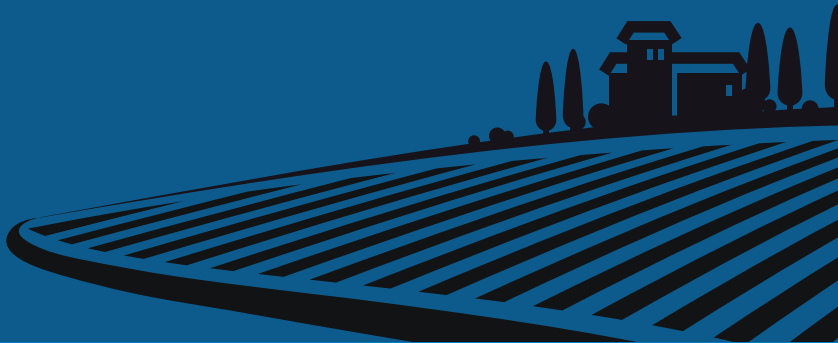


EXECUTIVE ROUNDTABLE: THE FUTURE OF AGRICULTURE

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SUMMARY PAPER

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By 2050, there will be 9.7bn people on the planet, bringing increased demand on the world's resources. When you consider that already one person in eight does not have enough food, the burden of 2bn extra people could be devastating if action is not taken. What the agricultural sector does now is vital if we are to prevent food insecurity, but it is already under a number of pressures such as reducing its environmental impact.

New technology, the likes of big data and innovative farming practices promise possible solutions but there are challenges. When farmers are under financial constraints and absorbed in their daily operations, adopting new technology is not a priority. Meanwhile, politics are at play. Whose ultimate responsibility is it to feed the extra mouths: should countries be encouraged to be more self-sufficient or is it the collective responsibility of everyone to work together?

The Economist's roundtable discussion brought together a wide range of stakeholders to look at the path ahead. We would like to thank all participants for their valuable contributions.

Making Farms Smarter



New technology and precision farming are revolutionising the agricultural sector, with high-tech systems and machines helping farmers to better utilise their land and reduce their environmental footprint.

Carlo Lambro, brand president at New Holland, talked of the work the company has done in making greener farm machinery. More high-tech equipment not only reduces emissions but also brings big productivity gains for the farmer. He pointed out that today you can run a New Holland tractor for over 180 days and produce the same amount of emissions as a machine of ten years

ago would have made in just one day. A combine harvester, meanwhile, is now over 15% more productive than a machine a decade ago. More eco-friendly wine can also be produced: its grape harvesters, in combination with speciality tractors, can achieve a 10% reduction in the overall carbon footprint of each and every bottle of wine.

Tim Hamers, technical advisor at CEMA, looked at ways to make equipment as effective as possible. Rather than reducing the energy consumption of a machine, a more powerful piece of equipment may be more effective and reduce the need to repeat work.

The use of drones is helping farmers use their lands more precisely. Damien van Eeckhout, head of international development, Airinov, explained how the company uses drones to create a map that highlights the differences in a farmer's land so that they can tailor the likes of how much fertiliser is used in each area. In a three-year study, it found that its technique increased crop yields by 3 to 10%.

Other developments include the potential of genomics. Marie-Cécile Damave, agronomist, head of innovation and markets, Saf Agr'iDées, noted that precision agriculture is not just about crops but also animal production and increased knowledge of genomics is allowing for more precise breeding.

Like many other sectors, big data is making its presence known in agriculture.

The new high-tech machines and systems can collect vast amounts of information. This data at a basic level allows for better and more automated farm management but has much wider applications.

Antonio Marzia, head of data analytics and services, CNH Industrial, talked of how

a harvesting machine, for instance, can collect data on its environment while carrying out its usual tasks. Information such as yield and soil conditions can be automatically collected while harvesting, and then used by the farmer to create their own eco-system of suppliers and partners. This can be taken further so that an automated machine could be provided with a layer of data-driven artificial intelligence enabling it to make basic decisions.

A number of different business models can be created around the collection of data. The information could be used by third parties for the likes of certification, agronomists for better utilisation of resources, or used by insurers to build more customised packages for a customer. Delegates debated who owns the information: Mr Marzia said that it is the customer who owns it; the business is just acting as a bank of that information.



The Take-up Challenge

While all these developments allow for more effective farming, they are often the preserve of big operations. Will they translate to smaller farms and countries in the developing world with limited resources?

Ms Damave said that the technology is not necessarily expensive. Something as simple as a mobile phone helps enhance communication for a farmer. Other participants put forward

that a basic soil probe is inexpensive but effective.

Chair Geoffrey Carr, science editor at *The Economist*, noted that farmers are understandably conservative: if they lose a crop they lose their income for a year. They will only adopt technologies that are safe and will deliver. It can be a challenge to get widespread adoption. Gilles Cavalli, co-founder of Agrifind, says its approach is to encourage farmers to

advise other farmers. Peer-to-peer connections are crucial.

Mr Hamers added that changes in policy could help stimulate demand. Farmers are almost forced to put land aside as part of greening measures but if they would be allowed to show they are hitting environmental targets through technology instead then it would be a way forward.



Sean Lennon, head of tractors product line, NHAG, talked of the company's efforts to create an energy-independent farm where farmers can generate their own energy by using for example biomass derived from agricultural waste, manure and crop residues, thus creating a virtuous cycle. Bio-methane powered farm machinery could have a big impact on reducing a farm's environmental footprint. However, it is key to provide an incentive for the farmer, by demonstrating how such equipment is beneficial, both in terms of total cost and results.

Participants discussed the contribution of tech start-ups

in helping to create smart agriculture. The sector is now appealing to entrepreneurs given there are lower barriers to entry as many of the developments are software-led. One delegate argued that many start-ups are taken aback when farmers don't want to use their latest innovation. The better approach would be to ask the farmer what their problems are and then to offer solutions rather than providing a product that is not asked for.

Delegates looked at how technological innovation in agriculture could be financed. There is some appetite for venture capital, albeit in a limited way. It was added that being client-centric is crucial.

Help the farmer to make more money and the rest will come. If you have customers buying your solutions, you don't need investors, it was argued.

One of the biggest potential stumbling blocks is interoperability. For all the cleverness of the new solutions, they need to be able to work together. For the farmer, it has to be seamless as well as easy to fix when things go wrong. Interoperability and open-source solutions are vital.

Emmanuel Ladent, group head of the agricultural product line at Michelin, added that smart agriculture is not just about high technology. Education on best practice is a big part of the equation, and this can translate world-wide at little cost. Better soil protection, for example, could pay dividends. He added that there are huge productivity discrepancies between areas that look after the land and those that don't. Bad practices such as the compaction of soil can cause problems: damaged soil can take as long as 15 years to bring back to normal productivity. A study showed that by using a low compaction technology such as low-pressure tyres, yield could be improved by 4%. If this was applied to the world, it would be the equivalent of all US production, he said.

Food vs Fuel

Delegates looked at the relationship between the agricultural sector and energy, given it is both a major consumer and a provider, offering land for renewables and a source of feedstock for biomass energy generation.

Marie Donnelly, director for renewables, research and innovation, energy efficiency, at the European Commission, talked of how diversification into energy production has great potential with the farming community becoming the epicentre of local and sustainable energy. This energy is not just biofuels for transport, although that is a major focus, but also in heating and cooling. Biomass is the only source of energy that reaches the sorts of temperatures that the steel industry requires, for example. This could be a win-win situation for the economy and for the agricultural sector.

But the idea of agriculture becoming a centre for fuel does not sit well with some, particularly consumers and NGOs who see it as taking food from the mouths of children to put fuel in the tank of a car. The sector has not done well on the messaging.

Several delegates said that there is no need for fuel and food to be in

competition, and the two things can work hand-in-hand. Bruce Dale, university distinguished professor, chemical engineering and materials science, Michigan State University, gave the example of a farming initiative in Italy called 'biogas done right'. The farmers grow their regular food crop, then grow a sequential crop on the land that would otherwise be left fallow. This harvest then goes into biogas digesters, which produce biogas or biomethane. The nutrient-rich residue from the digesters is then spread on the fields. The soil as a result is becoming more fertile and better able to hold rainfall and nitrogen. The next step is to use the biofuels to power the tractors, which would make a circular farm economy. This sort of model needs to be applied world-wide, he argued. Agriculture as it is depends on fossil energy and fossil mineral nutrients and we have to fix that. We must make agriculture sustainable, he said.

Ms Damave also agreed that food and fuel crops can be complementary rather than in competition and this can be achieved by using all parts of the crop: one part for the food sector, another in feed, the rest in fuel.

"Today you can run a New Holland tractor for over 180 days and produce the same amount of emissions as a machine of ten years ago would have in just one day. This is thanks to the improved engine technology developed by FPT Industrial, the powertrain manufacturer of CNH Industrial."



Susanna Pflüger, general director of the European Biogas Association, added that there is too much emphasis on the debate of food versus fuel when most of the feedstock for biogas production in Europe is not currently coming from crops; indeed there is a wide variety of feedstocks. But more could be made of other sources such as manure.

Giovanni Perrella, senior energy advisor at the energy department, Italian Ministry of Economic Development, talked of the country's mandate that fuel suppliers

will need to mix diesel or petrol with advanced biofuels, with biomethane a key part of the strategy. The agricultural sector has a big role to play in the decarbonisation of the economy, and this approach provides a source of income for local farmers.

But there are challenges in this vision of farming being at the heart of energy production. Geoffrey Carr argued that it might prove hard to produce the vast amounts of hydrocarbon fuels needed from agriculture at a price that is competitive to digging them out of the ground.

Feed the World

The discussion moved on to the politics of feeding the world given the pressures of increased demand. Should countries be encouraged to be self-sufficient or continue with the approach that some places are better able to produce food than others and should trade with the rest of the world?

There are initiatives that are helping farmers in emerging

markets, such as supporting them in areas like water management. It is important to encourage others to become self-sufficient and to spread best practice, it was said.

There is also a practical problem to be solved if we continue along the path of relying on some parts of the world to feed the others: the cold chain is not there

to deliver food to where it is needed in a timely way. It was noted that this results in almost 50% of the food produced being wasted. Finding a fossil-free cold-chain mechanism that will also allow small-scale cold distribution should be a priority.

Cooperation is Crucial



While there was much debate about the way forward, one key theme stood out across many of the topics that were discussed, and that is if we are to solve a potential food crisis, we will need a multi-stakeholder approach.

The private sector must play its part – and Carlo Lambro pointed to examples of how his company is working with the likes of the Italian government and the European Commission to drive things forward. A coordinated effort is key. He added that one company is but a drop in the ocean, and the reality is everyone

needs to work together.

It is also vital that in all the new technology developments, the farmer is at the heart of it, and a big push towards universal standards is needed to make the smart farm a reality and one that can be translated world-wide.

“I would like to highlight that CNH Industrial is at the forefront of the use of renewable fuels. We have experience of over 25 years in compressed natural gas and more than 30,000 CNG engines have been sold so far. They are equipping Iveco trucks, vans and buses, the widest range on the market, and are ensuring lower pollutants than a conventional diesel vehicle. Iveco, the commercial vehicle brand, has also electric vans and hybrid buses in its product offering. All these vehicles are providing a solution to many of the issues we face today: local air quality (since NOx and PM emissions are extra-low), global warming and noise pollution.”

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