4차 산업혁명에 대응한 세정의 지능화 방안 연구

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1. **국외훈련 개요**

1. 훈련국 : 영국

2. 훈련기관명 : 엑시터 대학교

(University of Exeter)

3. 훈련분야 : 조세행정

4. 훈련기간 : 2018.6∼2020.6

**2. 훈련기관 개요**

1. 기관명: 엑시터 대학교(University of Exeter)

2. 홈페이지 주소: https://www.exeter.ac.uk

3. 학교 주소: Stocker Rd, Exeter, Devon (EX4 4PY)

4. 학교 특징: 영국 내 우수 대학교 총 24곳만 가입되어 있는 Russell

Group에 속해 있음

5. 훈련기관 개요

엑서터 대학교는 문리대학, 생명과학대학, 공학·수학·물리학대학, 경영대학, 지리학대학, 인문·사회과학대학, 법과대학, 페닌슐라의과대학(Peninsula Medical School), 심리대학, 스포츠·보건대학 등으로 구성

전세계 130개국가에서 온 22,085명의 학생들이 수학 중이며, 2017년 기준으로 2,165의 교수진과 2,539명의 행정직원이 근무하고 있음

엑시터 대학교는 Steatham, St Luke, Penryn 3개의 캠퍼스를 가지고 있음.

2015/16 년 The Times와 The Sunday Times 스포츠 및 관련학문분야의 올해의 대학으로 선정되었고, 2012/13년에는 타임즈와 선데이 타임즈 (The Times and the Sunday Times)가 제작 한 고등 교육 리그 테이블에서 영국 최고의 대학으로 선정되었으며, 또한 타임즈의 QS 세계 대학 순위와 Higher Education 순위에서 세계 200대 대학 중 하나로 선정되기도 함

3. 공공행정석사(MPA)과정

공공행정석사 과정은 College of Social Sciences and International Studies의 정치학과에 편제되어 있음. 동 과정은 공공 부문 조직의 고용 증명 및 후원이 있어야 하며 대학과 스폰서간에 합의를 전제로 함

정치학과는 2017년 The Times와 The Sunday Times의 Good University Guide 정치학으로 9위를 차지하고 있음. 정치학과는 2014년 영국 정부의 주요대학 연구품질 측정기준 인 Research Excellence Framework에서 5위를 차지하는 등 영국에서 세계 최고 수준이며 국제적으로 우수한 것으로 평가됨. 영국의 경제 사회 연구위원회 (Economic and Social Research Council), 유럽 집행위원회 (European Commission) 및 Leverhulme Trust의 주요상을 수상하기도 함

정치학과는 국제 관계, 정치 이론, 공공 정책 및 행정, 비교 정치, 여론 및 정치 행동을 포함한 정치학의 모든 주요 영역에서 다양한 학위 프로그램을 제공

공공 행정 석사과정(MPA)은 효과적인 공공 서비스를 형성하고 제공하는 문제를 해결할 수 있도록 교육과정을 설계

엑시터 MPA는 점차 글로벌화되고 있는 행정 환경에 맞춰 국제적인 관점의 연구에 중점. 영국과 해외의 다양한 조직에서 일하는 실무자들과 함께 공공 정책, 행정 및 규제에 관한 최신 아이디어를 공유할 수 있도록 프로그램을 구성

또한 민간단체 또는 공공-민간 파트너십, 효과적인 리더십, 금융 위기 관리, 변화 예측, 성과 관리, 거버넌스 및 윤리 실천, 위험 및 의사 결정 및 지속 가능성과 같은 공공 부문이 직면 한 주요 문제를 다룸

MPA는 고위 공무원 및 주요 금융 컨설턴트의 전문 지식을 갖춘 전문가들이 학위 과정에 참여. 오랫동안 부처 및 국가 정부와 협력해 왔으며 UN, 세계 은행, 유럽 집행위원회, 노동 연금 부서, OECD 및 재무부와 같은 조직에 정책적 자문도 진행

<필수 과목>

Management and Governance: Comparing Public Administration around the World

Policy and Politics: the theory and Strategy of Delivering Public Services

MPA Dissertation

<선택 과목>

The Politics, Policy and Practice of Sustainable Development

The New Public Management: Principles, Practice and Prospects

Policy Analysis and Evaluation

Regulation and Reform: Analysis and Policy

Public Sector Finance for Managers

Behavioral Public Policy and Administration

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**Chapter 1. Introduction**

**1.** **Overview**

The Fourth Industrial Revolution (4IR), discussed at the Davos Forum in 2016, will stimulate social and economic transformation based on new technology innovation. Governments and corporations around the world are encouraged to develop information technologies such as artificial intelligence, big data and large-scale investment is being expanded to strengthen competitiveness.

McKinsey (2013) predicts that by 2025, the impact of knowledge labor automation through artificial intelligence will rise from $ 5.2 trillion to $ 6.7 trillion per year, leading-edge technology will change the industrial structure, (South Korean related ministries, 2016), which will bring about a total revolution in not only economic and social aspects but also human life as a whole. Therefore, in order to secure competitiveness, governments in various countries need to develop technology and foster relevant industries, as well as to cope with various side effects such as deepening of social inequality and infringement of personal information.

This report researches the meaning and characteristics of the 4IR and focuses on e-Government on how the government will prepare for the social and economic changes triggered by the 4IR. Therefore, since only a few comments were made about the necessity of direct and nationwide policies such as investment and education-related policies required to cope with social and economic changes, it is necessary to conduct additional research.

This paper examines the current status of digitalization policy in response to the 4IR of the UK and South Korea. The two countries belong to the 'D7' (D7 countries are UK, Israel, New Zealand, Korea, Canada, Uruguay, Estonia), a government group that leads digital innovation as the leading digital government. In addition, the UK is ranked 1st among OECD member countries in the world's first AI preparedness rankings published by Oxford insight in 2017, and 2nd among 194 countries in the 2019 report. (Oxford insight, 2017 & 2019)

Therefore it is worthwhile to compare the status to prepare for the 4IR.of the two countries' government and tax agencies. Through this, it draws out the policy lessons needed for the digitalization strategy of both countries and taxation authorities to proactively respond to the changes that the 4IR will bring.

Additionally, this paper mainly reviewed the case of chatbot for customer consultation service among various AI use cases. With the development of artificial intelligence technologies such as machine learning and natural language processing, the chatbot services are spreading to all industries, but South Korea has not yet become common. Accordingly, this report aims to draw policy implications that will help tax administrations in South Korea's tax authorities by reviewing AI use cases by governments of other countries.

**2. Theoretical framework**

Efforts to reduce costs while maintaining the quality of service to the people are key to public sector reform, with governments pushing for digitalization based on new technologies. As a result, there is a growing need to ensure effective and efficient implementation of e-government in order to improve public sector productivity, revitalize the economy through public sector reform and sustainable development of the national economy. (OECD 2011)

This part theoretically examines the efforts of many countries around the world to innovate their governments by improving their efficiency and effectiveness through the digitalization of their governments from a new public management perspective. It also reviews the policy transfer, the theoretical background needed to study and benchmark the strategies and policies of the two governments. Although the limits of New Public Management (NPM) have been addressed by some scholars (Dunleavy et al., 2005, Massey, A, 2018), the NPM approach continues to dominate public sector reform. (Massey, A., 2018)

1) New Public Management (NPM)

NPM introduced private sector management techniques. (Osborne, S. P. (2009) According to Murray Scott, M and Robins, and G (2011) reports, NPM characteristics such as restructuring, customer-oriented administration, introduction of private sector management, performance measurement and efficiency pursuit have affected public sector reforms, and these government policies have shaped the scheme of e-government. One of the characteristics is the emphasis on performance management (Osborne, S. P. (2009)

Performance measurements represent the processes that define, maintain, and use metrics to enhance efficiency, effectiveness, productivity, customer satisfaction, and more. (Poister, T.H., 2003)

Efficiency is the input-to-output ratio. As an economic sense, the ratio of cost to economic benefits is efficiency. Effectiveness is the relationship between output and outcomes. The execution of a policy yields output and the output is expressed as outputs affected by external factors. Thus, efficiency measures how much output have been created through input. This is not affected by external factors. (Mandl U., Dierx A., Ilzkovitz F., 2008, Mihaiu, et al., 2010). For example, if a chatbot is used for a consultation phone as part of a computerized tax administration, the number of calls or hours of call will be output, and the use of chatbot will enhance customer convenience and reduce the staff's workload. This will be outcomes. Input and output are factors that affect efficiency. Input is typically the cost of a policy program. Output is an indicator that will be evaluated first in the public sector, which determines the level of efficiency. Effectiveness is an external factor and the outsourcing that the output affects. Environmental factors such as lifestyle and different economic impacts affect effectiveness. (Mandl U., Dierx A., Ilzkovitz F., 2008; Mihaiu, et al., 2010).

M. Profiroiu noted that "performance in the public sector means interrelationships between goals, means and results, and performance is the result of the pursuit of efficiency and effectiveness." (Profiroiu M., 2001, p.8; Mihaiu, et al., 2010) E-governments based on NPM can be useful in achieving efficiency among government agencies and in achieving customer-centric service delivery goals, but they can have negative consequences in the pursuit of fairness and social equity in the public sector. Thus, as e-government programs develop, public values should be a priority for governments. (Scott, M and Robbins, G, 2011) Emphasis on the customer-centric, service-oriented public sector of e-government can be regarded as another component of NPM. Electronic governments have changed the way public services are provided using technology, especially the Internet, as a means of providing services. This gives citizens more convenient access to government information and services (Scott, M. and Robbins, G., 2010) and contributes to reducing the administrative burden on the people.

Public policy scholars Pamela Herd and Donald Moynihan define the administration as bureaucracy, complicated paperwork and puzzling rules. This contact in administrative affairs can lead to postponement and annoyance, which can eventually undermine the effectiveness of public policy and prevent individuals from claiming basic rights. It also disproportionately affects the underprivileged, who lack the resources to cover the financial and psychological costs of coping with these administrative burdens. Administration strain affects people's perception of the government and can often perpetuate long-standing inequality. Public policy scholars Pamela Herd and Donald Moynihan define the administration as bureaucracy, complex paperwork and complex regulations. The government can reduce the psychological and economic burden of the people through interaction with the public. This can reduce social inequalities caused by administrative burden, promote civic engagement, and implement effective policies that will work for all citizens. (Herd, P., and Moynihan, D.P., 2018)

2) Comparative public administration and Policy transfer

According to the study by Jamil E. Jreisat, the advantages of comparative public administration are as follows. (Jreisat, 2005)

First, comparative public administration has come to understand the patterns and regularities of administrative actions and actions, and not limited to the views of a country, but explore, reflect, and better understand the universal administrative properties, thereby developing knowledge. Second, comparative methods are essential for the development and application of administrative theory. (Heady, 2001) Third, it enables us to look at broader administration and to identify various issues to promote understanding of global characteristics. This helps to recognize the shortcomings and limitations of a single national administration. Fourth, comparative studies can benchmark other countries' best practices in improving the administrative system, thus helping to design and implement public policies. (Liou, 2000). Finally, through comparison methods, administrative knowledge and information contribute to practical needs and expand the range of choices. (Khademian, 1998)

Paul Cairney (2013) defines "Policy learning" and "Policy transfer" as follows: "Policy learning" is the use of knowledge based on information about current problems, lessons from the past or lessons from other people's experiences to inform policy decisions. On the other hand, 'Policy transfer' is when one government brings policies from another country. This includes meanings such as 'lesson-drawing', 'policy diffusion' and 'policy convergence'. In the case of policy transfers, the government may decide not to transfer the policy after learning from the experience of other countries, or may transfer the policy without actually understanding why the policy exporting country was successful. Thus, transferring a policy may not reflect the policy or may not be practicable. Success in policy transfer requires extensive research, including policies, political systems and social systems of exporting countries, to ensure that best practices can be transferred. This is because the policy may only work under certain circumstances or may not be aware of such situations. (Cairney 2013)

**3. Methodology of the Study**

As the social and economic environment changes with the development of innovative technologies called the Fourth Industrial Revolution, governments are preparing various countermeasures to cope with this.

This study researches the fourth industrial revolution and its characteristics through various literature first, and then examines the need for a government role in coping with such environmental changes, causing any socio-economic changes.

South Korea and the U.K. are the leading e-government group D7 (Digital-7) countries, and were ranked first in the U.N. e-government evaluation for Korea for three consecutive times (2010, 2012, 2014) while the U.K. ranked first in the U.N. e-government evaluation in 2016. (Gov.UK 2017) Both countries' e-government models have been internationally recognized for excellence and are benchmarked in many other countries. (Do, K. et al., 2018; Gov.UK 2017). In addition, in terms of AI, the UK was ranked 1st among OECD member countries in the AI readiness ranking published by Oxford insight in 2017, and 2nd among 194 countries in the 2019 report, leading the AI sector. (Oxford insight, 2017 & 2019)

As the UK is a leader in digital government and AI in this way, this study draws on policy learning and practical implications from the perspective of the Korean government and tax authorities by identifying and comparing the government's countermeasures to counter the 4th industrial revolution in the UK and Korea. .

Various documents and web searches were carried out to check the status and strategy of the UK and the Korean government and taxation authorities in response to the Fourth Industrial Revolution. The data from the two countries were reviewed on the websites of the OECD, EU and UN.

In the U.K., the government (Gov.UK) and the National Audit Office (NAO) websites were also investigated, in the case of Korea, the Ministry of Public Administration and Security, the National Information Society Agency (NIA), and the National Tax Service (NTS) websites.

Also, Case studies on chat-bots for customer service and AI to improve tax compliance have been reviewed in the literature and electronically in the United Kingdom, the United States, Korea, as well as in the central and local governments and private for considering how AI is actually being used and the possibility of future adoption by the South Korean government or tax agency sectors of various countries.

**Chapter 2. The Fourth Industrial Revolution and role of government**

**1. Definition and Characteristics**

1) Definition the 4IR

"The 4IR," presented by economist Klaus Schwab at the 46th Davos Forum in January 2016, is a next-generation industrial revolution led by artificial intelligence, robotics and life sciences, which has the impact of the "4th Industrial Revolution" on the public sector. (Deloitte, 2017)

Klaus Schwab presented three grounds for the 4IR. The first is the velocity. Unlike the first and third industrial revolutions, the 4IR is developing at exponential rates, not linear ones. The second is scope. The 4IR fuses diverse science and technology based on digital development, which leads to the transition of paradigm without economy, enterprise and society. The third is system impact. The 4IR is accompanied by a change of systems between countries, between enterprises, between industries and society as a whole. (Schwab, K., 2016a)

2) Characteristics of the 4IR

The characteristics of the 4IR can be summarized as follows. First, Super Intelligence; AI, Internet of things (IoT), and Big Data. Artificial intelligence can utilize big data and analyze it, and it is possible to derive the result that goes beyond human intelligence as a subject of intelligent information system instead of human being. Second, Hyper connectivity; This means that connectivity is increasing exponentially with people and people, objects and objects, people and objects through the development of IoT (Internet of things) and IoE (Internet of Everything) based on ICT technology. By 2020, 3 billion of the world's population expect to be connected to the Internet through 50 billion smart devices. (Klaus Schwab K Schwab, supra note 26)Third, Fusion The 4IR is a fusion of digital, physics, and biology. The convergence of these three fields is making huge changes like nuclear fission. (Schwab, K, 2016b)

**2. The impact of the Fourth Industrial Revolution on social and economic effects**

1) Changing the Industrial Structure

First, data and knowledge will emerge as a new competitive source for the industry. Intelligence information technology constantly improves algorithm performance through self-learning of large-scale data. Thus, companies with algorithms that can build an ecosystem where data and knowledge become a major competitive source of industry and secure data on their own will lead the market and generate a lot of profit. The importance of large-scale facilities and personnel will be reduced, and market response such as the provision of consumer-tailored products and services will be important, thereby shifting the manufacturing base back to the developed market. Second, the competition method of the industry has changed based on the competition of platforms and ecosystems. The key to the intelligent information technology utilization industry is the structure in which more users participate in the platform-based ecosystem and continue to generate and utilize data. ICT platform companies will lead the industry ecosystem based on their high productivity and large number of subscribers, and existing companies will be competing to become platform operators, and companies that have entered the market first will be able to monopolize the market and expand the technology gap among companies. (Korean Related ministries, 2016)

2) Changes in the employment structure of employment

First, job changes are expected. As intellectual, middle-level office work and precise manual labor are automated, the role of workers is focused on creative and emotional work that cannot be replaced by automation, and jobs are created in new industries due to technological innovation, which is feared to polarize the employment structure. Second, the traditional concept of lifelong workplace in the form of employment rapidly weakens and increases the flexibility of employment. Corporate functions such as logistics, manufacturing and marketing are applied without boundaries between industries through platforms, and employment will also be shifted to functional expertise rather than industry expertise. In particular, the development of platform-based services such as shared economy, O2O service and public labor will continue to expand irregular employment such as platform workers. (Korean Related ministries, 2016)

3) Changes in Human Living Environment

First, convenience and stability of life are increased. The cost of various services such as health care, education, and public security is reduced and quality improvement is made, which increases convenience and stability. In addition, the quality of life improves as personal personalized service is provided throughout life. Second, the deepening polarization caused by the winner-take-all structure and the widening amount of information collected could cause privacy breaches and threaten the national system in the event of hacking into intelligence information service networks such as power and transportation. (Korean Related ministries, 2016)

**3. Government's role and countermeasures against the fourth industrial revolution**

In order to reduce the unexpected side effects that may occur due to the large social and economic ripple effects of the fourth industry and to support innovation and technology development to maximize the positive effects, the government must have the agility and ability to respond to the rapidly changing new technology environment. To this end, government agencies need to closely cooperate with businesses and civil society. (Schwab, K, 2016a). It is also necessary to innovate the administrative system and policies.

Herweijer, C. et al. (2018) recommends 16 policy directions to support 4IR's sustainable global growth and address the side effects of changes in the social environment in the Discussion paper submitted to the G20 meeting as a global solution paper. The 16 recommendations for the G20 include the following five comprehensive recommendations (1-5), the four proposals for investment in R&D and education (6-9) two suggestions for increasing active participation and awareness of businesses and people (10-11) and encouraging data technology and training, policy frames that manage the potential bias of algorithms and suggestions are for policies and procedures that take into account the ethical aspects of the system. (12-16)

Comprehensive Recommendations

1. 4IR Policies and Environments should be supported for technological development.

2. Appropriate safeguards should be developed to minimize unintended negative consequences and to protect data and data identity.

3. Efforts should be made to identify and manage systemic risks arising from 4IRs.

4. Skills should be managed across government functions to ensure technical social and environmental protection devices and opportunities

5. 4IR technical experts should be encouraged to develop and distribute overall mechanisms and solutions through interaction in a wide range of areas, including philosophy, law, psychology and policy, other than computer science and engineering.

6-9. 4IR Challenges require investment in research and education and a policy foundation.

10-11 Promote technology development and policies to mitigate unintended consequences and adverse effects and support for raising awareness of the 4IR.

12. To maximize the opportunity to learn large amounts of data and machine learning for sustainable 4IR solutions, we need to help create a better data environment, including access and data technologies.

13. Since the raw data used by technology companies' algorithms generally reflect social-specific biases and biases, policy frame work should be developed to balance concerns about unfair and discriminatory practices in big data with technical and ethical challenges associated with monitoring and censoring potential human data by supporting technology companies, research institutes and universities.

14. Identify the ethical aspects of cyber and physical systems and prepare policies and procedures for the security of controls, data and digital identities.

15. In order to protect personal rights, definitions, and public services before the law, work to give digital identities to all people in the world should be recognized and supported.

16. To provide expert opinions to policymakers, it is proposed to establish a task force dedicated to the 4IR. (Herweijer, C. et al., 2018)

Internet, portal solutions, social media, mobile platforms, cloud computing and big data technologies are creating new opportunities for citizens. This also leads to changes in the way tax managers do their jobs by providing tax agencies with the chance to manage taxes and support and engage taxpayers. Technologies such as data management, smart portal solutions and systems allow taxation authorities to change how they operate, how they deliver services and how they manage compliance risks, and, above all, develop an environment that makes tax compliance less burdensome and more effective to taxpayers. (OECD, 2016)

In order to adapt to the new environment called the 4IR, according to the OECD (2016) report, tax managers must consider the following:

• E service and digital delivery to quickly respond to taxpayer expectations

• Agile response to rapid and unexpected changes

• Need to simplify and integrate collaboration platforms for timely response

• Coordinate compliance approaches and use of new technologies to integrate expanded services

• Develop new capabilities and build data-driven and intelligence-driven culture

**Chapter 3. Current Status of Response in the UK**

**1. The current state of pan-governmental response in the UK**

The UK government is one of the most advanced digital governments in the world, ranking first in the United Nations' e-government evaluation in 2016. The internationally well-known GOV has been used internationally, and Government Digital Services (GDS) has led the digital transition of government and is an internationally imitated model. (Gov.UK 2017)

1) Strategy

In the 2000s, the UK government initiated government innovation on the basis of ICT. Through the "Transformational Government: Enable by Technology" in 2005 and the "Government ICT Strategy" in 2010 and promoted the creation of a department responsible for digital channels. In 2011, we set up GDS to transform access to government information, develop user-first technology, and provide efficient services to customers through the uses of digital technology. In 2012, it announced policies such as 'Government Digital Strategy'. By creating a single government website (GOV), it gradually integrated each individual departmental web site. Through this policy process, the UK government continued to pursue digital-based government innovation. (Moon, J., 2017, NAO 2017)

The 'Government Transformation Strategy', announced in 2017, will use ICT until 2020 to transform government services with a focus on changes in the way government officials work, tendencies and cultures, and to make the government a digital organization to respond sensitively to the surrounding environment. This strategy also aims to establish a new relationship between citizens and government in the digital society. . (Gov.UK 2017) government- transformation-strategy (2017.2)

In order to transform the government into digital, first, the government service for citizens such as citizens, enterprises. Second, the government aims to achieve its policy goals in a flexible manner through innovation within the government and improve government services through cooperation among government agencies. Third, it focuses on effective implementation of government services through various channels. Policy. (Moon, J., 2017, Gov.UK 2017)

This government innovation strategy focuses on five goals. To address these three objectives, it present five detailed strategies: 1. Business Innovation 2. Promoting people, technology and culture 3. Building tools, processes and governance for public officials 4. Improved data availability 5. Share platforms, components, and reusable business functions (NAO 2017)

This strategy is supported by Government Digital Services (GDS), which enables government digital initiatives. According to the EU report (2018), the role of GDS is as follows. First, establish standards for government digital technology and share best practices to support the enhancement of government digital capabilities. Second, activate government-wide digital, data, and technology communities to set professional standards and standardize approaches to recruitment, salary and career development. Third, check whether these expertise are implemented effectively as the center of digital expertise, such as discovering new ideas and developing prototypes. Fourth, build, improve and operate products and services that are available to government or local governments. Fifth, provide expertise in digital and data to support important projects within the UK government. Finally, assure for digital projects through expenditure control, service evaluation and cooperation with the project authorities. (EU, 2018)

2) AI Policy

Prime Minister Teresa May announced at the 2018 World Economic Forum that the UK would be the world leader in artificial intelligence, making the UK a place to start and grow an AI business. In particular, the UK ranked first in the Government AI Readiness Index developed by Oxford Insight. The index evaluates public service reforms, economic and technical infrastructure. (Future of Life 2018) In March 2017, the UK government announced the UK Digital Strategy to recognize artificial intelligence as an important factor in the growth of the UK digital economy. (OECD 2019a) “Industrial Strategy '', announced in November 2017, selected AI as the top four challenge for the future of the UK. This includes 1. AI and data transformation, 2. Sustainable development, 3. Prospect of Motility, 4. Ageing nation. (UK, 2017) In April 2018, “AI Sector Deal” presented the implementation plan for “Industrial Strategy” in five areas: 1. Investment for AI technology, 2. Fosterage high-skilled people, 3. Infrastructure creation, 4. Collaboration with private sector to improve productivity, 5. Contribution for transforming area. (UK, 2017). It also aims to improve human efficiency and productivity through the use of AI. (ITTS, 2019)

Main policy

- “Idea”

• Increased R & D investment in public and private sectors, investing 2.4% of GDP by 2027

• Increased R & D tax credits from 11% to 12% to facilitate investment

• “Invested £ 750 million in the Industrial Strategy Challenge Fund program (UK 2018, ITTS 2019)

- “People”.

• Establish cooperation between universities and industry to foster world-class high-skilled human resources

• Invest an additional £ 460 million in math, digital, and technical education to help address science, technology, engineering, and math (STEM) skills shortages

• Supporting a new national retraining program with an investment of £ 64 million in digital and construction education to enable the acquisition of new technologies as the economy changes (UK, 2018, ITTS, 2019).

- Infrastructure

• Increased national productivity investment fund to £ 31 billion to support investment in transportation, housing and digital infrastructure

• £ 400 million infrastructure investment and £ 100 million plug-in subsidies to support electric vehicles

• £ 1 trillion to build a digital infrastructure for the public, £ 176 million to 5G, and £ 2 trillion to encourage the building of local networks (UK, 2018, ITTS, 2019)

- Business environment

• Government and private partnerships aimed at improving productivity in the life sciences, construction, artificial intelligence and automotive sectors.

• Investment funds through the British Business Bank for high growth potential companies, including AI

• Measures to improve productivity and growth for SMEs (UK, 2018, ITTS, 2019)

- Place

• Realize regional industry policies that provide economic opportunities based on region

• Funding £ 1.7 billion to increase productivity in urban areas, creating a Transforming City fund

£ 1,000 in support of pilot projects for professional development of teachers working in poor areas (UK, 2018, ITTS, 2019)

Policy promotion organization

The UK's Ministry of Business, Energy and Industry Strategy (BEIS) inaugurated and led the implementation of the “Industrial Strategy” and “AI Sector Deal” strategies. (IITP, 2019). The UK government established Office for Artificial Intelligence (OAI) to implement the "AI Sector Deal" and also has The Centre for Data Ethics and Innovation to secure public trust and provide advice for safe and moral innovation in artificial intelligence-based technology. In addition, there is the AI Council, which oversees the implementation of AI national policies and leverages expertise, OECD (2019) and the Alan Turing Institute, which conducts data science and AI research. (ITTS, 2019)

3) Government Status

(1) Unification of government online services

The UK government has been pursuing individual government departments since late 1999 with the aim of providing more efficient public services by increasing the quality of services and reducing administrative costs through online public services. In the 2000s, there were more than 1,800 sites operated by government ministries. In May 2010, the coalition government established the Government Digital Service (GDS) and promoted a single portal. GOV.UK started in 2012 and integrated 1800 sites into 295 in November 2018. GOV is the online service of government ministries. Although integrated into the UK, individual government departments have their own sites and content based on consistent design and technology. (NAO 2017, IfG 2019)

- Portal user count and mobile usage increase

The number of weekly users of GOV.UK has steadily increased from about 4 million in early 2013 to about 14 million in early 2018. GOV.UK has increased the use of mobile phones to use government services in mobile phones. The number of users accessed via mobile services increased to 43% in November 2018 compared to 18% in June 2013. In general, many mobile devices generate lots of traffic. In HMRC, unlike this trend, traffic mainly occurs in computers. (IfG 2019)

- Approximately 800 services

Digital services have soared from 25 at the end of 2015 to 800 now. Department of Business, Energy and Industrial Strategy (BEIS), Department for Environment, Food and Rural Affairs (Defra), Department of Health and Social Care (DHSC); These four ministries, including relevant public organizations, provide 482 services, accounting for more than 50 percent of digital services (25 percent of transactions). On the other hand, HMRC manages 50 services but handles 68% of all government transactions. In the case of HMRC and DWP (Department for Work and Pensions), most services are handled by the ministries themselves, but most of them are managed by ministries related to ministries that manage the operations on behalf of ministries. About 75% of services are provided to companies and 25% are provided to individuals. (IfG 2019)

(2) E-government Infrastructure

Infrastructure is the tools and facilities needed to implement digital government. The main tools of the EU countries in response to the digital environment are: 1. e-government portal 2. Data management 3. ID function. (EU, 2019) The following is a list of UK government portals, including these three.

- GOV.UK'

'GOV.UK' is a UK government integrated website. A government portal site allows individuals and businesses to access all public services and related information easily and effectively. The site is managed by Government Digital Service and is available in 2012. Through this site, citizens can access individual websites of hundreds of government departments and public agencies. In December 2014, over 1,800 individual government departments sites were closed and consolidated into GOV. (EU 2018)

- Data.gov.uk

Data.gov.uk, which opened in 2010, is a government data disclosure service that makes government data available for public use, not personal information. Data.gov.uk covers 20,971 government data from 1357 central and local government agencies. It communicates the government's guidelines and uses it as a channel for requests for data that is not disclosed by citizens. In March 2018, the site was updated to open the data search service. (EU 2018, https://data.gov.uk/about)

- GOV.UK Verify

GOV.UK Verify' is a certification service that proves that citizens can easily and safely access public services such as tax return, driver's license, and information confirmation online. The service was formally launched in May 2016 and has collaborated with the public and private sectors, including the Privacy and Consumer Advisory Group. An individual with an address in the United Kingdom will select an authorized government-approved accredited institution online to proceed with the identity verification process online. To date, GOV.UK Verify has been used by eight departments to provide 17 government services. These services include filing tax returns, applying for a driver's license, claiming retirement benefits, and receiving state pensions. (NIA 2018, EU 2018)

Previously, Government Gateway service was used as an identification tool for individuals and companies since 2001, but it was gradually replaced by GOV.UK Verify and the service was terminated in 2019. More than two million people have now created verification accounts to conduct more than six million security transactions with the government. However, since there are only 18 departments in use and the government service does not mandate Verify registration, the number of users is very low compared to that of target users of 25 million (registered until 2025). Current trends do not reach the target even in 2033. (EU 2019)

- “GOV.UK Pay”

“GOV.UK Pay” is a digital security payment service launched in September 2016. The government will not need to purchase a separate payment system for each department within the government, the cost of collection will be reduced and convenience will be increased. (EU 2018, https://www.payments.service.gov.uk)

- “GOV.UK Notify”

The “GOV.UK notify” is an integrated information alerting service that allows the government to send e-mails, text messages, and postal mail so that citizens can use the service they want without needing to call the government. Basic information and customized guidance services such as application and processing information of voter registration and passport are available. The government can reduce the time and cost of spending on public contact including by phone calls or visits, and is able to interact with citizens through feedback through the website. GOV.UK. As of July 2018, Notify is being used by 96 agencies and 292 services in the UK. (NIA 2018, EU 2018)

- Other key points

The UK government digital charter was announced on January 25, 2018, with the UK becoming the best place to start and grow the digital business and become the safest place to access online in the world. Online harm and liability, data and artificial intelligence, reform, information breach and cyber security (EU 2019).Her Majesty's Revenue and Customs (HM Revenue and Customs or HMRC) is a non-ministerial department of the UK Government.

**2. HMRC's Response Status**

Her Majesty's Revenue and Customs (HM Revenue and Customs or HMRC) is a non-ministerial department of the UK Government. It has the authority to collect taxes and customs to be covered by public services. The three objectives of the HMRC are to maximize tax revenue and prevent tax evasion & avoidance. Second, to reform tax and payment for customers, and third, to promote specialization and efficiency of organization. NAO (2018)

1) Strategy: “HMRC’s transformation plans”

HMRC has been implementing major “transformation plans” since 2016 aimed at becoming the world's most digitally advanced tax authority. (NAO, 2018) By 2020, this program will allow HMRC to increase its efficiency by cutting costs by a total of £ 1.9 billion, including reductions in telephone calls and letters by 2019-2035 (H.C., 2018).

The purpose of tax digitization is to modernize tax administration through digital solutions. This gives a fundamental change in the way tax systems work:

• Improving effectiveness • Improving efficiency • It is easier for taxpayers to acquire their right. (HMRC 2019)

The HMRC transform plan aims to turn all individuals and businesses into fully digital tax systems that can perform digital transactions. Tax digitization improves effectiveness and efficiency, and taxpayers get their rights easily by making a fundamental change in the way tax systems work. Simplify and automate processes for HMRC reform plans, improve taxpayer data availability and improve working conditions. The plans of the HMRC consist of 15 programs. Each program consists of several individual projects. (C & AG, 2018) The table below is organized as a whole.

“HMRC’s transformation portfolio”

|  |  |
| --- | --- |
| Program | Description |
| Making Tax Digital for Individuals | Modernizing tax administration for individuals through digital solutions. Making more data visible to customers through Personal Tax Accounts (PTAs) and developing HMRC’s use of information provided through the PTAs. |
| Making Tax Digital for Business | Modernizing tax administration for business through digital solutions. Allowing businesses to keep their records digitally and update HMRC quarterly. |
| Compliance for the Future | Building internal compliance capability at HMRC. |
| Customs Transformation | Preparing for the UK’s exit from the EU by implementing a new Customs Declaration Service, replacing the existing system. |
| Building Our Future Locations | Creating 13 regional centers, redeploying staff and disposing of buildings. |
| Corporate Services | Removing bureaucracy, and introducing a self-service culture, lower service costs, shared services and improved experience for staff. |
| Benefits Transformation | • Tax-Free Childcare and Universal Credit – accounts to support parents’ childcare costs; and to replace Tax Credits with Universal Credit.  • Help to Save – access to government-backed savings accounts to help working people on low incomes build up their savings.  • Future of Child Benefit – a new HMRC Child Benefit IT system to replace the existing system. |
| Policy Driven Change | Implementing policy initiatives not funded from Spending Review 2015. |
| Data Platform | Delivering data standards and improving data quality |
| Enterprise Data Hub | Delivering a digital repository for storing and sharing data. |
| Digital Platform | Delivering a number of enabling platforms including Government Gateway and the digital tax platform. |
| Finance Platform | Enabling digital payments by customers, better internal reporting and a more efficient accounting system |
| Process Platform | Developing processes to support future ways of working.  (formerly known as Columbus Cloud) |
| Securing Our Technical Future | Moving to secure cloud-based computing and rationalizing existing IT infrastructure. |
| People Capabilities | Developing people capabilities (culture, ways of working and career pathways) to support the future organization. |

Source: Report by the Comptroller & Auditor General, HM Revenue & Customs 2017-18 Accounts, Session 2017-2019, HC 1222, July 2018, HM Revenue & Customs, Departmental Overview, National Audit Office December 2018

Modification of Transformation Plan by priority such as the UK leaving the EU. The original plan of the HMRC was disrupted by unexpected additional requests that the UK decided to leave the EU. Therefore, in order to reduce risk and budget, HMRC prioritized the size and complexity of the innovative portfolio, related risks and dependencies, and reduced it to 128 from 267 initially. Through this, HMRC pursues innovative change in the long run and ensures efficiency in the short term. (C & AG, 2018)

The HMRC spent £ 8,882 million in the planned transition budget for the first two years of the plan (2016-17 and 2017-18) and expects to spend £ 1.74 billion on transformation by March 31, 2020. According to C & AG's (2018) report, the HMRC conducted an innovation plan that included:

• Reduced £ 410 million in annual efficiency compared to target £ 380 million (2017-18)

• Additional revenue of £ 3,355 (2017-18)

• More than 14 million online users of personal tax accounts

• Establish a total of 13 new regional centers. (NAO 2018)

- Merits of transformation

According to the C & AG report (2018), the benefits of reform are:

Sustainable cost savings through improved efficiency

The HMRC estimates that prioritization has led to a cost reduction through improved efficiency of the original target, but will decrease by £ 427 million from £ 717 million in annual budget by 2019-20.

- Additional tax revenue effect

Due to the lack of proper management of digital recordkeeping and reporting errors, it is expected to generate additional £ 920 million by 2020-21 and £ 1 billion by 2023 in tax revenue through Tax Digital for Business, to in additional tax revenues. In addition, HMRC had an additional tax revenue of 293 million pounds by the end of March 2018 through Tax Digital for individuals.

- Digitization progress

More than 14 million people have access to their new online Personal Tax Account, the first regional center has opened, and IT contracts have been replaced and improved. HMRC is constantly striving to improve its operating system. (C & AG, 2018)

2) AI Strategy

HMRC is a government agency that charges and collects UK national and customs duties. Its main purpose is to finance the UK government's public services, and to provide financial support for families and individuals. To this end, tax authorities perform fairly, effectively and efficiently. It also helps taxpayers to pay taxes faithfully and avoids tax evasion.

HMRC has three main goals:

• Maximizing fiscal revenue and suppressing tax avoidance

• Innovation in tax and tax return methods for the public

• Creating a professional, efficient and participatory organization (UK Parliament 2019)

HMRC's Innovation Program

HMRC aims to move to a system where all individuals and businesses can conduct digital transactions with the ambition to become the world's most digitized tax administration. To support this, HMRC plans to simplify and automate the process, better utilize data on taxpayers, and modernize the work environment to improve the quality of tax services and increase efficiency. To digitize, HMRC planned to spend £ 1.8 billion on the transition between 2016-17 and 2019-2020 in 2015 (NAO 2019). It is an important task to create an organization that can respond to and adapt to the rapidly growing technology and the growing demand for public services from customers. HMRC is dedicated to technology development to see how AI can help with the most complex tax management. (CBR 2018)

Tax agency has been running innovative programs from 2015 to 2025 and is committed to using AI and robotics for automation. During the 2018-2019 fiscal year, 15.7 million transactions were completed in 78 individually automated processes. (PT 2019) Robots currently perform a variety of daily tasks, such as administrative tasks, data collection, sending letters to customers, and supporting legislative compliance. Instead of simply automating the traditional manual process, robotics ensures that pop-up messages provided to the user are read and the necessary steps are taken to comply with data protection laws. The robot is currently used by up to 4,570 HMRC employees and is one of the most widely used solutions (Gov.UK 2018).

HMRC is considering using AI for external use, such as providing customer service. Some robot tools have already been used in transactions with HMRC's customers and use new channels such as social media to help with simple query processing. A virtual assistant Chat bot called Rita also supports technical issues. In the future, the application of robotics and AI will expand. Despite concerns that AI and robotics will replace jobs, HMRC is optimistic that the fast-paced digital world will benefit everyone (CBR 2018). UK Tax authority will continue to work to improve the efficiency of better citizen-centric and public services to collect taxes using AI and machine learning. In addition, a working group is formed throughout the organization to raise awareness of AI ethics issues and to consider necessary governance. (PT 2019)

3) HMRC’s status

HMRC increased its total tax revenue to £ 605.8 million in 2017-18, up 5.4% from 2016-17. (HMRC 2018). Government tax revenues mainly come from income tax on individuals and businesses, employment contribution and consumption taxes including value added tax (VAT). (ICAEW 2019) As of 2016, the income tax portion of total tax revenue is 42.6%. Among them, personal income tax is 27.1% and corporate income tax is 8.3%. The proportion of indirect tax including VAT is 38.6% of total tax revenue, and VAT is 20.2% of which. Most of the tax revenues are personal income tax and value added tax. (EU 2018 b).

Most individuals do not file an income tax return, which for the most part is simple, they do not have to report anymore and deduct the correct tax amount. People with more complicated tax matters, such as investment income or business and real estate income, still should report on an annual basis. (ICAEW 2019)

(1) Digitalization

The digital reform of HMRC began in 2013 (Collard, A., 2018). The introduction of electronic tax reporting on value added tax, personal income tax and corporation income tax has continued to make use of digital technology in the field of tax administration. (ICAEW, 2019) 92.8% of income tax self-assessment and 47% of tax credit renewal for low income subsidy application online. HMRC (2018). HMRC announced the "Making Tax Digital Roadmap" in December 2015 and has been announcing the abolition of annual tax declaration since 2020. (Campbell, D. F.J. and Hanschitz, G., 2018, Gov.UK, 2017) Also, VAT tax returns had to be submitted online for years, but in most case they were simply entered in the GOV's HTML page. Only 12% submitted files using XML. Companies will be required to submit VAT returns directly to the HMRC API platform for MTD's overall goal of electronically keeping accounting records from April 2019. (ICAEW, 2019) According to the HMRC Annual report (2018), there was an additional tax revenue effect of £ 13m through online self-assessment tax return from 2016.

(2) Personal Tax Account (PTA)

HMRC In December 2015, we opened a PTA for individual taxpayers. The PTA is a safe place to check, update and manage tax information related to HMRC. For example, customers can see the tax they are paying and the tax history they have already paid (Collard, A., 2018). Initially, the number of users was less than half the number of users who use it continuously increased. (ICAEW 2019) Currently, there are more than 16 million users. (HMRC 2018)

(3) Business Tax Account (BTA)

Companies can join a business tax account (BTA) that provides access to information and services. (ICAEW 2019) In 2018, more than 3.3 million operators are using line business tax accounts. In addition, HMRC has worked with tax and business software developers to create products and services that work well with their own systems and operations. (HMRC Digital 2018)

(4) API platform

HMRC has the world's best application programming interface (API) strategy that allows outside organizations both inside and outside government to access, modify and submit data in a secure environment. The API platform is an integral part of the Making Tax Digital program, and many authentication and security controls have been created to support this, so that only authorized users are allowed access to the information and the data is secure. The API platform has already had 200 million transactions and is increasing. This is expected to bring innovation to the tax software market. (Collard, A., 2018)

(5) 'Robots'

HMRC is innovating the way its staff work through using of automation technology as well as reforming customer service using digital. Robotics and artificial intelligence enable us to provide efficient and effective services. Robots are software that can perform tasks in a manner similar that of humans and can automate processes without fundamental IT critical changes. Robots eliminate dull and repetitive work and free employees in public contact. At the same time, it provides efficient and efficient customer-oriented services. For example, in a customer center, 'robots' can help customers get information easily. So far, more than 56 robots have processed more than 14 million transactions. (Collard, A., 2018)

(6) Customer service

The HMRC has eight main objectives in relation to customer service:

1. Processing of UK tax credits and child allowance claim within 22 days. (13.8 day)

2. Overseas Tax Credit Request Processing within 92 days (55.6 days)

3. 80% processing within 15 days for mail responses (80.7%)

4. 95% processing within 40 days for mail responses (97.1%)

5. Answer phone in 5 minutes (4.28 minutes)

6. No more than 15% of customers waited 10 minutes or more to be connected an adviser (14.6%)

7. Processing of 95% online application within 7 days (94.6%)

8. Achieved customer satisfaction of HMRC's digital service over 80% (79.8%) (H.C., 2018).

The contents of the parentheses for each of the above objectives are the performance of 2017-2018 (NAO, 2018, HMRC, 2018) with the advancement of digital technology, customers are able to access information and services more quickly and directly. Services have also improved. According to HMRC's annual report (2018), about 80% of customers are "satisfied" or "very satisfied" with digital services.

The increased number of customers accessing digitized information means that it has helped to reduce the workload and intensity of the telephone office. The time required to reach the customer service team was 4 minutes and 47 seconds on average (HMRC, 2018), but the need for a dedicated phone line was high because more than 46 million calls were received. (Collard, A., 2018)

(7) Cyber Security

Because HMRC is a data-rich organization, data security is very important, and it uses expertise to constantly monitor and detect cybercrime in systems including the Internet. (HMRC 2018)

Intelligent crimes such as cyberattacks and phishing are increasing using HMRC's regular notifications and branding. HMRC is a major target of cybercrime. (REDSCAN 2019) Therefore, HMRC has been investing continuously to protect digital service and customer information, and to cope with increasingly sophisticated cybercrime such as phishing. (HMRC 2018)

The cyber security team of HMRC succeeded in building a technology control device to prevent criminal activity. The status of HMRC's cybercrime response is as follows.

• Preventing 450 million phishing e-mails from reaching taxpayer mailboxes.

• reducing 90% of SMiSing's phonetic text phishing by using an innovative pilot provided

• In 2018, more than 16,000 malicious Web sites were removed.

• Use Transaction Monitoring to block suspicious transactions in real time. (Collard, A., 2018)

**Chapter 4. Current Status of Response in South Korea**

According to the 50-year history of e-government in South Korea, the history of e-government is related to technology, policy and legal systems, and e-government services. In other words, the emergence of new ICT technologies creates demand for new administrative services, and governments make policy and reform laws and institutions to meet this demand. As a result, new e-government services are built and provided. This e-government service changed the administrative environment, and when new ICT technology appeared again, the remodeling work of the old e-government system started and this cycle was continued and developed. (MOIS, 2017b)

**1. The current state of pan-governmental response in South Korea**

In 2001, the South Korean government enacted the "E-Government Act" for the first time in the world and has been striving to innovate the electronic administration system to improve civil convenience and administrative efficiency. As a result, it has been ranked No. 1 in the United Nations' e-government evaluation for the third consecutive year (2010, 2012 and 2014) and has been recognized globally by Korea's e-government and is leading the global e-government through export of e-government software. (Do, K. et al., 2018) As the use of intelligent information technology including the Big Data and Internet of Things accelerated in 2016, “E-government 2020 Master & Action Plan” was established by the need of new e-government strategy. (NIA, 2018b)

In 2017, the “Basic Plan for Intelligent Government” have been introduced to combine new technologies such as artificial intelligence and digital data to enhance the rationality and efficiency of administration and provide customized services to the public. (MOIS, 2017)

As the use of intelligent information technologies such as Big Data and Internet of Things accelerated in 2016, , “E-government 2020 Master & Action Plan” plan were established in accordance with the necessity of a new e-government strategy. In addition, in 2017, “Action plan for Intelligent Government“. It was established to combine new technologies such as artificial intelligence and digital data to enhance the rationality and efficiency of administration and to provide customized services to the public. (MOIS, 2017a)

1) Strategy of the “Action plan for Intelligent Government“

The South Korean government has a vision that the intelligent government should use the intelligent information technology to optimize the government services based on the people, innovate the way of working on its own, and share the information of the state administration with the people to create a safe and comfortable society. I have. The following four goals have been set to promote the vision. (MOIS, 2017a)

• Government minded with intelligent and customized services (“Wonderful Mind-Caring Gov.”)

• Government to solve problems in advance through artificial intelligence-based administrative system (“Innovative Problem-Solving Gov.”)

• Government to share new economic and social values with the people based on Platform (“Sustainable Value-Sharing Gov.”)

• Government to ensure safety by utilizing advanced technology to prevent risks and respond promptly (“Enhanced Safety-Keeping Gov.”) (MOIS, 2017a)

(1) “Wonderful Mind-Caring Government”

It is to provide a warm service to look after the difficulties of the people first and to look after them so that all citizens can enjoy without discrimination. It keeps track of individual situation and service history, provides secretarial service tailored to individual, and resolves complaints quickly. This will help improve social participation and quality of life and resolve various gaps. (NIA, 2018b, MOIS, 2017a)

(2) “Innovative Problem-Solving Government”

AI will continue to learn and redesign the administrative process, and through the big data analysis, it will find out the optimal policy means and timing to help government officials to establish and implement wise policies. In addition, it will intelligently analyze the needs of citizens expressed through various means and continuously reflect on the administration of the state and establish a nationwide integrated data management system to preemptively identify and systematically support scientific policy making and services is expected. (NIA, 2018b)

(3) “Sustainable Value-Sharing Government”

A platform-based digital partnership between the people and the government to jointly produce and share new economic and social values is implemented and the transition to a transparent society is promoted. The public infrastructure and data provided by the government will expand public-led policy decisions and the public services completed by the public. (MOIS, 2017a)

(4) “Enhanced Safety-Keeping Government”

To prepare for new threats that are difficult to predict, the government will reorganize its pre-sensing reserve system using advanced technologies and strengthen its immediate and flexible response capabilities. (MOIS, 2017a)

2) AI policy

In December 2016, the Korean government published “Mid to Long Term Master Plan in Preparation for the Intelligence information Society” to respond to the changes in the Fourth Industrial Revolution. The plan aims to build an intelligent IT foundation to achieve the vision of a human-centered, intelligent society. In May 2018, `` Artificial Intelligence R & D Strategies '' was released to strengthen artificial intelligence research and development (OECD, 2019a). In January 2019, we announced “Data and AI Economy Strategies,” including infrastructure construction and institutional improvements for the convergence between data and AI. (ITTS, 2019) The main contents of the Korean government's AI strategy announced in 2018 are as follows.

- Technology: Secure world-class AI technology

• Secure AI core technology

Implement large-scale AI projects in the public sector to secure early AI core technologies such as language understanding, vision awareness, and situational judgment, and adjust targets reflecting technological and environmental changes to existing AI national strategic project development tasks.

• Create innovation synergy in AI and other areas

Promote the joint development of related fields by integrating AI in areas with high ripple effects when successful such as new drugs and future materials (Korean Government, 2018)

- Manpower: Nurturing and securing talented human resources

• Training high-quality human resources

New designation of artificial intelligence graduate school, close cooperation with overseas AI outstanding institutions, 'cultivation of more than 1,400 high-quality manpower such as master's and doctoral degree by 22 years, expansion of artificial intelligence field support of university research center

• Fostering Convergence Talent

Focus on securing human resources such as fostering AI convergence talents by industry and cultivating approximately 3,600 talents by 2022 (Korean Government, 2018)

- Infrastructure: Create an open cooperative research foundation

• Providing AI resources

Expanding the AI Open Innovation Hub (January 2018), which provides one-stop online support for AI development core infrastructure, including data and computing power and algorithms, to promote AI utilization across all industries.

• Creating artificial intelligence brain labs

A research group that gathers top researchers from home and abroad, designates one regional hub university with AI-based cooperation as AI brain lab, and conducts research on AI-related departments such as computer engineering and mathematics, and promotes the creation of an open and cooperative artificial intelligence technology innovation infrastructure.

• Establishing an artificial intelligence innovation platform

Establishing an online challenge platform to solve AI-based economic and social problems based on the autonomous competition of the private sector (2019~) and to create a challenging and creative platform for AI-based solutions.

• Improving the system

Improving the system for the design of an architecture for ethical AI and enabling open source projects in each research phase to create an open and cooperative R&D ecosystem. (Korean Government, 2018)

- Policy Promotion Organization

The Ministry of Trade, Industry and Energy and the Ministry of Science and ICT are supporting the R & D development to secure AI technology and promote AI specialists to secure AI experts. (ITTS, 2019) The Ministry of Science and ICT established an artificial intelligence R & D strategy and formed an 'Intelligent Intelligence Strategy Council' to implement this strategy. It consists of public officials from government ministries such as welfare, industry, administrative safety, and defense and private industry-academia-university experts. The council operates three divisions so that the strategies of technology, talent and infrastructure can be linked and integrated. The main role of the council is to re-examine the R & D strategy and objectives in accordance with the progress of key tasks and changes in the technology and policy environment. In addition, it is to prepare detailed strategies for core tasks in each sector of the technology- talent-based sector. (Korean Government, 2018)

3) Government Status

In 2013, the new government changed the paradigm of government in the following direction. (MOIS, 2017b)

• Transparent government sharing public information with the public based on 'communication and cooperation'

• Competent government to innovate the way of working through collaboration and communication among ministries

• Serving Government to Expand and Provide Customized Services to the People

As a result, the convergence service that removes the partition between departments more actively has been started and the personalized service has begun to be expanded. In addition, efforts have been made to innovate e-government based on the ICT technology with the emergence of various new technologies such as the spread of the national smartphone, network technology, IoT, big data, and AI. Since 2013, we have begun to integrate public services into customized services. We have also launched e-government services that combine new technologies such as cloud, big data, location-based technology, RFID sensor and mobile. Furthermore, the government has opened public data to the private sector, making it available to the private sector. In 2016, the government has set up the 'E-Government 2020 Master Plan' to prepare for the paradigm shift to cope with ICT technology change and the 4IR era. (MOIS, 2017b)

(1) Customized service delivery

It has been sought to find out what services the public wants to receive in their lives, and to provide integrated and individualized services without discrimination of business domain. The integration of administrative services for these beneficiary tailored administrative services is intended to eliminate the boundaries between the ministries and areas of public services. (MOIS, 2017b)

(2) Build an integrated service platform

Since the year 2017, the government has provided 'Government 24' by integrating major portals related to the public service distributed to the central government and the local government. 'Government 24' is a combination of the existing 'civil complaints 24', 'Korean government portal', 'Announcement e' (administrative & autonomous system) and 22 other services. In 2020, 282 services with high utilization rate among 1,594 online services of public institutions will be available immediately from the government. (MOIS, 2017c, Choi, Y, 2017) Once the service is unified, a single visit to one of the distributed 12,000 public agency Web sites can solve the necessary government service at one time. (MOIS, 2017b)

(3) Collaborate with the public through opening public data

Opening for public use of public data was fully implemented in 2013, and at the end of 2015, the public data was opened to the public data portal. (www.data.go.kr) It has been expanding to open up the data on public demand and private utilization data since 2016. (MOIS, 2017b)

(4) e-government applying new technology

- Creating Cloud computing environment

From 2015, cloud storage has made it easier to share documents between government departments. In August 2016, several government agencies built a common cloud infrastructure for concurrent access, automatic capacity control, and account consolidation management, and the record management system was gradually phased into the cloud. (MOIS, 2017b)

- Establishing Big Data framework

The 'Big Data Common Basis and Demonstration Project', which was launched in 2014, carried out eleven analytical tasks, including the storage and construction of big data that can be used jointly with the enhancement of existing Big Data common platform. In particular, large-scale data has been stored and constructed so that population movement, weather, and traffic volume information can be used jointly, and the collection volume of SNS data in the private sector has also greatly expanded. (MOIS, 2017b)

In order to strengthen the analysis of the disaster safety field, the Big Data common platform was linked with the disaster safety system including the forest fire forecasting system and the imperial safety platform. In these projects, the central ministries and municipalities have been constructed to enable frequent analysis of urgent social issues using the Big Data common infrastructure. (MOIS, 2017b)

- Building Mobile e-government service

Since 2010, "mobile e-government" has been promoted due to the proliferation of smartphone users. Starting in 14 types in 2011, more than 100 mobile administrative services are being provided by 2015. In addition, as of the end of 2015, 1,768 public apps were developed by public agencies such as central government and local organizations. (MOIS, 2017b)

(5) E-government Infrastructure

Representative services of South Korea e-government are as follows.

- "Government 24"

"Government 24" is a government service integration portal opened in 2017 by integrating "civil complaint 24" for one-stop civil complaint processing that can prevent forgery and alteration of electronic civil documents opened in 2009. This is evolving and expanding through the provision of mobile services and the linkage between government departments. There are 59,000 public services in Korea (Jun. 2016), 5,304 of which provide online services. Government 24 provides 40 online services, 1,483 civil application documents, and 374 mobile application services (Aug. 2018) and provides 70,000 policy information from government and public agencies in one window (Gov.24). (Do, K. et al., 2018)

- Public Data Portal

The public data portal (www.data.go.kr) aims to open and utilize public data privately. By the end of 2015, public data was opened to public data portal, and currently 22,000 file data, 2,500 open API, and 91 standard data are being released. (Do, K. et al., 2018)

- Public Information Sharing System (PISS)

PISS allows all administrative agencies, 174 public institutions, 41 financial institutions and 196 educational institutions to conduct their work electronically by sharing information with each other, thus making it easier for the people to file civil petitions and more efficient administration at the government level. By allowing people to submit required documents online without visiting relevant agencies, the time and administration burden of visiting the agency can be greatly reduced. (Do, K. et al., 2018)

- E Government Standard Framework

E Government Standard Framework is to implement the infrastructure and common modules necessary for software development in advance and use it jointly. It has been promoted since 2008 to strengthen the interoperability of information systems by standardizing the development framework necessary for construction and operation of information systems in the public sector and to prevent technological dependence on specific companies that manage government information projects. E Government Standard Framework has been applied to 17 projects in nine countries including Bulgaria, Nepal, Tunisia and Vietnam with the strength of the standard framework of domestic and foreign technology excellence verification and open SW. (Do, K. et al., 2018)

**2. Response status of the National Tax Service (NTS)**

The National Tax Service (NTS), which is mainly responsible for charging and collecting national taxes (excluding customs and local taxes), was established on March 3, 1966 as an external organization of the Ministry of Finance. The main functions of NTS can be described in detail as follows.

1. Collect tax revenue required for national operation

2. Improve taxation fairness and protect taxpayer rights (NTS 2019a)

The National Tax Service (NTS) has continuously upgraded its national tax administration computer system based on ICT technology. In 1996, according to South Korea's National Information and Communications Technology Strategy, "National Information Promotion Plan," NTS opened TIS to improve business process efficiency and enhance tax compliances to meet changing environment and tax policies. As a result, the Internal Revenue Service has promoted the modernization of the national tax administration. In 2002, the Home Tax Service (HTS) was established to allow taxpayers to report and pay various taxes including VAT and income tax at home or at work using the Internet. This improved taxpayer satisfaction and reduced the management cost. In 2015, NTS opened the Neo Tax Integrated System (NTIS) by integrating various distributed systems such as TIS, HTS and Cash Receipt system. It consists of an Internal Portal for the internal work of NTS employees and an external portal HTS for taxpayers. (Awasthi, R. et al., 2019)

1) NTS Strategy

The NTS has announced the direction of its work implementation every year and the performance of its work last year. Under the “2019 Management Plan of Tax Administration, the NTS aims to focus on making practical changes and achievements that people can experience in their daily lives under the vision of implementing fair tax administration with the people. Six detailed implementation plans for the above strategy for future-oriented tax administration innovation that meets the public's trust and expectations are presented below. (NTS 2019b)

• Securing stable national financial demand

• Establishing a tax service that supports voluntary and honest taxation

• Realizing tax justice by strictly responding to unfair tax evasion practices

• Expanding tax revenue for a well-to-do economy

• Strengthening scientific tax administration capabilities based on advanced technology

• Promoting sincere internal reform to meet changed values

(1) Securing stable national financial demand

Tax revenues under the jurisdiction of the NTS account for 59.7 percent of the country's total annual revenue and 96.5 percent of the total national tax, so it is important to secure stable tax revenues to support the national financial needs. A variety of factors affecting tax revenues, such as economic conditions and interest rate hikes in major countries, are analyzed on a regular basis to systematically respond to changes in tax revenues, support tax compliances, and efficiently manage arrears. (NTS 2019c)

(2) Establishing a tax service that supports voluntary and honest taxation

It provides taxpayer-tailored help data before reporting to assist taxpayers' faithful tax return, or to make it easier to report them through the pre-filed service of the report. The government will provide private sector-specialized human resources for tax consultation that meets the level of taxpayers and expand tax points to honest taxpayers in order to spread the voluntary tax payment culture and strengthen policy promotion. (NTS 2019c)

(3) Realizing tax justice by strictly responding to unfair tax evasion practices

Concentrate on investigation capabilities to prevent illegal outflow of corporate funds from large corporations and private households and to root out tax evasion for irregular inheritance of large property owners. To cope with intelligent offshore tax evasion and multinational tax evasion, such as using tax havens and the digital economy, the government introduced a system to punish experts for helping them as accomplices and to establish an information analysis system for aggressive tax avoidance by multinational companies. (NTS 2019c)

(4) Expanding tax revenue for a well-to-do economy

Expand incentives for low-income earners who are self-employed and have great economic difficulties and strengthen customized support to help job-creating companies, young start-ups and new growth businesses grow without tax difficulties. Strictly review the legality of the procedure so that the taxpayer's rights and interests are protected through the "Taxpayers Advocacy Committee" composed of external members, and disclose the details of the committee's review of the annual report to enhance fairness. (NTS 2019c)

(5) Strengthening scientific tax administration capabilities based on advanced technology

The Big Data Center was launched in 2019 as a control tower for scientific tax administration, promoting innovative changes in the overall tax administration, including tax payment services, tax evasion, tax base management and the way it works. Improving the professional scientific and technological capabilities of internal superior personnel and increasing the capacity of tax administration by recruiting private professionals. (NTS 2019c)

(6) Promoting sincere internal reform to meet changed values

Focus on finding and solving tasks that need improvement from the perspective of the site so that voluntary internal reform can be carried out away from the customary work style. To enhance the utilization and accessibility of national tax statistics, information is actively disclosed and plans to expand the national tax statistics center in the mid- to long-term. (NTS 2019c, SFC 2019)

2) AI strategy

With the rapid development of digitization and technological tools, the level of taxpayer service needs is rising. In addition, a large amount of information is accumulated, which is difficult to process with existing systems. The National Tax Service (NTS) recognizes the need to change to a tax administration suitable for a new era by preemptively preparing for these changes and leading continuous tax administration innovation. Introducing innovative technologies such as big data and AI into the tax administration, 72 detailed implementation tasks were selected to achieve the three core values of NTS: 'Less Compliance burden', 'Fair Taxation' and 'Effective Tax Administration'. The main three are as follows.

“Work Tax Leveling based on average workload calculation” for “AI Tax Secretary” for “Less Compliance burden”, “Compliance Risk Prediction” for “Fair Taxation”, and “Effective Tax Administration”

First, “AI Tax Secretary” is an AI-based tax assistance service that provides information to taxpayers and assists in reporting and payment.

-NTS provides counseling services that meet the individual needs of taxpayers by putting and learning vast amounts of information such as taxpayer's report and payment information and national tax-related counseling records accumulated over decades into the machine learning platform.

Taxpayers can receive tax counseling at any time via telephone, website, mobile app, etc. Also, by combining voice recognition technology, they can effectively provide services to taxpayers unfamiliar with IT technology.

Second, “Compliance Risk Prediction” for “Fair Taxation” is to select taxpayers with high risk of unfaithfulness as targets for investigation or to use them for management of delinquents using big data and artificial intelligence. The network data that can grasp the complicated special relationship of the taxpayer and the data possessed such as the taxpayer's assets, income, consumption data, research cases, and post-verification data are converted into a form that AI can learn and put into a machine learning platform. AI information on unfaithful risk can be used in various fields such as reporting, investigation and arrears management.

Finally, it is the Workload Leveling on Average Workload Calculation to improve work efficiency. By analyzing the time it takes for AI to handle each field and the difficulty level of each task, it calculates the time required for each unit to handle each unit of staff with average experience.

This will enable efficient work performance by adjusting the number of employees by local tax office and reallocating work.

Restrictions for using AI and big data in tax administration include securing of competent human resources, protecting personal information and legal restrictions on collecting necessary information, and maintaining the security of retained tax information. (NTS 2019h)

3) NTS’ Status

At the 2016 Tax Administration Forum, which marks the 50th anniversary of the NTS' independence from the Ministry of Finance and Economy, taxpayers evaluated the most important service using the Internet, such as the National Tax Service's homepage and HTS. Among the representative tax service channels of telephone, visit, announcement, and online, experience rate (85.4%) and satisfaction rate (87.9%) of online service were the highest. NTS has consistently focused on computerizing tax administration in order to increase efficiency of tax administration and improve the quality of tax service to the people. (NTS 2016)

NTS wrote a new chapter in digital tax administration by opening the Neo Tax Integrated System (NTIS) in 2015. In 2018, it obtained ISO/IEC 20000 certification, an international standard for IT service management systems. NTIS consists of the Internal Portal System (IPS) for the handling of internal affairs of NTS staff and the Home Tax System (HTS) that provides services for taxpayers over the Internet. The main functions of IPS are as follows. 1. Platform for Taxation: IPS supports the entire tax investigation through online tax management and analysis of tax evasion charges, and handles most national tax affairs, including claims of non-compliance and collection. 2. Connection to external agencies: All tax information is interconnected based on business license number and resident registration number. The IPS is linked to 390 external agency systems, including state agencies and financial institutions, and collects taxable data online and utilizes it for various tax operations, and provides tax information to other state agencies based on the law. 3. Paperless work environment: All documents submitted by taxpayer are stored in "Digital Storage" which is electronically managed and can be viewed on internal PCs at any time and utilized for analysis work. 4. Information Analysis Portal (IAP): IAP was deployed by integrating multiple disparate analytical systems. There is an integrated taxpayer analysis function that shows various analysis results at a glance. Statistics required for the work can be extracted more easily, such as collection history and tax return status by tax item. 5. Guidance on tax compliance: Provide various pre-analysis functions and guidance for taxpayers to report in advance. As a result, this is contributing to improving tax revenue performance. (NTS, 2018)

HTS is a taxpayer portal service that allows taxpayers to handle most of their tax affairs on PCs or smartphones without visiting the tax office. As of the end of 2018, about 19 million people have joined the total population of 50 million. The cumulative number of visitors is about 4.6 billion (September 2017), and the annual visitor number reaches 1.5 billion people, making it the most popular public administration site in Korea. The functions of the HTS are as follows. 1. e-filing; HTS can file electronic reports in 12 different categories, including income tax and additional taxes, excluding inheritance tax, and submit reports online. In addition, NTS has implemented the system to make electronic reporting easier and more convenient for taxpayers, including providing a "pre-filed service" that fills the report with the taxable data they have. Due to these efforts, the proportion of digital tax return in total tax filing has been continuously increased to 27.4% in 2002, 80.2% in 2008 and 95.6% in 2016. In 2016, the e-filing ratio was 91.6 percent for VAT, 95.2 percent for income tax and 98.8 percent for corporations. In addition, taxpayers can pay taxes through HTS without visiting financial institutions themselves. It was first implemented for the VAT in April 2002 and expanded to all tax types in June 2002. Taxpayers can pay by bank transfer, credit card or Paypal from their accounts. 2. Issue tax documents; Using HTS, taxpayers can get various tax-related documents anytime, anywhere. In addition, the tax certificate is applied with an anti-fraud technology, and the original verification of the issued certificate is also possible. 3. e-tax invoice; NTS introduced the VAT e-Tax Invoice in 2011 and mandated that all corporations and individuals with annual sales of more than US $ 300,000 should be issued mandatory. Taxpayers can issue and view electronic tax invoices as proof of transaction through HTS. In 2018, approximately 600 million tax bills were issued electronically, representing 99.9% of the total tax bill. Electronic tax invoices can quickly detect and prevent false tax invoices, taxpayers do not have to keep paper bills, and this data is provided to Pre-filled service. (NTS, 2018) 4. Cash receipt; this policy was introduced in 2005 to secure tax sources for cash transactions. Merchants shall issue cash receipts through credit card devices, the Internet, mobile phones or ARS if required by consumers. The business operators and consumers can issue cash receipts from HTS, inquire the issuance details and use them for various tax reports. In the case of consumers, a certain percentage of the amount of cash receipts issued may be subject to a tax deduction. The business operators subject to cash receipts have a membership rate of 97 per cent. As of 2016, about 5 billion cash receipts are issued annually, with 101 trillion won, which is 7.3 percent of GDP. The system contributes to the prevention of tax evasion in cash transactions. 5. Simplified year-end tax settlement; The NTS operates 'Year-end tax settlement simplified service' that collects and provides income tax deduction data needed for the year-end settlement from banks, hospitals and schools. In the past, various income tax deductions such as medical expenses, education expenses, and donations were collected and reported by the employees themselves. However, since 2006, it has become the most popular web service in Korea by having HTS check the deduction information. In addition, by upgrading the simplified service, the NTS informs the payment and refund tax amount in advance and provides "easy year-end settlement" service that automatically fills up tax returns and allows them to submit them online. Taxpayers are saving time and money, and their tax compliance is improving. 6. Mobile App Service; Most services offered through HTS are also available on smartphones. In the case of e-filing, the size of the screen on the smartphone is small, which is usually offered for simple forms or small taxpayers. In addition, taxpayers have access to a variety of services through smartphone apps, such as e-payment, consultation, sending of tax documents, issuing e-tax invoice, checking cash receipts. At the end of April 2019, more than 5 million taxpayers installed the HTS app on their smartphones and used the service. (NTS, 2019)

(1) NTS' Response to the Fourth Industrial Revolution

NTS has been pursuing to introduce big data to respond to changing circumstances such as the 4th industrial revolution and to implement scientific tax administration for the three major values of national tax administration: "Less compliance burden," "Fair taxation" and "More effective tax administration." (NTS 2019d)

The NTS's 2015 computer system (NTIS) was assessed to have limitations in collecting and analyzing unstructured data such as voice, text and images, although it has made progress in improving tax compliance and detecting tax evasion by analyzing data based on the structured data collected by taxpayers' filing, other government agencies, public organizations and financial institutions. (Lee, S., et al. 2017) It has decided to combine AI-based big data technologies to complement them. (Digital Times 2018)

The NTS Big Data plan aims to provide taxpayer-tailored filing assistance by utilizing advanced information technologies such as artificial intelligence Chabot, and materials to support tax compliance, improve the environment for user-friendly reporting and reduce the cost of tax cooperation. Based on big data, the NTS strives to create a healthy and vibrant organizational culture by reducing the number of simple and repetitive tasks of front-line employees. Information technology will also be used to root out expedient tax evasion. (NTS 2019e)

According to the National Tax Administration Reform Committee (NTS 2019d) meeting in March 2019, Big Data-related progress through 2018 is as follows.

• Preparatory organization; in January 2018 a Big Data TF team was formed consisting of employees with expertise in computer and tax fields who prepared for the establishment of the "Big Data Center" and will perform all the tasks related to big data in the future.

• Based on system design; information service strategy planning (ISP) related to big data, and business process redesign (BPR) project, the infrastructure system was completed in 2018.

• Implementation of priority tasks; 4 tasks including unfair credit card purchase tax deduction and real resistance of Taxpayer analysis with high effectiveness, specificity and spreading possibility were selected as big data priorities starting from 2018 and an in-depth analysis was started.

• Training professionals; training programs such as big data platforms, artificial intelligence and machine learning, statistical analysis and Python programming have been in operation since June 2018 in conjunction with the Korea Advanced Institute of Science and Technology (KAIST) to foster internal big data experts. (NTS 2019d)

(2) Big Data Center Operation Plan

With the plan to open the "Big Data Center" in 2019, NTS is seeking to expand the number of experts specializing in platform construction and carry out analysis tasks by securing about 10 billion won in budget for new information service projects. (NTS 2019e) Future operational plans are as follows: 1. Reinforcement of systems; development of internal portal systems to expand hardware and software for the utilization of high-tech technologies such as big data and AI, and to integrate and manage the entire process of big data analysis. 2. Reinforcement of expertise; active recruitment of internal and private professionals to secure outstanding human resources, diverse public-private partnerships to strengthen analysis capabilities and an outside advisory group to review effective use of big data. 3. Strengthening security controls; preparing security devices to thoroughly protect taxpayer's personal information in the data analysis process, for instance deploying big data computing systems on the NTS's internal network, taking measures not to identify personal information, and introducing security programs. Since the establishment of the Big Data Center, The big data analysis team will be operated by each area of tax administration, such as corporations and investigation, to analyze the priority issues with high ripple effects, and to identify and carry out phased tasks by 2021 under the mid- to long-term plan. This will accelerate innovation by making science and intelligence the entire tax administration, including tax evasion, tax payment services and working methods. (NTS 2019d)

**Chapter 5. AI application case studies**

In the private sector as well as the public sector, the use of chatbots for communication between the government and citizens is expanding by utilizing AI technologies such as natural language processing, machine learning, and data mining and various types of existing data. (Androutsopoulou et al. 2019)

Chatbots will be available in four areas:

- Service and information search

With a chatbot that can guide citizens where they can get a particular service, it will save them time, effort, and money to go to ministries, representatives, and homepages.

- Qualification

Chatbots can be used to verify the government's understanding of welfare programs or the user's eligibility and how to use these benefits.

- Service provision

Chatbots can direct citizens' nearest centers, hours of use, and appropriate departments to use services to use specific services, and will be able to consult with them using AI technology.

- Citizen feedback

Quickly collect user's experiences through chatbots in an easy and comfortable way through chatbots, text messages, phone calls, and surveys of visitors to collect feedback from users, and automatically deliver feedback to the appropriate department So that prompt action can be taken. (Industry Viewpoint 2018)

As described above, the chatbot will contribute to reducing the cost of providing the government service and improving the quality and speed of the service.

The following is the cases of a government agency using chatbots. And AI

**1. Chatbot cases public sectors**

1) Singapore Public Service Chatbot “Ask Jamie”

'Ask Jamie' Virtual Assistant

The Government of Singapore (GovTech) and Smart Nation and Digital Government (SNDGO) are virtual assistants (VAs) that citizens and businesses can implement on government agency websites since 2014 to explore online government services and improve service delivery. Ask Jamie 'service. To date, questions from 70 government agencies can be answered.

Virtual assistants are chatbots that can communicate and provide answers to specific questions using machine learning techniques known as natural language processing.

'Ask Jamie' is a virtual assistant (VA) that can be implemented on a government website, and is trained to answer questions within a specific domain. Trained, Jamie became proficient in identifying keywords in the questions and answering them correctly. If the question turns out to be more complex than it can handle, live chat can send the relevant form to the customer to help solve the complex problem.

'Ask Jamie' provides the following benefits.

• It is available 24 hours a day, 365 days a year to improve access to the government.

• It is convenient to receive quick and direct answers to inquiries. .

• Improving user experience through interactive digital interaction

• Questions and answers related to 70 government agencies are available on one site without the need to visit websites of multiple agencies

Citizens can now receive hands-free voice services without using buttons or dials.

As a future plan, it has evolved further from the chatbot function, and it is possible to use e-mail through voice through VA, and it is conducting a demonstration of the automated call response service (Ask Jamie Voice) of the Ministry of Social and Family Development. In the future, this service can be expanded to automate the call center, reduce the resources required to operate the call center, and reduce costs. Also, call agents can focus on more complex questions.

It is also planning to enable smooth communication to citizens anytime and anywhere through various channels such as Facebook messenger, Skype, and Telegram as well as websites. (GovTech, 2020)

2) Australian Taxation Office (ATO): Alex

The Australian Taxation Office (ATO) launched Alex, a customer service chatbot in March 2016, which was introduced to help general tax inquiries for individuals and businesses related to taxes, such as reporting income and deductions. Alex has received international attention from the media as an example of digital transformation. (salsadigital 2020).

ATO has partnered with US software company Nuance Communications to implement a customer service channel. Alex is never forgetting and friendly once taught and is available 24/7. From March 2016 to December 14, 2016, nearly 1 million virtual conversations were held, and the most used during the July to October tax filing period. In addition, because Alex captures customer interactions in text form, the ATO can analyze the information at a more granular level. (Innovation & Science Australia, 2017, Criterion Conferences, 2016)

The basic information provided by Alex was first developed using data from the phone and website that the ATO inquired about, and is reviewed and expanded every few months thereafter.

The percentage of Alex's first contact with the customer to solve the problem was 80%, exceeding the industry standard of 60-65%. In addition, off the 8 million phone calls annually, 76%, or 75 thousand hours, are reduced (Accenture 2017).This means that by automating the problem of repetitive and frequent inquiries, employees who were engaged in simple repetitive counseling can concentrate on solving complex problems. (Innovation & Science Australia 2017)

3) Swedish chatbot “Erik”

‘Erik’ is a tax chat bot service implemented by the Swedish National Tax Board (NTB), which has been in effect since 2003. (KISDI 2017, NIA 2018) Once a year, when taxpayers file income tax returns, the Swedish Revenue Service answers many questions about income tax returns and forms. The Swedish NTB's target group is 7 million citizens. It is 70% of the total Swedish population. Many of these visit the NTB website before filing an income tax return, and the large number of calls and emails concentrated during the tax filing period puts a heavy burden on customer service, and questions are repeated. (chatbots.org 2020) As a result, the Swedish NTB, an interactive conversation system, 'Erik', provides chatbot services related to tax filing through the website for two months during the tax return period. In addition, in cooperation with more than 20 banks, it is possible to report to a real operator through a joint electronic signature and chatting if there is a technical problem. (chatbots.org 2020, NIA 2018) The tax authority is also learning and evaluating key questions from customers through 'Erik', and continuing to provide services to build additional knowledge and improve the functionality of the system. The tax agency's “Erik” was positively evaluated for media reports such as TV, radio, and newspapers, and was selected as the best internal idea by the National Tax Board in 2003. . (KISDI 2017, chatbots.org 2020)

4) South Korea's Gyeonggi-do intelligent 'local tax consultation bot'

 'Local Tax Counseling Bot' was the first AI-based chatbot in South Korea to be launched in June 2017.

Local tax complaints, such as property and automobile taxes, are typical civic complaints that continue to occur, such as a difficult call connection due to the congestion of telephone consultations or simple complaints, but a lot of time. Accordingly, Gyeonggi-do introduced artificial intelligence chatbot service for real-time response and processing in the local tax field. (Dong-A Biz N July 28, 2017).

From simple complaints related to tax-related terms and tax law provisions to information on contact information for local tax representatives, AI is a service that automatically understands the intentions of civil complaints and answers them.

About 650 local tax officials from 31 cities and counties in Gyeonggi-do and Gyeonggi-do have worked together for one year, and web / mobile (smarttax.gg.go. kr) Artificial intelligence automatically responds 24 hours a day, 365 days a year.

For example, a civil servant asked, “How much is the car tax when purchasing a car?” When asked, the AI-based two-way interactive chatbot asks material questions such as "How is the car model year?" And "What is the amount of exhaust?"

The accumulated “intelligent counseling database” is registered as a copyright. (Gyeonggi-do News Portal | 2017-06-26 Gyeonggi-do, the first nationwide 3,115 local tax information copyright registered)

By introducing a chatbot in the local tax consultation service, social costs incurred in the customer consultation process can be lowered, and tax officials can increase work efficiency, contributing to the improvement of public service quality. (Dong-A Biz N, July 28, 2017, “Gyeonggi Metropolitan Government expects dramatic improvement in response rate and accuracy of “inteligent local tax counseling bot”).

**2. Operation Support Bot**

NASA was the first agency in the federal government to implement Robotics Process Automation (RPA), and the NSSC (NASA Shared Services Center) utilizes three robots running nine jobs.

Since 2006, the NASA Shared Services Center (NSSC) has been providing support services to NASA with the goal of reducing cost expenditure, enhancing service quality, and improving customer service satisfaction. NSSC continues to seek opportunities for the provision and innovation of business support services.

NSSC's Intelligent Automation Services (IAS) team is using RPA for automated tasks. The RPA software mimics the human interaction with the computer, allowing NSSC to automate the process and let the “Bot” do it. Digital bots are highly reliable because they do not get tired of repetitive and large amounts of work like humans. (NASA 2018)

In May 2017, NASA launched the Federal Government's first digital bot “George Washington” to support human resources, procurement processes, financial management, and data centers across the organization. Washington Bot logs in to financial management software, Washington reads and processes email, acts like other employees who provide feedback, and provides it to employees.

In June 2017, NSSC added “John Adams bot” for fund distribution and has NSSC's third bot, “Pioneer bot”, which makes a procurement request. (GCN 2019)

Although NSSC successfully introduced RPA, there was no reduction in staff. NSSC plans to hire more RPA bots in the future so that employees can spend more time on high value-added work. The RPA has become an effective and effective means of transforming the federal workforce from simple repetitive tasks to complex, professional tasks. (NASA 2018)

**Chapter 6. Comparative Analysis**

In the current situation of increasing efficiency of U.K. and Korea's tax agencies and strengthening customer service using new technologies in the 4IR era, differences between the two taxation authorities was analyzed in terms of strategy, integrated service platform, Big data and cyber security. Among these four differences, lessons from the two taxation authorities are presented in three aspects that should be focused and supplemented in the 4IR era, with the exception of integrated sites that are not directly relevant to tax authorities and should be reviewed at the government level. In addition, the applicability of these implications is reviewed at the end of this chapter.

**1. Drawing lesson between NTS and HMRC**

1) Difference between NTS and HMRC

(1) Strategy

HMRC set up a transformation plan as a five-year strategy, which plans to cut costs by 191 million pounds from 2016 to 2020 and increase efficiency," said H.C. The 2018 C & AG's report said it did not meet its cost-cutting target by 2018, but expected a reduction of £42 million in costs by 2019-2020 and expected to generate an additional £920 million in tax revenue by 2021. In addition, the company announces its performance through HMRC annual report every year.

In contrast, the NTS announced the direction of implementation of the work in the year and the performance of last year through the "Plan for Management of National Tax Administration" every year without a specific road map for the mid- to long-term period. Although expectations or goals for the savings from the digitization of NTS and the tax revenue effects were not clear, the results from the computerization are identified as follows. The compliance cost, which accounted for 0.85 percent of GDP in 2007, fell to 0.80 percent in 2011, 0.68 percent in 2014 and as part of NTS fair taxation, the use of credit cards pushed to foster taxable income rose to 70.3 percent in 2017 from 7.9 percent in 1999. (NTS 2019g)

In the UK, the five-year plan has the advantage of continuing reform with a long-term vision. On the other hand, as noted in the C&AG (2018) report, it is necessary to review the portfolio of transformation at least once a year and adjust the plans accordingly to be able to respond to changes in the external environment. This should be implemented in accordance with the purpose of the five-year long-term plan, but innovation that are responsive to changes in the environment should be made. Infrastructure and system projects should be closely monitored to see how they affect efficiency and sub-projects.

(2) Building an integrated service platform

The UK government created separate Web sites for each ministry over the late 1990s and 2000s, resulting in more than 1,800 sites. Since 2012, the government's online activities have been integrated into a single domain on Gov.UK reducing the number of government Web sites accessible to outside users from 1,800 to 295. The use of GOV.UK has steadily increased from about 4 million net users per week in early 2013 to about 14 million in early 2018. GOV.UK is designed to focus on the needs of users, not just the integration of websites. It is a standard platform that can evolve to meet the needs of the people for information and services. IfG (2019)

In the case of South Korea, e-government was promoted as a means to overcome the economic crisis in the wake of the IMF foreign exchange crisis in late 1997. Accordingly, the website has been operated by the central and local governments for each service. However, since July 2017, 'Government 24' has been provided by integrating government-proven document issuance services and 23 types of benefit public services that have been provided to various central and local governments in order to establish an integrated platform that allows complete processing of services from one window to information, application, processing status and result verification. This will allow users to resolve the government services they need at once, away from the individual requests made on the Web sites of about 12,000 public organizations. MOIS (2017b)

UK’s 1800 government websites were integrated by Gov.UK so customers can access the required services only if they visit this way. In Korea, however, only direct public services are integrated, making it difficult to visit individual websites for different areas of service.

The South Korean government is continuing to push for the unification of its services (MOIS, 2017c, Choi, Y, 2017), which will make 282 services available to the Government 24 out of 1,594 online services by 2020. For users, however, only some services are integrated, making it difficult to find the services they want and raising concerns about overlapping investments by service and website. Therefore, it is necessary to share the experience of deploying a single integrated service platform for government departments, such as Gov.UK, to pursue customer convenience and enhance e-government efficiency.

(3) Big Data

In case of NTS, it will open a big data center in 2019 to expand hardware and software for utilizing cutting-edge technologies such as big data and AI, and strengthen professional capabilities and data security to develop an internal portal system that integrates and manages the entire process of big data analysis. (NTS 2019d) NTS plans to introduce a big data-based artificial intelligence prediction system to detect abnormal tax evasion in a system that can be handled through the computer system (NTIS) based on big data. NTS (2018) For HMRC, in 2010 HMRC launched a 'Connect' database, a system built by collecting data and information from local councils and even from public and private sources, including social media, to identify where tax avoidance could occur. (Wilson, 2017)

For example, information on purchases and overseas travel through online sales sites or airline databases to identify the level of consumption of taxpayers and verify the adequacy of income reports. The NTS collects information through government agencies, public institutions, and financial institutions, but HMRC shares databases with various government and private organizations, such as online sales sites and airline databases other than tax or financial departments. In addition, the company plans to collect social media such as Twitter and Facebook, as well as unstructured data such as e-mail and voice, and utilize it in the analysis using big data technology (Lee, et al, 2017) NTS is planning to collect and utilize unstructured data with the establishment of Big Data Center in 2019. With regard to the promotion of data analysis expertise, NTS plans to actively recruit private experts, along with the placement and training of its best internal staff.

(4) Cyber Security

Both HMRC and NTS have their own cybersecurity teams (HMRC; Cyber Security Team ("CST") and are working with the National Cyber Security Center (NCSC) to prepare for cyber threats, respectively.

UK and South Korea are preparing for cyberattacks in a variety of ways, including using of Firewall, encrypting important personal information, detecting and preventing of phishing & SMiShing and blocking harmful sites in common.

The strengths of both countries in cybersecurity are as follows.

In the case of Korea, the government is preparing for an intelligent Cyberattack by organizing a network dedicated to the administration that is completely separated from the Internet's commercial network for protection of personal information. The Internet commercial network is used for the Home tax service, where individuals file tax returns and pay tax. The Internet data will be sent to an intranet dedicated to the National Tax Service after undergoing various security checks, including malware infection. Security checks such as block and virus treatment of illegal software are performed two additional times during data transfer and intranet upload. Taxpayer report data accumulated in Intranet, combined with data collected from third parties, are separately managed in the intranet, thus enhancing taxpayer information security. (NTS 2019f)

In the UK, scamming is well handled, which has recently posed a threat to customers." (Wooller, 2018) In Korea, scamming cases have been found in the banking sector, but no cases have been announced in relation to the National Tax Service. According to Wooller’s article (2018), although it does not break the law, 'scammers' creates a website that is easily misunderstood as HMRC, which allows customers to use HMRC's services. They are earning money by making customers pay for these services. HMRC CST is actively seeking these misleading sites and is working with third-party domain management companies to challenge the use of trademarks. If the case is won, the domain is transferred to HMRC. So far, more than 100 domains have been restored. (Wooller, 2018)

2) Lesson drawing from the difference for both tax agencies

(1) NTS, lesson from HMRC

- Strategy

HMRC is driven by its long-term vision of a five-year reform. However, the NTS has established a direction of work in accordance with the changing situation year after year without a mid- to long-term roadmap. There is a lack of expectations about the projected cost savings or additional revenue effects in the planning process.

As in the case of HMRC, it is necessary to adjust the operation plan annually under mid- to long-term plans and to proceed with the task by calculating cost-cutting goals and additional revenue effects in order to pursue efficiency.

In addition, we will check the level of achievement achieved during performance evaluation and identify the reasons for failure to achieve the goal to ensure effective performance.

- Big data

In the case of NTS, only tax or financial information is provided by the government, public institutions, and financial institutions, so the accumulation of data from various government and public institutions is required. In addition, because data collection is limited to the private sector, such as HMRC, it is necessary to have institutional mechanisms to secure portal companies or social media data. With the establishment of the Big Data Center in 2019, it is also planned to attempt to accumulate and analyze data on unstructured data such as images and voice, but at a stage that has yet to be implemented, benchmarking HMRC's data accumulation and analysis technologies will help.

- Cyber Security

NTS is more secure as data is collected and analyzed through an internal network completely separated from the commercial Internet network in which customers report and pay taxes. In addition, the NTS is taking various measures against cyber threats to the HTS web site and intranet systems. However, additional measures are needed for the Phishing and Scamming techniques that impersonate the National Tax Service that threatens taxpayers. It is necessary to seek ways to cope with cyber threats against customers as well as the protection of the NTS system itself. In particular, in order to prepare for cyberattacks that are becoming more intelligent, it is necessary to thoroughly prepare for possible future risks by sharing technologies to cope with various cybercrimes, such as HMRC's defense measures against scamming.

(2) HMRC, lesson from NTS

- Strategy

In the case of HMRC, the five-year plan has the advantage of continuing reform with a long-term vision. In such cases, however, there is a weakness in not being able to cope with changes in the external environment if it is operated under a plan established several years ago. Therefore, it will be necessary to revise and supplement transformation in accordance with the changed environment every year, such as Korea, within the big framework of the five-year plan. It is necessary to review the portfolio of transformation at least once a year and adjust the plans accordingly to be able to respond to changes in the external environment. This should be implemented in accordance with the purpose of the five-year long-term plan, but innovation that are responsive to changes in the environment should be made. Infrastructure and system projects should be closely monitored to see how they affect efficiency and sub-projects. (C&AG, 2018)

- Big data

It is necessary to review the recruitment of private data analysis experts based on new technologies, such as NTS. In the case of HMRC, it has used structured and unstructured data such as voice and images from government agencies, public institutions, financial institutions and various private institutions. In contrast, the NTS established the Big Data Center in 2019 and plans to acquire and utilize data from various sources other than those received by the government, public organizations and financial institutions, which can be seen as lagging behind HMRC in the scope and ability to analyze the data deployed. In the case of Korea, however, it plans to strengthen its analysis capabilities by securing various experts such as big data and AI, as well as fostering outstanding personnel inside. Because the amount of data accumulated by the tax agent is large and contains a lot of sensitive personal information, training HMRC internal experts can be an advantage in data security. However, it is difficult for the internal staff to respond to the speed of development of new technologies, so it is necessary to utilize the capabilities of outside technology experts such as NTS.

- Cyber Security

It may be proposed to operate a separate customer network and HMRC's internal network, such as NTS. Similar to NTS, HMRC is developing various defense measures against systems, websites and customer data to cope with cyber-attacks. It also operates a professional Cyber Security Team to cope with cyber threats in HMRC.

Customers can access only the published website. The data and work security of the tax agent could be enhanced if the Internet networks used by customers, such as NTS, and the internal business networks, were entirely separate. This requires the establishment of a separate administrative network, which may raise questions about the feasibility of HMRC.

3) Review applicable of policy lessons

(1) Strategic aspect

With regard to the establishment of short- and long-term strategies, it will be likely to reflect because it is due to internal decisions by NTS and HMRC. In the case of NTS, there may be opinions that it is difficult to establish a long-term strategy since the NTS chief is usually replaced every two years, but since the task continuity of the NTS continues separately from the replacement of the chief, short-term strategy can be established every year considering various social and economic changes under the long-term strategy, as in HMRC. In the case of HMRC, short-term strategies such as strategy planning of NTS will soon be established in HMRC, as the need for short-term strategies to respond quickly to changes in circumstances under the long-term strategy has been pointed out by the National Audit Office (NAO).

(2) Big data aspect

The implications for big data are that in terms of applicability, NTS should complement the legal basis for data collection, and in the case of HMRC, decisions will be made after examining the pros and cons of using external workers. Since NTS aims to establish a big data center in 2019, it is necessary to collect data through various channels such as HMRC, government agencies, public institutions, and private organizations, and collect data in various forms such as voice, image, and video. There is this. Since data collection on various types of atypical data is a technical problem, it will be possible to study the method of benchmarking the case of developed countries such as the UK without any restrictions. However, in order to collect data from various sources, there is a problem of personal information protection. Therefore, it is necessary to revise related laws to provide a basis for securing data. In the case of HMRC, improving the ability to collect and use big data through training of internal employees has a strong strength in data security of taxation authorities dealing with sensitive personal information, but is agile in taxing transactions and tax evasion types using fast-moving new technologies. To do this, it would be more efficient to use an external IT technician. Since this is fully acceptable by HMRC's policy judgment, it will be possible to examine the benefits of using external human resources.

(3) Cyber Security aspect

Proposals related to cyber security will need to be reviewed for acceptability through mutual benchmarking, as the computer networks of the two governments differ from the computer systems. In the case of NTS, it is necessary to identify the various types and coping tips of cyberattacks in HMRC and address possible cyber threats in the future, even if there are no such cases today. To do this, the NTS Computer Security Team will be able to prepare for various cyberattacks by re-checking the problems in the NTS's security system by requesting HMRC's cooperation after internal decisions, through meetings with HMRC Cybersecurity Team to learn cyberattack cases and countermeasures. For HMRC, building a separate administrative network, such as NTS, can be effective in preparing for cyberattacks, but this requires the creation of a separate network, so the feasibility of pan-governmental policy decisions should be prioritized and budget and other issues reviewed, but physical disconnects from external systems contacted by the HMRC's internal systems and taxpayers may be useful in reviewing existing security vulnerabilities.

**2. Drawing lesson from AI studies**

**1) Differences**

(1) Integrated chatbot vs. individual chatbot

Singapore's government is in the position of AI leader, accounting for 1 in 194 countries in AI preparedness rankings published in the 2019 Oxford insight report (Oxford insight 2019) The Singapore government has been providing a virtual assistant (VA) service called 'Ask Jamie' on the government integrated website for convenient access to government services since 2014. Citizens and businesses can ask and answer questions related to 70 government agencies in one place without having to visit the websites of several government agencies. (GovTech 2020)

In the case of South Korea, the public sector is also expanding chatbot services to communicate with the public in real time and improve the quality of customer service. The public government is pursuing a chatbot service individually for each government department, local government, and public institution. (NIA, 2018) Korean tax authorities also announced the introduction of a chatbot service for taxpayer tax consultations at the 2019 OECD FTA meeting. (NTS, 2019)

(2) Customer Call Center: Chatbots vs Traditional channels

Sweden and Australia's tax authorities have been using chatbots to effectively cope with the overload of call centers on tax consultations, which are concentrated during the income tax reporting period. The Swedish National Tax Board has been running a chatbot ‘Erik’ on the NTB website for two months from the 2003 income tax reporting period. (KISDI, 2017, NIA, 2018, chatbots.org, 2020). The chatbot responds to many repetitive questions about income tax filings and forms that are concentrated during the tax filing period. (chatbots.org, 2020) The Australian Taxation Office (ATO) introduced Alex, a customer service chatbot, in March 2016 to help general tax inquiries for individuals and businesses related to taxes, such as reporting income and deductions. (salsadigital 2020). Chatbots are accessible 24 hours a day, 365 days a year, making taxpayers accessible, as well as answering repetitive and simple questions, allowing employees to focus on solving more complex problems. (Innovation and Science Australia 2017)

The Korean National Tax Service (NTS) has not yet introduced a chatbot. During the tax filing period, telephone and internet consultations are concentrated. As of 2018, the National Tax Counseling Center, which specializes in taxpayer counseling, has 44 million phone consultations and 290,000 internet consultations. In January and May, when there are many tax consultations, a quarter of the total annual consultation is concentrated. (National Tax Stat 2019)

(3) Operation support Bot

The United Kingdom and the United States are using AI technology-based chatbots and business support bots to increase employee efficiency.

HMRC in the UK supports a technical problem faced by a virtual assistant chatbot called “Rita” while employees are doing their jobs. (CBR 2018)

NASA in the United States introduced “George Washington” in May 2017 to support personnel and financial management to streamline the work of staffs. Subsequently, “John Adams bot” and “Pioneer bot” were used for fund distribution and procurement requests. This promoted the efficiency of the work by letting employees focus on complex and professional work rather than simple repetitive work. (NASA 2018)

The Korean government has difficulty in securing investment resources for the use of advanced digital technologies such as AI as the maintenance cost (40.5%, '17) of the e-government system (16,282, '17) project continues to increase. Not only that, but it also leads to the stagnation of work methods and public service innovation. (Korean Government. (2019b).

(4) AI ethic & safe guidance

The UK government as well as international organizations such as the OECD and the EC are concerned about AI ethics and safety.

The UK the Office for Artificial Intelligence (OAI), the Government Digital Service (GDS) and The Alan Turing Institute have published AI Ethics and Safety Guides for the use of AI systems in the public sector (UK Gov, 2020, NIA, 2019). In addition, the UK HMRC is planning to form a working group to continuously utilize AI and machine learning, raise awareness of AI ethics issues throughout the organization, and consider necessary governance. (PT, 2019)

In 2018, the Korean government released an intelligent information society ethical guideline to strengthen the ethical responsibility of technology developers and suppliers and to prevent misuse by users (MSIT, 2018). In the case of a Korean tax agency, it is planning to use AI technology, and it is insufficient to consider AI safety and ethical issues.

**2) Lesson drawing from the difference**

(1) Introducing an integrated government-wide chatbot

The introduction of a government-wide integrated chatbot can prevent duplicate investment and provide convenience to citizens.

Singapore and the United Kingdom unified the websites of individual government departments and opened a single, unified government website, where citizens needed one place without spending time searching through multiple websites to find out which departments offered specific services. Information about the service can be conveniently secured. In addition, Singapore is equipped with a chatbot that can chat via text and voice from an integrated website.

It is necessary to introduce a government-wide chatbot like the Singapore government in order to improve the quality of government services and increase access to customers' government services.

Since South Korea's administrative department is encouraging the use of AI technology, the introduction of chatbots by individual ministries, local governments, and public institutions is a trend that may lead to concerns over duplicate investment and to the government's financial burden.

For example, in South Korea, Gyeonggi-do introduced a chatbot for local tax counseling. Local governments that enforce local tax laws vary from city to city, but local tax laws are one and the same. Nevertheless, the individual installation of a local tax counseling service bot for each local government causes national budget waste. Also, regardless of the introduction of chatbots, citizens will continue to have trouble finding a ministry that provides information about the service they are looking for.

  (2) ICustomer service goal setting and feedback by introducing chatbot for customer consultation

It is possible to improve the quality of customer consultation services and relocate the counseling staffs put into simple and repetitive inquiries into complex and difficult tasks.

For customer consultation services, it is urgent to introduce chatbots for tax consultation, such as the Swedish and Australian tax authorities. In the case of the National Tax Consultation Center of the Korean taxation authority, the average response rate for customer's phone or internet consultation by year from 2015 to 2018 is low, ranging from 50 to 60%. It was noted by the National Assembly that the opportunity to receive tax information was blocked and the meaning of the existence of the National Tax Consultation Center was faded (NARS 2019). Australian tax authorities have reduced 76% of their 8 million calls per year, saving 75 thousand hours (Accenture 2017). Reducing the current number of 44 million phone calls from the National Tax Counseling Center by 76% will provide better consultation services. In addition, the manpower that was put into the work replaced by the chatbot can focus on areas that require other advanced work skills.

Furthermore, if the overload of taxpayer counseling is relieved to a certain extent through the introduction of chatbots, it will be necessary to set specific targets and evaluate their performance in order to improve the quality of customer service, such as the customer service goals set by HMRC. For example: 1. Within 5 minutes, connect with an agent, 2. The percentage of customers who waited 10 minutes or more to connect with an agent is less than 15%, 3. The level of satisfaction with digital consultation is more than 80%. The quality of service will be improved by reducing the dissatisfaction with customer service through feedback on why the goal was not achieved and whether there was a problem in setting the goal by setting this specific goal and evaluating the execution results for one year thereafter.

(3) Utilization of AI technology for operation support

It is necessary to use chatbots based on AI technology from HMRC in the United Kingdom and NASA in the United States and bots in order to increase the work efficiency of employees. The main advantage of Chatbot's interactive user interface is that it is easy to use for both internal and external users. (GCN 2019) chatbots can also be used for internal employee processing.

Although the computer system of the National Tax Service of Korea is being introduced to other countries as a best practice, employees spend a lot of time working, finding tax laws and regulations, how to apply them to practice, and learning how to handle them. In addition, employees with low job proficiency often ask experienced colleagues, which degrades the work efficiency of highly skilled staff. Chatbot will improve the efficiency of the entire organization by providing relevant laws and business guidelines promptly and accurately to public officials' questions in the course of work.

In addition, if the repetitive and administrative tasks such as personnel and finance of the South Korean tax authorities are replaced by robots, it will be possible to maximize efficiency by securing more personnel to concentrate on the core tasks of the National Tax Service.

NASA, which introduced the robot system for the first time in the United States, replaced the support field, not the core one, with a robot. AI introduction is known to have an adverse effect of increasing the unemployment rate, but in the case of NASA, it aimed to improve the performance of core and important tasks by relocating the workforce as a high value-added task.

The National Tax Service's manpower is more than 20,000, making it the third-largest organization among government departments in the Republic of Korea. Therefore, it has a repetitive nature with a large amount of work in departments that support technical tasks in the computational field of employees and support services such as personnel management, payroll, procurement, and financial management of the National Tax Service. In the administrative field, there is a low degree of relevance to the core tasks of the National Tax Service. The introduction of robots can increase the willingness to work for these employees and improve work efficiency for core tasks.

(4) Establishing an innovation team for governance by introducing new technologies and preparing AI ethic & safe guidance

It is necessary to have a technology innovation team in the NTS computer department to monitor new technologies and to establish governance necessary for the use of AI technologies such as ethics and safety guidelines.

In the case of HMRC, the architecture and innovation team within the computational organization is monitoring new solutions and reviewing open source usage. In addition, a working group was formed across the organization raise awareness about AI ethics and safety issues and to consider necessary governance, (PT 2019).

NTS entered the field of big data construction and AI technology late despite being a leading tax authority for electronic tax administration. For example, chatbot technology was introduced from Sweden NTB 2003, Singapore government 2014, and Australian ATO 2016 to promote efficiency in customer consultation. Although chatbot technology has relatively low risk among AI technologies and can be used with a relatively short preparation period, NTS launched a partial service in 2019. The introduction of most new technologies requires a huge budget and requires specialized technical manpower, so long-term design is necessary, and in order to lead changes in national tax administration in line with new technology trends, it is necessary to keep up with the new technological environment with a long-term perspective. Therefore, similar to HMRC, it is necessary to establish a technology innovation team in the computer information management office to monitor new technologies through interaction with technology providers for new solutions to review the necessity of introduction.

On the other hand, governments and tax authorities in each country have established ethical and safety guidelines, such as preventing damage from AI abuse and protecting privacy. HMRC has established working groups across the organization to raise awareness of AI ethics and safety issues and to consider the governance needed.

In the case of NTS, the 2018 government-provided intelligent informatization socio-ethical guidelines should be included in the AI ​​utilization plan so that ethical guidelines can be observed in the tax agency's big data construction and utilization and AI technology use planning stages.

From the development stage of chatbots using AI of taxation authorities, AI ethics and safety guidelines should be prepared and training to spread awareness of ethical standards among employees should be provided. In addition, as in the case of HMRC, efforts will be needed to strengthen the ethical responsibility of technology developers and suppliers and to prevent damages caused by misuse of users.

**3) Review applicability of policy lessons**

(1) Introducing an integrated government-wide chatbot n integrated government-wide chatbot

As there is no cross-government integrated website like the UK or Singapore, it will be difficult to apply the integrated chatbot early, but South Korea continues to promote service unification by operating “Government 24” that integrates 282 frequently used services from customers. (MOIS, 2017c, Chio, Y, 2017) A realistic alternative would be to implement a chatbot based on integrated customer service provided by Government 24. NTS, as well as the jurisdiction of the integrated service, will provide the data needed to implement the "government 24" chatbot.

(2) Customer service goal setting and feedback by introducing chatbot for customer consultation

Introduction of chatbot for customer consultation

Since the Korean National Tax Service (KIS) has accumulated all of its business data through NTIS, the national tax administration business system, it collects and utilizes data on vast data such as tax return and payments information of taxpayers, and national tax consultation records (NTS 2019h) It will be possible by benchmarking previous cases such as Australia and Sweden without any restrictions and researching ways to utilize them. However, since tax-related matters are sensitive personal information, it is necessary to prepare for the information protection problems that emerged in the case of the NHS chatbot in the UK.

(3) Utilization of AI technology for operation support

As mentioned above, there will be no difficulty in using the chatbot service using customer service such as tax consultation based on various data built by the Korean National Tax Service, as well as the internal staff's work support assistant. According to GCN (2019), the main advantage of chatbot's interactive user interface is ease of use for both internal and external users. The efficiency of work will be improved by quick and prompt support for the complicated tax law knowledge experienced by employees and the existing work processing guidelines. However, even if the chatbot is available to internal and external users, there are security reasons, so it is necessary to separately provide chatbot data for internal employees and chatbot data for external customers to secure data based on chat technology.

(4) Establishing an innovation team for governance by introducing new technologies and preparing AI ethic & safe guidance

As the Korean government already has AI ethic & safe guidance, the Korean tax agency should include measures to make it aware of awareness of ethical guidelines, such as preventing damage from AI abuse, such as HMRC in the UK. As it is still in the planning stage, it will be necessary to consider cases in other countries and consider how to implement existing government guidelines.

**Chapter 7. Conclusion**

The 4IR will be another major revolution for mankind. As mentioned earlier, there will be three major changes in social and economic terms. First, the importance of large-scale facilities and personnel decreases and the industrial structure changes as a new source of competition with data knowledge. Second, office work and manual labor will be automated, replacing the role of workers and changing the employment structure by creating jobs in the new industrial sector due to technological innovation. Finally, in terms of human living environment, improving the quality of service such as medical education and policing can make human life convenient and stable, while big data can cause invasion of privacy.

The G20 governments, including the British and South Korean governments, are working on various policies to counter these big changes that the fourth industrial revolution will bring. It is pushing for a pan-national policy to seize opportunities for economic development by laying the foundation for investment in research and development and education related to new technologies. Meanwhile, it is preparing for the ethical aspects that technological innovation will cause, as well as the side effects of personal and government information leaks. It is also developing customer-centric, efficient e-government to respond quickly to changes caused by the innovation. In this paper, the policy of responding to the nationwide 4IR for developing new technologies, promoting investment and education is suspended.

The digitization strategies and current status of the UK and South Korean governments and tax agencies, which are working to cope with the fourth industry centering on e-government within the government, were reviewed. Through this, the implications were presented after analyzing the differences between the two tax authorities in terms of strategies, big data and cyber security that tax authorities should focus on and supplement in the face of the 4IR.

The government and taxation authorities of the UK and South Korea are pushing for short- and long-term strategies to improve the government's efficiency and build customer-oriented administration by using various advanced technologies such as big data and artificial intelligence. Tax agencies' strategy to digitize tax administration is to improve compliance by making tax reporting and payment convenient through digitalization of tax administration, and to reduce taxpayer administrative burden and compliance cost. In addition to the provision of customer-oriented tax administration services, the new technology is used to build, analyze, and utilize big data to prevent tax evasions or avoidance, thereby ensuring stable national fiscal income and realizing tax justice.

Advances in technology, called the 4IR, provide many benefits to taxpayers and tax authorities as described earlier, but digitized government systems and personal information are vulnerable to cyber threats. Although both NTS and HMRC have formed a task force for cyber security and are preparing for various cyber-attacks under a cooperative system with the National Cyber Security Center, the international cooperation system of technologies to defend against cyber-crimes is needed as the intellectualization and internationalization of cyber-crimes are deepening.

The following suggestions have been put forward for the tax agencies of South Korea and the United Kingdom through their study of strategies and implementation of the fourth industry by digital government leaders UK and South Korea's taxation authorities.

In the case of NTS, there is a need to share with HMRC in three respects. First, in addition to the one-year time-contingent short-term strategy in terms of strategy, it is necessary to collect more than three years of long-term strategies that can be pursued with long-term vision, such as the UK strategy. Second, when it comes to big data, it is necessary to collect structured and unstructured data from various government departments, public institutions and private sectors as well as financial and financial-related government departments. Third, in order to prepare for various risks associated with cybersecurity, the method of coping with cybercrime, such as HMRC's scamming, should be benchmarked.

For HMRC, there are three points to share from NTS: First, short-term strategic settings are needed to actively respond to changes in economic and social situations each year, along with long-term strategies on the strategic side. Second, it is necessary to quickly respond to the changing technology environment by recruiting private big data professionals. Third, it is to strengthen the computer system and information protection by reviewing measures to separate the internal business network from the external network used by the taxpayer by establishing the special administrative network.

Among these proposals, the strategic aspect could be reflected if only the tax agencies of the two countries have a will. The big data and security sectors will have difficulty in fully applying the two countries' government systems, supporting legal systems, economic and social environments and computing systems. However, if the best practices of other countries are studied and applied according to the situation of each country, it will help the administrative development of each country.

As for AI technology use cases, taxation authorities in countries around the world are establishing strategies to actively respond to rapidly changing technology and social and economic changes. The main goals are as follows. First, improving customer service using new AI technology, second, increasing work efficiency and reducing costs, third, detecting tax evasion using big data and AI technology, and improving compliance, and fourth, responding to data security and cyber-attacks. The tax agencies are striving to increase customer satisfaction by improving the quality of customer service through the above strategies, while at the same time reducing costs and increasing work efficiency. Apart from that it has been confirmed through examples of countries that governments and tax agencies in various countries are using chatbots and business support robots to achieve these goals.

Furthermore, in Korea, it has been known as a leader in digital government, but even in the private sector as well as in government and public institutions, the use of chatbots is not being activated and is in the introduction stage. In this regard, the differences in the use cases of other countries were compared with that of Korea's tax authorities, and the implications that would be helpful to the Korean government and tax authorities were reviewed.

First, it is necessary to introduce a government-integrated chat bot such as Singapore. The UK and Singapore provide information on government services in one place through an integrated government web page. On top of that, in Singapore, the chatbot function has been added to the government integrated website to respond to customers' questions quickly and conveniently. In Korea, chatbots are being promoted for each institution, so there is concern about duplicated investment, and it is inconvenient for customers to find the relevant institution in order to receive information about a specific service. In Korea, it is difficult to practice this right away, as there are websites for each institution. First of all, a realistic alternative would be to introduce a chatbot to a “government 24” website that integrates 282 services frequently used by customers, and gradually expand the integrated service.

Second, it is urgent to introduce a chatbot for customer consultation. The Korea National Tax Counseling Center was noted by the National Assembly in 2019 with a low customer response rate of only 50-60%. (NARS 2019). The Australian ATO has reduced 76% of the number of phone calls by introducing chatbots. (Accenture 2017). In Korea, all work is done in a computerized system, so data such as national tax consultation records are already established, so it will be possible to introduce chatbots early. However, since tax-related counseling deals with sensitive personal information, personal information protection measures should be considered when introducing chatbots.

Third is the introduction of chatbots and work support assistants to support internal work of employees. In the UK HMRC, chatbots are used to support employees' technical problems, and in the United States, NASA has introduced job bots to support repetitive and simple administrative tasks, creating an environment where employees can focus on more complex and important tasks. . With the introduction of chatbots and business support assistants, it will increase efficiency in tax affairs that require complex and diverse tax knowledge and experience.

Fourth, it is necessary to form a team for governance, such as introducing new technologies and preparing AI ethics and safety guidelines. The introduction and use of new technology require a long-term design, such as a huge budget and requires specialized technical personnel, and it is necessary to lead the change of national tax administration in line with new technology trends. It is necessary to monitor the new technology through interaction with the technology provider to review the need for adoption. In addition, governments and tax authorities in each country have established ethical guidelines such as privacy infringement and prevention of damage caused by AI misuse. NTS will need to set AI ethics and safety guidelines and develop an AI initiative that includes ethical training for employees.

The above proposals will help improve the efficiency of the government of the Korean government as well as the National Tax Service and improve the quality of customer service. However, this research paper was reviewed mainly on the introduction of chatbot technology. In the field of data analysis and investigation, studies were not conducted due to lack of literature and use cases.

Additionally, the computer system and electrical information of the government and taxation authorities are sensitive sectors, and public data on this part may be at a rough level. Therefore, there was a limit to the data collection because the collection of necessary evidence was only made within the scope of public disclosure by the two governments, which were collected on government websites, EU, OECD, and external presentation data.

Also, this study focuses on e-government and chatbot cases to increase efficiency in government and to enhance customer convenience in response to the 4IR. A comprehensive approach should be developed through research on various governmental roles to promote the development of various new technologies that brought about the 4IR and cope with the side effects. Also, as the wave of the fourth transformation of the industrial revolution is a common problem facing the world, it is necessary to study international best practice in various aspects as well as the UK and South Korea digital government and chatbot cases mentioned in this paper.

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