Addressing food insecurity in the digital age

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Credit: Engin Akyurt from Pexels

In the search for food —whether through foraging, hunting or agriculture —we are constantly at war with nature. In addition, food is distributed unequally: over 800 million people experience hunger while two billion are overweight or obese.

Successive industrial revolutions have defined who we are and what we eat. In the mid-18th century, steam engines, railways and mechanized agriculture changed the ways food was produced and transported.

The Second Industrial Revolution, in the mid-19th century, brought electrical grids, assembly lines and mass production. Job loss happened in agriculture, while employment in the manufacturing and service sector grew. In the United States, for instance, 90 per cent of people worked on farms at the beginning of the 19th century, but now it is under two per cent.

The Third Industrial Revolution began with the invention of the transistor in 1947. While opening up the digital revolution, transistors have been integral to all digital devices, from personal gadgets to farm appliances. For instance, efficient use of plant nutrients, pesticides, seeds or water is possible by using information technologies and other digital applications, like sensors, robotics, drones, GPS and autonomous vehicles.

The Fourth Industrial Revolution is a result of the rapid development and application of physical, digital and biological technologies. It offers countless possibilities to grow more food in different ways, such as gene-edited plants and animals, yeast-brewed milk, vegan cheese and lab-grown meat.

Imagine a future where we go to grocery stores, buy printer cartridges and print our food at home using 3-D printers. We could set the printer up with the right amount of nutrients, for instance, according to age- or gender-specific needs.

These technologies can be and have been controversial in society; our research program sheds some light on making controversial technologies responsible to society.

Technology not the elixir

While enthusiasm for the Fourth Industrial Revolution is understood, it also comes with anxieties, including unprecedented job losses and insecurity related to artificial intelligence. The U.S. will see half of jobs automated by mid-century. Artificial intelligence can provide existential threats to humans, leading to an ethical question about who will control the means of production: humans or robots?

Setting aside potential warfare between humans and robots, technology is used to triumph over nature and food production is one among many ways humans do this. As we enter the Anthropocene age, we have caused environmental pollution, biodiversity loss, land degradation and climate change beyond what is safe for the planet.

Industrial revolutions in agriculture led to the 1960s "Green Revolution" in the Global South, which not only increased crop yield rapidly but also caused environmental pollution, land degradation and biodiversity loss.

Humans have caused existential threats to non-human species, including those essential for food production. We are in the midst of the sixth mass extinction. An asteroid may have ended the age of the dinosaurs, but in the Anthropocene it is the impact of humans. According to a recent article in *Science*, species extinction is occuring at a rate a thousand times faster than before human influence.

Social injustice

Together with environmental damage, industrial revolutions also exacerbate social injustice. Even 200 years after the First Industrial Revolution, animal and human drudgery continue in many parts of the world. The Green Revolution technologies have not reached smallholder

farmers who lack irrigated land and cannot afford modern inputs, especially in sub-Saharan Africa.

The Second Industrial Revolution left behind 17 per cent of people across the world who lack electricity. In Canada, 250 or so remote communities are off-the-grid to this day.

Social injustice is further worsened by access to broadband infrastructure and services. The Third Industrial Revolution failed to serve 50 per cent of people worldwide who still require the internet. Fourteen per cent of Canadians still don't have a broadband internet connection at home.

Although all levels of government in Canada have prioritized broadband infrastructure and services for economic growth, technology alone can't deliver. For instance, our research confirms that automation has replaced low-skilled jobs in agriculture in the U.S. and Canada.

Yet, with about eight billion global subscriptions, mobile phones are an exception, improving lives and livelihoods in developing areas. People in remote areas with neither broadband internet nor landlines have access to smartphones.

A just transition to our common future

World leaders adopted the Solidarity and Just Transition Silesia Declaration in 2018 to promote socially responsible climate action. This declaration has provided a vision for low-carbon and climate-resilient futures for countries across the world, such as the U.S. Democrats' Green New Deal.

Read more: How to fight climate change in agriculture while protecting jobs

In addition to climate action, the just transition principle could also address job loss and income insecurity related to automation. Some experts believe that the universal basic income scheme can reduce human sufferings regardless of the cause —climate change, automation, inequality or otherwise.

While they could generate important lessons, pilot projects on universal basic income are being terminated early, for example, in Ontario and Finland. As far as food security is concerned, income guarantee alone isn't sufficient. Scholars rather propose a universal basic services scheme , which includes access to food, water, public transport, basic phone, broadband, health care and education.

Citizen science for responsible innovation

Educating future leaders on science and engineering ethics can better prepare them for what to expect and how to deal with potential controversies.

Our research shows that we could get ready for the Fourth Industrial Revolution by transforming the triple-helix of university, government, industry collaboration into a matrix model to include civil society as a legitimate collaborator. It would give citizen scientists a rightful place in research and innovation systems.

Citizen science comes in various forms. For example, the U.S. National Audubon Society's Christmas Bird Count is arguably the first citizen science project, at over 115 years old. Citizen science in agriculture includes engaging farmers in participatory crop improvement, participatory plant breeding and farmers' field schools.

Before we advance any further, we need to take care of those who don't have access to basic infrastructure and services so that they can fully

participate in the digital age. In a bid to feed the future, we can't afford to repeat the social, ecological and environmental problems of past industrial revolutions.

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