

The Fourth Industrial Revolution and agriculture

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There is no constant but change, said Heraclitus, a Greek philosopher who lived 2 500 years ago. We could justifiably argue that we live in a world where change is often dramatic, and where it happens at exponential speed. Prof Klaus Schwab, chairman of the World Economic Forum and author of *The Fourth Industrial Revolution* says the Fourth Industrial Revolution has started, and it will profoundly alter how we live, work and relate to one another.

The history of industrialisation

Birthered in England during the latter part of the 18th century, the First Industrial Revolution was largely driven by coal-fuelled steam power which made factory production possible, and by a technique of smelting iron ore with coke, which made cheap production of better quality iron and steel possible. England could supply the demand for military

hardware, and later, build an extensive rail network. The First Industrial Revolution greatly accelerated urbanisation as people moved to the cities to work, and industry replaced agriculture.

The Second Industrial Revolution, between 1870 and 1914, was a time of rapid industrialisation, improving the technologies of the first using gas, oil and electric power.

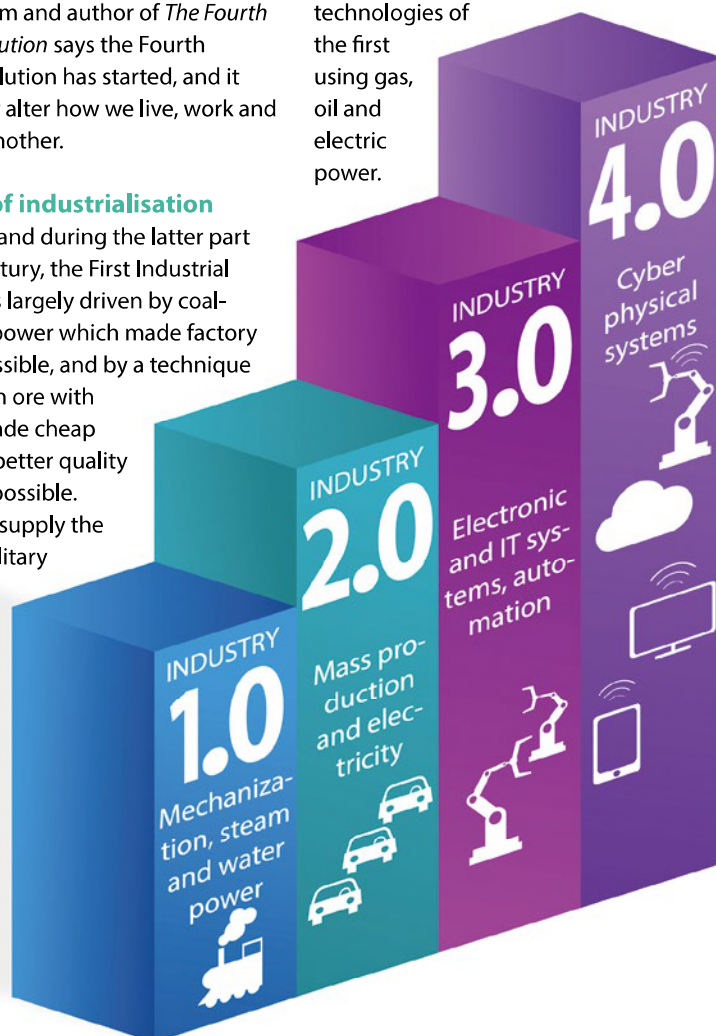


Figure 1: The first three industrial revolutions were initiated by available energy sources and changes in those sources. The Fourth Industrial Revolution is characterised by digitalisation.

The motor car, the first aircraft and the telephone were among the new technologies, and economies of scale were seen.

Nuclear energy ushered in the Third Industrial Revolution after World War II. In the 1970s, the introduction of electronics and information technology allowed for automation in production processes, powerful telecommunication systems and computers.

The Fourth Industrial Revolution began with the age of the internet at the start of the new millennium and is based on cyber-physical production systems that integrate computation, networking and physical processes. Digitalisation means that we can manage the physical world from the virtual world. This brings changes to the industrial and agricultural sectors.

Growth and urbanisation

The predictions are that there will be striking changes in world population dynamics. Projected population growth is expected to be concentrated in Africa and South Asia. By mid-century, two thirds of the global population will be urbanised. Already, more people live in cities than in rural areas.

South Asia's population is predicted to grow until mid-century, while the sub-Saharan population will continue to expand until the end of the century. Predictions show a world population of 11 billion people by 2100 – with nine billion of these people living in Asia and Africa.

More food, more feed, more fuel

To meet the demand for food, the global agriculture sector will have to produce 50% more food, feed and biofuel by 2050 than it did in 2012. According to a United Nations (UN) report, the greatest challenges will be in sub-Saharan Africa and South Asia, where

an increase in production of roughly 112% is expected. The rest of the world must increase production by a little more than 34%.

On a positive note, judging by past performance, these demands can be met. Agricultural production more than tripled between 1960 and 2015, with part of this increase ascribed to productivity-enhancing green revolution technologies and expansion in the use of natural resources, such as land and water. In the future, rapid technological development and innovations may offer solutions to agriculture's requirements.

An astonishing process of industrialisation and globalisation of the food and agriculture market has occurred. Everywhere, except perhaps in the deepest rural areas, there has been an increase in the distance from farm to fork. Food supply chains have lengthened, and there is an increase in the consumption of processed, packaged and prepared food.

However, this expansion in food production and economic growth comes at a high price. Almost half of the earth's forests have been cut down, groundwater sources have been depleted and global biodiversity has been eroded. And despite the increase in productivity, hunger and malnutrition remain a reality in parts of the world. The current rate of progress will not be enough to eradicate hunger by 2050.

Innovation and trade

Mobile technology plays an important role in keeping farmers informed of the weather, input availability, market prices and connecting them to buyers. Current mobile phone subscribers represent almost 60% of people in low-income countries, and more than 90% of the additional users to be reached by 2020 will live in low- and middle-income countries.

The international trade of agricultural products has accelerated since the start of the new millennium. A reduction in trade occurred during the financial crisis, with slow recovery and slower growth experienced since the crisis.

Despite the relatively fast growth in the trade of agricultural products, most food consumed in countries is locally produced. South Africa, like many other African and South Asian countries, is a net importer of food. Our consumed food imports are in

the category of 0 to 20%. Net exporting countries such as Argentina, Australia and the United States export more than 50% of their domestic food supply.

Pests and diseases

Although farmers are conditioned to deal with pests and diseases, food security is newly threatened by an alarming increase in the number of outbreaks of transboundary pests and diseases. On the local front, we had the fall armyworm outbreak of 2016 and the more recent outbreaks of avian influenza (bird flu) and foot-and-mouth disease.

Transboundary animal diseases cause high mortalities and disease rates. This continues to disrupt international and regional livestock markets and trade, posing a constant threat to the livelihoods of livestock farmers worldwide. Poorly regulated animal movement contributes to the spread of animal diseases, such as lumpy skin disease and foot-and-mouth disease.

The international community lacks the capacity and the coordination to prevent, control and eradicate emerging transboundary animal diseases. A UN report states that the successful control of transboundary pests and diseases will reduce yield losses in crops and pastures and improve productivity.

Apart from the food security problem, transboundary diseases have economic, social and environmental impacts. The upsurge in zoonotic diseases, such as avian influenza, could have serious repercussions on human health.

Food losses and waste

On the one side of the value chain there is an expected increase in future production, while on the other side losses (consumption) should also be reduced. Roughly a third of all food produced is lost or wasted in the food chain between production and consumption. The loss of food is seen as an accidental occurrence due to inadequate technology or a lack of knowledge and skills. Food wastage is characterised by an element of intended or unintended behaviour, such as the removal of food by choice.

Food waste is mostly associated with final consumption, but the deliberate discharge of food can occur in any link

in the supply chain. Annually 1,3 billion tons of edible food originally intended for human consumption, is lost or wasted.

In low-income countries, significant levels of food loss occur upstream during harvest and post-harvest handling due to a lack of investment in production. In sub-Saharan Africa, data shows that a little more than 35% of produced food intended for human consumption is lost or wasted along the supply chain. The biggest losses in these countries occur during harvesting (12,5%) and post-harvest handling (12,7%). In comparison, European countries show greater efficiency in the earlier stages of the value chain with the greatest losses occurring in the final stage (consumption loss of 12,6%).

Reducing food losses may require greater use of energy to preserve food products. How this energy is produced and delivered to the points along the value chain will impact the environment and local economy.

A decrease in food waste requires change in consumer behaviour. Policies need to create conditions that will enable individuals along the food supply chain to achieve socially optimal levels of food loss and wastage.

What agriculture can expect

From an agricultural perspective, we can expect an increase in the use of labour-saving technologies and practices that focus on intensive production systems.

Resource conservation and sustainable farming practices will continue to receive attention. Aquaponics and hydroponic farms may become more popular in South African agriculture and producers will require training and financial assistance to access these intensive farming systems.

The world has become a 'global village' with easy access to markets. We may see producers starting to move away from these easy trading practices and isolate their farms so that they are better protected against biosecurity risks in the future. One could also argue for better protection of local producers, such as the poultry and sugar sectors, against world markets. 🌍

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