TRANSFORMING AGRICULTURE WITH DATA-DRIVEN INSIGHTS

How to prosper in the evolving market for digital agritech

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1 WHERE NEXT FOR AGRICULTURE?

There's a race to seize the opportunities presented by digital agritech.

New technologies that capture, process and interpret data are transforming agriculture, enabling the sector to become more productive and efficient than ever before.

Our research maps this evolving landscape, to help players of all sizes understand how to prosper in a fast-maturing market where only the fittest will survive. At this exciting time for the sector, we highlight how companies must harness the power of data to make smarter and faster decisions.

We're working in this area using our technology and innovation expertise. This is helping the sector identify solutions to the global food challenges of today and tomorrow.

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Why the excitement?

A 'see and spray' weed control machine from Blue River Technologies uses computer vision to pinpoint weeds, make the decision whether to spray the individual plant with herbicide and carry out this action. The company claims the technology has the potential to reduce the volume of herbicide required by 90 per cent.[1]

Meanwhile, software developed by technology company, Granular, enables farmers to manage their farms more efficiently by pulling data from every part of the business into one place. The software currently serves farms covering some two million acres in the US, as well as others in Canada and Australia.[2]

Big names in the machine and equipment and agriscience sectors are now fully alert to the opportunities from digital agritech. They're looking to collaborate with technology companies and start-ups, assembling and analysing data from different sources to unlock new insight and help farmers make smarter decisions.

For evidence of the excitement around digital agritech, look no further than the two examples above. In 2017, John Deere acquired Blue River Technology for $305m,[3] while DuPont paid $300 million to acquire Granular.[4] These investments are part of a strong trend that has developed as major players in the agri-value chain seek to establish a dominant position and build integrated solutions that meet customers' needs.

Among smaller players, there's strong activity, too. More recently, for example, Amvac Chemical granted global distribution of their prescriptive application equipment system to US positioning technology company, Trimble.[5] As a result, farmers using the Amvac system will be able to control and manage multiple inputs across each field more accurately and efficiently.

Turning data into value

For players big and small, the ambition is to turn data into value. A wide range of technologies, including farm management software, in-field sensors, drones and satellites, now capture data from farms across continents. Combining this information and applying sophisticated analysis delivers fresh – and valuable – insight for businesses throughout the agricultural value chain. That chain comprises growers, input suppliers, machine and equipment manufacturers, dealers, food producers, retailers and consumers.

Our research sets out to map this evolving landscape, investigating 11 established businesses and 200 start-ups and technology companies active in digital agritech.

For the major companies, we examined:

- how the market is developing
- how and why different types of companies are investing
- which names are beginning to dominate.

For the start-ups and technology companies, we explored:

- how they're creating value from data
- how they'll generate revenue
- where they're getting their funding.

Our key insights:

1. Value now lies in creating and integrating smart data – but many agritech companies only focus on one part of the data chain
2. Collaboration is imperative to seizing the digital agritech opportunity – companies that fail to do so will get left behind
3. The prize of 'dominant platform' is yet to be won – leaders are emerging, but the race is still on
4. Most start-ups and technology players – 75 per cent – lack a visible sustainable revenue model
5. Market consolidation means start-ups and technology companies need a plan for survival.

1 bluerivertechnology.com/
2 agweb.com/article/DuPont-buys-granular-ag-software-company-naa-sonja-begemann/
3 agfundernews.com/breaking-exclusive-john-deere-acquires-see-spray-robotics-startup-blue-river-technology-305m.html
4 agweb.com/article/DuPont-buys-granular-ag-software-company-naa-sonja-begemann/
5 bloomberg.com/research/stocks/private/snapshot.asp?privcapId=763493

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2 MAPPING THE DIGITAL AGRICULTURE LANDSCAPE

Digital agritech: the time is right

The world's population is growing fast and so the need for food is ever greater. Digital agritech will help feed the world.

Between 2010 and 2050, the world's population is expected to increase from 6.8 billion to 9.8 billion people.[6] To feed everyone, the Food and Agriculture Organization (FAO) estimates food and feed production will need to increase by 50 to 70 per cent.[7]

At the same time, the Intergovernmental Panel on Climate Change, a United Nations (UN) panel, estimates food production will decline by 2 per cent every decade as a result of climate change.[8] In addition, there will be no increase in the amount of arable land available. In fact, as cities expand to accommodate more people, there could be less land for growing than now.[9]

New technologies, including digital agritech, will be vital to securing the food supply for future generations. For example, CropX uses cloud-based software and in-field sensors to help farmers deliver the right amount of water to each plant, boosting yield and saving water. Another system, iCrop, provides farmers with data on levels of moisture in the soil and enables them to increase yields by 5 per cent with 49 per cent less water.[10]

New technologies will also play a key role in supporting the UN's 2030 Sustainable Development Goals (SDGs),[11] which aim to promote prosperity while protecting the planet. Digital agritech helps growers understand how to use resources more efficiently, increase consistency and boost yield. So these technologies will contribute to SDGs focused on eradicating hunger, promoting sustainable water management and protecting life on land and below water.

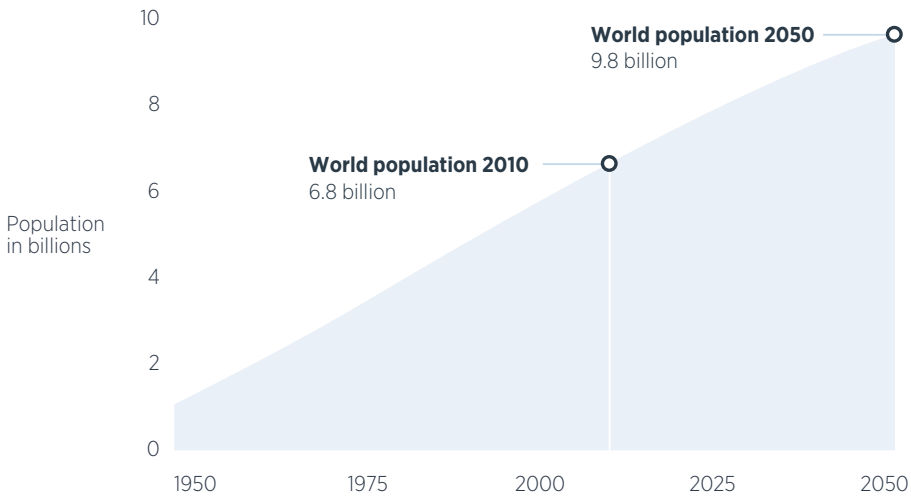

Figure 1: *World population growth.*

Source: un.org/development/desa/publications/world-population-prospects-the-2017-revision.html

6 un.org/development/desa/publications/world-population-prospects-the-2017-revision.html
7 fao.org/3/a-i6583e.pdf
8 nytimes.com/2013/11/02/science/earth/science-panel-warns-of-risks-to-food-supply-from-climate-change.html
9 Yield reduction 2 per cent – Climate Change Seen Posing Risk to Food Supplies, nytimes.com, 1 November 2013
10 forbes.com/sites/maggiemcgrath/2017/06/28/the-25-most-innovative-ag-tech-startups/#5dd48ee44883
11 un.org/sustainabledevelopment/

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CASE STORY

Descartes Labs: Anticipating crop failure with satellite imagery

Descartes Labs gathers and processes satellite and other imagery to make predictions about crop yields. Their forecasts aren't only of interest to companies that buy and sell agricultural commodities. Descartes's data has the potential to provide vital insight for government agencies seeking to prepare for and avert famine. In 2017, Descartes won a contract from the U.S. Defense Department to help create crop failure alerts based on satellite imagery of the Middle East and North Africa.[12]

12 http://fortune.com/2017/03/23/new-mexico-descartes-labs-darpa-grant/

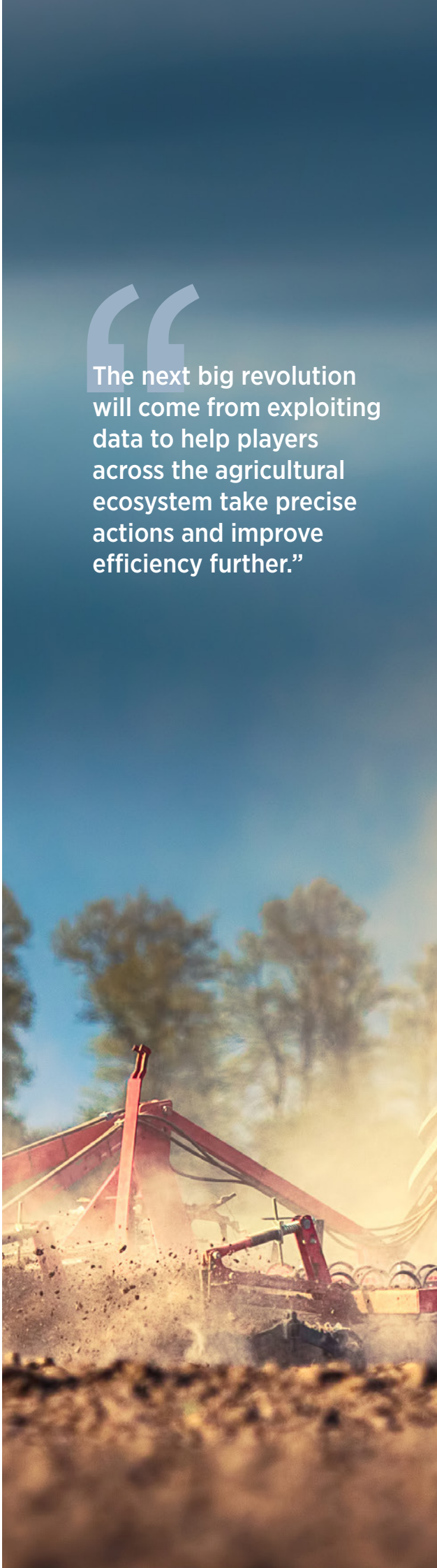
How digital agritech creates value

Digital agritech has the potential to create value for stakeholders throughout the agricultural value chain.

Digital technologies, such as GPS-guided tractors and automated sprayers and harvesters, have already delivered huge efficiency gains. The next big revolution will come from exploiting data to help players across the agricultural ecosystem take precise actions and improve efficiency further.

Digital technologies:

- Give input suppliers like agriscience companies and seed, chemicals and biologicals providers, a far better knowledge of individual farms, enabling them to provide growers with a more personalised, tailored service
- Help machine and equipment manufacturers make the shift from selling physical products, such as tractors and cultivators, to selling higher-value services, such as 'free of weed', that improve outcomes for farmers
- Enable growers to manage inputs, such as fertilisers and pesticides, more precisely, and reduce costs as a result
- Provide dealers/traders with accurate forecasts on future yield, quality and quantity of traded crops, such as wheat, corn and soy, to help large commodity traders improve risk management
- Improve food manufacturers' ability to predict the availability of raw materials and help them manage market risk
- Allow retailers to inform consumers exactly who has produced their food and where, and potentially encourage consumers to choose food and drink products from sustainable sources.



"The next big revolution will come from exploiting data to help players across the agricultural ecosystem take precise actions and improve efficiency further."

AGRICULTURAL VALUE CHAIN

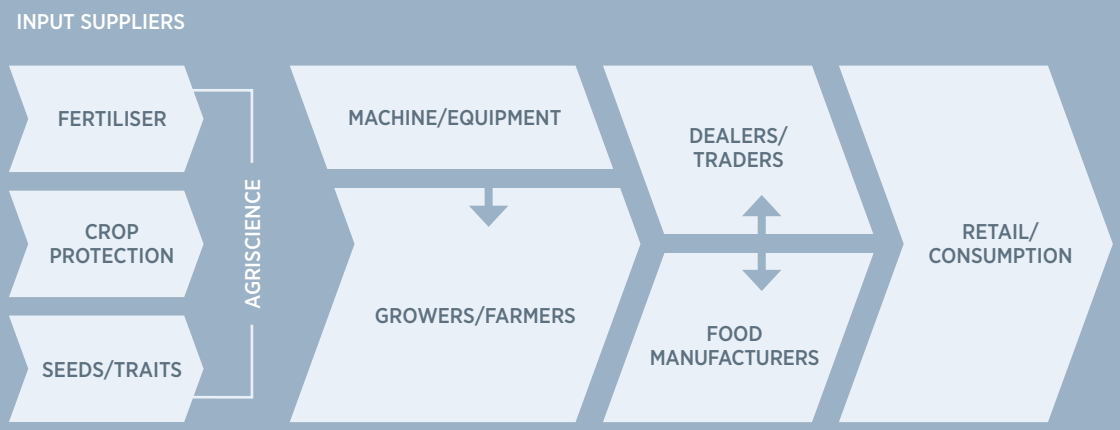


Figure 2: *Agricultural value chain.* Source: PA Consulting Group

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The new digital agriculture ecosystem

To secure the capabilities they need for agritech solutions, new and established players in agriculture need to collaborate, from farm to fork. This imperative is driving dramatic disruption across the industry. Traditional boundaries are breaking down and segments are merging.

Digital technologies and data are drawing agrochemicals, seeds and traits, biotechnology, the supply chain, the food chain, traceability, sustainability, resource management and distribution into a new agriculture ecosystem.

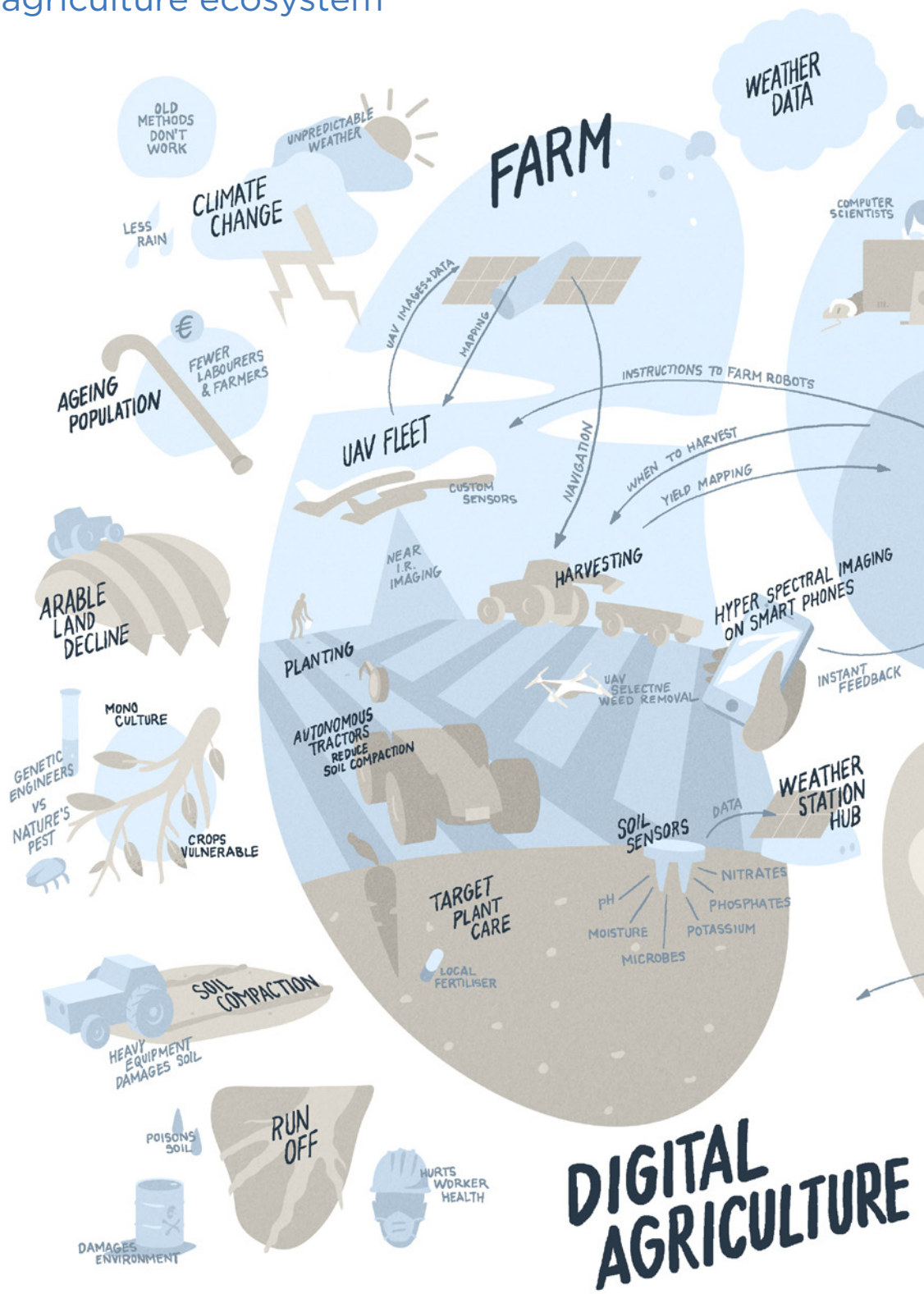

Figure 3: *The new agriculture ecosystem.*

Source: PA Consulting Group

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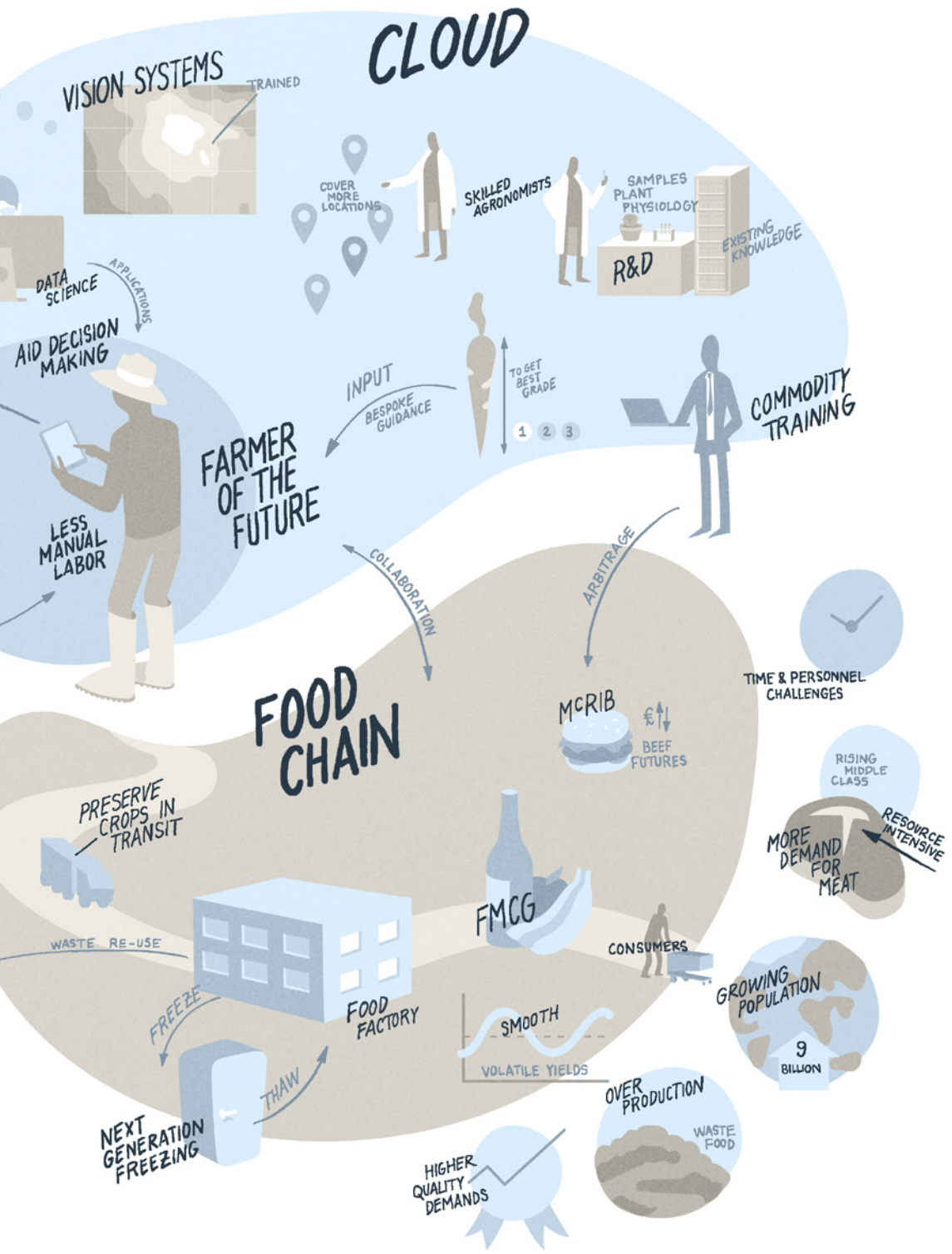

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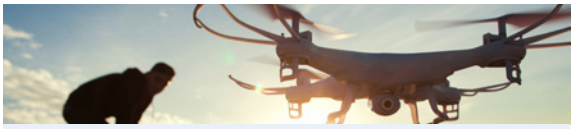
Data: at the heart of digital agritech

Digital agritech depends on data – from real-time microdata specific to individual farms and fields to macro data on weather conditions for whole continents and year-to-year climate trends.

Digital agritech companies are taking advantage of advances in processing power and the reduced cost of data storage and sensors to combine raw data from different sources and create smart data. Advanced algorithms are delivering fresh intelligence to enable users to make the right decisions to optimise inputs, maximise outputs and increase efficiency and returns. As the amount of data available to systems increases, intelligence becomes more accurate. Take the weed control system from Blue River Technology. As the system increases its collection of images through continuous monitoring of fields, it gets better and better at distinguishing weeds from value crops.

Almost all start-ups or technology companies in the agritech space build their businesses around one or more of three types of data-related activity:

- **Data capture/generation:** using technology to collect data, through sensors (in the soil, on the plant or in the air, for example) or imaging technology like satellites and drones.
- **Data processing and management:** aggregating data from different sources and applying analytics to unlock insight.
- **Decision support and implementation:** providing software that delivers specific recommendations for users, and tools (hardware and software) allowing them to implement recommendations.



Data capture/generation

- **Sensors**
  (air, in field, on plant, on/in soil, on/in animal)
- **Imaging**
  (satellite, drone)

Data processing and management

- **Data analytics/algorithms**
  (turning raw data into smart data)
- **Exchange/platform**
  (bringing several parties/ data sources together)
- **Data storage/cloud**
  (solutions for easy data storage, access and availability)

Decision support and implementation

- **Software**
  (decision support, farm management)
- **Hardware**
  (smart fertilisation, irrigation, pest control, indoor agriculture/farming, machine automation)

CASE STORY

Farmobile: Putting a value on farmers' data

It's widely assumed that data generated by farmers is free. But Farmobile helps farmers own and earn from their data. Farmobile's in-cab units gather machine and agronomic data from the field. The company then uses this to produce electronic field records for customers. Farmobile also helps farmers sell their data to companies that provide decision support, field mapping and prescription services. When the company launched the Farmobile Data Store in 2016, they guaranteed to pay farmers at least $2 per acre for their planting and harvest data.[13]

13 farms.com/news/farmobile-will-pay-minnesota-farmers-for-data-105978.aspx

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Maximising value with integrated solutions

Integrated solutions make the link right through from data capture and analysis to decision support and implementation, to maximise benefit for users.

Many of the products and services agritech companies are developing cover only one part of the data value chain: data capture, data analysis or decision support. But, alone, each has limited value for users. To maximise benefit, the different parts need to be integrated.

For example, technology companies developing drones or in-field sensors are involved with data capture – but the data has no value until analysed, perhaps by an innovative start-up developing sophisticated algorithms. And the output from this analysis has no value until it is translated into insight and made available to farmers. This could be via farm management software, or directly translated into an automated action, such as spraying or harvesting.

To deliver these integrated solutions, major players need a wider range of capabilities than before. Machine and equipment manufacturers, for example, might need access to data science expertise, while agriscience companies also require better access to data-capture technologies. Companies specialising in data capture or data analysis need a way to get insight to farmers.

A recent deal between Ceres Imaging and The Climate Corporation provides a great example of how collaboration is creating fully integrated solutions.[14] Ceres develops and builds sensors that are attached to fixed-wing aircraft to capture high-resolution images of crops. The company then applies machine learning and data science to identify pests and diseases. A link-up with FieldView, the digital agriculture platform from The Climate Corporation, adds the final component. Farmers can now access Ceres's analysis via FieldView and understand where to take action to protect crops.

Across the digital agriculture ecosystem, evidence of companies' efforts to assemble new capabilities has produced a surge in acquisitions and partnerships.

14 climate.com/newsroom/the-climate-corporation-partners-with-advanced-aerial-imagery-providers-to-deliver-deeper-crop-analysis-tools-for-farmers/73

Integrated solutions support digital business transformation

Thinking from the Global Center for Digital Business Transformation, a joint initiative from IMD and Cisco, underlines the value of integrated solutions. A team led by Professor Michael Wade identifies the need for organisations undergoing digital transformation to develop a capability called 'digital business agility'.[15] Integrated solutions can help deliver this.

Digital business agility consists of three elements: hyperawareness, informed decision-making and fast execution. Hyperawareness describes an organisation's capability to recognise future trends. Informed decision-making is the capability to actively analyse information that comes in through hyperawareness. And fast execution is an organisation's capability to turn decisions into action.

The three elements are a perfect match for the three different types of data-related activity driving agritech: data capture/generation (relating to hyperawareness); data processing and management (relating to informed decision-making); decision support and implementation (relating to fast execution).

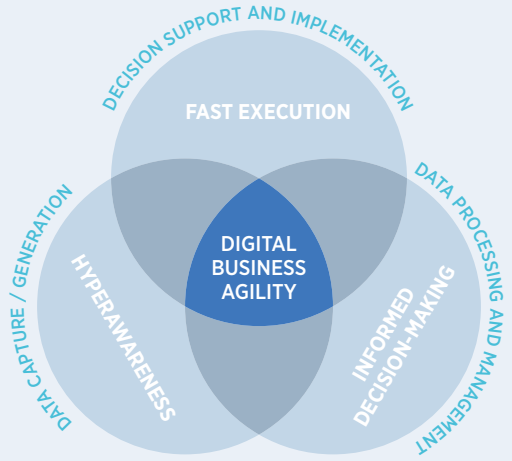

Figure 4: *Digital business agility components*

Source: imd.org/research/insightsimd/digital-business-agility-and-workforce-transformation/

15 Digital Business Transformation, A Conceptual Framework, June 2015, Global Center for Digital Business Transformation

The race to become the dominant platform

Established players want to become the go-to provider.

As established players invest to assemble the capabilities they need, they are also developing platforms that offer users easy access to a full range of products and services. Platforms typically allow users to purchase both proprietary and third-party applications, enable access from multiple devices and offer data storage via cloud solutions. It's not dissimilar to the way Apple operates in the consumer space, offering access to email, shopping, storage and map apps from other providers via Apple devices.

All the big names have launched their own platforms and each aims to become the go-to solution for farmers. There's plenty at stake. The consumer world shows how companies first to capture a significant share of users can go on to dominate the sector. Apple, Amazon and Google all capitalised on their early success in winning users. They were able to develop economies of scale, make their platforms attractive as a host for third-party apps and overpower other contenders who were slower out of the blocks.

For farmers, which platform to choose is a difficult decision. Once they've made their choice, they're likely to find themselves increasingly locked in, just as consumers find themselves locked into Apple, Google or Amazon's ecosystems.

Meanwhile, the hundreds of small technology companies and start-ups now operating in the space need to work out how to survive in this evolving scenario. Do they plan to develop as a stand-alone solution – and if they do, can they attract the number of users they need to develop a viable business? Or are they looking to collaborate with – or even be acquired by – one of the major players? If this is the case, which platform should they aim to align their solution with?

> "All the big names have launched their own platforms and each aims to become the go-to solution for farmers."

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3 OUR KEY INSIGHTS

The five main insights from our study

1. Value now lies in creating and integrating smart data – but many agritech companies only focus on one part of the data chain

Huge volumes of data about how crops grow are now easily available. The data-capture challenge has been solved, and data in itself won't be a differentiating factor for agritech businesses. To create value now, businesses must aggregate multiple layers of information and apply the right algorithms to unlock new insight.

Making the link from data capture to analysis to decision support is key, but this type of integration is happening too rarely. In practice, many agritech companies are focused on just one part of the chain.

To provide the integrated solutions farmers need, companies must collaborate and consider the following strategies:

- Establish partnerships to secure access to data, and consider multiple sources to have enough (and the right) 'raw material' available for informed decision-making
- Focus on the analysis and decision-support components of the solution. This is the route to sustainable competitive advantage
- Decide how to acquire analysis and decision-support capabilities. Will you build them in-house or access them through acquisitions? Acquiring means you build them quickly, and have access to the most 'up-to-date' knowledge pool. On the other hand, it will most likely be expensive, and there could be a cultural clash with your existing organisation when it comes to integration into an existing team and structure.

2. Collaboration is imperative to seizing the digital agritech opportunity – companies that fail to do so will get left behind

The major agriscience and machine and equipment companies are working hard to acquire the new capabilities they need to seize digital agritech opportunities. These include data science, data mining, application development, customer experience planning, system integration, solutions architecture and ecommerce.

Different types of company are approaching the challenge in different ways. Machine and equipment companies are capitalising on their existing platforms, data from their GPS technology and access to farmers to form partnerships with complementary businesses. Agriscience companies are also forming partnerships with larger players, but they're much more likely to use acquisition as a way of accessing capabilities in smaller companies. Without the head start enjoyed by machine and equipment companies, they must move fast to catch up.

Beyond acquisitions and partnerships, investment can be an attractive option for corporates. Even minority investments into start-ups provide a seat on the board, an overview of technology and trends and, in many instances, an information advantage when the start-up is up for sale. Corporate investors could overpay when they take a minority investment in a financing round, so must guard against this tendency.

3. The prize of 'dominant platform' is yet to be won – leaders are emerging, but the race is still on

All established companies offer a platform for farmers and some, like Monsanto, have opened their platforms up to third-party service providers. The platform that captures the most users now, in the relatively early stages of the agritech revolution, is likely to become the dominant one, akin to Apple or Google in the consumer space. The more users a platform has, the more attractive it becomes as a place for other companies to offer their services and technologies.

It's not yet clear which platform will dominate but, for now, Monsanto and John Deere look to be ahead. Monsanto's Climate FieldView platform has already captured more than 100,000 users and covers more than 120 million acres. Platforms guard their user numbers closely, but figures on acres covered are more freely available. Publicly available figures show that DuPont's Encirca platform now covers around 75 million acres, keeping it within touching distance of Monsanto. DuPont's acquisition of Granular shows the race is not yet over.

Ultimately, the size of a platform's user base will determine its value.

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This means platform owners should:

- Be bold. Invest to attract users and don't rule out the possibility of offering services for free
- Adjust traditional key performance indicators for return on investment to a longer-term horizon, and adapt the value capture model later.

4. Most start-ups and technology players – 75 per cent – lack a visible sustainable revenue model

There are plenty of start-ups and technology companies, and they are using a wide range of revenue models including subscription, pay-per-use and pay-by-area models, as well as transaction-based and pure hardware purchase models.

However, for the vast majority – a surprising 75 per cent – we were unable to clearly identify their revenue model. On their websites, most state what they want to accomplish and what they offer, but there's no or very limited information about how to buy the product or service, or what it costs.

These companies are largely funded by venture capital and private equity, and are therefore able to rapidly develop new products and services. But many are in the dangerous position of doing this without having identified customers or routes to market.

Even if the main driver is to develop the business for acquisition, these companies should also define a sustainable revenue model – in case they are not ultimately acquired.

5. Market consolidation means start-ups and technology companies need a plan for survival

The number of new agritech companies entering the market seems to have peaked in 2015. There are fewer further entrants as the market now seems saturated; a period of consolidation is under way. Several proven businesses such as Granular, ZedX and Descartes Labs have already been 'captured' by major players (DuPont, BASF and Cargill, respectively).

Start-ups and technology companies that want to survive must be able to answer key questions:

- Can we stand alone as a niche offering? Or do we need to fit into the integrated systems being developed by established players?
- If we want to stand alone, who are the buyers for our products and services? What is our specific business and revenue model and what is the impact on our development road map? Are our offerings scaleable?
- If we seek investment, which type of investor works best for us (venture capitalists/private equity or corporations) and what can they offer?

Digital agritech's biggest names

Eleven major companies currently dominate the agritech space. They're a mix of agriscience leaders and machine and equipment manufacturers plus two key technology players: Trimble and the smaller Iteris. These are the 11 major companies included in our research.

AGRISCIENCE COMPANIES		
Companies in alphabetical order	Agri-related turnover 2016 (€ millions)*	Platform and launch year*,**
BASF	5.7	Maglis (2016)
Bayer	9.9	xarvio (originally Bayer Agronomy Tools) (2015)
Dow	5.6	None
DuPont	8.6	Encirca (2014)
Monsanto	12.2	Climate FieldView (2015)
Syngenta	11.5	FarmAssist (2001) and AgriEdge (2015)

MACHINE AND EQUIPMENT MANUFACTURERS		
AGCO	6.7	Fuse (2013)
CLAAS	3.6	EASY (2010)
John Deere	24.0	MyJohnDeere (2012)

TECHNOLOGY COMPANIES		
Iteris	0.1	ClearAg (2015)
Trimble	2.2	Trimble Ag Software (2016)

* PA research, company information, estimates
** incorporating previous existing solutions

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4 STUDY RESULTS: ESTABLISHED PLAYERS

How is the market developing among major players?

Since 2013, activity by the 11 major companies to strengthen their agritech capabilities has shown a marked increase. This period of intense activity begins with Monsanto's acquisition of the data analytics firm The Climate Corporation. The $930-million deal seems to have acted as a wake-up call to the rest of the industry.

Our research tracks 136 deals – across partnerships, acquisitions and investments – by the top 11 companies and their venture arms since 1997, with activity reaching a peak in 2015. In 2016, overall activity began to decline, as the number of acquisitions and investments started to fall away. Excessive valuations and the failure of some start-ups and smaller companies to meet business-case targets could explain this decline. In addition, some established players began building their own capabilities internally, rather than buying them in.

Despite the decline in acquisitions since 2015, a large number of partnerships were agreed between 2015 and 2017 and, as a result, overall activity levels remain high.

Three companies lead the pack in terms of the number of deals entered. Trimble has been the most active, notching up 25 different partnerships and acquisitions. Iteris and Monsanto, with 20 deals each, are close behind.

The desire to establish a comprehensive platform is driving the high number of deals by Monsanto and Trimble. It's all about bringing as many offerings on board as fast as possible.

The driver for Iteris is different. This much smaller company is aiming to leverage their technology capabilities and extend their market reach by partnering with agriscience and software companies.

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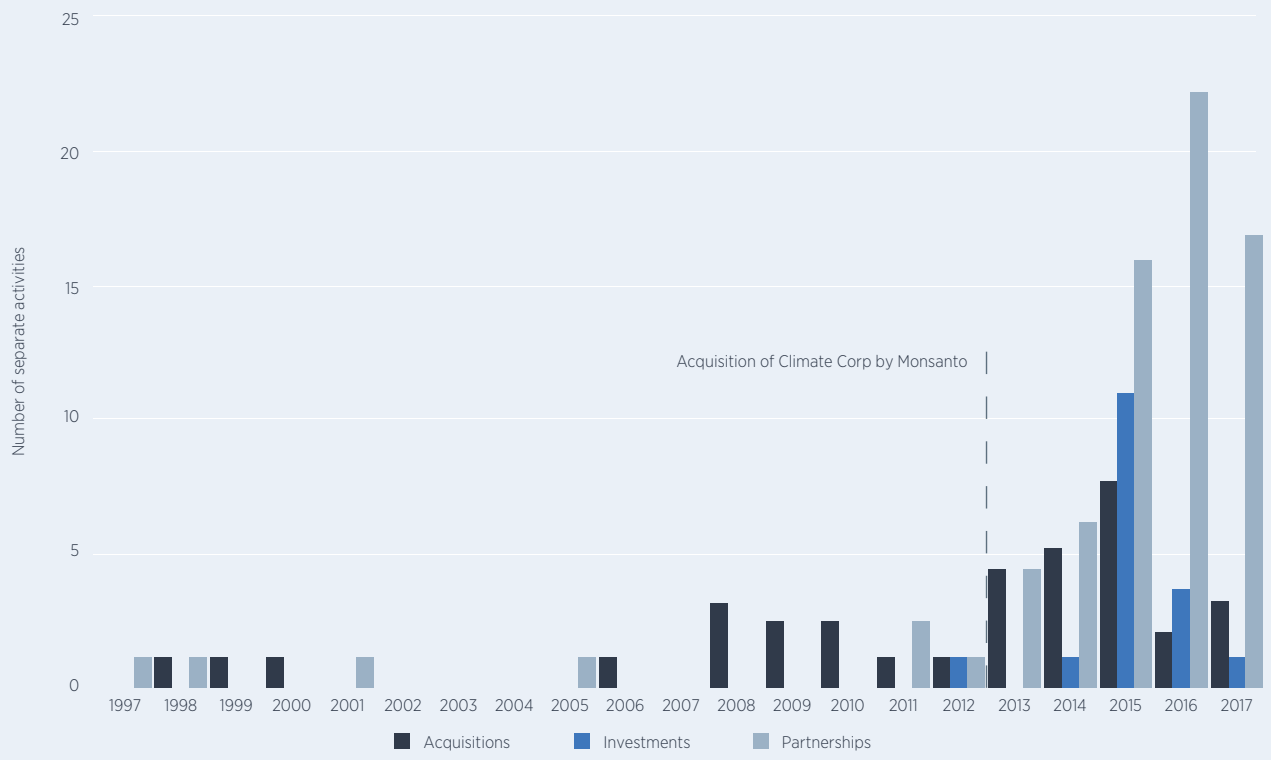


Figure 5: *Activities of established companies – year of activity*

Source: PA Consulting Group

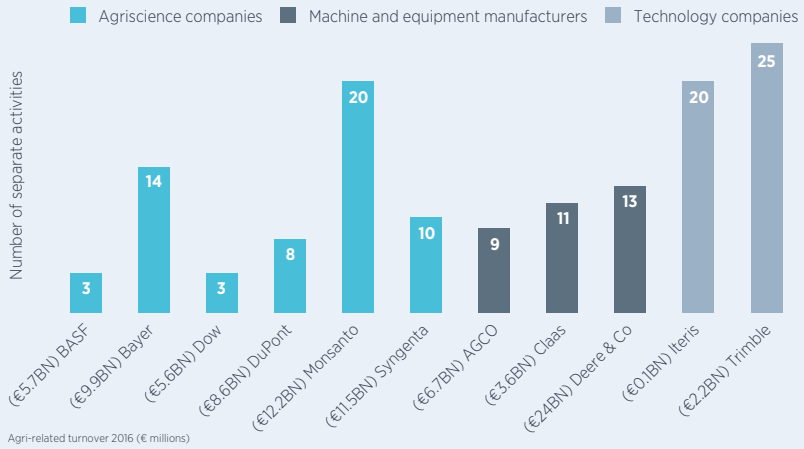


Figure 6: *Established companies' collaboration activity*

Source: PA Consulting Group

How and why are different types of company investing?

Partnerships are the preferred option

Across the board, by far the most popular model for established companies seeking to extend their capabilities is partnership. Of the 136 deals we tracked, more than 60 per cent were partnerships. In fact, there were more than twice as many partnerships as investments, and almost five times as many partnerships as acquisitions.

There are several reasons for partnerships' popularity among established players. They require less financing – entering a partnership is cheaper than making an acquisition. And because partnerships don't need to be exclusive, they're less risky. Major companies don't need to invest too heavily in emerging and, as yet, unproven solutions.

Partnerships can be advantageous for start-ups and technology companies too. With this model, they don't need to bind themselves to one of the major players' platforms – or can, at least, delay doing this until the sector landscape becomes more settled.

The preference for partnerships isn't uniform across the sector. Investment can also be an attractive option for corporates.

Even minority investments into start-ups provide a seat on the board, an overview on technology and trends and, in many instances, an information advantage when the start-up is up for sale.

Each of the three groups of major players – machine and equipment manufacturers, agriscience companies and technology companies – shows a preference for a different model. Importantly, the focus for collaboration activity also varies among and within groups.

Machine and equipment manufacturers: developing their platforms

Machine and equipment manufacturers already have excellent access to farmers and are capitalising on this to secure partnerships that allow them to develop their existing platforms. They forge links with software, hardware, data science and agritech companies across the value chain. Manufacturers rarely acquire companies themselves.

Agriscience companies: investing in new technology capabilities

Agriscience companies generally focus on acquiring new technology capabilities to complement their science expertise. Monsanto and DuPont break the mould. Following major acquisitions (of The Climate Corporation and Granular, respectively), these two have a stronger focus on developing platforms to rival those of the machine and equipment manufacturers.

In general, agriscience companies prefer to secure new capabilities or develop their platforms by acquiring or investing in smaller companies.

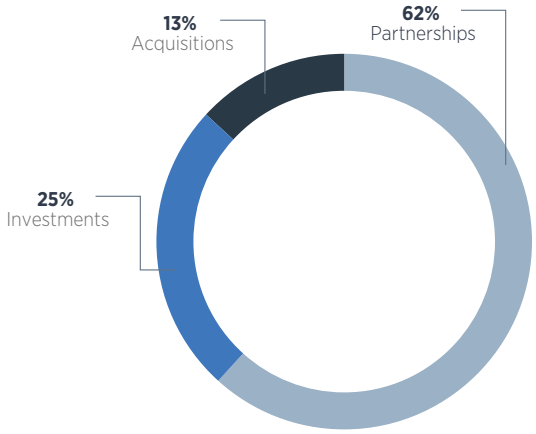
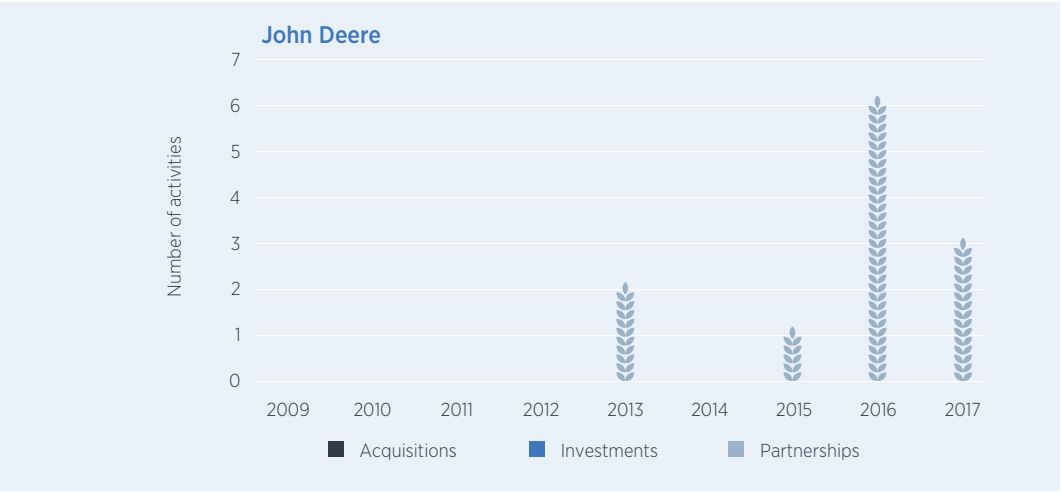


Figure 7: *Activity to strengthen capabilities*

Source: PA Consulting Group



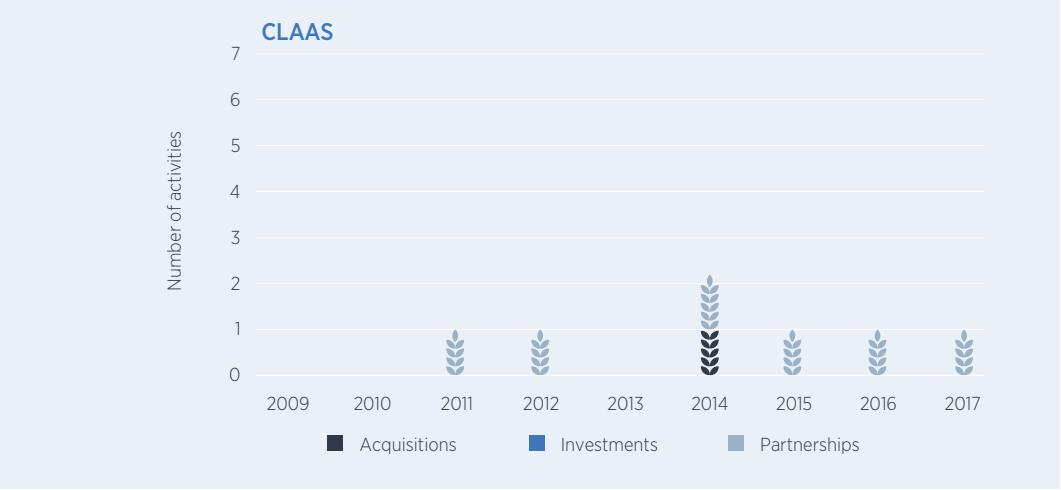


Figure 8:
Machine and equipment companies' activities by type of collaboration

Source: PA Consulting Group

Machine and equipment companies are continuously fostering their platform/ecosystem by entering into partnerships with different stakeholders across the digital agricultural value chain (including software, hardware, data science and agriscience companies). Noticeably, they are rarely acquiring companies themselves.

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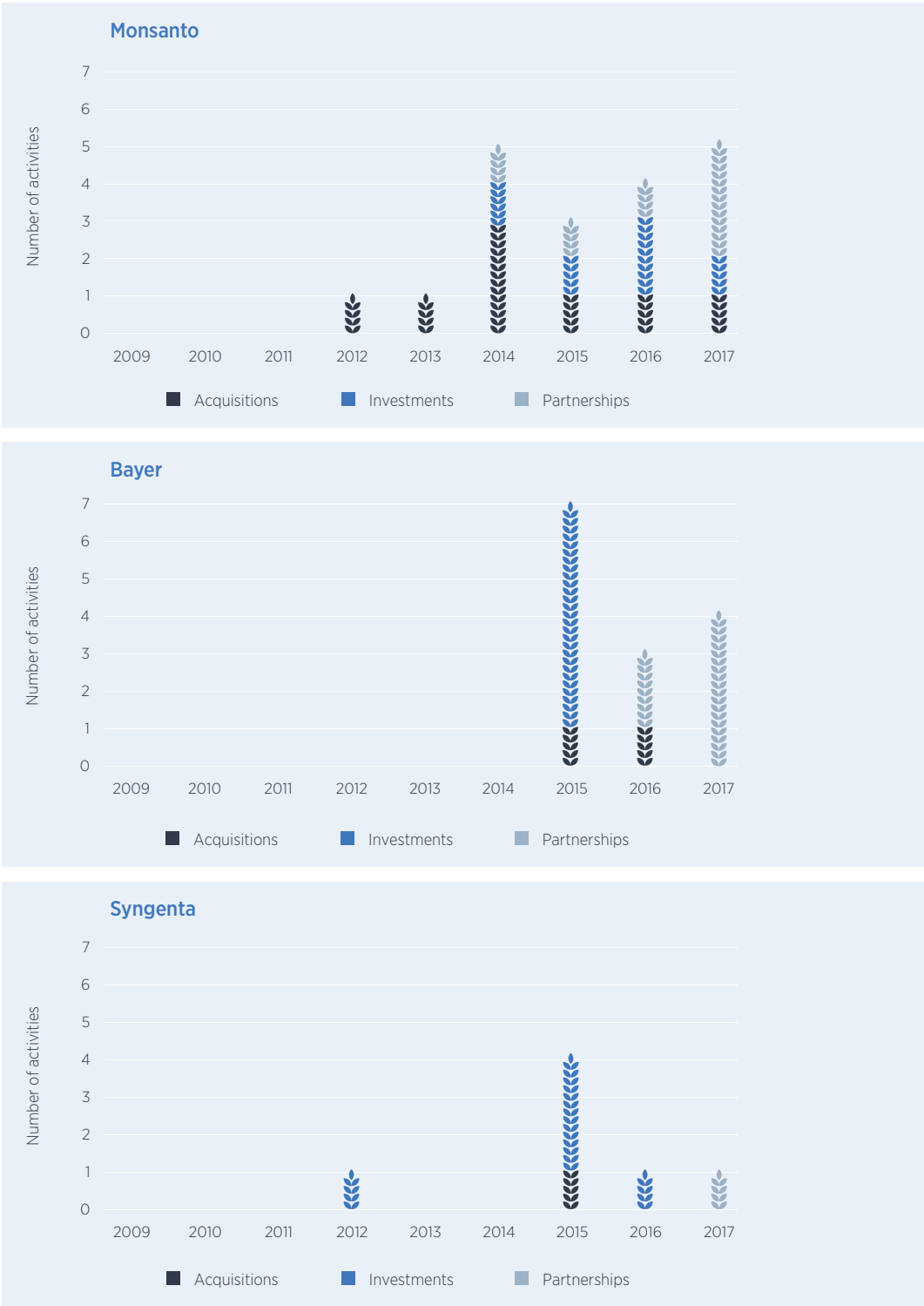
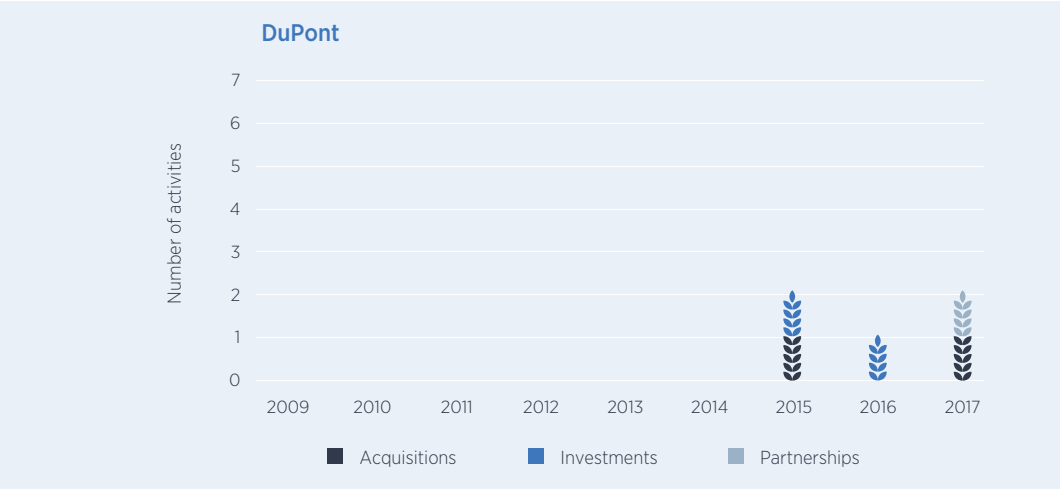
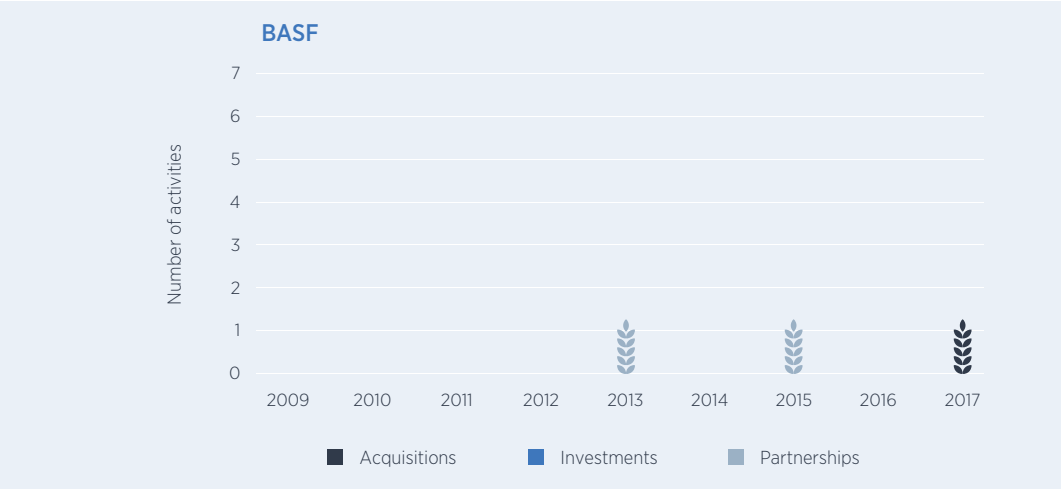
Figure 9: *Agriscience companies' activities by type of collaboration*

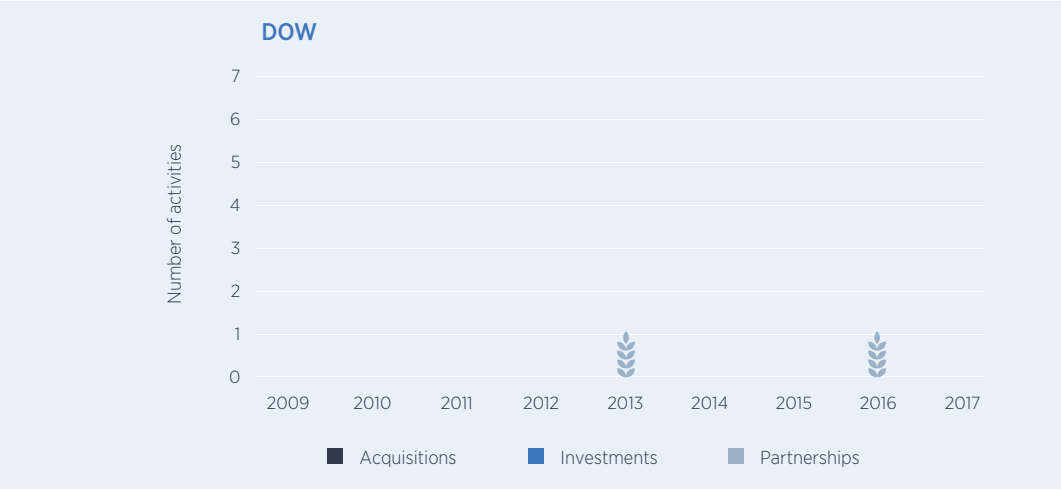
Source: PA Consulting Group

Leading agriscience companies: Monsanto was more active at an earlier stage than Bayer and Syngenta. When analysing the specific collaborations in further detail (see Figure 11), we see that Monsanto focuses on establishing an ecosystem, while Bayer focuses on building capabilities.









Lagging agriscience companies: Dow will be compensating their weaker position with the merger with DuPont, resulting in a joint offering; BASF is building up its capabilities (slowly).

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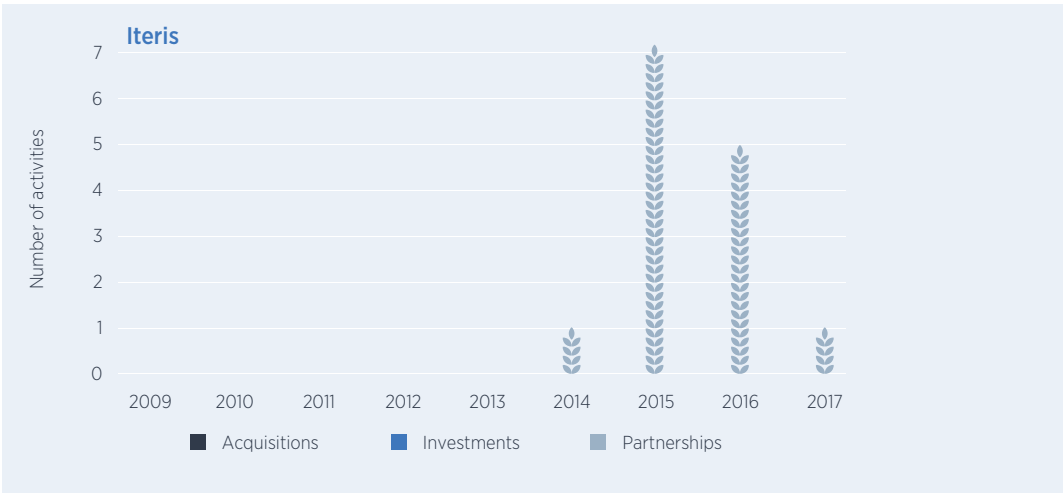
Technology companies: expanding their ecosystems

A third group – the technology companies, Trimble and Iteris – is intent on developing its own ecosystems. Each is choosing to do this by different means. Trimble has been fostering its capabilities by making acquisitions since 2009, but since 2015 has also been using partnerships to extend its market reach. Iteris has entered 15 partnerships, mostly with agriscience and software companies, since 2014. This company hasn't made any acquisitions or investments in this period.

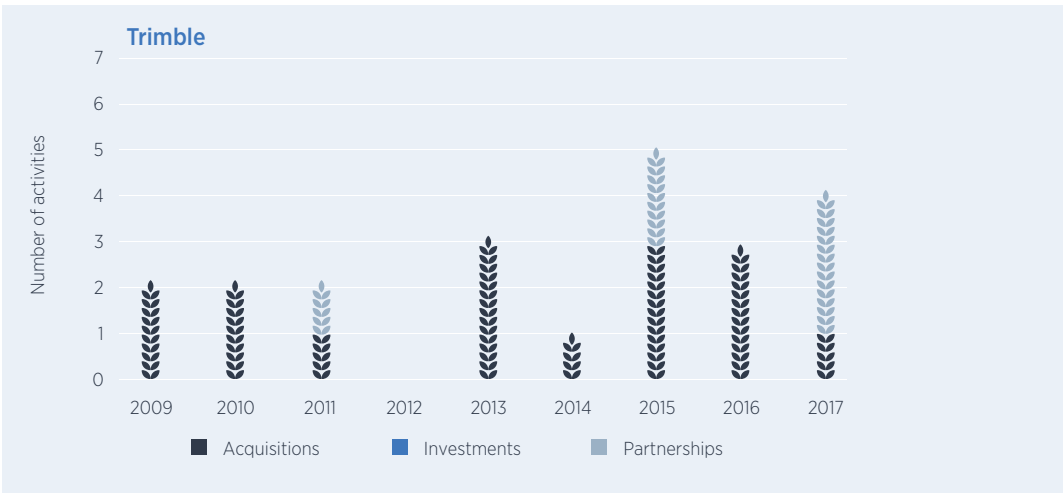
Figure 10: *Technology companies' activities by type of collaboration*

Source: PA Consulting Group

Iteris is focusing on its platform ClearAg, extending market reach by entering into partnership with several stakeholders (especially agriscience and software companies). However, Iteris is very small in turnover compared to all other established companies.



Trimble is fostering its capabilities by continuous acquisitions since 2009, creating a unique offering, and now broadening their market reach by entering into partnerships, offering their unique capabilities to other stakeholders.

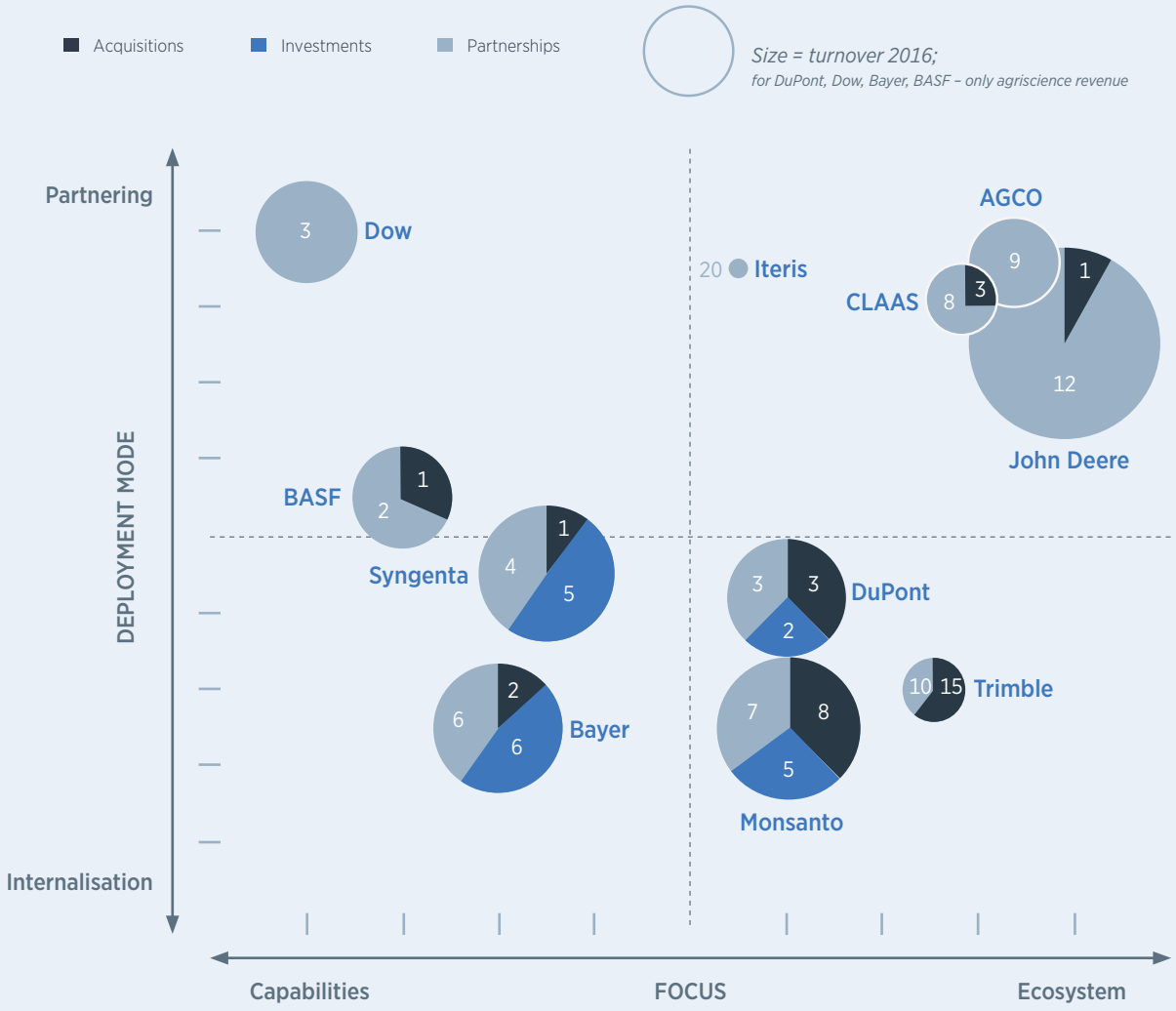


Positioning themselves for the race in becoming the 'leading platform' in agriculture.

All established companies offer a platform for farmers. The platform that captures the most users is likely to become the dominant one, akin to Apple or Google in the consumer space. The companies included in our research show a different focus (either more towards building capabilities or building an ecosystem), as well as different deployment modes (relying on partnering versus internalisation).

Figure 11: *Focus and deployment mode of established companies*

Source: PA Consulting Group



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Which major players are beginning to dominate?

Two big names, Monsanto and John Deere, each from different sectors (agriscience and machine and equipment manufacturers, respectively), are starting to pull ahead with their platforms. Two further companies are emerging as possible future challengers. The recent acquisition of Granular by DuPont (agriscience) positions the company to catch the leaders. Trimble (technology) has also strengthened their position with the acquisition of several technology companies in recent years and a number of partnerships along the agri-value chain.

Monsanto

Monsanto has been developing its position with a steady stream of investments, partnerships and acquisitions since 2012. Monsanto's priority since then has been to develop their platform. In 2013, they acquired The Climate Corporation and less than two years later launched its platform FieldView. In 2016, they opened up the platform to independent application providers and FieldView now has some 100,000 users. Monsanto's latest activity includes a partnership with data-capture specialists Ceres Imaging.

John Deere

John Deere launched their platform, MyJohnDeere, in 2012, and have gone on to establish no less than 12 partnerships to develop it. By acquiring Blue River Technology in 2017, they secured a complete set of capabilities in data capture, data analysis/processing and decision support/implementation. As a machine and equipment manufacturer, John Deere already had an extensive customer base among farmers. By building on their long track record in digital agritech, they've continually expanded the services and support they offer through MyJohnDeere.

DuPont

DuPont began making acquisitions to support their agritech ambitions back in 1999, through DuPont Pioneer in the US. There has been a sharp increase in their activity since 2014 – mostly acquisitions. The most significant of these is DuPont's acquisition in 2017 of Granular. The $300-million deal gives DuPont ownership of an easy-to-use farm-management software solution and a solid base for hosting additional services in future.

Trimble

Technology company Trimble operates across a range of sectors, including construction, utilities and logistics. Their interest in agritech dates back to 2000 when they acquired Spectra Precision Group. Since then, they have made more than 20 partnership deals and acquisitions, and in 2016 launched Trimble Ag Software. Trimble's software addresses the needs of a broad range of stakeholders, including farmers, advisers, agricultural retailers and food-processing companies. Their products and services drive success not only on the farm but throughout the entire agricultural supply chain.

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5 STUDY RESULTS: START-UPS AND TECHNOLOGY INNOVATORS

A galaxy of start-ups and technology innovators

Hundreds of start-ups and technology companies are active in the digital agritech space. Our research covers more than 200 active companies, although there are likely to be more newly-founded companies still below the radar. We aimed to achieve a representative group rather than identify every single agritech start-up.

Our analysis, which includes companies dating back to 1998, shows a step change in the number of new start-ups in 2012. In the period 2012–15 alone, 125 digital agritech companies were established. The number of new start-ups appears to tail off in 2016, but it's not yet clear whether this has really happened or whether companies founded in 2016 are still too small to be visible to the market. Another possibility is that companies are turning their attention to other technologies, such as new approaches to farming (vertical or indoor farming), genetics (CRISPR technology) or new ways of making food (for example, manufacturing gelatine without involving animals).

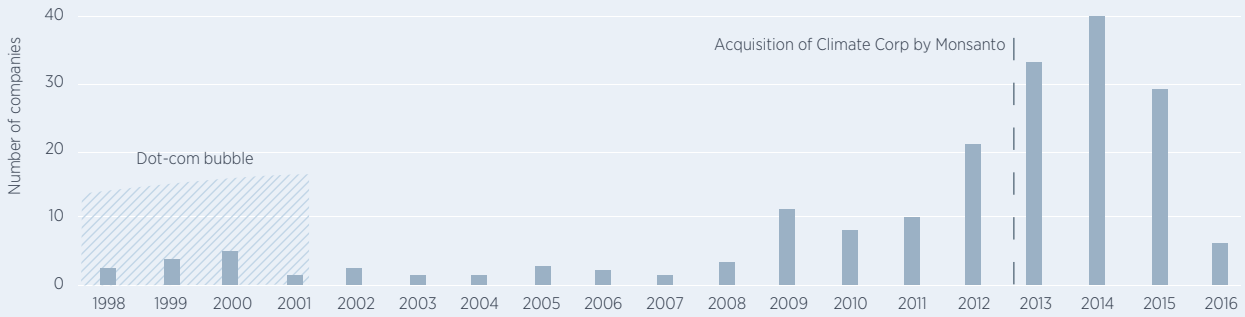

Figure 12: *Start-up/year of foundation*

Many of these young companies are still small: 40% have just 1–10 employees. Another 35% are medium-sized with 11–50 employees.

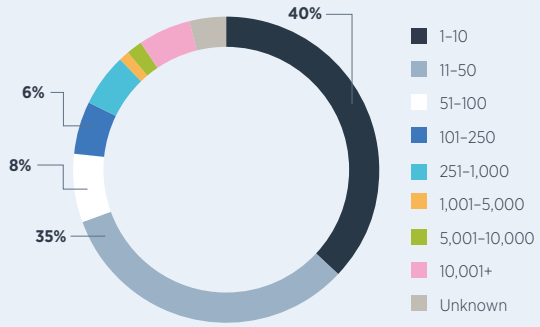

Figure 13: *Start-ups/number of employees*

More than 40% of agritech start-ups and companies originate in the US and a further 25% originate in Europe.

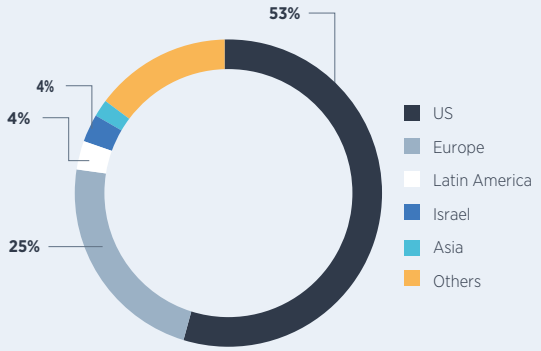

Figure 14: *Start-ups/geographic distribution*

Source (all): PA Consulting Group

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How are start-ups and technology companies creating value from data?

Digital agritech is all about making sense of big data sets and enabling farmers to use the intelligence revealed by new algorithms. So it's not surprising to see that 80 per cent of start-ups and technology companies are active in data processing and analysis, and 72 per cent are active at the decision support and implementation phase. Fewer (35 per cent) are involved in data capture.

Only one in five start-ups and technology companies included in our analysis offers integrated solutions that span all three components of the data value chain. In other words, they span capture, processing and analysis, and decision support and implementation. Developing integrated solutions requires a range of capabilities, which start-ups are unlikely to have access to or the resources to acquire. The implementation component of an integrated solution is the most difficult to deliver. It requires access to a fully integrated system incorporating both hardware and software. This explains start-ups' tendency to focus on data processing and analysis.

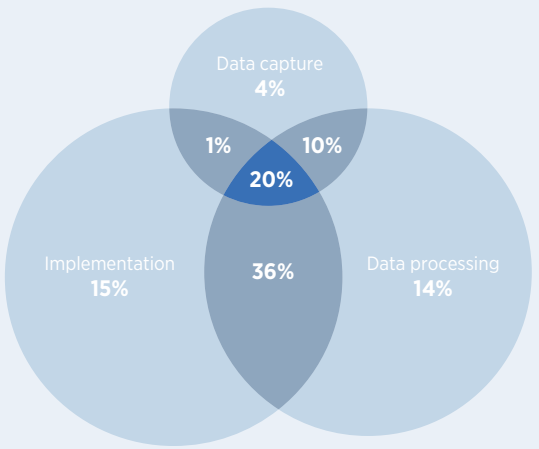

Figure 15: *Start-ups/product service offer (company involvement in data-related activity)*

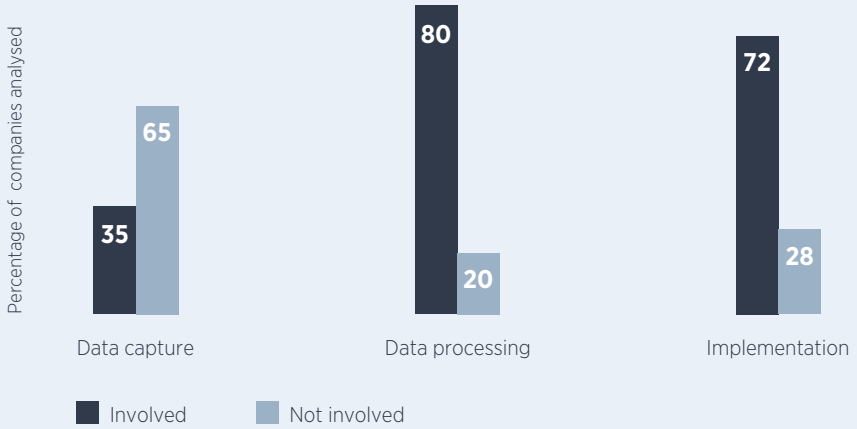

Figure 15 continued

Source (all): PA Consulting Group

Activity in focus: the role of start-ups in data capture, data processing and decision support

Start-ups and technology companies involved in data capture do this through a mix of sensors and imaging technologies.

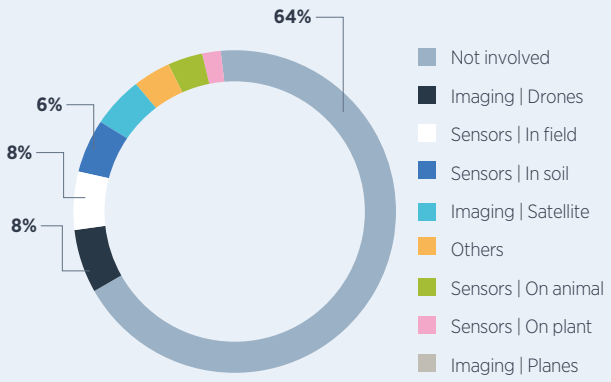

Figure 16: *Role of start-ups in data capture*

Most start-ups and technology companies involved in data processing are focused on analytics and algorithms.

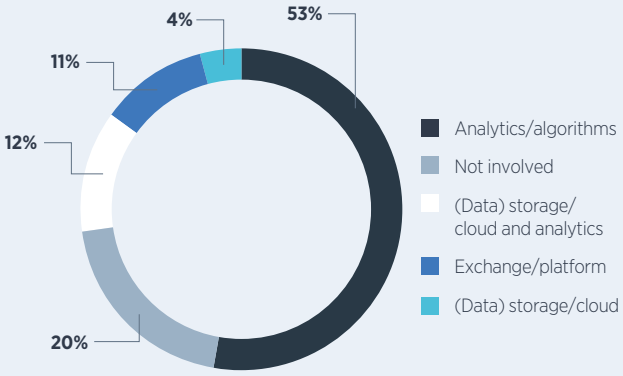

Figure 17: *Activities of start-ups in data processing*

Most start-ups and technology companies involved in implementation are focused on developing decision-support software.

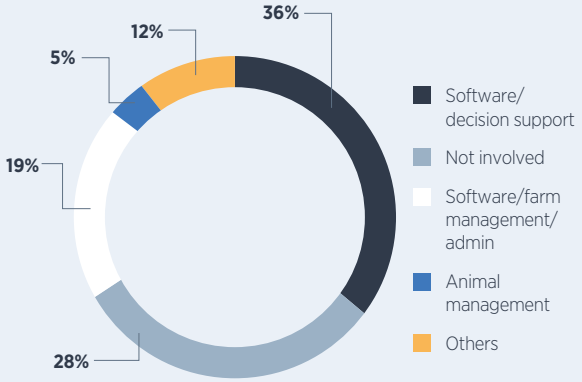

Figure 18: *Involvement of start-ups in decision support*

Most start-ups and technology offer solutions that can be applied to a variety of crops. A small number offer solutions for particular crops, such as grapes, fruit and nuts, or for cattle.

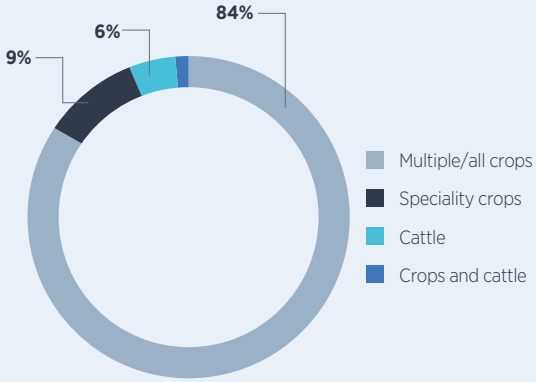

Figure 19: *Start-ups/crop use*

Source (all): PA Consulting Group

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How do start-ups and technology companies generate value?

In the digital economy, companies can generate value in three ways:

- by using digital technologies to transform the customer experience
- by designing smart products and services
- by transforming activities in the value chain, such as R&D, supply chain, production and distribution.

Most digital agritech start-ups and technology companies (77 per cent) are involved in developing smart products and services, including hardware, software and hardware/software combinations.

A further 21 per cent are focused on transforming the customer experience by developing services, such as farm management software, that help farmers manage and gain insight from data.

Just 2 per cent are involved further along the supply chain. These companies are developing solutions that enable agricultural products to be traced and tracked as they're distributed.

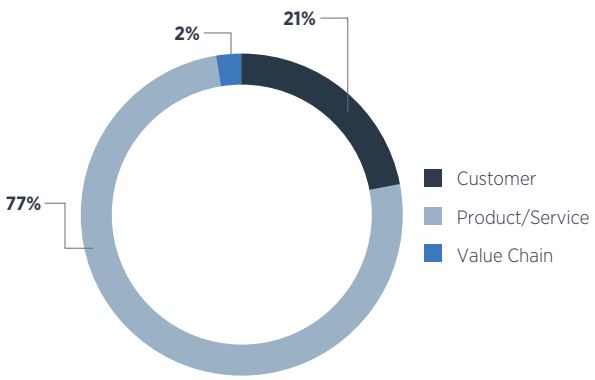

Figure 20: *Start-ups: business model type*

Source: PA Consulting Group

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And how will they generate revenue?

Start-ups and technology companies are using a range of revenue models. These include pay-per-use (this model is often used by companies renting out machinery) and pay-by-area (often used by drone and satellite monitoring companies).

The most popular way to generate revenue is through subscription. Of the companies in our survey, 10 per cent generate income in this way. These tend to be companies providing farm management software, mostly on an annual subscription basis.

However, for the vast majority – a surprising 75 per cent – we were unable to clearly identify their revenue model. On their websites, most state what they want to accomplish and what they offer, but there's no or very limited information about how to buy the product or service, or what it costs.

The priority for most companies still seems to be to develop their products and services. Having secured finance, they're free to do this. Most companies in our survey are four years old or less. Even in these early stages, it's vital to develop products and services that meet customers' needs, and that customers will be willing to pay for.

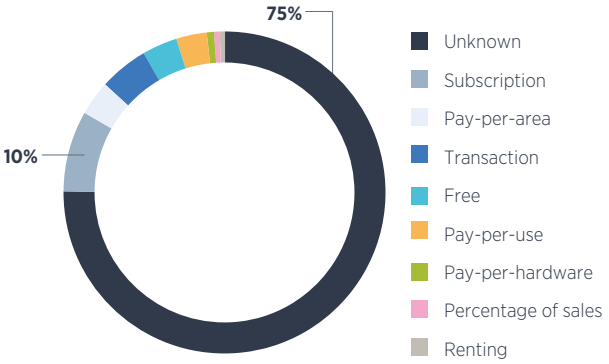

Figure 21: *Start-ups: revenue model*

Source: PA Consulting Group

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Where are start-ups and technology companies getting their funding?

Many companies prefer to keep their funding and sources of finance under wraps. We were able to gather investor information for 130 of the 200 companies covered by our survey. For these, funding comes from a range of investors: venture funds, accelerators, corporates, crowd sourcing and public organisations such as the EU. Most have funding from more than one category and often, within each category, from more than one source.

Venture capitalists and private equity companies are the prime source of funding for most start-ups and technology companies. 106 companies have funding from venture funds, with 18 and 17 securing funding from accelerators and corporates, respectively. EU and public funding, enjoyed by 12 companies, is always awarded in conjunction with other investors.

Venture capital and private equity funding is enabling these start-ups and technology companies to rapidly develop new products and services. But many are in the dangerous position of doing this without having identified customers or routes to market. Even if the main driver is to develop the business for acquisition, these companies should also define a sustainable business and revenue model – in case they are not ultimately acquired.

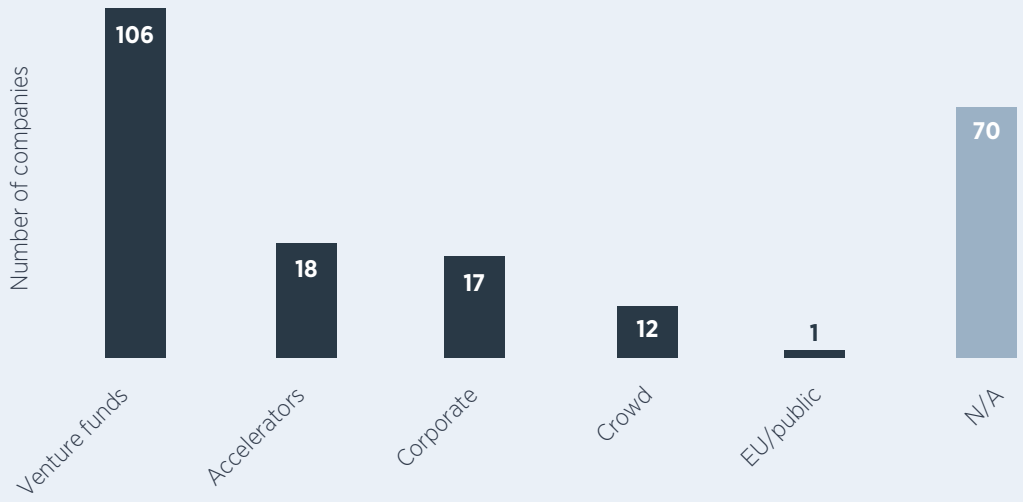

Figure 22: *Start-ups: business model type.*

Source: PA Consulting Group

CASE STORY

University of Cambridge: A collaboration with PA Consulting Group to make farming smarter

We're working with the University of Cambridge to combine different technologies in the best way to solve specific problems for farmers, food producers and others. We've used drones to produce 2D and 3D maps of fields. The data will help farmers increase crop yields through insights about 'lodged' crops that bend at the stem and can't be harvested. And we've explored how machine learning can combine the maps with other data to see problems like this coming, so farmers can tackle them early and keep costs down.

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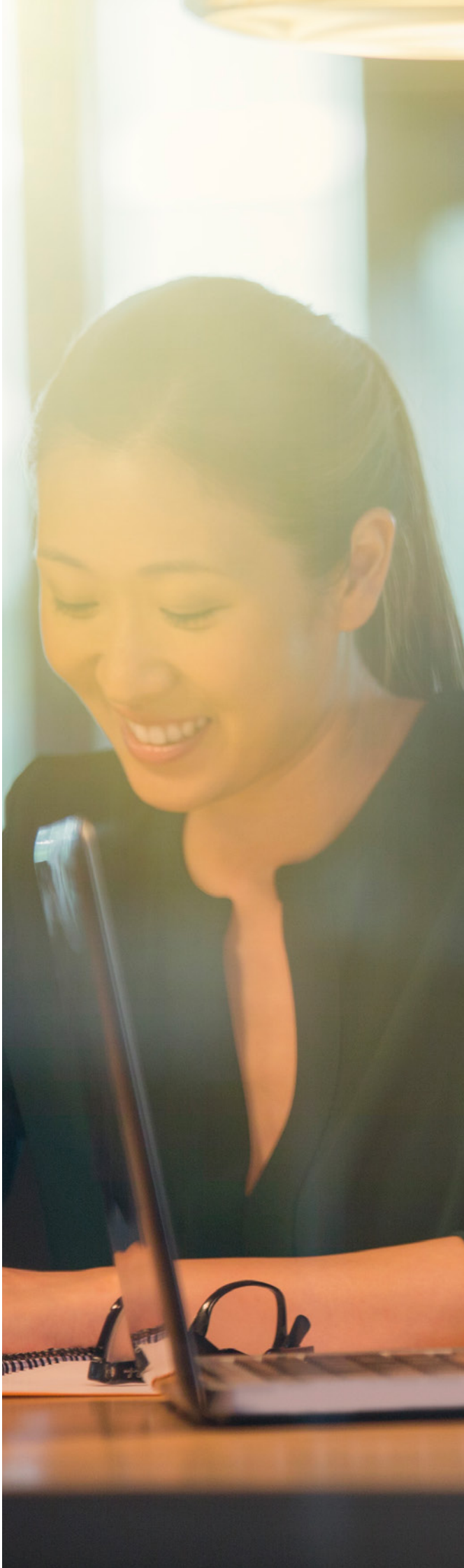
ABOUT OUR RESEARCH

Our research took place between January and July 2017 and is based on publicly available information. We used sources such as Crunchbase, Owler, AngelList, Bloomberg and AgFunder.

We aimed to include enough companies to detect patterns and trends. Our analysis is restricted to companies with information available in English. So companies in Latin America with websites only in Spanish or Portuguese, for example, are not included.

We allocated each company to one of three categories of data-driven business (data capture, data analysis, decision support) according to its main activity. A sensor company might offer some kind of software for data analysis but focus most of its R&D on manufacturing and selling the sensor that captures the data. In that case we categorised the company as a data-capture company, not a software or decision-support company.

We only included companies offering data-related products and services.



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As strategies, technologies and innovation collide, we turn complexity into opportunity.

Our diverse teams of experts combine innovative thinking and breakthrough technologies to progress further, faster. Our clients adapt and transform, and together we achieve enduring results.

We are over 2,600 specialists in consumer, defence and security, energy and utilities, financial services, government, healthcare, life sciences, manufacturing, and transport, travel and logistics. And we operate globally from offices across the Americas, Europe, the Nordics and the Gulf.

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