論　説

Artificial Intelligence and Lessons from Japan's Public Sector

Susumu Kamimura

Author Note

Susumu Kamimura is a professor of the College of Law at Nihon University. Before 2016, he worked in the government of Japan for over 30 years, mainly in the fields of Public Administration, Policy Evaluation, and e-Government. His last government post was as the Director-General of the Administrative Management Bureau, Ministry of Internal Affairs and Communications (MIC).

This article is based on a paper presented at the International Conference on Digital Social Sciences, Humanities, and Education held at Yogyakarta State University from September 4 to 5, 2018.

Correspondence concerning this article should be addressed to Susumu Kamimura, Department of Law, Nihon University, 2-3-1 Kanda-Misaki-Cho, Chiyoda-Ku, Tokyo, 101-8375 Japan. Contact: kamimura.susumu@nihon-u. ac.jp

Abstract

Despite the numerous benefits anticipated from using Artificial Intelligence (AI), this technology has not been fully implemented in the public sector, although AI has the potential to reduce administrative costs while providing more timely and effective responses. This paper clarifies the reasons

for this relative delay in Japan's private sector by classifying the contributing factors into three categories. The first is *problems with e-government in general*. Multiple previous attempts to effect a highly digitalized and citizen-oriented government have failed, for reasons that include insufficient data management and the lack of Business Process Reengineering (BPR). The second category relates to AI-specific effects, such as the *black-box effect* or *lack of human feelings,* which could become an enormous disadvantage in a citizen-based government. The third category comprises factors characteristic of an administration engaged in *multistakeholder processes*, which include the need for accountability and responsibility. The logical and clear-cut solutions typically generated by AI are not always suitable in this context. This paper concludes that given these difficulties, even though AI represents a viable tool for achieving the long-desired more person-oriented government, at least in the near future, AI is unlikely to replace all human officials.

Artificial Intelligence and Lessons from Japan's Public Sector

Introduction

Artificial Intelligence (hereafter AI) is a popular theme for those who are interested in improving many aspects of our society. We encounter the word AI everywhere today, especially in the fields of medicine, education, e-commerce, and banking. In more familiar terms, we unconsciously use AI in our daily lives, for example when we use Google translator or Apple's SIRI. Compared to the private sector, however, we hear references to AI much less often in government or administrative fields. In Japan, we only hear about AI in reference to experimental attempts to use it. What can explain this difference between the public and private sectors? Are there any specific reasons that can explain this *phenomenon* logically?

As a former practitioner of e-government for over 30 years, the author is accustomed to hearing questions such as "Why is government always slow to introduce new technologies compared to the private sector?" With the dawn of the AI age, the number of times these questions are raised seems to have increased, and the cleavage between sectors has widened.

This paper, based mostly on Japan's experiences with AI, aims to clarify why governments have lagged in adopting AI technologies. It also presents some issues that must be overcome if we are to harness AI's potential for better governance in the public sector. The method used to conduct the research for this paper is largely based on a comparative study of Japan's e-government measures. Consequently, two research axes are presented in the following analysis:

Axis A: e-government (basic information technology (IT) usage)/AI (futuristic IT usage); and

Axis B: private sector (profit)/public sector (accountability).

Japan's E-government Efforts

Many criticisms can be leveled at the government administration's shortcomings. They include inefficiency, ineffectiveness, and sometimes the rude attitudes of its officers. Therefore, every government is eternally searching for a *magic wand* that will provide a solution for an accumulation of government problems. The e-government has introduced measures—such as the Japanese version of the national-ID system nicknamed *My Number*—that are thought to be relatively promising. These attempts have not always been fully successful, however, and the results of evaluations of these measures have in general been rather disappointing. In other words, they have failed to achieve expected outcomes such as greater efficiency in the ministry's work or improved customer-oriented services. All possible causes for these failures must be considered to achieve this paper's objective of clarifying the reasons

AI has not been fully implemented in the public sector.

AI and E-government (Axis A)

What is AI?

The definition we adopt for AI in this paper is the following:

AI is the field devoted to building artifacts capable of displaying, in controlled, well-understood environments, and over sustained periods of time, behavior that we consider to be intelligent, or more generally, behaviors that we take to be at the heart of what it is to have a mind. (Frankish et al., 2014)

More simply, AI is software that enhances and automates the knowledge-based work done by humans (Griffin & Green, 2016).

The key concepts to be considered here are the following:

1. AI manipulates data using computers and shares this functionality with Information and Communication Technology (ICT).

2. AI independently learns to identify processes and patterns. In particular, unsupervised AI machine learning is not restricted to following explicit rules or instructions from human beings to conduct this function. This is AI's main characteristic, and in this regard, it is very different from traditional ICT.

What is e-government?

The OECD has two definitions of e-government. The first is that e-government is "the use of information and communication technologies, and particularly the Internet, as a tool to achieve better government" (OECD, 2003). The second definition is that "e-government (understood as both ICT usage and its broad impact on public governance) has moved from being 'just another office tool,' through the phase of being a tool for transformation of the public sector, to becoming a key lever for innovation and change" (OECD, 2009).

AI does not change any of these concepts, but strengthens them in a broader sense. In particular, as OECD emphasized the significance of the paradigm shift from a government-centric system to a customer-centered personalized service and a citizen-centric service system (Kamimura, 2010), AI would be the most appropriate means of realizing this outcome, if only governments were able to draw on AI as the private sector does.

Elements of e-government and AI

AI uses the basic infrastructure and technologies prepared for e-government—such as the Internet, cloud computing, IoT, whole-of-government approach, big-data, and image processing—as its basis (Kamimura et al., 2012). AI also uses these elements while deploying cutting-edge technologies such as neural networking. The expected goals of e-government are the basic (and eternal) objectives of government reform, and do not differ greatly from AI use in general. They include the following:

- greater efficiency: more services that are delivered more efficiently and with greater accuracy
- better services: personalized services are available 24 hours a day, 7 days a week
- breaking silos: developing a whole-of-government approach and sharing data
- building trust: enhancing transparency and creating more direct interfaces
- reform oriented: reducing corruption and alleviating administrative procedural burdens
- contributing to economic reform: cutting costs and providing cheaper services (Japan's e-Government Initiatives, n.d.).

Differences Between Public-Private (Axis B)

An extensive body of politico-administrative literature analyzes the

characteristics of government relative to those of private organizations, and Table 1 below provides a simplified summary of these differences.

Table 1 *Differences between private/public sector working environments*[1]

Sector	Key factors	Engine	Governance
private	profit, competition, challenge	market mechanisms	shareholder control
public	accountability, transparency, fairness	rule of law	multistakeholder political control

These sectors have opposite mindsets. Failures are largely tolerated in private companies, and in some cases praised as a signal of the challenge-spirit. In the public sector, however, 100% certainty is required, and failure is not permitted. In addition, this sector does not always adopt economically-sound solutions, since political interference sometimes distorts market logic.

Merits of AI Usage in the Public Sector

Many countries now use AI in the public sector, albeit at a small scale, and numerous reports in the United States document the practical use of AI in the public sector (Chambers, 2015; Griffin & Green, 2016; NRI, 2017).These applications include urban planning, food poisoning detection, *e-raters* for university examinations,[2] assessing an inmate's risk of reoffending, previsioning the length of a patient's stay in hospital, making bail decisions, and previsioning the likelihood of criminal activities. (Williams et al., 2017).

An American research institute has summarized AI's expected benefits for government under four pillars: (i) predictive analytics, (ii) detection, (iii) computer vision, and (iv) natural language processing (Centre for Public Impact, 2017). Each pillar's basic function draws on the computer's capacity to identify, sort, and search for information in massive and complex datasets, on the basis of which AI grasps and judges a situation.

Predictive analytics is useful for policymaking in anticipation of future changes or trends. Detection is used to evaluate the possibility of abnormal events such as machine breakdowns or human wrongdoing, and identifying fraud in various administrative applications. Computer vision analyzes digital images for purposes such as face recognition and CT scan diagnoses. Natural language processing is used for translation or auto-responding call-centers, with appropriate responses to complaints or inquiries provided automatically. In other words, their functions involve reasoning, machine learning, robotics, natural language processing, perceiving objects, information storage, and speech and handwriting recognition (Russel & Norvig, 2013). Policymakers might also input multiple different parameters for an AI algorithm to identify both the best outputs under each set of parameters and optimum policy alternatives.

The benefits of AI for citizens include saving taxpayers' money, quicker responses, customized services, more effective outcomes, and accurate results. The benefits for officials include liberating human resources from tedious routine work for more valuable work. In other words, officials would have more time for normative judgments, instead of factual activities, and be able to concentrate on work that involves emotions and requires empathy or creativity (IAIS, 2016).

Japan's Experience: AI Use-Case in the Japanese Administration

Several AI experiments have been carried out at local and central government levels in Japan, but none has reached the operational stage.

Local Government's Experiences

In an experiment conducted by the University of Kyusyu and Fujitsu Co., the City of Saitama began using AI to gather data on family income, parents' working-hours, and nursery location preferences for nursery assignments. The results of this experiment showed that making nursery assignments, which had

previously required 30 officials to work 50 hours each, had been completed in several seconds, and produced the same results (Kyusyu University, 2017).

Kawasaki City conducted an experiment of *interactive FAQ services on administrative service procedures* using AI, which increased the likelihood of finding more appropriate answers by sorting and clustering a huge amount of information including *Frequently Asked Questions* (FAQ) stored on its website (Kawasaki-City, 2018).

Osaka city will use AI this year for family registration services, as a result of which officials are expected to make more accurate and faster judgments, regardless of their years of experience. During this experimental operation at two ward offices, the knowledge of complicated systems and experienced staff will be accumulated in AI (Osaka, 2018).

Since January 2017, the City of Chiba has used machine learning to automatically detect road pavement damage. This pilot project is being co-conducted with the University of Tokyo, and consists of the IoT system sending road images captured by in-vehicle cameras to a server, after which AI analyzes the degree of damage according to levels stipulated in each district's regulations (Chiba, 2018).

Central Government's Experiences

There are two major examples of planned AI use in the central government. The National Tax Agency (NTA) is planning to introduce new inquiries and survey selection systems using AI. These measures are expected to facilitate more advanced and accurate research for detecting delinquencies and frauds (NTA, 2018). The second example is provided by the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), which will use AI to assess the usefulness of area pricing. Specifically, AI learns and analyzes the occurrence of previous traffic congestion, assesses changes in traffic, and predicts future traffic congestion (MLIT, 2018).

Future Expectations

In Japan's central ministries, two areas are thought to involve the most tedious and time-consuming tasks and require enormous manpower: preparing for parliamentary questions and drafting bills. A report on an AI assisted parliamentary-answering system showed that despite many favorable conditions for the use of AI in this field (such as the accumulation of enormous data sets in the forms of minutes and parliamentary records), the results were disappointing. AI served as an excellent search engine, but failed to grasp the meanings of lawmakers' fuzzy questions, or the underlying intent of ministers' ambiguous and equivocal answers (NRI, 2017).

The IAIS report confirmed that since AI was also performant in legal analysis (Ashley, 2017), it could greatly reduce the workload involved in drafting bills if it could correctly estimate the consistency between related laws, or eliminate contradictory words and phrases. It might also offer impact simulations that illustrated the effects of new legislation. This remains an idea, however, and actual implementation has not yet been initiated.

Issues to be Solved

To answer this paper's main question—why has AI usage not progressed in the Japanese Public sector—it may be helpful to classify the reasons for this outcome into three categories: problems with e-government in general, AI specific problems, and characteristics of government.

Problems with e-government in General

As already stated, AI will not be effective if there is no solid basis for e-government. The first point is about data. In Japan, the so-called *once-only principle* has never been realized, despite repeated government promises.[3] This failure can be attributed to data management problems. To achieve a whole-of-government system, data formats must be aligned across each section. This condition is hard to meet, however, because of a data silo situation that reflects

the insular management of government's data systems. Further, there are many unstructured data sets and relatively small amounts of machine-readable data within the administration.[4] Thus, managing the existing data and gathering immense amounts of preliminary data is problematic.

The second factor is a lack of BPR (Business Process Reengineering) of government's business. No government section has been able to shift all its operations from paper-based to digital, which is why online administrative service rates remain at only 46%, while the target rate for 2021 is 70%. In addition, the shared government human resources management (HRM) and payroll system has never been operational, because the ministries did not adapt to a shared service system. Consequently, this system was stopped and completely reviewed.[5]

The third reason for the lack of a solid base for e-government is a shortage of IT skills. IT-workers account for only 1.8% of all workforces,[6] compared to 5.2% in the UK, and 3.0% in the United States. The Ministry of Economy, Trade and Industry estimates that the number of IT workers needed in Japan will be about eight hundred thousand.[7]

The privacy issue is another factor. Japanese people are extremely sensitive to a lack of privacy, and that is the main reason Japan does not have a true national ID system, and its partial substitute—*My Number*—has not been fully implemented. An AI-powered precise identification of personal features will not be readily tolerated.

Officials' reluctant attitudes toward the new technologies are the last point here. The National Social Insurance Agency's labor union strongly resisted the introduction of a computer system, which led to a delay and inaccurate pension payments.[8] Fear of unemployment was one reason for this incident. Since Oxford University predicted that 47% of jobs were at risk of replacement by 2030, including those of many middle-class professions, because of computerization (Frey & Osborne, 2013), their concerns may be valid.

Specific AI Problems 1: Black-Box Effect

Two main characteristics of AI must also be noted as problematic. The first is what the IAIS report called the *black-box effect* (IAIS, 2016), which means that machine learning—and especially Deep Learning—cannot be observed from the outside, and a machine cannot explain why it has reached one solution and not another one.

The author thinks this is the most likely reason AI has not been deployed in the public sector, where *transparency* and *accountability* are often more important than *efficiency* or *low-cost*. This point will be discussed in more detail later in this paper.

Specific AI Problems 2: Lack of "Human Feelings"

As a natural consequence of the black-box effect, AI results do not convey any emotion or empathy, which may be one reason administrative jobs related to the human interface with the clients will not disappear in the near future. With regard to these tasks, there are many illogical inquiries, inconsistent complaints, and background situations that are not evident from official application forms. All these cases require human imagination and insight to be resolved, in fields that may affect basic human needs, rights, and duties such as social welfare and education. In sum, the Japanese public and an aging population are not comfortable with non-human AI interactions.

Characteristics of Public Administration

As shown in Table 1, there are some clear differences between public and private sectors' characteristics. First, decisions made by governments are not as logical as those made by private enterprises. Government's decisions often rely on power balances between multiple stakeholders, and have to take into consideration many elements such as social backgrounds, human relationships, conflicts between social classes, and vested interests. It is naïve to suppose there are optimal solutions, in the sense of economics, statistics, or utilitarian theories.

As for accountability, questions such as "can AI take responsibility for its solutions?" may be asked. If AI produces incorrect results, as in cases of incorrect diagnostics or pointless recommendations, who would be responsible for the resulting damages? Can politicians or government officials refuse to take responsibility for these failures? The IAIS report concluded that AI was only useful for suggesting candidates or alternatives for a final decision. This decision could not to be left to AI, since it could not present the evidence-based proof necessary for government decisions (IAIS, 2016). The issue of public acceptance also remains. Even if the results produced by AI are identical to those produced by humans, as was almost the case for the above-mentioned e-rating in the United States or the nursery assignment in Saitama, the author posits that citizens retain some uneasy feelings about AI judgments. Apart from the arguments that somehow exaggerated anxieties over *superintelligence* (Bostrom, 2014) or *singularity* (Kurzwell, 2006), we must not forget the potential antipathy felt toward computers that exceed human comprehension and work autonomously, outside human control.

Conclusion-Implications

Based on instructions issued by the Prime Minister in his *Public-Private Dialogue Toward Investment for the Future* in April 2016, the Japanese government established the *Strategic Council for AI Technology*. This Council, acting as a control tower, is tasked with promoting AI use in Japanese society and industry. Here, AI is regarded as a panacea for overcoming the multiple difficulties faced in this country, namely managing populations, declining productivity, and budget deficits (Strategic Council for AI Technology, 2017). AI, however, does not hold promise for improving the public sector— something that was not mentioned in the Council's report—for reasons stated above.

As the author has indicated, AI is a component of e-government measures,

and unless the sources of e-government's failures are addressed, AI will follow the same path. In addition, AI has specific characteristics, such as the black-box effect and the lack of feeling, which might be suitable for scientific research or business/market analysis, but not for daily administrative activities. For the latter, issues of accountability, transparency, and responsibility are key public sector elements that differ considerably from issues in the private sector. The government must also have a strong capacity for empathy and imagination to respond to each citizen's needs.

AI seems to bear a double burden (the derivation of e-government and problems specific to AI) when being adapted to the government's business, and at least in the short-term, it is unlikely that AI will assume many human roles in the public sector. We should not, however, forget the expected benefits of AI. The OECD has stated that the ultimate objective of e-government is to create a true citizen-oriented government (OECD, 2009). Well-managed AI is very likely to attain this goal, which has not yet been achieved by previous measures. A government that successfully leverages AI will be able to identify each citizen's needs and situations more effectively than it had on previous occasions. Drawing on big data, AI could facilitate tailored and much more personalized services in fields such as welfare payments, immigration decisions, and responding to citizens' queries. At the same time, new legislation or guidelines will be needed to manage AI specific issues such as the black-box effect, unfeelingness, and the lack of accountability (Yanaga & Shishido, 2018). Without these frameworks, the fears and anxieties associated with AI use will remain perpetual hindrances to harnessing its potential powers.

A well-known AI architect—John Giannandrea, Apple's Chief of Machine Learning and AI Strategy—said recently that the nature of AI is not to match or replace humans.[9] The clever and well-managed use of AI in government might well lead us to a future in which governments operate somewhat more

efficiently and somewhat more effectively. In a best-case scenario, it will liberate officials from tedious routine work, freeing them up for more human based and creative tasks. Once work-sharing between humans and AI is achieved, there will be considerable hope for achieving an improved and more citizen friendly government in the future.

1 Table created by the author.

2 In 2012, an AI-powered "e-rater" assessed 16,000 essays in 20 seconds and demonstrated the same level of accuracy achieved by human evaluators (Winerip, 2012).

3 The once-only-principle reduces paperwork by requiring people and businesses to provide information on multiple administrative procedures, such as moving and founding a company, to the government only once.

4 In 2016, the Japanese government launched a so-called E-Laws Project/ Legislative Activity and Work Support System in which all legal texts are provided in XML format. Prior to this change, these texts had not been standardized and were not machine-readable.

5 Revised Optimal Plan for the HRM and payroll system. February 2017.

6 Annual Report on the Japanese Economy and Public Finance 2018, Cabinet Office.

7 http://www.meti.go.jp/committee/kenkyukai/shoujo/daiyoji_sangyo_skill/pdf/001_s03_00.pdf

8 *Report of the Inspection Commission on the National Pension Records Problems*. 2007. Ministry of Internal Affairs and Communication (in Japanese).

9 *Financial Times* April 7/8, 2018 "*Type of artificial intelligence.*"

References

Ashley, K. D. (2017). *Artificial intelligence and legal analytics: New tools for law practice in the digital age*. Cambridge: Cambridge University Press.

Bostrom, N. (2014). *Superintelligence: Paths, dangers, strategies*. Oxford University Press.

Center for Public Impact. (2017). *Destination unknown: Exploring the impact of artificial intelligence on government*. Retrieved July 26, 2018 from https://resources.centreforpublicimpact.org/production/2017/09/Destination-Unknown-AI-and-government.pdf

Chambers, J. (2015). *Automatic for the people: How global governments are using AI. Civil Service World*. Retrieved July 18, 2018 from http://www.civilserviceworld.

com/articles/feature/automatic-people-how-global-governments-are-using-ai

Chiba. (n.d.). (Online). Retrieved July 26, 2018 from http://www.city.chiba.jp/somu/ shichokoshitsu/hisho/hodo/documents/160119-03-01.pdf (in Japanese)

Frankish, K., & Ramsey, W. R. (2014). *The Cambridge handbook of artificial intelligence*. Cambridge: Cambridge University Press.

Frey, C. B., & Osborne, M. A. (2013). *The future of employment: How susceptible are jobs to computerization?* Retrieved July 26, 2018, from https://www. oxfordmartin.ox.ac.uk/downloads/academic/The_Future_of_Employment.pdf

Griffin, C., & Green, A. (2016). *Advanced science and the future of government.* Retrieved July 26, 2018 from https://www.cs.cityu.edu.hk/~hwchun/doc/news/ Advanced_Science_future_of_gov_en.pdf

IAIS (Institute of Administrative Information Systems). (2016). *Research on the use of artificial intelligence in the public administration*. Tokyo: IAIS (in Japanese).

Japan's e-Government Initiatives. (n.d.). (Online). Retrieved July 26, 2018 from http://www.e-gov.go.jp/en/e-government.html

Kamimura, S. (2010). The definitions of e-government and its paradigm-shift. *Kikan Gyousei Kanri Kenkyu, (131),* 29–42 (in Japanese).

Kamimura, S., Takahashi, K., & Doi, R. (2012). *On e-government (E-government ron)*. Tokyo: Sankei-sya Press (in Japanese).

Kawasaki City. (2018). *Report on the experiment for the AI inquiry assistance services*. Retrieved July 26, 2018 from http://www.city.kawasaki.jp/170/ cmsfiles/contents/0000086/86637/AI0306.pdf (in Japanese)

Kurzwell, R. (2006). *The singularity is near: When humans transcend biology.* Penguin Books.

Kyusyu University (in Japanese). Retrieved on July 26, 2018 from http://www. kyushu-u.ac.jp/f/31361/17_09_01.pdf

MLIT. (n.d.). (Online). Retrieved July 26, 2018 from http://www.mlit.go.jp/road/ir/ir-council/keizai_senryaku/pdf07/3.pdf (in Japanese)

NTA (National Tax Agency). (2018). *The recent efforts on "The future image of tax administration."* Retrieved July 26, 2018 from https://www.nta.go.jp/ information/release/kokuzeicho/2017/syouraizou/pdf/syouraizo_3006.pdf

NRI (Nomura Research Institute). (2017). *Report on the utilization of artificial intelligence for administrative affairs (Research consigned by Ministry of Economy, Trade and Industry)*. Tokyo: NRI.

OECD. (2003). *The e-Government imperative*. OECD e-government studies.

OECD. (2009). *Rethinking e-government services*. OECD e-government studies.

Osaka. (n.d.). (Online). Retrieved July 26, 2018 from http://www.city.osaka.lg.jp/ hodoshiryo/seisakukikakushitsu/0000423679.html (in Japanese)

Russell, S., & Norvig, P. (2013). *Artificial intelligence: A modern approach* (3rd ed.).

Prentice Hall.

Strategic Council for AI Technology. (2017). *Artificial intelligence technology strategy*. Tokyo: Cabinet Office. Retrieved July 26, 2018 from http://www.nedo. go.jp/content/100865202.pdf

Yanaga, M., & Shishido, J. (2018). *AI, robotics and legislation.* Tokyo: Yuhi-kaku.

William D. Eggers, W. D., Schatsky, D., & Viechnicki, P. (2017) *AI-augmented government-Using cognitive technologies to redesign public sector work.* Retrieved July 26, 2018 from https://www2.deloitte.com/content/dam/insights/ us/articles/3832_AI-augmented-government/DUP_AI-augmented-government. pdf

Winerip, M. (2012). *Facing a robo-grader? Just keep obfuscating mellifluously, April 22, 2012.* Retrieved July 26, 3018 from https://immagic.com/eLibrary/ ARCHIVES/GENERAL/GENPRESS/N120422W.pdf