IMPACT OF COVID-19 ON INDUSTRY 4.0 AND IMPLICATIONS FOR KENYAN MANUFACTURING

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1. Introduction

The Fourth Industrial Revolution is a project in the high-tech strategy of the German government that promotes the computerization of traditional industries such as manufacturing. It portends the ongoing automation of traditional manufacturing and industrial practices, using modern smart technology. Large-scale machine-to-machine communication (M2M) and the internet of things (IoT) are integrated for increased automation, improved communication and self-monitoring, and production of smart machines that can analyze and diagnose issues without the need for human intervention. Industry 4.0 technologies were already transforming manufacturers' operations before the COVID-19 pandemic. The proverbial "business as usual" has been forced to consider new ways of working and this has forced the implementation of technology to be fast-tracked in order to digitize the workforce. It has been observed that players utilizing Industry 4.0 are better-positioned to weather the storm, having moved faster and further than their peers during the crisis. However on the flip side adoption is costly and diverging between technology haves and have-nots. The role of Industry 4.0 becomes even more critical in the backdrop of a crisis such as COVID-19. This paper will discuss the major features of a post pandemic future; reimagining manufacturing operations after COVID-19 and the implications for Kenya Manufacturing.

2. Approach

2.1 What is Industry 4.0

The phrase Fourth Industrial Revolution (4IR) was first introduced by Klaus Schwab, executive chairman of the World Economic Forum, in a 2015 and was the 2016 theme of the World Economic Forum Annual Meeting, in Davos-Klosters, Switzerland. The term "Industrie 4.0", shortened to I4.0 or simply I4, originated in 2011 from a project in the high-tech strategy of the German government, which promotes the computerization of its manufacturing industry. It was publicly introduced in the same year at the Hannover Fair. The characteristics given for Industry 4.0 strategy are: the strong customization of products under the conditions of highly flexible mass production. The required automation technology is improved by the introduction of methods of self-optimization, self-configuration, self-diagnosis, cognition and intelligent support of workers in their increasingly complex work. Basically it refers to the next developmental stage in the organisation of the entire value chain process in the manufacturing industry. The concept is now wide spread globally across Europe, Asia and the US. The terms 'internet of things' (IoT), Industrial Internet of Things (IIOT), 'internet of everything' or smart manufacturing are often used as equivalents.

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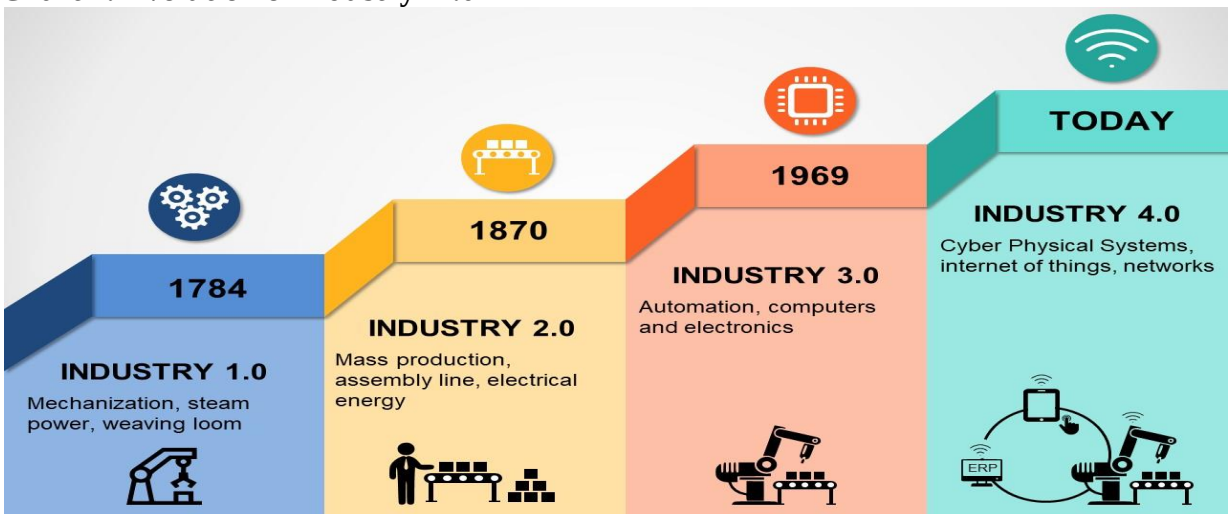
Chart 1: Evolution of industry I4.0



The widespread adoption by the manufacturing industry of information and communication technology (ICT) is increasingly blurring the boundaries between the real world and the virtual world, and is creating new production systems, namely cyberphysical production systems (CPPSs). CPPSs link IT with mechanical and electronic components that then communicate with each other via a network. Smart machines continually share information about current stock levels, problems, errors or faults, and changes in orders or demand. Processes and deadlines are coordinated with the aim of boosting efficiency and optimising throughput times, capacity utilisation and quality in development, production, purchasing, sales and marketing.

Chart 2: Environment of 4.0

Chart 3: Industry 4.0 Pillars

Adopted from https://cervirobotics.com/the-revolution-of-industry-4-0/

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Smart factories and their CPPSs are at the heart of I4.0, interfacing with other smart infrastructures, such as those of smart mobility, the smart grid, smart logistics and smart homes and buildings. Links to both business and social networks – the business web and the social web also play an increasingly important role in the digital.

2.2 Shifting comparative advantages in IR4.0 and the Digital Divide

Middle-income countries, particularly many emerging Asian economies, have scope to develop comparative advantages in the increasingly technology-led manufacturing, as shown by their relatively high scores on key competitiveness factors along with their growing domestic supply chains and consumer markets. The United States, Europe, and East Asia, which already dominate global manufacturing, are making the greatest investments in robotics and other I4.0 technologies, thereby raising the prospect of further concentration of manufacturing activity in these hubs. In 2017, around 75% of robot sales were concentrated in China, Korea, Germany, Japan, and the United States. China and the United States are leading in investment in artificial intelligence and its deployment in manufacturing and most of the investment in the IOT. The same cannot be said of Africa where Kenya is.

3. Discussions

3.1 Impact of COVID on Manufacturing

In April, 2020 the world was gripped by the Covid-19 pandemic which emanated from China. China contributes to about 19% of world GDP (Statista 2020) and is a traditional base for manufacturing and home for high technology and modern manufacturing. There was lock-down and closure of plants and stoppage of travel/transportation across the globe. The domino effect of that across the supply network has resulted in significant supply chain disruption. Some manufacturers ceased production completely, and others greatly reduced demand and others have seen a huge increase in demand. The pandemic also led to cancellation of technical and technological conferences leading to technology industry being likely to suffer from a downturn in innovation processes as a result of lost business opportunities for potential partnerships.

The magnitude of the impact of the pandemic on a global level can be gauged from the statement of the World Trade Organization (WTO) which has projected that global trade in goods is set to decline steeply between 13% and 32% in 2020. Similarly, the IMF has revised downwards the Sub Saharan Africa economic growth prospect for 2020 from an expected growth of 3.5% to -1.6%. A Survey undertaken by Kenya Association of Manufacturers (KAM) and KPMG in about 180 industries in EAC found that about 40% of workforce has been reduced with most manufactures working to reduce cost, retain jobs and improve cash flows; 91% of non-essential goods manufacturers have seen a significant fall in demand compared to 74% of essential goods manufacturers; Production has dropped and 42% are currently operating at less than half their production capacity, while the average utilized capacity for MSMEs is 37% and 76% are having difficulties in locally sourcing or importing raw materials and 67% found access to market challenging.

Previous industrial revolutions were inspired by the need to fulfill upcoming needs – mass production and high-speed and bulk movement of people and goods. This is similar to the current pandemic, which has hastened several trends, including local sourcing and innovation as manufacturers change their lines to produce critical essential items to be used in the fight against COVID-19, for example masks and ventilators. I4.0 has the potential to fill these gaps by ensuring continuity, reducing costs while increasing output. I4.0 technologies were already transforming manufacturers' operations before the pandemic and was gaining momentum before COVID-19, helping companies transform their operations in everything from production efficiency to product customization, with improvements in speed to market, service effectiveness, and new-business model creation.

The growing need for transfer of enormous amounts of data due to the isolation of humans due to the pandemic has highlighted the need for 5G technology. It also caused the use of virtual reality in businesses with most organizations offering employees and opportunity to work from home. Industries leaders immediate response to the crisis was to go digital and leverage Industry 4.0 solutions. Unfortunately the potential asymmetry in adoption in the wake of the pandemic has caused some companies globally to freeze their I4.0 initiatives to preserve cash. Many manufacturers now focus primarily on survival and on reducing the damage caused by a pandemic. The financial crisis for producers is already leading to a significant reduction in non-essential expenditure and less needed investment. In a survey undertaken by KAM/KPMG, manufacturers have had to rapidly change focus. The top three priorities for the majority of businesses before Covid-19 were to increase profitability, increase revenue and increase domestic market share. These strategies have now been pushed down the agenda and are overtaken by 78% were focused on reducing costs, 61% retaining jobs, and53% improving cash flow. Companies are now on the recovery path and it is believed that as more businesses emerge from the crisis, the case for further digitization at scale will likely be stronger than ever.

3.2 The significance of Industrialization and Manufacturing sector to the Kenyan economy

Manufacturing has been recognized as the main engine for vibrant growth and the creation of the nation's wealth (Rele 2020) and:

a) Accounts for the bulk of world exports (77 per cent in 2014), is less exposed to external shocks, price fluctuations, climatic conditions and unfair competition policies and the price of manufactured goods tends to be more stable than that of commodities.
b) Has the potential to create strong forward and backward linkages with other sectors of the economy such as pharmaceutical, agriculture machinery and capital good and the services sector such as banking, insurance, communication and transport.
c) Has the potential to offer employment opportunities directly or indirectly.
d) Generates externalities in technology development, skill creation, and learning that are crucial for competitiveness. For instance, manufacturing is the main vehicle for technology development and innovation at various levels. Globally, 95% of firms' R&D expenditure is undertaken within the manufacturing sector.
e) The internationalization of production and geographical distribution of the activities of multinational corporations (MNCs) has benefited manufacturing in the developing world more than other sectors of the economy. The trend towards the vertical disintegration of

production activities means that developing countries have higher chances of integrating into global value chains.

Given the strategic importance of the manufacturing sector in Kenya, it must adjust to the challenges posed by COVID-19 and industry 4.0. As we work towards rebound strategies, we need to develop structures that work for the economy in the presence or absence of a crisis. The manufacturing sector has continued to develop solutions to keep the economy moving, such as ensuring that there is no shortage of supplies and partnering with the government to develop rebound strategies.

3.3 Policy Implications of Technology Adoption; Innovation And Industry 4.0

3.4 Status of Technology, Innovation and Industry 4.0 in Kenya

Research and innovation are key to sustained industrial growth and manufacturing, to move past the initial successful stages which are often largely the result of foreign direct investments (FDI). It enables greater product diversification and competitiveness in the long-run. In Kenya and the wider East African Community (EAC), R&D is still weak. Kenya is at the early stages of industrialization, with activities mainly oriented towards the absorption and adaptation of foreign technologies into existing production structures and processes, including adaptive design of products for local markets. Some firms undertake reverse engineering imported capital goods; learn about performing maintenance and repair operations, and production/adaptation of spare parts.

3.5 Implications Of I4.0 Post Covid-19

Under the current circumstance most manufacturers have the following priorities today: Phase 1 - Survival; Phase 2 - Recovery; Phase 3 - Renewed work in a new post-crisis life. The goal of all manufacturers is to get to Phase 3 as soon as possible at the lowest price. When we define for the Phase 3 an Operating Model, we need to consider the experiences of the crisis period and try to build a more resistant and agile business. I4.0 enable

a) Visibility of real-time availability of raw materials, finished products, people and property using artificial intelligence and machine learning to continually review and reschedule– activities and Robotic Process Automation (RPA) to support labor intensive activities.
b) Remote work and collaboration. Beyond basic contact- and location-tracing mobile apps and videoconferencing applications, machine-vision algorithms and wearable technologies, are also helping maintain safe distancing.
c) Manufacturers to automate data collection by adding sensors or directly tapping into machines' programmable logic controllers (PLCs) to collect data and display it on live dashboards enabling monitoring factory performance remotely in real time. They can deploy interventions when needed remotely.
d) Utilization of mobile technology and augmented / virtual reality to enable workers to more– easily perform tasks for which they have not been trained. This could help with skills shortages due to isolation or restart of production technologies with digital twins and remote support from OEMs would improve resource availability.

e) 3D printing of spare parts stuck in the supply chain.
f) Use of autonomous electric vehicles and AGVs to reduce dependence on people and to– further help with social distance.

4. Recommendations And Conclusions

Given Kenya's unique context, policymakers must ask the right questions to make sure the country can capitalize on the revolution. Currently the country has strong investment growth in new technology-led areas of AI, Big Data Analytics, block chain, additive manufacturing and drones. It is evident that the disruptions caused due by COVID-19 also calls for a relook the way the Kenyan manufacturing sector has set its priorities and offers an opportunity to revisit the competitiveness and consequently, the country's manufacturing policy. The country needs to move more towards self sufficiency. Post-COVID-19 period marks the effective start of de-globalization and reshoring where most countries are bringing manufacturing and services back to the their countries from overseas and the country needs to move in a similar direction. The following are recommended to strengthen the country's manufacturing sector post COVID-19:

4.1 It is recommended that Government:

a) Boost efforts aimed at creating a predictable and stable environment that makes it possible for the existing industry to invest in R&D in readiness to supplement efforts to leverage I4.0. This will allow industry to channel its resources and investments towards developing cutting edge excellence centers that are in sync with global trends, making them disruption-ready.
b) Increase local content by putting in place local content policies/ preferential procurement schemes: Such a policy would support strengthening linkages between the different sectors, particularly the manufacturing and primary sectors, provide manufacturers with market access and incentivize them to invest more thus bring in new technologies like I4.0.
c) Gives incentives to promote both foreign and domestic investments to foster technology acquisition and manufacturing. Factors which attract investment include labour skills, tax rates, infrastructure, and access to Special Processing Zones (SPZ) or Special Economic Zones (SEZs). For effectiveness, the incentives or interventions related to these should be time-bound and strictly linked to performance targets.
d) Direct more public resources to applied research and raise expenditure on R&D. Support in developing and making more effective industrial research and technology development centres and incubator services will attract FDI inflows as well.
e) Put in place programmes to increase capacities of local suppliers to provide the products required by larger (exporting) firms in terms of product type, quality, quantity, price and reliability.
f) Upscaling, upgrading and modernization MSMEs e.g. development of clusters is a common approach. For this, the 'one village one product' notion can be encouraged, and technology provided.
g) Provide Industrial Financing. In general, manufacturing firms require long-term financing options, which financial institutions normally are less willing to offer. Banks should be incentivised to provide such funds.
h) Encourage capital good imports: Capital good imports are critical for countries at early stages of their industrialisation process, as locally developed technology is still weak or inexistent.

This can be done by strategically easing access to a selected set of capital goods and inputs required for production, without hampering sales of local/regional producers.

i) Supporting TVET and universities produce more valuable digitally oriented skills for industry. New technologies are demanding higher-level skills.
j) Builds digital infrastructure through increasing access to digital services and updating policies on data, digitizing the economy and managing the digital change in an inclusive and sustainable manner. Also provides financial and policy support to help manufacturers access and take advantage of ICT technologies.

4.2 It is recommended that Manufacturers/Private Sector:

a) Reorganize and reorient their supply chains, workforce and even suppliers to see how to develop new supply chains, undertake product diversification and higher value addition..
b) Acquire already developed technologies hence leap- frog and quickly creating new products/business models.
c) Take advantage of rapidly developing I4.0 technologies to adopt quick-win solutions that help companies respond and adapt to the new norms—such as tracking employee health, enforcing safe distancing on the shop floor, and supporting remote collaboration, digital work instructions for operators; among others.
d) Put in place cross-functional team and governance structures then help ensure quick execution including top-management commitment.
e) Undertake digital capability acquisition. Implementing agile working methodologies empowers teams with the tools, processes, and best practices for achieving success in a digital world.

4.3 Conclusion

As organizations begin to restart their operations post pandemic they have an opportunity to re-imagine a future with digitized, resilient operations. Early successes have shown that companies can start on their industry 4.0 journey in a small way and then scale quickly—if they commit to Industry 4.0 transformation in line with their business environment and their strategic objectives. Automation of systems is one of the strategies of helping business to survive and a launching pad for rebound and if embraced, shall enable continuity and provide a platform to further make businesses resilient, both in the medium and long terms enabling increased efficiency, enhanced productivity, flexibility, costs reduction, innovation, and higher revenues and eventually, increased profitability. The COVID-19 pandemic should inspire us to strongly consider and hasten our taking up of Industry 4.0.

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