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# Disaster and Climate Change Issues in Japan's Society 5.0—A Discussion

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Received: 16 February 2020; Accepted: 29 February 2020; Published: 2 March 2020


**Abstract:** Faced with a number of socio-economic challenges and a continuously rising risk of more frequent and higher-impact disasters, the Japanese government, in cooperation with the private sector, has formulated a new comprehensive strategy, under the name of "Society 5.0", which is to utilize a number of various technological innovative solutions in an attempt to provide a secure future for its citizens, centering around several important sectors. The current paper aims to discuss disaster risk and climate change policies in Society 5.0 in particular, with some special focus on adaptation and inclusiveness. We start with giving details on the Society 5.0 concept and its goals, after which we focus more specifically on how disaster and climate change policies are integrated into the new strategy and proceed to discuss several contentious issues which represent both opportunities and risks or challenges for implementing the concept in a truly sustainable way. The paper tries to present various points of view and hopes to provide some food for future thought and research, rather than solutions or specific suggestions.

**Keywords:** Society 5.0; disaster management; climate change; technology; innovation; Japan; adaptation; inclusiveness

## 1. Challenges before Japan and Society 5.0

In the summer of 2018, Japan was hit by several grave disasters. A 6.1-magnitude earthquake shook Osaka in June, as a result of which five people lost their lives and 400 were injured. Approximately 225 people died in 15 prefectures in Western and South-Western Japan during heavy rainfalls in July. During a month-long heatwave from July to August, 133 people died and more than 55,000 were treated for heat exhaustion. More than 10 people died and over 600 were injured in Japan's Kansai region during typhoon Jebi in September. At least 31 lost their lives and more than 400 were injured as a result of a 6.7-magnitude earthquake, which hit Hokkaido on 6 September [1]. That year Japan registered 14 disasters but just five of them amounted to more than USD 1 billion in economic losses [2].

At the same time, the 2018 Cabinet Office's White Paper on Disaster Management in Japan indicated that annual average temperatures are expected to rise significantly across the country toward the end of the 21st century (2076–2095), an increase of approximately 4.5 degrees under the RCP8.5 scenario in comparison to the end of the 20th century. The report also projects an increase in both short-duration downpours and a number of dry days. As a result, an increased number and intensity of disasters is also expected [3].

To add to this, Japan is facing a number of other challenges, all of which could play a role in exacerbating hazard risks. The nation is one of the fastest aging societies in the world coupled with a very low birth rate, which leads to a dwindling labor force and an increased cost for social security services and healthcare. By 2050, the workforce is projected to shrink from 77 million to 53 million people. Most of the public infrastructure, built in the post-war years between the 1950s and the 1970s

is also aging and will require massive investment for replacement and rebuilding [4]. The increasing demands for energy and the diminishing food security are of particular concern not only for the Japanese administration but for populations worldwide. As the world population is expected to reach more than 9 billion people by 2050, these trends will become the status quo [5].

In an attempt to tackle the complex challenges of the present and the future, the Japanese government, in cooperation with the private sector, has formulated a new comprehensive strategy, under the name of Society 5.0, which is to utilize a number of various technological innovative solutions and through them reach a more secure and sustainable economic and societal development. Society 5.0 is meant to be a "human-centered society [ ... ] that highly integrates cyberspace and physical space" in the domains of manufacturing, mobility, healthcare, agriculture, energy, and disaster prevention [6].

A number of initiatives in Japan and worldwide have already looked towards developing new technologies to support disaster and climate change management efforts. The Disaster Risk Analysis System (DRAS), for instance, helps to inform decision-makers and ordinary citizens in Bosnia and Herzegovina on floods, earthquakes, and landslides. The social venture mHS City Lab has introduced RCL Cloud digital tools that assist low-income communities in India with information on housing reconstruction [7]. Social media has been used to understand perceptions of migrants and refugees and big data has been analyzed to study rescue patterns in the Mediterranean Sea [8]. GIS and computer modeling systems have allowed to study and forecast changes and linkages between weather, water, soils, earth, and human activity and are now able to showcase the interdependencies among various and complex economic, social and environmental impacts [9].

Society 5.0 plans to continuously improve such technologies to be able to predict earthquakes, tsunami and climatic changes more accurately and at an earlier stage and to respond more efficiently when disasters strike. The new strategy is also expected to assist in developing sustainable adaptation policies that link stakeholders and communities and ensure an improved cycle of resource use and services. The government of Japan plans to create the first 'super-smart' nation in the world and to share its experience with other interested nations and thus work towards building a better and safer world [6]. Such technologies, however, can carry potential threats, related to data privacy, cyber threats, issues of accountability, increased cost of development and maintenance and increased societal inequalities, all of which deserve sober attention.

The current paper aims to discuss disaster risk and climate change policies in Society 5.0 with some special focus on adaptation and inclusiveness. We start with giving details on the Society 5.0 concept and its goals, after which we focus more specifically on how disaster and climate change policies are integrated into the new strategy and proceed to discuss several contentious issues which represent both opportunities and risks or challenges for implementing the concept in a truly sustainable way. The paper tries to provide various points of view and food for future thought and research, rather than solutions or specific suggestions. The information included in this research is mostly collected from official documents of the Government of Japan, as well as documents of the Japan Business Federation–Keidanren. That said, as data on the practical implementation of Society 5.0 is still relatively scant there is a level of speculation on part of the authors.

## 2. What Is Society 5.0?

Society 5.0 is described as the step in human development that follows Society 1.0 of the hunter-gatherers, Society 2.0–the development of agriculture and the beginning of permanent settlements, Society 3.0–the process of industrialization, and Society 4.0–the information age of the Internet and communication technology (as illustrated in Figure 1). Society 5.0 is the response to the inevitable technological innovation and the increased use of big data, artificial intelligence (AI), the Internet of Things (IoT) and robotics [10] (see Figure 1).

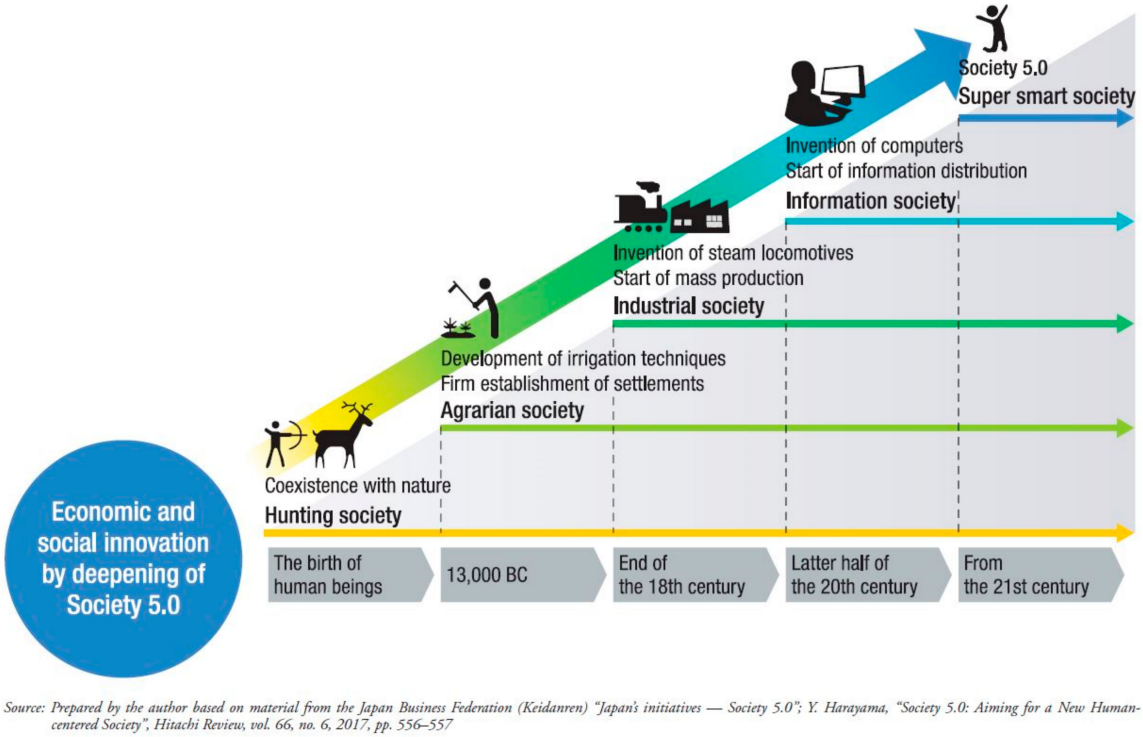


**Figure 1.** Evolution of human societies, leading to Society 5.0. Source: Fukuyama, 2018 [4].

Society 4.0, or Industry 4.0 (originally Industrie 4.0) was a term coined in 2011 by the German government, which is used in its high-tech development strategy for the future. The strategy prioritizes digitization of the economy and the society, more sustainable production of energy, and a merge of sectors for limiting energy waste, intelligent mobility, smart city creation, encouraging circular economy, and high automation using the advances in technology. IoT, machine learning, and provision of real-time data are the new tools that Industry 4.0 is planning to employ toward that end [11–13].

Society 5.0 is similar to Industry 4.0 but takes a step forward, depicting a data-driven economy and society–a Super Smart Society, with a focus on individual needs and capabilities. The concept envisages a merge between the real (physical) world with the cyberspace in order to efficiently collect more precise and personalized data for improved problem solving and value creation [4]. The vast amount of information which until now required a great amount of time and human resources is now meant to be analyzed by AI much faster and transformed into easy to understand data which humans can use in industry and social services [14].

This process is expected to change the way society functions in almost all areas of human life and to positively affect the economic development of Japan and other nations, as well as to assist in tackling a number of social challenges [4]. Dr. Harayama, an Executive Member of the Council for Science, Technology and Innovation, Cabinet Office of Japan, described the Society 5.0 vision in the following way: "[ . . . ] a society where the various needs of society are finely differentiated and met by providing the necessary products and services in the required amounts to the people who need them when they need them, and in which all people can receive high-quality services and live a comfortable, vigorous life that makes allowances for their various differences such as age, sex, region, or language. It is called this to indicate a new society created by transformations led by scientific and technological innovation [ . . . ]" [15] (p. 10).

Society 5.0 is to influence almost all aspects of daily life but has mostly focused on nine economic and social sectors, as shown in the Table 1:

**Table 1.** Economic and social changes in Society 5.0–focus areas. Source: adapted from Keidanren, 2018 [16,17].

| Sector | Policies |
| --- | --- |
| Cities and Regions | Improved data sharing on energy, transportation, water, waste, human traffic, etc.; community decentralization in suburban and rural areas; respect for diversity. |
| Energy | Development of affordable sustainable energy; development of micro-grid systems to respond to local conditions. |
| Disaster Prevention | Information sharing across organizations; utilization of digital technologies; continuation of medical services and aid in the event of disasters. |
| Healthcare | Focus on prevention and individualized healthcare services; access to personalized life-stage data, utilizing AI-based medical services, such as telemedicine. |
| Agriculture and Food | Utilization of technology for crop growth and optimization of the food value chain; inclusion of various actors. |
| Logistics | Utilization of technology for automation of logistics; data sharing across the whole supply chain; personalized products responding to specific customer needs. |
| Manufacturing and Services | Focus on services, not hardware; customers will be able to order items specifically designed for their needs; support for small businesses to produce high-quality goods. |
| Finance | Diversification of financial services with the help of digital technologies; better distribution of funds across society; improved access to financial services, based on utilization of crypto-currencies and token economies, such as blockchain. |
| Public Service | Improved services by public administration based on digitization and improved data sharing; establishing safety nets in response to safety issues. |

The Society 5.0 concept was made official policy for the first time when it was included in the 2016 Fifth Science and Technology Basic Plan, formulated by the Council of Science, Technology, and Innovation, under the administration of the Ministry of Education, Culture, Sports, Science and Technology (MEXT) and the Ministry of Economy, Trade and Industry (METI). The policy was discussed and coordinated with private sector representatives and has been widely supported by the Japan Business Federation–Keidanren and its member companies, most of which are large corporations. This close collaboration has resulted in Industry-Government Committees being formed, working on developing approaches to realizing Society 5.0 within their focus sectors. All involved parties have pledged that the new strategy for the future will substantially support the achievement of the United Nations' Sustainable Development Goals (SDGs) and will ensure the creation of a sustainable, inclusive and human-centered society [10]. Japan also intends to spread this concept widely and work with other interested nations on its implementation [6].

For the purposes of this paper, the authors have mainly focused on how Society 5.0 will or could impact disaster risk and climate change policy and practices, putting a special accent on adaptation and inclusiveness. These will be discussed in the next sections.

## 3. Disaster and Climate Change Management in Society 5.0

In its 2016 5th Science and Technology Basic Plan, the Government of Japan foresees a number of measures aimed at improving policies and practices for tackling disasters and climate change and related issues:

(a) The disastrous effects of the 2011 Great East Japan Earthquake have prompted Japan to think about alternative energy sources, more specifically about developing technology that can provide more efficient energy production and distribution, as well as will look for means to reduce the cost of renewable energy. In this regard, the Government has pledged to support research and development and work with industry and the municipalities [18].

(b) In the face of increasing food insecurity due to the combined effects of climate change, expanding the global population and deficiency in labor in the farming industry, Japan has considered methods to improve food production and supply. "Smarter" agriculture is being promoted, which utilizes information and communication technology, robots and independent vehicles and machines to reduce labor and costs. AI and sensors will also be used to assist farmers in weather prediction and in monitoring the level of water, soil minerals, and others to improve nutrients in crops [18].

(c) Learning from past disasters and preparing for a potential major earthquake close to Tokyo, Japan has also pledged to focus on research and development on technologies for designing and building disaster-resilient infrastructure. This effort also includes the detection of hazardous pollutants in the atmosphere, in water and the soil, as well as radioactive pollutants. This also means setting up new regulations and guidelines and adjusting the safety ratings for chemical substances and pollutants [18].

(d) In order to tackle the increasing effects of climate change, the Government will also pursue the usage of satellites, radars, sensors and other technology to monitor real-life environmental data and will support the development of carbon capture and storage (CCS) technologies [18].

Working together with the government, the Japan Business Federation–Keidanren, envisages linking specific technological solutions and outputs to the SDGs within the framework of Society 5.0. Thus, the federation plans to develop an early warning alert system for the detection and prevention of infectious diseases using several types of monitoring data in line with SDG 3 Good Health and Well-being. In the field of disaster and climate change management, Keidanren considers using High-Performance Computing to analyze meteorological and other observation data, then create simulations to improve preparedness. Remote sensing will be used to improve monitoring of a number of systems, among which water quality, the status of forests, and the level of land degradation in selected areas, working to respond to the requirements of SDGs 13 Climate Action, 14 Life Below Water and 15 Life on Land [19].

More recently, the Action Plan of the Growth Strategy of Japan from 21 June 2019 gave some details of the vision of the Japanese government on the implementation of Society 5.0 in relation to compliance with the SDGs and the 2015 Paris Agreement. In the document the government pledges to reduce GHG emissions by 80% by 2050, leading to a decarbonized society, and thus trying to limit the negative effects of climate change, which could also impact disaster risk factors. To achieve this, the cabinet intends to focus on research and development in innovations, to lead a global cooperation effort between research institutions from various countries, to involve both the public and the private sector and to create favorable policies for green finance and market creation. Ambitious technological innovations are also foreseen in order to reduce the cost of alternative energy providers, e.g., production of hydrogen, and to commercialize methods such as artificial photosynthesis which can utilize CO2 emissions [14].

An example for a move in that direction is the development of hydro vehicles, called fuel cell vehicles (FCVs) which run on hydrogen and do not emit CO2. For the commercialization of such vehicles, there is a need to construct hydrogen refueling stations to provide hydro gas instead of gasoline and diesel. The gas company Taiyo Nippon Sanso designed mobile stations with multiple functions and at half the cost of conventional hydrogen refueling stations, supporting the wider use of FCVs [20].

The Government's Cabinet Office also mentions using AI to be able to quickly analyze a vast array of available data from satellites, weather radars, observation drones, sensors, and social media at the

same time to receive comprehensive real-time information before and in times of disasters. This will allow for improved preparedness, as information on impending disasters and evacuation routes and shelters will be sent to individuals' smartphones. Robots and drones are envisaged to assist in search and rescue missions and in delivering relief goods and medicine [6].

Since 2018, Puerto Rico, for instance, has been testing operating drones for the delivery of medical supplies to remote areas. The drones are capable of delivering medical supplies, which are required to be contained in specific temperature conditions, such as vaccines, as well as non-refrigerated packages, such as asthma medicines. The initiative was undertaken after seeing the devastating effects of Hurricane Maria the previous year and the desire for improved response measures. In a 2017 trial in Sweden, drones managed to deliver aid to heart attack victims 17 minutes earlier than the emergency team [21].

Another example comes from the research team of the Mechatronics lab at the Kyoto University, Japan, which is currently developing advanced snake robots, capable of crawling into narrow spaces, moving through corners, and overcoming various obstacles, which can be used to search for victims in collapsed or dangerous buildings in cases of disasters. The robot is also capable of climbing tubes and stairs. The team has been working on adding a screwdriver unit to the robot so that it can be used in pipe inspections and rescue operations, including developing an amphibious model for underwater operations. The snake robot was used during the 2018 heavy rainfalls in Okayama Prefecture to support a search mission in a destroyed house with a risk of a secondary collapse. The robot managed to successfully bring out the valuables of the residents [22,23].

In 2016, Hitachi Ltd. started constructing RemixWater, a system capable of desalinating seawater and turning it into drinking water, for the needs of selected communities in South Africa in an attempt to tackle prolonged drought and water insecurity. The technology uses less energy and is more environmentally friendly than previous desalination systems [24].

Another company, NTT DATA Corporation, has created a 3D mapping service, called AW3D, which makes use of data from satellite images from JAXA and Maxar Technologies to build detailed topographic maps with up to 50 cm resolution data and which covers the whole planet. The tool uses artificial intelligence and big data to analyze the information, which allows for reduced costs and shorter timelines. AW3D has already delivered valuable insights, providing disaster and public health-related maps in more than 115 countries [25].

Keidanren also mentions that disaster information sharing will be facilitated through information collaboration systems, which will collect data on damages and aid supplies from evacuation centers, from IoT systems, and from social media, and will be shared in real-time with relevant local and regional respondents from the public and the private sector [16].

Going back to Table 1 in this paper, we could deduce that certain improvements in other areas and services would also have an impact on disaster management activities. The availability of comprehensive data on energy, human flow, transportation systems, water and waste in living areas, for example, will assist in creating situation awareness maps and could speed up the response. The digitization of public services, allowing for quick access to information on population distribution, housing, public buildings (schools, hospitals, care homes, etc.), as well as digitally connected logistical networks could also lead to improvements in a number of areas, such as locating victims, identification of groups of people with special needs, damage assessment, and assessment of routs for aid distribution, to name a few. Access to financial services for traditionally marginalized groups could mean improved nutrition and living conditions, which could also have an effect on how people prepare and respond to climate change and disaster-related hazards.

## 4. Discussion

### *4.1. Society 5.0 and Adaptation*

The IPCC's Fifth Assessment Report has indicated that global temperatures will rise in all assessed scenarios, even if measures are taken to reduce greenhouse gas emissions. Being faced with an increase in disastrous events, Japan has realized the need to invest efforts not only in prevention and response but also in developing adaptation measures to cope with the current and future risks. As a result, the Government released its first National Plan for Adaptation to the Impacts of Climate Change in November 2015. Its aim is to minimize potential hazards and to "create a secure, safe, and sustainable society that can quickly recover from those impacts" [26].

Assessments of the current and future plausible impacts of climate change on a number of important sectors showed the highest levels of risk in relation to agricultural production of rice and fruit trees, predicting also an increase in pests and weeds, degradation of native species in ecosystems, as well as an increased risk of disasters, such as floods, tidal waves, storm surges, typhoons and heat waves [26].

In the search for solutions, the Government also issued the Fifth Basic Environment Plan on 17 April 2018, which highlighted the benefits of applying the Regional Circular and Ecological Sphere (R-CES) concept to support the creation of sustainable societies [27–29]. The R-CES concept encourages the sustainable utilization of local and regional resources, while also creating natural links between rural and urban areas and between systems (e.g., forests and rivers and the countryside), which do not strain the eco-system and support the efforts towards reaching a decarbonized society. These systems are to enhance adaptation to both climate change and disaster management risks, ensuring improved resource management and access to food and water supplies and energy and improved logistics and communication [30].

Society 5.0 links with and aims to offer a number of solutions to respond to the above-mentioned policies. Table 2 below shows an interface between the focus sectors identified in the National Plan for Adaptation to the Impacts of Climate Change and the focus sectors of Society 5.0 and how some of the proposed solutions in Society 5.0 could benefit adaptation measures (see Table 2).

Looking at the table above and the proposed solutions it becomes clear that building a more sustainable society and ensuring improved adaptation and response measures involves cooperation between multiple sectors and actors. To add to this, the increasing and more complex vulnerabilities of communities (e.g., aging, inequalities, urbanization, limited resources, etc.) mean that such measures will have to continuously change and adapt so as to be able to adequately respond to the new challenges [31]. Effective and timely communication and coordination between various respondents have become a priority in order to ensure that there is no overlap of activities and that all actors are complying with rules and standards.

Realizing this need, the Council for Science, Technology, and Innovation of the Cabinet Office collaborated together with Hitachi to develop the Sharing Information Platform for Disaster Management (SIP4D). The Platform collects input from various organizations, involved the private sector, civil society, and local respondents, combines and distributes the knowledge and data to all parties in a timely manner and in the same data format. This allows for much easier information sharing between multiple respondents that each uses their own data formats and processes. If information is insufficient, the system operates a logical integration function, providing an estimation of which roads or facilities might be passable or not, using hazard maps and images obtained prior to or during the disastrous event [31].

**Table 2.** Adaptation measures for vital sectors in Society 5.0. (Prepared by authors with sources from: Govt of Japan 2015 [26]; Keidanren, 2018 [19]; Keidanren, 2017 [17]; Harayama, 2017 [15]; Mitra et al., 2019 [27]).

| Adaptation/ Society 5.0 | Agri/Forest | Water | Natural Ecosystem | Disaster | Health | Econ. Activities | Urban |
|---|---|---|---|---|---|---|---|
| **Cities and Regions** | Improved links between urban and rural (R-CES) and sustainable resource use, living in harmony with nature | | Green infrastructure | Utilization of various types of data for monitoring, early prediction, and early warning | Easy access to medical services and personalized health data | Sharing of risk information, business continuation plans, new business models based on services | Smart city principles |
| **Energy** | Promotion of circular economy and sustainable energy to limit waste, green infrastructure, use of hydropower energy, | | | Introducing micro-grids and local mechanisms to ensure continued supply during disasters | Continuation of energy supply for healthcare providers in all conditions | Supporting innovations and entrepreneurship for clean energy | Smart energy grids, decentralization of energy supply |
| **Disaster** | Remote sensing and oceanographic data for monitoring water quality, forests, land degradation | | | Sensors for risk assessment, monitoring of infrastructure conditions, improved data for weather predictions using High-Performance Computing, mapping | Telemedicine to insure continued medical services during disasters, drones for aid supplies, personalized medical data. | Resilient infrastructure, early warning, drones and robots for supplies, optimization of supply chains through sharing data | Sensors for detecting infrastructure conditions, local energy supply, new materials for more resilient infrastructure. |
| **Healthcare** | Easy access to healthcare in rural areas | Water-borne disease prevention through monitoring | Ecosystem-based health care | Developing an early-warning alert system for infectious diseases by using multiple types of monitoring data | Access to healthcare and personalized health data | Improved healthcare services for workers | Urban heating and air quality monitoring |

**Table 2.** *Cont.*

| Adaptation/ Society 5.0 | Agri/Forest | Water | Natural Ecosystem | Disaster | Health | Econ. Activities | Urban |
|---|---|---|---|---|---|---|---|
| **Agri and food** | Early prediction of climate change impacts on crops, smart agriculture through automation and improved monitoring of weather conditions, methods for increasing the nutritional value in plants, understanding ecology | | | Early prediction and improved preparedness, water storage techniques | Production of healthy food with high nutritional value | More stable food price as a result of increased food security | Encouraging urban and semi-urban agriculture |
| **Logistics** | Improved urban-rural linkages for food supply | Improved water resource management | Green logistics | Technologies for continued aid supplies and emergency logistics | Ease the access to medical services and delivery of medical supplies | Facilitation of the flow of goods, real-time logistical tracking, improved efficiency | |
| **Manufacture/ services** | Limiting production waste, green economy, more efficient use of resources | | | Sharing of risk information, business continuation plans | New medical equipment development | Support for smaller businesses to produce high-quality goods and services | Production of goods for individual needs of consumers |
| **Finance** | Insurance schemes | Eco-tax, green economy | | Continuation of financial services | Investing in preventive healthcare, insurance | Diversifying of financial services, cashless economy | Investing in smart living |
| **Public services** | Developing comprehensive information-sharing platforms and coordination mechanisms with partners from the private sector, academia, and communities, monitoring mechanisms for early detection of hazards, development of rules and regulations and standardization of interfaces and data formats, human resource development. | | | | | | |

SIP4D was used during the 2016 Kumamoto earthquake to support damage assessment. The system assisted in: (a) identifying the level of the seismic intensity distribution in different areas and the amount of destroyed or damaged buildings, (b) identifying the condition of roads, (c) sharing of facility status information and the number and needs of evacuees. All of this made coordination between different agencies and actors easier and helped respondents visit hospitals and shelters more efficiently [31]. In the Society 5.0 age, much more information from various data sets and social media is to be utilized, requiring an update of existing systems and new regulations for data sharing. In Japan, a special team was set up in April 2017 to form a disaster information hub that is tasked with drafting rules for the use and sharing of information and which involves multiple actors from the private and the public sectors [31].

That said, there are a number of issues and uncertainties which still remain. Ensuring cybersecurity, adopting accountability measures and penalties for lawbreakers, the continuously changing nature of data itself and the differences in values between communities, countries, and regions once outside of national borders represent only a portion of the questions which need to be answered. To add to this, respondents collect information on some of the most vulnerable populations but at the moment there is no clear mechanism for including their voices in the process of decision-making on how their data is going to be used [32]. A truly inclusive Society 5.0 will need to include communities in the process as well.

To add to this, it is important to note that an essential part of every adaptation process is awareness-raising and providing early on education to communities. In December 2017, a New Economic Policy Package was developed and released that contains specific measures aimed at the realization of Japan's future strategy. The document describes the intention of the government to bring about free education and continuous learning opportunities for people of all ages, with specific supportive measures for low-income or disadvantaged groups, which would ensure that all generations are equipped with new skills that might be needed in Society 5.0 [33]. While the document is clearly designed to address economic development issues this concept could incorporate streamlining of disaster risk and climate change information and adaptive and response measures into educational programs. The nature of Society 5.0 means that those could be presented in interactive ways (such as games) depending on the audience, ensuring easy memorizing. As human resource development is a part and parcel of the new strategy that would mean that including disaster and climate change components in such programs would reach the majority of people and improve overall community preparedness.

Examples of different approaches could also be found in already existing initiatives. The Kashiwa-no-ha (Oak Leaves) smart city project, for instance, represents a public-private-academic initiative, which also involves citizens in the decision-making process related to the further development of the area. A 273-hectare site close to Tokyo was marked for re-development in 2001 and an express train line was built, connecting it with the capital. Several university campuses and private companies collaborated to develop the space as a "place for innovation" and an Urban Design Center was opened to coordinate activities aimed at solving local issues. Sustainability and energy conservation became an important part of life in the Kashiwa-no-ha after the 2011 Toyoko earthquake leads to an energy blackout for several days. In response, the Mitsui Fudosan private company created an integrated power distribution system that allows for power-sharing between public and private buildings and can supply 60% percent of the usual energy in a case of an emergency for three days [34]. This example shows that one of the possible ways to improve adaptation while including communities and ensuring coordination between parties could be to encourage the creation of multi-stakeholder bodies that engage local residents and actively seek to understand actual needs and take advantage of existing local knowledge. A way to reach out to communities could, for example, be through linking with "machizukuri" ("city making") groups which are traditional for Japan and which are already involved in improving community life. This practice could be adapted to different countries and regions according to local culture and customs.

### *4.2. Society 5.0 and Inclusiveness*

With the development of strategies for the implementation of Society 5.0 the government of Japan, together with businesses and other partners has started looking into standardization of policies and rules, which are to ensure that the benefits of the new type of society will be distributed evenly and that personal data of citizens will be utilized in a responsible manner. Thus far five principles have been established: inclusivity, sustainability, human-centered approach, innovative thinking, and improved governance. Alongside these principles, the government has indicated that it would like to create a more inclusive model, where a wide spectrum of actors is included in the implementation of Society 5.0. Such groups of previously excluded people would include women and youth, for instance [15,35].

The effects from the 2018 disastrous West Japan floods and the Faxai and Hagibis typhoons of 2019 have proved that current disaster management policies and practices still do not provide adequate support for disadvantaged groups. In October 2019, approximately 103 people died due to floods and landslides during typhoons Hagibis and Buailoi, of whom 60, or more than 50%, were 65 years of age or older [36]. It was also reported that two homeless people were denied shelter in northern Tokyo and one homeless person was found dead near a flooded area during typhoon Hagibis, causing a public outcry [37].

Earlier, in September the same year, more than 100 people got injured and three people died while trying to repair their own homes in Chiba prefecture after typhoon Faxai. The majority of the victims were also elderly people. At the same time, more than 500 public schools in Chiba were damaged, obstructing classes and posing danger to the students [38]. In the 2018 West Japan floods, out of 169 dead victims, 118 were in the age group above 60, and six were under 10 years old. Many of the elderly people were living alone and could not reach higher ground to wait for rescue [39].

These examples come to show the importance of an all-inclusive approach to developing Society 5.0 or any disaster or climate change management policy and in each phase of the disaster management cycle. If Society 5.0 is to be truly inclusive it will need to consider a diverse group of people, including the elderly, young children, pregnant women, economically challenged, people with disabilities, people from different ethnicities and religions, foreigners, and other groups which might be disadvantaged. On 15 February 2019, a Council for Social Principles of Human-centric AI was established in Japan which consists of a number of academic bodies, public institutions, and private sectors. The Council recommended the implementation of several principles among which: (1) a human-centric principle, which means AI should not impede the fundamental human rights established by legislation, (2) principle of education, promising that people will have the equal opportunity to learn and use AI technology in a safe manner and will receive sufficient information on benefits and risks of using such technology, (3) principle of privacy protection related to the uses of personal data, which should not impede individual freedom and equality, (4) principle of ensuring security (cyber-security), (5) principle of fair competition which aims to prevent data monopoly, (6) principle of fairness, accountability and transparency void of segregation and bias, and (7) principle of innovation which supports joint efforts of different actors [40]. While the principles reflect the need for equality and an all-of-society humanistic approach it does not mention the inclusion of marginalized groups in the decision-making process. The Council does not appear to include members of civil society organizations, for instance.

A tangible step towards inclusion could be reaching out to community-based organizations and promoting publicly available platforms for discussion and opinion sharing early on in the process. It is very important to point out that teaching new skills and using innovative technologies might prove successful in controlled environments in companies or test city areas where employees are monitored and performing defined tasks but it is a completely different matter to incorporate intelligent technology and tools in the everyday lives of millions of residents, and especially in the lives of the groups that Society 5.0 aims to include (children, women out of the workforce, the elderly, people with disabilities), even after conducting workshops and courses [41]. The new policies suggest the inclusion

of relevant activities from the beginning of education but would that mean that several generations will have to suffer the brunt of adapting to the rapid changes, trapped in the trial and error process?

To add to this, technological development, accurate data, and improved communication and coordination can assist in such initiatives only if bias is excluded from the picture. Tests in machine learning, for example, have shown that in the process, based on the input of a large amount of existing information, if such input is biased or discriminative against certain social groups, then the result of the machine learning experiment will also be biased and discriminative. A test in 2019 showed that Google's AI-based hate speech detector was biased against black people. In October the same year, it was also found that an algorithm used by a great number of healthcare providers in the USA was set up to allocate care resources on the basis of how much it would cost to treat every patient. The logic behind the algorithm was that the more expensive the treatment, the greater the need the patient has. This bias, however, can lead to unequal access to healthcare and marginalize certain groups of society [42].

In Society 5.0, people will receive detailed disaster risk information on their mobile phones and big data will be utilized for improved information gathering and sharing. The 2017–2020 statistics show that approximately 107 million people in Japan (out of 126.8 million overall population) own a mobile phone [43]. That said, there are still portions of the population who do not use a mobile phone (usually very young children, elderly people, homeless), or who are not tech-savvy.

Outside of Japan, in many places where emergencies occur, using big data analytics to extract information from social media could deliver biased results, as social media users are usually more economically stable, male and urban. The poor and women are among the most marginalized groups in under-developed and developing economies [32], but even in Japan, digital literacy and access to technology are questionable in rural areas.

Finally, in its Fifth Science and Technology Basic Plan, the government has recognized that in promoting technological innovation outside of Japan, and mostly in emerging and developing nations, it is important to include various social groups, support low-income individuals, and formed equitable partnerships "that break away from the aid-driven forms of cooperation that have prevailed up to now". This "inclusive innovation" approach is to build partnerships based on the strengths of each member and to address disparities through discussions, joints research and forming international professional networks [18] (p. 58). This, however, means that technology will have to become widely accessible and affordable which is currently not the case. To add to this, even if the official policy describes responding to the needs of disadvantaged groups, it is yet to be seen how those groups will be integrated into the process, as it appears that until now the policy has been formulated mostly in a top-down manner by government administration and large businesses.

### *4.3. Contentious Issues in Society 5.0*

Japan has taken steps towards developing definitions, principles, and standards for the focus areas of Society 5.0 and is considering proposing the devised standards to ISO in order to promote them in the international community. For this task, a Society 5.0 Standardization Promotion Committee, supported by the Ministry of Economy, Trade, and Industry, was established in 2018 with the task to research the applicability of Society 5.0 in and outside of Japan and to draft guidelines on the responsible use of data and related technologies [35].

Still, one of the most contentious issues for realizing Society 5.0 remains the issue of ethics, as different nations and even communities within a country or a region can have different values and understandings of how personal data should be treated and used. International frameworks and guidelines in the field of technological innovations are needed urgently but there is a risk that similarly to other international initiatives, such frameworks might remain mostly advisory rather than legally binding in order to pass the minimum acceptance bar by nations. Completely separating climate change and disaster management talks from other sectors cannot provide a viable solution as sectors are interdependent and data and systems will be closely integrated into Society 5.0.

In a 2019 interview, Mr. Murat Sönmez, Head of the World Economic Forum Centre for the Fourth Industrial Revolution Network, put forward several ideas relating to managing data, discussing the possibility to establish "circuit breakers" into intelligent devices, meaning that information will stop flowing if a non-ethical request is made to the system. In order to prevent companies from monopolizing data, he suggested that certain restrictions be introduced so that data could be used only for specific intended purposes with tracking mechanism of who is using the data and for what purposes. Protocols for data exchange between parties and trading tokens could also be introduced to put a value on information and to identify data ownership. If such mechanisms are established and there is an agreement between countries, cross-border exchanges of information would also be possible. The question, then, is who will monitor this process and will act as a regulator, as well as who will coordinate the process and ensure the protection of data of individuals. Multiple trials will need to take place before such systems could become widely operational [44].

Another issue of accountability relates to system and product failures and maintenance of the technology. Most of the current and future technological solutions are produced by the private sector and will need to be maintained and updated by the product or service providers. This means that legislation needs to be in place to establish rules and terms for prolonged support and determination of responsible parties in cases of failures [45].

Moreover, as technologies, such as drones, become increasingly affordable and accessible more and more citizens get involved in the response, which might have very positive outcomes but may also become dangerous when there is no prior training. During the devastating 2017 wildfires in California drones of private individuals obstructed the work of firefighters. In this case, law enforcement officials have judged that responsibility will be carried by the drone operators and not the manufacturers but there is a clear need for establishing legislation in the area. More recently, countries have started requiring licenses for flying drones, and especially drones used for supplying medical aid, but drones are only a small part of the overall issue. Some experts have also warned against over-relying on private companies for the provision of humanitarian assistance when lives are endangered [45].

One more issue worth mentioning here is the so-called e-waste (electronic waste) management. A study by the United Nations University showed that the United States, China, and Japan were the three countries generating the largest amounts of e-waste respectively [46]. In 2016, 44.7 million metric tonnes of e-waste was generated worldwide of which only 20% is documented as collected and recycled. The rest are usually incinerated or land-filled, risking the leakage of toxic materials in the environment and posing a threat to sustainable development. The study also showed that more and more nations are adopting legislation to tackle the issue with close to 66% of the world population being covered by e-waste legislation by 2017, the percentage was 44% in 2014 [47].

Japan has implemented a number of regulations and has established a take-back system for the collection and recycling of e-waste materials but still, the difference between the amount of generated and collected e-waste is tremendous (in 2016, for instance, the country generated 2.1 Mt and collected 546.4 Kt of e-waste) [47]. The extensive utilization of technologies in Society 5.0 means that substantial efforts will need to be made to ensure environmental protection and public health are sustained. This could, for instance, include the development of more and new types of biodegradable materials. New national, regional and international agreements will also need to be in place to establish rules for improved collection and recycling of e-waste.

### *4.4. Final Remarks*

Tokyo is among the greenest cities in Asia-Pacific. Specific policies and legislation were introduced to improve energy use efficiency, protect the natural environment and to promote greening of buildings in order to mitigate heat island creation. In 2009, a study revealed that even though 43% of urban citizens in Japan reside in Tokyo alone, the carbon emission levels of the capital were lower than in other highly populous cities. A number of environmentally friendly initiatives have also been planned for years to come which include financial incentives for commercial buildings that opt for utilization of

renewable energy, new recycling practices and planting half a million trees in Tokyo Bay to create a 'sea forest' [48]. In China, the city of Wuhan has started implementing ambitious projects to turn vast areas into natural sponges in an attempt to tackle an increasing number of heavy floods due to climate change. The city turned spaces into 'flood-able' parks, introducing new permeable pavements, wetlands, rain gardens and green belts [49]. Copenhagen has also opted for a more nature-based solution to possible flood and drought risks. The country's 'green and blue' approach includes the creation of parks that can become lakes during heavy rains. In 2010 an old military site was transformed into a nature reserve and birds, insects and animals have returned into the area [50].

These examples show that low-tech solutions could be at least equally effective as high-tech ones. In its Basic Environment Plan, the Ministry of Environment of Japan mentioned the importance of living in symbiosis with nature, noting that "We need to make full use of [this] traditional knowledge in conjunction with ICTs and other modern science and technologies, thereby ensuring minimal environmental impacts even as Japan's economy grows" [29] (p. 13). Society 5.0 promises 'freedom' from security and safety threats for its residents, based on new technological solutions, but it is essential to combine these efforts with already existing knowledge that has proved to work.

Moreover, what is currently available as examples for practical measures is rather vague in content. Before decentralizing energy sources, for example, there is a need to ensure that local suppliers can provide non-intermittent energy at an affordable cost which is also resilient to complex disasters and can adapt to the continuously changing climate. Areas that lack the potential to be self-reliant will still need to be supported from outside while prices remain affordable. Designing policies will require small-scale testing, risk assessment and foresight to understand more comprehensively the long-term results of possible solutions and innovations in advance.

The innovations of Society 5.0 could transform disaster and climate change management practices in ways that correspond to the increasing challenge of possible complex and mega-disasters, which allow for early detection of and adaptation to hazards and which assists respondents to reach more people faster and more efficiently. However, technology and innovation alone will not solve the pertinent issues in disaster management. These will only have a positive effect if applied in a responsible way by respondents and as long as the underlying issues and the nature of the problems are truly understood [50]. The basic needs of people caught in disasters are still food, shelter and psychological comfort and the solutions could be surprisingly simple or already existing [51]. Finally, to ensure that Society 5.0 does not evolve into a big corporation's top-down policy it is essential that tangible efforts are made to include smaller businesses and communities from various backgrounds in order to truly serve the needs of those it claims to put in its center.

**Author Contributions:** A.V.M. was responsible for the research and drafting of the paper as a whole, for the body and flow of the paper, and for all editing. R.S. has directly contributed to the contents of Table 2 and has provided overall coordination and guidance for the structure, flow, and focus of the paper. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research received no external funding.

**Acknowledgments:** The first author is thankful to the Ministry of Education, Culture, Sports, Science, and Technology (MEXT) of Japan for the provided scholarship to conduct research in the field of disaster risk reduction, and for the support received from the Disaster Resilience and Sustainable Development Program of the Graduate School of Media and Governance, Keio University, Japan, in conducting this study. All authors have read and agreed to the published version of the manuscript.

**Conflicts of Interest:** The authors declare no conflict of interest.

## References

1. Sim, W. Earthquakes, rains, heatwave, typhoon: Japan's brutal summer of 2018. *The Straits Times*, 8 September 2018. Available online: https://www.straitstimes.com/asia/east-asia/earthquakes-rains-heatwave-typhoon-japans-brutal-summer-2018 (accessed on 29 January 2020).

2. Fujimura, K. 2018: Japan's Year of Catastrophes. *AIR*, 24 April 2019. Available online: https://www.air-worldwide.com/publications/air-currents/2019/2018-japans-year-of-catastrophes/ (accessed on 29 January 2020).
3. Cabinet Office of Japan. White Paper: Disaster Management in Japan 2018. 2018. Available online: http://www.bousai.go.jp/kaigirep/hakusho/pdf/H30_hakusho_english.pdf (accessed on 29 January 2020).
4. Fukuyama, M. Society 5.0: Aiming for a New Human-Centered Society. Special Article 2. *Japan SPOTLIGHT* **2018**, *1*, 47–50.
5. United Nations (UN): Department of Economic and Social Affairs. World Population Prospects 2019. Population Dynamics. Graphs/Profiles. 2019. Available online: https://population.un.org/wpp/Graphs/Probabilistic/POP/TOT/900 (accessed on 29 January 2020).
6. Cabinet Office website. Society 5.0. 2019. Available online: https://www8.cao.go.jp/cstp/society5_0/index.html (accessed on 4 January 2020). (In Japanese)
7. Xia, Y. 2019 Global Platform for Disaster Risk Reduction Behavioural & Social Sciences Website. 2019. Available online: https://socialsciences.nature.com/users/170168-yang-xia/posts/49656-2019-global-platform-for-disaster-risk-reduction (accessed on 4 July 2019).
8. UN Global Pulse Website. 2019. Available online: https://www.unglobalpulse.org/projects (accessed on 4 July 2019).
9. UNDRR. *Global Assessment Report on Disaster Risk Reduction*; United Nations Office for Disaster Risk Reduction (UNDRR): Geneva, Switzerland, 2019. Available online: https://gar.unisdr.org/report-2019 (accessed on 4 July 2019).
10. UNESCO. Japan Pushing Ahead with Society 5.0 to Overcome Chronic Social Challenges. 21 February 2019. Available online: https://en.unesco.org/news/japan-pushing-ahead-society-50-overcome-chronic-social-challenges (accessed on 18 December 2019).
11. Granrath, L. Japan's Society 5.0: Going Beyond Industry 4.0. Japan Industry News. Available online: https://www.japanindustrynews.com/2017/08/japans-society-5-0-going-beyond-industry-4-0/ (accessed on 18 December 2019).
12. Bundesministerium für Bildung und Forschung/Federal Ministry of Education and Research (BMBF) -Internetredaktion. Zukunftsprojekt Industrie 4.0 - BMBF. Bmbf.de. website (Federal Ministry of Education and Research website). Available online: https://www.bmbf.de/de/zukunftsprojekt-industrie-4-0-848.html (accessed on 18 December 2019).
13. Bundesministerium für Bildung und Forschung/Federal Ministry of Education and Research (BMBF). Research and innovation that benefit people. The High-Tech Strategy 2025. Available online: https://www.bmbf.de/upload_filestore/pub/Research_and_innovation_that_benefit_the_people.pdf (accessed on 18 December 2019).
14. Prime Minister of Japan and His Cabinet Website. Action Plan of the Growth Strategy. 2019. Available online: https://www.kantei.go.jp/jp/singi/keizaisaisei/pdf/ap2019en.pdf (accessed on 17 December 2019).
15. Harayama, Y. Society 5.0: Aiming for a New Human-Centered Society Japan's Science and Technology Policies for Addressing Global Social Challenges. *Hitachi Rev.* **2017**, *66*, 554–555. Available online: http://www.hitachi.com/rev/archive/2017/r2017_06/pdf/p08-13_TRENDS.pdf (accessed on 19 December 2019).
16. Keidanren. Society 5.0 – Co-Creating the Future (Excerpt). 2018. Available online: http://www.keidanren.or.jp/en/policy/2018/095_proposal.pdf (accessed on 8 January 2020).
17. Keidanren. Society 5.0 – Co-Creating the Future (Excerpt) [Outline]. 2018. Available online: https://www.keidanren.or.jp/en/policy/2018/095_outline.pdf (accessed on 8 January 2020).
18. Government of Japan. The 5th Science and Technology Basic Plan [Provisional Translation]. 2016. Available online: https://www8.cao.go.jp/cstp/english/basic/5thbasicplan.pdf (accessed on 4 January 2020).
19. Keidanren. Society 5.0 for SDGs (graph). 2017. Available online: http://www.keidanren.or.jp/en/policy/csr/2017reference2.pdf (accessed on 17 December 2019).
20. Taiyo Nippon Sanso. Hydro Shuttle, a Hydrogen Station for Promoting FCV. 2019. Available online: http://www.tn-sanso.co.jp/jp/our_technology/hydro-shuttle.html (accessed on 7 January 2020).
21. Healthcare IT News Australia. Puerto Rico piloting drones to deliver emergency medical supplies. *Healthcare IT News*, 7 September 2018. Available online: https://www.healthcareitnews.com/news/puerto-rico-piloting-drones-deliver-emergency-medical-supplies (accessed on 8 January 2020).

22. Kyoto University Website. Matsuno Mechatronics Lab Graduate School of Engineering. Research on Snake Robots. 2019. Available online: http://www.mechatronics.me.kyoto-u.ac.jp/modules/kenkyu/index.php?content_id=27&ml_lang=en (accessed on 8 January 2020).
23. Kyoto University Website. Fumitoshi Matsuno. A Robot Developed by the Professors of the Graduate School of Engineering Conducted Disaster Response Activities at the Site of the Collapse of Handayama in Okayama Prefecture Due to Heavy Rains in Western Japan. 2018. Available online: http://www.kyoto-u.ac.jp/ja/research/events_news/department/kougaku/news/2018/180726_1.html/ (accessed on 8 January 2020). (In Japanese)
24. Hitachi. Commencement of the Demonstration Project for "RemixWater", Seawater Desalination and Water Reuse Integrated System in the Republic of South Africa. 2016. Available online: http://www.hitachi.com/New/cnews/month/2016/11/161118a.html (accessed on 7 January 2020).
25. KeidanrenSDGs. Global High-Resolution 3D Map: AW3D. 2019. Available online: https://www.keidanrensdgs-world.com/dat (accessed on 7 January 2020).
26. Government of Japan. National Plan for Adaptation to the Impacts of Climate Change. Cabinet Decision on 27 November 201. 2015. Available online: https://www.env.go.jp/en/focus/docs/files/20151127-101.pdf (accessed on 18 January 2020).
27. Mitra, B.K.; Shaw, R.; Fujino, J.; Watabe, A.; Takeda, T. Regional Circular and Ecological Sphere Concept for Sustainable Resource Management and Collective Resilience of Urban and Rural Lessons from Japan. In Proceedings of the 4th World Congress on Disaster Management, Mumbai, India, 29 January–1 February 2019. Available online: https://iges.or.jp/en/pub/regional-circular-and-ecological-sphere/en (accessed on 18 January 2020).
28. Ministry of the Environment of Japan. Outline of the Fifth Basic Environment Plan. April 2018 (presentation). 2018. Available online: https://www.env.go.jp/policy/kihon_keikaku/plan/plan_5/attach/ref_en-02.pdf (accessed on 18 January 2020).
29. Ministry of the Environment of Japan. The Basic Environment Plan. Cabinet decision on 17 April 2018. 2018. Available online: https://www.env.go.jp/en/policy/plan/5th_basic/plan.pdf (accessed on 29 January 2020).
30. Ministry of the Environment of Japan. Creation of a Regional Circular and Ecological Sphere (Regional CES) to Address Local Challenges. Annual Report on the Environment in Japan 2018. 2018. Available online: https://www.env.go.jp/en/wpaper/2018/pdf/04.pdf (accessed on 23 January 2020).
31. Usuda, Y.; Tanimoto, K.; Ono, I.; Matsui, T. Enhancements to Resilient Functions for Preventing and Minimizing Disasters. Development of Sharing Information Platform for Disaster Management. *Hitachi Rev.* **2017**, *66*, 758–759. Available online: https://www.hitachi.com/rev/archive/2017/r2017_07/r7-11/index.html (accessed on 23 January 2020).
32. Larsson, N. How technology can help disaster response. *The Guardian*, 25 January 2017. Available online: https://www.theguardian.com/global-development-professionals-network/2017/jan/25/the-future-of-technology-in-disaster-response (accessed on 8 January 2020).
33. Government of Japan. New Economic Policy Package [Provisional Translation]. 2017. Available online: https://www5.cao.go.jp/keizai1/package/20171208_package_en.pdf (accessed on 29 February 2020).
34. Japan BRANDVOICE. Japan Sparks New Life In Local Communities with Human-Centric Smart Cities. *Forbes*, 23 December 2019. Available online: https://www.forbes.com/sites/japan/2019/12/23/japan-sparks-new-life-in-local-communities-with-human-centric-smart-cities/#5b9360b64398 (accessed on 29 February 2020).
35. Okamoto, M. Standardization activities on "Society 5.0" in Japan (presentation). Standardization in a living concept "Society 5.0", BSN Seminar, Jakarta, Indonesia, 2019-03-27. In Proceedings of the BSN Seminar, Jakarta, Indonesia, 27 March 2019. Available online: https://www.bsn.go.id/uploads/download/0._standardization_activities_on_society_5.0_in_japan_okamoto_masahide.pdf (accessed on 18 January 2020).
36. The Mainichi. 30 Victims of Floods Triggered by Recent Typhoons in Japan Died in Cars. 2019. Available online: https://mainichi.jp/english/articles/20191112/p2a/00m/0na/004000c (accessed on 18 January 2020).
37. The Guardian. Japan's PM Pledges to Act after Homeless Men Denied Typhoon Refuge. 2019. Available online: https://www.theguardian.com/world/2019/oct/15/japan-shinzo-abe-pledges-action-homeless-men-denied-shelter-access-typhoon-hagibis (accessed on 18 January 2020).
38. The Japan Times. Three Die and over 100 Injured While Repairing Homes in Typhoon-Hit Chiba. 2019. Available online: https://www.japantimes.co.jp/news/2019/09/19/national/three-die-100-injured-repairs-typhoon-chiba/#.XiLy-sgzY2w (accessed on 18 January 2020).

39. The Japan Times. 70% of Rain Victims in West Japan Were 60 or Older, Death Tallies Show. 2018. Available online: https://www.japantimes.co.jp/news/2018/07/16/national/elderly-accounted-70-victims-died-torrential-rains-western-japan-tally/#.XiL7v8gzY2w (accessed on 18 January 2020).
40. Council for Social Principles of Human-centric AI. Social Principles of Human-Centric AI. 2019. Available online: https://www.cas.go.jp/jp/seisaku/jinkouchinou/pdf/humancentricai.pdf (accessed on 29 February 2020).
41. Gladden, M.E. Who Will Be the Members of Society 5.0? Towards an Anthropology of Technologically Posthumanized Future Societies. *Soc. Sci.* **2019**, 148. [CrossRef]
42. Blier, N. Bias in AI and Machine Learning: Sources and Solutions. 2019. Available online: https://www.lexalytics.com/lexablog/bias-in-ai-machine-learning (accessed on 18 January 2020).
43. Statista. Number of Mobile Phone Users in Japan from 2013 to 2020. 2019. Available online: https://www.statista.com/statistics/274672/forecast-of-mobile-phone-users-in-japan/ (accessed on 18 January 2020).
44. Sönmez, M.; Suzuki, N. Towards a Society Where Everyone Can Enjoy the Benefits of New Digital Technologies. How the Fourth Industrial Revolution Is Driving the Realization of Society 5.0. *Hitachi Rev.* 2019, 68, pp. 132–133. Available online: https://www.hitachi.com/rev/archive/2019/r2019_02/discussion/index.html (accessed on 23 January 2020).
45. Woodward, A. When It Comes to Natural Disasters, Technology Has An Unavoidable Dark Side. *Futurism*, 1 February 2018. Available online: https://futurism.com/technology-natural-disaster (accessed on 24 January 2020).
46. The Japan Times. E-Waste Recycling Still Falling Short. 2015. Available online: https://www.japantimes.co.jp/opinion/2015/05/09/editorials/e-waste-recycling-still-falling-short/#.Xivr8GgzY2w (accessed on 25 January 2020).
47. Baldé, C.P.; Forti, V.; Gray, V.; Kuehr, R.; Stegmann, P. The Global E-waste Monitor – 2017. United Nations University (UNU): Bonn, Germany; International Telecommunication Union (ITU): Geneva, Switzerland; International Solid Waste Association (ISWA): Vienna, Austria, 2017. Available online: https://collections.unu.edu/eserv/UNU:6341/Global-E-waste_Monitor_2017__electronic_single_pages_.pdf (accessed on 25 January 2020).
48. SmartCity Press. What Makes Tokyo The Greenest City Of Asia-Pacific Region. 2017. Available online: https://www.smartcity.press/asia-pacifics-greenest-city-tokyo/ (accessed on 29 January 2020).
49. Ling, J. Inside China's leading 'sponge city': Wuhan's war with water. *The Guardian*, 23 January 2019. Available online: https://www.theguardian.com/cities/2019/jan/23/inside-chinas-leading-sponge-city-wuhans-war-with-water (accessed on 29 January 2020).
50. Fleming, A. The case for making low-tech 'dumb' cities instead of 'smart' ones. *The Guardian*, 15 January 2020. Available online: https://www.theguardian.com/cities/2020/jan/15/the-case-for-making-low-tech-dumb-cities-instead-of-smart-ones?CMP=share_btn_fb&fbclid=IwAR0h7Mwg9uOeeMAVY4Cw6-0rOrUup9ftBMzbA1d3RVt8-bHpu-7P4gsijaw (accessed on 27 January 2020).
51. Yoo, T. 4 Ways Technology Can Help Us Respond to Disasters. World Economic Forum Website. 2018. Available online: https://www.weforum.org/agenda/2018/01/4-ways-technology-can-play-a-critical-role-in-disaster-response/ (accessed on 8 July 2019).