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A VISION ABOUT THE FARMING SECTOR'S FUTURE: WHAT IS IN THERE FOR FARMERS IN THE TIME OF *THE SECOND MACHINE AGE*?

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What is in there for farmers in the time of *the second machine age*?

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Abstract

Recent technological advances both on the farm and in the lab have made farming more independent form nature than ever before. Arguably, the new and accessible technologies are helping us to better understand and 'manage' nature and thus for first time in history farming is becoming as any other industry, susceptible to specialisation and economies of scale. This in turn, besides increased productivity, leads to fundamental organisational change away from family control towards corporate forms with associated implications for employment and rural livelihoods – new technology in farming replaces both 'muscles and brains'.

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A vision about the farming sector's future:

What is in there for farmers in the time of *the second machine age*?

In their best-selling book *The Second Machine Age* Erik Brynjolfsson and Andrew McAfee (2014) argue that there is a new digital revolution unfolding. While as a result of the first Industrial Revolution 'machines replaced muscles' the new Digital Revolution is leading to 'machines replacing brains'. In a recent article in *The Guardian* Evan *Fraser and Sylvain Charlebois (2016) discuss how the latest technology adoption serge in farming is good for food security but they also pose the question to what extent the farming jobs are under treat.*

What is actually happening?

The revolutionising of agriculture is taking off in two distinct areas. Both on-farm and genome-scale increasingly affordable technologies are boosting the efficiency of modern farming. On the farm, satellite driven geo-positioning systems and sensors detect nutrients and water in soil. This technology is enabling tractors, harvesters and planters to make decisions about what to plant, when to fertilise, and how much to irrigate. As the technology progresses, equipment will ultimately be able to tailor decisions on a yard-by-yard basis. Robots can already do much of the harvesting of lettuce and tomatoes in greenhouses. In the dairy industry robotic milking and computer controlled feeding equipment allow for the careful management of individual animals within a herd. A similar technological revolution is happening with the genetics of plants and animals making it much easier to identify individual plants and animals that are particularly robust or productive and less dependent of nature.

It is worth noting that along with this striking technological shift a related and similarly significant trend towards globalization of trade has led to market expansion and rise in the global demand for farm products.

Why is it happening now?

Since the onset of the Industrial Revolution developments in technology and other social factors have changed the way we work and the types of work that we do. Leading us to the shape of the industrial landscape today where services are the dominant industries while farming accounts for only a few percent of the work force. Nevertheless, the importance of farming varies between urban and rural areas and across counties and regions. The changes in industry composition have been accompanied by a general transition of the industrial organization from family firms to large, factory-style corporations.

Notably farming has been an exception and remained a last bastion of family production providing livelihood in rural areas. According to Douglas Allen and Dean Lueck (2003) who published the influential book *The Nature of the Farm,* the main reason for farming deviating from the trends in industrial restructuring is its technological specificity associated with strong nature dependence. Production stages in farming tend to be short, infrequent, and require few distinct tasks, thus limiting the benefits of specialization and making wage labour especially costly to monitor. Notwithstanding the market expansion effects of globalization providing some opportunities for gaining economies of scale, only when farmers can truly control the effects of nature by mitigating the effects of seasonality and random shocks to output does farm organisation gravitate toward factory processes, developing into large-scale corporate forms found elsewhere in the economy.

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technologies are helping us to better understand and 'manage' nature and thus for first time in history farming is becoming as any other industry, susceptible to specialisation and economies of scale. This in turn, besides increased productivity, leads to fundamental organisational change away from family control towards corporate forms with associated implications for employment and rural livelihoods – automation in farming replaces both 'muscles and brains'.

What does the future hold?

A simple economic model and evidence from the last two centuries since the start of the Industrial Revolution demonstrate that an increase in labour productivity does not reduce employment in the long run. While inventions in technology may mean fewer labour hours are needed to make any particular good, labour-saving technology tends to reduce the costs of producing each unit, resulting in lower prices. Lower prices, in turn, lead to higher demand for goods, and, correspondingly, to higher demand for workers, in the same or related up-and downstream industries.

Would the Digital Revolution be any different? Tyler Cowen (2013) in his recent book *Average Is Over* has argued that the rapid advance of machines and computing will create two classes: a highly skilled elite, making up about a tenth of the population, who will profit handsomely by learning to work alongside machines; and everyone else, who will see their wages stagnate or decline. Evidence from the last two decades, from both the U.S. and Western Europe on 'wage polarisation' and corresponding 'job polarisation' provided by several authors is consistent with the view that technological developments during the period tended to complement the abstract skills at the high end of the skill and wage distribution, and, in some instances, the non-routine tasks performed in a number of lower-wage jobs.

Either of the two scenarios described above could apply to farming. To realize the optimistic scenario will require a major commitment to increasing education and skill levels as well as fostering business and organization innovation. Regional, national, and even international effort will be important, but arguably, based on political economy arguments, such commitment could better be uphold at *supra-national* level. The pessimistic scenario, which in the case of farming is quite possible considering that agricultural land is a finite and limited resource, makes meeting those challenges even more imperative, if we are to avoid that a substantial portion of the farming population is deprived of their traditional livelihoods. Notwithstanding the importance of education and skills upgrading, if Brynjolfsson, McAfee, and Tyler are right about the implications of the Digital Revolution for jobs and employment, the re-distributional role of the national and supra-national governments will also become increasingly important in supporting those who fall behind.

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