The Principal Japanese AI and Robot Law, Strategy and Research toward Establishing Basic Principles

慶應義塾大学総合政策学部教授
新 保 史 生
SHIMPO Fumio

1. Introduction

The evolution of Artificial Intelligence (AI), is rapidly advancing. If we fail to scrutinize the new information security countermeasures for the use of intelligent robots and artificially intelligent entities or if we fail to scrutinize the legal issues accompanying the spread of consumer electronics, robots equipped with AI, and cars that operate as highly automated vehicle systems, the types of security problems which have impacted the development of the Internet could arise again in other, new contexts that involve artificial intelligence. Surely, there is a fear that this danger will spread beyond the problems within 'virtual spaces' (such as the Internet), and present threats which will dramatically raise the likelihood of physical danger resulting from the actions caused by AI.

The possibility of an AI running out of control and posing a danger to humans has been noted as one of the potential threats posed by robots that are becoming more and more autonomous. This is precisely the threat which has been depicted in movies. However, it is currently believed that a considerable amount of time is still needed for AI to evolve to the point where it is self-aware enough to spontaneously take defensive actions on behalf of itself or others. It must be stressed that at this moment in time, the possibility of this kind of threat immediately becoming a reality is thought to be low.

In this paper, I will introduce the recent Japanese AI and Robot Law and Strategy toward establishing Basic principles and research trend in Japan[1].

2. The Relationship Between Robots, Artificial Intelligence and the Internet of Things

A society which connects to networks anywhere and at any time should be termed a 'Ubiquitous Network Society' (UNS). In addition, a society which uses robots and AI, without a 'conscious awareness' of the robots themselves should likewise be called a 'Robot Coexistence Society' (RCS). Robots do not have self-consciousness at this moment in time. People have doubts about whether robots are capable of having self-consciousness. For example, automated driving cars are indistinguishable from cars in general and therefore, in terms of self-consciousness, it is clear that they cannot make moral choices like human-beings are able to. Additionally, a robot coexistence society is a society characterized by human-robot symbiosis which uses autonomous AI equipped robots routinely connected to networks in various contexts, and thus can be termed a Ubiquitous Robot Society.

In other words, what needs to be examined and explored with Robots and AI related legal issues is the response to the new issues which will arise with the spread - through the combination of robots, AI, and the Internet of Things, (IoT) - of autonomous robots. The response of the legal professionals will be based on their current knowledge of the law regarding both current and future legal issues. However, the general public must be allowed to comment on

1) *See also,* Fumio Shimpo, *Japan's Role in Establishing Standards for Artificial Intelligence Development*, The Carnegie Endowment for International Peace on Artificial Intelligence (AI) Development and Alliance Engagement (January 2017) 〈http://carnegieendowment.org/2017/01/12/japan-s-role-in-establishing-standards-for-artificial-intelligence-development-pub-68311〉.

non-legal issues such as on the morality of the use of the robots; the most obvious being the use of sex robots. A legal response is also needed for cases in which major societal or systemic reform is required to address the use of robots that are gaining in intelligence. Thus, Robot Law[2] needs to consider the ideal forms of legal and social systems in a Robot Coexistence Society and Ubiquitous Network Society. As far as the fundamental principles of law and legal thinking are concerned, the debate over new problems involving AI and autonomous robots use may possibly spark a paradigm shift in law. The problems caused by autonomously operating robots may not be able to be resolved using the current standards and legal systems which were developed originally for the industrial robots operated by humans and performed within the scope of a programmed machine.

It is crucial for the law to examine which party in the design, development and use of autonomous entities will bear which specific type of legal liability in the event of problems or damages resulting from the incorrect operations of an AI's 'autonomous decision'. For example, the premise underlying liability for illegal actions under Tort Liability has been such that it is possible to foresee the results which could occur from accidents. However, currently, based on the Japanese Civil Law and the Product Liability Law, it is difficult to impose a burden of proof of liability on developers or manufacturers for the actions automatically triggered by an AI because they exceed the scope of human control. In this case, while we must consider who should be the party bearing product liability or strict liability as is currently understood under Tort Law, legal scholars should also question the use of product liability related to damages resulting from an autonomous decision made by AI. Given that we can question the imposition of liability if an incident results from a defect in a robot operating with AI, it is unlikely that the robot with AI will be able to implement any preventative countermeasures in advance to mitigate the effects of such defects because of its autonomous nature. In addition, the current legal system may not have the mechanisms to resolve issues of liability for damages due to a runaway or uncontrollable AI. Furthermore, it is to be expected that robots will be connected to networks and routinely used in a wide variety of objects and locations as the IoT expands. Thus, there will be an expected increase in the various problems in daily life caused by autonomous robots connected to such networks and unevenly distributed throughout nearby familiar places.

The evolution of AI has been remarkable in the last few decades and now we see the arrival of a so-called 'Third-Generation AI Boom'. Consumer electronics and home appliance products controlled by AI are also emerging. The development of an Highly Automated Vehicle (HAV) is also advancing with automated driving systems controlled by an AI operating in place of a human driver. These cars have also become 'connected cars', being connected to 5G networks through the IoT. One of the main concerns accompanying the evolution of AI, are the fears that autonomous AI will spontaneously choose to threaten humans, as dramatized in the movie 'Terminator'. However, this will not become a real problem in the foreseeable future until AI advances to the point where it becomes cognizant of its own existence and 'aware' of the necessity of eliminating threats to itself. However, it may be necessary to examine a malfunctioning of an autonomous Robot or runaway AI as a problem which could become an immediate threat. Additionally, a major consequence of the new technical applications of AI is the issue of 'function creep' in which the functions for achieving an original purpose at the time of design come to be used for different purposes. On this point, there is a high possibility that AI which has evolved through deep learning will produce unforeseen results due to the principle of function creep.

One example of a legal issue pertaining to function creep is illustrated in the following case: after identifying the cause of an error occurring in a service which performs Biometric automatic authentication via facial recognition equipment, it came to light that

2) *See*, Ugo Pagallo, The Laws of Robots - Crimes, Contracts, and Torts (2013) (The Japanese edition of The Laws of Robots was translated by Fumio Shimpo, Takayuki Matsuo, Ikuko Kudo, Ryota Akasaka and published from Keiso Shobo in 2018), Ryan Calo, A. Michael Froomkin, Ian Kerr, Robot Law (2016).

an error was triggered by skin color; i.e., the service unintentionally reacted to information related to race. This error resulted in unintentional racial discrimination. Although facial recognition software is designed to be racially neutral, its operation ultimately led to discriminatory practices due to the unexpected error produced by algorithms. This rather complicated issue, with constitutional law implications, differs from the more straightforward legal problem of misuse where objects are used for purposes other than their original purpose (such as HAV being used for suicide bombings).

3. The Definition of a Robot in Japan

As a precondition for discussing Robot Law and confirming that Robot Law relates to AI because robots are increasingly equipped with more and more AI, it may be need to have a clear legal definition of 'Robots' which are therefore subject to this law.

The Japanese AI strategy has a close relationship with Robot Strategy and the related legal issues are considered not only that of the use of AI independently but also of autonomous robots with AI use in the Internet of things (IoT). Actually, there is also no clear definition of AI in law, in any regulation or in any standards in Japan. This is because concerns about robots equipped with AI are provided for under the current law and regulations.

As noted, in Japan, several definitions of the term Robot are currently used. In the Japanese Industrial Standards JIS B 0134:2015[3], 'Robots and Robotic Devices: Vocabulary' (The definitions of the terms used here are related to robots and robotic devices operating in both industrial and non-industrial environments). An 'industrial robot' is defined as a 'machine used in industry which has manipulation and movement functions through automatic control and which can perform all varieties of operations by means of programs'. Furthermore, the ISO 8373 defines a robot as an 'actuated mechanism, programmable in two or more axes, (4.3), with a degree of autonomy, (2.2), moving within its environment, to perform intended tasks'[4].

The '2016 Report of the Research Council on Robotics Policy' issued by the Japanese Ministry of Economy, Trade and Industry (METI) attempted a systematic definition of the term Robot by proposing three conditions which robots must satisfy to be called robots. They must have: a) 'sensors'; b) 'intelligence/control systems'; and c) 'drive systems'. In short, robots could be appropriately defined as 'intelligent mechanical systems'. The report further attempted to subdivide the 'next-generation robots' into two subtypes: (1) 'next-generation industrial robots', those which can replace humans and/or work in cooperation with humans in multiple types of variable production, and, (2) 'service robots,' those which coexist with humans in places such as the home or service businesses, while providing services related to diverse applications, such as cleaning, security, welfare and well-being, life support and amusement.

An additional definition of the term Robot comes from the Patent Office in Japan. Robot technology is broadly classified into 'component technologies which comprise the fundamental technologies upon which a robot is built' and 'applied technologies which are necessary when actually utilizing a robot'. Component technologies are further divided into five major categories: 1) overall structural technologies; 2) partial structural technologies; 3) control technologies; 4) intelligent technologies, and 5) communication technologies.

In addition, 25 intermediate categories are set within these 5 major categories. Furthermore, applied technologies are divided into three intermediate categories and 33 individual subcategories. Notably, these definitions are changing. In the 2001 'Study Report on Technology Trends in Patent Applications', a robot was defined as a 'machine which possesses manipulation functions', or a 'machine which has movement functions and possesses functions to independently obtain external information and determine its own actions'. Next, the 2006 Study Report additionally defined a robot as a 'machine which

3) Industrial robots are defined in 'ISO 8373:2012' ('Robots and Robotic Devices: Vocabulary, IDT'), on which the JIS B standards are based.

4) ISO 8373:2012, 2.6 robot 〈https://www.iso.org/standard/55890.html〉, 〈https://www.iso.org/obp/ui/#iso:std:iso:8373:ed-2:v1:en〉.

has communication functions and possesses functions to independently obtain external information, determine and then take its own actions'. Thus, machines which converse with people started being treated as robots, even if they lacked movement or manipulation functions.

There is no clear definition regarding AI in law, regulation and any standards in Japan. On the contrary, the definition of a robots which will be able to equip with AI is a provided by Law and regulations. As noted above, robots, according to the above mentioned definitions given by METI[5] (a) 'sensors'; b) 'intelligence/control systems'; and c) 'drive systems'), require sensors, intelligence/control systems and drive systems. As such, by using intelligence/control system applications which move objects via smartphone sensors, we are now able to move connected devices even if they lack drive systems. Moreover, these changed definitions also include objects which function as robots only in terms of their intelligence/control systems, such as conversation robots which operate through AI. In other words, the progress of AI and the spread of the IoT have led to the emergence of robots which do not conform to the existing definition. Thus, despite the existence of a clear definition for industrial robots, no definition exists for general-purpose robots. Robots which do not conform to the conventional definitions of robots could be expected to proliferate in the future[6].

4. Governmental Policy Trends regarding Robot

4.1 The Industrial Background of the Current Japanese Robot Strategy

The necessity for Robot Law linked to the Japanese industrial policies is obvious and it is equally necessary to recognize that a 'Fourth Industrial Revolution' and 'Society 5.0' will be accompanied by a major reform in our society and within the legal system in general.

Japan holds a high share of the market for industrial robots and according to a 'Results of Trends Survey on the Robot Industry Market[7] ', the global market for industrial robots has grown by approximately 60% during the last five years in terms of monetary value. World Robotics 2016 Industrial Robots[8] indicated that in 2015, robot sales increased by 15% to 253,748 units, again by far the highest level ever recorded for one year. The main driver of the growth in 2015 was the general industry with an increase of 33% compared to 2014, in particular the electronics industry (+41%), metal industry (+39%), the chemical, plastics and rubber industry (+16%).

The scale of the Japanese Robot market was approximately 630 billion (JPY), (approximately 4.8 billion (EUR)), in 2015. Although the Japanese market has contracted by approximately 25% during the last five years in terms of the number of units produced, it still maintains its status as the largest market provider in the world. However, the Chinese market has roughly quadrupled during the past five years and in terms of the number of units produced, it is growing at a rate which is catching up quickly with current Japanese production[9].

The basic policy regarding the utilization of AI and robots was announced as 'The New Robot Strategy' ('Vision, Strategy Action Plan')[10]. This policy was issued on 10th February, 2015 following a decision of The Headquarters for Japan's Economic Revitalization at 'The Fifth Public-Private Dialogue towards Investment for the Future' on 12th April, 2016, goals for the research and development of AI and a roadmap for its industrialization were decided

5) '2016 Report of the Research Council on Robotics Policy' issued by the Japanese Ministry of Economy, Trade and Industry.

6) Takato Natsui *"The End of Asimov's Principle - Possibility of Robot Law"* Horitsu Ronso (The Law Diagram) Vol. 89, No. 4・5 Merger Number (2017)(in Japanese).

7) The Japan Machinery Federation, The Research report on Promotion of Robot Industry and Technology, 〈http://www.jmf.or.jp/content/files/houkokusho/27nendo/27jigyo_06.pdf〉.

8) World Robotics Industrial Robots - International Federation of Robotics 〈https://ifr.org/worldrobotics〉, Executive Summary World Robotics 2016 Industrial Robots 〈https://ifr.org/img/uploads/Executive_Summary_WR_Industrial_Robots_20161.pdf〉.

9) Id, PP.3–9.

10) Headquarters for Japan's Economic Revitalization, *New Robot Strategy*, Ministry of Economy, Trade and Industry of Japan, October 2, 2015 〈 http://www.meti.go.jp/english/press/2015/pdf/0123_01b.pdf〉.

upon. The New Robot Strategy was created by the Robot Revolution Realization Committee[11], which was established by the Cabinet Secretariat, in cooperation with the Japanese Ministry of Economy, Trade and Industry, (METI). The strategy's distinctive features are that it broadly and flexibly outlines the concept of robots in general without limiting itself to the conventional industrial robots of the past.

4.2 The Background of the Strategy

Regarding the background of 'The New Robot Strategy', there are the serious issues of a declining birth rate and ageing society which are progressing at an unparalleled rate worldwide and thus Japan has become one of the first among other nations to encounter the associated challenges of a decline in the number of the working-age population, a shortage in labor, and higher social security costs. The number of senior citizens aged over 65 and above hit the record-high level of over 34.6 million as of 18th September, 2016 equaling 27.3%[12] of the total population of Japan, (The So-Called 'Population- Aging Rate').

4.3 The Robot Revolution

The aim of the Robot strategy is to achieve ultimately a robot revolution and so the strategy refers to the significant and consequential changes which will be caused by a robot revolution which are listed as follows:

1) turning what was not originally to be positioned as robot in conventional manners into robots through the advancement of sensor and AI technologies, (e.g., automobile, household appliance, mobile phone or housing will be considered a type of robots.);
2) utilizing robots in the actual site of manufacturing as well as various scenes of daily life which leads to the last point;
3) forming a society where new added value, convenience and wealth are created through the reinforcement of global competitiveness in the fields of manufacturing and service as well as the derivation of social issues.

Japan's Robot strategy mentioned some factors for achieving a robot revolution. In the course of a transformation into 'flexible robots with universal user-friendliness', the making of 'module-driven robots' is one of the objectives which will begin a process which will end ultimately with the creation of a 'mainstream robot model' utilizing a common platform, catering to diverse needs through different module combinations. These module-driven robots equipped with AI will be linked to IT-integrated ones which will meet the demand for the creation and utilization of robots equipped with such functionality as, 'Autonomy', 'Data-Terminals' and 'Networks'. Moreover, the strategy insists that robot concepts must be developed further in order to maximize a continuing trend of new innovation through ever more flexible approaches to robot concepts. In contrast to the conventional viewpoint of seeing robots simply as machines equipped with three basic, systematic elements of sensor, intelligence/control and actuator[13]. However, via the advancement of digitalization, the diffusion of cloud computing and the progress of AI, robots will be driven by independent intelligence/controls based on an AI-enabling access to many and various people groups and also by 'objects' in a real world, without the help of a specific actuation system[14].

4.4 The Three Pillars toward The Robot Revolution

Japan's New Robot strategy is built on the following three 'pillars':

1) a global base for robot innovation; i.e., a significant reinforcement of robot creativity;
2) (Japan becoming) the world's leading society in the sector, maximizing robot capacity and show-

11) The Robot Revolution Realization Committee 〈http://www.kantei.go.jp/jp/singi/robot/〉.

12) MIC, *The statistics from elderly people in Japan (over 65 years old) - named after 'Respect for the Aged Day'*, 〈http://www.stat.go.jp/data/topics/pdf/topics97.pdf〉.

13) This concept and definition is provided the Japanese Industrial Standards (JIS).

14) The strategy give an example of such system as developing and offering sensor and intelligence/control systems alone is sufficient for robots to function such as loading drive application on smart phone OS (iOS or Android) for smart phones to function as remote controller device.

casing the realization of daily life with these robots;

3) (Japan being) the world leader in developing this strategy for a new and worldwide robot era.

In attempting to build these three pillars, this strategy provides an 'action plan: the five-year plan', and following this, 'The Robot Revolution Initiative[15] (RRI)', which was established to serve as the focus for the wide-range of stake holders who want to promote Japan's Robot Strategy. The RRI will not only have the required implementation status of underpinning governmental policy but also it will be supported by the large number of related stake holders whose economic aim is achieving the targets of the New Robot Strategy.

5. Policy Regarding AI

5.1 The 5th Science and Technology Basic Programme (2016-2020)

The Council for Science, Technology and Innovation, a Cabinet Office of Japan issued 'The 5th Science and Technology Basic Programme 2016-2020[16], on 22nd January, 2016. This basic programme stated clearly and forcefully that AI technology will play an important role for accelerating industrial promotion strategy in realizing 'Society 5.0'[17]. In this envisaged society, the relationship between science and technology will play a major role in innovation and the development of a worldwide society. Consequently, ethical, legal and social efforts must be made to solve the inevitable problems which will occur in the age of an AI era. In addition, this plan advocated the conducting of strategic and relevant research under the cooperation of the related governmental Ministries with an aim of strengthening common fundamental technologies and human resources by clarifying what are precisely the AI technical issues needed to have a 'society 5.0, (the super smart society)'.

5.2 Considerations of the Ministry of Internal Affairs and Communications, (MIC)

Regarding AI policy considerations, The Ministry of Internal Affairs and Communications began its deliberations in February 2015. In the initial policy aspect discussions, the first step was to recognize the need for future long-term investigations towards the 'Technological Singularity'. February 2016 witnessed the continuation of discussions via 'The Conference on the AI Networking'. The conference issued its 20th June, 2016 report 'The Impact and Risks of AI Networking - Issues for the realization of A Wisdom Network Society', (WINS)[18]. The report was the first systematic review of AI networking issues in Japan. Referring to the OECD guidelines governing privacy and security, it became necessary to begin discussions and considerations toward formulating international guidelines and principles to govern the R&D of AI. This report focused on: (1) risks related to function, legal systems in general and individual rights and interests; (2) AI network development and risk emergence; (3) predictable risk and uncertain risk.

In this report, WINS focused firstly on how 'wisdom' should be conceived as both an aspirational goal for society and as a guide for a 'sophisticated information communication network society and knowledge society'. Secondly, the report also evaluated the impact of AI networking on the 'public arena' (towns), 'life arena' (people) and the 'industrial arena' (jobs) from the 2020's to the 2040's. Thirdly, the report also designed a framework for studying

15) The Robot Revolution Initiative 〈https://www.jmfrri.gr.jp〉.

16) Fifth Science and Technology Basic Plan (Cabinet decision on January 22, Heisei 28) 〈http: //www8.cao.go.jp/cstp/kihonkeikaku/index5.html〉.

17) The meaning of the term 'Society 5.0' is the new society created by transformations led by scientific and technological innovation, after hunter-gatherer society (Society 1.0), agricultural society (Society 2.0), industrial society (Society 3.0), and information society (Society 4.0). Council for Science, Technology and Innovation Cabinet Office, Government of Japan, Report on the 5th Science and Technology Basic Plan (December 18, 2015) P.13.

18) Ministry of Internal Affairs and Communications, Telecommunications Research Laboratory The Conference on the AI Networking, *The Impact and Risks of AI Networking - Issues for the realization of A Wisdom Network Society (WINS)* 〈http://www.soumu.go.jp/menu_news/s-news/01iicp01_02000050.html〉.

and evaluating the risks of AI networking and, illustrated examples of the anticipated risks. Finally, the report presented a design for the principles of future research and development, an ideal form of user protection and an ideal form of the basic rules of society. The report advocated the necessity for improving study systems within Japan, in preparation for the development of international sites to host future debates regarding the issues about AI networking.

The evaluations were carried out in a hypothetical chronological order from the 2020's to the 2040's. The anticipated risks of AI networking were listed within a framework and decisions about how to deal with the anticipated risks were based on current research and development on an ideal form of user protection, an ideal form of the basic rules of society and so on. Next, the report advocated the need to improve AI networking review systems within Japan in preparation for the organization of international conferences to promote for continued debate on the subject. Thirdly, eight principles of AI networking research and development were publicized and agreed to at 'the ICT ministers' meeting' of the G7 summit held in April 2016.

At the first version of this report, the eight principles of AI research and development shown in the report were publicized. Furthermore, the report 'Towards Promotion of International Discussion on AI Networking[19],' was issued on 28th July 2017. The updated guideline added 'Principle of Collaboration' as a 9th principle.

Furthermore, 'The Draft AI R&D GUIDELINES for International Discussions (28th July 2017)' was issued.

The proposed guideline constitute from 1) Purpose, 2) Basic Philosophies, 3) Definition of Terms and Scope, 4) AI R&D Principles.

This guideline added the following Basic Philosophies.

1. To realize a human-centered society where all human beings across the board enjoy the benefits from their life in harmony with AI networks, while human dignity and individual autonomy are respected.

2. To share the Guidelines, as non-binding soft law, and their best practices internationally among stakeholders, as, with the rapid development of the R&D and utilization of AI, networked AI systems are expected to have broad and significant impacts on human beings and society beyond national borders.

3. To ensure an appropriate balance between the benefits and risks of AI networks, so as to: (a) promote the benefits from AI networks through innovative and open R&D activities and fair competition; and (b) mitigate the risk that AI systems might infringe rights or interests, while fully respecting the value of the democratic society such as academic freedom and freedom of expression.

4. To make sure that AI R&D activities based on specific technologies or techniques are not hindered in light of ensuring technological neutrality, and to be mindful that developers are not imposed of excessive burden, as the rapid progress of AI-related technologies is anticipated to continue. And

5. To constantly review the Guidelines and flexibly revise them as necessary through international discussions, considering the extent of the progress of AI networking, because AI-related technologies and AI utilization are expected to continue to advance dramatically. Also, to strive for broad and flexible discussions including the involvement of related stakeholders, when reviewing the Guidelines.

Then, this guideline proposed to issue the following nine principles for research and development.

1) Principle of collaboration—Developers should pay attention to the interconnectivity and interoperability of AI systems.

2) Principle of transparency—Developers should pay attention to the verifiability of inputs/outputs of AI systems and the explainability of their judgments.

3) Principle of controllability—Developers should pay attention to the controllability of AI systems.

4) Principle of safety—Developers should take it into consideration that AI systems will not harm the life, body, or property of users or third parties through actuators or other devices.

19) The Ministry of Internal Affairs and Communications, *Towards Promotion of International Discussion on AI Networking* 〈http://www.soumu.go.jp/main_content/000499625.pdf〉.

5) Principle of security—Developers should pay attention to the security of AI systems.

6) Principle of privacy—Developers should take it into consideration that AI systems will not infringe the privacy of users or third parties.

7) Principle of ethics—Developers should respect human dignity and individual autonomy in R&D of AI systems.

8) Principle of user assistance—Developers should take it into consideration that AI systems will support users and make it possible to give them opportunities for choice in appropriate manners.

9) Principle of accountability—Developers should make efforts to fulfill their accountability to stakeholders including users of AI systems.

5.3 The Artificial Intelligence Technology Strategy Council

The Artificial Intelligence Technology Strategy Council was established in order to conduct research and development for improving AI technology and for boosting its 'Industrialization Road Map'. This council was established by 'The 5th Public-Private Dialogue for Future Investment conference[20]' at The Japan Economic Revival Headquarters held on 12th April, 2016. As a result of examination into FY 2016, the council published 'The Artificial Intelligence Technology Strategy[21]' (31st March, 2017).

This strategy outlined the governmental promotion system of the AI Technology Development Industrialization Roadmap (A fusion of AI and other related technologies, research and development of AI technology). In order to achieve the goals of this strategy, 'The R & D Goals of AI and the Industrialization Road Map' was issued on 31st March, 2017.

When the Strategic Council for AI Technology was established, the Research Coordination Council and Industry Coordination Council was also established. The Research Coordination Council' role was to provide a link mechanism for research and development carried out by the various competent ministries. The Industry Coordination Council carried out surveys and investigations on (1) establishing a roadmap for industrialization, (2) the fostering of human resources, (3) data maintenance/provision and open tools, and (4) measures such as for fostering startups and financial linkages, in aiming towards research and development carried out by the competent ministries and social implementation of other businesses. With regard to ethical aspects of AI technology, intellectual property rights, personal information protection, and the promotion of open data, separate opportunities for scrutiny have been established by the government as cross-governmental sector items.

The priority areas of the Industrialization Roadmap which refer to the development and utilization of AI mainly focus on (1) the necessity for urgent solutions to social issues, (2) the contribution to economic ripple effects, and (3) the expectations of economic contributions to society due to AI technology. Based on these perspectives, 'productivity', 'health, medical care and welfare' and 'mobility' and 'information security' were determined as areas for which reviews would be made as such cross-sectional areas.

5.4 Considerations by the Cabinet Office

The Advisory Board on Artificial Intelligence and Human Society' started its discussions on 30th May, 2016, under the initiative of the Minister of State for Science and Technology Policy, composed of members with various backgrounds in fields such as engineering, philosophy, law, economics, and social sciences. The Advisory Board issued its 'Report 2017 on Artificial Intelligence and Human Society[22]' (24th March, 2017).

The Advisory Board tried to clarify common key issues of AI technologies and human society from a multi-stakeholder point of view, i.e., from the viewpoints of users, researchers, engineers, artists, people across generations, including children, businesses,

20) The Prime Minister in Action, *Public-Private Dialogue towards Investment for the Future* 〈http://japan.kantei.go.jp/97_abe/actions/201604/12article6.html〉.

21) New Energy and Industrial Technology Development Organization(NEDO), *The Artificial Intelligence Technology Strategy*, 〈http://www.nedo.go.jp〉.

22) The Advisory Board on Artificial Intelligence and Human Society, Report 2017 on Artificial Intelligence and Human Society 〈http://www8.cao.go.jp/cstp/tyousakai/ai/summary/aisociety_en.pdf〉.

and governments. The report summarize the extracted key issues as follows[23]:

Ethical issues: A significant action is to consider the balance between human decisions and AI-based decisions depending on the situations and objects to be judged. The balance change causes the emergence of a new sense of ethics. If users confirm AI services that enable them to manipulate someone's mind and/or to evaluate people, discussions of ethics might especially be needed. Careful attention contributes to proper AI progress that has the possibility to change human concepts, since AI technologies augment human beings' senses and abilities. New evaluation procedures have required the observation of the values (e.g., originality, utility, and virtue) of the products made and actions performed by humans, by AI technologies, and through the cooperation of both.

Legal issues: Determining the locus of responsibility for accidents involving AI technology along with preparing insurance for probabilistic risks contributes to social acceptance and helping users understand the risks of utilizing AI technologies. Exploitation of big data while considering information privacy protection requires the consideration of appropriate institutional frameworks (laws, guidelines, and contracts). Considering the rights to and incentives for the creation of AI technologies remains a subject of further study for multi-stakeholders. In-depth analysis and basic research (e.g., social sciences) play an important role in reconsidering fundamental concepts, such as human responsibilities, that the modern law is based on.

Economic issues: Individuals changing their work style and updating their abilities propose to harmonize each person's abilities with a creative job/task. These changes also require that companies reconsider their decision-making techniques and staff (re)assignment to take advantage of work flexibility. At the government level, combining educational and employment policies is one of the effective procedures for mobilizing labor, revitalizing the economy, and preventing economic disparities.

Educational issues: The significant issues are understanding the advantages and limitations of the present AI technologies, properly utilizing AI technologies, and performing creative activities in collaboration with AI technologies. An educational policy functions according to discussions of how to efficiently reform curriculums based on evidence that shows the technologies' limitations, the critical human abilities differentiated from present AI technologies, and the essential human abilities to be acquired.

Social issues: There is a need to create space for dialogue among people with different visions and ideas and to consider common, fundamental social values. One of the fundamental issues is the need to facilitate provisions against the "AI divide," unbalanced social costs relative to AI, and discrimination that occurs because of the technologies' procession. Continuous assessments of social pathology, conflict, and dependence on AI technologies will offer solutions to these issues.

Research and development (R&D) issues: Researchers and engineers are required to engage in R&D with professional ethics while observing ethical codes and guidelines. Technologies for cyber security and privacy protection must be advanced. Basic research to ensure that AI technologies are controllable and show transparency by explaining the processes and logic of calculations made by AI technologies contribute to their social implications. Advancing AI technologies that are beneficial for human society requires basic sciences, including social sciences to study societal issues that may arise in the future, observing the social acceptance of their stochastic behaviors such as deep learning, and creating an environment that supports open science to enhance the diversity of AI technologies.

5.5 Investigations by the Intellectual Property Strategy Headquarters

The Intellectual Property Strategy Headquarters in Japan[24] has established A 'New Information Goods Review Committee, Validation, Evaluation and Planning Sub-Committee'. This committee published a report[25] in March 2017 which aims to make provisions for a new intellectual property system which

23) Id, PP.3-6.

24) The Intellectual Property Strategy Headquarters 〈http://www.kantei.go.jp/jp/singi/titeki2/〉.

will promote a foundation for strengthening industrial competitiveness through the promotion of data and AI utilization. Intellectual property outcomes which are autonomously created by AI will not be viewed in the same way as are intellectual property outcomes which are created by a 'natural persons'. Therefore, such intellectual property may not be protected by the current Japanese intellectual property law since such content is not included in the concept of 'the object of protection of copyright'. Furthermore, in the future, it is expected that the number of copyrighted materials created by AI will drastically increase.

For this reason, it is important that we study and construct a new intellectual property system which will protect all new 'information goods' vis-à-vis all copyright, industrial property rights and other intellectual property. In summary: the considerations of the above-mentioned headquarters were focused mainly on a desire to solve the above problems by:

1) having a perspective of strengthening industrial competitiveness aimed at an enhancement of industrial competitiveness by creating 'value added-ness' within a wide range of industries, by maximizing the utilization of data and AI as intellectual property;

2) creating a balance between the need for protection and the utilization of data and AI; that is, a balanced mechanism in which the investment activities of the data and AI stakeholders are adequately protected, but where a smooth and active utilization will be achieved:

3) having an 'international perspective', that is, by which cross-border issues can be resolved on how to implement digital network systems which are underpinned by a premise that the use of data/AI will grow as economic and industrial globalization progresses.

5.6 Considerations by the Ministry of Economy and Trade Industry (METI)

'The Industrial Structure Council - New Industrial Structure Committee' is a committee of the METI, established to investigate issues with respect to 'The Fourth Industrial Revolution', beginning August 2016. The Council issued a report entitled 'The New Industrial Structure Vision[26]' on 30th May, 2017. The ensuing 'New Industrial Structure Vision' summarizes the measures which are needed to realize an affluent Japanese society by stimulating economic growth and tackling structural problems by deploying technological innovation in IoT, Big Data, AI and Robot-use. The report provides a 'Target-Backward Road Map' to demonstrate and embody Japan's medium and long-term future goals and strategies which will lead ultimately to a 'breakthrough project' aimed at concrete institutional reform.

5.7 The IT Strategy Headquarters PDS Committee

The National Strategic Headquarters for The Promotion of an Advanced Information and Communications Network Society (The IT Strategy Headquarters[27]), established a 'Data Distribution Environment Improvement Committee[28]'. This committee has published the 'Data Interaction Working Group Interim Report in the AI and IoT Era', on 15th march, 2017. The popular and universal use of IoT equipment and the evolution of AI, has given society all the opportunity to efficiently and effectively collect, share, analyze and utilize a wide variety of large amounts of data. As a result, this committee indicated the importance of 'data distribution environmental improvement' to promote fully the adequate utilization of such 'Big Data', leading to a maximizing of the potential of AI by enabling the use of a wide variety of large amounts of data in the afore-mentioned 'Society 5.0'. A study sponsored by

25) The Intellectual Property Strategy Headquarters, *New Information Goods Review Committee, Validation, Evaluation and Planning Sub-Committee*, 〈http://www.kantei.go.jp/jp/singi/titeki2/tyousakai/kensho_hyoka_kikaku/〉.

26) Ministry of Economy, Trade and Industry, *the New Industrial Structure Vision* 〈http://www.meti.go.jp/english/press/2017/0530_003.html〉.

27) IT Strategy Headquarters 〈http://japan.kantei.go.jp/policy/it/index_e.html〉.

28) Data Distribution Environment Improvement Committee 〈http://www.kantei.go.jp/jp/singi/it2/senmon_bunka/data_ryutsuseibi/kentokai.html#detakatsuyo_wg〉.

this committee aimed to promote a so-called 'PDS' (Personal Data Store), created by private enterprises and information banks, as a mechanism for facilitating individual decision-making. based on informed consent.

5.8 Industrial Sector Considerations

COCN（Council on Competitiveness-Nippon[29]）is conducting studies on the use of AI in industry. COCN issued the reports, 'The Realization of Industrial Enhancement Improvement through AI, Robot, Human Co-Evolution', (March 2016) and 'Negotiation between Artificial Intelligence: Society's Super Smart through Collaboration - Smooth Achievement of Each Objective and Formation of Reciprocal Relationships ' (15th February, 2017)[30].

6. Policy Trends regarding Highly Automated Vehicles

6.1 Considerations by The Ministry of Land, Infrastructure, Transport and Tourism and METI

In preparation for the 2020 Tokyo Olympics, studies are being conducted to enable self-driving cars with automatic driving systems to drive on the public roads. In June 2012, the Study Committee on Autopilot Systems was established within the Ministry of Land, Infrastructure, Transport and Tourism, (MLIT), to investigate the issues related to automated driving, (i.e., autopilot systems), on the public highways as a means of ensuring the realization of these systems.

Recent consideration regarding Automated Vehicles commenced in February 2015 and were conducted by 'The Ministry of Land, Infrastructure, Transport and Tourism' (MLIT) and 'The Ministry of Economy, Trade and Industry' (METI). MLIT and METI established an 'Automated Driving Business Review Committee' and this committee issued a report entitled 'Future Action Policy' (23rd March 2016). However, the METI and MLIT strategy only focuses on the promotion of the automated driving industry. It is the NPA which is responsible for considering the legal issues.

In this report, Automated Driving, ('General Vehicles: Levels 2, 3') and Automated Driving, ('Level 2') will be possible as early as 2018. The report describes eight ways of achieving this while at the same time focusing on the following vital and related functions and principles: map usage, communications, social acceptability, ergonomics, functional safety, security, 'recognition technology' and 'judgment technology'. In the report, automated driving ('General Vehicles: Level 4'), is defined as vehicle ability to make use of 'dedicated spaces', vehicle ability to 'mix' with general traffic. In order to achieve these abilities, it is envisaged that there will be a collecting of ideas from a wide range of stakeholders, including those from overseas. 'The Convoy Driving Control System' ('Convoy Track: Level 2') is expected to realize so-called 'Three or More Convoy Track Driving' in nighttime long-distance transportation. Automatic Valet Parking, (Dedicated Space: General Vehicles: Level 4), will realize the opportunity for private parking lots by around 2020; as is the case with Automated Driving ('General Vehicles: Level 4'). A consensus will be sought from the associated stakeholders concerning 'role sharing' and the standardization of vehicle parking lots.

6.2 Considerations of the National Police Agency

In order to further the discussion of the institutional and legal issues as they concern the above technical developments, since October 2015, the Investigative Study Committee on Institutional Issues in Self-Driving of the National Police Agency has examined institutional issues in self-driving in order to create proposed Guidelines for verification tests and proof-of-concept demonstrations on public roads relating to self-driving systems in a desire to streamline the issues in terms of the law and operation as they affect self-driving systems.

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29) Council on Competitiveness-Nippon 〈http://www.cocn.jp/〉.

30) Council on Competitiveness-Nippon, *Realization of Improvement of Industrial Capability by Co-evolution of AI, Robot, People*, 〈http://www.cocn.jp/thema86-L.pdf〉, *Supersmarting of Society through Negotiation, Collaboration and Cooperation among Artificial Intelligence*, 〈http://www.cocn.jp/thema94-L.pdf〉.

Considerations of the 'Study Committee of the National Police Agency', (NPA) began in October 2015 and thus are well under way regarding Japan's Road Traffic Law and the 'Rules of the Road' with respect to such Automated Driving on public roads. The NPA aims to prepare thorough guidelines to be followed regarding any future public road demonstration experiments by automated driving systems.

As regards automated driving technology, (ADT), this committee is expected to be able to solve any related congestion problems by ensuring the optimal running of ADT, thus 'smoothing' traffic flow. Via ADT, there is an NPA expectation of a reduction in traffic accidents caused by human error, a reduction in environmental pollution because of the ADT ability to avoid unnecessary acceleration/deceleration, an improvement in fuel economy and a reduction in co_2 emissions by suppressing air resistance and congestion. Of even more significance is the fact that ADT is expected to provide more mobility and health and well-being support for the elderly by both increasing the opportunities for 'driving' and by improving the comfort of 'the drive' itself; particularly in long-distance travelling. A 'Driving Support System Advancement Plan' was drafted as early as the 25th October, 2013. A decision of an NPA liaison meeting in order to achieve this vision.

The NPA Study Committee investigated also the other legal and institutional issues with respect to automated driving and published a report, 'The Investigative Review Committee on the Institutional Problems of Automated Driving Movement[31]', on 7th April 2016. Following this, 'The Guidelines for Public Road Demonstration Experiments on Automatic Driving Systems[32]' were announced in May 2016. According to the guidelines: (1) vehicles used for public road demonstration experiments must conform with the safety standards of road transport vehicles; (2) those who become 'drivers' must ride in the driver's seat of the experimental vehicle and must always check the surrounding road traffic conditions, must monitor the condition of the vehicle itself and must perform any necessary operations to ensure 'vehicle safety' so as not to cause harm to other people in case of emergencies; (3) must comply with all of the relevant laws and regulations, including the Road Traffic Law with regard to driving.

'Entities' may also conduct public road demonstration experiments under the current law, provided that the following conditions are met: (1) the basic responsibilities of the implementing entity are detailed; (2) safety-ensuring measures are detailed also in the descriptions of the public road demonstration experiments themselves; (3) the requirements for the test drivers are both understood and accepted; (4) requirements of the automated driving system related to the test drivers are both understood and accepted; (5) the need for the recording and storage of 'Probe of Data'(Car Probe Data), on experimental vehicles during the demonstration experiments is both understood and accepted; (6) adequate responses in the case of traffic accidents; (7) the securing of a 'compensation capacity' is both understood and accepted; and (8) the need for advance contact with related organizations is both understood and accepted.

Finally, 'The Survey Research Report for the Gradual Realization of Automated Driving' was issued in March 2017 and following this, 'The Criteria for The Application for Use Permission of Roads related to Public Road Demonstration Experiments of Remote Type Automated Driving Systems' was decided by the NPA in June 2017.

6.3 The Strategic Innovation Creation Program, (SIP)

Regarding the technical and institutional issues necessary for realizing the automated driving system, the 'Strategic Innovation Creation Program', (SIP, 21st May, 2015, Cabinet Office, National Police Agency, Ministry of Internal Affairs and Communications, Ministry of Economy, Trade and Industry, Ministry of Land, Infrastructure, Transport and Tourism) was issued. Regarding the development and demonstration of the automated driving system,

31) National Police Agency, *Research Report for the Step-by-step Realization of Automatic Operation* 〈https://www.npa.go.jp/bureau/traffic/council/jidounten/28houkokusyo.pdf〉.

32) National Police Agency, *Guidelines for Public Road Demonstration Experiments on Automatic Driving System* (April 2016) 〈https://www.npa.go.jp/koutsuu/kikaku/gaideline.pdf〉.

the following are required: (1) the development of 'map information advancement' (The 'Dynamic Map'); (2) development and verification experiments concerned with the 'Generation Technology of Prefetch Information by ITS', (3) technology development and demonstration experiments for improving 'sensing ability'; (4) the development of HMI（Human Machine Interface）technology for automated driving systems; (5) the development of technologies for strengthening system security; (6) 'commercialization' research and demonstration experiments for realizing the automated driving system.

7. Policy Trends Regarding Unmanned Aerial Vehicles, (UAV/Drones)

The Japanese government commenced its considerations with respect to UAV flight policy because of an incident in which a UAV fell onto the roof of the Prime Minister's office. UAV collisions and 'fall accidents' have been occurring frequently in Japan and so the Aeronautical Law was amended on the 11th September, 2015. The amended law provides that: (1) any airspace in Japan requires UAV flight permission before use; (2) The newly amended rules and methods governing UAV flights are both understood and accepted; (3) search and rescue missions are exempted from these Japanese airspace flight restrictions.

Any person using UAV`s must follow the 'general flight regulations'; these are: (1) there will be the creation of a restricted airspace for UAV flights; (2) there will be no night flights; (3) the UAV must always be monitored by visual inspection. However, if the weight of any UAV is less than 200g, then this UAV should not be subject to these regulations. In addition, the 'Small Unmanned Aerial Vehicles Flight Restriction Law' was enacted on 18th March 2016. This law provides for designated areas into which are forbidden, the flights of any UAV's. These areas include for example, the National Diet Building, the Prime Ministers House, any government establishments and foreign embassies and any nuclear power plants.

8. The Application of the Special Zones

8.1 The Background and Needs of the Special Zone

When considering the new problems such as the recent AI issues, the Japanese strategy has been to set guidelines as an administrative guidance enacted by governmental agencies without amending the current law; thus requiring private enterprises to comply with them. Such an approach must be similar for each country[33] in order to examine whether or not legal regulation is needed. Furthermore, it would be helpful to conduct trials of these technologically innovative issues.

However, it will take time for the government to revise the related laws and then to create the new guidelines. If such new initiatives are not able to be implemented before the completion of the review of the current legal system, new business deployment and research and development might be delayed. Therefore, in order to solve these structural issues, The Japanese Headquarters for the Promotion of Special Zones for Structural Reform was established on December 18th, 2002; following this, the National Strategic Special Zones Law was enforced in 2013. The purpose of this law is the setting up of 'Special Zones, (Tokku)[34] ' for structural reform where exceptions to the regulations have been established corresponding to the unique characteristics of any specific region, thus promoting customized structural reform in areas such as education, agriculture and social welfare, the revitalizing of local economies, the developing of the national/regional economy and of AI & Robot-related services.

With respect to the specific issues concerning these special zones, the implementation of projects promoting deregulation without amending the law

33）*See, e.g.*, Woodrow Hartzog, *Unfair and Deceptive Robots,* 74 Md. L. Rev. 785 (2015),Bryant Walker Smith, *Autonomous Legal Reasoning?: Legal and Ethical Issues In The Technologies of Conflict: Controlling Humans ad Machines*, 30 Temp. Int'l & Comp. L.J. 167 mentioned which kinds of factors should be considered by the Administrative, Legal and Community strategies.

34）The concept of 'Tokku' is similar to the recent debate with respect to Regulatory Sandbox (RS)〈https://www.fca.org.uk/firms/regulatory-sandbox〉

has been permitted. By setting up these special zones where regulatory exceptions have been established because of the zones' specific circumstances, voluntary plans (which is submitted by applicants) have been proposed by municipal bodies and private-sector enterprises.

8.2 The Structure of the Special Zone

The Law on Special Zones for Structural Reform, (Law No. 189, 2003), was enacted for the setting-up of the 'Special Zones for Structural Reform, (Kozo-Kaikaku-Tokku)'. The purpose of this law is to promote socio-economic structural reform and the revitalization of the regional areas in fields such as education, distribution, agriculture, social welfare and research and development, through the establishment of special zones for structural reform which respect as much as possible the initiatives of the local public bodies.[35)]

Furthermore, the law on The National Strategic Special Zones, (Law No. 107, 2013), was also enacted for the setting-up of special zones in areas designated by the national government in order to promote regulatory reforms and other measures which will be needed to promote projects carried out jointly by the central government, local governments and the private sector. The Industrial Competitiveness Enhancement Act, (Law No. 98 2014), was also enacted for promoting: (1) The establishing of Special Arrangements for Corporate Field Tests; (2) The removal of 'Grey Zone Areas'; (3) The Encouraging of Investment in Venture Businesses; (4) The Promoting of Investment in Cutting-Edge Facilities; (5) The Promoting of Business Restructuring.

8.3 The Acreditated Special Zones for Structural Reform

The significance of these Special Zones is that they will alter completely the historical concept that regulations should be enforced uniformly throughout Japan. Instead, a concept of 'Localism or Regional Revitalization' has been introduced via which the 'Special Zones concept' for geographically-limited areas allows for certain regulations to be eased or even lifted. If this concept results in success, then the number of Special Zones with their regulatory exemptions will be expanded nationwide.

The total number of accreditated Special Zones is 1,309 as of March 30th 2018 and the examples of Special Zones for Structural Reform for AI & Robots are as follows[36)]:

1. Robot Development and Demonstration Experiment Special Zone (Fukuoka City)[37)] (2003)

-Facilitation of permission for experiments such as robot walking on public roads
- Experiments to promote R & D for active robots in the human living area
- Investigate to revitalize the regional economy by creating a new robot industry

2. Sagami Special Industry Zone for Robots (Kanagawa Prefecture)[38)] (2014)

Supports field-testing by public invitation to corporations by offering a pre-testing site and conducting tests for life supporting robots used in nursing facilities utilizing old schools which have been closed.

3. Safety Testing Center for Life Supporting Robots (Tsukuba City)[39)] (2015)

Supports 18 varieties of tests such as running tests, human interaction tests, durability tests, EMC tests, etc. for the purpose of obtaining safety certified life supporting robots (under ISO13482, etc.).

Already four different robots have been ISO13482

35) In details of the purpose and content of the Special Zones for Structural Reform, see, Cabinet Decision, *Outline of the Law on the Special Zones for Structural Reform July 26, 2002* 〈http://japan.kantei.go.jp/policy/kouzou2/konkyo_e.html〉. Wataru Suzuki, *How to Evaluate Special Zones for Structural Reform: On a Perspective of Econometric Approach*, Government Auditing Review Volume12 (MARCH 2005) 〈http://report.jbaudit.go.jp/english_exchange/volume12/e12d03.pdf〉.

36) Robot & AI related special zone 〈http://www.rtnet-biz.jp/rtsic/info/rinfo/tokku.html〉.

37) Fukuoka Island-City 〈http://island-city.city.fukuoka.lg.jp/news/detail/254/back:1〉

38) Robot Town Sagami 〈http://sagamirobot.pref.kanagawa.jp/〉

39) City of Tsukuba, Robot Special Zone 〈http://council.rt-tsukuba.jp/〉

certified using this facility.

4. Haneda Airport Robot Experiment Special Zone (Ota Ward, Tokyo)[40] (2015)

Public road demonstration experiment project of boarding type mobile support robot.

Experiments on boarding type mobile support robots as means of transportation for airport employees and airport users.

- Demonstration experiments such as safety, effectiveness and affinity in running on public roads and consider efforts for future practical application.

5. Toyota-City Standing Base Type Personal Mobility Experiment Special Zone (Toyota City)[41] (2014)

- Toyota Motor Corporation has headquarters in Toyota-City.
- Experiments are conducted to create a mobile environment with low carbon and high convenience by combining standing riding personal mobility with public transportation.
- The aim of this project is to use riding personal mobility as one of the new means of transport in the future city traffic.

8.4 The National Strategic Special Zones for Level 4 Automated Vehicles

In October 2017, the Japanese Government announced its National Strategic Special Zones for Level 4 Automated Vehicles, (Fully Automated Vehicles), Deployment Project on the public roads. In order to construct the supporting social systems and legal systems for this 'future technological development', public road safety demonstration experiments were conducted in order to collect safety-related data.

The new special zone consists of the following three demonstration projects.

1. Robot Taxi

In the Shonan area such as Fujisawa city, a taxi service using an AI equipped robot taxi for residents (about 50 people) on trunk roads within 3 km. Collaborating with major supermarkets for support of shopping using the Level 4 automated vehicle.

2. Utilization of Automatic Driving Vehicles in the Event of a Disaster

Implemented in the disaster high risk area (Arahama area). Demonstrate level 4 in the district roads and elementary school yard. Cooperate with Tohoku University to contribute to urban development for reconstruction and emergency response at the time of disaster occurrence.

3. Running Test on General Road using 3D Sensor

Performed in Nagoya city. Based on demonstration results on the national first general road experiment in 2017 spring test, implementing more advanced demonstration using 3D sensors.

9. An Overview of Research Trends in Japan

9.1 The Genealogy of Research Groups with respect to AI Legal Issues

Some Japanese research groups have held workshops, symposia and organized study groups focusing on legal issues regarding AI. The first legal workshop focused mainly on legal issues with respect to autonomous robots and was held on 22nd November, 2014 at the SFC Open Research Forum and was entitled, 'The 202X Robot and Social System', Keio University, Shonan Fujisawa Campus (SFC). Particular research on the social acceptability of AI appeared in a special issue of 'Artificial Intelligence Society Journal', (Vol.29, No.5, September 2014), and was an opportunity to start the study group 'AIR', (Acceptable Intelligence with Responsibility). This study group discusses the ways in which artificial intelligence technology is infiltrating our society.

40) Haneda Robotics Lab 〈https://www.tokyo-airport-bldg.co.jp/hanedaroboticslab/〉

41) Toyota-City Standing Base Type Personal Mobility Experiment 〈http://www.city.toyota.aichi.jp/pressrelease/201408/1000880.html〉

9.2 The Japanese Society for Artificial Intelligence

'The Japanese Society for Artificial Intelligence' (JSAI) Ethics Committee began its work in December, 2014 with establishing a code of ethics and examining the relationship between Artificial Intelligence and society[42]. This committee issued 'Ethical Guidelines for an Artificial Intelligence Society' (28th February, 2017), and was intended to be used by JSAI society members. The purpose of these ethical guidelines was to provide a moral foundation for JSAI members to become better aware of their social responsibilities and encourage effective communications within the society. JSAI members were required to comply with these guidelines.

The JSAI AI ethical guidelines are as follows:

1) (Contribution to Humanity) Members of the JSAI will contribute to the peace, safety, welfare, and public interest of humanity. They will protect basic human rights and will respect cultural diversity. As specialists, members of the JSAI need to eliminate the threat to human safety whilst designing, developing, and using AI.

2) (Abidance to Laws and Regulations) Members of the JSAI must respect laws and regulations relating to research and development, intellectual property, as well as any other relevant contractual agreements. Members of the JSAI must not bring harm to others through violation of information or properties belonging to others. Members of the JSAI must not use AI with the intention of harming others, be it directly or indirectly.

3) (Respect for the Privacy of Others) Members of the JSAI will respect the privacy of others with regards to their research and development of AI. Members of the JSAI have the duty to treat personal information appropriately and in accordance with relevant laws and regulations.

4) (Fairness) Members of the JSAI will always be fair. Members of the JSAI will acknowledge that the use of AI may bring about additional inequality and discrimination in society which did not exist before, and will not be biased when developing AI. Members of the JSAI will, to the best of their ability, ensure that AI is developed as a resource which can be used by humanity in a fair and equal manner.

5) (Security) As specialists, members of the JSAI shall recognize the need for AI to be safe and acknowledge their responsibility in keeping AI under control. In the development and use of AI, members of the JSAI will always pay attention to safety, controllability and required confidentiality while ensuring that users of AI are provided appropriate and sufficient information.

6) (Act with Integrity) Members of the JSAI are to acknowledge the significant impact which AI can have on society. They will therefore act with integrity and in a way which can be trusted by society. As specialists, members of the JSAI will not assert false or unclear claims and are obliged to explain the technical limitations or problems in AI systems truthfully and in a scientifically sound manner.

7) (Accountability and Social Responsibility) Members of the JSAI must verify the performance and resulting impact of AI technologies that they have researched and developed. In the event that potential danger is identified, a warning must be effectively communicated to all of society. Members of the JSAI will understand that their research and development can be used against their knowledge for the purposes of harming others, and will put in efforts to prevent such misuse. If misuse of AI is discovered and reported, there shall be no loss suffered by those who discover and report the misuse.

8) (Communication with Society and Self-Development) Members of the JSAI must aim to improve and enhance society's understanding of AI. Members of the JSAI understand that there are diverse views of AI within society, and will earnestly learn from them. They will strengthen their understanding of society and maintain consistent and effective communication with them, with the aim of contributing to the overall peace and happiness of mankind. As highly-specialized professionals, members of the JSAI will always strive for self-improvement and will also support others in pursuing the same goal.

9) (Abidance to Ethics Guidelines by AI) AI must

42) Yutaka Matsuo, Toyoaki Nishida, Koichi Hori, Hideaki Takeda, Satoshi Hase, Makoto Shiono, Hiroshitakashi Hattori, Yusuna Ema, Katsue Nagakura, *Artificial Intelligence and Ethics*, Artificial Intelligence Journal 31 (5) PP.635–641 (2016).

abide by the policies described above in the same manner as the members of the JSAI in order to become a member or a quasi-member of society.

9.3 The AI&Society Study Group

The 'AI&Society Study Group' was established by Tomohiro Inoue and Koichi Takahashi on 5th February, 2015 by as a workshop for multidisciplinary consideration of the social impact of the development of AI technology. The study group conducts research using a multifaceted approach with Dr. Koichi Takahashi who is a founder of this study group advocating references to philosophy, (The Humanities), economics, (Economics), law, (Law), politics, (Politics), sociology, (Sociology); the abbreviation being HELPS.

9.4 The Robot Law Study Group (The Information Network Law Society)

The various academic research organizations within Japan whose specific responsibility is that of AI and Robot use and law established the Robot Law Study Group on 21st May, 2016, as a research-committee of the Information Network Law Association Japan. Before the establishment of the study group, 'The Robot Law Association Preparation Study Group' met on 10th October, 2015[43]. However, there were some difficulties in establishing a new Robot Law Association in Japan. Therefore, the Robot Law Study Group was established on behalf of Robot Law Association, as an academic research organization formulated as a research group of the Information Network Law Society. The study group is holding study meetings to conduct research on legal issues related to AI and robots for enhancing future legal and policy research focusing on Ethical, Legal, and Social Implications (ELSI).

At the first study group meeting, I publicly presented 'Eight New Principles of The Laws of Robot' ('Tentative Proposal by Dr. Fumio Shimpo', 10th October 2015). These principles were reported at the 2015 meeting as the fundamental principles which are required for a 'Robot Coexistence Society' of the future in reference to the 'OECD 2013 Privacy Principles'. Invasions of privacy, which are difficult to remedy after the fact and which make complex, recovery to a status quo position, problems which are caused by autonomous robot negative actions also should not be dealt with after the fact. If we are to achieve a successful robot coexistence society, firstly, we must consider what 'people' must do in relating positively with robots which are 'near-human'. The first steps in this consideration are those to do with the measures necessary for creating a 'basic principles for using AI and Robot'.

10. Deliberation for using AI and Robots in Public Sector

AI and robots are expected to be used in the future in improving public administration. However, improper use of such AI and robots could lead to 'Big Brother' risks. It is possible that such use of robots will not be limited to the automation of the anticipated areas, such as quasi-legal administrative tasks. Thus, we may see robots taking over the responsibilities of civil servants. However, it should be noted that an AI which is able to respond to mundane inquiries could liberate staff from those tasks which are seen as 'repetitive responses' and somewhat dull. For example, if the 'person' in charge of a service counter is just an automated autonomous robot, all concerns about this 'person' resorting to acts of emotional impatience when dealing with the public.

Equally, there are high expectations anticipated as a result of using robots for reducing the maintenance management burden of public facilities and infrastructure, while not reducing the quality of service. We can also assume that the ability to produce government information will be dramatically accelerated by the use of AI with 'open data' sources. It is likely that AI will be useful for understanding and investigating in detail past case studies in order to guarantee the fairness of any former administrative actions. Of equal importance is the situation where an AI is proven to be able to both create and analyze automatically meeting minutes. Such an ability would not only reduce the management burden of

43)　The Robot Law Association Preparation Study Group 〈http://robotlaw.jp/〉.

Table 1. Eight New Principles of The Laws of Robot, (Tentative Proposal by Dr. Fumio Shimpo)]

① 'Humanity First';	・a robot may not injure a human being; ・a robot shall not become a human being;
② 'Obedience to Order';	・a robot must obey orders given by humans; ・the manageability and controllability of a robot must be guaranteed;
③ 'Secrecy and Privacy';	・a robot must guard the secrets which it has learned; ・a robot must protect Privacy;
④ 'Use Limitation';	・the use of a robot for purposes other than its original purpose of use must be restricted; ・uses contrary to public order and to standards of decency, (eg the sex robot industry), must be restricted; ・uses for the purposes of harming or threatening humans must be limited, with exception of legal usage in this area; ・consideration of the ethics of using robots must be made;
⑤ 'Security Safeguards';	・ensure safety associated with the use of robots; ・formulate safety standards for development and use based on such standards; ・arrangement of system to guarantee an environment in which robots can be used comfortably;
⑥ 'Openness/Transparency';	・guarantee the public release of robot development content; ・guarantee transparency in the ways of using robots.
⑦ 'Individual Participation';	・individual participation in formulating rules for robot use; ・restrictions on the management of individuals by robots;
⑧ 'Accountability';	・dealing with the liability, (legal liability) arising from the handling of robots; ・considering ethical and moral responsibility when handling robots.

coping with the recording of what precisely has been discussed during a huge number of meetings, but it would also enable these minutes to be used effectively and efficiently, as information for facilitating the drafting of new policies based on an AI analysis of the large quantities of official documentation. In order to achieve this outcome, Japan's Cabinet Office's Round-Table Conference on Artificial Intelligence and Human Society, which began its investigations in May 2016, conducted trials using AI to analyze such huge amounts of meeting minutes. Easy-to-understand meeting minutes will contribute also to more government transparency and effective communication with general public.

The use of AI to gather and analyze government information may also make it possible for residents to more easily discover illegal or wrongful financial accounting, (where there are audit requests from residents to governmental authorities), and to more easily analyze official documents disclosed through freedom of information requests. However, we must consider the question, in the context of information disclosure, to what extent can information generated by AI, such as the information forming the basis of draft policy measure decision-making information obtained through 'deep learning', be disclosed?

If robots and AI are introduced into law enforcement and government administration, we must further evaluate and cautiously investigate not only their positive uses but also their problems in terms of the related policing and administrative laws. Although the fear of future over-controlling nation-states using a mass collection of data has been embodied in the dictator, 'Big Brother', featured in George Orwell's futuristic novel '1984', it is possible to 'positively' and centrally manage all of the images captured by security cameras on streets, instantaneously to analyze these images in real-time through facial recognition technology and to constantly monitor the movements of citizens and to analyze their personal data online. However, a future in which an AI autonomously determines, from the results of

such monitoring, which civil code steps to take in order to promote crime prevention, the appropriate control and protection of citizens may be a step too far in the direction of a 'Big Brother Effect'.[44] Where the legal and ethical principle is not stipulated that robots must be subject to the rule of law, and when the specific limits to the introduction of robots and AI within government operations are not agreed and settled, then there is the risk that this 'Big Brother Effect' will be come into being.

It is also necessary to investigate what would be an ideal form of censure in the event that damages to public infrastructure systems were to be caused by the use of administrative robots. If such damages were caused by a defect in the robots themselves, these damages could conceivably be subject to compensation by the state as defects in the installation or management within public facilities. On the other hand, damages which arise from the deliberate or accidental misuse or malfunction of administrative robots would most likely be judged under 'negligence of the duty to guarantee safety', rather than under 'managerial liability' of any facilities.

In the context of governmental organizations, if AI is involved in governmental agencies' decision-making, as expert information-source advisors, is there not then a possibility that the AI itself will be deemed to be advisory bodies, rather than just parts of any given meetings or committee structures? If robots immediately enforce administrative decisions in order to achieve governmental objectives, could we say that these robots are independently serving the functions and aims of enforcement agencies? In the future, will it also be acceptable for autonomous robots, (not remotely-operated robots), installed with AI, to autonomously exercise the use of force, without waiting for orders from the relevant governmental agencies? We simply cannot say at this point in time that there is a zero possibility of lethal, autonomous robots automatically pursuing their targets of attack being used not for military purposes, but for law enforcement.

11. Deliberation for using AI and Robots in Private Sector

The private sector issues associated with the use and spread of robots and AI which should be investigated, are many and are diverse in nature. It will be necessary to investigate these matters from both the perspective of problems in substantive law, such as the Civil Code and its associated laws (The Product Liability Act, Copyright Act etc.) and procedural law (The Civil Procedural Law).

The problems within the domain of the Civil Code are too numerous to detail here but they would include by way of example, accidents with HAV, the protection of personal rights and interests (such as the safeguarding of individual privacy) vis-a-vis AI machine learning, the protection of intellectual property 'created' by AI, compensation for damages associated with an autonomous robot being misused or running out of control and robots deemed to be 'actual members of the family'.

In property law, the time is coming when the management of property will start being entrusted to robots and AI. Fintech, (a platform used in investment decisions, etc., which utilizes AI), is also being used currently, and services are being offered which will entrust to an AI, the managing or investing of your personal assets.

In matters of liability involving accidents with HAV, the so-called 'Trolley Problem' is often debated. This is the problem of whether a priority order for avoiding danger can be judged or decided, (e.g., whether to collide with an object or a person when directly facing an unavoidable accident), according to the objects that will be hit or by evaluation functions based on properties such as the number of pedestrians who will be hit, age and gender.

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44) *See,* Tal Z. Zarsky, *Transparent Predictions,* 2013 U. Ill. L. Rev. 1503 (2013) (descriving the predictive modeling process while focusing on initiatives carried out in the context of federal income tax collection and law enforcement), *See also,* Andrew Guthrie Ferguson, *Big Data and Predictive Reasonable Suspicion,* 163 U. Pa. L. Rev. 327 (2015), Elizabeth E. Joh, *Artificial Intelligence and The Law: Essay: Policing by Numbers: Big Data and The Fourth Amendment*, 89 Wash. L. Rev. 35 (2014), Danielle Keats Citron and Frank Pasquale, *Artificial Intelligence and the Law: Essay: The Scored Society: Due Process for Automated Predictions*, 89 Wash. L. Rev. 1 (2014).

As a problem of legal liability not only is it difficult to draw a clear line in this extreme choice, (where the question of whom ultimately bears liability remains undecided). No decision has been shown that everybody can agree with ethically. We also see the view that as long as this problem is unresolved, completely HAV (Level 4 if classifying this into the levels of self-driving from Level 0-4), on public roads cannot be practically used. In terms of the Civil Code, for Levels 1-3 we could, after debating the legal positioning of the operator, debate the theoretical liability of the operator, passengers or the manufacturer in the event of an accident; we could also investigate the ideal form of insurance. For Level 4, there may not be anything else that can be done besides trying to devise an ideal form of manufacturer liability.

On the other hand, since the software itself (which is information), is not a tangible object, it is not subject to product liability[45]. If an AI is installed in HAV or robot, this AI would fall under the category of a manufactured product as property built into the robot (which is a tangible object). Therefore, if the AI harms other people, it would be possible to pursue product liability via the manufacturer. However, if an accident occurred due to an error in the navigation map installed in a highly-autumated system, it would not be possible to judge product liability via the map information error itself based on the current Japanese Product Liability Law. Storing images is essential for clarifying where liability lies during an accident.

Collecting massive amounts of information is also necessary for an AI's machine learning. However, massive amounts of information about individuals is also included within that information, and more efforts are needed to safeguard individuals' personal rights and interests. By analyzing personal information extracted from Big Data and using it for profiling, behavioral targeting is already being used to present online shoppers with recommended products and advertising chosen in line with personal tastes. In addition, using AI in business transactions and recommending products by using a specific method, it has also become possible to recommend products to shoppers that they have a high probability of purchasing. In the most extreme AI-related transactions, which greatly influence an individual's self-determination and manipulate that person's manifestation of intention, if steps are not taken on the business operator's side to inform the customer that the transaction is with an AI, before a consumer requests something in sophisticated AI profiling transactions, (by applying a law designed to legally obligate this, for instance), then future regulation will be needed to the effect that manifestation of intention has no effect for requests which were enticed by an AI, which would be equivalent to a mistake of an element, (Article 95 of the Japanese Civil Code).

Products that an AI autonomously creates are not subject to rights under the current intellectual property system. Protection of 'training machine-learning models' created by an AI's analysis of data is also an issue. It is now becoming possible for an AI to create content that looks like human creation, and the ideal form of protection for so-called 'quasi-creations' is being examined.

12. Issues of Security Safeguards and Protections for Safety

In the future, we must continue developing the principles mentioned above. However, since a review is urgently needed on the principles of security safeguards and safety protections, I would like to touch on these in this section of the discussion.

12.1 New Issues in Information Security Countermeasures

Due to the spread of AI and robot use, the need for improved, information security countermeasures for the chips which comprise the physical make up of these media and devices are predicted to become a major issue. The reason for this is that with the growth of the IoT, all objects are in the process of being connected to networks. As a result, it is now possible to operate various home electronics and

45) *See*, Michael C. Gemignani, *Product Liability and Software,* 8 Rutgers Computer & Tech. L.J. 173 (1981), Brannigan & Dayhoff, Nimmer & Krauthaus, *Computer Error and User Liability Risk*, 26 Jurimetrics J. 121 (1986).

other objects via these networks. Moreover, if we create societies in which robots and AI, due to their levels of sophistication, are commonly and routinely used, the need for these improved, information security countermeasures will increase proportionally.

Various network security countermeasures have been developed for safeguarding information security, such as those for preventing unauthorized access via networks and for protecting against computer viruses, malware and so on. However, the security of the actual devices themselves remains vulnerable. By way of example, chips are designed to be inherently rewriteable, therefore currently, it is easy to open a machine or device and rewrite any chips which have been installed.

Car devices called 'immobilizers' are used to prevent car theft. These devices allow cars to be operated by matching codes electronically, in contrast to traditional keys. It is extremely difficult to forge or to produce counterfeit copies of such 'electronic keys'. Immobilizers are considered to be an extremely effective means of preventing car theft because cars will not operate if the electronic codes do not match. Yet, even cars which have immobilizers have been stolen. Thieves merely have to smash the car window and open up the dashboard and start the engine by replacing the installed immobilizer with another immobilizer.

Thus, similar problems are predicted to arise if robots start to be commonly used in the future because of their autonomous features. It is assumed that similar problems will occur even where robots are equipped with AI. Regarding the security of robots connected to the network by IoT, it is expected that exploitation and unauthorized use will occur when robots are infected with computer viruses and malware. Various security countermeasures have been made on the Internet but the security measures of the chips physically installed in the robots have not been tested sufficiently. Therefore, we should recognize that similar issues like above mentioned immobilizer will occur due to the spread of the IoT and such problems which will undoubtedly occur due to the daily use of such AI-equipped robots will become a familiar threat; a problem which could be easily exploited by merely replacing the chip mounted on the robot.

12.2 New Security Threats

There is an assumption that robots will be used to commit crimes through hacking or through unauthorized access to robots via networks, that robots will be made to autonomously commit crimes through infection with 'crime-committing malware'. Since 'The Act on The Prohibition of Unauthorized Computer Access' prohibits the use of a computer where you have no authorization to access its contents via a network, such similar, unauthorized access to a robot connected to a network is subject also to punishment. However, the (criminal) manual reprogramming, rather than the network reprogramming, of a robot, cannot be punished under this law.

Let us consider the impact which would occur if robots which manage infrastructure, malfunction, or cease operating, due to 'Denial of Service (Dos) attacks'. A network composed of large numbers of 'zombie computers' and hijacked by malicious third parties through malware, is called a 'botnet'. The origin of this word is 'robot', in the sense it is used to mean 'puppet'. When these literal 'robot botnet networks' appear, where their multiple malware 'infecting robots' attack specific targets all at once, with denial of service attacks, the threat to our society will be incalculable. Therefore, we must implement countermeasures against these threats.

13. The Significance of Robot Law in the Age of AI

AI and Robots are tools created by humans, and are currently at the stage where they are nothing more than tools which only operate according to human intentions. Consequently, the associated legal topic of product liability should be given a thorough legal re-examination. However, if autonomous robots controlled by AI system come to be used everywhere in society, the above mentioned consequent use problems which cannot be addressed by such a re-examination of the current laws will necessitate the creation of new legal systems. As an example of the current legal dilemma, I will refer the reader to an accident involving a robot which was caused by inaccurate information or software defect malfunction.

This major shift in society caused by the spread of the use of robots has been also referred to as the arrival of the Fourth Industrial Revolution. In order to attain a safe and reliable robot coexistence society, we must immediately start to prepare social systems which are able to accommodate such a greater use of robots and to examine the relevant and ensuing legal issues. Before robots are actually introduced on such a large scale into real society, it is necessary to establish clear, legal policies which will underpin a robot use strategy, ethically resolved for the industrial world and for researchers engaged in technical development.

What must first be considered for utilizing AI and autonomous Robot is not thinking about which rules are needed to restrict research into, and development of, technologies which may pose new threats to humans. Instead, we must think about how we should regulate those humans who want to use these technologies in potentially harmful ways.