

DIGITISING AGRICULTURE

Unlocking the potential in the agricultural value chain

Digital has changed business forever – and the agricultural sector is no exception. The digitisation of applications, processes and technologies is giving the sector the opportunity to become more insight-driven, efficient and productive.

Some of the biggest players in the agricultural market are investing millions into digital.

Monsanto, the world's largest hybrid-seed producer, has spent around \$1 billion in recent years acquiring companies with promising new technologies. In 2013, for instance, it acquired data analytics firm Climate Corporation – a company that uses remote sensing to map around 29 million fields in the US and combines this with climate information. By 2010 alone, its database contained 150 billion soil observations and 10 trillion weather-simulation points. This enabled Monsanto to produce a map of the US which shows which seeds grow best in which field – and under what conditions.^{1, 2}

The company is confident this bold move will pay off. Farmers who have tried out Monsanto's system have already reported increased yields of around 5% over two years and the organisation claims there is \$20 billion of 'untapped yield opportunity'.³

Our research, which surveys 30 senior executives from various industries across the agricultural sector, reveals respondents predict the digital agriculture market to triple from \$5 billion to \$15 billion by 2021. Clearly, there is considerable untapped potential but many companies in the agro-science, machines & equipment and technology industries are struggling to position themselves.

Through our research we have identified four key questions executives need to answer to take advantage of these rapidly emerging opportunities:

- Market: where in the market will digitising agriculture create the most value?
- Data: what data solutions will be the most useful in digitising agriculture?
- Business model: what business model and capabilities are required for market entry?
- Go-to-market: what are the drivers, opportunities and challenges in bringing digital agriculture to market?

In the following pages, we tackle the answers to these pressing questions.

1. 'Digital disruption on the farm', economist.com, 24 May 2014, www.economist.com/news/business/21602757-managers-most-traditional-industries-distrust-promising-new-technology-digital

2. 'Monsanto Buys Climate Corp For \$930 Million', forbes.com, 2 October 2013, www.forbes.com/sites/bruceupbin/2013/10/02/monsanto-buys-climate-corp-for-930-million/

3. 'Monsanto to acquire The Climate Corporation', <http://news.monsanto.com/press-release/corporate/monsanto-acquire-climate-corporation-combination-provide-farmers-broad-suite>

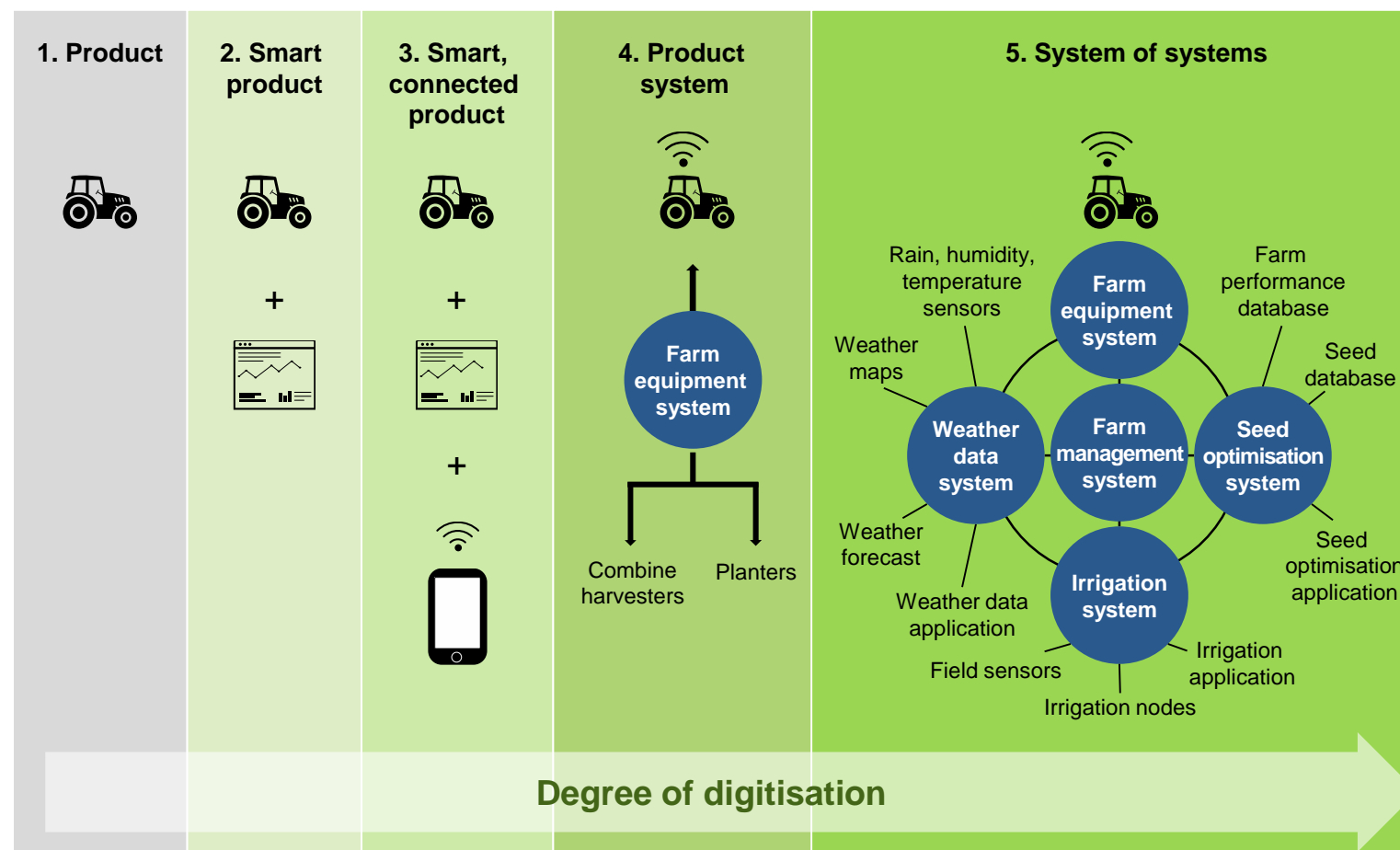
Our definition of digital agriculture encompasses three areas:

Data intelligence – equipping single machines with real-time data on weather, soil and air quality, and crop maturity, for example, to create an automated farming process.

Analysis – examining data gathered by satellites, weather stations and agricultural machinery.

Communication – using digital devices to provide best practice information (tutorials), environmental updates (weather), market and product information, and to enable knowledge sharing and collaboration.

The development of digitisation – from products to systems¹



1. Based on Harvard Business Review, 11/2014: 'How Smart, Connected Products Are Transforming Competition'



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Agriculture technology has experienced rapid innovation and is continually advancing beyond the machine.¹

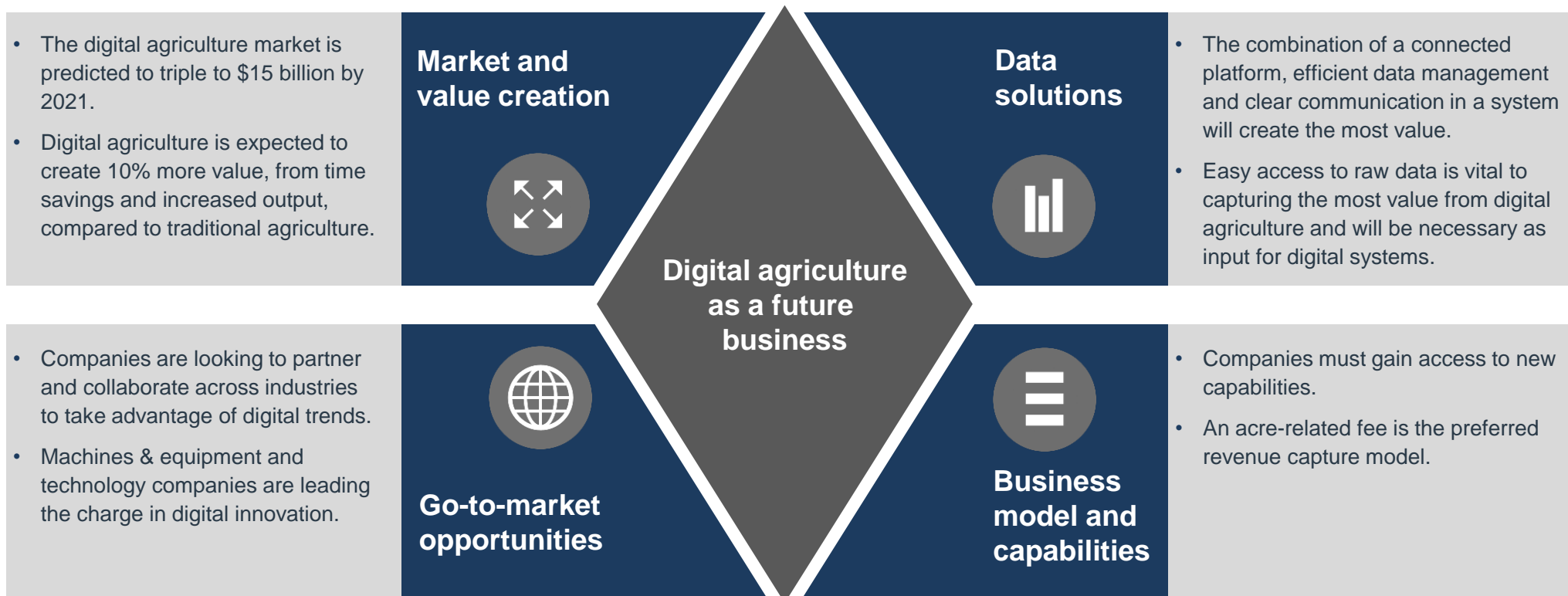
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Matt Rushing, Vice President Product Line, Advanced Technology Solutions (ATS), AGCO

1. 'AGCO and Mutual Mobile lead next generation of connected agriculture',
<http://www.mutualmobile.com/press-releases/agco-mutual-mobile-lead-next-generation-connected-agriculture>

Key findings

The results of our research address four areas critical for digital agriculture as a future business:



1

ABOUT OUR RESEARCH

About our respondents

Digital farming is an increasingly global issue, offering the chance to push up yields by roughly 5% over two years – a feat no other single intervention could match, according to some farmers.¹

To understand how the digitisation of agriculture is affecting organisations, we surveyed 30 executives from across the entire digital farming spectrum:

- By sector: agro-science makes up nearly 50% of participants, followed by machines & equipment (20%) and technology (15%)
- By size: around two-thirds of participating companies have a revenue of more than \$5 billion
- By geography: the companies have a strong European business focus, followed by the Americas – with Asia and Africa being less represented.

Figure 1: Participants by sector

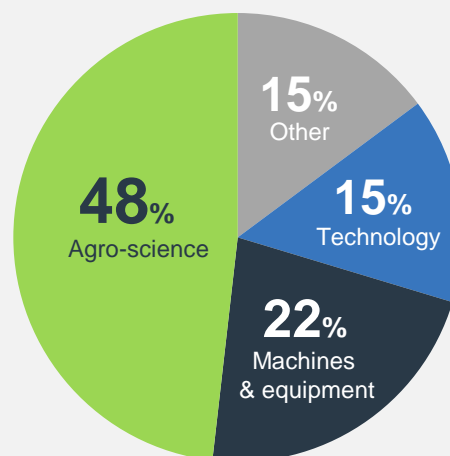


Figure 2: Annual revenue in US dollars

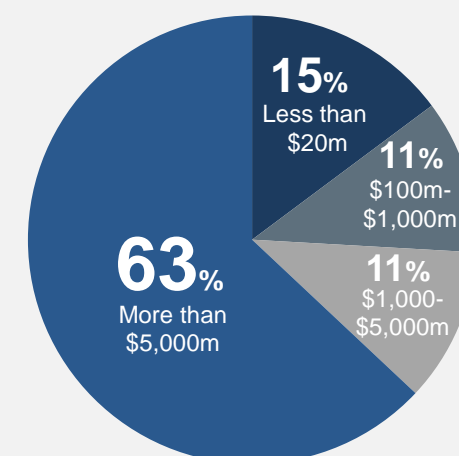
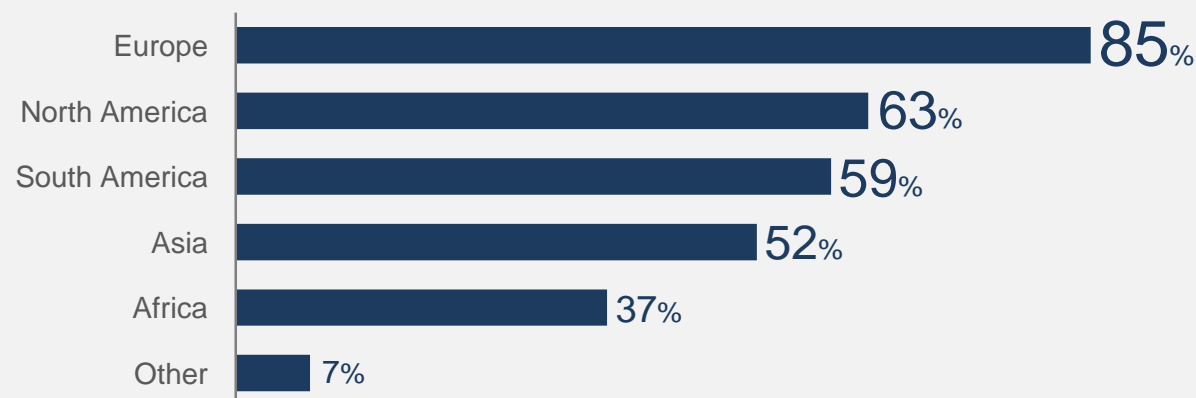


Figure 3: Participants by main geography for business



1. 'Digital disruption on the farm', economist.com, 24 May 2014, www.economist.com/news/business/21602757-managers-most-traditional-industries-distrust-promising-new-technology-digital

2

MARKET: WHERE WILL DIGITISING
AGRICULTURE CREATE THE MOST
VALUE?



Digital agriculture will grow by 20% per year to \$15 billion by 2021

Contrary to predictions that growth in the digital agriculture market will reach \$3.7 billion by 2018¹, the senior executives we surveyed expect the market to be worth \$9 billion by 2018 and \$15 billion by 2021 – representing a compound annual growth rate of around 20%. This growth includes the value of software, algorithms, platforms and links between farming and technology hardware.

Technology companies envisage faster market growth, with estimates of a market worth over \$10 billion in 2015. In strong contrast, agro-science companies predict growth to reach just \$6 billion by 2018. These big differences in anticipated growth indicate that the situation remains unclear, with the true figure likely to lie somewhere near the average.

The highest market potential is seen in North America (33% of total global potential), followed by Europe (24%) and South America (19%). This emphasises the immediate potential of digitising agriculture for large-field crops by acre. There is less potential in regions such as Africa and Asia due to less advanced farming conditions, scattered farming and connectivity issues.

Figure 4: Anticipated global market size for digital agriculture

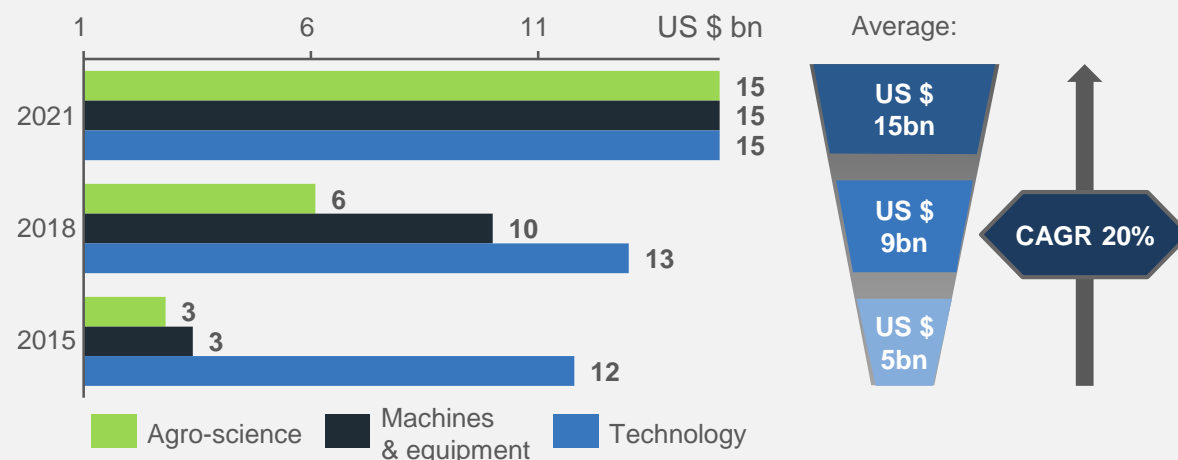
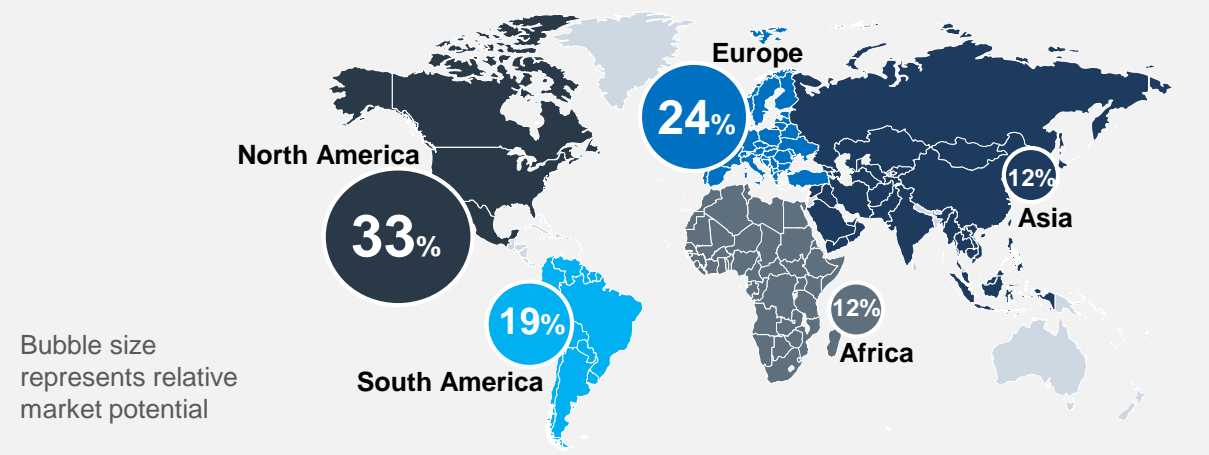


Figure 5: The future market potential of digital agriculture by region



1. 'DuPont's Encirca farm services to bolster agricultural revenues', forbes.com, 11 March 2014, www.forbes.com/sites/greatspeculations/2014/03/11/duponts-encirca-farm-services-to-bolster-agricultural-revenues



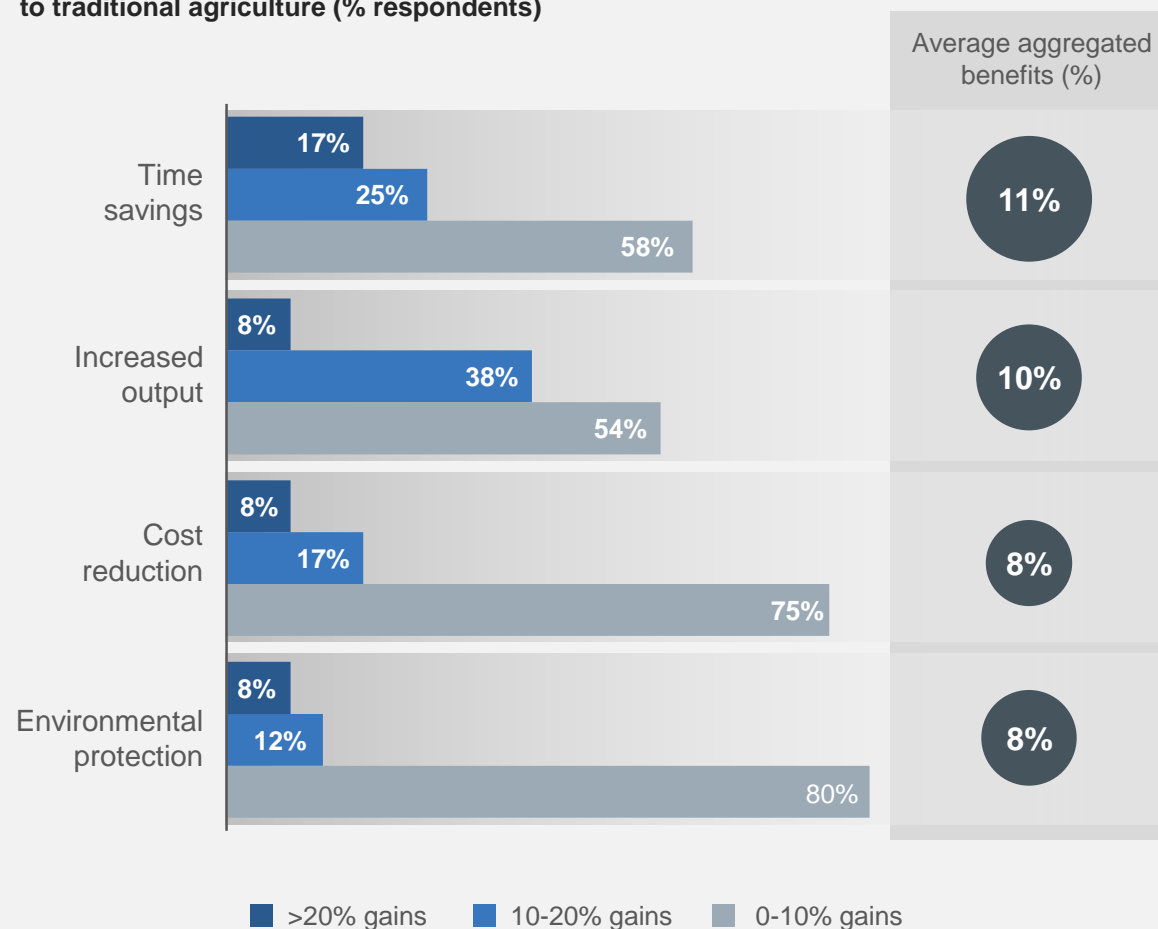
Digital agriculture will produce time savings of over 10% compared to traditional techniques

Senior executives expect to see the greatest gains in digitisation to come in the form of time savings and increased output: 42% predict time savings of more than 10% and 46% foresee an increase in output of more than 10%. Less significant, but still worthwhile, benefits are felt in cost reduction (25% predict more than or equal to 10%) and in reducing environmental impacts (20% predict more than or equal to 10%).

Even though these figures indicate quite a remarkable change for agriculture, we believe they are realistic, particularly in light of our research results.

To realise these opportunities and turn expectation into revenue, the correct business model needs to be applied. You can read more about this in section four.

Figure 6: The benefits of digital agriculture compared to traditional agriculture (% respondents)



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Our technology provides farmers with superior power. The trick lies in personalising the specific product for the particular field.¹

”

Tobias Menne, Project leader Digital Farming, Bayer CropScience

1. 'Landwirtschaft 4.0: Mit Satellit zum Ernteerfolg', Die Presse, 15 October 2015, http://diepresse.com/home/wirtschaft/international/4843770/Landwirtschaft-40_Mit-Satellit-zum-Ernteerfolg



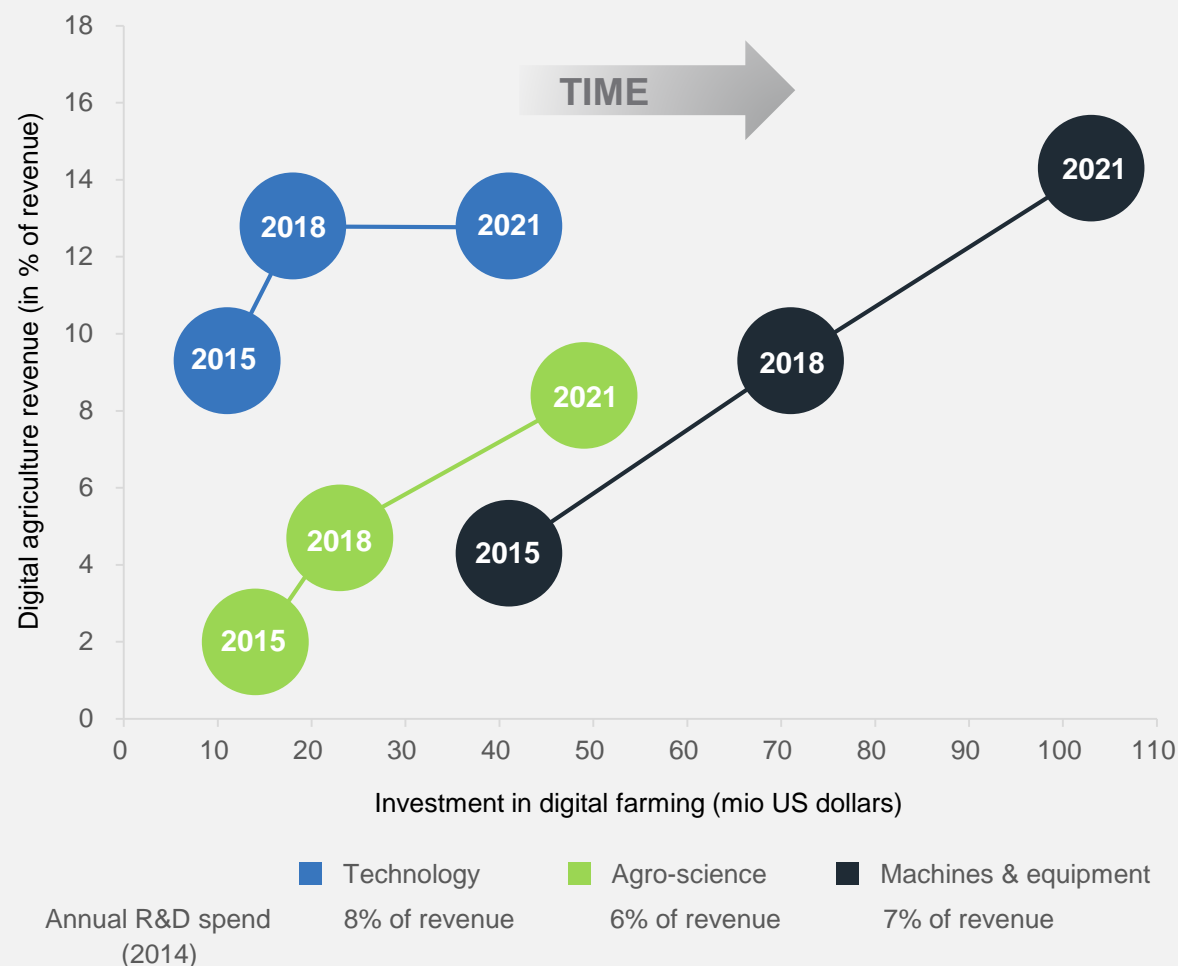
Technology and machines & equipment companies predict a strong surge in sales

Agro-science companies anticipate a relatively low return from digitisation of agriculture, and consequently expect to be making a research and development (R&D) investment of just 8% of total revenue in 2021.

In contrast, technology as well as machines & equipment companies predict they will generate up to 14% of total revenue in 2021 from digital agriculture and invest accordingly. These figures underline different approaches to digital agriculture by different sectors.

Both machines & equipment and agro-science companies expect to see an increase in revenue following their increased investment. This will stem from their development of new products and services that will be launched into the market. Technology companies meanwhile expect to reach a steady revenue level between 2018 and 2021, with investment used to improve offerings already launched in the marketplace.

Figure 7: Average R&D investment for digital agriculture





“

I love that people think agriculture is a late adopter to technology. The truth is different; we're seeing bigger innovations than ever, and the agriculture industry is jumping in.¹

”

Steve Lucas, President Platform Solutions, SAP

1. 'Frankenstates: Winning the agriculture tech war', CNBC, 23 June 2014, <http://www.cnbc.com/2014/06/23/frankenstates-winning-the-agriculture-tech-war.html>



There is no common view on what element will create value

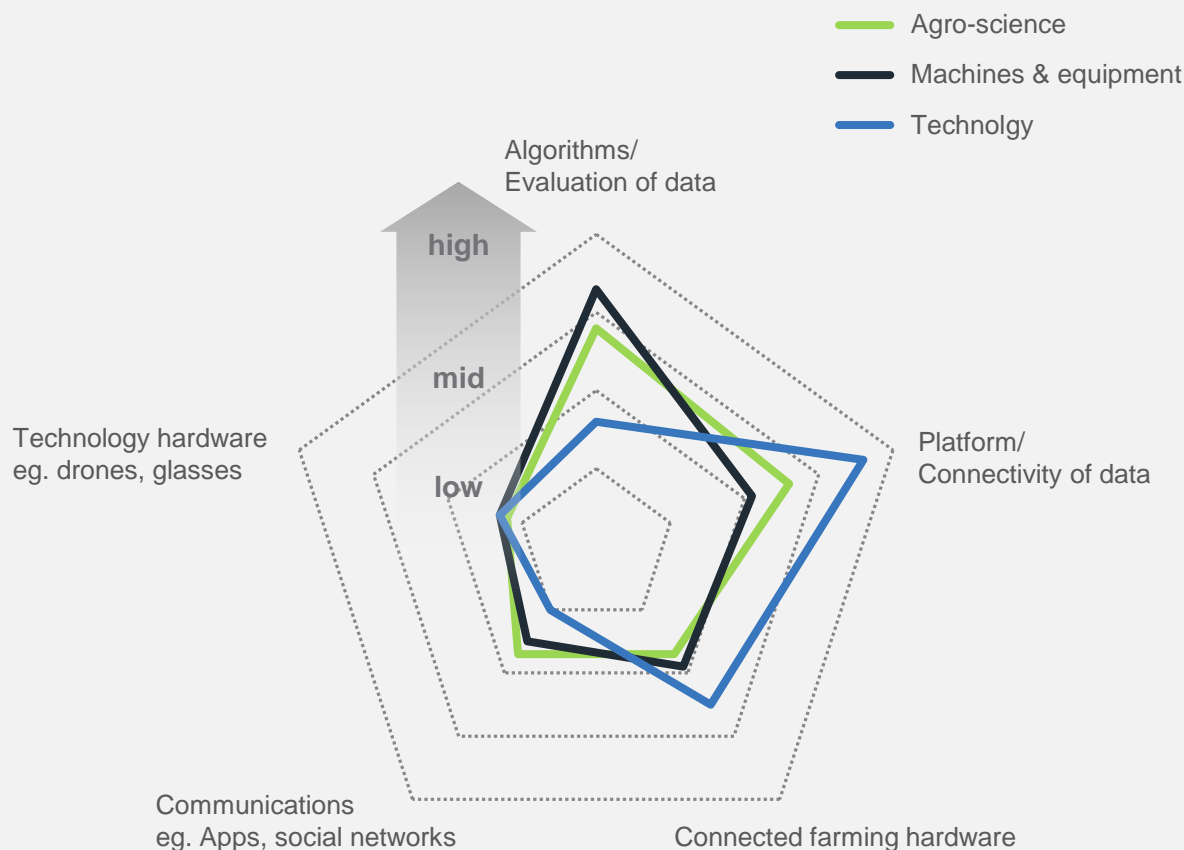
Five elements are essential for creating value from the digitisation of agriculture:

- Algorithms to calculate seed parameters
- Platforms that provide a common ground to link hardware, software, producers and consumers
- Smart farming hardware such as computer-driven seeding machines
- Communications including apps
- Technology hardware such as drones.

There are significant variations in what each sector views as relevant. Technology companies are betting that platforms will create the most value (eg. SAP offering cloud solutions for farming/machines & equipment companies). Meanwhile, machines & equipment and agro-science companies see algorithms and data evaluation as key. This highlights the importance of incorporating these factors into the business model and investing in the right capabilities.

Communications and technology hardware are a low priority for all sectors. This reflects the thousands of agriculture apps already available, from services such as drone control and image processing through to cloud storage, mapping and data analysis.¹

Figure 8: The importance of value-creating elements for digitising agriculture



1. Australian Farm Institute, 'Digital agriculture promises productivity growth, but depends on infrastructure', <http://www.farminstitute.org.au/ag-forum/digital>

3

DATA: WHAT DATA SOLUTIONS
WILL BE THE MOST USEFUL IN
DIGITAL AGRICULTURE?



The digital agriculture 'ecosystem' will drive developments in data solutions

Participants across sectors are focusing on the development of three solutions – platform, algorithms and communication. Together, these components make up an 'ecosystem' which builds the foundation for an effective future business model – vital in ensuring the success of digital agriculture. It is interesting that even machines & equipment organisations see these elements as more important than farming hardware which is the very core of their business.

We also found that when considering platforms, executives are prioritising the development of their own platform or using existing solutions. It will be interesting to see how this plays out in the market as it may lead to several solutions competing or one triumphant player dominating to ensure compatibility. The latter presents an opportunity for new and existing platform providers to set the standard and take the lead.

Figure 9: The focus of digital agriculture development activities

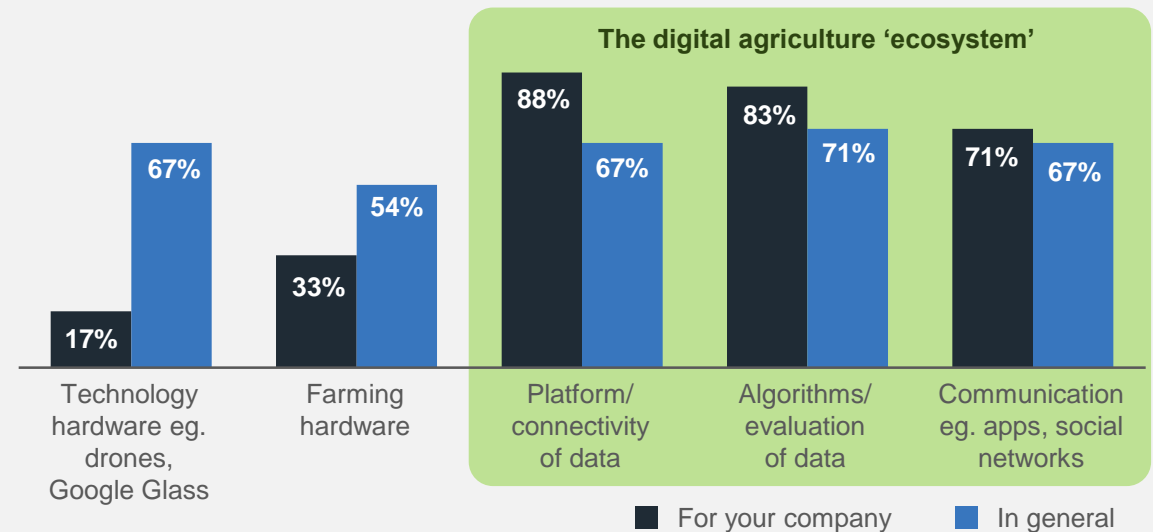
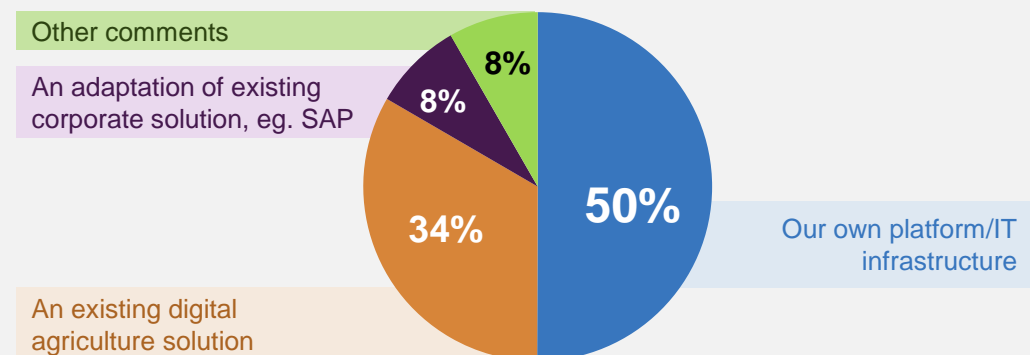


Figure 10: Platform development targets



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We might need a sort of SAP
or Microsoft for agriculture,
user-friendly and easy.¹

Martin Richenhagen, Chairman and CEO, AGCO

”

1. 'Die Angst der Bauern vor Google', Handelsblatt, 10 November 2015,
<http://www.handelsblatt.com/unternehmen/handel-konsumgueter/digitale-landwirtschaft-die-angst-der-bauern-vor-google/12567822.html>



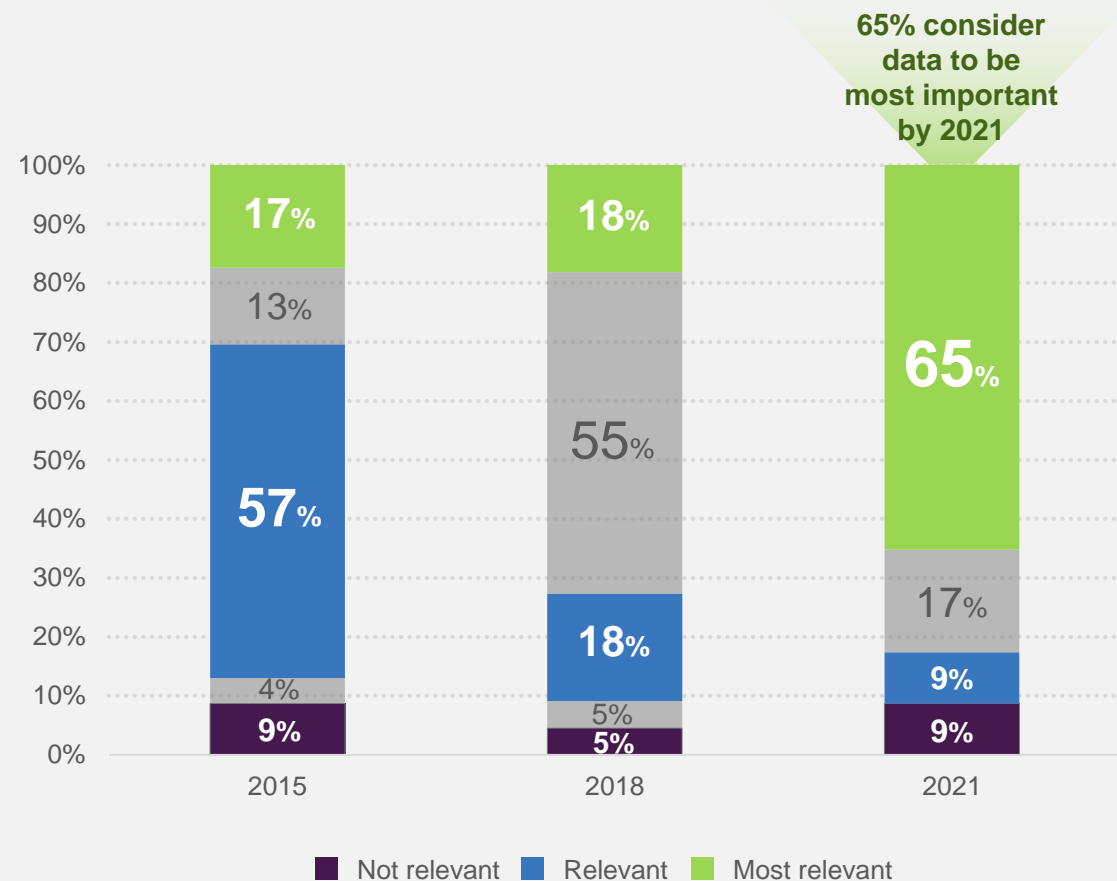
Data will play a key role in digital agriculture

One of the key elements for future digital-agriculture solutions is data. All systems, including those for farm equipment, weather data, seed optimisation and irrigation, will be dependent on the analysis of data. The quality of the input data will be critical to the output quality.

Currently, companies do not view data as a relevant factor in their business models – but this is set to change, with 65% of all companies expecting data to be very relevant to their business model in 2021. This indicates that without data these business models won't be viable in the future. Each time data is analysed, the predictions generated become more accurate and the underlying business model improves.

It is crucial that companies ensure secure access to data and process it intelligently. There are good examples already: Monsanto acquired Climate Corporation for its data science expertise; Bayer CropScience partners with manufacturer John Deere to integrate data access, wireless data transmission and delivery of recommended prescriptions to help farmers optimise return on investment.

Figure 11: The importance of data in organisations' business models





Specialised data and algorithms for analysis are essential

Data is available from a range of sources – some data can be easily and freely obtained from customers/farmers, while other data needs to be processed and modified in a logical way to be combined with other data and help create data intelligence.

Farmers are a vital source of historical and farmer-specific data which can make a key difference when interpreted in a smart way. As such, this data is a key driver of value in the business model. Most farmers provide such data for free, eg. planting data, sprayed products and statistics on yield/harvest. But in future, they could become aware of the huge potential value such data provides to companies. As a result, the industry needs to recognise farmers and their data as a key resource to which access must be secured.

Even though smart data (the logical connection of data sets and subsequent analysis of correlations) will be generated by industry, raw data from the fields still provides a key foundation. Linking with and securing data from farmers will become key.

Figure 12: Data classification

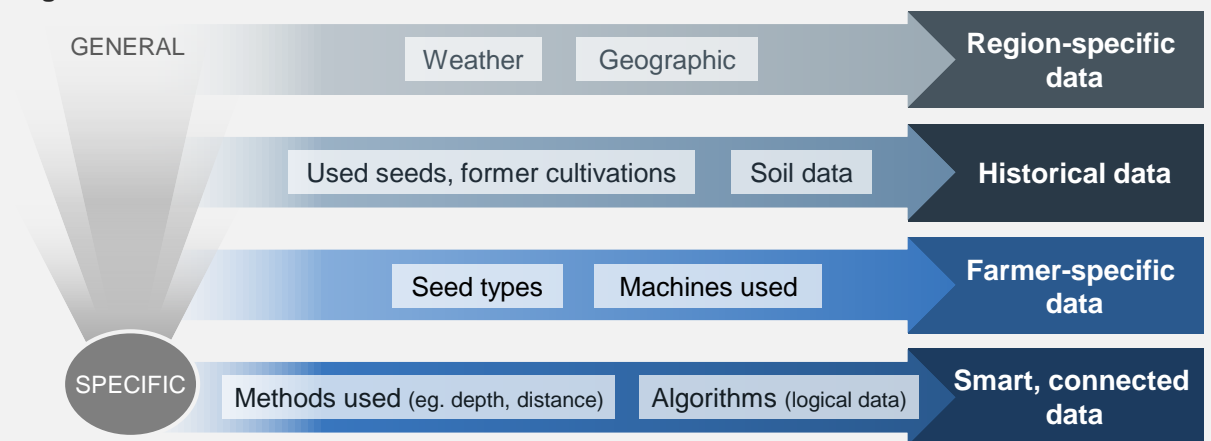
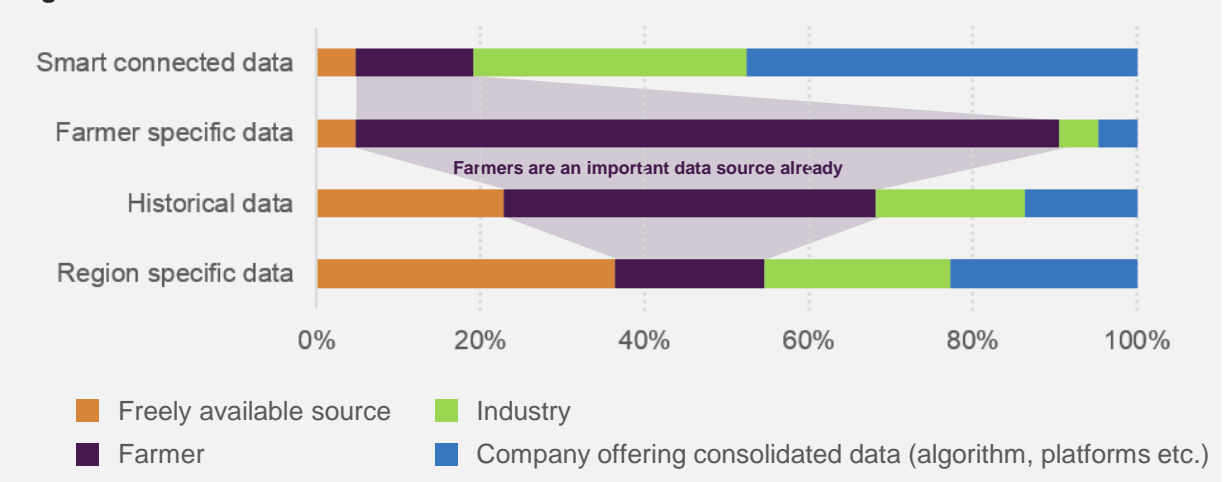


Figure 13: Current source of data





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Strategic use of information
is an important factor in
successful agriculture.¹

”

John May, president, agricultural solutions and chief information officer, John Deere

1. John Deere, https://www.deere.com/en_US/corporate/our_company/news_and_media/press_releases/2015/corporate/2015nov03-corporaterelease.page



Smart consolidation of data stands out as a critical topic for future value capture

While access to data appears to be an issue, the evaluation and analysis of data is even more important. These points need to be assured and put into practice before a successful business can start.

Investment in algorithms and specific capabilities to evaluate and consolidate data is a key asset to consider for the future. John Deere already focuses on this by teaming up with SAP.¹

Figure 14: Critical topics related to relevance of data for business model



1. SAP, <http://news.sap.com/sap-business-suite-powered-by-sap-hana-comes-just-in-time-for-john-deere-3/>

4

BUSINESS MODEL: WHAT
BUSINESS MODEL AND
CAPABILITIES ARE REQUIRED
FOR MARKET ENTRY?



Digital agriculture will create future business

Nearly 90% of all companies think digitising agriculture will create future business, with creating competitive advantage (80%), developing a unique selling proposition and new customers (each 60%) cited as the main benefits.

It is clear that digital agriculture is at the same time about defending market positions and maintaining reputation as well as attracting new customers. Digital agriculture can help companies to differentiate their offer with extra value added services at a time when their existing products are becoming interchangeable.

Our analysis reveals expectations for the top three benefits are rated lower in agro-science companies than in technology companies. This suggests agro-science organisations have not yet found the right way to turn digital agriculture into a competitive advantage or a unique selling proposition. However, some players are making progress: Monsanto, for example, through external investment, and Bayer which is developing a global digital farming organisation that provides satellite data analysed to guide use of herbicides, and which has the potential for future expansion.¹

Figure 15: The impact of digital agriculture on future business

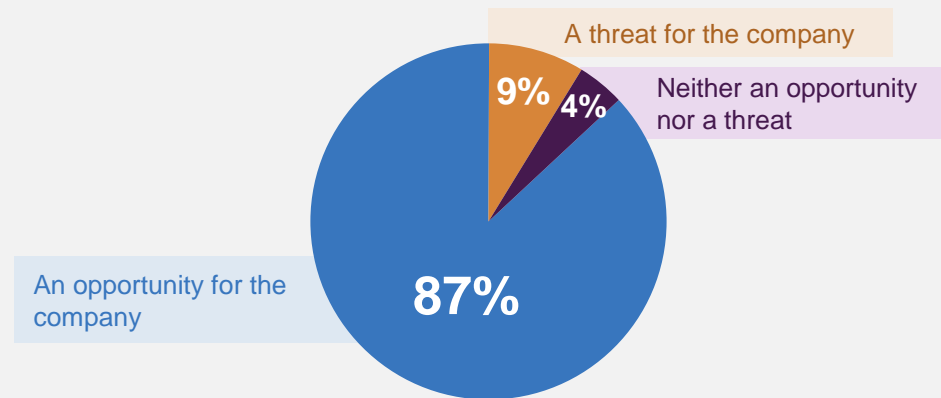
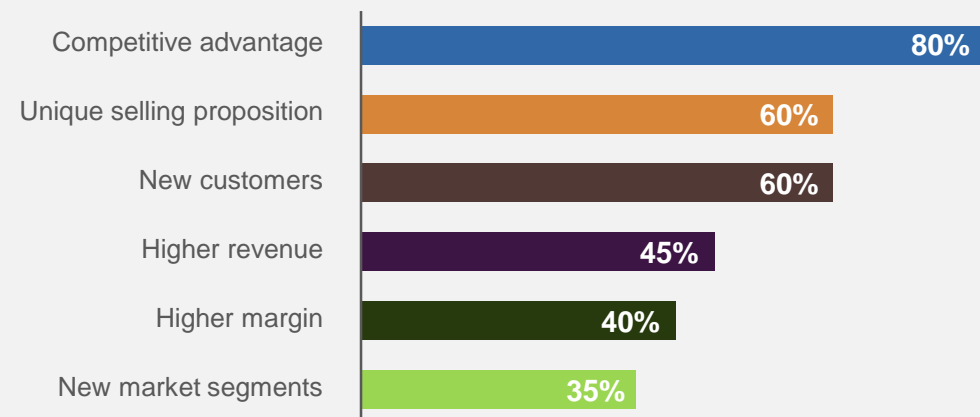


Figure 16: Predicted benefits from digital agriculture



1. 'Landwirtschaft 4.0: Mit Satellit zum Ernteerfolg', Die Presse, 15 October 2015, http://diepresse.com/home/wirtschaft/international/4843770/Landwirtschaft-40_Mit-Satellit-zum-Ernteerfolg

“

We enable precision agriculture information technology by converting field data into application input through patented meters and software innovation. On a global basis, the interest from agro industry solution providers is high, and we are opening our platform to all partners in the seed, equipment or prescription business.

”

Bob Trogele, COO, American Vanguard Corp.



An acre-related fee is the preferred revenue-capture model

The traditional and dominant \$/acre model is a clear favourite for digital agriculture. This is the model used by farmers in which the crop area is the unit of measure for cost/benefit calculations.

When looking across sectors, technology and machines & equipment companies appear to be more open to trialling new ways of capturing value that move beyond traditional farming models. However, if new models prevail, all industry players would need to agree on them.

The stage in the value chain at which the additional value from digital agriculture will be captured is shown in Figure 18. Farmers are expected to capture the highest share (25%), followed by machines & equipment companies (23%) and technology companies (23%). This drives home the importance of engaging with farmers. Without a business model that provides value to the farming community, companies will struggle to realise value from digital agriculture – because farmers are an essential player at the end of the value chain and would otherwise reject digitisation.

Figure 17: Preferred revenue-capture model for digital agriculture (multiple answers)

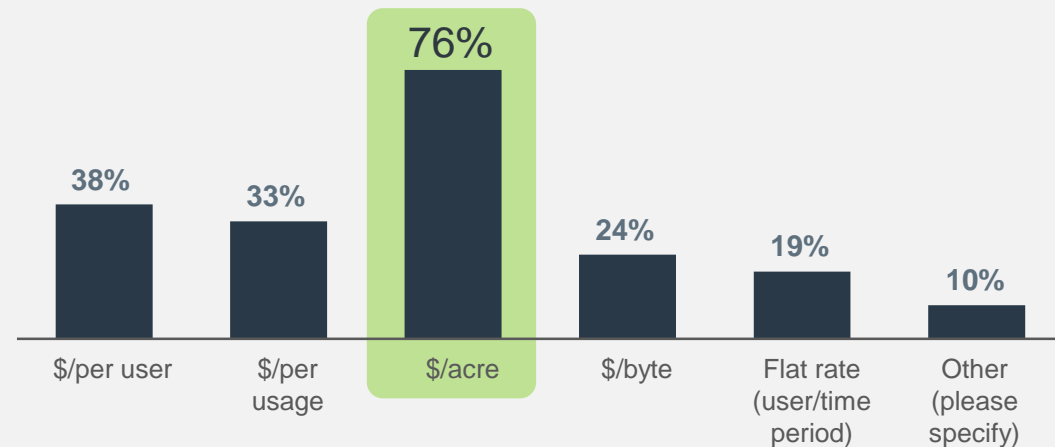
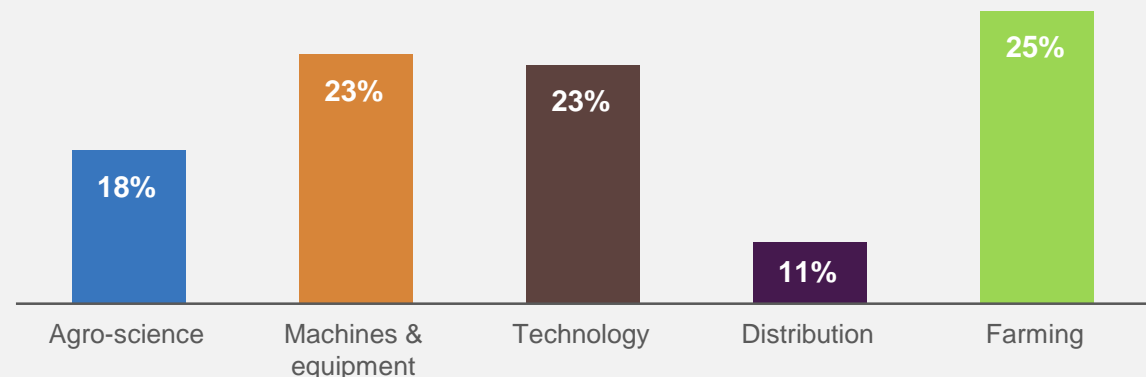


Figure 18: Value distribution along the agriculture value chain (total = 100%)





Less than one-third have a dedicated organisation for digitising agriculture

Despite 87% of respondents viewing digital agriculture as an opportunity for future business, just 28% of companies have established an organisation within their business devoted to it. Of those that do have a dedicated organisation, most are machines & equipment and technology companies.

Our view is that companies should establish their own organisation to develop innovative business models for digital agriculture more quickly and in a more focused manner.

There are several possible options for securing the necessary capabilities. Partnering models, ideal as a short-term solution, are the most popular approach (91%). Respondents told us they valued exclusive collaborations in particular. Only machines & equipment companies, such as John Deere, appear open to non-exclusive partnerships.

The second most preferred option, one with a mid-term horizon, is developing capabilities in-house. Acquiring capabilities and investing in ventures/start-ups is seen as least favourable. Nevertheless, this has been the choice of Monsanto with the acquisition of Climate Corporation.

Figure 19: Companies' current organisational setup for digital agriculture

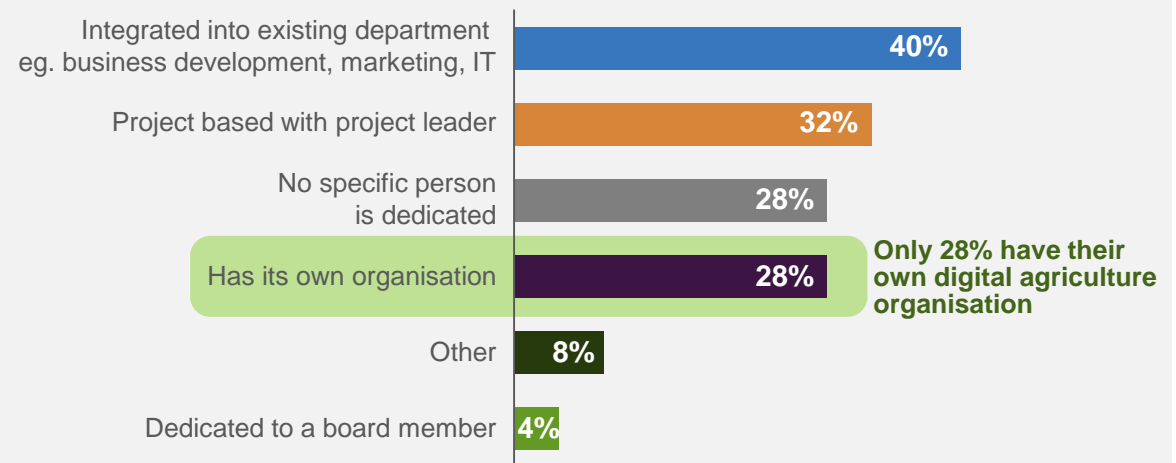
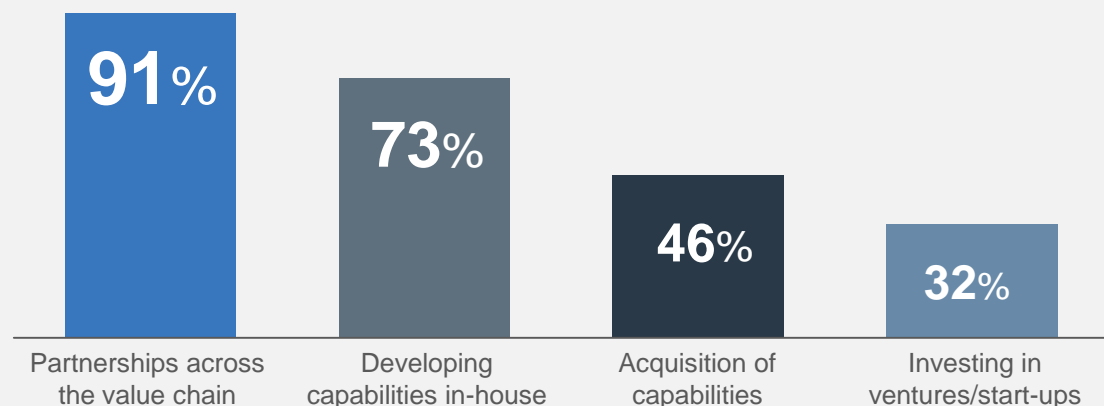


Figure 20: Strategies used to develop digital agriculture capabilities (multiple answers)



5

GO-TO-MARKET: WHAT ARE THE DRIVERS, OPPORTUNITIES AND CHALLENGES IN BRINGING DIGITAL AGRICULTURE TO MARKET?



Machines & equipment companies and technology companies are leading on innovation

Machines & equipment companies are viewed as driving innovation in digital agriculture. This may not come as a surprise as these companies participated in the development of GPS-assisted machines in the 1980s. John Deere was a leader in this development and helped farmers achieve higher productivity with less waste and more output at lower cost.

Nearly all companies are developing solutions in data evaluation, platforms and communications (the digital agriculture ecosystem referred to in section 3), while very few companies are working on technology hardware. This emphasises the importance of data, how to get access to it, and how to link all market participants on a common platform.

To realise these solutions, several approaches are seen as feasible, with a preference given to exclusive partnering arrangements with companies across the value chain (cited by 70%). A breakdown is given on the next page that shows how companies are planning to collaborate across sectors.

Figure 21: Companies driving innovation in digital agriculture

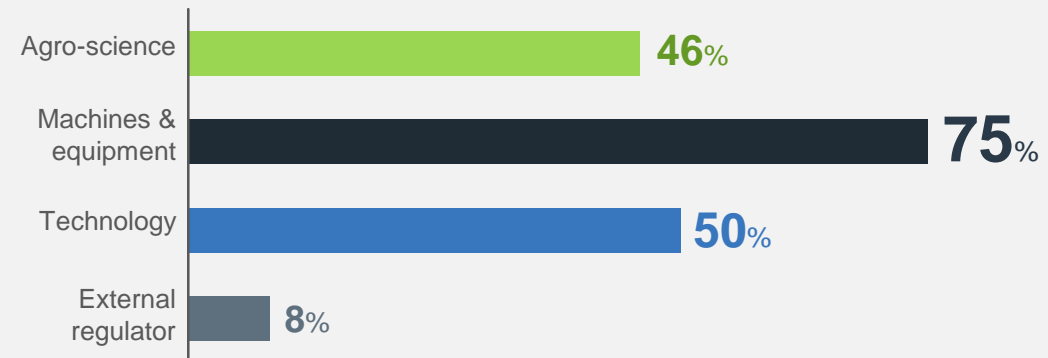
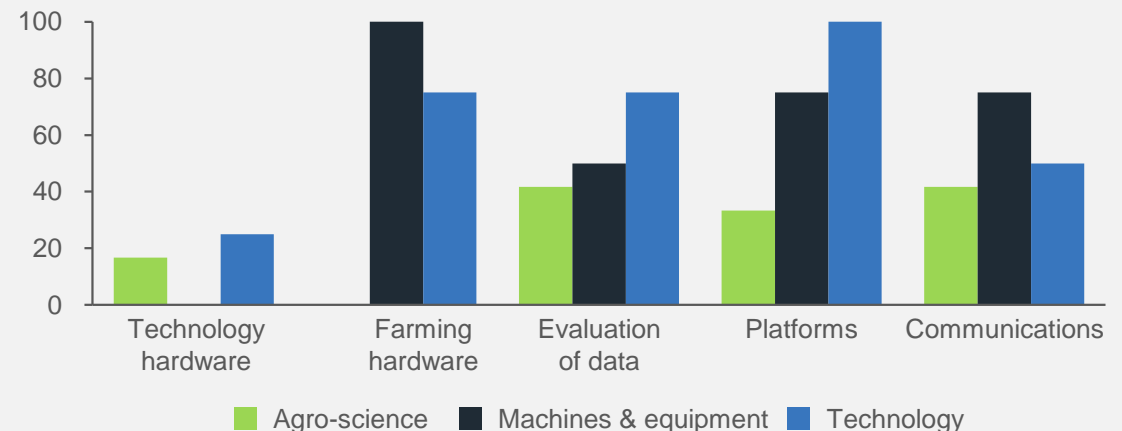


Figure 22: Companies' current development areas in digital agriculture (in %; multiple answers)





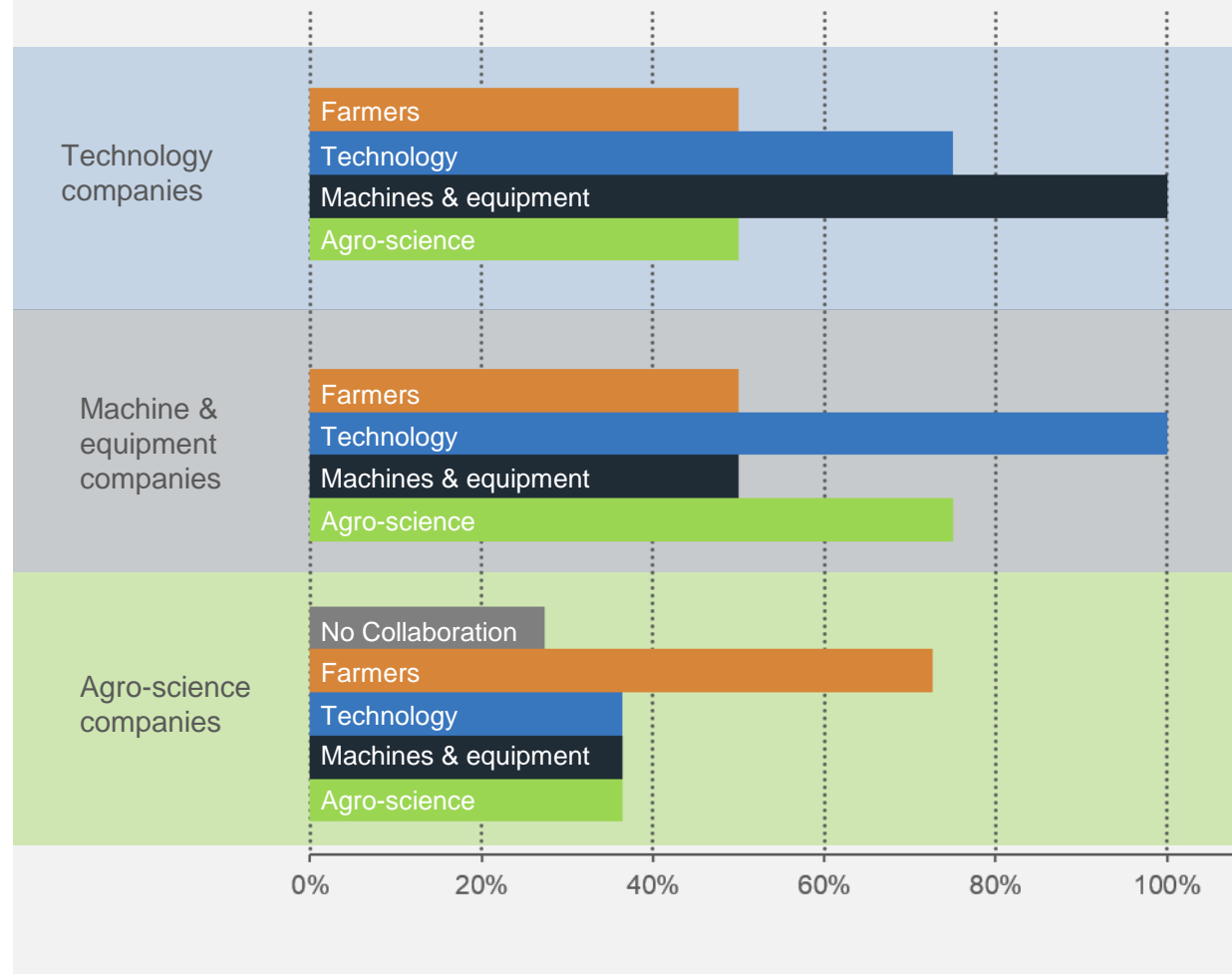
Companies plan to collaborate and invest in digital agriculture

Interestingly, all machines & equipment and technology companies taking part in our research plan to partner with each other. Machines & equipment companies also plan to collaborate with agro-science companies, but to a lesser extent.

Surprisingly, agro-science companies are the least likely to be planning cross-sector collaborations, although they are eager to collaborate with farmers. These organisations need to avoid falling behind as access to farmers alone will not be sufficient to secure future business. Bayer has already realised this and has entered into a collaboration for a satellite-driven approach.¹

Collaboration seems to be essential to enable new products to cover the entire value chain. An example of this is when seed producer DuPont Pioneer teamed up with farm-machinery maker John Deere to transmit advice on seeds and fertilisers to farmers in the field.

Figure 23: Targeted collaborations by participant groups (in %)



1. 'Landwirtschaft 4.0: Mit Satellit zum Ernteerfolg', Die Presse, 15 October 2015, http://diepresse.com/home/wirtschaft/international/4843770/Landwirtschaft-40_Mit-Satellit-zum-Ernteerfolg



Budget is the main barrier to investing in digital agriculture – but should it be?

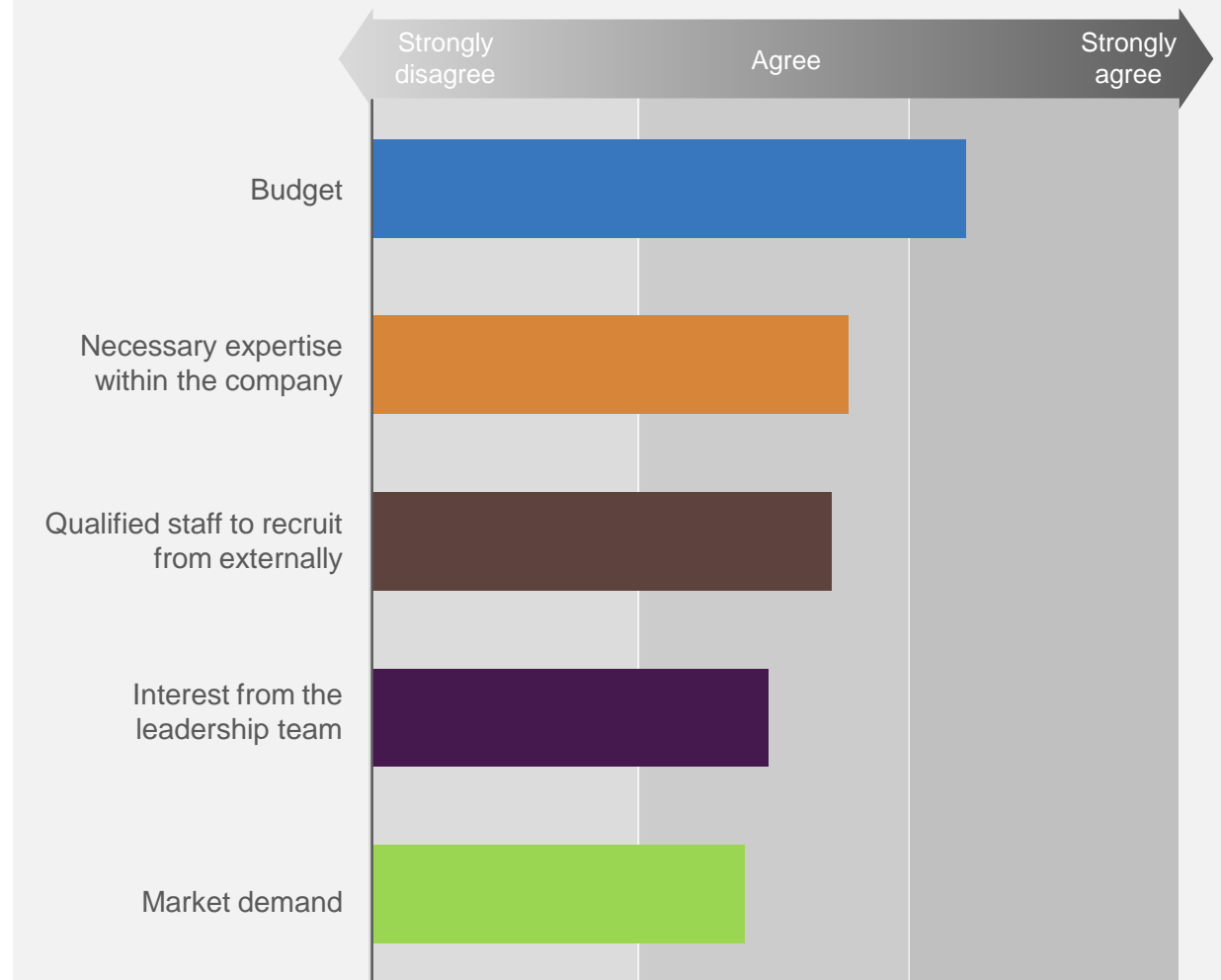
Across all sectors, budget is seen as the main hurdle to investing more in digital agriculture. However, this barrier should not be hard to address since we are talking about a future market segment with huge growth expectations. Monsanto seems to have made its decision and has put a huge bet on this expectation of future growth.

The next barrier is the need for expertise in digital agriculture. This is often not available internally and also difficult to acquire externally. Acquiring external expertise might be a quick fix, but it must go hand-in-hand with the long-term development of internal capabilities.

In general, companies need to take more risk when assessing future market potential and should reflect market potential in their management decisions.

Company internal factors, specifically interest from the leadership team and current market demand, are ranked as less significant barriers to investing in digital agriculture.

Figure 24: The barriers to investing in digital agriculture





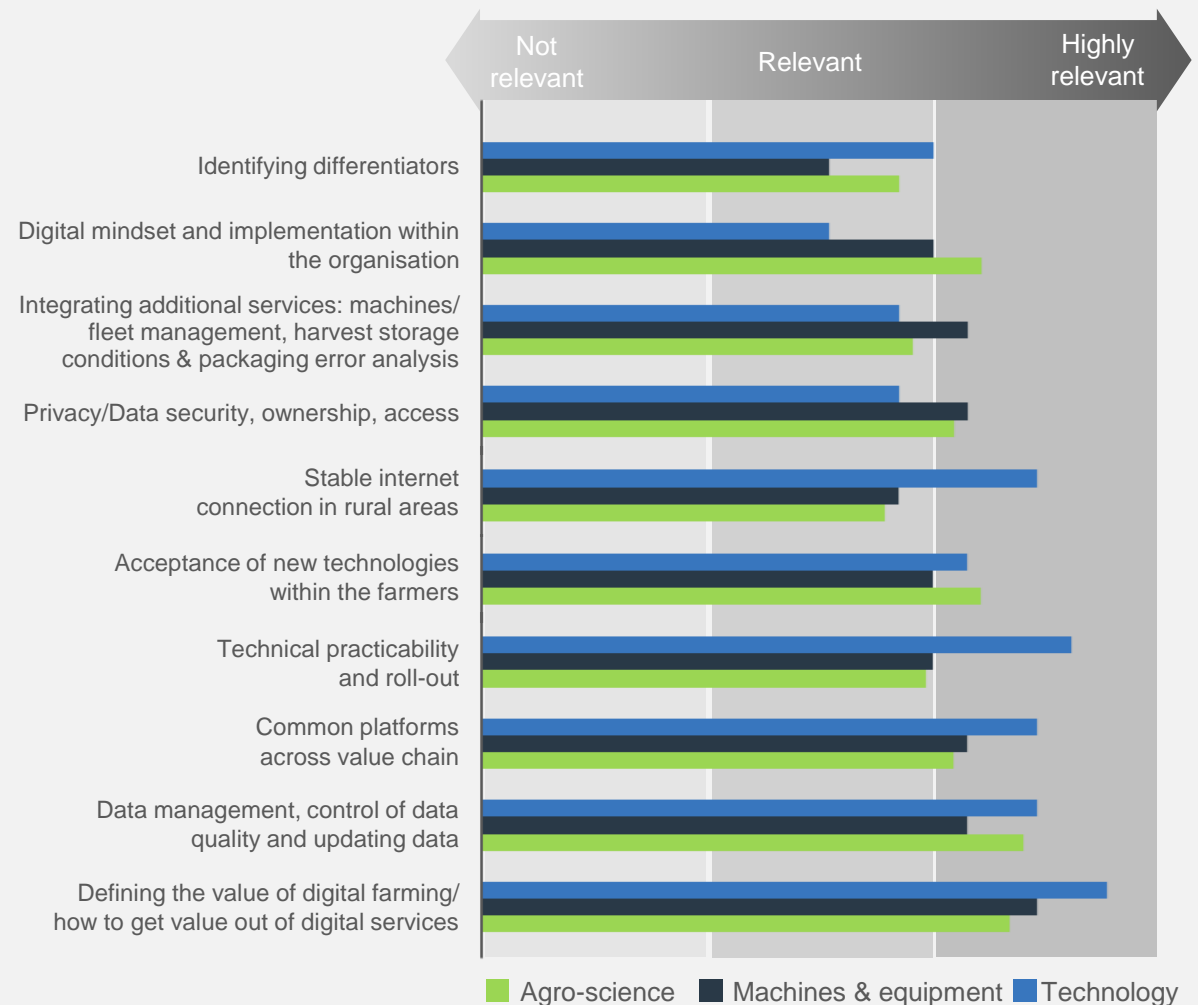
Capturing data is the biggest challenge companies need to overcome

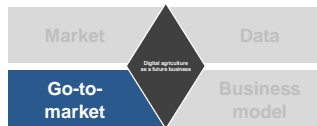
The key challenge identified by respondents when digitising agriculture is defining how to get value out of digital services (scores 77%), followed by managing data, controlling data quality and updating data (scores 75%).

Technology companies rate defining how to get value out of digital services, and technical practicability and market roll-out as more relevant than other types of company. This may be due to their experience with technology roll-outs – in other words, they know about the complexity and what can go wrong.

Machines & equipment producers see the integration of additional services as being a higher challenge than the average. They are likely to bring in their experience from previous integration efforts of different components, i.e. autonomous driving, where they already handle large amounts of data connected with hardware and software components, in different interfaces, and know about the pros and cons.

Figure 25: Challenges of digitising agriculture





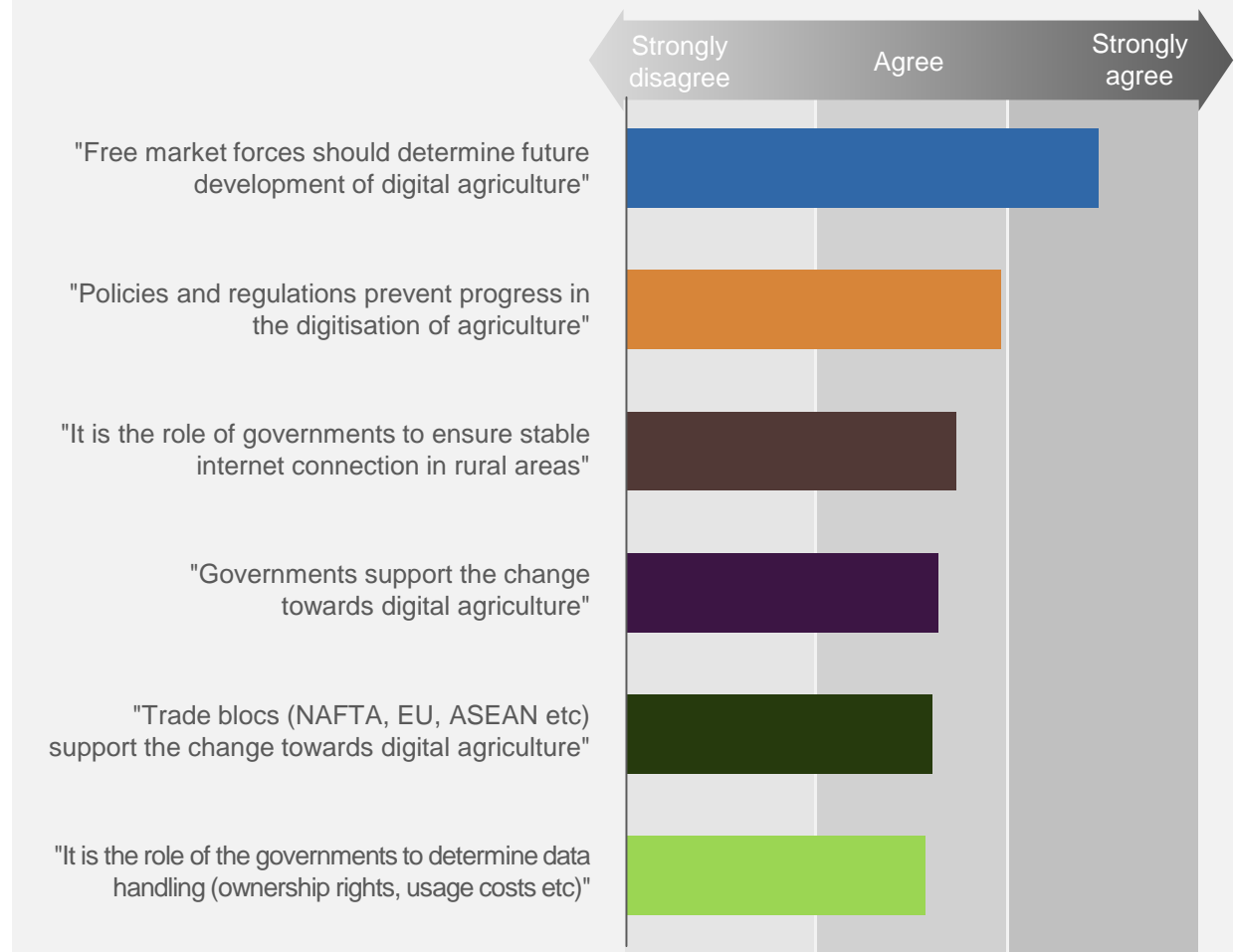
The future of digital agriculture should be market led

Participants are united in their agreement that the future of digital agriculture should be determined by free market forces (scores 77%).

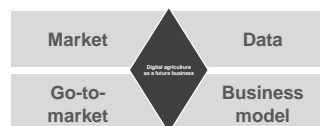
While governments are seen to support the digitisation of agriculture, through the provision of sufficient infrastructure for instance, there is a prevailing view that policies and regulations prevent progress in the digitisation of agriculture.

When it comes to regulation of the use of drones or ownership of information, respondents clearly feel the government could significantly hinder progress in digital agriculture. Regulations for aircrafts, for example, are a blocker for the commercial use of bigger drones and privacy laws strongly regulate the use of any picture material.¹

Figure 26: The external impacts on digital agriculture



1. 'Fliegende Geschäftsmodelle', Handelsblatt, 21 July 2015



We propose the following key recommendations to ensure a more successful market entry into digital agriculture.

Market:

Invest to participate in growing market

- **Investments are needed** to tap into the growth potential. The market for digital agriculture is growing by 20% per annum (four times the OECD average growth) – presenting huge opportunities.
- Consider a **bold move**, such as Monsanto's investment in Climate Corporation, which will set you apart from competitors in a way that incremental steps will not.

Data:

Secure access to data and 'enhance' it

- **Secure access to data**, especially from farmers; raw data is a key foundation.
- **Consider partnering with other companies** to develop a platform – but ensure you avoid limiting the market with an isolated solution.
- **Invest in capabilities** to evaluate and enhance data – smart data analytics is where value creation will take place.

Business model:

Build up the right capabilities to secure competitive advantage

- **Develop a business model that creates significant benefits for farmers** – farmers are an essential part at the end of the value chain.
- **Use the \$/acre model** – when you develop digital-agriculture capabilities, begin with models farmers are familiar with.
- **Develop required 'new' capabilities**: look for partnerships (short-term) and establish in-house capabilities (medium-term).
- **Create a dedicated organisation for digital agriculture** – secure independence from the existing organisation.

Go-to-market:

Think ahead – see the opportunities and overcome challenges

- **Collaborate** – agro-science companies need to increase their collaboration with other sectors and follow the lead of technology and machines & equipment firms.
- It is still an **entrepreneurial decision**: provide a dedicated budget – and invest in the future based on a clear business case and implementation plan.



We Make the Difference

An employee-owned firm of over 2,500 people, we operate globally from offices across the Americas, Europe, the Nordics, the Gulf and Asia Pacific.

We are experts in energy, financial services, life sciences and healthcare, manufacturing, government and public services, defence and security, telecommunications, transport and logistics.

Our deep industry knowledge together with skills in management consulting, technology and innovation allows us to challenge conventional thinking and deliver exceptional results that have a lasting impact on businesses, governments and communities worldwide.

Our clients choose us because we don't just believe in making a difference.

We believe in making *the* difference.

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