The People Power Revolution that toppled former South Korean President Park Geun-hye was historic and unprecedented. Among other things, it represented a visceral call by the public for clean government and an accountable democracy. The tasks now facing newly elected President Moon Jae-in are daunting and urgent.

ESSAYS BY
- Yoonkyung Lee 8
- John Nilsson-Wright 18
- Myung-bok Bae 24
- Sang-young Rhyu 30
- Jae-jin Yang 36
- Wonhyuk Lim 42
- Kyungsoo Choi 48

PLUS
- Inauguration speech by President Moon Jae-in 14
The Fourth Industrial Revolution and Its Challenges
By Wonhyuk Lim

As South Korea’s economy faces slowing growth, widening income gaps, an ageing population and a workforce increasingly divided between full-time workers and the growing legion of part-time or contract workers, it is bracing for the potentially destabilizing effects of the so-called Fourth Industrial Revolution.

Advances in artificial intelligence, machine learning and robotics, as well as the rising number of devices and products connected to the internet, herald radical changes to the workplace. Wonhyuk Lim explores the policy challenges facing the new government of President Moon Jae-in.

ON MARCH 9, 2016, anyone with more than a passing interest in the complex board game Go (Baduk in Korean) knew something monumental had happened. AlphaGo, a computer program developed by Google’s DeepMind, had just defeated 18-time world champion Lee Sedol. When AlphaGo beat him handily in the next two games as well, Lee emphasized the defeat was “Lee Sedol’s defeat,” and “not a defeat for mankind,” but he confessed he felt “powerless.” Although Lee came up with a most brilliant move of his own to defeat AlphaGo in the next game, AlphaGo prevailed 4-1 in the five-game match. The writing seemed to be on the wall: it was one thing to have a machine perform simple and routine tasks, but if a machine could beat a world Go champion renowned for his creativity such as Lee, people wondered whether anyone’s job would be safe from the onslaught of machines. The South Korean government quickly announced on March 17 that it would invest 1 trillion won (US$880 million) in artificial intelligence (AI) over the next five years, but the implications of AlphaGo’s victory seemed to run much deeper than promoting a new industry.

Earlier in the same year, the World Economic Forum’s annual gathering in Davos, Switzerland had trumpeted the arrival of the Fourth Industrial Revolution. Just as the steam engine, dynamo and computer ushered in the First, Second, and Third Industrial Revolutions, it was argued that advances in AI, robotics and the so-called Internet of Things (IoT) — which involves all manner of devices connected to the internet — would bring about the Fourth Industrial Revolution. The concept is related to “Industrie 4.0,” a German high-tech strategy that promotes the computerization of manufacturing through developing cyber-physical systems, as the fourth phase of industrial development after mechanization, mass production and computerization. There is an ongoing debate as to whether the Fourth Industrial Revolution is a distinct revolution or an extension of the Third Industrial Revolution. After all, discussions on “thinking machines” have been around since the advent of the computer in the 1940s, and there is no single innovation that defines a new era comparable to the steam engine, dynamo or computer. But whether the development of cyber-physical systems or “intelligent robots” qualifies semantically as a revolution, its real impact on society is the same.

NEW FRONTIERS
A misnomer or not, the Fourth Industrial Revolution is driven by technological advances in computing power, learning algorithms and connectivity. First, the exponential growth of computing power has accelerated in the 21st century. According to Ray Kurzweil, computing power (as measured by the number of calculations per second that could be obtained for US$1,000) matched the capacity of one insect brain in 2001 and one mouse brain in 2010, respectively. It is projected to match the capacity of one human brain by 2023 and all human brains by 2050. Second, in AI, self-learning algorithms have made major advances in recent years. For example, AlphaGo applies neural networks, in which evaluation heuristics are not hard-coded by human beings, but learned by the program itself through millions of Go matches it has played and analyzed. Third, the connection of devices has increased sharply with the spread of the internet and smartphones. Connectivity will take another leap with IoT. These technological advances have made it possible for “thinking machines” to generate and process more data than ever before (Big Data), and draw insightful conclusions about observed phenomena, as shown by the example of AlphaGo. Combining these thinking machines with physical machines can open up new frontiers. The self-driving car is perhaps the best-known example. Also, on top of these technological advances, radically improved and affordable miniaturization has made it possible to decentralize and deconstruct the workplace. Instead of having workers perform their tasks on company equipment in a centralized office, they can do the same tasks using their personal devices at home and connect with their colleagues and customers. Going further, employed workers can be replaced by independent suppliers in the so-called “gig economy,” where individuals provide their services on a short-term freelance basis without employment-based regulatory protection and welfare benefits. Last but not least, without having to invest heavily in facilities and equipment, a company can do great deal of business by providing an effective two-way platform between suppliers and customers. Alibaba and Uber may be two of the best-known examples of companies employing this model. These developments have serious implications for employment and competition.

To analyze the impact of the Fourth Industrial Revolution on employment, it is necessary to break up a job into its constituent activities, which in turn depend on underlying skills.1 Robots are very good at some physical skills (e.g., gross motor skills) and low-level cognitive skills (e.g., recognizing known patterns/cat-
These changes associated with the Fourth Industrial Revolution call for proactive policy responses. In education, students should learn how to race with machines, rather than against them; they should work with machines to augment their own skills. Students should focus on developing high-level cognitive skills as well as interpersonal skills, which cannot be replaced easily with machines.

FUTURE SKILLING
What this implies is that the Fourth Industrial Revolution will affect not only the quantity of employment but also its composition. As automation progresses and productivity improves, and if people’s preference for leisure over work prevails, the average number of work hours is likely to decline. Just as the average number of work hours per week has come down from 60 hours or more in the 19th century to 40 hours or so today, it is likely to decline further. Even as the average work week shrinks, the overall quantity of employment may stay the same or even increase. Also, jobs of the future, on average, will have a greater share of skills that cannot be easily replaced by machines. New occupations will be created based on these skills.

As for competition, even as it becomes easier for suppliers and customers to connect with each other, to the extent that the two sides depend on a common platform for their interaction, the market power of dominant platforms is likely to increase due to network effects. The position of Google in advertising is perhaps the best-known example. Also, because digital transformation is rapid but uneven, access to and adoption of new technologies will have a critical impact on the prospects of companies. According to Jonathan Woetzel at McKinsey, if the level of digitization (as measured by the use of digital technology as well as spending and training in hardware and software) in the leading sectors in the US was scored at 100 in 1997, that in the lagging sectors was only 8. By 2013, the level of digitization in the leading sectors had soared to 410, but that in the lagging sectors increased only to 14. Given the imperative of digital transformation, it would be better to adopt a new technology and make complementary changes to improve efficiency rather than stay with an existing technology that offers little room for improvement, even if the latter option is less expensive in the short run.

These changes associated with the Fourth Industrial Revolution call for proactive policy responses. In education, students should learn how to race with machines, rather than against them; they should work with machines to augment their own skills. Students should focus on developing high-level cognitive skills as well as interpersonal skills, which cannot be replaced easily with machines. School curricula should be flexibly adjusted to reflect the needs of the future. Also, given the rapid pace of technological change, lifetime education should be the norm, and public support for retraining should be increased. In social policy, employment-based regulatory protection and welfare benefits should be transformed and broadened to cover the gig economy. Although the gig economy can lower costs and improve efficiency by reducing overhead and deconstructing the workplace, its attempt to profit by regulatory arbitrage should be firmly addressed. Also, a social safety net should be devised for those who fail to find employment despite their honest efforts, due to their outdated skills and lack of capacity to adapt to new technologies.

In innovation and competition policy, systematic efforts should be made to provide high-quality digital infrastructure and create a business ecosystem that is consistent with the Fourth
Industrial Revolution. Not only should the government work with the private sector to mobilize resources to build digital networks and platforms, it should ensure fair, reasonable and nondiscriminatory access to them. Given the explosion of e-commerce over the past decade, ensuring such access allows start-ups and small-and-medium-sized enterprises (SMEs) to participate in global value chains just like large, established companies. In addition, the government should establish effective cybersecurity rules and provide public support to companies that may lack expertise and resources to prevent hacking. In a related vein, the government should facilitate the dissemination of new technologies, especially the results of publicly supported R&D. To promote innovation and competition, the government should also curb rent-seeking activities such as collusion and unfair trade practices and apply performance-based reward and discipline principles. Finally, for dominant platforms that function as a de facto gateway for suppliers and customers, the government should consider applying the essential facility principle.

WHAT ABOUT SOUTH KOREA?
In South Korea’s case, some of these common policy challenges are particularly acute due to its rigid educational system and lopsided business ecosystem. Although South Korean students learn to use the computer at an early age, an almost life-or-death focus on university entrance examinations makes it difficult for them to develop high-level cognitive skills and interpersonal skills. Project-based learning and teamwork should be emphasized over rote memory and individual essay writing. At the university level, rigid entrance quotas by academic majors all but prevent flexible reallocation. For example, the software engineering major accounts for only 7 percent of engineering students at Seoul National University, whereas it has increased to more than 40 percent at Stanford University. Allowing students to choose their major after, say, a couple of years of study could help address this problem. Lifetime education represents another critical challenge, because there is currently hardly any support for retraining.

Although the South Korean government has generally done a superb job providing high-quality digital infrastructure, it should improve cybersecurity and ensure better access not only to the infrastructure but also new technologies. Most important, South Korea’s business ecosystem should be fundamentally transformed into a performance-based one. It is not enough for the government to place some behavioral restrictions on the chaebol — South Korea’s family-owned business groups, which account for a large share of the country’s economy — and provide compensatory support to startups and SMEs. It should adopt structural measures to promote competition and prevent collusion and unfair trade practices. At the same time, financial support for startups and SMEs should be linked to performance and have phase-out and graduation dates so as to prevent perpetual dependency. Equally important is public support for business consultation, which would allow startups and SMEs to build capabilities and develop alternative value chains instead of being beholden to an exclusive subcontracting arrangement. Also, venture capital functions should be transferred from the risk-averse public sector to the private sector, which is better motivated by high-powered incentives. Last but not least, regulations should be transformed from a positive-list system to a negative-list system so as to facilitate unconventional innovations that often cross sectoral boundaries.

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