Automation for Global Economy: The Future of Nigeria

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ABSTRACT

Automation is the creation of technology and its application with the aim of controlling and monitoring the production and delivery of goods and services. It is an evolving technology that covers areas such as manufacturing, transport, defense, operations, information and business management. Despite advancement in automation and its role in the development and sustainability of global economy, some countries of the world like Nigeria are yet to harness its automation potentialto improve their processes and procedures. This paper seeks to present an overview of automation and highlights the need for Nigeria like any other developing countries to fully embrace it in banking, mining and agricultural industries as well as governmental and non-governmental services. It is evident that automation initiative, if properly planned and implemented, will facilitate 'Ease of doing business', improve productivity that may translate to increase in Gross Domestic Product (GDP), attract both foreign and indigenous investors, and reposition Nigeria in the global market.

1.0 INTRODUCTION

Automation may be seen as the technology by which processes or procedures are performed without human assistance. Most emerging economies have embraced automation to promote economic growth. The middle-income countries, having rapidly deepened manufacturing capabilities of automation,were able to participate in global value chains and steadily increase their penetration of overseas markets [7, 9]. Automation is a boon for developing economies like Nigeria as it could lead to gains in productivity which is the ultimate driver of growth and development. Regardless of the timing, automation could be the shot in the arm that the global economy needs in the years ahead. It was reported in [1, 2, 4] that automation could increase global GDP growth between 0.8% and 1.4% annually if appropriate measures are taken. Considering the labour effect alone, it was estimated that by 2065, productivity growth that automation could add to the largest economy of the world (G19 and Nigeria) is the equivalent of an additional 1.1 billion to 2.2 billion full-time workers which enhances continued prosperity in aging nations and provides additional boost to fast-growing ones[3,6]. Reworking business processes, developing new products and services, and business model in addition to automation will help to achieve long-term economic growth aspirations in Nigeria. *'It is no longer a distant prospect, as posited by Brian Arthur some years back, that global economy now turns 'autonomous' where digital processes talk to other digital processes and create new digital processes all without human intervention with the current researches in artificial intelligence'.* It is an established fact that automation has led to advancement of human workers even though it is yet to be felt in Nigeria. The influx of sophisticated technologies will enable human workers to think of working in new and innovative ways [1,5]. In a recent article by the Financial Times, Gillian Tett made it clear that automation can substitute for labour but also creates new human-machine complementary and new jobs. A new study by PricewaterhouseCooper also reveals that the world economy could be more than double in size by 2050 due to technology-driven productivity.

Therefore, exploiting emerging technologies of the Fourth Industrial Revolutiondepicted in [9] should be an utmost strategic priority of both governmental and non-governmental organizations in Nigeria if they must compete with

advance economies in the global market. Most companies of the world are infusing products, services and operations with digital assets and technologies while disrupting old business models and creating new ones. Automation requiresextensivechanges in how an organization performs and how humans go about their daily work. On this note, it is true to say; *'Automation is solely behind the so-called fourth industrial revolution (Industry 4.0) for emerging economies and for their development strategies'*.

2.0 AUTOMATION POTENTIALS IN NIGERIA

Almost half the activities that people are paid to do in the global economy have the potential to be automated by adopting demonstrated technology. With current technology, $14.6 trillion in wages are associated with activities that are automated. These potentials differ among countries ranging from 40% to 55%. Fig. 1 reveals that Nigeria has automation potential of 45.7% while Japan has the highest (55.7%). For Nigeria to improve on its potentials and remain internationally competitive in the global market, there is need to revive and automate government owned companies like Ajaokuta Steel Company while providing enabling environment for private ones to operateeffectively.Besides, government at all levels should lead by example by ensuring that all their official processes and procedures are highly automated.Adopting automation in the global economy is dependent upon factors not limited to the following;

- Deployment in the workplace only begins when machines have reached the level of performance in the capabilities required to carry out particular activities. While machines outperform humans on some of the activities including information retrieval, gross motor skills, optimization and planning, many other capabilities need more technological development.
- **Cost of developing and deploying solutions**: Cost is one of the major factors that affect adoption of automation in business environment.
- **Labour market dynamics**: The quality (for instance, skills), quantity, as well as supply, demand, and costs of human labour as an alternative affect which activities will be automated. Labour market dynamics differ by geography, not only in terms of how different and evolving demographics affect the base supply of labour, but also different wage rates.
- **Regulation and social acceptance**: Even when deploying automation makes business sense, the rate of adoption can be affected by contextual factors such as regulatory approval and the reaction of users. Government policy has great influence in adopting and deploying automation. Individuals may also feel uncomfortable about the new world where machines replace human interaction in some intimate life settings like hospital and places where machines are expected to make life and death decisions, such as when driving.

Taking these factors into account, it willtakesome time for the effect of automation on current work activities to play out fully in Nigeria. While theeffects of automation might be slow at macro level within entire sectors of Nigeria economy,itcould be quite fast at micro level especially for an individual worker whose activities areautomated and companies whose industries are disrupted by competitors using automation.Analysis of technical automation potential of the global economy shows that the proportions of national economy in sectors such as manufacturing, accommodation and food services have relatively high automation potentials compared with the proportion in sectorsengaged in management andadministration.

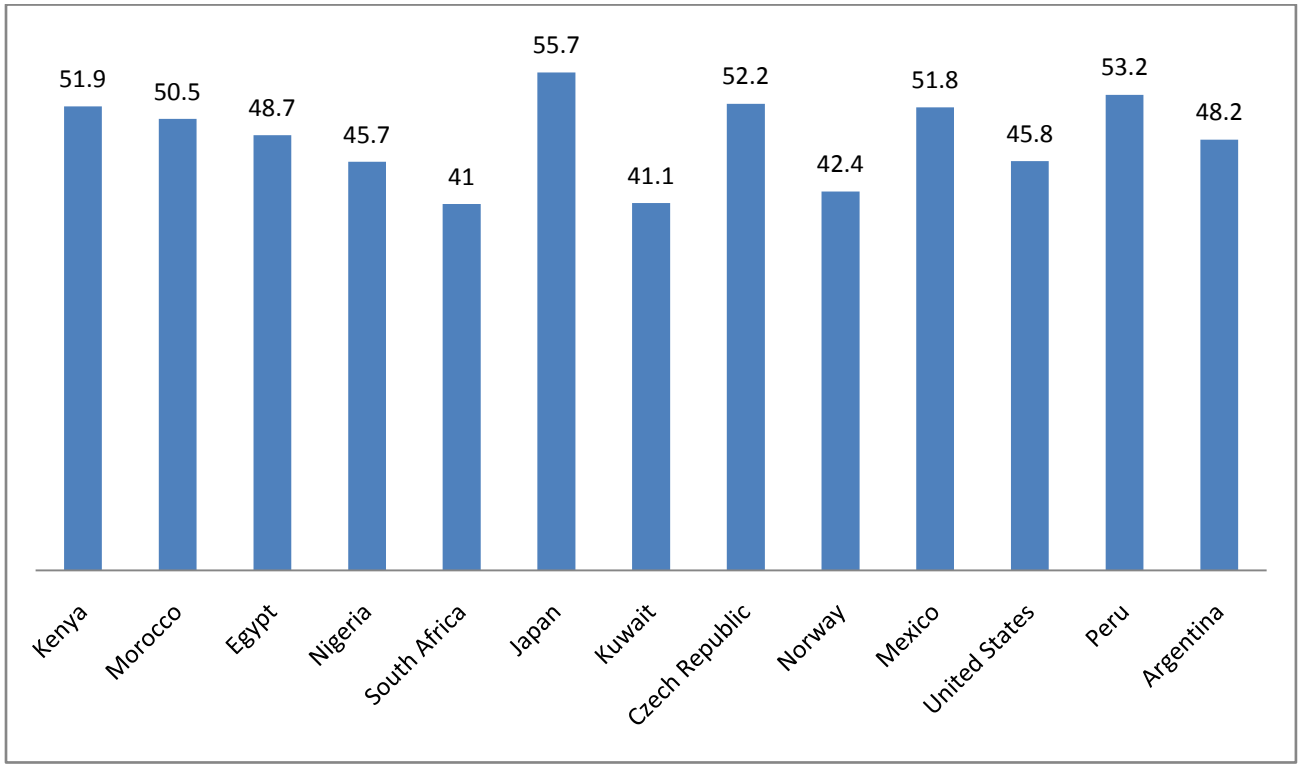

Figure 1 Automation Potentials (in %) of Different Countries of the World

(Data adapted from Oxford Economic Forecasts; Emsi database; US Bureau of Labor Statistics; McKinsey Global Institute analysis)

3.0 OVERVIEW OF INDUSTRIAL AUTOMATION

Industrial automation is the use of various devices to control industrial processes and machineries without significant intervention from humans in order to achieve automatic control performance.Equipment to connect the signals to the control devices and HMI (Human Machine Interface) systems.

3.1 Structure of Industrial Automation

The structure of industrial automation exists in various levels of operations as highlighted below:

i. **Sensor level**: This is also called process layer. It uses sensors and actuators to get the values of the process variables in continuous or periodic manner. This acts as eyes and arms of industrial processes. Some of the devices involved are pneumatic instruments, smart devices, etc.
ii. **Automation control level**: Automation control level, also called control layer, uses industrial control devices like PC's/PLC's/DCS, etc. This level utilizes various embedded processors and PID algorithms to control processes.
iii. **Supervision level**: This is termed SCADA layer. It gets lots of channel information and stores the data in the system database. It requires data from various control devices and displays them on HMI.
iv. **Enterprise level**: This performs tasks like scheduling, orders and sales, product planning, etc.

3.2 Functional Elements of Industrial Automation

. Figure 2 shows the structure of industrial automation and its various functional elements.

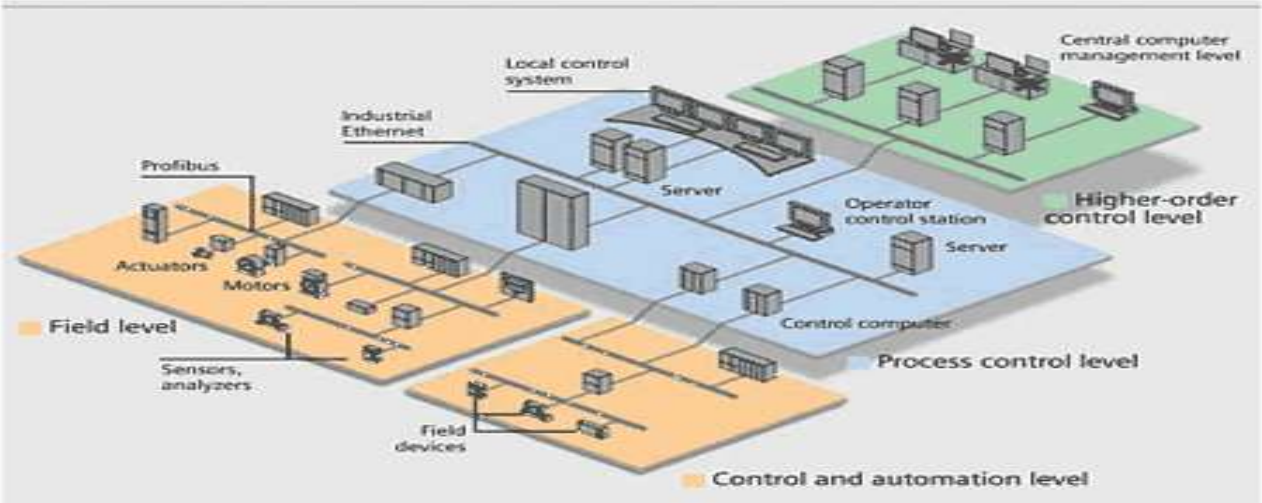

Figure 2 Functional Elements of Industrial Automation

a) Sensing and Actuating Elements

Sensors or sensing elements which include thermocouples, RTDs, strain gauges, etc.convert physical process variables such as flow, pressure, temperature, etc. into electrical or pneumatic form. The signals from these sensors are used for processing, analyzing, and decisions in order to produce control output. Finally, the controllers produce the computed outputs and are applied as electrical or pneumatic signal inputs to the actuating elements. Actuators convert the electrical or pneumatic signals into physical process variables. Some of the actuators include control valves, relays, motors, etc.

Figure 3 Sensing and Actuating Elements in Industry

b) Control System Elements

The controller (which is either continuous control system or sequential/logic control system) processes both sensing and supervisory values and produces control output to various actuating devices depending on the control structure.PLCs come with dedicated software which allows for their ease of being programmed to perform corresponding control operatio

Figure 4 Programmable Logic Controller

c) Supervisory Control Elements

The major elements on this level are process station PCs and Human Machine Interface. These process station PCs are responsible for functions like set point computations, performance monitoring, diagnostics, startup, shutdown and other emergency operations. Human Machine Interface or operator interface displays process information such as process variable status, logging results to the database, generating alarm signals, etc. More so, Distributed Control Systems (DCS) provide their own HMI for the graphical display of various industrial parameters.

Figure 5 Human Machine Interface

3.3 Need for Automated Industry in Nigeria

The highly increasing competitiveness over the industry demands high quality and most consistent products with competitive prices. Therefore, industries in Nigeria could be made viable and contribute to the national economy to its fullest by implementing the following through automation:

i. Embracing centralized control whereby the control of disparate assets could be integrated into a single location which either brings control from far-flung fields or just to optimize processes. This will be beneficial to chemical manufacturing, oil exploration and other manufacturing companies.
ii. Deployment of robots to inspect and maintain power plant.
iii. Provision of multiple layers of industrial security that cover everything from security assessments to protecting physical access of facilities and continuous network monitoring.
iv. Using a cloud-based computerized maintenance management system (CMMS) to streamline processes and inventory management.

The benefits of the above when fully implemented are as follow

- Increase in labour productivity.
- Improvement in product quality;one can get reliable and uniform product quality by using real time hardware control devices.
- Reduction in manual routine tasks.
- Increase in flexibility.

- Remote monitoring.
- Safety improvement.

3.0 THE NEED FOR HOME AUTOMATION.

4.0 It is a step forward to what is referred to as the 'Internet of Things' in which everything has an assigned IP address that can be monitored and accessed remotely. Smart devices and appliances can be connected to a local area network, via Ethernet or Wi-Fi. Electrical systems and individual points, like light switches and electrical outlets, are also integrated into home automation networks. And also, businesses have explored the potentials of IP-based inventory tracking.Therefore, home automation, if optimally utilized, offer the following benefits:

a) Operational efficiency: The inefficiency of operation of conventional wall switches can be overwhelmed using various home automation systems.
b) Reduction of power loss: The loss of power can be reduced and manpower required for home automation is less compared to conventional methods.
c) Ease of operation: Home automations based on IR, RF, android application, Arduino Bluetooth and DTMF are more efficient and easily operated than the conventional home appliances.
d) Safety: Home automation provides safety and prevents the user from electrical power short circuits while using conventional wall switches to operate loads.
e) Security: Home automation system with automated door locking and security cameras facilitates more security.
f) Time saving: Home automation system saves a lot of time to operate home appliances from anywhere at ease.

5.0 AUTOMATION FOR FINANCIAL REPORTING AND BANKING SYSTEM IN NIGERIA

Financial reporting and banking system are critical areas of global economy that cannot be immune from automation and digital means of operation as explained in this section.

5.1 Automation in Financial Reporting

It has the potential to greatly diminish errors prone to human intervention and streamline the financial reporting processareas throughout the corporate infrastructures.Therefore,to sustain viability and remain competitive in globalized business environment, financial organizations in Nigeria should be encouraged to embrace automation by using software in back office processes to produce financial reports, such as balance sheets, accounting reports and financial statements amongst others. Some of the benefits of automated financial reporting are as follow;

- Saving hours of manual and tedious work to identify issues caused by human errors.
- Time-saving in preparing final reports.
- Cost reduction.
- Multiplier effect of efficiency and knowledge.
- Detection of opportunities and risks.
- Integration of information across the enterprise.
- Standardization of processes and financial data.
- Increase in reliability and security of back up of data.

5.2 Automation in Banking System

In banking system, automation has brought tremendous changes to both banking industry and its customers. However, this is not without shortcomings and challenges, hence the need for more sophisticated automated banking processes and procedures. Irrespective of challenges, the deployment of ATM terminals has averagely improved the performance of Nigeria banks[7]. The introduction of Automated Teller Machine (ATM) marked the down of contemporary digital banking that replaced the cascading labour-intensive transaction system effected through paper-based payment instrument [5]. Nigeria Interbank Settlement System, NIBSS, reported that 4.7 trillion naira cash withdrawal was made through ATMs in 2016 which was 22.5% increase over the 3.97 trillion naira withdrew in 2015. In the same report, it was captured that bank customers made 154 million instant transfers valued at 38 trillion naira using NIBSS instant payment platform in 2016. Similarly, bank customers made 63.7 million transactions worth 759 billion naira through Point of Sale (POS) devices, 47 million mobile payment transactions worth of 756billion naira were credited through the 21 licensed mobile payment operators in the same year. All these would not have been possible without automation. As cashless transaction progresses, ATM fraud may become a difficult issue to handle. Hence there is need for automation in the key areas highlighted below:

- Increasing the security layers to subvert the tricks of web scammers.
- Provision of extra security layer that can prevent third party to make use of someone's ATM card for unauthorized withdrawals electronically.
- Deployment of forensic-based ATM. With this, the finger print of whoever wants to withdraw from an ATM will be captured, processed and compared with the registered finger print before appropriate decision is taken. Permit in the form of codes will be required from the ATM card owners or bank as the case may be before a third party can withdraw using someone's ATM card.
- Creating a platform where ATMs are linked and real time information about customers' transactions can be detected and accessed within the limit of financial regulationand other relevant regulatory bodies.This will make it difficult to withdraw money with ATM cardsbelonging to criminals from any ATM.
- Deployment of GPS-based ATM that gets activated once ATM card(with embedded tracking device) is inserted. This enhances easy tracking of ATM fraudsters as the information about whoever withdraws as well as the scene captured by its camera will be sent to the appropriate authority via GPS.

6.0 IMPACT OF AUTOMATION ON 'EASE OF DOING BUSINESS'

Ease of doing business, an aggregate figure which includes different parameters that define the way and manner business is done in a country, can be facilitated and improved upon through automation. It is a good news that Nigeria is now ranked 145th position out of 190 countries in the 'Ease of Doing Business' index for 2018 and among the top 10 improved countries worldwide according to World Bank. This report indicates that Nigeria had moved up by 24 points from 169th position on the 2016 ranking.

To improve ranking in ease of doing business in Nigeria and become the top 5 of the world, automation is highly needed for;

- Widening the scope of e-governance that increases transparency, simplifies and streamlines regulations.
- Faster judicial system that speeds up the judgment of cases related to patent violation, labour laws and business operations.
- Speeding up process of construction permit.
- Improving trading across border i.e. reducing paper work and the time of processing as well as the cost to import/export.
- Realizing smart grid network to tackle some of the challenges posed by epileptic power supply in Nigeria.

- Improving the intelligent security system.
- Migrating to intelligent-based traffic management system to cater for logistic problems.

Therefore, automation stands to reduce hours to file taxes, days to start business and days for registration, licensing and filling.

7.0 RELEVANCE OF AUTOMATION IN ECONOMIC DIVERSIFICATION IN NIGERIA

To efficiently and sustainably diversify economy in Nigeria from the current state of mono-economy, there is need for government at all levels, private individuals and academia to critically look into and fully harness potentials in agriculture and mining sectors in Nigeria. *Does 'automation' have a role to play?* The only answer to this question is 'YES' because the future of Nigeria economy is 'automation'.Further explanation shall be covered in this section.

7.1 AUTOMATION IN AGRICULTURE

Nigeria is predominantly agricultural society even though it depends heavily on oil industry for its budgetary revenue. Surprisingly, approximately70% of the population engages in agricultural production but could not feed the entire nation. Therefore, there is a fundamental problem that requires attention. One of the major challenges of farming in Nigeria is inadequate mechanized farm implements. If Nigeria must feed itself, export its agricultural produce and compete with other countries in the global market, then there is need for automation in agricultural processes and practice.And also, Padraig Belton, a Technology of Business reporter, stated that:*'' in not-too-distant future, our fields could be tilted, sown, tended and harvested entirely by fleets of co-operating autonomous machines by land and air''*. Therefore, different countries and individuals have put in measures to address automation in agriculture. Some of these are highlighted hereunder:

a) Engineers in Shropshire, England, have shown the possibility to farm in a field without a human setting foot in it.
b) Engineers from Harper Adam University together with Precision Decisions (a farming technology company in North Yorkshire) have tested prototype machines that will make it possible for dry farming.
c) In Japan, the world's first entirely automated lettuce farm is on course.

What should Nigeria and Nigeriansdo to revive agricultural sector for effective and sustainable diversification of economy?

This is simple! Government at all levels in collaboration with academia, private individuals and professional bodies like NIEEE, NSEetcshouldprovide the following automated devices or tools at subsidize rate:

i. **Driverless tractors** that can tilt the soil, tend the farm land and follow pre-programmed routes around large farms.
ii. **Drones**that can assess crop health and soil conditions, monitor crop growth rates, spot crop diseases, and spray crops with pesticide and herbicides.
iii. **Autonomous precision seeding** that has the ability to place seeds at precise locations and depths in such that each has the best chance of growing.
iv. **Weeding automated system** that either uses lasers to kill the weeds or use computer vision technology to detect weeds and then spray a targeted drop of herbicides onto them.
v. **Autonomous pruning and thinning system** that uses computer vision to detect a particular plant as it drives over them and decides in that moment which plant to keep and which to remove.

vi. **Nursery automated system** that can provide automation solutions for seedling, potting and warehousing living plants in greenhouses.
vii. **Ground sensors** that can monitor the amount of water and nutrients in the soil, and then trigger irrigation and fertilizer applications appropriately.
viii. **Automated preservative devices**that can regulate temperatures, pressures and humidity of agricultural produce.
ix. **Autonomous system** that can be used to round up animals like sheep over long and distance terrain as well as remote controlled the animals.
x. **Collaborative automated system** that can help in the milking process on dairy farms.

The above automated devices could help farmers produce more agricultural produce for consumption and more cash crops for exportation with reduced labour cost.

7.2 NEED FOR AUTOMATION IN MINING

It is worthy of notice that automation plays important roles which spans in all stages of mining as obtained in the world. Mining, if properly addressed, can take Nigeria and Nigerians to a greater height. To buttress thispoint,the minister of Mines and Steel Development, Dr Kayode Fayemi, emphasized that minerals and metal sector has the capability to raise the GDP from N103 billion (in 2015) to N141 billion in 2020 at an average annual growth rate of 8.54 per cent as projected in Economic Recovery and Growth Plan (2017-2020).

To achieve and sustain the desired trajectory in the mining sector, Governments at all levels, in collaboration with academia, professional bodies like NIEEE,NSE etc and all stake holders, should adopt and make available the following automated devices/advanced technologies for mining processes and operations:

a) Automated/robotic devices powered by artificial intelligence that can perform a range of task including but not limited to drilling, blasting ,loading, healing, boring, hauling, remote operation, bolting mine roofs, ore sampling and rescuing trapped miners.
b) Receive data over a network without requiring human-human or human-computer interaction. IOT platform :
    - Improves traceability and visibility of the entire mining operation.
    - Improve the maintenance and operation of machines.
c) 3D Imaging Technologies for improving the efficacy of seismic surveys used to study the geology of potential mining areas. A 3D laser scanning helps to capture spatial data using laser light. It also enables geologists to build 3D geological maps combining the surface mapping data.
d) Plasma Technology for increasing precision metal yields.

8.0 CONCLUSION

Automation has major influence on the economy and will continue to be over the next decade.Employingmore automated processes and procedures in day-to-day activities will place Nigeria high in ‘ease of doing business’ and in the global market. And also, deployment of automated systems in industries and various homes could lead to significant benefits for the whole economy, for instance, greater GDP, higher productivity, increase in customizing the consumer experience, new opportunities with increased technology and potential for a revitalization of the local industries with self-employed workers having the ability to use their creativity to join a fast changing economy. To crown it all, the future of Nigeria is automation. So, think automation! Do automation! Use automation!

REFERENCES:

[1] A.Daron, and D. H. Autor, "Skills, tasks, and technologies: Implications for employment andearnings*,"inHandbook of Labor Economics*, volume 4B, David Card and OrleyAshenfelter, eds., Elsevier,2011.

[2] A. Melanie, T. Gregory, and U.Zierahn, *The risk of automation for jobs in OECD countries: A comparativeanalysis*, OECD Social, Employment and Migrationworking paper number 189, OECD, May 2016.

[3] A. David, "Why are there still so many jobs? The history and future of workplace automation," *Journal ofEconomic Perspectives*, volume 29, number 3, 2015.

[4] B. Carlos, R. Fuente, I.Caballero,and M. Luz Rodríguez-Méndez, "Beer discriminationusing a portableelectronic tongue based on screenprintedelectrodes," *Journal of Food Engineering*, volume 157, July 2015.

[5] B. James, "Toil and technology," *Finance & Development*, volume 52, number 1, March 2015.

[6] C. Michael, J. Manyika, and M. Miremadi, "The four fundamentals of workplace automation,"*McKinsey Quarterly*, November 2015.

[7] Evangelista, Rinaldo, Paolo Guerrieri, and ValentinaMeliciani, "The economic impact of digital technologies inEurope," *Economics of Innovation and New Technology*,November 2014.

[8] US Executive Office of the President, *Artificial intelligence, automation, and the economy*, December 2016.

[9] World Economic Forum, *The future of jobs: Employment, skills, and workforce strategy for the fourthIndustrialRevolution*, January 2016.