

RESEARCH ARTICLE

Philippine Readiness for the 4th Industrial Revolution: A Case Study

Junmo Kim¹, Ador R. Torneo², and Seung-Bum Yang^{1*}

¹Konkuk University, South Korea

²De La Salle University, Philippines

sbyang@konkuk.ac.kr

Abstract: This explores how the fourth industrial revolution (FIR) affects developing countries, specifically in the case of the Philippines. It presents an alternative account to the claim that the world is ready to enter the FIR. The analyses show that the readiness of the Philippines for FIR is not the same as developed and industrialized countries. The authors argue that developing countries like the Philippines will not go through FIR in the same way the developed countries do, given their different economic context and limited access to technological advances. Just as the Philippines participated in the third industrial revolution in a manner that is different from the developed countries, it will also participate in the FIR in a different manner. This article will provide insights to its possible participation and its implications.

Keywords: Philippines, industry 4.0, 4th industrial revolution, fourth industrial revolution, service sector, business process outsourcing

Industrial revolutions take place when a new means of production introduces drastic changes to the spheres of economics, politics, business, and society. Humanity has thus far gone through three industrial revolutions (Drath & Horch, 2014; Stearns, 2013), and we are undergoing a fourth. The first industrial revolution took place in Britain with the introduction of mechanization. The second industrial revolution took place with mass production and electrification. The third industrial revolution introduced digitization, the personal computer, and the Internet. The fourth industrial revolution (FIR) is “characterized by a much more ubiquitous and mobile internet, by smaller and

more powerful sensors that have become cheaper, and by artificial intelligence and machine learning” (Schwab, 2016, p.7). During the three previous industrial revolutions, as well as the fourth industrial revolution currently taking place, technological breakthroughs played a central part in the sweeping and radical changes that took place (Schwab, 2016; Stearns, 2013).

These industrial revolutions did not only affect production.. They also changed the way people relate to each other, the way people are governed, the way people think, and even the way people understand themselves (Stearns, 2013). Industrial revolutions are

therefore not only about innovations in the field of production, which naturally takes place as a matter of time. Rather, they are about how certain innovations, or group of innovations, effectively create a new way of living.

Industrial revolutions exhibit the “destructive creativity” that is inherent in capitalism. According to Schumpeter (2003, p.83), “the process of creative destruction is . . . the essence of capitalism. . . . It is what capitalism consists of and what every capitalist concern has got to live in.” The opening up of new markets and development from the craft shop to the factory undergo the same process of “industrial mutation” that “incessantly revolutionizes the economic structure from within” by continuously destroying the old one and continuously creating a new one.

Less efficient, less productive, and less valuable modes of production are effectively devalued and destroyed as better modes take their place, according to the logic of the free market that always tends towards equilibrium and is by nature competitive. An industrial revolution can be described as a particularly swift and forceful version of this otherwise commonplace economic mechanism.

The World Economic Forum (2015) report on future technologies named six “megatrends” that are most likely to shape society in the fourth industrial revolution: people and the Internet; computing, communications, and storage everywhere; the Internet of things; artificial intelligence (AI) and big data; the sharing economy and distributed trust; and the digitization of matter.

In the Developing World

A notable absence in this relatively new discussion of FIR is a detailed description of how the developing world is supposed to participate in the FIR. Schwab (2016) discussed how the FIR may play out in developing countries in *The Fourth Industrial Revolution* and made important points in this regard. First, although advanced and middle-income economies have experienced the transformations associated with the FIR, “this does not mean that the fourth industrial revolution will inevitably impact developing economies” (p. 48). Second, these transformations may be destructive, given that it may involve a “re-shoring” of manufacturing to advanced economies. Finally, the FIR may foster a global economic environment with

increased social tensions, conflicts, and fragmentation.

Schwab (2016) showed great concern for the outcome of the FIR in the developing world because the sweeping positive changes (which are emphasized in his book) are the next logical step in a technologically advanced economy. The FIR is the result of the exponential increase in computing power and the corresponding advances in their applications in technology (Caruso, 2017; Guoping, Yun, & Aizhi, 2017; Schwab, 2016). The developing world, however, has limited access to such advances. For example, the World Economic Forum (2016) report on networked readiness (i.e., the capacity of countries to use information and communication technologies to improve competitiveness and well-being) showed that networked readiness is highly correlated with per capita income. Developing countries generally rate low in both.

The question of how the FIR will affect the developing world is an important one. This is also an important question for the Philippines. Given that the concept of FIR was initially conceived with developed and industrialized countries in mind, there is understandably a lack of research on how FIR will affect the developing world. A cursory observation of the world today shows that the distributions of wealth, productivity, and technology are not uniform. It is therefore reasonable to expect that the FIR will also affect the world in an uneven manner.

The potential impacts of FIR can be viewed from the perspective of world-systems theory, in which the world is separated according to core and periphery. In the world economy, core countries depend on and dominate the periphery and semi-periphery countries. The core countries own the means of production (even some of those physically located in the periphery and semi-periphery countries through intellectual property) while obtaining labor from periphery and semi-periphery countries. For this study, world-systems theory is simplified into the following conceptual framework: The world economy is a supply chain of countries which links those that produce the most for the least return to countries that produce the least with the most return.

This framework shows that the uneven economic distribution of the world economy is not only a contingent order but is, in fact, a structural necessity. Moreover, the FIR as it is described by Schwab (2016), is a description of the future for the core countries or countries that produce the least for the

most return. The question of how the other parts of the supply chain will be shaped by FIR remains open. This article seeks to answer this question with a focus on the Philippines. Data on the different sectors of the economy that are affected and are likely to be affected by FIR are presented from various sources (including the Observatory of Economic Complexity, the Philippine Overseas Employment Administration, the World Bank, and other studies) to provide context to the discussion. It is intended as a starting point for investigating how developing countries might participate in such a future and the role that it would play.

Literature Review

Like the previous industrial revolutions, the new mode of production in the FIR transformed many industries. For example, the entertainment industry moved from pre-planned programming to the on-demand services offered by Netflix, Hulu, and YouTube (Schwab, 2016). Competitors who were too late in adopting the on-demand Internet model suffered either great losses or closed down altogether, as in the case of Blockbuster Video. In the retail industry, Amazon used the Internet to redefine the shopping experience. The ease with which a user may find a product online, purchase the product, and have it delivered effectively disrupted the usual retail model. As a result, the number of online retail platforms increased while brick-and-mortar stores suffered tremendous losses.

Rifkin (2011) discussed the third industrial revolution in terms of what he called “lateral power.” He also discussed what he pertained to as the five pillars of the third industrial revolution. These are: “(1) shifting to renewable energy; (2) transforming the building stock of every continent into micro-power plants to collect renewable energies on site; (3) deploying hydrogen and other storage technologies in every building and throughout the infrastructure to store intermittent energies; (4) using Internet technology to transform the power grid of every continent into an energy-sharing intergrid that acts just like the Internet (when millions of buildings are generating a small amount of energy on site, they can sell surplus back to the grid and share electricity with their continental neighbors); and (5) transitioning the transport fleet to electric plug-in and fuel cell vehicles

that can buy and sell electricity on a smart, continental, interactive power grid.” (p. 37).

The third industrial revolution according to Rifkin (2011) is just short of what would later be conceived as the FIR. Rifkin also emphasized the importance of the Internet but he placed more importance in an interconnected network of energy production. Nonetheless, he was able to determine the trends that would later characterize the FIR, such as the importance of 3D printing and a decentralized economy that would disrupt the normal functioning of capitalism as we know it today.

The Internet of things is the foundation for cyber-physical-systems (CPS), systems in which the communication between the machines as well as between the system of machines and its operator become advanced enough to constitute a “dialogue” (Brettel, Friederichsen, Keller, & Rosenberg, 2014). These innovations will come together to create “smart factories” (Brettel et al., 2014; Drath & Horch, 2014; Gilchrist, 2016; Schwab, 2016), wherein the enhanced coordination between machines as well as between machines and humans will provide short development periods, individualization on demand, flexibility, decentralization, and resource efficiency (Lasi, Kemper, Fettke, Feld, & Hoffmann, 2014). These smart factories will become the new standard in global manufacturing, a global shift in manufacturing called Industry 4.0.

Robotics, AI, and automation will also play a significant part in the upcoming future (Ross, 2016; Schwab, 2016). Computers and robots are now accomplishing an increasing number of tasks, and they are beginning to take the place of human workers in many fields. If robots are not replacing human workers, they are complementing them in the workplace, such as machines that obtain items in a warehouse or machines that assemble car parts. As an increasing number of computers and robots replace humans in working environments, a crisis in employment may arise that may in turn, lead to increased inequality. It may also decrease opportunities for developing countries to offer low-cost labor, which is an established pathway for development (Schwab, 2016).

Although the FIR is mostly discussed in the literature as Industry 4.0, a term that focuses on the industrial applications of new and upcoming technology, the all-encompassing nature of the changes have also compelled other scholars to write

about the effects of the FIR in fields such as business, society, politics, and medicine (Guoping et al., 2017; Ross, 2016; Schwab, 2016). They argued that these technologies will create a more decentralized world in which individuals will have more power in influencing significant events that used to be restricted to a small sector of society, such as elected leaders (Caruso, 2017; Rifkin, 2011; Schwab, 2016). This decentralized world will be participatory, as a result of the Internet, the mobile phone, and social media.

Big data is another trend that will drastically change the socio-political landscape of the future (Floridi, 2014; Schwab, 2016). Big data is the use of large quantities of information to increase the effectiveness of decision-making in a variety of contexts; it usually exhibits veracity, variability, and value (Gandomi & Haider, 2015). This data can be used in a variety of ways, from recommending items to an Amazon customer based on his previous purchases to deciding which ads should be shown to a particular user based on his Internet activity.

For Floridi (2014), the impact of big data in our daily lives is so profound and has changed our way of living to such a great degree, that he considered this central to the FIR. Big data also changes the landscape of politics in four ways. First, information and communication technologies will democratize data, and governments will no longer become the centralized origin of information that can exclusively exercise informational power. Second, geography will become porous and irrelevant, as more people communicate through the Internet, and put pressure on the state, which remains a territorial entity. Third, the “deterritorialization” previously mentioned will change the topology of politics so that groups from all over the world can converge according to some shared common goal or interest. Finally, all the above will reshape the nature of democracy because individuals are now more empowered in terms of sharing their viewpoints. This does not necessarily mean that democracy will be strengthened but the capacity of the crowd to reason and respond to events as opposed to, say, a few people that were chosen through a meritocratic process will be more observable.

One of the most important concerns for the future is the possibility of social inequality, which also brings with it increased risk for social unrest (Schwab, 2016). The future economy will favor providers of intellectual and physical capital, rather than laborers and low-skill

workers, which will widen the already-existing wealth gap (Guoping et al., 2017). For example, Lee and Wie (2015) noted the widening wage gap in Indonesia since the early 2000s. Their economic analysis of trade and foreign direct investment found that technological change significantly affected skilled labor demand and wage inequality. Imports and foreign direct investment increased wage inequality causing demand to shift toward more skilled workers.

Current trends also exhibit the so-called “platform effect,” in which platforms such as Alibaba, Amazon, and Google are growing at the expense of small businesses (Schwab, 2016; Srnicek, 2017). For Srnicek (2017), these platforms tend towards expansion, monopolization, and invulnerability. These companies are increasing their scope so that companies like Google, which was once only a search engine company, are now expanding into the business of car manufacturing. Facebook, a social networking company, now also supports business transactions. These platforms are also becoming an increasingly pervasive in everyday life so much so that they are also tending towards monopolization in their drive to dominate their particular core business areas.

These trends show that future economies have a risk of becoming unequal if the negative potentials of these trends are not properly contained. Guoping et al. (2017) offered coping strategies for governments to ensure that social inequality is constrained during the FIR. First, the authors suggested training so that workers adapt to the influx of new technologies and, if this is not possible or adequate, encouraging labor mobility as industries undergo a period of transformation. Second, they suggested that the government should ensure that the middle class does not shrink through income polarization by ensuring equal education rights, increasing the wages of the middle class, or leveraging tax and social security.

The widespread use of mobile phones and the availability of mobile Internet produced the sharing economy, in which online platforms are used to connect consumers and providers while minimizing middleman costs efficiently. The new economy may also usher in a new class, the “precarariat,” who depends on multiple sources of “precarious” income (Caruso, 2017; Schwab, 2016; Standing, 2011, 2014). Although the term was used in the 1980s to describe temporary or seasonal workers, the term is used in the context of the FIR to describe laborers who depend on

temporary employment contracts and do not have a secure source of income (Schwab, 2016; Standing, 2011, 2014).

The precariat way of life is usually romanticized, which is recognizable in the discourse of firms who participate in the sharing economy (Standing, 2011). For example, Uber frequently emphasizes the freedom of working whenever one wants. However, Uber downplays the fact that it is not responsible for its contractors the same way that companies are responsible for employees. This lack of regulation is what allows Uber contractors to use the service to earn money easily, but it is also what allows Uber to disregard traditional firm responsibilities.

Thus, as with many technological advancements, the impact of the sharing economy on the world economy and society is ambiguous. On the one hand, it provides efficient services through the use of the online, mobile platform. The service is easy to use with few regulatory requirements for both contractors and consumers. However, it also radically restructures the nature of work and the relationship between firms and workers. This restructuring can bring benefits as well as harm. Schwab (2016) placed importance on creating new social and employment contracts that adequately respond to the rapidly changing nature of work.

The literature on the FIR emphasizes the importance of resilience when faced with the radical shifts that are about to take place (Caruso, 2017; Drath & Horch,

2014; Guoping et al., 2017; Schwab, 2016; World Economic Forum, 2015, 2016). In fact, resilience and innovation may be the most important factor for determining success in the future, given that the upcoming technological advances will severely disrupt business, society, and our everyday lives (Schwab, 2016; World Economic Forum, 2016), so much so that it may replace cost-effectiveness and, as mentioned above, play a part in the re-shoring of manufacturing from developing nations (Schwab, 2016).

Moreover, given the new ways of thinking and doing things that are about to emerge from the FIR, the society must also begin to build new institutions (new laws, new social contracts, new customs) that correspond to our upcoming way of life (Ross, 2016; Schwab, 2016). The nature of employment will also change during the FIR. Talent will become more important than any other factor, such as capital (Guoping et al., 2017; Schwab, 2016).

The Philippines

The Public Opinion Research Group of the World Bank (2016) conducted “The Philippines Country Opinion Survey” as a part of the County Opinion Survey Program series. According to the 2016 survey results, the most urgent agenda in the country was reported as poverty reduction and public sector reform, followed by job creation (Table 1). Economic

Table 1
Most Urgent Agenda in the Country According to the Philippines Country Survey

Ranking	Items	Percentage (N=435)	Can be Combined into Economic Development Category
1	Poverty Reduction	41%	Yes
2	Public Sector Governance	31%	
3	Job Creation	26%	Yes
4	Climate Change	22%	
5	Food Security	21%	
6	Education	20%	
7	Agricultural Development	17%	Yes
8	Anti-Corruption	16%	
9	Transport	15%	
10	Social Protection	10%	
11	Economic Growth	10%	Yes
12	Rural Development	9%	Yes

Source: World Bank (2016)

growth marked relatively low on this scale. The survey result shows that economic development remains an important agenda because the issues of job creation and poverty reduction have been listed as top priority issues. However, contrary to this agenda-level discussion, a different story can be presented when it comes to analyzing the current status of the country's industrial competitiveness.

The economy of the Philippines is characterized by a young labor force, a heavy dependence on the service sector, and the strong role of overseas Filipinos in the national economy. As of 2016, the population size of Philippines is 101.0 million (Philippine Statistics Authority, 2016). Overall, the population is relatively young (Table 2). The median age of the population is 24.3 years old. More than 50% of the total population is less than 25 years old. Of the total population, 68.7 million are 15 years old and over. The total labor force is 43.7 million. Approximately half of the labor force is less than 35 years old; 32% of the total labor force is 35 to 54 years old. In Table 4, the service sector is the largest group of the labor force (54.6%), followed by agriculture (28.3%) and industry (17.1%) (Philippine Statistics Authority, 2016).

Table 2
Share of Working Age Population by Age Group

Age Group	Share of Working Population
15 - 24	28.1 %
25 - 34	21.7 %
35 - 44	17.5 %
45 - 54	14.3 %
55 - 64	9.9 %
65 and over	8.5 %
Total	100.0 %

Source: Philippine Statistics Authority, 2016

According to Hill (2003), the Philippines has historically experienced a boom-bust pattern in terms of its industrialization. Industrialization declined sharply in 1971–72, followed by strong growth and then modest expansion until the late '70s. The economy collapsed in 1983–86, before it recovered during the early Aquino period and then contracted again in the early 1990s. After several years of growth

under Ramos, the Asian financial crisis once again slowed industrialization, before growth resumed by 1999. Moreover, Hill noted two important features of industrialization in the Philippines. First, the lack of economic dynamism in the country did not produce rapid structural changes in the country. Second, de-industrialization appears to occur at a low per capita income.

Yap (2000) further noted that the Asian financial crisis affected construction, financial services, and real estate. In addition, he noted that manufacturing was also affected, although growth for manufacturing had already slowed before the crisis in the fourth quarter of 1995. The agricultural sector easily recovered in 1998 from the result of El Nino, which contributed to the growth of the services sector by 4% through a corresponding growth in food manufacturing.

Table 3
Percent Distribution of Employed Persons by Sector

Agriculture	28.3 %
Agriculture and forestry	25.4 %
Fishing	2.9 %
Industry	17.1 %
Mining and quarrying	0.5 %
Manufacturing	8.1 %
Electricity, gas and water	0.2 %
Water supply	0.2 %
Construction	8.1 %
Services	54.6 %
Total	100.0 %

Source: Philippine Statistics Authority, 2016

According to the Philippine Statistics Authority (2017), electronic products are the country's top export, amounting to US\$2.455 billion or 50.9% of the total export revenue in April 2017. This is followed by machinery and transport equipment; other manufactured products (7.3%, US\$349.56 million); ignition writing set and other wiring sets used in vehicles, aircraft, and ships (3%, US\$145.80 million); and chemicals (3%, US\$145.72 million). Electronic products are also the most imported item in the country,

accounting for 26.5% and amounting to US\$1.809 billion. This is followed by minerals, fuels, lubricants, and related materials (10%, US\$727.48 million); transport equipment (10.4%, US\$714.00 million); industrial machinery and equipment (6.9%; US\$471.08 million); and iron and steel (5%, US\$344.35 million). Of the electronic products, 18.3% (US\$1.253 billion) is composed of semiconductors, making it also the lead import of the country.

The total trade value of the Philippines in April 2017 is US\$11.663 billion, which is an increase of 4.6% from US\$11.149 billion in April of the previous year. While total exports increased by 12.1% to US\$4.805 billion (from US\$4.285 billion in 2016), total imports decreased by 0.1% to US\$6.857 billion (from US\$6.865 billion in 2016).

Japan accounted for 14.8% of all exports in April 2017, amounting to US\$710.03 million, followed by the U.S.A. (13.6%, US\$653.05 million), Hong Kong (13.5%, US\$646.86 million), People's Republic of China (11.1%, US\$534.60 million), and Singapore (6.3%, US\$304.92 million). Other top 10 destinations include Thailand, Germany, the Republic of Korea, Taiwan, and Malta. Total exports from these countries amounted to US\$3.764 billion, 78.3% of all imports.

The People's Republic of China accounted for 18.1% of all imports, amounting to US\$1.240 billion, followed by Japan (12.5%, US\$854.43 million), the Republic of Korea (8.6%, US\$592.12 million), the U.S.A. (7.7%, US\$530.74 million), and Thailand (6.5%, US\$446.87 million). Other top 10 destinations for imports include Singapore, Indonesia, Taiwan, Malaysia, and Hong Kong which account for US\$5.322 billion or 77.6% of total imports.

Outside observers may think that the main industry of the Philippines is solely composed of traditional light industries, such as textiles and apparel. Although these industries are present, it exists alongside high-tech industries, the export performance of which has been increasing over the years. Figure 1 shows that the high technology product exports of the country has increased dramatically since 1994. It also shows that although there have been ups and downs during the recent decade, as of 2012, the high technology export volume of the Philippines has reached a level comparable to that of Ireland, a developed country in the European Union. It is worth noting however that such exports are still relatively low as manufacturing

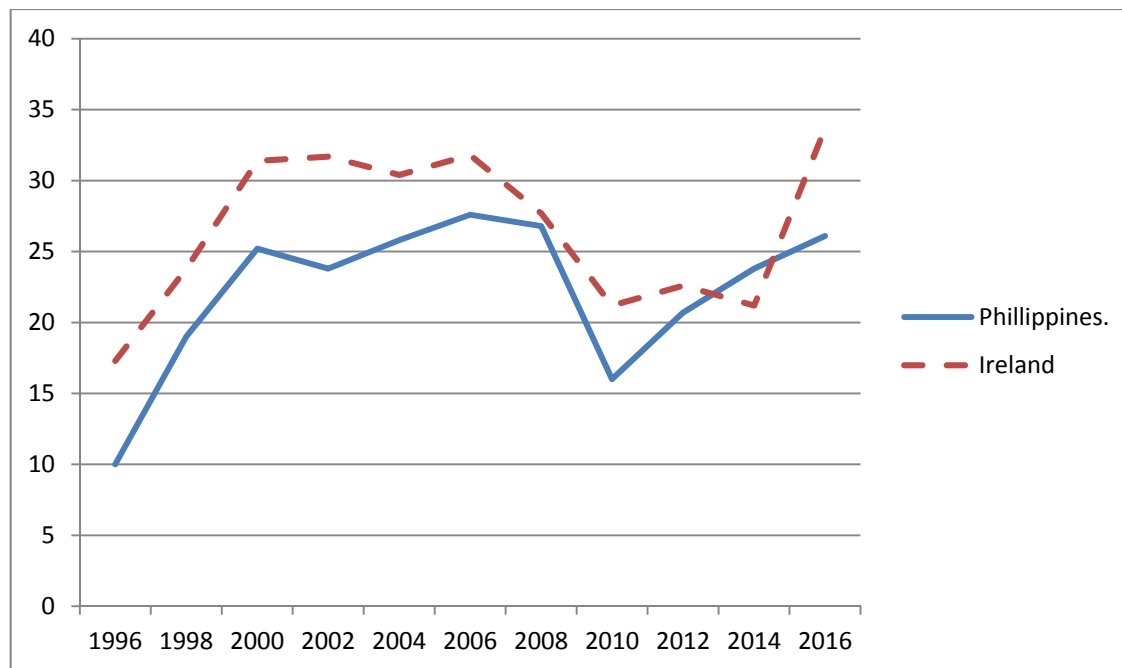
and industry comprise a smaller share of the Philippine economy relative to the services sector.

Table 5 shows how the manufacturing sector of the Philippines has grown in the last decade. Manufacturing accounted for 21.47% to 23.4% of GDP from 2008 to 2017. Manufacturing is also the fourth largest destination of foreign investments in the country. More importantly, the contribution of the manufacturing sector to job creation has also been substantially increasing doubling from 2015 to 2016 (Philippine Board of Investments, 2016). While the manufacturing sector's share of the economy is still below that of the service sector and is unlikely to overtake it anytime soon, growth in this sector is a positive sign for the Philippine economy.

Examination of the industry profile of the Philippines produces several insights. First, industrial sectors range from traditional light industries such as food, wood, and paper to petroleum, chemical, fabricated metal, and electrical machinery sectors. Second, although the proportion of machinery sectors and chemical sectors are not high, finding a relatively high presence of electrical machinery and communication equipment sectors when statistical categories are combined is possible. Third, the data demonstrates the theoretical point by Raymond Vernon (1992) that the international arena displays an industrial and technological life cycle dynamic, in which the Philippines receives the manufacturing momentum from other countries. The existence of the counterpart sectors in the country work as an indication of future industrialization. Thus, the country is not very far behind other industrialized countries in the sense that the country can expand its "traditional industrial revolution" type of industrialization.

Since the late 1960s, the Philippine government has effectively encouraged overseas employment despite official statements frequent emphasis on the priority for domestic job creation. It established the Philippine Overseas Employment Administration in 1982 to monitor and promote the welfare of overseas Filipino workers. The largest land-based deployments of Overseas Filipino Workers are in the Middle East. Saudi Arabia and United Arab Emirates are among the top two destinations as of 2015 as can be seen in Table 6.

In 2016, the total economy of the Philippines is US\$304.9 billion in GDP and is US\$3,580 in gross national income per capita (Cruz et al., 2016). To



Source: The World Bank (2017)

Figure 1. High tech exports by the Philippines in current U.S. dollars compared with Ireland (In Billion U.S. dollars)

a large degree, the Philippine economy depends on overseas Filipino workers. The total number of overseas Filipino workers 2.3 million in 2015, which is approximately 5.3% of the total labor force (Philippine Overseas Employment Administration, 2015). Cash remittances from overseas Filipino workers reached US\$26.9 billion in 2016 (Bangko Sentral ng Pilipinas, n.d.), which is 8.8% of the total economy of the Philippines. This amount increases when unofficial remittances are taken into account.

One notable feature of the Philippine economy is the dominance of the service sector. Unlike other countries that underwent a period of transition from agriculture into industries and manufacturing followed later by transition into the services, the Philippine services sector expanded rapidly without having fully gone through the preceding phase of industrialization and manufacturing. As of 2017, services accounted for 57.5 % of the GDP compared to the industry's share of 34.0% and agriculture, hunting, forestry, and fishing's 8.5% of the national economy according to the Philippine Statistics Authority (2018).

Services wasn't always the largest sector in the economy. The Philippine Statistics Authority (2015)

reported that 86% of the total number of establishments in 2012 were in the services sector; an increase of 62.1% from 2006. The services sector in 2012 comprised 56.7% of all establishments, whereas the industry sector only comprised 42.3%. This marked a shift from an industry-based economy to a service-based one, as the services sector only comprised 46.3% of all establishments whereas the industry sector comprised 52.7% in 2006.

The growth in the services sector occurs side by side with the development of technology enabled sectors. Developments in information and communications technology has allowed the Philippines to develop services catering to the needs of industrialized countries. Among the services sector, the information technology (IT) and business processing outsourcing (BPO) sectors are the most notable. The IT-BPO sector's contribution to the economy is approaching the level of overseas remittances, which has long been one of the main contributors to GDP. Mitra (2011) argued that the BPO sector is poised to transform not just the economy but also the society especially if accompanied by transformation and expansion of the IT sector. The growth in BPOs is expected to be accompanied by

Table 5*Industry Profile of the Philippines: Manufacturing Value Added (% Share of GDP) as of 3rd Quarter 2017*

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Food manufactures	8.55	8.82	8.41	8.37	8.42	8.22	8.28	7.94	8.03	7.45
Beverage industries	0.96	0.87	0.88	0.99	0.96	0.87	1.02	0.95	0.98	0.88
Tobacco manufactures	0.21	0.21	0.1	0.08	0.07	0.06	0.06	0.07	0.07	0.07
Textile manufactures	0.68	0.55	0.55	0.52	0.48	0.39	0.42	0.43	0.37	0.30
Wearing apparel	0.71	0.55	0.46	0.47	0.63	0.49	0.45	0.41	0.39	0.39
Footwear and leather and leather products	0.15	0.11	0.1	0.09	0.1	0.1	0.1	0.1	0.10	0.08
Wood, bamboo, cane and rattan articles	0.31	0.26	0.25	0.22	0.23	0.2	0.19	0.23	0.25	0.20
Paper and paper products	0.21	0.2	0.22	0.24	0.22	0.19	0.19	0.2	0.20	0.21
Publishing and printing	0.17	0.16	0.15	0.14	0.13	0.12	0.21	0.24	0.23	0.20
Petroleum and other fuel products	1.14	0.92	0.98	0.86	0.77	0.64	0.69	0.65	0.61	0.60
Chemical & chemical products	1.36	1.28	1.36	1.55	1.51	2.73	2.67	2.91	2.99	2.59
Rubber and plastic products	0.31	0.35	0.36	0.37	0.36	0.34	0.34	0.33	0.39	0.40
Non-metallic mineral products	0.52	0.55	0.56	0.56	0.6	0.61	0.55	0.57	0.52	0.56
Basic metal industries	0.54	0.44	0.46	0.44	0.33	0.46	0.46	0.46	0.61	0.76
Fabricated metal products	0.26	0.23	0.24	0.24	0.22	0.21	0.28	0.29	0.27	0.43
Machinery and equipment except electrical	0.35	0.31	0.35	0.34	0.32	0.32	0.37	0.41	0.48	0.51
Office, accounting and computing machinery	0.33	0.3	0.29	0.29	0.33	0.31	0.33	0.27	0.36	0.43
Electrical machinery and apparatus	0.47	0.43	0.53	0.55	0.57	0.49	0.48	0.49	0.52	0.55
Radio, television and communication equipment and apparatus	4.13	3.53	4.27	4.11	3.78	3.88	3.86	4.1	3.76	4.41
Transport equipment	0.42	0.46	0.55	0.5	0.53	0.4	0.4	0.41	0.48	0.48
Furniture and fixtures	0.36	0.32	0.35	0.67	0.85	1.14	1.32	1.19	1.11	1.09
Miscellaneous manufactures	0.66	0.63	0.76	0.82	0.72	0.6	0.56	0.53	0.48	0.51
<i>Total as % of GDP</i>	<i>22.82</i>	<i>21.47</i>	<i>22.18</i>	<i>22.41</i>	<i>22.12</i>	<i>22.80</i>	<i>23.24</i>	<i>23.19</i>	<i>23.19</i>	<i>23.10</i>

Source: Philippine Board of Investments (2018)

Table 6
Documentation of Overseas Filipino Workers (Contracts Processed)

Type	2015	2014	% Change
Land-based	1,823,715	1,873,180	-2.64
New Hires	614,748	639,679	-3.90
Rehires	1,208,967	1,233,501	-1.99
Sea-based	519,977	517,972	0.39
Total	2,343,692	2,391,152	-1.98

Source: Philippine Overseas Employment Administration, 2015

Table 7
Deployed Land-based Overseas Filipino Workers by Destination (Top 10)

Destinations	2015	2014	% Change
Saudi Arabia	406,089	402,837	0.81
United Arab Emirates	227,076	246,231	-7.78
Singapore	141,453	140,205	0.89
Qatar	133,169	114,511	16.29
Kuwait	86,019	70,098	22.71
Hong Kong	85,704	105,737	-18.95
Taiwan	62,598	58,681	6.68
Malaysia	26,199	31,451	-16.70
Oman	22,274	15,880	40.26
Bahrain	21,428	18,958	13.03
Other Destinations	225,866	226,253	-0.17
Total	1,437,875	1,430,842	0.49

Source: Philippine Overseas Employment Administration, 2015

the development of IT services, Telecom and other ICTs industries as well as education and have broad economic and social implications.

The IT-BPO sector is among the largest contributors to the Philippine economy. In 2017, its contribution to the economy reached around US\$22.1 billion representing more than 7% of the GDP. This is comparable to the US\$31.3 billion personal remittances of overseas Filipinos which comprise around 10% of the economy for the same period (World Bank, 2018). IT-BPOs range from voice-services associated with call-centers, which still comprise the largest share, to emerging high-value services such as health care processing and coding, legal transcription, IT

outsourcing, and animation and game development. IT-BPOs are estimated to be directly employing at least 1.3 million Filipinos as of 2016 (Errighi, Khatiwada, & Bodwell, 2016).

The Fourth Industrial Revolution in the Philippines

It is difficult at this time to argue that a developing country in the periphery like the Philippines will benefit from FIR in the same way as the developed and industrialized countries at the core will do. Its industrial profile in Table 3 and 5 show that unlike developed countries, manufacturing and industrial sectors are

relatively small and underdeveloped, contributing only around 21-23% of the GDP. Even high-tech sectors, such as electronics, are also relatively small and largely assemble or supplies parts needed (e.g., printed circuit boards) by a larger global supply chain centered around multi-national corporations based in developed and industrialized countries. As well, the economy of the Philippines is largely dependent on its ability to provide skilled and unskilled labor. The country survey of most urgent national concerns in Table 1 also showed that the top priorities for the Philippines are addressing poverty and governance.

While much of the FIR discussions in developed countries with industrialized and knowledge-based economies revolve around new and exciting technologies and the promises of AI, robotics, and automation (e.g., Schwab, 2016), these same technologies can be seen in developing countries as a potential threat. After all, the competitive advantage of developing countries like the Philippines is primarily its large pool of young, well-educated labor force and low labor costs rather than technology. The various data and the review of literature in the preceding section shows that the Philippines participate in the global economy by having local labor produce parts or assemble goods, by sending unskilled and skilled workers overseas as labor migrants, or by offering front-end or back-end services through IT-BPO companies. The FIR however may bring about lower-cost technological alternatives to human labor.

The IT-BPO industry is of particular importance to the discussion of the FIR, given its strong links to technology. This industry includes services such as call centers, human resources, accounting, and payroll outsourcing (Philippine Statistics Authority, 2012). The IT-BPO industry is one of the most dynamic sectors in the Philippines and is steadily growing (Tullao, Fernandez, Cabuay, & Serrano, 2012). This industry transforms not only larger cities such as those in Metro Manila but also smaller cities such as Iloilo, Baguio, and Bacolod into global services production networks that bypass the industrial stage of development (Beerepoot & Vogelzang, 2016).

The IT-BPO industry in the Philippines largely plays a supporting role to businesses and clients overseas. According to the Philippine Statistics Authority (2012), of the 1,868 establishments within the information and communication (537) and administrative and support service activities (1,331) industries in 2010, a total

of 506 or 27.1% participated in IT-BPO activities. Of these participating businesses, 226 or 44.7% engaged in call center activities, followed by computer programming (169, 33.4%), and then data processing (39, 7.7%). The growth of the IT-BPO industry in the Philippines is arguably linked to its ability to supply high quality and low-cost outsourced front and back-end services to overseas clients. Arguably, the growth of IT-BPO services in developing countries at the periphery like the Philippines is shaped by and depends on the demands for outsourced services in core developed countries.

The case of the IT-BPO sector in the Philippines provides an interesting case on the double-edged nature of FIR on developing countries. On one hand, the FIR creates opportunities for developing countries in the periphery like the Philippines to benefit from the developments and innovations in core developed economies. The FIR brings about new technologies that facilitate communication and allows work to be outsourced across geographical borders. As predicted by the dual market theory (Massey et al., 1993), it can also push workers in developed countries to high-skilled high-value positions thus freeing up positions in the lower end of the value chain. Vacated positions can be filled by domestic workers, immigrants (e.g., Torneo and Yang, 2015), or by outsourced labor from other countries, as in the case of IT-BPOs.

On the other hand, the FIR also brings about new technologies and innovations that could also potentially displace workers in the IT-BPO sector. For example, many companies are already resorting to AI, machine learning, and robotic automation of many simple routine services to cut down further on costs. An advisory principal of KPMG, one the largest auditing company in the world, claims that "In the next 15 years, it's likely that 45 percent, and maybe up to 75 percent, of existing offshore jobs in the financial services sector will be performed by robots, or more precisely, robotic process automation (RPA)" (KPMG, 2016, p.2). Philippine IT-BPOs engaged in services that can be automated or transferred to AI are therefore vulnerable to displacement. To survive, Philippine IT-BPOs workers will need to transition to complex higher value services that still require human involvement (Errighi, Khatiwada, & Bodwell, 2016)

So how does the Philippines respond? The report entitled *IT-BPM Roadmap 2022 Accelerate PH: Future*

Ready Roadmap 2022, the blueprint developed by industry associations and the Philippine government, targets 1.8 million direct jobs, 7.6 million direct and indirect employment in this sector by 2022, US\$40 billion in annual revenue, and 73% mid to high value jobs (IBPAP, 2018). This requires overcoming challenges including: lack of ICT infrastructure, high attritions, wage inflation, shortage of in terms of higher level technical and management expertise, limited available venture capital, and limited local investments (Mitra, 2011).

In dealing with the changing landscape accompanying FIR, the *IT-BPM Roadmap 2022* aims to upgrade the Philippines IT-BPO sector into what it considers to be complex and higher value-services that are less vulnerable to automation. These includes five sub-sectors: Contact Center and BPO subsector, Information Technology (IT) Services subsector, Health Information Management (HIM) subsector, the Animation and Game Development subsector, and Global In-house Center (GIC) subsector. These include: Engineering Services Outsourcing (ESO), Data Analytics, Performance Management, Legal Process Outsourcing (LPO), Application Development Management (ADM), System Integration, Automation Enablement, IoT-Enablement languages, Preventive Health, Remote Healthcare Management, Provider Services, 3D animation, Augmented & Virtual Reality (AR/VR), Gamification, Industry specific services for Telecom, Healthcare, and Insurance and Pharmaceutical (IBPAP, 2018, p.14).

Although some infrastructure is in place for the FIR to take place in the Philippines, several issues regarding the effectiveness and nature of the FIR in the developing world remains. The data show that the country is nominally ready for FIR. Several trends that presage the arrival of FIR are present. Some parts of the country are technologically advanced and participate in the high-tech world economy. Although specific technologies such as AI and robotics are not yet widely present in the Philippines, the country is primed for their arrival. Other advances such as the sharing economy and high Internet penetration are already present and set to evolve. There are also E-governance projects that automate processes to deliver better public services (Magno & Serafica, 2001). Considering the uneven diffusion of information technology, efforts are also made to bridge the digital divide through e-community centers (Magno, 2014).

The most important question when interpreting this data, however, is the matter of uniformity discussed above. The discrepancy between the readiness of the U.S.A. and Europe compared to the readiness of the developing world in general and the Philippines in particular shows that there is no uniformity with regard to the advance of technological innovation. Importantly, although the next logical step for the developed Western world is the FIR, this is not necessarily true of the Philippines. The next logical step does not seem to be the world described by Schwab (2016), although such a world, if it presents itself to the Western world, will have a different set of implications for the developing world.

Thus, there are structural barriers that prevent the Philippines from becoming truly ready for the FIR. Just as the Philippines, and the rest of the developing world, participated in the third industrial revolution in a manner that is distinct from first-world countries, it would be more reasonable to expect that the Philippines will participate in the FIR in a different, possibly unpredictable manner, particularly if re-shoring does take place and cheap labor can no longer be used by developing countries as an avenue for advancement.

Concluding Notes

Schwab (2016) presented an optimistic view of the future, given recent advances in computer and medical technology, as well as the corresponding advances in economics and politics. However, there are several compelling reasons why we may be skeptical of his claims and the promises of the FIR in general. First, claims regarding the world-changing effects of emerging technologies do not sufficiently take into account the role of the developing world. This gap in the account of the future is sufficiently significant to warrant a skeptical response to the overwhelming positive predictions for the future. The role of the developing world is an important element in any system that hopes to describe the future, and the failure of accounts of the FIR to sufficiently account for the role of the developing world in the upcoming revolution points to a deficiency in foresight. Thus, these predictions are rendered less than useful and more akin to optimistic projections.

The economic and social world order is most appropriately viewed as a system, in which all parts affect the entire system through their synchronic

functioning. Supposing that the claims regarding technological advancements do take place in the developed world, this still leaves the question of how the developing world will be affected by these advancements, how they will function as a result of these advancements, and how they will affect the developed world given these advancements. Thus, the optimistic projections of the FIR are better viewed as projections of only a single, particular trajectory that nonetheless fails to encompass all the dynamics involved in describing a world system. This is akin to describing the current political-economic state of the world only according to the capabilities of the developed world without stressing the corresponding reliance of the developed world to the developing world in terms of materials and labor.

Moreover, technological progress and the corresponding political and economic changes that result from it do not affect the world in a uniform manner. Inequalities in terms of development are self-evident and a necessary consideration for assessing the present and the future. Some nations have not yet reached the so-called industrial revolution, for example, even though the developed world has moved far beyond it. The question regarding the FIR is therefore not only a question of what will take place in the future but exactly who is included in this version of the future. For example, although the third industrial revolution in the form of the Internet and globalization manifested in the developed world as connectedness, consumerism, significant increases in technological advancement, and so on, it manifested in a different form for the developing world: Cheap off-shore labor and outsourcing.

The analysis of the FIR in the Philippines presented above present an alternative account to the claim that the world is ready to enter the FIR as presented by Schwab. The results show that the Philippines will have a different experience of the FIR, at least initially. The findings merit further studies on how the FIR may affect the developing world.

Acknowledgment

The authors would like to thank the editors and reviewers for the very helpful comments and suggestions. They would also like to acknowledge the able assistance of Mr. Pacholo Rafael K. Mercado who served as Research Assistant for this study.

Conflict of interest

None.

Ethical clearance

The study was approved by the institution.

References

- Beerepoot, N., & Vogelzang, E. (2016). Service outsourcing to smaller cities in the Philippines: The formation of an emerging local middle class. In B. Lambregts, N. Beerepoot, & R. C. Kloosterman (Eds.), *The local impact of globalization in South and Southeast Asia: Offshore business processes in service industries* (pp. 195–207). New York, NY: Routledge.
- Bangko Sentral ng Pilipinas. (2016). *Overseas Filipino remittances*. Retrieved from: <http://www.bsp.gov.ph/statistics/keystat/ofw.htm>
- Brettel, M., Friederichsen, N., Keller, M., & Rosenberg, M. (2014). How virtualization, decentralization and network building change the manufacturing landscape: An industry 4.0 perspective. *International Journal of Mechanical, Aerospace, Industrial, Mechatronic and Manufacturing Engineering*, 8(1), 37–44. Retrieved from <http://waset.org/publications/9997144>
- Caruso, L. (2017). Digital innovation and the fourth industrial revolution: Epochal societal changes? *AI & Society*, 33(3), 1–14. <https://doi.org/10.1007/s00146-017-0736-1>
- Cruz, K., Limkin, J., Del Castillo, N., Chua, K., Van Den Brink, R., & Galang, R. (2016). Philippine economic update: Moving full speed ahead—Accelerating reforms to create more and better jobs. *Philippine economic update*. Washington, D.C.: World Bank Group. Retrieved from: <http://documents.worldbank.org/curated/en/845151468185031838/Philippine-economic-update-moving-full-speed-ahead-accelerating-reforms-to-create-more-and-better-jobs>
- Drath, R., & Horch, A. (2014). Industrie 4.0: Hit or hype? *IEEE Industrial Electronics Magazine*, 8(2), 56–58. doi:10.1109/MIE.2014.2312079
- Errighi, L., Khatiwada, S., & Bodwell, C. (2016). Business process outsourcing in the Philippines: Challenges for decent work. *ILO Asia-Pacific Working Paper Series*. Bangkok, Thailand: International Labour Organization. Retrieved from: http://ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/---sro-bangkok/documents/publication/wcms_538193.pdf
- Floridi, L. (2014). *The 4th revolution: How the infosphere is reshaping human reality*. Oxford, UK: Oxford University Press.

- Gandomi, A., & Haider, M. (2015). Beyond the hype: Big data concepts, methods, and analytics. *International Journal of Information Management*, 35(2), 137–144. <https://doi.org/10.1016/j.ijinfomgt.2014.10.007>
- Gilchrist, A. (2016). *Industry 4.0: The industrial internet of things*. Nonthaburi, Thailand: Apress.
- Guoping, L., Yun, H., & Aizhi, W. (2017). Fourth industrial revolution: Technological drivers, impacts, and coping methods. *Chinese Geographical Science*, 27(4), 626–637. doi:10.1007/s1169-017-0890-x
- Hill, H. (2003). Industry. In A. M. Balisacan, & H. Hill (Eds.), *The Philippine economy: Development, policies, and challenges* (pp. 219–253). Oxford, UK: Oxford University Press.
- IT and Business Process Association of the Philippines [IBPAP]. (2018). *IT-BPM Roadmap 2022: Accelerate PH: Future Ready. Executive Summary*. [pdf file]. Retrieved from: http://boi.gov.ph/wp-content/uploads/2018/03/Executive-Summary-Accelerate-PH-Future-Ready-Roadmap-2022_with-corrections.pdf
- KPMG. (2016). *Rise of the robots*. Retrieved from: <https://assets.kpmg/content/dam/kpmg/pdf/2016/06/rise-of-the-robots.pdf>
- Lasi, H., Kemper, H.-G., Fettke, P., Feld, T., & Hoffmann, M. (2014). Industry 4.0. *Business & Information Systems Engineering*, 6(4), 239–242. Retrieved from <https://aisel.aisnet.org/bise/vol6/iss4/5/>
- Lee, J.-W., & Wie, D. (2015). Technological change, skill demand, and wage inequality: Evidence from Indonesia. *World Development*, 67, 238–250. doi:10.1016/j.worlddev.2014.10.020
- Magno, F. A. (2014). E-governance and social inclusion: Community E-centers in the Philippines. In S. Baum & A. Mahizhnan (Eds.), *E-governance and social inclusion: Concepts and cases* (pp. 256–270). Hershey, PA: IGI Global.
- Magno, F. A., & Serafica, R. (2001). *Information technology for good governance*. Yuchengco Center for Good Governance, De La Salle University. Retrieved from <http://unpan1.un.org/intradoc/groups/public/documents/apcity/unpan002708.pdf>
- Mitra, R.M. (2011). *BPO Sector Growth and Inclusive Development in the Philippines*. Washington, D.C.: World Bank. Retrieved from: <https://openknowledge.worldbank.org/bitstream/handle/10986/27398/660930WP0P122100B0BPO0Sector0Growth.pdf?sequence=1&isAllowed=y>
- Massey, D. S., Arango, J., Hugo, G., Kouaouci, A., Pellegrino, A., & Taylor, J. E. (1993). Theories of international migration: A review and appraisal. *Population and development review*, 431-466.
- Philippine Board of Investments. (2016). Robust industries, global opportunities. *Philippines 2016 Annual Report*. Retrieved from: <http://boi.gov.ph/resources/publications/>
- Philippine Board of Investments. (2018). *Manufacturing value added by sector*. Retrieved from: http://boi.gov.ph/wp-content/uploads/2018/02/Manufacturing-Value-Added_Share-to-GDP-2008-2017.xlsx
- Philippine Overseas Employment Administration. (2015). *OFW statistics* [Data file]. Retrieved from <http://www.poea.gov.ph/>
- Philippine Statistics Authority. (2012). *2010 ASPBI - Business process outsourcing (BPO) activities: Preliminary results* [Data file]. Retrieved from <https://psa.gov.ph/content/2010-aspbi-business-process-outsourcing-bpo-activities-preliminary-results>
- Philippine Statistics Authority. (2015). *2012 census of Philippine business and industry - economy-wide for all establishments: Final results* [Data file]. Retrieved from <https://psa.gov.ph/content/2012-census-philippine-business-and-industry-economy-wide-all-establishments-final-results>
- Philippine Statistics Authority. (2016). *Employment situation* [Data file]. Retrieved from <http://www.psa.gov.ph/>
- Philippine Statistics Authority. (2017). *Philippine export and import performance: April 2017* [Data file]. Retrieved from: <https://psa.gov.ph/content/philippine-export-and-import-performance-april-2017>
- Philippine Statistics Authority. (2018). *Gross Domestic Product of the Philippines Highlights for 2017*. Retrieved from: <https://psa.gov.ph/regional-accounts/grdp/highlights>
- Rifkin, J. (2011). *The third industrial revolution: How lateral power is transforming energy, the economy, and the world*. New York, NY: Palgrave Macmillan.
- Ross, A. (2016). *The industries of the future*. New York, NY: Simon & Schuster.
- Schumpeter, J. A. (2003). *Capitalism, socialism and democracy*. New York, NY: Routledge.
- Schwab, K. (2016). *The fourth industrial revolution*. Geneva, Switzerland: World Economic Forum.
- Srnicek, N. (2017). The challenges of platform capitalism: Understanding the logic of a new business model. *Juncture*, 23(4), 254–257. <https://doi.org/10.1111/newe.12023>
- Standing, G. (2011). *The precariat: The new dangerous class*. New York, NY: Bloomsbury.
- Standing, G. (2014). *A precariat charter: From denizens to citizens*. New York, NY: Bloomsbury.
- Stearns, P. N. (2013). *The industrial revolution in world history* (4th ed.). Philadelphia, PA: Westview.
- Torneo, A. R., & Yang, S. B. (2015). Policy dissonance and the challenges of managing the impacts of South Korea's industrial and demographic transition through immigration. *International Journal of Technology, Policy and Management*, 15(1), 95-111.
- Tullao, T. S., Fernandez, R., Cabuay, C., & Serrano, D. (2012). IT-BPO industry profile, prospects, challenges

- and issues for growth. *Policy Brief: Career Guides for Selected Industries, 4(2)*. Retrieved from https://dlsu-aki.weebly.com/uploads/1/0/2/2/102266760/volume_iv-2_aki_policy_brief_-_tullao_fernandez_cabuay_serrano_revised_2.pdf
- Vernon, R. (1992). International investment and international trade in the product cycle. In *International Economic Policies and their Theoretical Foundations (Second Edition)* (pp. 415-435).
- World Bank. (2016). *World Bank Group country opinion survey* [Data file]. Retrieved from <http://www.worldbank.org/>
- World Bank. (2018). *Philippines economic update: Investing in the future*. Retrieved from <http://pubdocs.worldbank.org/en/280741523838376587/Philippines-Economic-Update-April-15-2018-final.pdf>
- World Economic Forum. (2015). *Deep shift: Technology tipping points and societal impacts*. Geneva, Switzerland: Author.
- World Economic Forum. (2016). *The global information technology report 2016*. Geneva, Switzerland: Author.
- Yap, J. T. (2000). The Philippine economy in 2000: Prospects and key issues. *Development Research News, 18(1)*, 1–5. Retrieved from <https://dirp4.pids.gov.ph/ris/pdf/pidsdrn2000jf.PDF>