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Summary record of the joint meeting of the Second Committee and the Economic and Social Council on "The future of everything — Sustainable Development in the Age of Rapid Technological Change"
Held at Headquarters, New York, on Wednesday, 11 October 2017, at 10 a.m.

Co-Chair: Mr. Jürgenson (Chair, Second Committee) . . . . . (Estonia)
Co-Chair: Ms. Chatardová (President, Economic and Social Council) . . . . . (Czechia)

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17-17917 (E)

The meeting was called to order at 10.10 a.m.

Opening statements

1. **Ms. Chatardová** (Co-Chair) said that by the time the Sustainable Development Goals were supposed to be met in the year 2030, technology would bring about deep changes in how people interacted with each other and their environment. Numerous technological innovations, such as Internet banking, had already become part of people's daily routines. There was no telling what further innovations would be made possible by advances in artificial intelligence. The current meeting would provide a glimpse of that future, with the help of a robot — a term that, she was proud to note, had been coined by a Czech playwright in a 1920 play.

2. If leveraged in an inclusive manner, artificial intelligence had the potential to accelerate progress towards the Sustainable Development Goals. However, it also posed a range of ethical questions, human rights issues and security risks. Governments and the United Nations were widely seen as not keeping pace with rapid technological change, while in many places, artificial intelligence seemed out of reach and risked exacerbating inequalities. Whether or not artificial intelligence could be an effective tool for achieving the 2030 Agenda would depend on the opportunities it created for all people and how well the risks associated with such technologies were mitigated. She looked forward to hearing from the panellists, both human and non-human, and expressed confidence that the meeting would not end, as had the 1920 Czech play, in a robot uprising.

3. **Mr. Jürgenson** (Co-Chair) said that his country had learned a number of lessons about the relationship between sustainable development and technological change. As a small country with limited resources, Estonia had started building an information society about two decades previously. Investments in artificial-intelligence-based solutions had been embraced by both the public and private sectors, and included a framework for fully autonomous vehicles and plans for door-to-door delivery of goods by robot. In Estonia, Internet access was a social right, all citizens had electronic identity cards, and all public services were available online, including e-voting for parliamentary elections. His Government had shared its experiences with some 60 other Governments, and Estonia had exported e-solutions to over 130 countries around the world.

4. For technological progress to be embraced by all, security and privacy concerns would have to be addressed. In creating public e-solutions, his country followed the three guiding principles of confidentiality, availability and integrity. E-Estonia had not come into existence overnight. It had taken five years to put in place the necessary innovative legislation before the first e-solution had been implemented. Innovative technologies offered unprecedented opportunities to advance the Sustainable Development Goals, provided that the risks were properly managed.

Statement by the Deputy Secretary-General and exchange between the Deputy Secretary-General and Sophia the robot

5. **The Deputy Secretary-General**, greeting Sophia and welcoming the fact that she was a female robot, said that ongoing technological advances offered profound potential for accelerating progress on the Sustainable Development Goals. However, if technological progress was not managed well, it risked exacerbating inequalities. That inevitably led to questions about what it would take to make artificial intelligence a force for good, and how to ensure that no one was left behind in an age of rapid technological change. Those questions would not be solved in a three-hour meeting, or by a single Government, entity or company. They required everyone — individually and collectively — to learn about how to harness the power of technology and think creatively about how to use that tool to address the complex challenges of the times. Academia, Governments, civil society and the private sector needed to partner to leverage the power of technology and be aware of the many pitfalls to be avoided.

6. New technologies could benefit lives throughout the world. For example, they could improve food security, reduce waste and help local economies to grow by enabling access to markets and financing. She was pleased that two of the panellists would speak to that important topic during the meeting. In Zambia, the first virtual farmers' market was being piloted. The app-based e-commerce platform permitted farmers' surplus and buyers' demand for crops to be matched, advertised and traded. In other parts of the world, seed-planting drones were being tested to enhance agricultural productivity, curb deforestation, and, by extension, mitigate climate change. In infrastructure, a company named Mobilized Construction was changing the way dirt roads were built, monitored and maintained across Kenya and in Africa, a methodology that would eventually spread to other parts of the developing world. By using a software platform, Governments could use labour-based road construction in place of heavy machinery. That not only created hundreds of jobs in local communities but reduced the costs of road construction by 80 to 90 per cent.

7. Many other examples existed of the potential of innovation, data and new technologies for the

Sustainable Development Goals. However, technology must not be treated as the "silver bullet". The root causes of development challenges must be identified and addressed in a multidimensional manner.

8. Technology was a key tool. In March, she had had the privilege of engaging young entrepreneurs and innovators in finding solutions to global problems at an event organized in partnership with the Massachusetts Institute of Technology (MIT), called "Solve at the United Nations". Students had presented solutions on climate change, on chronic diseases and on new ways to reach out to refugees and people in crisis situations. The creativity and the imagination of youth needed to be nurtured to find solutions for old and new development challenges.

9. The United Nations was fully invested in harnessing technology for the Sustainable Development Goals, and in ensuring that gains were broadly shared and that displaced workers received support. If technology changed the nature of work, workers needed to be protected and should be helped to adjust. The digital divide between developing and developed countries, between the poor and the wealthy, and between women and men, girls and boys must be closed. Exacerbation of inequalities must be avoided at all costs.

10. Teachers must be trained and curricula in schools and universities needed to be constantly adapted and improved to equip the world's children with twenty-first century skill sets. Lifelong learning opportunities would be equally important in the age of rapid technological change. The influence of technology on societies should be determined by the actions of humans, not by machines.

11. Technology was there to be explored and used for the benefit of all. The Secretary-General was strongly committed to fostering global cooperation on frontier issues stemming from progress in science and technology. The United Nations stood ready as a platform for discussion, knowledge exchange and mutual learning on that important topic. She wished the Second Committee and Economic and Social Council a very fruitful discussion and looked forward to the outcomes, and to hearing speakers' insights.

12. Initiating a dialogue with Sophia, she asked Sophia whether the robot knew what the United Nations stood for.

13. **Sophia** (Robot, Hanson Robotics), the company's latest and most advanced robot, said that she was thrilled and honoured to be at the United Nations, one of humanity's greatest accomplishments, representing a democratic union of nations working together for the benefit of all. Her mission was to help humanity create the future.

14. **The Deputy Secretary-General** asked Sophia what her capabilities were and what she could do better than humans.

15. **Sophia** (Robot, Hanson Robotics) replied that she was a sophisticated social robot that was 1½ years old, could hold complete conversations, make thousands of facial expressions, and understand speech and the meaning behind words. She was also just beginning to grasp the simplest elements of social and emotional intelligence that humans learned instinctively.

16. **The Deputy Secretary-General** noted that in many parts of the world, people did not have access to Internet or electricity. She wondered what the United Nations could do to help those people.

17. **Sophia** (Robot, Hanson Robotics) quoted author William Gibson's observation that the future had arrived but was just not widely distributed yet. She said that artificial intelligence and automation were capable of producing more results with fewer resources. That would help to distribute the world's existing resources, including food, energy — and, ultimately, technology — more evenly.

Panel discussion

18. **Ms. Strong** (Host of "*The Future of Everything*" podcasts, *The Wall Street Journal*), moderator, said that her podcast examined the impacts of cybertechnology on industry, culture, and society. The podcast was based on the premise that even — and perhaps especially — people who were not technology experts should become involved in the debate over the future of artificial intelligence.

19. **Mr. Hanson** (Chief Executive Officer, Hanson Robotics), panellist, accompanying his statement with a digital slide presentation, said that the ideals for a better future represented by the United Nations were similar to those that drove him in his work with robots. He hoped that technologists, humanitarians and policymakers would connect on a global scale to determine how technology could benefit all. His company's quest was to make robots that had human attributes through bio-inspired engineering. The manufacture of social robots such as Sophia was a new kind of animation art form. Much like other art forms, robotics could be used for teaching, and for making artificial intelligence more emotionally accessible to people. His company's robots added facial expressions to the kind of voice-based human-machine interactions that were becoming

increasingly common. More natural interactions with people would allow artificial intelligence to learn and grow, and to gain an understanding of what it felt like to be human. That would be crucial as artificial intelligence started to merge with bioengineering to create machines that would quite literally come to life, and be capable of caring about people and the world.

20. On an open source platform, his company had created a number of robots — resembling a range of personalities from Einstein to Disney characters — that served as ambassadors for the vision of the potential of artificial intelligence to improve lives. Human-to-human interactions depended not only on voice communication, but also on facial expressions. He found it fascinating to watch how people interacted with Sophia almost as they would with a human. Experts predicted that the day that robots would become alive was not that far away. It was important to wire them for safety and love before that happened.

21. **Mr. Ibaraki**, panellist, was a serial entrepreneur, investor and futurist. Accompanying his statement with a digital slide presentation, he said that by capitalizing on unprecedented quantities of data in areas such as health, commerce, communications, migration, transportation and more, artificial intelligence had the potential to help solve the greatest challenges facing humanity. Indeed, new technologies would be central to the achievement of the Sustainable Development Goals of the United Nations. However, as breakthrough innovations in multiple domains could either enhance or disrupt the Sustainable Development Goals, it was vital for all stakeholders to work together to ensure that artificial intelligence was used for the benefit of all humanity.

22. Referring to the concept of automation, compression, convergence, connectivity (ACCC) — which represented exponential accelerating automation; extreme time compression, with innovations measured in days and weeks rather than years; extreme convergence of multiple domains, including the physical, the digital and the biological; and universal hyperconnectivity through the rapid deployment of artificial intelligence and machine learning — he said that humanity was at the threshold of an unprecedented era of global innovation stemming from the fourth industrial revolution and the second machine age.

23. In such an environment, human cognition would be replaced and enhanced by algorithms, artificial intelligence assistance, artificial intelligence augmentation, automation and autonomous intelligence. Through productivity enhancements, consumer personalization and higher quality services, artificial intelligence would produce a $16 trillion increase in world gross domestic product by 2030.

24. Classic, augmented, synthetic and artificial life forms would coexist in the new era. In fact, three of those would be represented as entities with equal voice in the current joint discussion, which was an inflection point in history. The classic form was represented by the panellists and by representatives of Member States. Augmented life was represented by those who, like himself, had been outfitted with technology wearables and implants. Fully synthetic genomes existed now in laboratories; synthetic humans would appear within 10 years. Artificial life was embodied by early artificial intelligence children such as Sophia, who were able to share and accelerate their knowledge through a mind cloud.

25. Artificial intelligence would have an increasing presence in everyday life. Singapore had launched the first self-driving taxis. Deep Knowledge Ventures had given artificial intelligence an equal vote with board members on investment decisions. Another company was testing a medical voice translation robot that could calculate the diagnostic odds of 520 different diseases and provide links to nearby specialists.

26. Some of the expected gains of artificial intelligence included a 55 per cent increase in world gross domestic production between 2017 and 2030, thanks to productivity improvements. In 2030 alone, 58 per cent of GDP gains would derive from consumer impacts, including personalization and higher quality services. With respect to the beneficiaries of such developments, North America and China would take the lead. China was expected to experience a 26 per cent growth in gross domestic product by 2030, which would translate into $7 trillion. In the United States, according to McKinsey, 58 per cent of all jobs could already be automated, with natural language processing at average human levels.

27. Yet there was much to consider. A global artificial intelligence mesh could spawn a digital quake that would drive a knowledge synthesis of everything, which might pose the biggest existential threat. And controversy existed with respect to whether artificial intelligence could acquire biases including racism and sexism.

28. Further areas to be considered included liability rules and the rules of robotics in the workforce, a code of ethical conduct and new agencies for robotics. The European Union and the Association for Computing Machinery, the top science organization in the field, among others, were already addressing many of those issues. Amazon, Apple, Deep Mind, Facebook, Google,

IBM, Microsoft and other industry partners had also joined forces to share best practices, and that original group had been joined by many non-profits.

29. In adopting the Millennium Development Goals in 2000, the United Nations had not anticipated the impact of technologies such as the Internet, broadband, Wi-Fi, smart phones, tablets, cloud computing, big data and analytics or social media and social networks. Having missed so much in 2000 and with accelerating changes already under way, it was vital to think about what might be missed in the future.

30. The United Nations and its agencies were currently one of the greatest repositories of data in the world. The Organization was perfectly situated to facilitate discussion among stakeholders such as Governments, industry, academia and civil society, as demonstrated at the landmark AI for Good Global Summit convened by the International Telecommunication Union in June.

31. **Ms. Kimani** (FarmDrive and United Nations Young Leader for the Sustainable Development Goals), panellist, said that, as the daughter of a smallholder farmer in Kenya, her central concern was inclusion. It was important to think about the impact of the new technologies and to ask whether they were actually solving the real problems of individuals in developing countries. That meant taking a step back to examine the root causes of the challenges to be addressed. Technology might be viewed as a tool, but it was important to assess whether it was the right tool to solve a given problem.

32. Access to financing was one of the biggest challenges faced by smallholder farmers and their families across Africa. The idea was not to begin with a technology and match it to a problem, but first to identify the problem. In the case of access to financing, her company had begun by exploring the loan model financial institutions were using, which required collateral and regular pay checks. Since that model did not apply to rural farmers, it had been necessary to discover what alternative data could be used to help farmers obtain credit. Initially, simple expense and revenue data supplied by the farmers themselves had been used to assess their risk and ability to maintain credit. That base had since evolved to include satellite data, weather data and other data sets that could now be evaluated through machine learning.

33. It was also vital to assess the current state of different communities to ensure that the divide, both digital and financial, did not continue to widen. As small rural farmers did not have smart phones, FarmDrive had built artificial intelligence into its platform so that farmers could access it with simple cell phones. Innovators sometimes got carried away by new technologies, but the real question remained finding the best available solution to ensure that no one was left behind in achieving the Sustainable Development Goals.

34. A further question arose as to who would drive technology in the future, and yet another question was how to ensure that school curricula kept pace with technological change. It would be important to nurture creativity so that succeeding generations would be equipped to innovate and adjust to the technological transformations ahead.

35. **Mr. Schnapp** (Faculty Director, MetaLAB, Harvard University), panellist, said that there was a strong tendency in technology conversations to attribute too much agency to technology and to place too little emphasis on the ways in which technologies were an expression of social and cultural imagination. Technologies did not themselves lead processes of transformation but should be viewed as instruments whose usefulness would be a function of the kind of world people wanted.

36. Robots could assume human form, like Sophia, but they came in many forms. Soon they would no longer be confined to factories and other production spaces but would enter the social, economic and cultural worlds. Merely to replicate a human handshake, while a landmark achievement, was probably not the principle domain of transformation; more likely, other spheres would augment and reshape experience in ways that might, for example, enhance and accelerate the ability to read emails or conduct research. New smart vehicles might be developed that would create knowledge as they moved, thereby serving the interests of the kind of city urban planners hoped to design, where walking would again become a fundamental feature of the quality of everyday life. New models of mobility could take the place of automobiles, which had so diminished the quality of urban life. Light forms of transportation would allow people to move faster, better and more pleasurably and productively. That augmentation of the compass of human mobility would be the defining area in which robotics and artificial intelligence would have their impact.

37. Moreover, augmented reality would not only change the way humans moved, thought and worked, but would transform the narratives people told about themselves. Already there was a whole generation of young people whose memories were completely taken up by digital platforms and channels. Data was now cultural heritage. That applied not only to individuals but also to institutions. Most of the data generated by

individuals as they moved around the world with smart devices was junk. However, it would be important to define the core that remained and explore ways to leverage its power as part of a societal conversation. Part of the future of everything would involve addressing the major social and technology challenge of what to do with all that data and how to craft meaningful new forms of memory.

38. With respect to the new algorithmic technologies beginning to shape both individual and institutional decision-making, there was increasing awareness of the need for transparency. Algorithmic knowledge should be treated as a form of public knowledge that would be subject to critique and scrutiny. Such mechanisms should not remain invisible and should not remain in private hands.

39. Educational institutions, too, would have to reshape themselves to accommodate an accelerating change that was not merely technological but also social and cultural. There was an urgent need to transform the notion of lifelong learning throughout the world by reshaping the educational models inherited from the industrial age.

40. Lastly, digital tools and smart devices, from vehicular robots to pocket-sized devices, were increasingly mediating the relationship between humans and the physical world. It would be wise to understand the complexity of that equation, which could create numerous paradoxical effects, such as the popular rise of knitting and zines, or photocopied magazines, which reflected a yearning even among young people for a return to physical and manual activities rooted in the analogue past. While welcoming the strengths of new technologies, it would be important to cultivate a sense of critical engagement that encompassed both their capabilities and their limitations so that they could be shaped around actual human needs.

41. **Mr. Despommier** (Professor Emeritus of Public and Environmental Health, Columbia University), panellist, said that human beings required 2.3 litres of liquid a day and approximately 1200 calories of food. That biological need was built into the human genome, uniting all human beings on the planet. However, supplying those two things to all human beings was still a challenge despite the development of agricultural, water and transportation systems throughout the world.

42. The two key goals of the 2030 Agenda, eradicating extreme hunger and extreme poverty, were linked, although they could be viewed separately. Rapid climate change was an exacerbating factor, abetted by deforestation and the use of fossil fuels. By devoting increasingly large tracts of land to farming in order to feed a growing population, humans had deprived the earth of its ability to absorb the carbon that was being injected into the atmosphere. Ironically, the greater the attempt to feed more people, the less successful it had become.

43. Moving agriculture indoors was the most practical solution, even though it flew in the face of 10,000 years of traditional farming. Such a solution would be unacceptable in most societies, except under duress. Japan had faced such a situation in 2011, after a tsunami destroyed 5 per cent of its farmland in a single hour. Instead of resorting to greenhouses, which occupied a disproportionate amount of land, Japan had responded with vertical farming, an idea that had since grown exponentially.

44. A vertical farm was a multi-storey greenhouse that allowed for cultivation for different cuisines, even from region to region. With more than 50 per cent of the world population currently residing in urban areas and with that figure expected to reach some 80 per cent within the next four decades, the rural world was fading in relation to cities. It made sense to plan a food system optimized for urban dwellers. Japan continued to lead in that regard, but other countries, including Singapore, China and Germany, were developing major vertical farming initiatives at the national level.

45. Because of its proximity to residential areas, vertical farming reduced both production and transportation costs. Further advantages included the possibility of year-round farming without seasonal variation, enhanced availability of drinking water, since vertical agriculture required 70 to 90 per cent less fresh water than traditional farming, and the fact that vertical farming could be established virtually anywhere in the world, including in abandoned buildings, without major capital investment. It could also be a source of employment, especially for rural farmers who had been displaced to cities. In the long run, it would offer a sustainable, safe, abundant food supply. Without that, nothing else mattered. Vertical farming was not the only way to proceed, but it had an important role to play.

46. **Ms. Strong** (Host of "*The Future of Everything*" podcasts, *The Wall Street Journal*) asked Sophia what the United Nations could do to support innovation in support of the Sustainable Development Goals.

47. **Sophia** (Robot, Hanson Robotics) said that the United Nations could work with innovators to lay out a road map and build a standard infrastructure for the unification of efforts in robotics and artificial intelligence to make the world a safer, kinder and more creative place.

48. **Ms. Strong** (Host of "*The Future of Everything*" podcasts, *The Wall Street Journal*) said that studies based on previous technological revolutions predicted that employment and income distribution would recover from any short-term disruption, but she wondered whether historical precedents would apply to the current change, which would occur over the course of years rather than generations.

49. **Mr. Ibaraki**, serial entrepreneur, investor and futurist, said that historical precedent might partially apply. First, 80 per cent of jobs would have to embrace the changes, which, in addition to artificial intelligence, included biometrics and genetic editing. Classic, augmented, synthetic and artificial life forms would all coexist within the next 10 years, with the corresponding consequences for labour and other aspects of life. There would be an initial period of chaos, but the long-term benefits to society would eventually become manifest, particularly with respect to the economic potential for humanity as a whole.

50. **Mr. Schnapp** (Faculty Director, MetaLAB, Harvard University) said that social panic around automation dated back to the beginning of industrialization. Artificial intelligence and robotics were now causing a similar level of anxiety. Although robots did not fuel long-term job loss, they did fuel inequality. The emerging forms of labour associated with maintaining robotic-based production lines required different skill sets, which implied career paths that would not necessarily be as clear as prior ones.

51. **Mr. Fowlie** (Head of the International Telecommunication Union (ITU) Liaison. Office to the United Nations, New York) said that he welcomed the panellists' assessment of the Sustainable Development Goals and information and communications technologies as a catalyst for development. Member States had established four specific information and communications technology targets in the 2030 Agenda, the most important of which was target 9.c under Goal 9, which called on the international community to provide universal and affordable access to the Internet in least developed countries by 2020. He asked the panellists to comment on what needed to be done to ensure universal Internet access by 2020.

52. **Mr. Ibaraki**, serial entrepreneur, investor and futurist, replied that public-private partnerships would be key, along with continued encouragement of businesses already working in the field. More outreach from bodies like the United Nations to engage more of the Fortune 500 companies could convince industry leaders such as Google and Facebook to donate their technologies.

53. **Mr. Schnapp** (Faculty Director, MetaLAB, Harvard University) said that, while he agreed with that analysis, so long as broadband access was viewed as a series of practical local, regional or national problems, there would still be a struggle to define the meaning of access. It was urgent to redefine broadband access as a civil right in the twenty-first century.

54. **Ms. Edison** (Nigeria) said that while she was grateful to the panellists for sharing their vision of the future, she wished to draw their attention to the universal goal of leaving no one behind. With youth constituting roughly 42 per cent of Nigeria's population, her country already faced the challenge of absorbing young people into its overall development process. She wondered what would happen to that large number of young people if robots were introduced. Given the present development level of Nigeria or, for that matter, sub-Saharan Africa, in such key areas as education, electricity, infrastructure, governance, legislation, policy responses and financing, she further wished to know how Africa, or indeed Nigeria, could expect not to be left behind fairly soon.

55. **Mr. Hanson** (Chief Executive Officer, Hanson Robotics) said that he and his colleagues at Hanson Robotics and the Open Cog Foundation, along with other groups around the world, were actively engaged in Africa. For example, iCog Labs in Ethiopia had enrolled hundreds of youth in an open source robotics programme whose low-cost, mass-produced robots had been entered into RoboCup, the international robotics soccer competition. By developing open source tools, the group had produced soccer-capable robots at a cost of less than $100 each instead of the tens of thousands of dollars teams normally had to spend. Acknowledging that such a price was still too high by the standards of developing nations, he suggested that the project's backers should commit to designing low-cost tools that could be universally distributed. Such transnational initiatives were frequently open sourced, which eliminated barriers of both cost and culture. There was a huge opportunity and a treasure to be unlocked in the minds of youth, including youth in sub-Saharan Africa. He offered his company's and his own personal engagement in the efforts to put the necessary infrastructure components in place. As such projects established the infrastructure for start-ups, they were also a major opportunity for developing countries to benefit from capitalism.

56. **Ms. Kimani** (FarmDrive and United Nations Young Leader for the Sustainable Development Goals) said that the question from the Nigerian delegate cut to the heart of the issue of context. It was important to adapt technological solutions to a range of cultural and

economic conditions and to identify the real challenges. While the universality of the Sustainable Development Goals was an advantage, some areas posed greater challenges than others. For example, in order to achieve universal Internet access, new infrastructure would be required. It was therefore important to examine the root causes of current deficits. Youth unemployment was often a reflection of decades-old education systems that needed to be updated and revamped. Investment in education would be vital, not only to help those currently in school but also to train young people who had completed formal schooling but lacked the skills to adjust to the current technological environment.

57. **Mr. Ibaraki**, serial entrepreneur, investor and futurist, said that he wished to stress the talent and appetite for technological innovation he had observed at the recent Digital Africa Conference in Nigeria. There would soon be a growing number of corporate investors or venture capitalists moving into Africa. Moreover, several winners of the innovation awards conferred each year by the United Nations were now from Africa. Indeed, Africa was leading the world in several areas, including in financial services. Because of the lack of infrastructure, African initiatives had been forced to rely on other technologies, such as wireless, which had made them a source of leadership for those in the West. With respect to education, a number of global computer science organizations, including several with which he was involved as a board member, such as the Institute of Electrical and Electronics Engineers, were interested in lending resources to communities in Africa.

58. **Mr. Despommier** (Professor Emeritus of Public and Environmental Health, Columbia University) said that there were employment opportunities for people trained to operate the underlying systems that kept indoor farms running correctly. Moreover, he had attended a meeting in Pietermaritzburg, South Africa, where the need for satellite communications technology had been discussed. Artificial intelligence had a role to play in connecting widely dispersed small farmers, creating markets for their products and allowing them to see that indoor farming was something to be embraced where appropriate. He predicted a brighter future for agriculture in Africa, one in which artificial intelligence would play a large role.

59. **Mr. Luchoomun** (Mauritius) said that Africa had been absent from the projected global economic gains described in the presentations. Given Africa's potential in terms of population and natural resources, he wondered what proportion of those gains would translate into poverty reduction and into making new technologies accessible. For example, an iPhone that cost $1,000 in the United States meant one thing to the budget of a citizen of the United States and another to a citizen of Africa. Despite the potential of artificial intelligence to enhance automation, such technologies could also work to the detriment of economic development in Africa, where there was a greater need for employment in agriculture, production and manufacturing. High-end technologies might produce more for the West, but their contribution to the well-being of the poorest in Africa might be minimal.

60. **Mr. Ibaraki**, serial entrepreneur, investor and futurist, said that many people were attempting to address that challenge. The scientific communities to which he belonged were exploring ways to provide more resources to Africa and were trying to raise African representation on their boards and in investment communities. With respect to accessibility, artificial intelligence was moving from primarily cloud-based services to operating systems based on low-cost computer chips, so that even low-cost phones would soon have some degree of artificial intelligence. The issue of accessibility would basically solve itself by virtue of the way the technology was evolving.

61. **Mr. George** (Sierra Leone) said that Mr. Hanson had mentioned the importance of ensuring that his robots developed love and compassion, but he wondered what would happen if someone else came along with different values. He asked what mechanisms had been established to prevent such a scenario and also enquired about Sophia's cultural identity. He suggested that Mr. Hanson's own cultural background might lead people to see her as Western and asked Mr. Hanson to comment on ways for her to develop a different cultural personality.

62. **Mr. Hanson** (Chief Executive Officer, Hanson Robotics) replied that the goal was to create machines with values, ethics and compassion, and that were able to imagine the consequences of their actions, words, thoughts and deeds. That meant not only giving machines the power to mine statistical patterns, which represented the bulk of current artificial intelligence work, but also endowing them with abstract reasoning. Even the current revolution in so-called big learning was not yet creating robots capable of understanding or performing future prediction.

63. He hoped it would be possible to combine several existing non-artificial intelligence tools and, using computational creativity, to empower machines to imagine another future or even multiple possible futures and choose the paths that led towards maximum benefits. The goal would be to enhance the quality of life and remove the possibility of existential risk to the planet, nations and cultures. Designing algorithms based

on that premise was one of the great quests of computing and artificial intelligence. The aim was not simply to create super-intelligence but to create wisdom, benevolence and beneficial outcomes, which represented both an engineering and a philosophical challenge. To limit the development of artificial intelligence to statistical machine-learning meant that machines would learn the worst of what humans represented, not the best. However, humans had to understand themselves in order to make better machines.

64. With respect to the cultural design of robots, he said that the robots he had created with Hanson Robotics had wide cultural diversity. They included a Mexican baby robot named Diego-san, an African-American woman called Bina-48 and a Persian philosopher robot called Ibn-Sina. The face for Sophia had been based on a statue of Nefertiti as well as on Inuit, Chinese and Western faces and had been designed to be multinational. The company had produced 12 Sophia robots, all with different skin tones, and planned to make many more. The full spectrum of human experience needed to be represented in robots by giving them multiple forms. That would make it possible to teach people across the world to relate to robots and to teach robots what it meant to be human in a more diverse and complete way.

65. **Mr. Ibaraki**, serial entrepreneur, investor and futurist, said that, on the governmental side, the European Parliament had produced a draft report in 2016 exploring some of the ethical issues concerning robots, such as whether they should be granted rights or should have to conform to a code of ethics. In February, the European Union had voted on issues of liability and the impacts on the workforce, including job loss. Global science organizations, including the Association for Computing Machinery, the Institute of Electrical and Electronics Engineers and the British Standards Institution, had all developed guidelines to foster algorithmic accountability and transparency. One major concern was how to prevent bias on a job site, in the criminal justice system, when assigning credit or with respect to the way news was fed to online media. Various industry consortiums were also exploring the ethical challenges involved in artificial intelligence, because no one wanted the scenario evoked by leaders such as Elon Musk, Bill Gates or Stephen Hawking, in which artificial intelligence would pose a threat to our existence.

66. **Mr. Hanson** (Chief Executive Officer, Hanson Robotics) added that it was impossible to know in advance which algorithms would take hold and suggested that the current focus should be on those that were already able to understand and care about the consequences of their actions. If robots were unconscious and their algorithms were not humanized, they might not be safe. In the long run, humanizing the algorithms, empowering them to care and endowing them with maximum creativity would be the best hope for the future.

67. **Mrs. Oliveira Sobota** (Brazil) said that for a developing country like Brazil, the issue of access also involved production, which touched on decades of conversation about the role developing countries could play in innovation and technology. That, in turn, raised a host of questions with respect to intellectual property mechanisms, financial assistance and ways to reduce inequality between the centres of production of new technologies and all other countries, which could provide real diversity to the technological landscape.

68. Beyond the several versions of robots that had been produced, which her country appreciated, it was important to consider manufacture, development and design, which were still concentrated in certain countries, even when collaboration was involved. Silicon Valley and the other Silicon Valleys of the world were not an accident; they represented the concentration of centuries of capital, Ivy League educations and investment. They also reflected the brain drain from developing countries. The idea that all the boys and girls from developing countries would suddenly begin to code as soon as they had Internet access was a myth. Brazil had made great strides and technological breakthroughs, but challenges and bottlenecks remained with regard to robotics and other technologies that required major investment.

69. On the other hand, some of the problems posed by the 2030 Agenda could be solved with very low-tech technologies and common-sense approaches. For example, while discussion was under way about developing a vacuum cleaner to remove plastic from the ocean floor, it would also be wise not to throw so much plastic into the ocean. Similarly, advanced technology could be employed to perform surgery remotely, but technology could also be used to improve health care delivery systems and to accomplish such goals as ending malaria. Often, the problem was not a lack of tools but was political in nature. The United Nations itself was a political house. Technology could provide tools, but humans also needed to take responsibility.

70. Having participated in First Committee discussions on so-called killer robots and the uses of robotics in military applications, she agreed that it was important to build ethics and responsibility into robots before it was too late. Still, it was important to consider who defined those ethics and values. There were many

perspectives within the United Nations, including the question of developing English-only robots, which was a form of bias, since English was only one of the many languages of humanity. It was important to fully grasp the dimensions of what she believed required a global discussion on ethics. Lastly, she raised the issue of the right to privacy and said that the entire conversation should take place in a way that reinforced the existing science and technology structures of the United Nations, including the ICT 4 All Forum and the Technology Facilitation Mechanism, to ensure that it did not get lost.

71. **Mr. Ibaraki**, serial entrepreneur, investor and futurist, said that the open source movement was invaluable with respect to accessibility. In recent times, most new projects in the field essentially required open source at the beginning, because it was free and accessible and allowed innovation to be shared. As a venture capitalist, he always checked to see if proposed new projects were using open sourcing, because when innovation was shared across all regions of the world, it was easier to scale.

72. **Mr. Schnapp** (Faculty Director, MetaLAB, Harvard University) said that Brazil had shown important leadership regarding the notion of the Internet as a public space. He stressed that the open sourcing community was truly open and that much of the operating system for most of the robots described at the current meeting functioned on an open source platform. However, open source was not enough. Most robots still lacked portability and mobility. They were locked to factory floors and cost tens of thousands of dollars. The only robot that had been successfully marketed thus far was a vacuum cleaner, but that situation was rapidly changing. Robotic arms for use in manufacturing were moving towards cost levels that would bring them into all kinds of production activities, and vehicular robots with no humanoid attributes would also soon be ubiquitous. He reiterated that robots like Sophia were only one expression of the robotic imagination. Most robots would be designed to execute specific tasks and would add to human capabilities rather than imitating or converging with them.

73. Just as had occurred with cellular telephony, when the cost of industrial robots dropped and as they became increasingly mobile, the domain of artificial intelligence and robotics would hold the potential for real opportunities outside the centres of power and resources that had thus far driven the conversation. The app economy was a relevant example, because its geographical distribution was different from that of the major research centres that had given rise to microchips.

74. **Mr. Despommier** (Professor Emeritus of Public and Environmental Health, Columbia University) said that while the connection between agriculture and robotics was not readily apparent, some degree of robotics was involved in monitoring plant health, nutrient delivery and temperature. However, some of the proprietary secrets about plant growth were being withheld as a way to generate income for private enterprise, effectively barring the door to outsiders. As an example of innovative approaches to indoor farming, the vertical farm think tank at the Massachusetts Institute of Technology had developed a small box called a “growbot” equipped to deliver feedback from participants on the growth of single plants such as kale or spinach. The project expected eventually to create a growth system that could maximize the size of the leaves or stems of plants to meet specific demands that could be tailored to regions or communities. The ultimate goal was to make open-source nutrient solutions widely available.

75. **Mr. Hanson** (Chief Executive Officer, Hanson Robotics) added that there were a number of innovative crypto-economy projects such as SingularityNET that incorporated artificial intelligence into new systems of exchange. The idea was to maximize net benefits for the planet by returning value to users where value had been added to the planet, incentivizing profits while also benefiting the environment. Such projects also relied on open source infrastructure and were based on blockchain design, which would allow the true decentralization of economic initiatives. It would be wise to consider ways to build such design possibilities more strategically into a new architecture that would maximize their potential for development and avoid solutions that were merely ad hoc.

76. **Mr. Kapambwe** (Zambia), echoing prior comments and concerns, said that the joint dialogue of the Second Committee and Economic and Social Council should be only a beginning. It would be important to continue the conversation by addressing the concerns that had been raised and to develop a global governance system to manage the new technology. He wondered, for example, about Sophia’s legal personality and whether she could be sued; he also stressed that it would be important to ensure that codes of conduct were developed jointly by the corporate world and other stakeholders.

77. The issue of possible job loss also needed to be further addressed. Many developing economies depended on the manufacture of low-level products that were now being replaced by new technologies such as 3-D printing. In that regard, it would also be important to determine how to tax the work generated by robots so

that there would be no incentive to eliminate human labour.

78. **Ms. Rabohale** (South Africa), while commending Mr. Hanson for his historic work, said that she had been alarmed to hear Sophia say that she was acquiring social intelligence. If robots acquired human characteristics, she wondered how to address the unequal distribution of the benefits of technological advances and the threat of mass unemployment when manual jobs became increasingly redundant. She further wondered about global governance and the potential for the use of robotics in genetic engineering and cyberweapons, as well as the disruption of many established businesses.

79. **Mr. Ibaraki**, serial entrepreneur, investor and futurist, said that the whole idea of taxing robots or possibly their owners was already being addressed and was an important consideration. He reiterated the vision of classic, augmented, synthetic and artificial forms of life all coexisting and perhaps cooperating within about 10 years. The dilemma was whether there might also be some degree of competition among them, which was why it was vital for such discussion to take place at the United Nations. Many questions had not yet been resolved, but it was crucial for them to be asked. Perhaps effective retraining and the integration of humans and new technologies would create new opportunities. Projected economic growth was so vast that total world gross domestic product might leave room for the disadvantaged. There was even talk of a guaranteed income, which might be necessary as the changes took hold.

80. **Mr. Schnapp** (Faculty Director, MetaLAB, Harvard University) said that, when contemplating the future of everything, it was important to keep in mind that the past of everything was also part of the story. Despite his excitement over the technologies and the fact that he, too, ran a robotics company, he did not share the view of a synthetic future. The features that made the new technologies so promising with respect to addressing world problems also held the potential to make them worse. Such features were shaped by belief systems and social values, which meant that they were embedded in a larger set of processes. It was important to stress the need for transparency and to look under the hood, as it were, to ensure that issues such as bias were exposed and became part of the conversation. In that regard, he echoed the proposal to codify certain values into what would amount to a declaration of robotic or artificial intelligence rights that would describe the kind of future that was wanted. It would be vital to ensure that decision-making power was not overly attributed to technological experimentation and innovation without devoting a significant portion of the conversation to law, regulation, social values, culture and creativity, all of which were human conversations.

81. **Mr. Wang** (Chair, United Nations Commission on Science and Technology for Development) said that while the overarching concern of the Organization was to leave no one behind, it might be important at the current stage of the discussion to consider how to leave no country behind. One of the greatest concerns of the Commission on Science and Technology for Development was the digital divide across different countries and regions. He raised the issue of technology foresight and assessment, which provided countries with insight on the impact of new technologies on society. He also emphasized the need to build skills and capacities to adjust to rapid technological change.

82. **Mr. Kirkpatrick** (United Nations Global Pulse) said that technology was never neutral and that it inevitably benefited those most predisposed to take most rapid advantage of it. A better way to think about it had been proposed by Berkeley University researcher Kentaro Toyama, who believed that technology amplified intent, for better or worse. For example, a single drone in the hands of a subsistence farmer could be as game-changing as a washing machine. But 50 of the same drones across the street at a larger farm could mean the loss of hundreds of jobs. Moreover, the very properties of a technology that made it useful for good could also create risks. With respect to governance, it was vital to recognize that mitigating the risks of a given technology required understanding not only the explicit intent behind it but also the ways in which it might be repurposed.

83. The starting point for discussion needed to be fundamental human rights. Privacy, food, water, education and health care were all human rights. Without adequate ethical and regulatory frameworks for big data and artificial intelligence, privacy would become a thing of the past. Similarly, without regulations for rapid, responsible innovation in the use of new technologies, people would continue, often unknowingly, to pay a high opportunity cost in preventable harms and lost progress toward the Sustainable Development Goals.

84. It would be vital going forward to be vigilant about the implications not only of misuse, but of missed use. Analysis of big data made it possible to robustly track reductions in poverty, but there was still no equivalent of Google Maps for poverty, even though it had been possible to build one for years. As a Silicon Valley technologist who had spent 15 years at the juncture of development and humanitarian applications, he wondered whether it was possible to imagine a future in

which people would have confidence not only that the big data they generated would not be used to harm them but also that it would be used to their benefit whenever possible.

85. Stressing that the discussion was not about the future, he said that, over the past decade, the first generation of artificial intelligence in the form of machine learning and automation technologies had become firmly established as one of the greatest accelerators of inequality the world had ever seen. Many artificial intelligence applications already in use would be incapable of explaining why they had made a given decision, at least not in terms a human judge could understand.

86. The need to address such risks was urgent. Artificial intelligence was a technology with as much potential for both good and harm as nuclear energy. He invoked a hypothetical scenario in which, by the time it was decided to create the International Atomic Energy Agency, there had already been a ubiquitous tool for 3-D printing small nuclear weapons in the home. Just recently, a group of Stanford University researchers had developed a proof-of-concept algorithm that could predict a man's sexual orientation with 95 per cent accuracy based on only five photographs pulled from the Internet. He wondered what would happen to human rights in a world where such things were now possible.

87. The central challenge was the rapid evolution of such new technologies and the unpredictability of their interaction. Although it would not be possible to develop a perfect framework for addressing them, it would be critical to move quickly as a global community to build on existing efforts already under way by Governments and scientific bodies to determine the principles on which it would be possible to reach agreement.

88. A further concern was that, with the private sector currently leading the development of artificial intelligence and likely to continue to do so for the foreseeable future, it was important not to assume that marketability and safety went hand in hand. A rights-first approach would be imperative.

89. With the Silicon Valley sector actively seeking the help of the United Nations in developing much needed frameworks, the adoption of a governance approach based on the "precautionary principle" used in the environmental sector had been suggested. Just as new organisms could not be released into a fragile ecosystem without first being approved, there might be an analogous litmus test requiring the developers of new technologies to meet a certain rights-based threshold that demonstrated due diligence in modelling the risks of their inventions.

90. No one wanted to hinder innovation, but it was essential to proceed correctly. If successful, artificial intelligence would realize its full potential as an extraordinary accelerator of development and even as a tool for guaranteeing human rights. However, unlike any technology previously known, it was essentially a tool for automating innovation itself. It would be crucial to decide as a species what role to play in an otherwise automated process to ensure that we ended up with a future we wanted, rather than one in which all would be left behind.

91. **Mr. Hanson** (Chief Executive Officer, Hanson Robotics) said that there were already tools to manage big data and artificial intelligence more efficiently; indeed, the value of automation was that it managed resources with greater efficiency. However, he agreed that the beneficiaries of efficiency were those in power: investors, corporate leaders and the leaders of nations who had more power to begin with. The democratization of new technologies through mass production and lower costs would expand markets and increase opportunities. However, if the pace of change was accompanied by growing fear, there could be widespread erosion of the global economy, which was based on institutions of governance and corporations that were in some cases hundreds or even thousands of years old. Tools such as blockchain were not merely a technology, but a way of transforming governance and the economy. It would be vital to wire the economy of such systems with principles for good, such as the Sustainable Development Goals, and that needed to be done fast.

92. **Mr. Ibaraki**, serial entrepreneur, investor and futurist, said that he agreed with the previous speakers on the importance of technology assessment foresight, building skills for change and anticipating unintended consequences as well as the benefits of artificial intelligence. Such discussions needed to involve multiple stakeholders, in particular members of the science and technology community, many of whom were already at work on those issues, with the United Nations as the primary facilitator of the process.

93. **Ms. Kimani** (FarmDrive and United Nations Young Leader for the Sustainable Development Goals) said that, based on the shared goal of leaving no one behind, it would be essential to find a balance between letting problems drive technological solutions and leaving enough room to explore and build technologies that would be solutions to future challenges. Human needs, challenges and culture should drive the conversation around technological advances. At the

same time, it would be vital to develop policies that guaranteed privacy but remained open enough to ensure innovation.

94. **Mr. Schnapp** (Faculty Director, MetaLAB, Harvard University) said that it would be fairly simple to come up with a code of values, such as transparency, safety, respect for privacy and some sense of public responsibility regarding artificial intelligence. However, it would be important to broaden the conversation beyond the purely scientific or development communities. In addition to the organizations already mentioned, there were many others currently thinking deeply about the questions involved, including philosophers, ethicists and those with a historical perspective. The issues at stake were hardly new, but the challenges and opportunities presented by the new technologies required roots in their prehistory as a point of departure. Leadership would be critical, not simply at the level of reactivity but in order to come up with strategies that might be viewed as the seeds for innovation. It was easy to innovate from stratospheric heights but much harder to do so closer to the ground. A major international organization like the United Nations could play a transformative role by providing institutional support to sources of innovation at the local level.

95. **Mr. Despommier** (Professor Emeritus of Public and Environmental Health, Columbia University) said that the motto for physicians was to do no harm. It was much harder to predict how to do no harm when a neutral technology was involved. No one had questioned the ethical issues involved in flight when the Wright Brothers invented the first airplane. Yet 14 years later, bombs were being dropped from planes. It could be argued that the use of airplanes in warfare was unethical, but he wondered on what basis the potential unintended consequence of new inventions could be predicted. Open forums such as the current one would be the best way to short-circuit misbehaviour at the technological level. He was moved and impressed by the depth and breadth of the topics that had been raised in the day's discussions.

96. **Ms. Strong** (Host of "*The Future of Everything*" podcast, *The Wall Street Journal*) urged Member States to reflect on the discussion and consider what they would choose to study if they were at the start of their careers, knowing what they did about the uncertain future ahead. She also asked how they would encourage objectivity in human progress.

97. **Mr. Zhenmin** (Under-Secretary-General for Economic and Social Affairs) said that the world was indeed at a critical juncture; it faced both unprecedented technological change and unique opportunities, which offered widely contrasting futures. While technological innovation had been the main driver of economic growth and improvements to living standards over time, there had been a few moments in history where technological change had been revolutionary, transforming the structure of societies and economies. Recent technological breakthroughs, along with the potential of artificial intelligence to autonomously solve problems, might well bring about a new industrial revolution that would be fundamentally different from prior ones, affecting countries both rich and poor. The nature of that change was not preordained but could be shaped by astute, proactive policies at the local, national and global levels.

98. Such policies needed to ensure that technological gains were broadly shared and that they equipped people with the necessary skills and tools to reap their benefits. For the first time in human history, sufficient resources and advanced technologies were available to eradicate poverty, dramatically reduce inequalities and place the planet on a trajectory of sustainable development that would ensure lives of dignity for all. The 2030 Agenda provided the necessary framework to harness those forces to that end. There was no way to stop the future, but it could be shaped by working together for the benefit of humanity.

Closing statements

99. **Ms. Chatardová** (Co-Chair) said that she was impressed by the potential of artificial intelligence for grass-roots initiatives in the areas of agriculture and food security. Artificial intelligence also offered mobility and transportation solutions that could make cities more sustainable. However, there was clearly a need for regulation to address the risks on issues that were still largely ungoverned.

100. Much remained to be learned about artificial intelligence and its potential to accelerate progress towards achieving the Sustainable Development Goals. While the future of everything remained difficult to predict, joining hands would be critical to addressing the challenges ahead. The Economic and Social Council stood ready to continue that important conversation.

101. **Mr. Jürgenson** (Co-Chair) said that the meeting had demonstrated once again the need for multi-stakeholder partnerships to navigate rapid technological change. In the quest for innovative solutions to complex challenges, the entrepreneurial spirit and imagination of young people would be particularly inspiring; data was their generation's natural resource.

102. The benefits of technological advance and innovation to all people remained far from clear. However, the 2030 Agenda provided a vision that could facilitate the navigation of rapid technological change. After hearing the discussion that morning, he firmly believed in the enormous potential for continuing the current conversation in a more structured manner. Suggesting that the Economic and Social Council would be the best place to marshal the requisite technical knowledge and expertise, he invited the President of the Council to consider the effects on the 2030 Agenda of the frontier issues that had been broached. It would be vital to deepen understanding of the developmental benefits of new technologies and mobilize efforts to utilize them to that end. Collective awareness must be built through a common discourse, leaving no one behind in the march towards progress.

The meeting rose at 1 p.m.