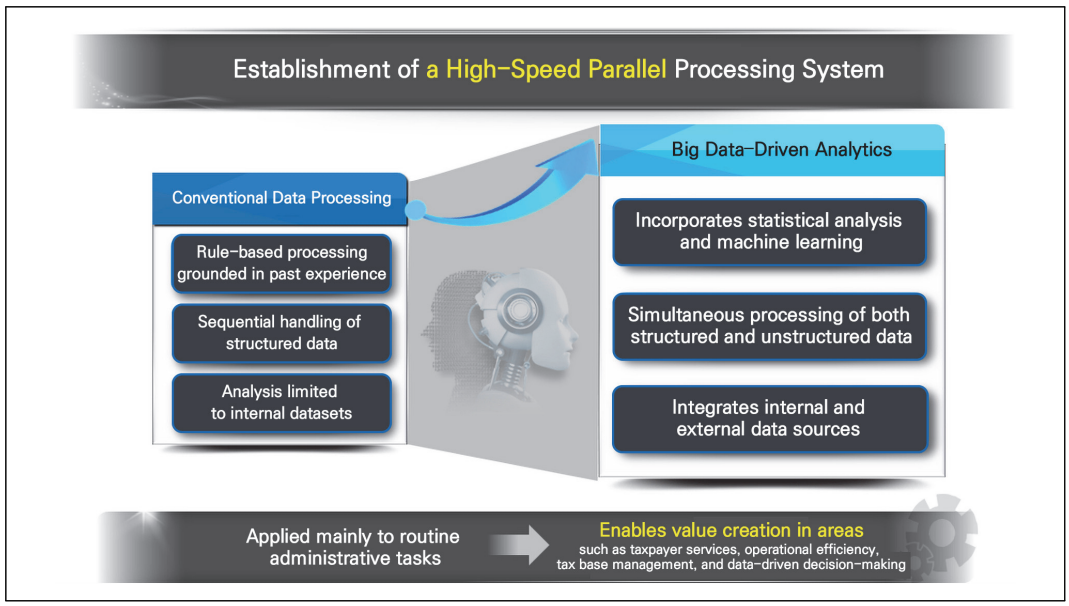
1) Background

☐ The National Tax Service's Big Data Center was established to leverage rapidly advancing intelligent information technologies such as AI and big data, with the aim of improving operational efficiency, enhancing taxpayer services, and ensuring fair taxation.

○ Whereas traditional processes relied on simple rules to sequentially handle only internal structured data, big data analytics now enable simultaneous processing of both structured and unstructured data from internal and external sources, creating opportunities for greater value generation[86].

86) National Tax Service (July 2, 2020), p. 6.

[Figure Ⅲ-5] Objectives of Utilizing the National Tax Service's Big Data Analytics



Source: National Tax Service (July, 2, 2020), p. 6.

2) Implementation Process

□ As part of the Moon Jae-in administration's 100 Key Policy Tasks, the National Tax Service launched its Big Data Center in July 2019 to apply advanced technologies such as big data and AI in support of the initiative to enhance tax equity and establish taxpayer-friendly tax administration[87)88)].

○ (Chatbot Consultation) A chatbot service was introduced on the National Tax Service's Hometax platform, initially providing consultations on value-added tax (VAT) in October 2019 and on comprehensive income tax in May 2020. The service now also includes items such as earned income tax credits and capital gains tax[89)].

○ (Business Registration Assistance) Since November 2019, big data analytics have been applied to streamline business registration processes[90)].

87) National Tax Service (November 27, 2017), p. 2.
88) National Tax Service (July 2, 2020), p. 1.
89) Ibid., p. 8.
90) National Tax Service (November 4, 2019), p. 1.

○ (Pre-filled and Auto-filled Tax Services) In 2015 and 2016, the pre-filled and auto-filled tax filing services were introduced. Later in 2021, the pre-filled service was enhanced to guide small business owners in identifying deductible expenses through big data analysis. And in 2022, the auto-filled service was upgraded to provide optimized deductions for individuals with non-business income[91].

○ (International Certification for Data Protection) In August 2020, the National Tax Service simultaneously obtained ISO 27001 (information security) and ISO 27701 (privacy management) certifications from the International Organization for Standardization (ISO), establishing internationally recognized standards for personal data protection in big data management[92].

○ (Tax Assistant) In 2023, an interactive Tax Assistant service was introduced to automatically generate tax return forms based on user questions and responses[93].

○ The service was initially offered for simplified VAT filings and has since expanded to include standard VAT returns for general taxpayers and preliminary filings for capital gains tax[94].

○ (AI-Powered Tax Consultation) In 2024, the National Tax Service launched an AI-powered tax consultation service utilizing voice recognition technology to provide real-time assistance[95].

3) Key Functions and Roles

□ Enhancing Operational Efficiency and Improving Taxpayer Convenience

○ (Business Registration Support) By analyzing historical cases through the big data system, the likelihood of business registration denial is pre-calculated and provided to staff in advance. As a result, the number of on-site inspections has decreased by approximately 40% (30,000 cases)[96].

91) National Tax Service Blog, https://blog.naver.com/ntscafe/223352175480, accessed June 13, 2024.
92) National Tax Service Blog, https://blog.naver.com/ntscafe/222095419640, accessed June 12, 2024.
93) National Tax Service (December 31, 2023), p. 1.
94) Ibid., p. 2.
95) National Tax Service (May 21, 2024), p. 2.
96) National Tax Service (July 2, 2020), p. 2.

- The reduction in field inspections has shortened the business registration issuance period from three to two days, allowing taxpayers to start their businesses more quickly, improving overall service convenience[97].

○ (Chatbot and AI-Powered Tax Consultation) Chatbot and AI-based tax consultation services provide taxpayers with around-the-clock support, resolving routine inquiries and enabling human agents to focus on more complex issues.

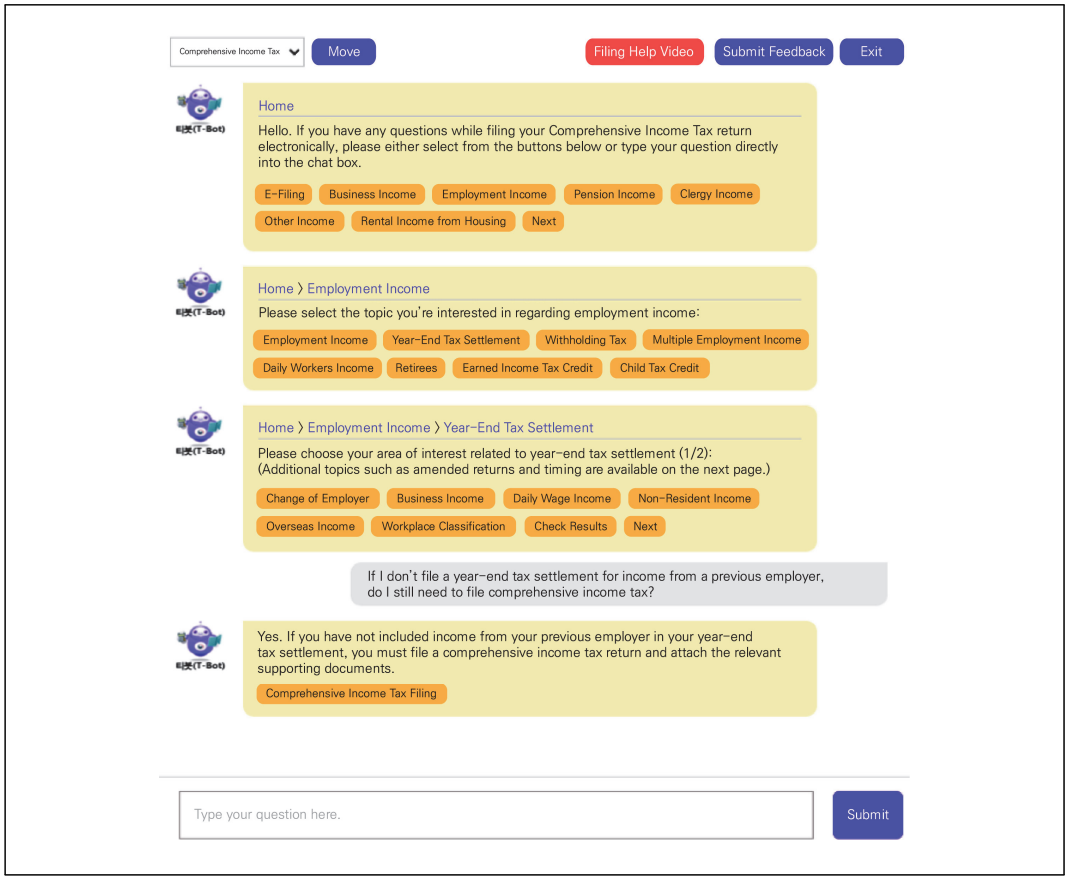
- The chatbot analyzes taxpayer questions using natural language processing (NLP) technology, drawing from a database of past consultations to deliver relevant answers.
- The AI consultation system, trained on over two million past cases, as well as tax laws, official rulings, and court precedents, responds to inquiries via voice and sends related resources by text message such as videos and user guides[98].
- The AI consultation system can serve up to 1,250 users simultaneously, and handled approximately 800,000 consultations in 2024, resolving about 80% (630,000 cases) of them. The call success rate rose from 24% last year to 98%, significantly reducing repeated call attempts and resulting in a 34% decrease in total call volume[99].

Natural Language Processing (NLP)

- Natural language refers to the everyday language used by humans, as opposed to artificial languages such as computer programming languages.
- Natural Language Processing is a technology that enables computers to understand and process human language by leveraging techniques for analyzing, interpreting, and generating natural language[100].

97) Ibid.
98) National Tax Service (May 21, 2024), p. 3.
99) Ibid.
100) Naver Knowledge Encyclopedia, https://terms.naver.com/entry.naver?docId=863247&cid=42346&categoryId=42346, accessed June 19, 2024.

[Figure Ⅲ-6] Example of the National Tax Service Chatbot Service



Source: National Tax Service Hometax Website, https://www.hometax.go.kr/, accessed June 12, 2024.

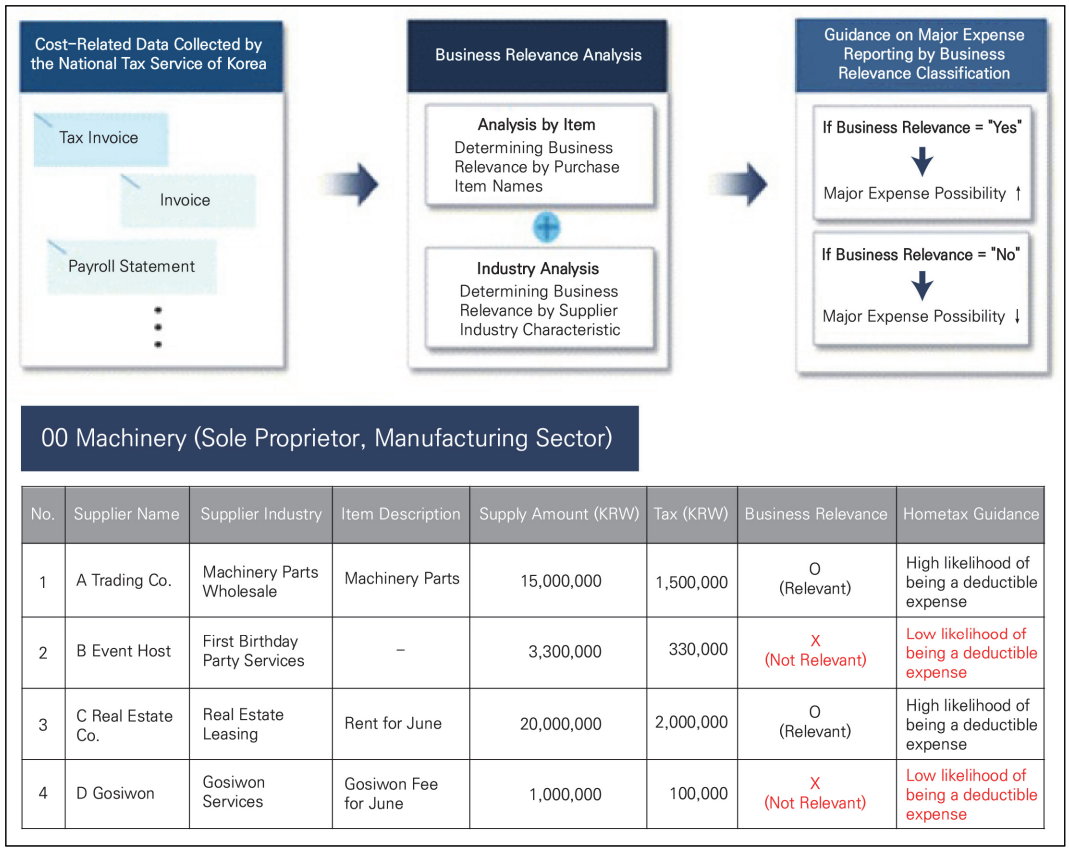
○ (Pre-Filled and Auto-Filled Filing Services) The Pre-Filled and Auto-Filled tax return services have improved by using big data analytics, allowing for more precise application and broader taxpayer coverage. These simplified filing methods support more accurate and timely self-reporting[101].

- Pre-Filled Service: Tailored for small business owners, this service uses big data to analyze the types of goods purchased and the industries of suppliers to determine the business relevance of expenses. The system then automatically populates deductible expenses into tax returns[102].

101) National Tax Service Blog, https://blog.naver.com/ntscafe/223352175480, accessed June 13, 2024.
102) National Tax Service (July 2, 2020), p. 7.

- Auto-Filled Service: Designed for non-business income earners (e.g., those with income from pensions or other sources besides employment), this service uses big data to generate optimized tax returns with minimal input, reducing the reporting burden[103].

[Figure Ⅲ-7] Example of Pre-Filled Service for Business-Related Expenses



00 Machinery (Sole Proprietor, Manufacturing Sector)

No.	Supplier Name	Supplier Industry	Item Description	Supply Amount (KRW)	Tax (KRW)	Business Relevance	Hometax Guidance
1	A Trading Co.	Machinery Parts Wholesale	Machinery Parts	15,000,000	1,500,000	O (Relevant)	High likelihood of being a deductible expense
2	B Event Host	First Birthday Party Services	–	3,300,000	330,000	X (Not Relevant)	Low likelihood of being a deductible expense
3	C Real Estate Co.	Real Estate Leasing	Rent for June	20,000,000	2,000,000	O (Relevant)	High likelihood of being a deductible expense
4	D Gosiwon	Gosiwon Services	Gosiwon Fee for June	1,000,000	100,000	X (Not Relevant)	Low likelihood of being a deductible expense

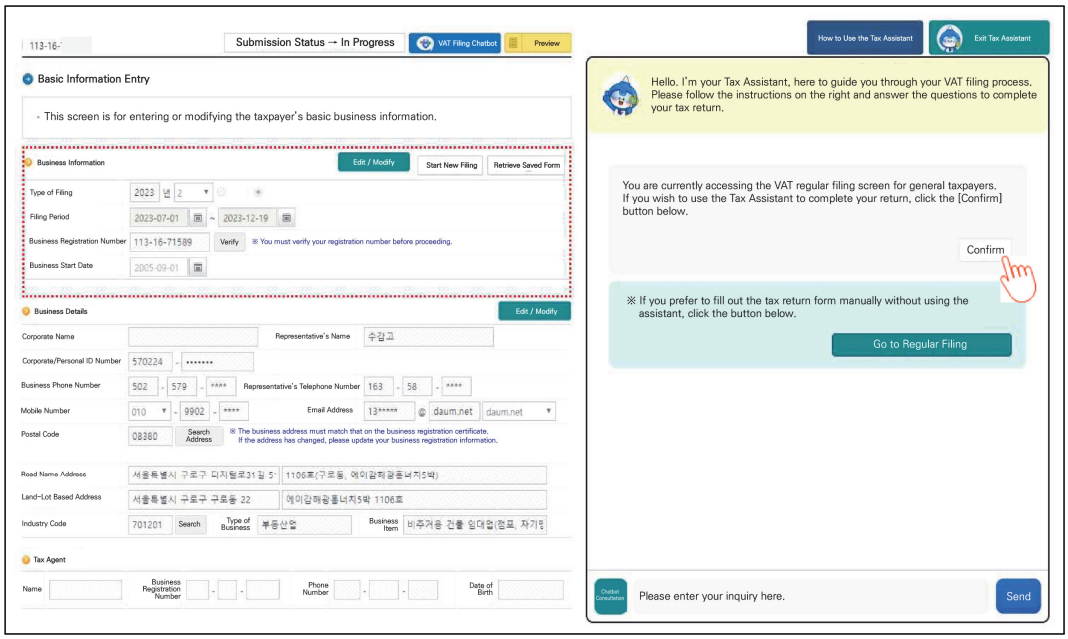
Source: National Tax Service (July 2, 2020), p. 7.

○ (Tax Assistant Service) The Tax Assistant is an interactive filing service that allows taxpayers to complete their returns quickly and easily by simply answering guided questions—without needing to understand complex tax terminology or official forms. As a result, user satisfaction is notably high[104].

103) National Tax Service Blog, https://blog.naver.com/ntscafe/223352175480, accessed June 13, 2024.
104) National Tax Service (December 31, 2023), p. 1.

- Information already held by the National Tax Service, such as electronic tax invoices and cash receipts, is pre-filled automatically. For other data such as cash income, users can provide responses through the dialogue interface. Complex terms are explained in plain, accessible language[105].
- Whereas the average satisfaction rate among general e-filing users is 86%, the satisfaction rate among users of the Tax Assistant service has reached 96%[106].

[Figure Ⅲ-8] A Screenshot of the First Page of the VAT Filing Tax Assistant



Source: National Tax Service (December 31, 2023).

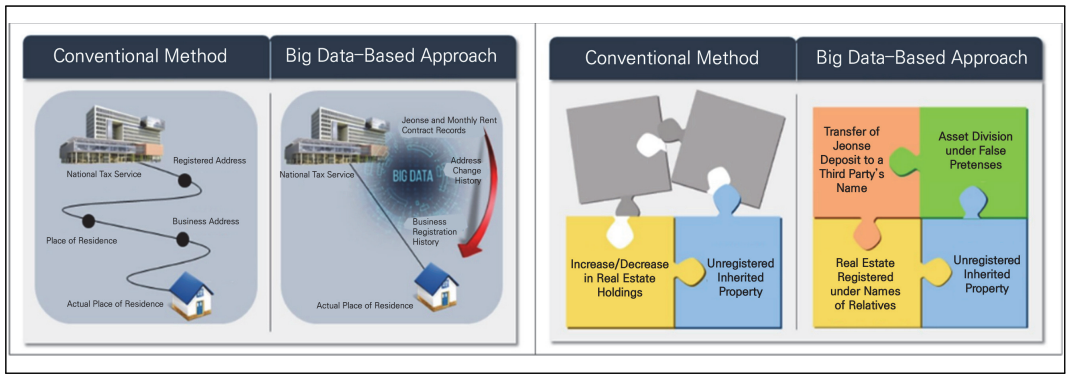
☐ Ensuring Fair Taxation through Tax Base Management

○ (Detection of Tax Evasion) Big data analytics enable the National Tax Service to track concealed assets held by high-value delinquent taxpayers, facilitating more effective oversight of the tax base and identification of tax evasion[107].

105) Ibid., p. 5.
106) Ibid., p. 1.
107) National Tax Service Blog, https://blog.naver.com/ntscafe/223352175480, accessed June 13, 2024.

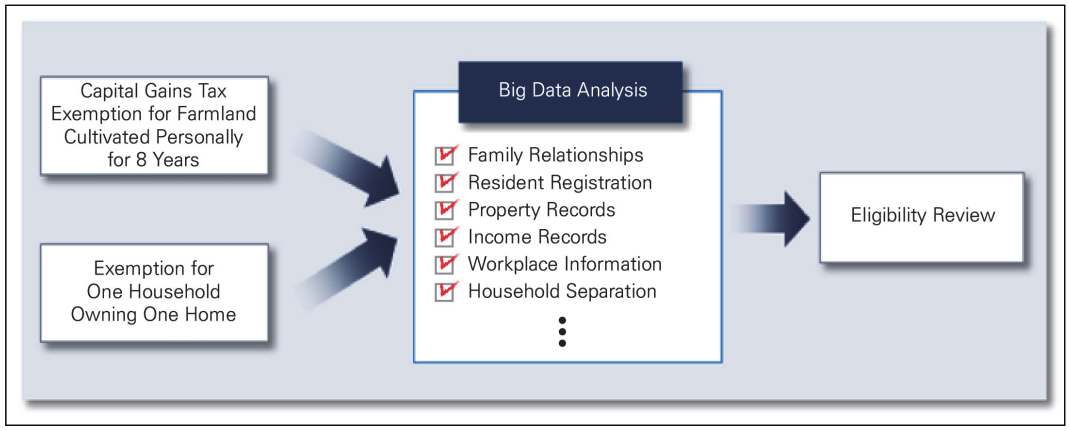
- By analyzing the income, expenditures, and property transactions of delinquent taxpayers and their close relatives, authorities can identify their actual place of residence and detect hidden assets[108].
- Each year, the NTS examines nearly 30,000 reports of borrowed-name accounts and uses big data to verify eligibility for tax exemptions and reliefs, as well as to uncover offshore tax evasion based on extensive data analysis[109].

[Figure Ⅲ-9] Identification of Actual Residence and Tracking of Concealed Assets



Source: National Tax Service Blog, https://blog.naver.com/ntscafe/223352175480, accessed June 13, 2024

[Figure Ⅲ-10] Detecting Tax Evasion through Big Data Analysis



Source: National Tax Service (July 2, 2020), p. 3.

108) Ibid.
109) National Tax Service (July 2, 2020), pp. 3-4.

E. (Chak) Blockchain-based Public Trust Platform of the Korea Minting, Security Printing & ID Card Operating Corporation

1) Background

☐ In 2018, the Korea Minting, Security Printing and ID Card Operating Corporation (KOMSCO) announced a mid-term innovation plan to promote "business model innovation" in response to internal and external changes[110].

○ With the decline in cash transactions and increase in online payments, KOMSCO recognized the need to expand beyond its traditional currency-related operations to keep pace with social and economic transformation.

○ Internally, the organization identified the need for greater flexibility and a culture that embraces innovation in order to effectively respond to environmental shifts.

○ From 2012 to 2016, revenues from KOMSCO's traditional business lines declined, while revenues from new growth areas increased.

- In 2016, new growth businesses accounted for 16.3% of KOMSCO's total revenue of KRW 464.3 billion.

○ To keep pace with the era of the Fourth Industrial Revolution, KOMSCO developed a strategy for business model innovation that leverages its core technological strengths in currency manufacturing, security printing, and identification systems to provide secure online services for payments, authentication, and digital trust.

☐ The development of a blockchain-based public trust platform has been designated as a key innovation initiative by KOMSCO[111].

○ Blockchain has emerged as a core technology of the Fourth Industrial Revolution and has been applied not only in finance, distribution, and logistics, but also in the areas of security and authentication.

110) Korea Minting, Security Printing & ID Card Operating Corp (2018).
111) Ibid.

○ KOMSCO has anticipated that in an increasingly digital society, blockchain technology will contribute to preventing forgery and tampering of digital assets and information[112].

○ Based on this vision, KOMSCO built the KOMSCO Platform in 2018—a secure mobile transaction and authentication platform utilizing blockchain—and aimed to expand and stabilize its services by 2022[113].

○ The platform has allowed users to access a variety of public services in a secure environment where anti-forgery technologies are integrated with blockchain[114].

○ It has also served as an open platform, enabling small and venture enterprises to freely develop their applications.

○ Through collaboration with these businesses, KOMSCO has sought to overcome its technological limitations while fostering mutual growth.

Blockchain

- Blockchain is a public digital ledger that records transaction data in blocks, which are sequentially linked over time and distributed across the computers of multiple participants without relying on a central server[115].
- A new block can only be added through consensus among participants. Each new block includes information from the previous one, making it extremely difficult to alter or falsify data, thereby ensuring its integrity. Since all transaction records are shared among participants, any modification to a block would affect all subsequent blocks, making it virtually impossible to alter data once recorded[116].

112) Korea Minting, Security Printing & ID Card Operating Corp (July 5, 2017).
113) Korea Minting, Security Printing & ID Card Operating Corp (2018), pp. 35-36.
114) Ibid., p. 35.
115) Seo & Jung (2018), pp. 288-289.
116) Kim (2018), pp. 104-105.

2) Implementation Process

□ As part of its mid-term innovation plan, KOMSCO launched the development of the KOMSCO Trust Platform in 2018, initiated a pilot service in 2019, and announced plans in 2022 to stabilize the platform and expand its services to overseas markets[117].

○ From the early stages of platform development, KOMSCO collaborated with private-sector companies.

- Even before the mid-term innovation plan was unveiled, KOMSCO signed an agreement in 2017 with the blockchain startup, “Coinplug”, to jointly develop core solutions for mobile electronic transactions and open APIs[118].
- In 2018, LG CNS was selected to lead the “Blockchain Open Platform Development” project, and subsequently partnered with KOMSCO to build a platform that integrates blockchain technology with public cloud services[119].
- The three core services of the jointly developed platform by KOMSCO and LG CNS include local (regional) digital currencies, mobile authentication, and document verification.

□ In February 2019, KOMSCO completed the development of its public trust platform and officially launched “Chak” (Change for Korea)[120].

○ Local governments using Chak are able to perform a range of administrative functions, such as issuing mobile local gift certificates, distributing welfare benefits, and delivering COVID-19 emergency relief funds.

□ Since the launch of Chak, KOMSCO has continued to demonstrate its technological leadership by filing patents related to blockchain and applying those innovations to the platform[121].

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117) Korea Minting, Security Printing & ID Card Operating Corp (2018), p. 36.
118) Korea Minting, Security Printing & ID Card Operating Corp (July 5, 2017).
119) The Hankyoreh (June 12, 2018), https://www.hani.co.kr/arti/economy/it/848738.html, accessed June 10, 2024.
120) Korea Minting, Security Printing & ID Card Operating Corp (February 14, 2019).
121) Korea Minting, Security Printing & ID Card Operating Corp (April 2, 2020).

○ In 2020, KOMSCO filed 12 patents related to blockchain anchoring technology and secured rights to 7 of them.

○ Anchoring technology refers to a method that ensures the reliability and stability of data anchoring between blockchain networks using multi-signature mechanisms.

- By anchoring data stored in the original platform onto another blockchain, this technology enhances the integrity and security of transactions.

□ More than just a tool for issuing mobile local gift certificates, Chak has evolved into a platform that supports a variety of public services. To improve user experience, Chak was upgraded to Chak 2.0 on June 15, 2023[122].

3) Key Functions and Roles

□ In February 2019, the cities of Seongnam and Siheung launched a pilot program using Chak to issue mobile local gift certificates[123].

○ Users could conveniently purchase gift certificates via their smartphone apps and redeem them at participating merchants by scanning the QR code.

○ For merchants, the platform reduced both transaction fees and the hassle of converting certificates at banks, while local governments were able to manage participating vendors more efficiently[124].

○ In Seongnam, a pilot project began on February 21, 2019, allowing 163 city government employees to use their welfare points as mobile local currency at approximately 80 nearby stores[125].

- Both employees and merchants reported high satisfaction with the pilot, leading to the official launch of mobile local currency issuance on April 19, 2019.

122) Newsis (June 11, 2023), https://www.newsis.com/view/?id=NISX20230611_0002334333&cID=10803&pID=14000, accessed June 10, 2024.
123) Korea Minting, Security Printing & ID Card Operating Corp (February 14, 2019).
124) Ibid.
125) Yonhap News Agency (April 14, 2019), https://www.yna.co.kr/view/AKR20190412150300061, accessed June 10, 2024.

- Compared to paper-based local currency, the mobile version offered lower issuance fees (1.8% via KOMSCO), and was particularly popular among younger users.

☐ The number of Chak users has steadily grown from 140,000 in 2019 to 670,000 in 2020, 1.47 million in 2021, and reached 2.2 million by the end of February 2023[126].

○ While only 5 local governments had adopted Chak in 2019, the number rose to 76 municipalities by 2023[127].

○ The total issuance of mobile local gift certificates via Chak also grew dramatically—from KRW 66.3 billion in 2019 to over KRW 2.5 trillion in 2022[128].

☐ Local governments have also used Chak to distribute emergency relief payments and welfare allowances, resulting in significant administrative cost savings[129].

○ The platform simplified the application and approval process, reducing administrative burden[130].

- Public officials are able to retrieve eligible recipients' data easily within Chak, and immediately disburse payments upon entry[131].
- Payments distributed through Chak include a variety of policy allowances such as agricultural and fisheries subsidies, youth allowances, and relocation support grants. Compared to direct cash payments, this method is less susceptible to misuse or fraudulent claims.
- In 2019, 4 municipalities used Chak to distribute 12 types of policy allowances totaling KRW 8 billion, and by 2023, 59 municipalities had used it to administer 351 types of allowances totaling KRW 94.3 billion[132].

126) Korea Minting, Security Printing & ID Card Operating Corp (March 17, 2023).
127) Korea Minting, Security Printing & ID Card Operating Corp (September 23, 2021).
128) Korea Minting, Security Printing & ID Card Operating Corp (May 25, 2023).
129) Korea Minting, Security Printing & ID Card Operating Corp (February 14, 2019).
130) Korea Minting, Security Printing & ID Card Operating Corp (January 24, 2024).
131) Korea Minting, Security Printing & ID Card Operating Corp (March 17, 2023).
132) Korea Minting, Security Printing & ID Card Operating Corp (January 24, 2024).

〈Table Ⅲ-1〉 Annual Trends in the Number of Local Governments, Number of Policy Allowances, and Total Allowance Disbursements

Category	2019	2020	2021	2022	2023
Number of Local Governments	4	13	60	52	59
Number of Policy Allowance Types	12	66	223	231	351
Total Disbursement Amount (KRW 100 million)	80	512	1,113	943	943

Source: KOMSCO (January 24, 2024), p. 2.

〈Table Ⅲ-2〉 Examples of Policy Allowance Provision by Local Government

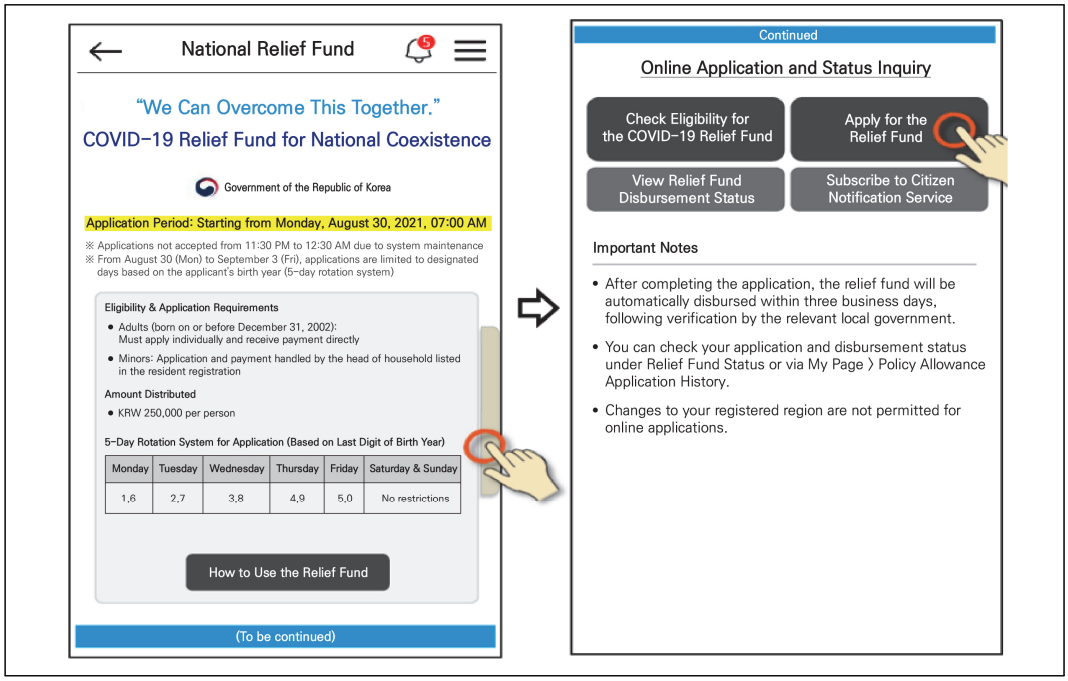
Local Government	Major Policy Allowances
Siheung City Hall	Youth Basic Income, Gyeonggi-do Youth Interview Allowance
Seongnam City Hall	Gyeonggi Women's Employment Support Grant, Postpartum Care Allowance, Youth Voucher Program
Sokcho City Hall	Hometown Love Donation Program (Return Gifts), Kkumdream Allowance, Agricultural and Fisheries Allowance
Yanggu County Office	Childbirth Incentive Grant, Farmers' Allowance
Naju City Hall	Elementary School Enrollment Support Grant
Jeongeup City Hall	Public Interest Allowance for Farmers, Childcare Allowance, Jeonbuk Youth Startup Farming Support
Gunsan City Hall	Gunsan Fisherfolk Public Interest Allowance, Youth Allowance, Farming Settlement Support Grant

Source: KOMSCO (January 24, 2024), p. 2.

□ In 2021, KOMSCO developed the application system for the "COVID-19 Relief Fund for National Coexistence," enabling citizens who wished to receive relief funds in the form of local gift certificates to easily check eligibility, apply for, and use the funds directly through the Chak platform[133].

133) Korea Minting, Security Printing & ID Card Operating Corp (September 2, 2021).

[Figure Ⅲ-11] COVID-19 Emergency Relief Grant Application System



Source: KOMSCO (September 2, 2021), p. 3.

2. International Case Studies

A. United States' Refund Review Program (RRP)

1) Background

□ The U.S. Internal Revenue Service (IRS) had been using the Electronic Fraud Detection System (EFDS) since 1994 to detect tax fraud. However, due to the system's obsolescence, the IRS initiated plans in 2009 to replace EFDS with the Return Review Program (RRP), a new system incorporating advanced technologies[134].

○ EFDS had limitations in handling the growing volume of fraud cases and in managing taxpayer compliance effectively.

134) Treasury Inspector General for Tax Administration (2017. 9. 25.)

○ The IRS anticipated that the RRP would detect a greater number of fraudulent returns more accurately than the previously used EFDS and the Dependent Database (DDb).

○ The RRP is capable of reviewing tax refunds associated with both Identity Theft (IDT) and Non-Identity Theft (Non-IDT).

- In addition, the RRP is more adaptable than EFDS in responding to evolving fraud patterns.

Identity Theft and Non-Identity Theft

• Identity theft occurs when someone uses one's personal information such as their name, Social Security Number (SSN) or other identifying information, without one's permission, to commit fraud or other crimes[135].

• Non-Identity Theft Fraud refers to fraudulent activity that occurs for reasons other than identity theft, in which offenders typically disguise their identity to gain access to victims and extract financial benefits from them[136].

2) Implementation Process

□ Although the implementation of the RRP was first initiated in 2009, full-scale development did not begin until 2014.

○ In 2011, the U.S. IRS signed a contract worth USD 6.25 million with the private company SAS to provide data analytics capabilities necessary for RRP[137].

- SAS provided tools for data mining, social network analysis, and unstructured data analysis to detect suspicious taxpayer behavior and potential fraud in tax filings.

○ However, as of January 2014, the development of RRP was temporarily put on hold, and the IRS began re-evaluating the previously announced plans[138].

135) IRS (2012), p. 1.
136) Center for Victim Research (2019), pp. 33~34.
137) Information Week (2011. 12. 8.), https://www.informationweek.com/it-sectors/irs-uses-analytics-to-help-collect-delinquent-taxes, accessed May 28, 2024.
138) Treasury Inspector General for Tax Administration (2017. 9. 25.), p. 1.

○ In March 2014, Phase 1 of the RRP transition was launched, and the following month, the IRS began piloting the RRP IDT model focused on detecting identity theft—marking the full-scale adoption of the RRP[139)][140)].

- Between March and July 2014, the RRP detected approximately 350,000 cases of fraudulent refunds that the EFDS had failed to identify[141)].
- The RRP IDT model was officially introduced during the 2015 tax season, and the EFDS IDT model was discontinued in the 2016 tax season[142)].
- The RRP Non-IDT model underwent a pilot test in September 2015 and was implemented in the 2016 tax season; the EFDS Non-IDT model was phased out in the 2017 tax season[143)].
- Although EFDS was fully retired in 2017, the accompanying Dependent Database (DDb) continued to be used to enhance identity theft detection[144)].

○ Since its implementation, the RRP has contributed to increased tax revenue by detecting fraudulent activities previously missed by EFDS.

- During the 2015 tax season, when both the EFDS and RRP IDT models were in operation, the former detected 9,416 identity theft cases, while the latter detected 256,204, clearly demonstrating its superior effectiveness[145)].
- In the 2016 tax season, when both EFDS and RRP Non-IDT models were active, the RRP model detected nearly six times more non-identity theft cases than EFDS[146)].
- In 2016, the IRS recovered USD 1.88 billion from identity theft cases and USD 328 million from non-identity theft fraud cases detected through the Return Review Program (RRP)[147)].

139) Treasury Inspector General for Tax Administration (2015. 7. 2.), p. 4.
140) Treasury Inspector General for Tax Administration (2017. 9. 25.), p. 1.
141) Treasury Inspector General for Tax Administration (2015. 7. 2.), p. 4.
142) Treasury Inspector General for Tax Administration (2017. 9. 25.), p. 2.
143) Ibid.
144) Ibid., p. 8.
145) Ibid., p. 6.
146) Ibid., p. 7.
147) Ibid., pp. 6-8.

□ Even after the implementation of the RRP, the U.S. IRS has continued to expand the program's capabilities by incorporating advanced technologies to more effectively detect identity theft, tax evasion, fraud, and taxpayer noncompliance.

○ In January 2016, the IRS approved a Release Plan (RP) outlining the costs, features, and implementation roadmap for Phase 1 of the RRP. Two RP projects were carried out through December 2017[148].

- The first project (R2.1) introduced new functionalities including ad-hoc reporting, enhanced in-return data presentation, and customized information for enterprise users.
- The second project (R2.2) further expanded the RRP's capabilities by enabling the system to handle a broader range of data, such as rejected returns and cluster management data.

○ By the 2017 tax season, RRP was analyzing a wider variety of data and using more standardized datasets, which contributed to a reduction in the False Detection Rate (FDR)[149].

- A lower FDR indicates a decrease in the number of tax refund claims incorrectly flagged as fraudulent, reflecting improved system accuracy.

○ From fiscal years 2020 to 2023, the IRS made significant advancements in the RRP, including enhanced data analytics capabilities, expanded automation, and integration of cloud services.

- With improved automation, the RRP gained the ability to automatically correct misclassified identity theft cases[150].
- The IRS and Amazon Web Services (AWS) established a network connection to GovCloud and replaced existing manual data analysis tools with the Palantir Solution[151].
- The IRS streamlined the data extraction process by enabling the transfer of files stored on external platform servers to the RRP system[152].

148) U.S. Department of the Treasury (2019), p. 43.
149) Treasury Inspector General for Tax Administration (2017. 9. 25.), pp. 10~13.
150) U.S. Department of the Treasury (2020), p. 28.
151) U.S. Department of the Treasury (2021), p. 32.
152) U.S. Department of the Treasury (2022), p. 36.

- The IRS provides the Selections and Analytics Platform (SNAP) for users in the Large Business and International Division (LB&I).[153].
- SNAP operates on a cloud-based platform and is used to identify undetected fraud cases, analyze emerging fraud trends through large-scale data analysis, and detect tax returns not yet confirmed as identity theft.[154].

○ For fiscal years 2024–2025, the IRS is conducting pilot programs, enhancing technical capacity, and expanding its automated systems to address newly emerging issues[155].

- Strengthening the IT capabilities of staff has been identified as a key priority to improve the IRS's overall tax compliance operations.

3) Key Functions and Roles

□ The RRP generates predictive models to detect △tax fraud, △noncompliance, and △identity theft, using data analytics techniques such as data mining[156].

○ Once a tax return is submitted, RRP evaluates the likelihood of fraud, noncompliance, or identity theft using pre-built models and assigns a risk score to each return.

- Scores range from 0.0 to 1.0, with higher values indicating a greater likelihood of fraudulent activity.

○ The RRP also uses data analytics to prevent automatic disbursement of tax refunds to taxpayers flagged as potentially fraudulent.

○ The RRP incorporates analytical technologies from multiple private-sector firms and has improved its fraud detection accuracy since its initial implementation.

- In 2016, among more than 693,000 returns flagged by RRP as identity theft cases, the true positive rate was 62%.
- For the 103,000 returns flagged as non-identity theft fraud, the true positive rate was 49%.

153) U.S. Department of the Treasury (2024), p. 46.
154) IRS (2023), p. 2.
155) U.S. Department of the Treasury (2024), p. 9.
156) U.S. Department of the Treasury (2023), p. 23.

- By Processing Year 2023[157], the true positive rates for identity theft rose to 69% and 51% for non-identity theft fraud[158].

□ Data analytics technologies are applied across all three core activities of the RRP—△Detection, △Selection, and △Prevention—which are carried out sequentially[159].

○ In the detection phase, analytics enable △the creation of predictive models, △the application of business rules, and △data clustering.

- For example, the RRP applies business rules to determine whether the required forms were submitted along with a tax return.
- Data clustering is a technique that automatically groups tax returns filed within the same geographic area, which is useful for identifying potential indicators of tax evasion within the clustered data.

○ In the selection phase, technology is used to automatically identify tax returns suspected of fraud, including identity theft.

- Once selected, these returns are reviewed manually by IRS personnel for further verification.

○ If a tax return is flagged as a potential fraudulent refund, the prevention phase of the RRP automatically freezes the refund until the issue is resolved, using a system that consolidates the analytical results of the individual return.

- The RRP integrates and shares all available taxpayer information with IRS personnel, thereby supporting further investigation into potential fraud or evasion.
- Starting with the 2018 tax season, the system also incorporated real-time feedback data to enhance the accuracy of identity theft detection filters.

157) Processing Year refers to the year in which a tax return is processed. For example, tax returns filed in 2022 were processed during Processing Year 2023, which spanned from January 23 to October 21, 2023 (IRS, 2023).
158) U.S. Department of the Treasury (2023), p. 26.
159) GAO (July 24, 2018), pp. 8~12.

Data Mining[160)]

A term derived from the analogy of mining for underground minerals, data mining refers to the technique of extracting valuable information from large volumes of data.

Cloud Service[161)]

A web-based software service in which programs are hosted on utility data servers over the internet, allowing users to access and use them anytime from computers or mobile devices.

4) Current Uses and Controversies of AI at the U.S. Internal Revenue Service (IRS)

□ The U.S. IRS experienced sustained budget constraints over the past decade, resulting in a 20% reduction in funding and a 38% decrease in staffing levels since 2010[162)].

○ However, the COVID-19 pandemic and related lockdown measures in 2020 placed additional pressure on resources and expanded the agency's responsibilities, including the distribution of emergency relief payments.

○ Recognizing the growing need to improve tax compliance and modernize taxpayer services, the U.S. Congress allocated $80 billion to the IRS through the Inflation Reduction Act of 2022.

160) Glossary of Information and Communication Technology Terms, Telecommunications Technology Association Website, https://terms.tta.or.kr/dictionary/dictionaryView.do?word_seq=040402-16, accessed June 27, 2024.

161) Glossary of Information and Communication Technology Terms, Telecommunications Technology Association Website, https://terms.tta.or.kr/dictionary/dictionaryView.do?subject=%ED%81%B4%EB%9D%BC%EC%9A%B0%EB%93%9C%20%EC%84%9C%EB%B9%84%EC%8A%A4, accessed June 27, 2024.

162) Tonneson+co (October 27, 2023.), https://tonneson.com/news-insights/irs-updates/how-ai-is-transforming-the-irs/, accessed July 30, 2024.

□ In September 2023, the U.S. IRS announced that a portion of its new funding would be used to integrate AI as part of its efforts to strengthen audits of high-income individuals, partnerships, and large corporations suspected of abusing tax laws.

○ The IRS expects AI to help address several challenges including providing real-time support through AI-powered chatbots, automating modeling and fraud detection, mitigating staffing shortages, and enhancing transparency and fairness in tax administration.

○ In January 2024, as part of its broader innovation agenda, the IRS reported ongoing progress in expanding tax enforcement targeting high-income individuals, large corporations, and complex partnerships. It stated that technologies such as AI and data science have recently been applied to intensify audits and public tax investigations of 76 large partnerships[163].

□ The U.S. IRS recently announced plans to use advanced AI technologies to predict the tax gap, identify taxpayers requiring audits, and detect patterns of noncompliance[164].

○ The tax gap refers to the difference between the amount of tax that individuals and businesses voluntarily pay and the amount they actually owe. It is calculated as an aggregate estimate across various tax categories, including individual income tax, corporate income tax, employment tax, and estate tax.

○ The tax gap has been a persistent issue for decades. To address noncompliance, the IRS classifies it into three categories: (1) Underreporting, (2) Underpayment, and (3) Non-filing.

□ Key concerns surrounding the IRS's use of AI include algorithmic bias, potential harm to taxpayers, and unwarranted audits. Notably, research has shown that due to algorithmic

163) U.S. Internal Revenue Service Website, https://www.irs.gov/newsroom/irs-ramps-up-new-initiatives-using-inflation-reduction-act-funding-to-ensure-complex-partnerships-large-corporations-pay-taxes-owed-continues-to-close-millionaire-tax-debt-cases, accessed July 16, 2024.

164) U.S. Government Accountability Office Website, https://www.gao.gov/tax-gap, accessed July 16, 2024.

bias, Black taxpayers are audited three to five times more often than individuals of other racial groups[165].

○ In response, members of the U.S. Congress and oversight bodies have demanded greater transparency from the IRS regarding the use of AI in what they describe as "financial surveillance" of citizens. They have raised concerns about privacy violations and the risk of personal data exposure.

- Some Republican lawmakers have accused the IRS and the Department of Justice of using AI-driven systems to monitor the personal transactions, bank accounts, and financial data of millions of Americans without due legal process[166].
- Members of House committees and special subcommittees have formally requested records related to the IRS's use of AI dating back to January 1, 2021[167].

○ A recent report by the Government Accountability Office (GAO) revealed that the IRS has not yet fully documented key components and technical specifications of the AI-based models used for audit case selection[168].

○ The IRS has denied the allegations, stating that claims suggesting the agency conducts daily surveillance of taxpayers using AI are completely false[169].

165) Tonneson+co (October 27, 2023.), https://tonneson.com/news-insights/irs-updates/how-ai-is-transforming-the-irs/, accessed July 30, 2024.
166) CBS News (March 27, 2024.), https://www.cbsnews.com/detroit/news/irs-using-artificial-intelligence-ai-taxes/, accessed July 19, 2024.
167) Government Executive (April 19, 2024.), https://www.govexec.com/management/2024/04/irs-commissioner-indicates-ai-will-play-growing-role-future-tax-collection/395867/, accessed July 30, 2024.
168) CDO Magazine (June 17, 2024.), https://www.cdomagazine.tech/leadership-moves/cla-appoints-spencer-lourens-as-chief-data-officer, accessed July 19, 2024.
169) Government Executive (April 19, 2024.), https://www.govexec.com/management/2024/04/irs-commissioner-indicates-ai-will-play-growing-role-future-tax-collection/395867/, accessed July 30, 2024.

B. United Kingdom's Universal Credit

1) Background

□ In November 2010, the United Kingdom's Department for Work and Pensions (DWP) announced the launch of Universal Credit, a digitally enabled integrated benefits system designed to overcome the limitations of the country's existing welfare programs.

○ The previous system consisted of six separate benefits: △Jobseeker's Allowance, △Employment and Support Allowance, △Working Tax Credit, △Income Support, △Child Benefit, and △Housing Benefit[170].

○ The complexity of administering these separate benefits hindered the efficiency of caseworkers and led to issues such as errors and fraudulent claims[171].

- Between fiscal years 2008/09 and 2010/11, the primary causes of benefit overpayments were customer error and fraud[172].
- In fiscal year 2010/11, the highest rate of fraud was recorded in Jobseeker's Allowance[173].

○ To address these issues, the DWP announced a plan to consolidate the six existing benefits into a single payment system—Universal Credit—which would be determined based on the recipient's income and other personal circumstances[174].

- Following a "digital first" principle, the DWP aimed to reduce errors and fraudulent claims by operating an online platform that maximizes user convenience and promotes digital interaction between claimants and administrators[175].
- The DWP's initial rollout plan envisioned that from October 2013 to April 2014, all new benefit claims would be processed under Universal Credit, followed by the transition of existing claimants into the new program from April 2014 to October 2017[176]. However, this plan was later revised multiple times.

170) DWP (2010), p. 18.
171) Ibid., p. 42.
172) Ibid., p. 20.
173) DWP (2012), p. 15.
174) DWP (2010), p. 18.
175) Ibid., p. 38. pp. 42~43.
176) DWP (2010), p. 37.

2) Implementation Process

□ Universal Credit was officially introduced in 2012 under a legal framework.

○ The Welfare Reform Act 2012, enacted that year, outlined the eligibility criteria and claimant responsibilities for receiving Universal Credit[177].

○ That same year, the DWP announced the launch of a Digital Strategy aimed at delivering Universal Credit as a fully digital service[178].

- Even before the strategy was introduced, the DWP had been using over 200 Application Programming Interfaces (APIs) internally, but they were limited to intra-departmental use.
- The DWP later announced plans to expand the use of APIs for data sharing with external organizations, with the goal of improving operational efficiency and reducing administrative costs through easier access to claimant information by relevant stakeholders.
- The DWP also signed major contracts with private firms—£525 million with IBM and £100 million with HP—to support the development and maintenance of IT systems and software[179].
- The Universal Credit system was also linked to the Real-Time Payment System used by HM Revenue & Customs (HMRC), allowing automatic verification of claimants' earnings[180].
- In 2017, the DWP projected that once Universal Credit was rolled out nationwide, 80% of benefit claimants would use the digital program[181].

□ However, in February 2013, the UK's Major Projects Authority (MPA)[182] raised concerns about the overall design and implementation of the Universal Credit system. In response, the DWP acknowledged the issues and initiated a reassessment of its implementation plan.

177) Legislation.Gov.Uk (2012), https://www.legislation.gov.uk/ukpga/2012/5/contents/enacted, accessed May 23, 2024.
178) DWP (December, 2012.), p. 29.
179) Michaelson (2013), p. 303.
180) DWP (2010), p. 35.
181) DWP (December, 2012.), p. 29.
182) The UK's Major Projects Authority (MPA) is now operating under the name Infrastructure and Projects Authority (IPA).

○ The MPA highlighted significant shortcomings in governance, management, and program design, and proposed measures to strengthen the program's structure[183].

- The MPA recommended that the DWP establish a more consistent and realistic implementation plan for the integrated benefits system. It also emphasized the importance of developing a secure and sustainable IT architecture and strengthening the capacity of program staff.
- In its internal assessment, the DWP admitted that, Despite the department's overall high level of IT capability, its information technology architecture at the time was underdeveloped. It also acknowledged limitations in the system's ability to detect potentially fraudulent claims using the available technology.

□ From February 2013, the DWP spent three months restructuring the program and, in doing so, provided two systems in parallel: the Live Service, which utilized pre-2013 IT assets to support benefit claims, and the Full Service, a new digital platform developed after the program's overhaul[184].

○ The Live Service was introduced in April 2013 to process simpler claims but has since been discontinued.

○ The Full Service was launched in May 2016 and was rolled out nationwide—including Northern Ireland—across all Job centres by December 2018[185].

○ The DWP adopted an agile approach in implementing and operating the Full Service, continuously improving the platform by resolving issues and adding features as they arose. This iterative approach allowed for more effective identification and incorporation of user needs throughout the system's development.

□ Contrary to its original goal, the DWP failed to complete the transition from legacy benefits[186] to Universal Credit by 2017 and now expects full implementation to be

183) NAO (2013)
184) NAO (2018), pp. 14~18.
185) Gov.UK (May 16, 2024.), https://www.gov.uk/government/organisations/department-for-work-pensions, accessed June 20, 2024.
186) Legacy benefits refer to the six types of welfare payments provided by the UK government prior to the introduction of Universal Credit.

achieved by 2028 or later[187].

○ The transition has been delayed multiple times due to the absence of enabling legislation, the COVID-19 pandemic, and other factors[188].

- In particular, delays have been attributed to the process of converting existing Employment and Support Allowance (ESA) claims to Universal Credit, and to the managed migration of eligible claimants into the new system.
- The managed migration of ESA and Housing Benefit claimants is now expected to begin in 2028/29, and the DWP is currently issuing migration notices to claimants subject to this process.

Types of Migration to Universal Credit[189]

With the introduction of the Universal Credit program, claimants who had been receiving legacy benefits have transitioned to Universal Credit through one of the following three routes, depending on their circumstances.

- Natural migration: Legacy benefit claimants need to switch to UC if their circumstances (such as their employment status) change in a way that means they need to make a new claim for support. DWP estimated that 0.8 million households would migrate naturally to UC or would stop claiming benefits altogether.
- Voluntary migration: Claimants may choose to move to UC even if there has been no change in their circumstances. DWP estimated that 0.2 million households would opt to move voluntarily.
- Managed migration: Under this process, DWP requires claimants to claim UC within three months of receiving a 'migration notice' after which their legacy benefits will stop. It expected to move 1.6 million households to UC through this route. Part Two of this report covers DWP's progress in migrating claimants to UC. DWP plans to move around 900,000 households claiming legacy benefits to UC by December 2024.

187) NAO (2024), p. 6; p. 13.
188) The full rollout of Universal Credit, originally scheduled for completion in 2017, has been repeatedly postponed to 2022, then 2023, and now to sometime after 2028.
189) NAO (2024), p. 19; p. 28.

□ The DWP estimates that full implementation of the Universal Credit (UC) program by 2026–27 will generate total benefits valued at £10.4 billion[190].

○ Universal Credit is expected to contribute to higher employment rates, reductions in fraud and error, and lower overall welfare spending.

- Due to the relaxation of eligibility rules during the COVID-19 pandemic, the fraud and error rate for Universal Credit rose to 14.7% in 2021–22.
- The DWP has set a target to reduce this rate to 6.5%, and with full implementation, it expects to recover approximately £1.3 billion in overpayments caused by fraud and error, and to avoid up to £3.6 billion in welfare expenditure.
- Administrative costs associated with welfare delivery are also expected to decline compared to the legacy benefits system, with estimated savings of £349 million in welfare administration for the 2022–23 fiscal year as a result of Universal Credit.

3) Key Functions and Roles

□ The most critical technology currently supporting the delivery of Universal Credit's digital services is the cloud platform, which has significantly reduced service delivery time by enabling automation at the deployment stage and establishing a standardized, cloud-native platform[191].

○ DWP Digital, the digital services arm of the DWP, oversees the department's technology infrastructure. It utilizes tools such as Kubernetes, Istio, and Terraform to enable automated workflows and consistently execute repeatable processes[192].

- Kubernetes: An open-source system that automates the deployment, scaling, and management of containerized applications.
- Istio: A service mesh that manages the network of microservices, facilitating interactions

190) Ibid., pp. 23~27.
191) DWP Digital, https://careers.dwp.gov.uk/our-teams/dwp-digital-engineering/software-engineering-cloud-technology/, accessed June 19, 2024.
192) IT World (May 10, 2022.), https://www.itworld.co.kr/tag/53045/189698/235709#csidx734efe7face3532a09859f2cf1c7462, accessed June 28. 2024.

between individual applications.

- Terraform: An open-source tool that standardizes the infrastructure deployment and management process. As a cloud-agnostic solution, it reduces system failures and enhances scalability.

○ The use of these modern cloud technologies enables faster diagnosis of issues when they arise and allows for automated problem resolution within the system.

○ DWP Digital aims to create an environment that facilitates the deployment of digital services by running all applications in containers and building a common platform architecture.

□ During the COVID-19 pandemic, as the number of Universal Credit applicants surged and working conditions for DWP staff shifted, the DWP was able to respond effectively to the crisis through its digital Universal Credit services[193].

○ The pandemic served as a catalyst for the further development of the Universal Credit program.

- The number of Universal Credit claimants rose from 1.2 million in April 2019 to 5.2 million in May 2020, and further to 5.8 million in November 2020, with the highest daily claim volumes recorded in March and April of that year[194].

○ In response, the DWP built a common platform and developed automated playbooks to eliminate repetitive tasks and improve processing speed[195].

- Prior to automation, the development and deployment of a new API typically took 5 to 6 months. With the automated playbooks, the process was reduced to just three weeks. Using this system, the DWP successfully developed and deployed a new API for automated identity verification within that shortened timeframe.

193) House of Commons Library (January 15, 2021), pp. 9~11.
194) The highest number of new claims was recorded on March 27, 2020, with 135,900 claims submitted in a single day.
195) IT World (May 10, 2022), https://www.itworld.co.kr/tag/53045/189698/235709#csidx734efe7face3532a09859f2cf1c7462, accessed June 28, 2024.

4) Current Use and Controversies of AI at the Department for Work and Pensions (DWP)

□ Since 2012, as part of its broader digital strategy, the UK government has introduced policies and reforms aimed at delivering public services under a "digital by default[196] " model. The government estimated that transitioning services from offline to digital channels could result in annual cost savings of between £1.7 billion and £1.8 billion[197].

○ In line with this strategy, the DWP began introducing AI technologies into the Universal Credit program starting in 2021.

□ Following the suspension of in-person investigations during the COVID-19 pandemic, the DWP began using machine learning algorithms, a key form of AI, in certain areas of the Universal Credit system from 2022 as a primary tool for detecting benefit fraud.

○ However, in 2022 alone, fraud and error within the Universal Credit system resulted in losses of over £8 billion. In response, the DWP expanded its use of machine learning and AI technologies in an effort to identify fraud and overpayments and recover more than £1 billion in public funds. Despite this, the project was not formally announced by the UK government[198].

○ In 2023, the DWP stated its intention to apply similar technologies to investigate specific areas of concern, including: △High rates of overpayments, △Unreported self-employed income, and △Falsified housing claims. However, it did not disclose a specific timeline for implementation[199].

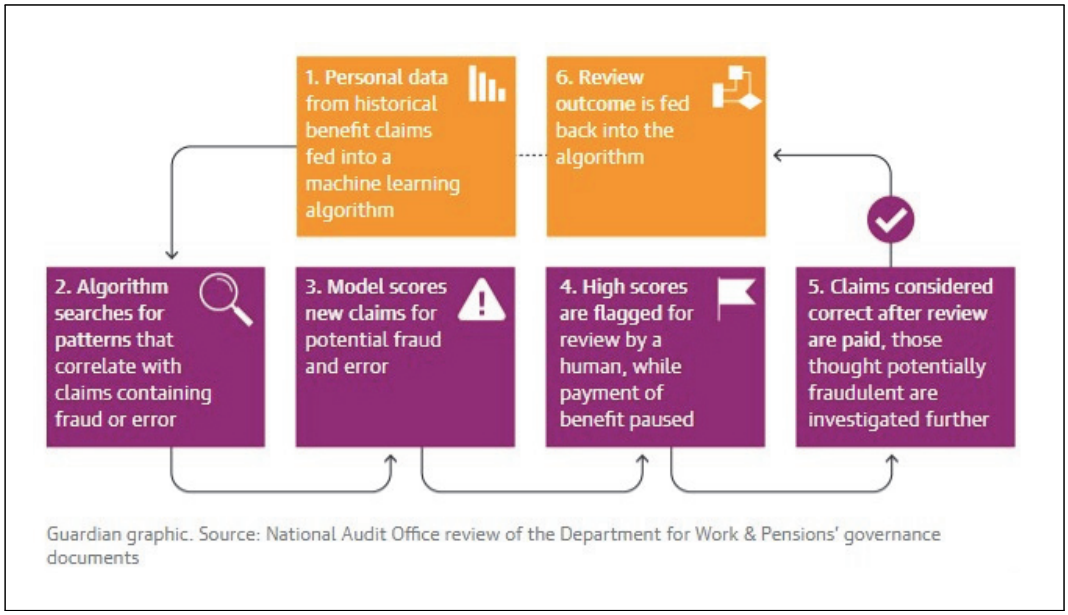
□ The process of detecting fraudulent benefit claims using AI involves extracting personal data from historical claim records and feeding it into machine learning algorithms. These algorithms identify patterns associated with fraud or error and assign a risk score to each new claim. Claims with high scores are flagged for manual review by DWP staff, during

196) The UK Government's Digital Strategy, announced in 2012 as part of its broader Digital Agenda.
197) Cabinet Office (2012), p. 2.
198) The Guardian (July 11, 2023.), https://www.theguardian.com/society/2023/jul/11/use-of-artificial-intelligence-widened-to-assess-universal-credit-applications-and-tackle, accessed June 28, 2024.
199) BBC (July 12, 2023.), https://www.bbc.com/news/uk-politics-66133665, accessed July 30, 2024.

which benefit payments are suspended.

○ If the claim is deemed valid upon review, benefits are disbursed. However, if the claim is found to be noncompliant, further investigation is conducted, and the outcome is fed back into the algorithm to improve its accuracy.

[Figure Ⅲ-12] Use of AI to Detect Fraudulent Allowance Claims



Source: The Guardian, https://www.theguardian.com/society/2023/jul/11/use-of-artificial-intelligence-widened-to-assess-universal-credit-applications-and-tackle, accessed June 28, 2024.

□ Meanwhile, the use of algorithms within the Universal Credit system has raised concerns over bias against certain population groups, with instances where benefit payments were automatically suspended due to incorrect assessments made by AI technologies[200].

○ Public backlash has intensified in the UK as several unjust cases have emerged, particularly affecting vulnerable groups such as people with disabilities and women. For example, one visually impaired woman had her disability benefits unfairly reduced and was left with more than £12,000 in alleged overpayments claimed by the DWP.

200) Big Issue (January 26, 2024.), https://www.bigissue.com/news/politics/dwp-benefit-claims-suspended-ai-universal-credit/, accessed June 28, 2024.

- Child poverty and disability rights advocates have demanded greater transparency from the DWP regarding its use of AI to evaluate welfare claims, and have called for credible assurances of fairness in the application of such technologies[201].
- UN experts have also warned that the UK government's expansion of its "digital by default" welfare system poses significant risks to vulnerable claimants, potentially exacerbating social inequality.

□ The DWP announced that it would reverse its practice of automatically suspending benefit payments based on AI-driven fraud detection[202].

□ Growing public criticism has also focused on the lack of transparency surrounding the DWP's use of AI, with concerns that the department has failed to provide meaningful information about how these technologies are being applied—prompting calls for increased external oversight.

○ Big Brother Watch, a UK civil liberties campaign group, claimed that the DWP refused freedom of information requests and blocked parliamentary questions regarding its use of AI[203].

○ The National Audit Office (NAO) and other public spending watchdogs have urged the DWP to release detailed information and internal assessments related to potential bias and inequality in its machine learning tools, in order to enhance the credibility of the system[204].

○ The DWP responded that it could not disclose specific details about how its algorithms function, citing the risk of misuse. It acknowledged the presence of biased outcomes in certain systems, but attributed them to insufficient user data, rather than the design of

201) The Guardian (September 3, 2023.), https://www.theguardian.com/politics/2023/sep/03/uk-warned-over-lack-transparency-use-ai-vet-welfare-claims, accessed July 19, 2024.
202) Big Issue (January 26, 2024.), https://www.bigissue.com/news/politics/dwp-benefit-claims-suspended-ai-universal-credit/, accessed June 28, 2024.
203) The Guardian (September 3, 2023.), https://www.theguardian.com/politics/2023/sep/03/uk-warned-over-lack-transparency-use-ai-vet-welfare-claims, accessed July 19, 2024.
204) BBC (July 12, 2023.), https://www.bbc.com/news/uk-politics-66133665, accessed July 30, 2024.

the algorithms themselves[205].

□ In 2024, following underwhelming performance of algorithms used by the UK government, more than 200,000 people were reportedly subjected to erroneous investigations related to housing benefit fraud and error[206].

○ Each month, thousands of UK households are being investigated over potentially fraudulent housing benefit claims based on inaccurate algorithmic assessments.

- These algorithms evaluate risk factors to determine whether a Universal Credit claim might be incorrect or fraudulent, taking into account data such as the claimant's age, gender, number of children, and tenancy agreements.

○ Until recently, the DWP maintained that surveillance would be conducted only in cases with reasonable suspicion, while continuing to indicate its intent to use AI to detect benefit fraud. However, over 40 civil society organizations in the UK have urged the government to abandon its current plans[207].

205) The Guardian (October 23, 2023.), https://www.theguardian.com/technology/2023/oct/23/uk-risks-scandal-over-bias-in-ai-tools-in-use-across-public-sector, accessed July 16, 2024.

206) The Guardian (June 23, 2024.), https://www.theguardian.com/society/article/2024/jun/23/dwp-algorithm-wrongly-flags-200000-people-possible-fraud-error, accessed June 28, 2024.

207) Yahoo News (April 19, 2024.), https://uk.news.yahoo.com/dwp-wants-press-ahead-plans-131848194.html?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referrer_sig=AQAAAB0SjKZXiR5rRsfJoF7ShEkbJRZIblOawC2oJKXE6XqrLtqxjRx8TeD8w2KNpjCFAfpFC2o36aYcVVTF3z4_c96n9wvhrUw085Lk7oMPoFhjeCjTnB_6-EbF1lhwRfmUKvJ1Ao9JCIEVKT7Bt5UIxeqqziqTDw-Z9tsf2-Gblp3K, accessed July 22, 2024.

C. France's Anti-Tax Evasion Measures and New Technologies

1) Background

□ Since 2013, the French government has actively introduced a range of measures to combat tax evasion.

○ Although France does not systematically quantify the full extent of tax fraud, estimates can be inferred from audit reports and annual publications by the General Directorate of Public Finances (DGFiP)[208].

○ For fiscal year 2012 alone, VAT-related tax evasion was estimated at approximately €20 to €25 billion.

2) Implementation Process

□ Since 2013, the Direction Générale des Finances Publiques (DGFiP)—France's tax authority under the Ministry of the Economy and Finance—has been strengthened in the area of tax evasion control, leading to the establishment of new departments and the adoption of technologies dedicated to tax enforcement.

○ In 2013, the DGFiP created the Service de Traitement des Déclarations Rectificatives (STDR), a department tasked with managing offshore tax evasion, enabling the recovery of unpaid taxes on undeclared foreign assets[209].

- In 2014 alone, taxes and penalties recovered through the STDR amounted to €1.9 billion.

○ The Supplementary Budget Act of 2014 introduced major provisions related to value-added tax (VAT)[210].

- Under this law, the DGFiP has been granted expanded authority to obtain information on individuals whose identities could not be verified through third parties.

208) Cour des Comptes (2023), pp. 3-4.
209) Direction Général des Finances Publiques (2015), p. 12.
210) Ibid., p. 11.

○ The DGFiP has also implemented policies and regulations to monitor tax compliance and reporting through new technologies.

- Notable examples include the Ciblage de la Fraude et Valorisation des Requêtes (CFV R[211]), a system for tax fraud detection and audit targeting, and the Foncier Innovant[212], an innovative property tax monitoring project.

□ The CFVR is a data analytics system developed by France's DGFiP to detect tax fraud and enhance the efficiency of tax audits.

○ Under Délibération n°2014-045, adopted in 2014, the DGFiP began using automated methods to monitor and prevent tax evasion[213].

○ By applying data mining techniques, the system analyzes the behavioral patterns of suspected tax evaders, detects similar activities, and identifies emerging types of fraud[214].

○ Following a pilot test on repeat offenders in 2014, the scope of monitoring has been expanded in 2015. From 2016, data analytics techniques have also been applied to cases involving individual taxpayers[215].

○ In 2018, the total amount of tax recovered was €5.6 billion, of which €640 million was recovered through data mining[216].

- The number of tax fraud cases identified grew significantly, from several hundred in 2016 to over 101,000 cases in 2020.

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211) Légifrance (2014), https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000043129895, accessed June12, 2024.

212) Ministére de la Transformation et de la Fonction Publiques (2023), https://www.modernisation.gouv.fr/presse/ftap-annonce-des-laureats-de-la-1ere-session-de-lappel-projets-2020, accessed June 12, 2024.

213) Légifrance (2014), https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000043129895, accessed June 12, 2024.

214) Ministère de l'Économie (2024), https://www.bercynumerique.finances.gouv.fr/le-data-mining-la-dgfip, accessed June 2, 2024.

215) Légifrance (2019), https://www.legifrance.gouv.fr/cnil/id/CNILTEXT000039438806/, accessed June 3, 2024.

216) The Connexion (2019), https://www.connexionfrance.com/news/56bn-in-unpaid-french-taxes-recovered-this-year/450358, accessed June 3, 2024.

○ In 2019, France has revised the CFVR regulations to broaden its scope and mitigate potential risks associated with the system[217].

- Under the revised framework, individual taxpayers with a history of fraud become permanent subjects of CFVR monitoring.
- Automated technologies are emphasized as being used solely as tools for identifying potential fraud, and access to personal data within the department is restricted to a limited number of authorized personnel.
- The DGFiP has also gained access to a wider range of data types for use in CFVR, allowing the system to be extended to real estate wealth tax (Impôt sur la Fortune Immobilière, IFI) calculations and corporate tax oversight.

□ The Foncier Innovant (Innovative Property Tax) project is an initiative that uses AI and big data to identify undeclared buildings and impose property taxes accordingly[218][219].

○ AI extracts building outlines from satellite imagery provided by the Institut National de l'Information Géographique et Forestière (IGN), and in a subsequent step, computer technologies are used to verify whether the identified structures correspond to properties for which taxes have actually been paid[220].

- The AI models and algorithmic tools are developed in collaboration with private firms Google and Capgemini.
- To ensure data security, the DGFiP conducts all analysis on a dedicated cloud infrastructure, and IT service providers are strictly prohibited from accessing any tax-related information.

217) Légifrance (2019), https://www.legifrance.gouv.fr/cnil/id/CNILTEXT000039438806/, accessed June 3, 2024.
218) Ministére de la Transformation et de la Fonction Publiques (2019), https://www.modernisation.gouv.fr/presse/ftap-annonce-des-laureats-de-la-1ere-session-de-lappel-projets-2020, accessed June 12, 2024.
219) Direction Général des Finances Publiques (2022), p. 1.
220) Direction Général des Finances Publiques, https://www.impots.gouv.fr/actualite/1-les-grandes-lignes-du-projet-du-foncier-innovant-afin-de-garantir-une-meilleure, accessed June 12, 2024.

□ AI and data mining are actively used not only to monitor tax compliance and collect property taxes, but also to detect tax evasion.

○ AI is being used to detect personal income tax evasion[221].

- Starting with income tax cases, the use of AI is expected to expand to uncover tax evasion by high-net-worth individuals and owners of high-value real estate.
- Through data mining, authorities can analyze all asset-related data of an individual and calculate the amount of tax that should be paid.
- AI can complete tasks in two hours that previously required 24 hours of work by ten separate agencies.
- The DGFiP aims to detect 50% of individual tax evasion cases using AI by 2027.

○ In 2021, the French government has adopted Décret n°2021-148, which authorizes tax authorities to use automation tools to analyze publicly available online information for the purpose of tracking tax evasion[222].

- The goal is to analyze online data to detect fraudulent behavior and develop fraud detection models based on this information[223].
- The scope includes personal social media accounts, online platforms such as Airbnb, and online classified ad sites[224].
- The Commission Nationale de l'Informatique et des Libertés (CNIL) supported the intention behind data collection following a pilot test in 2019, but also expressed concern that such practices could pose risks to freedom of expression[225].

221) The Connexion (December 20, 2023), https://www.connexionfrance.com/practical/how-french-tax-officials-are-using-ai-to-track-fraud/6092382023.12.20 accessed May 9, 2024.
222) Légifrance (2021), https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000043129895, accessed June 12, 2024.
223) Ibid.
224) Politico (February 19, 2021), https://www.politico.eu/article/france-starts-scrapping-social-media-to-catch-tax-fraudsters/ accessed June 12, 2024.
225) CNIL (September 30, 2019), https://www.cnil.fr/fr/projet-de-loi-de-finances-2020-publication-de-lavis-de-la-cnil, accessed June 12, 2024.

3) Key Functions and Roles

☐ The CFVR has contributed to increased tax revenue.

○ While unpaid taxes and penalties amounted to €15.66 billion in 2021, the figure decreased to €14.62 billion in 2022[226)227)].

- The French government has attributed this improvement in part to the performance of the CFVR system.

☐ The Foncier Innovant project began with a pilot initiative in 2022 across nine départements, focusing on identifying undeclared privately-owned swimming pools, and officially rolled out nationwide in 2023[228)].

○ In France, private swimming pools are subject to property taxation because they increase the taxable value of land[229)]. Municipalities can impose taxes based on the pool's size and type, even at the planning stage[230)].

- For in-ground pools exceeding 10 square meters, owners are required to declare the construction in advance to their local mairie (town hall). Pools under 10 square meters may be exempt from declaration depending on their location.
- Movable pools must be declared if they remain in place for more than three months, however, declaration requirements vary depending on their size.
- The construction-related tax on pools is based on a standard rate of €250 per square meter, in addition to applicable municipal (1–5%) taxes and département-level taxes separately.
- After the construction is completed, the taxable value of the property is reassessed, and the property tax (taxe foncière) is updated accordingly. Tax authorities estimate that the

226) MICAF (2023. 12.), p. 12.
227) Direction Général des Finances Publiques (2022), p. 1.
228) Direction General des Finances Publiques Website, https://www.impots.gouv.fr/actualite/generalisation-du-foncier-innovant, accessed June 27, 2024.
229) Direction General des Finances Publiques Website, https://www.impots.gouv.fr/actualite/generalisation-du-foncier-innovant accessed June 12, 2024.
230) Service-Public.fr (Feburary 11, 2022), https://www.service-public.fr/particuliers/vosdroits/F31404#, accessed June 12, 2024.

presence of a swimming pool increases the owner's annual property tax obligation by approximately 5–10%[231].

Administrative Divisions of France

- Région: The région is the highest-level administrative division in France, comparable to a province or "do" in Korea. It was established in 1982 following the enactment of the Decentralization Act. Originally composed of 22 regions, the number was reduced to 13 in mainland France through a consolidation and reorganization in 2016. There are currently 13 regions in metropolitan France and 5 overseas regions. Examples include Île-de-France, Bretagne, and Normandie.[232][233]
- Département: The département is an administrative division one level below the région. There are 96 départements in mainland France and 5 in overseas territories, bringing the total to 101 départements[234]. Île-de-France consists of eight départements, one of which is Paris[235].
- Commune: The commune is the lowest level of administrative division in France, originating from local community structures that date back to the 12th century. There are currently 35,358 communes across the country[236].

○ During the pilot project, more than 20,000 undeclared swimming pools were identified, of which 94% were subject to taxation.

- The DGFiP projected that the discovery of these pools could generate approximately €10 million in revenue.

231) The Connexion (January 11, 2024), https://www.connexionfrance.com/, accessed June 12, 2024.
232) Oh, et al. (2018), pp. 5-10.
233) European Committee of the Regions, https://portal.cor.europa.eu/divisionpowers/Pages/France-Introduction.aspx, accessed June 13, 2024.
234) European Committee of the Regions, https://portal.cor.europa.eu/divisionpowers/Pages/France-Introduction.aspx, accessed June 13, 2024.
235) Le Parisien (August 21, 2016), https://www.leparisien.fr/archives/d-ou-vient-le-nom-de-ce-departement-21-08-2016-6057241.php, accessed June 13, 2024.
236) European Committee of the Regions, https://portal.cor.europa.eu/divisionpowers/Pages/France-Introduction.aspx, accessed June 13, 2024.

- In 2022, it was also estimated that local governments could collect up to €40 million in additional local taxes from 2023.

○ After the pilot project concluded, the DGFiP identified 140,000 undeclared swimming pools in 2023—a sevenfold increase compared to 2022.

- These detections led to an additional €40 million in property tax (taxe foncière) revenue.

○ Between 2021 and 2023, the DGFiP invested €24 million in plans to apply AI to identify unreported buildings other than swimming pools[237].

- Starting in the second half of 2022, the project was extended to areas not included in the initial pilot, and by 2023, it was implemented nationwide[238].
- The use of AI is also planned for the identification of undeclared or misclassified buildings, including swimming pools[239].
- However, identifying buildings presents greater complexity and requires more sophisticated capabilities, and challenges are anticipated before the system can be fully implemented[240].

D. The Next-Generation Chatbot of the Inland Revenue Authority of Singapore (VICA)

1) Background

□ In 2023, the Inland Revenue Authority of Singapore (IRAS) introduced the Virtual Intelligent Chat Assistant (VICA) to overcome the limitations of traditional rule-based AI chatbots and to enhance both utility and efficiency by leveraging large language models (LLMs)[241].

237) Direction Général des Finances Publiques (2022), p. 2.
238) Ibid., p. 3.
239) Ibid.
240) The Connexion (December 20, 2023), https://www.connexionfrance.com/practical/how-french-tax-officials-are-using-ai-to-track-fraud/6092382023.12.20, accessed May 9, 2024.
241) GovInsider (September 14, 2023), https://govinsider.asia/intl-en/article/is-it-time-to-say-goodbye-to-ask-jamie-inside-govtechs-refresh-of-government-chatbots, accessed June 4, 2024.

○ Traditional rule-based chatbots can only respond according to pre-defined logic, which limits the scope of interaction and makes it difficult to adapt to new information or changing contexts[242].

- Furthermore, such chatbots often fail to understand variations in phrasing, requiring manual input of 10 to 15 different expressions for the same question to ensure accurate responses—an inefficient and labor-intensive process[243].

Large Language Model (LLM)

• A Large Language Model (LLM) is the foundational technology behind ChatGPT, which has recently gained widespread attention. By training on massive volumes of text data, an LLM can generate natural-sounding word combinations and perform a wide range of natural language processing tasks, including writing reports and composing poetry[244].

2) Implementation Process

□ In 2014, Singapore's Government Technology Agency (GovTech) and the Smart Nation Digital Government Office (SNDGO) jointly conceptualized a rule-based AI chatbot known as "Ask Jamie[245][246]."

○ Following the high-profile success of ChatGPT in 2022, public interest in its underlying technology—large language models (LLMs)—surged, prompting a rapid shift toward developing a next-generation chatbot, the Virtual Intelligent Chat Assistant (VICA)[247].

242) Jeong (2023), pp. 14-15.
243) GovInsider (September 14, 2023), https://govinsider.asia/intl-en/article/is-it-time-to-say-goodbye-to-ask-jamie-inside-govtechs-refresh-of-government-chatbots, accessed June 4, 2024.
244) Naver Knowledge Encyclopedia, https://terms.naver.com/entry.naver?docId=6653205&cid=42107&categoryId=42107, accessed June 20, 2024.
245) GovTech Singapore Website, https://www.tech.gov.sg/products-and-services/ask-jamie/, accessed June 4, 2024.
246) Myeong (2023), p. 22.
247) GovInsider (September 14, 2023), https://govinsider.asia/intl-en/article/is-it-time-to-say-goodbye-to-ask-jamie-inside-govtechs-refresh-of-government-chatbots, accessed June 4, 2024.

- "Ask Jamie," which had been deployed across more than 70 Singapore government agency websites, has gradually been replaced by VICA since 2023[248].
- In February 2023, the IRAS implemented VICA, enabling faster and more accurate delivery of personalized information to taxpayers. As a result, 70% of users gave the chatbot a positive rating[249].

3) Key Functions and Roles

□ The next-generation chatbot developed by the IRAS—the VICA—performs the following functions:

○ Provides instant responses to general tax-related inquiries

○ Offers information on various tax categories including income tax, corporate tax, goods and services tax (GST), property tax, stamp duty, withholding tax, and employer-related taxes

○ Delivers personalized transaction services through secure authentication

○ Facilitates access to transactional services (e.g., submitting forms, checking application statuses, retrieving tax records)

□ With the next-generation chatbot, the VICA, taxpayers can access the following transactional services:

○ Check whether they are required to file an income tax return

○ Verify outstanding tax balances

○ View their GIRO payment plan

○ Submit requests for waiver of penalties

○ Check the submission status of Form IR21 (tax clearance)

248) Ibid.

249) Inland Revenue Authority of Singapore Website, https://www.iras.gov.sg/news-events/newsroom/iras-annual-report-fy2022-23, accessed June 5, 2024.

□ The VICA has also reduced the number of unrecognized queries compared to previous rule-based AI chatbots.

○ Powered by a LLM, the chatbot provides accurate and relevant information by grouping multiple queries into relevant categories and understanding user questions regardless of how they are phrased by leveraging extensive semantic data[250][251].

- By handling a broader range of inquiries, the chatbot allows human agents to focus on more complex issues, improving overall service efficiency[252].

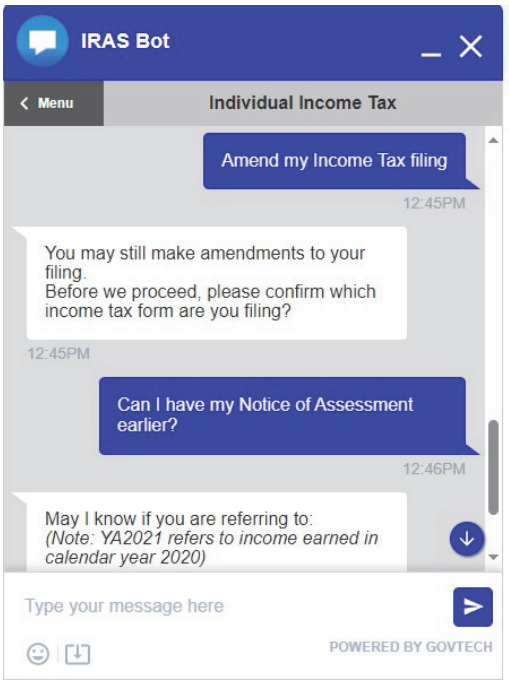
□ The training, management, and updating of the chatbot have become significantly more efficient, contributing to improved overall performance.

○ With VICA, the system can automatically generate variations of questions and answers, requiring only the administrator's approval. This makes chatbot training much more convenient compared to earlier systems that required manual entry of each variation[253].

- Additionally, VICA can identify and flag conflicting answers across related questions in advance, helping to prevent inaccurate or inconsistent training[254].

250) Singapore Government Developer Portal, https://www.developer.tech.gov.sg/products/categories/platform/virtual-intelligent-chat-assistant/overview.html, accessed June 4, 2024.
251) GovInsider (September 14, 2023), https://govinsider.asia/intl-en/article/is-it-time-to-say-goodbye-to-ask-jamie-inside-govtechs-refresh-of-government-chatbots, accessed June 4, 2024.
252) Ibid.
253) Singapore Government Developer Portal, https://www.developer.tech.gov.sg/products/categories/platform/virtual-intelligent-chat-assistant/overview.html, accessed June 4, 2024.
254) Ibid.

[Figure Ⅲ-13] Inland Revenue Authority of Singapore (IRAS) Bot



Source: Inland Revenue Authority of Singapore Website, https://www.iras.gov.sg, accessed June 5, 2024.

E. China's Blockchain-Based Electronic Invoicing System

1) Background

☐ China's blockchain-based electronic invoicing system has been introduced to improve the efficiency of tax administration and increase tax revenue by preventing invoice forgery and tampering, while also enabling the rapid exchange of information between internal and external stakeholders[255].

○ Value-added tax (VAT)[256], which accounts for more than half of China's tax revenue, has been a key focus. In 2016, Phase III of the Golden Tax Project was launched to

255) Xu & Zhang (2022), pp. 129-133.

256) An indirect tax imposed on the value added during the exchange of goods and services, equivalent to the Value-Added Tax (VAT) in Korea.

digitize the management of VAT invoices and curb fraud[257].

- However, traditional electronic invoices did not include real-time transaction details such as the time of transaction or the identities of both parties. This made it possible for businesses to manipulate or withhold invoice issuance to pursue private gains[258].

○ Despite the tax authority's development of multiple information management systems, taxpayer data was not consistently classified, verified, or updated in a timely manner, resulting in inefficient data handling and limited comparability across tax databases[259][260].

- For instance, a company might underreport employee wages for withholding purposes (individual income tax), but overreport them in corporate income tax filings—resulting in underreporting across both tax categories[261][262].

○ A lack of standardized protocols and technical infrastructure for data sharing between tax authorities and other stakeholders made it difficult to timely utilize tax information or detect and correct errors. This undermines trust between information providers and users and diminishes the overall efficiency of tax administration[263][264][265].

2) Implementation Process

□ In its 13th Five-Year National Informatization Plan, released in December 2016, the Chinese government designated blockchain as a priority initiative and issued corresponding guidelines for its development[266][267].

257) Xu & Zhang (2022), pp. 130~132.
258) Ibid., pp. 129~132.
259) Ibid., p. 132.
260) Zhang, et al. (2016), https://www.internationaltaxreview.com/article/2a694i8dxvazlhsxz4000/china-tax-big-data-and-beyond, accessed May 29, 2024.
261) Wu, et al. (2020), p. 57.
262) Xu & Zhang (2022), p. 132. Re-citation
263) Xu & Zhang (2022), pp. 132~133.
264) Wu, et al. (2020), p. 57.
265) Xu & Zhang (2022), p. 132. Re-citation
266) Xu & Zhang (2022), p. 129.
267) Song & Yang (2019), p. 4.

○ In June 2017, the State Administration of Taxation (SAT) established a Blockchain Research and Development Division and launched pilot projects using blockchain technology at local tax bureaus[268].

○ In 2018, the Shenzhen Tax Bureau, in collaboration with Tencent, launched a pilot program for issuing blockchain-based electronic invoices[269].

- In 2019 and 2020, approximately 23 million electronic invoices were issued via blockchain in Shenzhen. The success of the pilot led to expansion to other major cities including Beijing, Guangzhou, and Hangzhou[270].
- In 2021, the Institute of Electrical and Electronics Engineers Standards Association (IEEE SA) recognized Shenzhen's blockchain e-invoicing application as the first international standard for this technology[271].

3) Key Functions and Roles

□ Prevention of Invoice Forgery and Tampering

○ Through the distributed consensus model of blockchain technology, multiple participants are able to verify and validate transaction data, thereby enhancing data integrity and trust[272].

- In addition, the system automatically links and cross-references transaction data with the flow of cash and goods, enabling tax authorities to access complete, real-time tax information. This helps prevent tax evasion and contributes to increased tax revenue[273].

268) Xu & Zhang (2022), p. 129.
269) Ibid., p. 134.
270) Ibid., pp. 138~139.
271) Shenzhen Municipal Government Website, https://www.sz.gov.cn/en_szgov/business/news/content/post_8675244.html, accessed June 3, 2024.
272) Xu & Zhang (2022), p. 133.
273) Ibid., pp. 133~134.

□ Rapid Information Exchange Among Internal and External Tax Administration Stakeholders

○ By utilizing a distributed network and consensus algorithms, blockchain connects all relevant parties within the same network, allowing data entered by one participant to be immediately shared with others[274].

- This enhances transparency and efficiency in information sharing among stakeholders, thereby improving taxpayer compliance and facilitating more effective tax enforcement[275].

F. The Use of AI Algorithms in Public Finance in the Netherlands

1) Background

□ Since the early 2000s, the Dutch government has utilized AI and data analytics to prevent tax fraud, evasion, and abuse of social welfare subsidies. In addition to public finance, AI is applied across various sectors including finance, law enforcement, healthcare, and public services[276][277].

□ In the field of public finance, the Netherlands has implemented tools such as web scraping, social network analysis, and the System Risk Indication (SyRI) to improve administrative efficiency and reduce public sector costs.

2) Implementation Process

□ In 2004, the Dutch government established a legal foundation for inter-agency data sharing through the enactment of the Work and Social Assistance Act (Wet werk en bijstand, WWB)[278].

274) Xu & Zhang (2022), p. 134.
275) Ibid., p. 134.
276) University of Antwerp, https://www.uantwerpen.be/en/projects/aitax/country-reports/netherlands/, accessed August 13, 2024.
277) Chambers and Partner, https://practiceguides.chambers.com/practice-guides/artificial-intelligence-2024/netherlands/trends-and-developments, accessed August 13, 2024.
278) Library of Congress, https://www.loc.gov/item/global-legal-monitor/2020-03-13/netherlands-court-prohibits-governments-use-of-ai-software-to-detect-welfare-fraud/, accessed August 13, 2024.

□ To support the launch of the SyRI system in 2014, the government enacted the Structure of Implementation of Work and Income Act (Wet Structuur Uitvoeringsorganisatie Werk en Inkomen, SUWI), which provided a legal basis for public agencies to share and combine data[279].

□ While the Netherlands currently does not have a general law specifically regulating AI, the Council of the European Union approved the EU AI Act on May 21, 2024, which will go into effect 36 months after its adoption.

○ Presently, the use of AI in the public finance sector of the Netherlands is primarily guided by the provisions of the EU AI Act.

3) Key Functions and Roles

□ Four key technologies are currently utilized in the field of public finance in the Netherlands.

○ Web Scraping (XENON): Developed in 2004, XENON is a proprietary Dutch technology that automatically collects publicly available data from the internet, including social media and e-commerce platforms. This data is cross-referenced with tax databases to monitor taxpayer behavior and is used to detect potential tax evasion.

○ Social Network Analysis (SNA): SNA examines the social relationships between taxpayers, visualizing connections within networks to assess the risk of tax evasion. For example, it can detect suspicious patterns of transactions within specific groups.

○ Risk Management System (SyRI): SyRI aggregates data from multiple sources to create taxpayer profiles and uses algorithms to predict the likelihood of tax fraud. It identifies high-risk individuals for further investigation.

- However, Dutch civil society groups argued that SyRI infringed on privacy and human rights, leading to a lawsuit. In February 2020, the District Court of The Hague ruled that

279) Ibid.

SyRI violated Article 8 of the European Convention on Human Rights, resulting in the suspension of the system's use.

○ Nudging Techniques: Based on behavioral science, these techniques involve the use of algorithms to analyze previous taxpayer communications (such as notices and reminders) and deliver personalized messages that encourage timely tax filing and payment.

4) AI Utilization and Controversies: Childcare Benefits and Student Loans

□ Since 2005, the Netherlands Tax and Customs Administration has conducted investigations into suspected fraud related to childcare benefits, as part of broader efforts to regulate payments under the program. The Ministry of Social Affairs and Employment has overseen the integration of childcare allowances into the national welfare system and managed the program's operations[280].

○ In 2009, childcare agencies in the Netherlands were found to have committed fraud by involving parents in schemes to unlawfully claim childcare benefits. This led to a major public scandal, prompting the Dutch Ministry of Social Affairs to adopt a much stricter policy stance regarding the administration and disbursement of childcare benefits.[281].

○ In 2013, several Bulgarian immigrants were found to have abused the Dutch welfare system to fraudulently claim childcare benefits. However, many of them had already left the country by the time the fraud was uncovered. Subsequent investigations revealed that from 2007 to 2013, over 800 Bulgarian nationals had illegally claimed more than €4 million in benefits from the Dutch government.

□ In 2019, the Ministry of Social Affairs and Employment deployed AI to detect fraudulent claims for childcare benefits, resulting in the classification of approximately 26,000

280) CNBC (January 15, 2021), https://www.cnbc.com/2021/01/15/dutch-government-resigns-after-childcare-benefits-scandal-.html, accessed August 12, 2024.

281) De Correspondent (November 13, 2020), https://decorrespondent.nl/10628/tienduizenden-gedupeerden-maar-geen-daders-zo-ontstond-de-tragedie-achter-de-toeslagenaffaire/0f71ac81-d117-0d12-23a4-89513b0bb824, accessed August 13, 2024.

parents as fraudsters[282].

○ However, a later investigation by the Dutch parliamentary inquiry committee found that around 94% of these cases were wrongfully flagged, primarily affecting vulnerable groups such as low-income families, immigrants, and families with multiple children. This revealed the significant risks associated with biased application of AI in public systems[283].

○ The misclassification of innocent claimants caused severe financial hardship for many households, leading to job loss, divorce, loss of child custody, and in some tragic cases, suicide.

□ AI systems in the Netherlands disproportionately targeted individuals with dual citizenship or those without Dutch nationality, leading to widespread accusations of xenophobia and racial discrimination.

○ As the childcare benefits scandal escalated into a major social crisis, public outrage grew over the government's use of AI. In January 2021, the Dutch Prime Minister and his cabinet collectively resigned, retracting their stance on the use of AI in welfare administration.

○ The Dutch tax authority was subsequently fined approximately €3.7 million by the government for its role in the scandal.

□ The controversy surrounding AI in public administration has not been limited to the Netherlands. Similar concerns over human rights violations and threats to social welfare protections have emerged in countries such as the UK, Ireland, France, and Poland. In response, the European Parliament adopted a draft of the EU Artificial Intelligence Act in 2023[284].

282) Politico (March 29, 2022), https://www.politico.eu/article/dutch-scandal-serves-as-a-warning-for-europe-over-risks-of-using-algorithms/, accessed August 5, 2024.
283) EU Law Enforcement (April 30, 2021), https://eulawenforcement.com/?p=7941, accessed August 6, 2024.
284) Etoday (June 28, 2023), https://www.etoday.co.kr/news/view/2260881, accessed August 6, 2024.

○ The draft legislation outlines key requirements for the use of AI, including △safety, △ transparency, △traceability, △non-discrimination, and △environmental sustainability. It is the result of continued research and policy development across the European Union since 2020.

□ In relation to the Netherlands' broader challenges with AI deployment, the Dutch Ministry of Education began using algorithmic technologies in 2012 through the Dienst Uitvoering Onderwijs (DUO) program, which manages the allocation and disbursement of student loans required for higher education registration[285].

○ The DUO program employed an automated decision-making (ADM) system to verify the legitimacy of student loan claims—particularly targeting students living far from home, under the assumption that they might be more likely to fraudulently claim higher loan amounts.

- Since 2012, the DUO program identified a total of 9,923 potentially fraudulent cases using this method.
- The system relied on proxy data, which can indirectly expose sensitive personal information and result in indirect discrimination. Investigations revealed that among students flagged for not living at their registered address, approximately 97% were of immigrant background. This triggered an inquiry by the Dutch Data Protection Authority into the personal data processing methods of the algorithm.
- While the DUO system was expected to increase efficiency and reduce costs through the use of AI, it was ultimately found to be highly error-prone due to the complexity of real-world social conditions and legal ambiguity. As a result, the Dutch Ministry of Education officially suspended the use of the internal algorithmic system within DUO in June 2023.

285) Verfassungsblog (July 25, 2023), https://verfassungsblog.de/a-scandal-on-ai-in-administration-again/, accessed August 19, 2024.

Ⅳ. Summary and Policy Implications

1. Key Functions and Core Technologies of Digital Transformation by Country

□ The application of digital transformation and innovation in the field of public finance in Korea and other major countries, as examined in the previous sections, are summarized in the following table.

〈Table Ⅳ-1〉 Application of Advanced Technologies in Fiscal Sectors: Country Cases

Country	Application Area	Main Features and Improvements	Applied Technologies
Korea	Fiscal Management	(Next-Generation Digital Budget and Accounting System – dBrain+) Efficient fiscal operations, enhanced inter-ministerial collaboration, support for data-driven policy decisions	AI, Big Data
	Subsidies	(e-Naradoum) Improved transparency and efficiency in subsidy management, automation of administrative processes, AI-based fraud detection, customized services and information disclosure	AI
	Procurement	(Next-Generation KONEPS) System stability, improved user convenience, cost reduction	Big Data, AI, Blockchain, Cloud
	Tax Administration	(Digital Transformation of National Tax Service) Improved administrative efficiency, enhanced taxpayer experience, fairer taxation	Big Data, AI
	Digital Platform	(KOMSCO's Chak) Blockchain-based innovation, public-private collaboration, secured patents and platform stability	Blockchain
United States	Tax Administration	(Return Review Program – RRP) Fraud detection	Cloud, Data Mining
United Kingdom	Subsidies	(Universal Credit) Improved administrative efficiency, reduction in fraud, error, and welfare expenditures	Cloud, AI
France	Tax Administration	(Foncier Innovant / CFVR) Fraud detection and enhanced tax collection	Data Mining, AI
Singapore	Beyond Tax	(VICA) Enhanced usefulness and ease of training/management due to improved chatbot comprehension	Large Language Model (LLM)
China	Tax Administration	(Golden Tax Project) Prevention of invoice forgery and improved transparency through rapid information sharing among stakeholders	Blockchain
Netherlands	Subsidies	(SyRI) Fraud prevention, detection and monitoring of social benefit abuse	AI

Source: Compiled by the author based on the main text.

2. Country Case Highlights and Strategic Insights

A. Korea

□ (Next-Generation Digital Budget and Accounting System) The next-generation digital budget and accounting system (dBrain+) leverages big data and AI technologies to integrate and analyze fiscal data, thereby enhancing the efficiency of the government's fiscal management and providing a foundation for more evidence-based policy decision-making.

○ This is expected to strengthen inter-ministerial collaboration and improve the government's ability to forecast and manage risks throughout the budgeting and execution processes.

□ (e-Naradoum) The Integrated Management System for National Subsidies was introduced to ensure the transparent and efficient management of government subsidies. The automation of the whole subsidy process including disbursement, execution, and settlement has significantly improved administrative efficiency. Furthermore, its AI-based fraud detection system helps identify irregularities in advance and prevents the misuse or abuse of subsidy funds.

○ The system is expected to play a key role in promoting efficient execution of the national budget and strengthening public trust.

○ As the scale of subsidies continues to grow each year, the government faces ongoing challenges in further upgrading the system and enhancing safeguards against fraudulent claims.

□ (Next-Generation KONEPS) Korea is currently implementing a next-generation procurement system KONEPS that incorporates big data, AI, blockchain, and cloud technologies. This initiative aims to stabilize the aging legacy system, enhance user convenience, and achieve cost savings.

○ A notable issue involves cloud technology, which may lead to increased costs due to security-related concerns.

□ (Digital Transformation of the National Tax Service) In the area of taxation, Korea has introduced services such as business registration assistance, pre-filled and auto-filled tax forms, chatbot and AI-powered tax consultations, and a tax assistant service, all powered by big data and AI. These services aim to improve taxpayer convenience, detect tax evasion, and strengthen tax fairness through more effective revenue management.

○ The auto-filled service may cause confusion for taxpayers due to inaccurate calculations.

○ Chatbot and AI-based tax consultations remain limited in scope, as their ability to interpret the user's intent is underdeveloped and they are generally capable of answering only basic queries.

□ (KOMSCO's Chak Public Platform) KOMSCO developed the blockchain-based public trust platform Chak to enhance online payment security and prevent the tampering of digital assets.

○ Local governments use Chak to carry out tasks such as issuing mobile local gift certificates and disbursing welfare allowances.

○ In particular, using Chak to distribute welfare allowances helps reduce the risk of fraudulent claims and lower administrative costs.

○ The Chak public platform case demonstrates how blockchain technology can enhance transparency and security in public services while also improving administrative efficiency.

○ Notably, the platform illustrates the importance of public-private collaboration, as cooperation with private companies has enabled the overcoming of technological limitations and the delivery of innovative services.

B. United States

□ The introduction of the Return Review Program (RRP) by the U.S. Internal Revenue Service (IRS) significantly enhanced the detection of identity theft and tax fraud compared to the previously used Electronic Fraud Detection System (EFDS) by leveraging data mining, cloud technologies, and AI.

○ The adoption of AWS GovCloud and Palantir solutions improved data analysis efficiency, and audits of high-income individuals and large corporations have been strengthened to address the tax gap.

○ However, concerns over algorithmic bias and infringement of personal data have been raised in the AI deployment process, highlighting the growing need for transparent oversight and regulation.

C. United Kingdom

□ The UK Department for Work and Pensions (DWP) integrated six existing welfare benefits into Universal Credit, applying new technologies such as cloud platforms and AI.

○ These technologies aim to reduce the time required for benefit disbursement and prevent fraudulent claims, thereby enhancing welfare efficiency and reducing administrative costs.

○ However, the system has faced several limitations including delays in implementation, insufficient digital accessibility, and biases in AI systems.

○ In particular, unfair treatment of vulnerable groups and a lack of transparency have sparked public controversy.

□ The UK case suggests the need for a systematic strategy that includes addressing the digital divide, ensuring fair use of AI, improving accessibility, and strengthening external oversight.

D. France

☐ The DGFiP has implemented the CFVR program and the Foncier Innovant project to detect tax evasion, both of which utilize data mining and AI.

- ○ The CFVR program uses data mining to identify tax evaders and analyze fraudulent behavior.
- ○ The Foncier Innovant project applies AI to detect undeclared privately owned swimming pools and collect corresponding property taxes.
- ○ Through these programs, the DGFiP has been able to detect more cases of tax evasion and increase property tax collection compared to previous years.

E. Singapore

☐ Singapore has introduced the next-generation chatbot VICA, powered by large language models (LLMs), not only within its tax authority but also across various government agency websites.

- ○ Compared to traditional rule-based AI chatbots, VICA demonstrates improved comprehension of user queries, making it more useful, while also enhancing efficiency through easier management and training.
- ○ However, the use of LLMs in VICA raises concerns regarding the sources of training data, potential privacy violations, and the methods in place to protect personal information, all of which require further clarification.

F. China

☐ China has introduced blockchain-based electronic invoicing in tax administration to prevent invoice forgery and tampering, while enhancing transparency through rapid information exchange among stakeholders.

- ○ Prior to its adoption, there was no effective way to prevent the distortion of VAT invoice

information, which accounts for more than half of China's tax revenue. In addition, inefficient information processing made it difficult to build trust between information providers and users, undermining the overall efficiency of tax administration.

G. The Netherlands

□ The case of AI utilization in the Netherlands demonstrates the potential for maximizing technological efficiency in the public sector.

○ At the same time, it highlights that incorrect decisions made by AI systems can cause serious harm to vulnerable populations.

○ In particular, the use of biased data and algorithms may exacerbate human rights violations and social inequality, underscoring the need for legal regulations and ethical safeguards that reinforce transparency, non-discrimination, and accountability in the deployment of AI.

○ It is essential to establish institutional and technical foundations to ensure that AI technologies are used fairly and safely, while maintaining their benefits and earning public trust.

3. Policy Implications

□ Digital transformation is becoming a major turning point in contributing to innovations in the public finance sector. This report provides a multifaceted analysis of how digital technologies can enhance efficiency, transparency, and inclusiveness in fiscal management through key domestic and international case studies.

□ The various cases presented in this report suggest that while the advancement of digital technologies can serve as a strategic tool for overcoming existing limitations and generating new opportunities in public financial management, challenges remain that must also be addressed.

A. The Need for Change Management Strategies in the Implementation of New Digital Systems

□ (Resistance within Organizational Culture) The introduction of new digital systems requires changes to existing workflows, which may lead to resistance within the organization. It is therefore essential to implement a change management strategy to effectively address and manage such internal resistance.

□ (Insufficient Legal and Institutional Preparedness) Without proper legal and institutional support, it is difficult to ensure effectiveness in the operation of new digital systems. Accordingly, government-led guidelines and regulations must be established, along with continued efforts to train current personnel and develop human resources.

B. Reducing Bias and Enhancing Transparency in AI Systems

□ (Issues Arising from Biased Data) The performance of AI systems depends heavily on the quality and diversity of training data, and the use of biased data can lead to unfair outcomes. In several AI-driven policy decision cases referenced in this report, ensuring high-quality data was emphasized as a critical factor.

○ A notable example is the Dutch government's use of AI algorithms to detect welfare fraud and irregularities. However, the system disproportionately targeted specific social groups, leading to widespread policy controversy over data bias and algorithmic unfairness.

□ (Lack of Transparency) When the decision-making process of AI is opaque, it can undermine public trust in the outcomes. Therefore, it is necessary to ensure fairness in AI systems design and establish guidelines to enhance the transparency of decision-making processes.

○ In Singapore, the AI-based consultation system VICA was used to automatically process taxpayer requests. However, in its early stages, it failed to grasp certain linguistic or

cultural contexts, which lowered the level of user trust. Additionally, the lack of clarity regarding the sources of training data for the large language model (LLM) indicates a need for improvement in transparency.

C. Addressing the Limitations of Digital Decision-Making

□ (Limitations of Data-Driven Decision-Making) The adoption of digital systems may lead to inaccurate policy decisions if they rely on flawed data or biased analysis.

○ The UK government introduced the Universal Credit system using cloud platforms and AI technology to integrate six previously separate benefits and address inefficiencies in the existing system. However, bias in the AI algorithm led to cases of unfair suspension of benefits for certain social groups.

○ Similarly, the Dutch government sought to enhance administrative efficiency by using AI to detect fraudulent childcare benefit claims. However, bias in the AI system resulted in significant harm to low-income and immigrant households.

□ (Overreliance on Technology) When decision-making processes driven by big data and AI excessively reduce the role of human judgment, it can hinder flexible responses to unexpected situations. Therefore, it is essential to enhance the reliability of data used and establish a system that incorporates human oversight to complement AI-based decisions.

○ In France, AI and big data were used to detect tax evasion, but cases emerged in which incorrect data analysis led to tax notices being issued to innocent taxpayers, raising concerns about trust in the system and emphasizing the importance of human review in the decision-making process.

D. Strengthening the Protection of Personal Data and Privacy

□ (Data Security and Privacy) With an increase in the handling of sensitive personal information within digital systems, the risk of data breach grows. This necessitates the

strengthening of legal regulations and management practices, such as data protection laws.

○ In Korea, the National Tax Service manages its big data analysis system in accordance with international privacy protection standards. In the U.S., the Return Review Program (RRP) initially faced criticism for lacking adequate data protection measures, but later regained public trust by reinforcing related legal safeguards.

□ (Technical Measures) Privacy protection must be considered from the early stages of system design. Secure data storage and processing technologies, such as blockchain, should be employed to prevent tampering and to protect user data.

○ Korea's blockchain-based public trust platform developed by KOMSCO is regarded as a best practice in personal data protection.

E. Establishing Legal and Institutional Frameworks for AI

□ Although the need to establish legal and institutional frameworks for AI has been growing, various Korean ministries are currently promoting separate legislative proposals that remain pending in the National Assembly such as the Basic Act on AI (Ministry of Science and ICT), the Act on Promotion of Industrial Use of AI (Ministry of Trade, Industry and Energy), and the Act on Protection of AI Service Users (Korea Communications Commission).

○ In contrast, other countries have already enacted and implemented AI-related legislation, such as the National AI Initiative Act (2020) and the Inflation Reduction Act (2022) in the United States, and the EU AI Act (2024) in Europe. For Korea to actively leverage AI in the fiscal sector going forward, there is a clear need to streamline AI legislation and institutional frameworks[286].

286) The Korea Economic Daily (May 17, 2024) https://www.hankyung.com/article/2024051761581, accessed July 16, 2024.

□ On March 13, 2024, the European Union (EU) approved a regulatory framework for AI that aims to promote innovation while ensuring safety and the protection of fundamental rights. This framework is officially referred to as the AI Act.

○ The AI Act is the world's first comprehensive regulatory framework for AI. It sets out legal standards for the development, deployment, and use of AI systems, with the dual aim of protecting fundamental rights, democracy, the rule of law, and environmental sustainability from high-risk AI applications, while also fostering innovation and positioning Europe as a global leader in the field[287].

□ In addition, the United States enacted the National AI Initiative Act in 2020, while Japan is in the process of establishing a legal framework for generative AI. The United Kingdom has published a white paper titled "A Pro-Innovation Approach to AI Regulation," aiming to address potential risks associated with AI adoption while also enhancing its global competitiveness[288][289].

287) European Parliament, https://www.europarl.europa.eu/news/en/press-room/20240308IPR19015/artificial-intelligence-act-meps-adopt-landmark-law, accessed July 16, 2024.
288) The Korea Economic Daily (May 17, 2024) https://www.hankyung.com/article/2024051761581, accessed July 16, 2024.
289) GOV.UK, https://www.gov.uk/government/publications/ai-regulation-a-pro-innovation-approach/white-paper#part-7-conclusion-and-next-steps, accessed December 29, 2024.

〈Table Ⅳ-2〉 AI-Related Legislation and Key Issues by Country

Country/Region	AI-Related Law/Policy	Key Features	Main Issues
European Union (EU)	AI Act	– First global comprehensive AI regulatory framework – Protects fundamental rights from high-risk AI while promoting innovation – Emphasis on environmental sustainability	– Strict regulations may hinder innovation – Risk of regulatory gaps with other countries affecting industry competitiveness
United States	National AI Initiative Act	– Promotes R&D and responsible use of AI – Focus on enhancing global competitiveness – Emphasis on harmonizing federal and state regulations	– Relatively loose regulations may raise ethical concerns – Lack of robust data privacy and accountability frameworks
Japan	Legislation on Generative AI (under development)	– Aims to regulate the social and economic impacts of generative AI – Development of a legal framework in progress	– Early-stage regulatory efforts lack detail – Regulatory response lags behind technological advancement
Korea	AI Basic Act, Act on Promotion of Industrial Use of AI, Act on Protection of AI Service Users (pending in National Assembly)	– Separate legislative proposals by different ministries may increase costs and confusion for businesses – Lack of coordination across ministries	– Need to balance regulation and innovation – Regulatory compliance burden is heavier for SMEs
United Kingdom	White Paper: A Pro-Innovation Approach to AI Regulation	– Proposes a flexible regulatory model that avoids stifling innovation – Emphasizes the role of existing regulatory bodies– Global AI Safety Summit scheduled	– Guide-based rather than legally binding regulatory approach – Ongoing discussion on establishing an international AI oversight body

Source: Compiled by the author based on the main text.

References

[Digital Transformation in Public Finance Overview]

〈Korean Literature〉

김희열,「블록체인 플랫폼의 보안 위협과 대응 방안 분석」,『한국정보기술학회논문지』, 16(5), 2018, pp. 103~112. (Heeyoul Kim, "Analysis of Security Threats and Countermeasures on Blockchain Platforms," *Journal of KIIT*, 16(5), 2018, pp. 103-112.)

서무경·정이상,「4차 산업혁명시대의 블록체인 활용화에 관한 연구」,『예술인문사회 융합 멀티미디어 논문지』, 8(9), 2018, pp. 287~296. (Moo-Kyung Seo and Lee-Sang Jung, "A study on the Use of Block Chain in the 4th Industrial Revolution Era," *Asia-pacific Journal of Multimedia Services Convergent with Art, Humanities, and Sociology*, 8(9), 2018, pp. 287-296.)

고진,「민·관 협업으로 혁신을 선도하는 디지털플랫폼정부」.『행정포커스』, Vol. 157. 06-11. 한국행정연구원, 2022. (Go Jin, "Digital Platform Government Leading Innovation through Public-Private Collaboration," Administration Focus, 157, *Korea Institute of Public Administration*, 2022, pp. 6-11.)

박정화,「재정분야의 AI 활용 및 시사점」,『월간 나라재정』, 한국재정정보원, 제78호, 2023, pp. 4~9. (Park Jeong-hwa, "Application of AI in the Fiscal Sector and Its Implications," Monthly Public Finance (Wolgan Narajejeong), 78, *Korea Fiscal Information Service*, 2023, pp. 4-9.)

방준성,「AI 기술을 활용한 공공서비스 확대방안」,『KISDI AI Outlook』, 한국정보통신정책연구원, 2021 Vol 5, 2021. (Bang Jun-sung, "Strategies for Expanding Public Services through AI Technologies," *KISDI AI Outlook*, 2021(5), 2020, pp. 5-21.)

우석진,「인공지능과 재정」,『월간 나라재정』, 한국재정정보원, 제52호, 2021, pp. 12~15. (Woo Suk-jin, "Artificial Intelligence and Public Finance," Monthly Public Finance (Wolgan Narajejeong), 52, *Korea Fiscal Information Service*, 2021, pp. 12-15.)

이남령, 「현금영수증 제도 도입 효과에 대한 실증연구」, 『대한경영학회지』, 29(8), 2016, pp. 1367~1387. (Namryoung Lee, "An Empirical Study of the Effect of the Cash Receipt System," *Korean Journal of Business Administration*, 29(8), 2016, pp. 1367-1397.)

이종우·김익조, 「디지털 전환을 성공적으로 달성한 기업 사례연구: 전환 단계별 접근을 중심으로」, 『유통경영학회지』, 26(2), 2023, p. 55. (Jongwoo Lee and Eikjoe Kim, "Case Studies of Companies Successfully Achieving Digital Transformation: Focusing on a Step-by-step Approach to Conversion" *Journal of Distribution and Management Research,* 26(2), 2023, pp. 55-66.)

이상엽·김준현·유현영·김민경, 『빅데이터와 조세행정 – 최근 해외 트렌드를 중심으로』, 세법연구, 한국조세재정연구원, 제7호, 2017, pp. 12~14. (Sang-Yeob Lee, Jun-Hyun Kim, Hyun-Young Yoo, and Min-Kyung Kim, "Big Data and Tax Administration – Focusing on Recent International Trends", *Tax Law Review*, Korea Institute of Public Finance, No. 7, 2017, pp. 12–14.)

이혜진·김대중, 「디지털플랫폼정부 구축을 위한 표준화 동향 및 시사점」, 『한국통신학회지(정보와통신)』, 40(11), 2023, pp. 59~64. (Lee Hyejin & Kim Daejung, "Standardization Trends and Implications for Building the Digital Platform Government," *Information and Communications Magazine*, 40(11), 2023, pp. 59-64.)

한국지능정보사회진흥원, 「새정부의 '디지털 플랫폼 정부' 구현을 위한 추진방향과 과제」, 『D.gov 이슈분석』, 2022-4호, 2022. (National Information Society Agency, "Strategic Directions and Key Tasks for Implementing the Digital Platform Government under the New Administration," *D.gov Issue Analysis*, 2022(4), 2022)

_____, 「공공분야 생성형 AI 활용방안」, 『THE AI REPORT』, 2023-10호, 2023. (National Information Society Agency, "Application Strategies for Generative AI in the Public Sector," *THE AI REPORT*, 2023(10), 2023)

한국행정연구원, 「국가별 공공부문 AI 도입 및 활용 전략」, 『정부 혁신 트렌드』, 제4호, 2024. (Korea Institute of Public Administration, "National Strategies for AI Adoption and Utilization in the Public Sector by Country," *Government Innovation Trends*, 2024(4), 2024.)

_____, 『디지털플랫폼정부 구현을 통한 정부혁신 이행방안 연구: RPA(Robotic Process

Automation) 등 업무자동화 및 인공지능 기술 활용을 중심으로』, 2023. 2, pp. 13~17. (Korea Institute of Public Administration, *Study on the Implementation Plan for Government Innovation through the Establishment of a Digital Platform Government: Focusing on the Use of Robotic Process Automation (RPA) and Artificial Intelligence Technologies*, February 2023, pp. 13–17.)

_____, 「디지털정부의 새로운 항해, 디지털플랫폼 정부」, 『한국행정연구원 행정포커스』, Vol. 162, 2023. (Korea Institute of Public Administration, "A New Voyage of Digital Government: The Digital Platform Government," *KIPA Administrative Focus*, Vol. 162, 2023.)

〈International Literature〉

IMF, "Transforming Public Finance through GovTech," 2023.

Verizon, "Data Breach Investigations Report," 2022.

World Bank, "GovTech Maturity Index, 2022 Update: Trends in Public Sector Digital Transformation," 2022.

〈Websites〉

대한민국 정책브리핑, 「인공지능(AI)」, https://www.korea.kr/special/policyCurationView.do?newsId=148868542#L1, 검색일자: 2024. 7. 16. (Korea.krm, "AI", https://www.korea.kr/special/policyCurationView.do?newsId=148868542#L1, accessed July 16, 2024.)

디지털플랫폼정부위원회, 「디지털플랫폼정부 실현계획」, https://dpg.go.kr/DPG/contents/DPG03020000.do?schM=view&page=1&viewCount=9&id=&schBdcode=&schGroupCode=&id=20230530171501095647, 검색일자: 2024. 7. 29. (The Presidential Committee on the Digital Platform Government, "Plan for the Implementation of the Digital Platform Government", https://dpg.go.kr/DPG/contents/DPG03020000.do?schM=view&page=1&viewCount=9&id=&schBdcode=&schGroupCode=&id=20230530171501095647, accessed July 29, 2024.)

행정안전부, 「전자정부 법령 및 제도」, https://mois.go.kr/frt/sub/a06/b04/egovLawSystem/screen.do, 검색일자: 2024. 7. 16. (Ministry of the Interior and Safety, "Legislation and Institutional Framework for Electronic Government", https://mois.go.kr/frt/sub/a06/b04/egovLawSystem/screen.do, accessed July 16, 2024.)

[dBrain+]

〈Korean Literature〉

송석현, 「차세대 예산회계시스템, 재정데이터 분석센터의 효율적 구축에 관한 연구: 주요사례를 비교 분석하여」, 『한국지역정보화학회지』 제24권 제3호, 2021, pp. 1~21. (Seokhyun Song, "A Study on Efficient Construction of Next-Generation Budget Accounting System's Financial Data Analysis Center: Comparative analysis of major cases", *Journal of Korean Association for Regional Information Society*, Vol. 24, No. 3, 2021, pp. 1–21.)

임동완, 「디지털예산회계시스템의 단계적 발전방향에 대한 연구」, 『서울행정학회 학술대회 발표논문집』, 2012, p. 190. (Dongwan Lim, "A Study on the Phased Development Direction of the Digital Budget and Accounting System," *Proceedings of the Seoul Association for Public Administration Conference*, 2012, p. 190.)

〈Websites〉

국가법령정보센터, 「디지털예산회계시스템 운영 지침」, https://www.law.go.kr/LSW/admRulLsInfoP.do?admRulSeq=2100000179389, 검색일자: 2024. 5. 21. (Statutes of the Republic of Korea Website, https://elaw.klri.re.kr/kor_service/lawView.do?hseq=67744&lang=KOR, accessed June 25, 2024.)

기획재정부, 「'데이터 기반 정책결정 지원' 차세대 예산회계시스템 개통」, 보도자료, 2022. 1. 20., 검색일자: 2024. 6. 22. (Ministry of Economy and Finance, "Launch of the Next-Generation Budget and Accounting System for Supporting Data-Based Policy Decision-Making," Press Release, January 20, 2022, accessed June 22, 2024.)

_____, 「내년 1월부터 '디지털 예산회계시스템'본격 가동」, 보도자료, 2006. 9. 22., 검색일자:

2024. 6. 25. (Ministry of Economy and Finance, “Digital Budget and Accounting System to Be Fully Operated from January Next Year,” Press Release, September 22, 2006, accessed June 25, 2024.)

한국재정정보원, 「dBrain+ 운영」, https://www.fis.kr/ko/major_biz/dbrain_oper/main_func, 검색일자: 2024. 6. 25. (Korea Fiscal Information Service, “dBrain+ Operation,” https://www.fis.kr/ko/major_biz/dbrain_oper/main_func, accessed June 25, 2024.)

_____, 「dBrain+ 운영」, https://www.fis.kr/ko/major_biz/dbrain_oper/intro/status, 검색일자: 2024. 6. 25. (Korea Fiscal Information Service, https://www.fis.kr/ko/major_biz/dbrain_oper/intro/status, accessed June 25, 2024.)

〈Presentation Materials〉

한국재정정보원, 「2024 PEMNA 현장방문 발표자료」, 2024. 2. 27. (Korea Fiscal Information Service, “2024 PEMNA On-site Visit Presentation Materials,” February 27, 2024.)

[(e-NaRaDoUm) National Subsidy Integrated Management System]

〈Korean Literature〉

기획재정부, 「지난해 보조금 부정수급 역대 최대규모 적발」, 보도자료, 2024. 2. 15., 검색일자: 2024. 6. 22. (Ministry of Economy and Finance, “Record High Number of Fraudulent Subsidy Claims Detected Last Year,” Press Release, February 15, 2024, accessed June 22, 2024.)

기획재정부 국고보조금통합관리시스템 관리단, 「2022년도 국고보조금통합관리망 운영 계획(안)」, 2021. (Integrated Management System for National Subsidies Division, Ministry of Economy and Finance, “2022 Operational Plan for the Integrated Management Network of National Subsidies (Draft),” 2021.)

원종학·권오성·최진욱, 『국고보조금 관리체계로서의 평가제도 현황과 과제』, 한국조세재정연구원, 2021. (Jong-hak Weon, Osung Kwon, Jin-wook Choi, *Current Status and Challenges of the Evaluation System as a National Subsidy Management Framework*, Korea Institute

of Public Finance, 2021.)

조미옥·노희천,「보조사업 관리체계 개선방안: e나라도움(국고보조금통합관리시스템)을 중심으로」,『정부회계연구』, 20(2), 2022, pp. 103~135. (Meeok Cho & Hee-Chun Roh, "A Study on Improving Government Subsidy Programs: Focusing on the Integrated Government Subsidies Management System," *Korean Governmental Accounting Review*, 20(2), 2022, pp. 103-135.)

한승희,『국고보조금통합관리시스템(e나라도움) 관리·기능 개성방안: 사회복지분야를 중심으로』, 한국재정정보원, 2017. (Seunghee Han, *Enhancement Plan for the Management and Functions of the Integrated Management System for National Subsidies (e-NaRaDoUm): Focusing on the Social Welfare Sector*, Korea Fiscal Information Service, 2017.)

〈Websites〉

국가법령정보센터,「디지털예산회계시스템 운영 지침」, https://www.law.go.kr/LSW/admRulLsInfoP.do?admRulSeq=2100000179389, 검색일자: 2024. 5. 21. (Statutes of the Republic of Korea Website, https://elaw.klri.re.kr/kor_service/lawView.do?hseq=67744&lang=KOR, accessed June 25, 2024.)

보조금 통합 포털, https://www.bojo.go.kr/bojo.do#mark1, 검색일자: 2024. 10. 2. (Integrated Subsidy Portal, https://www.bojo.go.kr/bojo.do#mark1, accessed October 2, 2024.)

국가법령정보센터, https://www.law.go.kr/lsSc.do?section=&menuId=1&subMenuId=15&tabMenuId=81&eventGubun=060101&query=%EB%B3%B4%EC%A1%B0%EA%B8%88+%EA%B4%80%EB%A6%AC%EC%97%90+%EA%B4%80%ED%95%9C+%EB%B2%95%EB%A5%A0#undefined, 검색일자: 2024. 10. 2. (Statutes of the Republic of Korea Website, https://elaw.klri.re.kr/kor_service/lawView.do?hseq=66982&lang=KOR, accessed October 2, 2024.)

한국재정정보원, https://www.fis.kr/ko/major_biz/eNara_help_oper/government_subsidies, 검색일자: 2024. 10. 2. (Korea Fiscal Information Service, https://www.fis.kr/ko/major_biz/eNara_help_oper/government_subsidies, accessed October 2, 2024.)

[Public Procurement Service's Development of Next-Generation Korea ON-line e-Procurement System]

〈Korean Literature〉

이상엽·김준현·유현영·김민경, 『빅데이터와 조세행정 – 최근 해외 트렌드를 중심으로』, 세법연구, 한국조세재정연구원, 제7호, 2017, pp. 12-14. (Sang-Yeob Lee, Jun-Hyun Kim, Hyun-Young Yoo, and Min-Kyung Kim, "Big Data and Tax Administration – Focusing on Recent International Trends", *Tax Law Review*, Korea Institute of Public Finance, No. 7, 2017, pp. 12–14.)

조달청, 「공공조달 규모 209조원…역대 최고, 한국경제 활성화 견인」, 보도자료, 2024. 5. 2., 검색일자: 2024. 12. 16. (Public Procurement Service, "Public Procurement Reaches KRW 209 Trillion—All-Time High, Driving Korea's Economic Vitality," Press Release, May 2, 2024, accessed December 16, 2024.)

_____, 「조달청, 2023년까지 차세대 나라장터 구축」, 보도자료, 2020. 2. 25., 검색일자: 2024. 6. 25. (Public Procurement Service, "PPS to Complete Next-Generation KONEPS by 2023," Press Release, February 25, 2020, accessed June 25, 2024.)

_____, 「나라장터, 개통 20년 만에 완전 탈바꿈」, 보도자료, 2021. 4. 20., 검색일자: 2024. 6. 25. ("KONEPS Completely Transformed After 20 Years Since Its Launch," Press Release, April 20, 2021, accessed June 25, 2024.)

_____, 「조달청, 차세대 나라장터 구축 추진단 출범」, 보도자료, 2021. 7. 6., 검색일자: 2024. 6. 25. ("PPS Launches Task Force for the Construction of Next-Generation KONEPS," Press Release, July 6, 2021, accessed June 25, 2024.)

_____, 「디지털 공공조달 이끌 차세대 나라장터, '첫발' 내딛다」, 보도자료, 2021. 8. 10., 검색일자: 2024. 6. 25. ("Next-Generation KONEPS Takes Its First Step Toward Leading Digital Public Procurement," Press Release, August 10, 2021, accessed June 25, 2024.)

_____, 「정책실명제 중점관리 대상사업 사업내역」, 2023. ("Project Details of Key Initiatives under the Policy Name Disclosure System," 2023.)

_____, 「2024년도 예산 및 기금운용계획 사업설명자료(Ⅱ-1)」, 2024. ("2024 Budget and Fund

Operation Plan: Project Description Materials (Ⅱ-1)," 2024.)

〈Presentation Materials〉

김나리, 「차세대 나라장터」, 한국조세재정연구원 아태재정협력센터 전문가 세미나 발표자료, 2024. 6. 24. (Nari Kim, "Next-Generation KONEPS," Presentation at the Expert Seminar of the Asia-Pacific Finance Cooperation Center, Korea Institute of Public Finance, June 24, 2024.)

김병일, "AI/Data Analytics Project: Next-generation KONEPS," 9th Conference of the Asia Pacific Public Electronic Procurement Network 발표자료, 2023. 10. 18. (Byung-il Kim, "AI/Data Analytics Project: Next-Generation KONEPS," Presentation at the 9th Conference of the Asia Pacific Public Electronic Procurement Network, October 18, 2023.)

〈Websites〉

국가법령정보센터, 「전자조달의 이용 및 촉진에 관한 법률」, https://www.law.go.kr/lsInfoP.do?lsiSeq=218917&efYd=20201210#0000, 검색일자: 2024. 6. 25. (Statutes of the Republic of Korea Website, https://elaw.klri.re.kr/kor_service/lawView.do?hseq=55553&lang=KOR, accessed June 25, 2024.)

나라장터, 「나라장터 소개」, https://www.g2b.go.kr/gov/koneps/pt/intro/intro_02.html, 검색일자: 2024. 12. 16. (Korea ON-line e-Procurement System, "Introduction to KONEPS," https://www.g2b.go.kr/gov/koneps/pt/intro/intro_02.html, accessed December 16, 2024.)

_____, 「차세대 나라장터 개통 안내 및 유의사항」, https://www.g2b.go.kr/pt/e-support/fwdEsupportMain.do?supportUrl=/pt/notice/listNotice.do 검색일자: 2024. 12. 16. (Korea ON-line e-Procurement System, "Launch Information and Key Notices for the Next-Generation KONEPS", https://www.g2b.go.kr/pt/e-support/fwdEsupportMain.do?supportUrl=/pt/notice/listNotice.do, accessed December 16, 2024.)

조달청, 「나라장터, 더 쉽고 빨라진다」, https://www.pps.go.kr/kor/bbs/view.do?bbsSn=2312040012&key=00638, 검색일자: 2024.12.16. (Public Procurement Service, "KONEPS

Becomes Easier and Faster," https://www.pps.go.kr/kor/bbs/view.do?bbsSn=2312040012&key=00638, accessed December 16, 2024.)

_____, 「변화모습」, https://www.pps.go.kr/kor/content.do?key=01297, 검색일자: 2024. 12. 16. ("Changes and Improvements," https://www.pps.go.kr/kor/content.do?key=01297, accessed December 16, 2024.)

『Korea IT Times』, 「나라장터, 사용자 편의성과 업무효율성 Up, 운영비용 Down」, 2013. 1. 15., https://www.koreaittimes.com/news/articleView.html?idxno=25745, 검색일자: 2024. 12. 16. (*Korea IT Times*, "KONEPS: Enhanced User Convenience and Operational Efficiency, Reduced Operating Costs," January 15, 2013, https://www.koreaittimes.com/news/articleView.html?idxno=25745, accessed December 16, 2024.)

[National Tax Service's Digital Tax Administration Using Big Data and AI]

〈Korean Literature〉

국세청, 「국세청 빅데이터 자문단 위촉 및 자문 회의 개최」, 보도자료, 2017. 11. 27., 검색일자: 2024. 6. 13. (National Tax Service, "Appointment of the NTS Big Data Advisory Panel and Hosting of the Advisory Meeting," Press Release, November 27, 2017, accessed June 13, 2024.)

_____, 「국세청, 빅데이터로 사업자등록 즉시 발급률 높인다.」, 보도자료, 2019. 11. 4., 검색일자: 2024. 6. 19. (National Tax Service, "NTS to Increase Immediate Issuance Rate of Business Registrations Using Big Data," Press Release, November 4, 2019, accessed June 19, 2024.)

_____, 「국세청 빅데이터센터, 지난 1년간 국세행정 혁신을 위한 발판 마련」, 보도자료, 2020. 7. 2., 검색일자: 2024. 6. 20. (National Tax Service, "NTS Big Data Center Lays the Foundation for Innovation in Tax Administration Over the Past Year," Press Release, July 2, 2020, accessed June 20, 2024.)

_____, 「2023년 세금비서 서비스 도입 1년간의 성과」, 보도자료, 2023. 12. 31., 검색일자: 2024. 6. 19. ("One-Year Performance of the Tax Assistant Service Introduced in 2023," Press Release, December 31, 2023, accessed June 19, 2024.)

_____, 「정부기관 최초 AI상담 운영으로 상담률 98% 달성」, 보도자료, 2024. 5. 21., 검색일자: 2024. 6. 21. (“First AI Consultation Service Operated by a Government Agency Achieves 98% Response Rate,” Press Release, May 21, 2024, accessed June 21, 2024.)

〈Websites〉

국가법령정보센터, 「국세기본법」, https://www.law.go.kr/lsInfoP.do?lsiSeq=257977&efYd=20240401#0000, 검색일자: 2024. 6. 26. (National Law Information Center, “Framework Act on National Taxes,” https://www.law.go.kr/lsInfoP.do?lsiSeq=257977&efYd=20240401#0000, accessed June 26, 2024.)

국세청 블로그, 「국세청, 국가기관 최초로 ‘정보보호’ 국제표준인증 획득」, https://blog.naver.com/ntscafe/222095419640, 검색일자: 2024. 6. 12. (National Tax Service Blog, “NTS Becomes the First Government Agency to Obtain International Certification for Information Security,” https://blog.naver.com/ntscafe/222095419640, accessed June 12, 2024.)

_____, 「국세청 빅데이터센터, 디지털 국세행정 구축에 박차를 가하다!」, https://blog.naver.com/ntscafe/223352175480, 검색일자: 2024. 6. 13. (“NTS Big Data Center Accelerates the Development of Digital Tax Administration!” https://blog.naver.com/ntscafe/223352175480, accessed June 13, 2024.)

네이버 지식백과, 「자연어 처리」, https://terms.naver.com/entry.naver?docId=863247&cid=42346&categoryId=42346, 검색일자: 2024. 6. 19. (Naver Knowledge Encyclopedia, “Natural Language Processing,” https://terms.naver.com/entry.naver?docId=863247&cid=42346&categoryId=42346, accessed June 19, 2024.)

[(Chak) Blockchain-based Public Trust Platform of Korea Minting, Security Printing & ID Card Operating Corporation]

〈Korean Literature〉

김희열, 「블록체인 플랫폼의 보안 위협과 대응 방안 분석」, 『한국정보기술학회논문지』, 16(5), 2018, pp. 103~112. (Heeyoul Kim, “Analysis of Security Threats and Countermeasures

on Blockchain Platforms," *Journal of KIIT*, 16(5), 2018, pp. 103-112.)

서무경·정이상, 「4차 산업혁명시대의 블록체인 활용화에 관한 연구」, 『예술인문사회 융합 멀티미디어 논문지』, 8(9), 2018, pp. 287~296. (Moo-Kyung Seo and Lee-Sang Jung, "A study on the Use of Block Chain in the 4th Industrial Revolution Era," *Asia-pacific Journal of Multimedia Services Convergent with Art, Humanities, and Sociology*, 8(9), 2018, pp. 287-296.)

한국조폐공사, 「조폐공사, 국내 최초 공공분야 블록체인 플랫폼 개발 나선다」, 보도자료, 2017. 7. 5. (Korea Minting, Security Printing and ID Card Operating Corporation (KOMSCO), "KOMSCO to Develop the First Blockchain Platform for the Public Sector in Korea," Press Release, July 5, 2017.)

_____, 「2018 공공기관 혁신계획」, 한국조폐공사, 2018. ("2018 Innovation Plan for Public Institutions," Korea Minting, Security Printing and ID Card Operating Corporation (KOMSCO), 2018.)

_____, 「조폐공사 블록체인 공공플랫폼으로 보다 안전하고 편리한 대한민국을」, 보도자료, 2019. 2. 14. (Korea Minting, Security Printing and ID Card Operating Corporation (KOMSCO), "Toward a Safer and More Convenient Korea with KOMSCO's Blockchain Public Platform," Press Release, February 14, 2019.)

_____, 「조폐공사, '블록체인 앵커링 기술' 특허 취득」, 보도자료, 2020. 4. 2. (Korea Minting, Security Printing and ID Card Operating Corporation (KOMSCO), KOMSCO Acquires Patent for 'Blockchain Anchoring Technology'," Press Release, April 2, 2020.)

_____, 「조폐공사, '코로나 상생 국민지원금' 신청시스템 구축」, 보도자료, 2021. 9. 2. (Korea Minting, Security Printing and ID Card Operating Corporation (KOMSCO), "KOMSCO Builds Application System for 'COVID-19 Relief Funds for National Solidarity'," Press Release, September 2, 2021.)

_____, 「"모바일 상품권 '착'으로 지역경제 살리고, 행정비용도 줄여요"」, 보도자료, 2021. 9. 23. (Korea Minting, Security Printing and ID Card Operating Corporation (KOMSCO), "Revitalizing the Local Economy and Reducing Administrative Costs with the Mobile Voucher 'Chak'," Press Release, September 23, 2021.)

_____, 「조폐공사, 모바일 상품권 '착(chak)' 누적 가입자 200만명 돌파」, 보도자료, 2023. 3. 17. (Korea Minting, Security Printing and ID Card Operating Corporation (KOMSCO), "KOMSCO's Mobile Voucher 'Chak' Surpasses 2 Million Cumulative Users," Press Release, March 17, 2023.)

_____, 「조폐공사, 지역경제플랫폼 chak 아이디어 공모전 수상작 발표」, 보도자료, 2023. 5. 25. (Korea Minting, Security Printing and ID Card Operating Corporation (KOMSCO), "KOMSCO Announces Winners of the Chak Regional Economy Platform Idea Contest," Press Release, May 25, 2023.)

_____, 「조폐공사, '착(chak)'으로 정책수당 지급 확대」, 보도자료, 2024. 1. 24. (Korea Minting, Security Printing and ID Card Operating Corporation (KOMSCO), "KOMSCO Expands Policy Allowance Payments through 'Chak'," Press Release, January 24, 2024.)

〈Websites〉

『뉴시스』, 「시흥 지역화폐 '시루' 서비스 12-15일 일시 중단」, 2023. 6. 11, https://www.newsis.com/view/?id=NISX20230611_0002334333&cID=10803&pID=14000, 검색일자: 2024. 6. 10. (*Newsis*, "Siheung Local Currency 'Siru' Service Temporarily Suspended from June 12 to 15," June 11, 2023, https://www.newsis.com/view/?id=NISX20230611_0002334333&cID=10803&pID=14000, accessed June 10, 2024.)

『연합뉴스』, 「성남시, 19일 모바일 지역화폐 첫 발행…올해 253억 목표」, 2019. 4, 14., https://www.yna.co.kr/view/AKR20190412150300061, 검색일자: 2024. 6. 10. (*Yonhap News Agency*, "Seongnam City to Issue Its First Mobile Local Currency on the 19th, Targeting KRW 25.3 Billion This Year," April 14, 2019, https://www.yna.co.kr/view/AKR20190412150300061, accessed June 10, 2024.)

『한겨레』, 「조폐공사-LG CNS, 지역화폐 서비스 제공 블록체인 추진」, 2018. 6. 12., https://www.hani.co.kr/arti/economy/it/848738.html, 검색일자: 2024. 6. 10. (*The Hankyoreh*, "KOMSCO and LG CNS to Launch Blockchain-Based Local Currency Services," June 12, 2018, https://www.hani.co.kr/arti/economy/it/848738.html, accessed June 10, 2024.)

[United States' Refund Review Program]

〈International Literature〉

Center for Victim Research, “What We Know about Identity theft and Fraud Victims from Research-and Practice-Based Evidence,” Office for Victims of Crime, August, 2019.

Government Accountability Office, “Tax Fraud and Noncompliance: IRS could Further Leverage the Return Review Program to Strengthen Tax Enforcement,” 2018.

Internal Revenue Service, “Application PIA: Selection and Analytic Platform.”

_____, “Taxpayer Guide to Identity Theft,” IRS Fact Sheet, FS-2012-8, 2012.

Treasury Inspector General for Tax Administration, “The Return Review Program Enhances the Identification of Fraud; However, System Security Needs Improvement,” 2015.

_____, “The Return Review Program Increases Fraud Detection; However, Full Retirement of the Electronic Fraud Detection System Will Be Delayed,” 2017.

U.S. Department of the Treasury, “Internal Revenue Service: FY 2020 Capital Investment Plan,” 2019.

_____, “Internal Revenue Service: FY 2021 Capital Investment Plan,” 2020.

_____, “Internal Revenue Service: FY 2022 Capital Investment Plan,” 2021.

_____, “Internal Revenue Service: FY 2024 Capital Investment Plan,” 2022.

_____, “Internal Revenue Service: FY 2025 Capital Investment Plan,” 2024

〈Websites〉

한국정보통신기술협회 정보통신용어사전, “데이터 마이닝,” https://terms.tta.or.kr/dictionary/dictionaryView.do?subject=data%20mining, 검색일자: 2024. 6. 27. (Glossary of Information and Communication Technology Terms, Telecommunications Technology Association Website, “Data Mining,” https://terms.tta.or.kr/dictionary/dictionaryView.do?subject=data%20mining, accessed June 27, 2024.)

_____, "클라우드 서비스," https://terms.tta.or.kr/dictionary/dictionaryView.do?subject=%ED%81%B4%EB%9D%BC%EC%9A%B0%EB%93%9C%20%EC%84%9C%EB%B9%84%EC%8A%A4, 검색일자: 2024. 6. 27. ("Cloud Service," https://terms.tta.or.kr/dictionary/dictionaryView.do?subject=%ED%81%B4%EB%9D%BC%EC%9A%B0%EB%93%9C%20%EC%84%9C%EB%B9%84%EC%8A%A4, accessed June 27, 2024.)

CBS News, "IRS using artificial intelligence to make sure people aren't playing the system," March 27, 2024, https://www.cbsnews.com/detroit/news/irs-using-artificial-intelligence-ai-taxes/, accessed July 19, 2024.

CDO Magazine, "CLA Appoints Spencer Lourens as Chief Data Officer," June 17, 2024, https://www.cdomagazine.tech/leadership-moves/cla-appoints-spencer-lourens-as-chief-data-officer, accessed July 19, 2024.

Government Accountability Office, "Tax Gap," https://www.gao.gov/tax-gap, accessed July 16, 2024.

Government Executive, "IRS commissioner indicates AI will play growing role in future tax collection," April 19, 2024, https://www.govexec.com/management/2024/04/irs-commissioner-indicates-ai-will-play-growing-role-future-tax-collection/395867/, accessed July 30, 2024.

Information Week, "IRS Uses Analytics to Help Collect Delinquent Taxes," December 8, 2011, https://www.informationweek.com/it-sectors/irs-uses-analytics-to-help-collect-delinquent-taxes, accessed May 28, 2024.

Internal Revenue Service, "IRS ramps up new initiatives using Inflation Reduction Act funding to ensure complex partnerships, large corporations pay taxes owed, continues to close millionaire tax debt cases," Press Release, January 12, 2024, accessed July 16, 2024.

Tonneson+co, "Chatbots, Tax Evasion, and Big Data-How AI is Transforming the IRS," October 27, 2023, https://tonneson.com/news-insights/irs-updates/how-ai-is-transforming-the-irs/, accessed July 30, 2024.

[United Kingdom's Universal Credit]

〈International Literature〉

Cabinet Office, "Government Digital Strategy," 2012.

Department for Work and Pensions, "Universal Credit: Welfare that Works," 2010.

_____, "Fraud and Error in the Benefit System: 2010/11 Estimates (Great Britain) Revised Edition," 2012.

_____, "Digital Strategy," 2012.

House of Commons Library, "Coronavirus: Universal Credit during the Crisis," 2021.

Michaelson, Rosa, "Is Agile the Answer? The Case of Universal Credit," Grand Successes and Failures in IT. Public and Private Sectors Conference Paper, IFIP Advances in Information and Communication Technology, vol 402, Springer, 2013, pp. 295~309.

National Audit Office, "Universal Credit: Early Progress," 2013.

_____, "Rolling out Universal Credit," 2018.

_____, "Progress in Implementing Universal Credit," 2024.

〈Websites〉

BBC, "Universal Credit: Warnings over AI use to risk-score benefit claims," July 12, 2023, https://www.bbc.com/news/uk-politics-66133665, accessed July 30, 2024.

Big Issue, "DWP should never use AI to suspend benefit claims, experts insist: 'People are still struggling'," January 26, 2024, https://www.bigissue.com/news/politics/dwp-benefit-claims-suspended-ai-universal-credit/, accessed June 28, 2024.

DWP Digital, "Enhancing Our Software Engineering Capabilities with Cloud Technology," https://careers.dwp.gov.uk/our-teams/dwp-digital-engineering/software-engineering-cloud-technology/, accessed June 19, 2024.

GOV.UK, "Department for Wokrk & Pensions," May 16, 2024, https://www.gov.uk/government/organisations/department-for-work-pensions, accessed June 20, 2024.

『IT World』, 「'몇 시간에서 15분으로' 영국 정부 기관이 서비스 배포 시간을 단축한 방법」, 2022. 5. 10., https://www.itworld.co.kr/tag/53045/189698/235709#csidx734efe7face3532a09859f2cf1c7462, 검색일자: 2024. 6. 28. (IT World, "From Hours to 15 Minutes: How a UK Government Agency Reduced Service Deployment Time," May 10, 2022, https://www.itworld.co.kr/tag/53045/189698/235709#csidx734efe7face3532a09859f2cf1c7462, accessed June 28, 2024.)

Legislation.Gov.Uk, "Welfare Reform Act 2012," https://www.legislation.gov.uk/ukpga/2012/5/contents/enacted, accessed May 23, 2024.

The Guardian, "AI use widened to assess universal credit applications and tackle fraud," July 11, 2023, https://www.theguardian.com/society/2023/jul/11/use-of-artificial-intelligence-widened-to-assess-universal-credit-applications-and-tackle, accessed June 28, 2024.

_____, "UK warned over lack of transparency on use of AI to vet welfare claims," September 3, 2023, https://www.theguardian.com/politics/2023/sep/03/uk-warned-over-lack-transparency-use-ai-vet-welfare-claims, accessed July 19, 2024.

_____, "UK risks scandal over 'bias' in AI tools in use across public sector," October 23, 2023, https://www.theguardian.com/technology/2023/oct/23/uk-risks-scandal-over-bias-in-ai-tools-in-use-across-public-sector, accessed July 16, 2024.

_____, "DWP algorithm wrongly flags 200,000 people for possible fraud and error," June 23, 2024, https://www.theguardian.com/society/article/2024/jun/23/dwp-algorithm-wrongly-flags-200000-people-possible-fraud-error, accessed June 28, 2024.

Yahoo News, "DWP wants to press ahead with plans to use AI to scan millions of bank accounts," April 19, 2024, https://uk.news.yahoo.com/dwp-wants-press-ahead-plans-131848194.html?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referrer_sig=AQAAAB0SjKZXiR5rRsfJoF7ShEkbJRZIblOawC2oJKXE6XqrLtqxjRx8TeD8w2KNpjCFAfpFC2o36aYcVVTF3z4_c96n9wvhrUw085Lk7oMPoFhjeCjTnB_6-EbF1lhwRfmUKvJ1Ao9JCIEVKT7Bt5UIxeqqziqTDw-Z9tsf2-Gblp3K, accessed July 22, 2024.

[France's Anti-Tax Evasion Measures and the Role of New Technologies]

〈Korean Literature〉

오현석·김태연·이명헌·주재창, 『해외 농정추진체계 사례집』, 한국농촌경제연구원, R863 연구자료-1, 2018. pp. 5~10. (Hyunseok Oh, Taeyeon Kim, Myeongheon Lee, and Jaechang Joo, *Case Studies on Overseas Agricultural Policy Implementation Systems*, Korea Rural Economic Institute, R863 Research Material-1, 2018, pp. 5–10.)

〈International Literature〉

CNIL, "Projet de Loi de Finances 2020: Publication de l'Avis de la CNIL sur l'Expérimentation Permettant la Collecte de Données sur les Plateformes en Ligne," September 30, 2019, https://www.cnil.fr/fr/projet-de-loi-de-finances-2020-publication-de-lavis-de-la-cnil, accessed June 12, 2024.

Cour des Comptes, "Detection of Tax Fraud by Individuals: Methods Undoubtedly Modernised, but Results Still Inadequate," *Cour des Comptes*, 2023.

Direction Général des Finances Publiques, "Annual Report 2014," *Direction Général des Finances Publiques*, 2015.

_____, "L'Intelligence Artificielle au Service de la Lutte contre La Fraude: Bilan de l'Experimentation *〈〈Foncier Innovant〉〉*," 2022.

Le Parisien, "D'où Vient le Nom de Ce Département? Paris," August 21, 2016, https://www.leparisien.fr/archives/d-ou-vient-le-nom-de-ce-departement-21-08-2016-6057241.php, accessed June 13, 2024.

MICAF, "Lutte Contre la Fraude aux Finances Publiques: Résultats 2022," 2023.

Politico, "France Starts Scouring Social Media to Catch Tax Fraudsters," February 19, 2021, https://www.politico.eu/article/france-starts-scrapping-social-media-to-catch-tax-fraudsters/, accessed June 12, 2024.

The Connexion, "€5.6bn in Unpaid French Taxes Recovered This Year," October 24, 2019,

https://www.connexionfrance.com/news/56bn-in-unpaid-french-taxes-recovered-this-year/450358, accessed June 2, 2024.

_____, "How French Tax Officials Are Using AI to Track Fraud," December 20, 2023, https://www.connexionfrance.com/practical/how-french-tax-officials-are-using-ai-to-track-fraud/6092382023.12.20, accessed May 9, 2024.

〈Websites〉

Direction Général des Finances Publiques, https://www.impots.gouv.fr/actualite/generalisation-du-foncier-innovant, accessed June 27, 2024.

_____, "Expérimentation du Foncier Innovant," https://www.impots.gouv.fr/actualite/1-les-grandes-lignes-du-projet-du-foncier-innovant-afin-de-garantir-une-meilleure, accessed June 12, 2024.

European Committee of the Regions, "France," https://portal.cor.europa.eu/divisionpowers/Pages/France-Introduction.aspx, accessed June 13, 2024.

Légifrance, "Délibération n° 2014-045 du 30 janvier 2014 portant avis sur un projet d'arrêté portant création par la direction générale des finances publiques d'un traitement automatisé de lutte contre la fraude dénommé « ciblage de la fraude et valorisation des requêtes » (demande d'avis n° 1726052)," March 6, 2014, https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000028685085 accessed June 11, 2024.

_____, "Délibération 2019-115 du 12 September 2019," December 3, 2019, https://www.legifrance.gouv.fr/cnil/id/CNILTEXT000039438806/, accessed June 3, 2024.

_____, "Décret n°2021-148 du février 2021 portant modalités de mise en œuvre par la direction générale des finances publiques et la direction générale des douanes et droits indirects de traitements informatisés et automatisés permettant la collecte et l'exploitation de données rendues publiques sur les sites internet des opérateurs de plateforme en ligne," February 13, 2021, https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000043129895, accessed June 12, 2024.

Ministère de l'Économie, "Le Data-Mining à la DGFiP," May 31, 2024, https://www.bercynumerique.finances.gouv.fr/le-data-mining-la-dgfip, accessed June 2, 2024.

Ministére de la Transformation et de la Fonction Publiques, "FTAP: Annonce des Lauréts de la 1ère Session de l"Appel à Proejcts 2020," Press Release, July 5, 2019, accessed June 12, 2024.

Service-Public.fr, "Installation ou construction d'une piscine privative à usage unifamilial," February 11, 2012, https://www.service-public.fr/particuliers/vosdroits/F31404#, accessed June 12, 2024.

[Singapore Inland Revenue Authority's Next-Generation Chatbot: Virtual Intelligent Chat Assistant]

〈Korean Literature〉

명승환,「생각하는 AI시대의 정부, 재정정보 그리고 미래」,『월간 나라재정』, 한국재정정보원, 제78호, 2023, pp. 20~25. (Seunghwan Myung, "Government, Fiscal Information, and the Future in the Era of Thinking AI," *Monthly NaRa Fiscal*, Korea Fiscal Information Service, No. 78, 2023, pp. 20–25.)

정천수,「전통적인 챗봇과 ChatGPT 연계 서비스 방안 연구」,『JITAM』, 제30권 제4호, 2023, pp. 11~28. (Cheonsu Jeong, "A Study on the Service Integration of Traditional Chatbot and ChatGPT," *Journal of Information Technology Applications & Management*, 30(4), 2023, pp. 11-28.)

〈International Literature〉

GovInsider, "Is it time to say goodbye to 'Ask Jamie'? Inside GovTech's refresh of government chatbots," September 14, 2023, https://govinsider.asia/intl-en/article/is-it-time-to-say-goodbye-to-ask-jamie-inside-govtechs-refresh-of-government-chatbots, accessed June 4, 2024.

〈Websites〉

Inland Revenue Authority of Singapore, "IRAS Annual Report FY2022/23," Press Release, September 6, 2023, accessed June 5, 2024.

GovTech Sinapore, "'Ask Jamie' Virtual Assistant," https://www.tech.gov.sg/products-and-services/ask-jamie/, accessed June 4, 2024.

Singapore Government Developer Portal, "Virtual Intelligent Chat Assistant (VICA) – A Natural Language Processing (NLP) Chatbot for Citizens," https://www.developer.tech.gov.sg/products/categories/platform/virtual-intelligent-chat-assistant/overview.html, accessed June 4, 2024.

네이버 지식백과, "챗GPT," https://terms.naver.com/entry.naver?docId=6653205&cid=42107&categoryId=42107, 검색일자: 2024. 6. 20. (Naver Knowledge Encyclopedia, "ChatGPT," https://terms.naver.com/entry.naver?docId=6653205&cid=42107&categoryId=42107, accessed June 20, 2024.)

[China's Blockchain-Based Electronic Invoicing System]

〈Korean Literature〉

송인방·양영식, 「중국의 블록체인 기술에 대한 법적 규제와 그 시사점」, 『동북아법연구』, 제13권 제2호, 2019, pp. 1~22. (In-Bang Song, Young-Sik Yang, "Regulations on the block chain technology in China and their implications," *東北亞法硏究*, 13(2), 2019, pp. 1-22.)

〈International Literature〉

Wu, H., J. Zhu, and Z. W. Wang, "Thoughts on Applying Blockchain Technology to Build a New Pattern of Tax Co-Governance," *Tax Research*, 9, 2020, pp. 56~62.

Xu, Yan and Zeping Zhang, "Blockchain and Its Implications for Tax Administration in the People's Republic of China," *Taxation in the Digital Economy: New Models in Asia and the Pacific*, 2022, pp. 128~149.

Zhang, Tracy, Marianne Dong, David Ling, and Karmen Yeung, "China Tax—Big Data and Beyond," *International Tax Review*, December 5, 2016, https://www.internationaltaxreview.com/article/2a694i8dxvazlhsxz4000/china-tax-big-data-and-beyond, accessed May 29, 2024.

〈Websites〉

선전시 홈페이지, "City introduces world's 1st international standardization for blockchain e-invoice," April 7, 2021, https://www.sz.gov.cn/en_szgov/business/news/content/post_8675244.html, 검색일자: 2024. 6. 3. (Shenzhen Government Website, "City Introduces World's 1st International Standardization for Blockchain E-Invoice," April 7, 2021, https://www.sz.gov.cn/en_szgov/business/news/content/post_8675244.html, accessed June 3, 2024.)

[Use of Artificial Intelligence Algorithms in Public Finance in the Netherlands]

〈Websites〉

『이투데이』, 「공익성이 'AI 리스크' 줄인다」, 2023. 6. 28., https://www.etoday.co.kr/news/view/2260881, 검색일자: 2024. 8. 6. (*EToday*, "Public Interest Reduces 'AI Risks'," June 28, 2023, https://www.etoday.co.kr/news/view/2260881, accessed August 6, 2024.)

Chambers and Partner, "Artificial Intelligence 2024," May 28, 2024, https://practiceguides.chambers.com/practice-guides/artificial-intelligence-2024/netherlands/trends-and-developments, accessed August 13, 2024.

CNBC, "Dutch government resigns after childcare benefits scandal," January 15, 2021, https://www.cnbc.com/2021/01/15/dutch-government-resigns-after-childcare-benefits-scandal-.html, accessed August 12, 2024.

De Correspondent, "Tienduizenden gedupeerden, maar geen daders: zo ontstond de tragedie achter de toeslagenaffaire," November 13, 2020, https://decorrespondent.nl/10628/tienduizenden-gedupeerden-maar-geen-daders-zo-ontstond-de-tragedie-achter-de-toeslagenaffaire/0f71ac81-d117-0d12-23a4-89513b0bb824, accessed August 13, 2024.

EU Law Enforcement, "The Dutch benefits scandal: a cautionary tale for algorithmic enforcement," April 30, 2021, https://eulawenforcement.com/?p=7941, accessed August 6, 2024.

Library of Congress, "Netherlands: Court Prohibits Government's Use of AI Software to Detect Welfare Fraud," March 13, 2020 https://www.loc.gov/item/global-legal-monitor/2020-03-13/netherlands-court-prohibits-governments-use-of-ai-software-to-detect-welfare-fraud/, accessed August 19, 2024.

Politico, "Dutch scandal serves as a warning for Europe over risks of using algorithms," March 29, 2022, https://www.politico.eu/article/dutch-scandal-serves-as-a-warning-for-europe-over-risks-of-using-algorithms/, accessed August 5, 2024.

University of Antwerp, https://www.uantwerpen.be/en/projects/aitax/country-reports/netherlands/, accessed August 5, 2024.

Verfassungsblog, "A Scandal on AI in Administration, Again," July 25, 2023, https://verfassungsblog.de/a-scandal-on-ai-in-administration-again/, accessed August 19, 2024.

[Establishing Legal and Institutional Frameworks for AI]

〈Websites〉

『한국경제』, 「AI 큰그림 못 그리고…과기·산업·문화부 '따로국밥' 규제」, 2024. 5, 17., https://www.hankyung.com/article/2024051761581, 검색일자: 2024. 7. 16. (*The Korea Economic Daily*, "Failure to Draw a Big Picture for AI… Fragmented Regulations by Science, Industry, and Culture Ministries," May 17, 2024, https://www.hankyung.com/article/2024051761581, accessed July 16, 2024.)

European Parliament, "Artificial Intelligence Act: MEPs adopt landmark law," March 13, 2024, https://www.europarl.europa.eu/news/en/press-room/20240308IPR19015/artificial-intelligence-act-meps-adopt-landmark-law, accessed July 16, 2024.

GOV.UK, "A pro-innovation approach to AI regulation," March 29, 2023, https://practiceguides.chambers.com/practice-guides/artificial-intelligence-2024/netherlands/trends-and-developments, accessed December 29, 2024.

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