Increasingly, investment in agricultural research focuses on developing technological solutions to address the challenges that face the industry. Although agricultural technology can cut costs and improve sustainability, it can also have a negative impact on employment and reduce the 'human touch' farm labourers bring to production.

**RESEARCH ROUNDTABLE**

**Q:** Where do you stand on this issue, and how justified do you think the current emphasis on technology will prove in the long term?

**PROFESSOR JAC VARCO**  
(Mississippi State University, USA)

Our growers are increasingly being faced with the problem of finding qualified labour, so improved mechanisation or technologies that can substitute for labour are seen as beneficial. The technology that we are developing here in Mississippi does not substitute for labour, but rather encourages the employment of a more technically skilled labour workforce.

**PROFESSOR MARCIA ENDRES**  
(University of Minnesota, USA)

The use of precision technologies does not remove human labour on the farm; it might just modify what type of labour is done. Less menial tasks like feeding calves or milking cows will be necessary, but there is still the need to observe the cows, learn how to use the data collected by the technology, etc. This change will mean we have more technology-savvy workers on the farms.

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in greenhouse ‘protected agriculture’ to mitigate the impacts of changing weather patterns and pest infestation, while simultaneously addressing consumer demand for uniformity and quality.

The various stakeholder groups within the Equitable Food Initiative (EFI) might take varying organisational positions regarding these technological innovations and their impacts, and I won’t pretend to speak for any of them. However, as a certification scheme, EFI anticipates that human labour will continue to be a vital and indispensable factor in the production of fruits and vegetables for years to come. We also believe that consumer concern for ethical sourcing will grow as visibility into complex global supply chains is increased by technical innovations like produce traceability and the increased role social media plays in corporate accountability. As a result, we look to build a certification scheme that can not only adapt to technological shifts but also help drive transformation in the produce industry by deepening understanding of the value that workers can bring to the production process through training and verification.

I strongly support investments in agricultural research and endorse targeting funding on the development of technology. From its beginning 10,000 years ago, agriculture has focused on implementing new technologies based on knowledge derived from experimentation and observation. Farmers and breeders have used this knowledge to develop better-adapted or more resilient crop varieties, livestock and poultry, and have rapidly adopted numerous innovations and inventions that made life easier for farmers and consumers. Thus, investments in agricultural research have always centred on finding technological solutions to real problems faced by farmers and farm labourers. This is not robots replacing them; rather, it is about making their jobs easier. Throughout history, I am sure some claimed that jobs would be lost if farmers used iron ploughs with oxen instead of sticks to prepare the soil for seeding. While some highly inefficient jobs might have been lost, new ones with different skills and higher pay replaced them; indeed, this allowed many, for the first time, to harvest enough to feed their family. I think that it is really easy for those of us who live in cities, profiting from advancements, easier lives and changing job markets, to want farmers to continue to do back-breaking work. I grew up in agriculture and I know that the human touch will never disappear despite new technologies and equipment.

In my personal view, the negative impacts of agricultural technologies on farm employment cannot be generalised for all nations. If we look into the history, the active labour force in agriculture has gradually declined in industrialised countries and emerging economies. Hence, the development of agricultural technology and the rapid adoption of existing technologies have become imperative to the maintenance of crop productivity in these countries. Secondly, we cannot group all the technologies in a single basket and label them as having adverse effects on farm employment opportunities, because some of the technologies are laborious in themselves. For instance, integrated pest management (IPM) technologies are more labour intensive than traditional pest control methods using chemical pesticides. However, they are being promoted and adopted in the context of sustainable production systems, as well as human and environmental health. Hence, the impact of agricultural technologies on farm employment should not be viewed in a single dimension, and it varies from case to case and place to place. In the longer term, the development and adoption of agricultural technologies is an inevitable step towards enhanced sustainability and increasing production efficiency in countries and regions where the active agricultural labour force is shrinking rapidly.

It is essential to be able to supply the necessary food to feed the world’s growing population. Intensification of agriculture as a result of the implementation of technologies in developing countries during the Green Revolution (1940-1970) made it possible to increase agricultural output and reduce the threat of famine in countries such as Mexico, India and the Philippines. A new technological revolution in agriculture, where high-tech advances such as precision agriculture methods, water-efficient irrigation methods, environmentally conscious agrochemicals and genetically modified crops are incorporated in a sustainable manner, can provide solutions for better production under current and future threats, including drought, higher temperatures, soil salinity, insects and plant pathogens. Many new agricultural technologies can be applied to small and large farms, family owned or industry owned, and it doesn’t necessarily mean a replacement of the human component. Furthermore, use of cutting-edge technology in agriculture can be an incentive for people to get more involved in agriculture; in turn, as agriculture becomes less labour intensive, we can expect an increase in the number of small farms.
Investment in agricultural research has always focused on technological solutions to some extent. The oldest civilisations we know of built irrigation systems – and, surely, seed selection, crop care and animal raising techniques are older still. Technology has always been essential in agriculture, but it has never been a complete answer to something as comprehensive as sustainability, which incorporates a central ethical component of inter-generational responsibility. The situation today, with high unemployment and underemployment in many agricultural systems, is also about highly restricted migration policies, and the failed industrial strategies of many countries – as well as unfair and distorted international markets.

The ‘human touch’ is not how I would frame something as vital as employment. The theory of structural transformation says that by investing in agriculture and increasing productivity, food will be cheaper. Cheaper food will allow industrial workers to buy things other than food, stimulating demand in the economy (for clothes, housing, consumer durables, etc). In turn, that will generate new jobs for people whose agricultural labour has been mechanised.

But for many countries, those other goods are imported, not manufactured at home. In this situation, no jobs are generated for the agricultural labour that is released from farming by the increase in productivity.

Farm labour has also not declined. What has declined is farmer-owned farms run at a scale that allows the family to provide most of the labour used on the land. Technology has been both a blessing and a bane. The crucial factors to consider are what technologies, the purpose for which they are introduced, and their implications for people, ecologies and the future of the planet.

I think the question is the framing of the technology. Technology can be good or bad, it’s what purpose the developing technology serves that makes the difference. If you are developing technology to increase yield per hectare, regardless of levels of input, or even without radical changes in input of non-renewable resources, then the technology is not going to be helpful. That’s not the fault of it, but the framing of the research. That is what we have at the moment by and large, certainly in the UK, but in much of the rest of the world too. We have a framing of research into agriculture that assumes the key question we need to answer is how we increase yield output per hectare in tonnes. In fact, what we need to do is improve yield in tonnes per hectare per tonne of non-renewable input. The yield measurement should not be simply tonnes of output, but tonnes of human edible food per hectare.

Tech that encourages us to produce small crops for biofuels, or more crops for biology, are not helping to feed the world. In fact, by taking land out of food production, they are making it more difficult to feed the world, however wonderful the yield per hectare in tonnes may sound. The high yield, which relies on continuing high levels of manufactured nitrogen, is simply cooking the planet by increasing greenhouse gas emissions.