Transforming Biocontrol: The Role of AI in Revolutionizing Agricultural Practices

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Luca Volontè / Analyst / Agribusiness Crop Science

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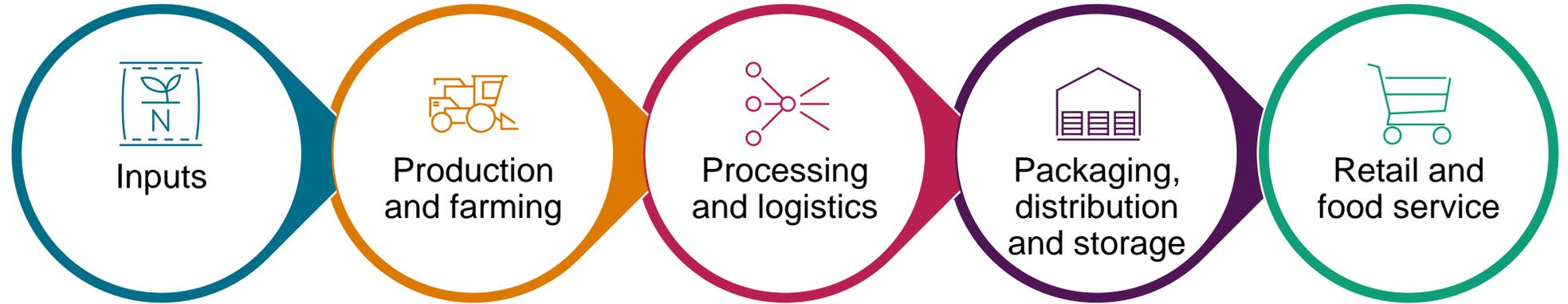
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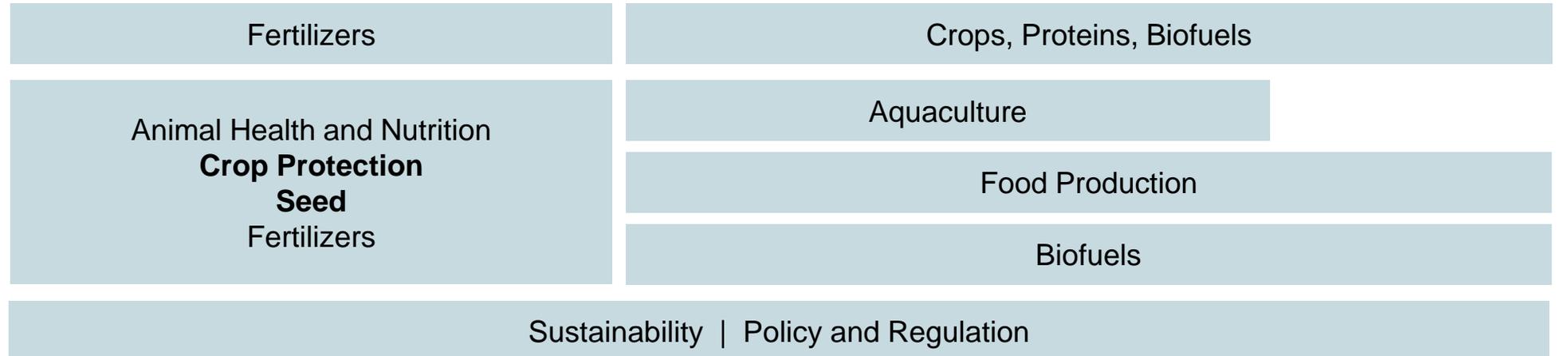
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Agriculture value chain

S&P Global Agribusiness provides expertise and coverage across the value chain

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| Inputs | Production and farming | Processing and logistics | Packaging, distribution and storage | Retail and food service |

Covering:
- Supply and demand
- Price and forecasts
- News
- Market sizing
- Costs and margins
- Insights

Fertilizers	Crops, Proteins, Biofuels
Animal Health and Nutrition **Crop Protection** **Seed** Fertilizers	Aquaculture
	Food Production
	Biofuels
Sustainability | Policy and Regulation	

Data compiled October 2025.
Source: S&P Global Commodity Insights.

A significant challenge at hand

By 2050, agriculture will need to produce almost 50% more food, fiber and biofuel than in 2012[*]

In the context of climate change, limited land and natural resources:

- Adapt to changing weather patterns
- Keep soils fertile, protect biodiversity
- Tackle pests

Produce more with less:

- Supply affordable, sufficient, nutritious, safe and sustainably produced food
- Contribute to biofuel demand
- Support the circular bio-based economy and contribute to a lower atmospheric CO_2 concentration

Increase yield with:

- New seed technologies, resistant traits to biotic and abiotic stress
- New PPP, more pest-specific, lower AI rates, less toxic
- Biologicals (BCAs, Biostimulants, Biofertilizers)
- Digital agriculture, new application methods, AI

Global crop production future growth factors

Pie chart:
- Yield growth: 87%
- Cropping intensity: 7%
- Land use expansion: 6%
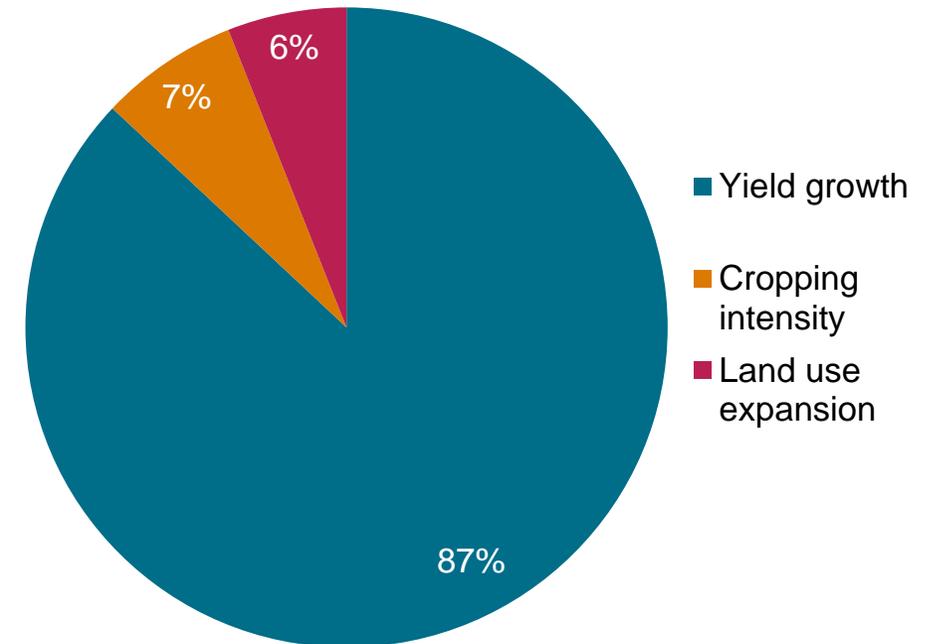
Increasing crop productivity and quality:
More yield | Limited land | Less fertilizers | Less water | Less pesticides

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AI is not a new technology in the market

AI timeline

1950–60
Supervised ML

1970–80
Unsupervised ML

1980–90s
Reinforced ML
Recurrent neural network

2017
Transformer

2020–22
Large language models
Retrieval augmented generation

2023
Large multimodal models

2024
Agentic AI
Nobel prize: Use of an AI algorithm to solve the protein-folding problem

Developing
Causal AI

Now
Narrow AI

Future
Artificial general intelligence
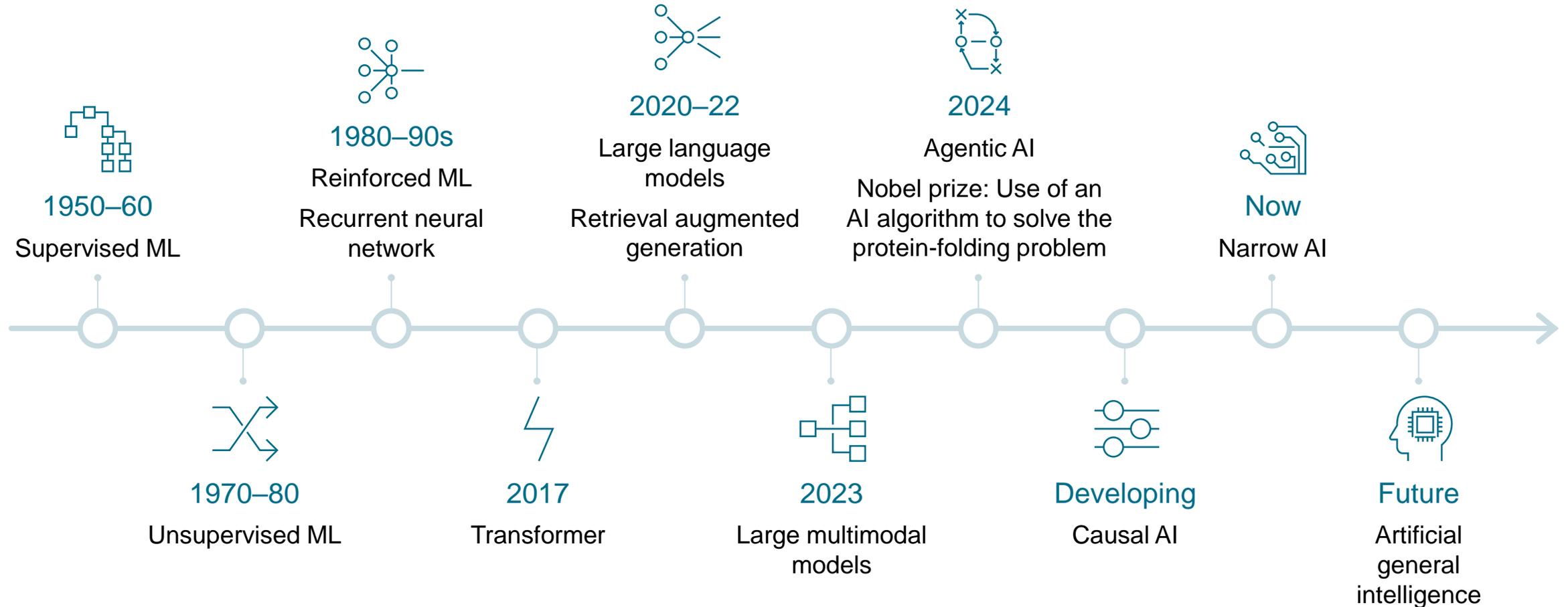
Data compiled October 2025.
Source: S&P Global Commodity Insights.

AI in pharmaceuticals

- **Large pharmaceutical companies** were **early adopters** and are **investing** heavily in AI
- The industry's earliest AI projects date back about a decade and have culminated in the licensing of machine learning modules used in **drug discovery** to identify potentially useful compounds and explore potential applications
- Early adoption of AI was characterized by big pharmaceutical companies' deployment of machine learning systems developed by **technology companies**. That combination of big pharma and big tech has expanded from then.
- At the same time, big pharmaceutical companies are increasingly **partnering** with smaller, **AI-driven pharmaceutical companies** to accelerate drug discovery processes
- Successes and advancements in AI have led to **wider adoption**, **integration**, and **new applications** of the technology in drug development.
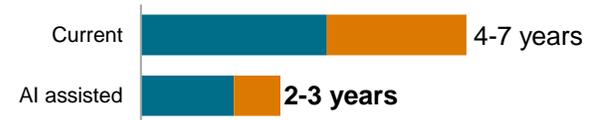
AI in pharmaceuticals: bigger budgets, faster development
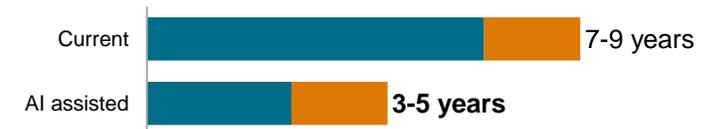
Global pharmaceuticals' AI budgets

2022
$1 billion

2027

$22 billion
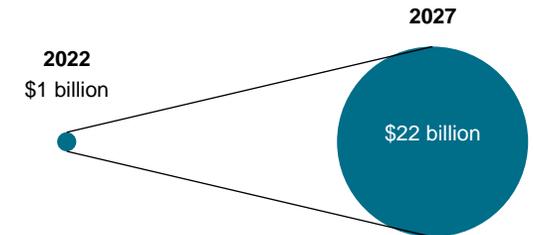
Faster development of new medicines

Drug discovery and pre-clinical studies

Current — 4-7 years

AI assisted — **2-3 years**

Clinical development

Current — 7-9 years

AI assisted — **3-5 years**

Data compiled October 2025.
Source: S&P Global Ratings, Boston Consulting Group;

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Market resistors: Hurdles for biologicals to cross

- **R&D costs and go-to-market timelines**: especially relevant in a market that is becoming more stringent toward conventional PPP and an increasingly competitive biologicals market where innovation is crucial.

- **Complex molecules:** can present production, formulation, and supply chain challenges. These often require specialized knowledge and technology, which may not be readily available to all manufacturers, leading to bottlenecks in supply chains.

- **Market reputation**: the perception of agricultural biologicals can be a barrier to acceptance.

- **Efficacy and breadth of spectrum**: in some cases, their performance may not always match that of conventional chemical products.

- **Mode of Action**: the contact action of many biologicals versus systemic action can limit their effectiveness in certain applications.

- **Variable results**: the variability in results due to multiple influencing factors can lead to skepticism.

- **Expertise gap**: lhe lack of deep expertise among growers and advisors is a significant barrier.

1 – R&D costs and go-to-market timelines

2 – Profitability

3 – Complexity

4 – High cost of production

5 – Storage and logistic challenge

6 – Market reputation

7 – Versatility and efficacy versus conventional
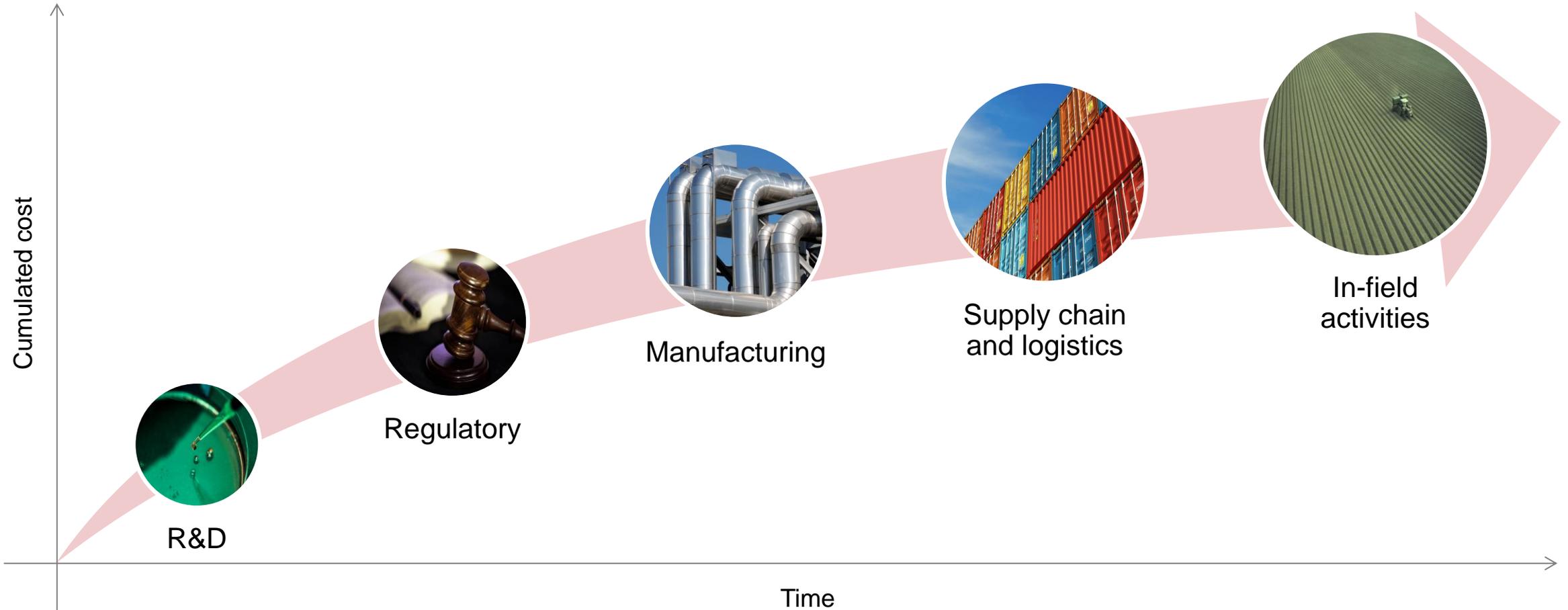
8 – High number of treatments needed

9 – More difficult to use, more technical support needed

Can AI facilitate further growth in the field of biologicals?

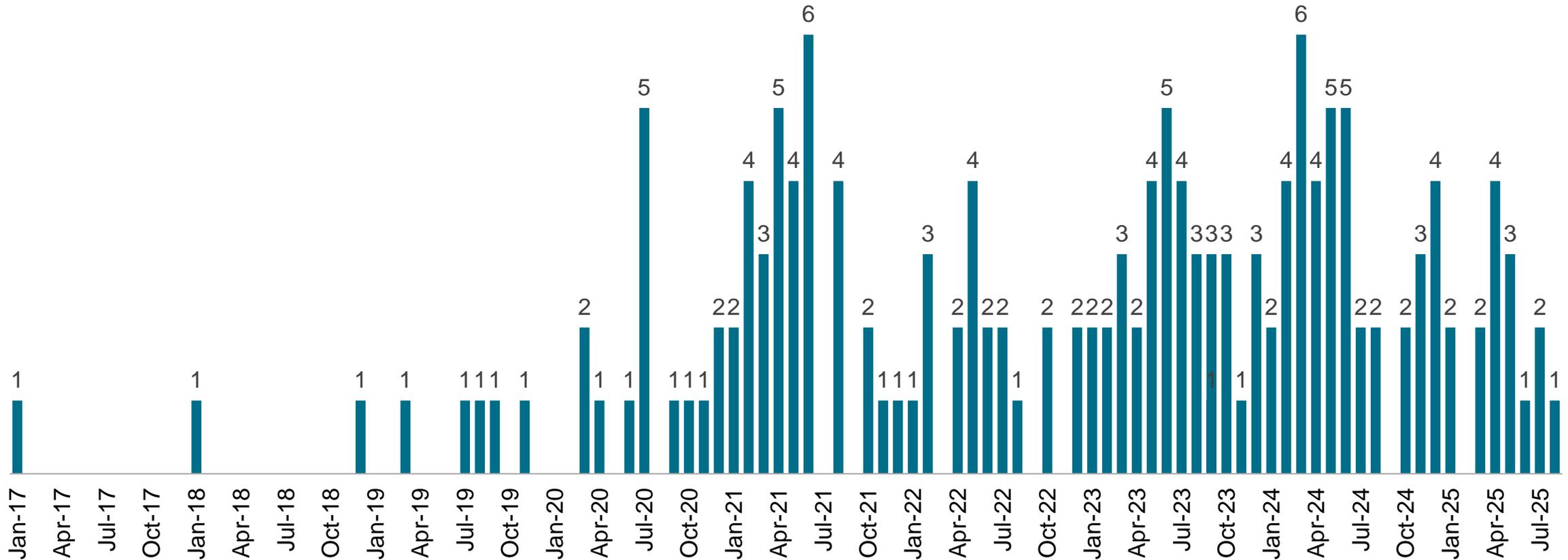Data compiled October 2025.
Source: S&P Global Commodity Insights;

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AI in the crop science sector

Cumulated cost

R&D

Regulatory

Manufacturing

Supply chain
and logistics

In-field
activities

Time

Data compiled October 2025.
Source: S&P Global Commodity Insights.

AI and machine learning deals in the crop science sector

Count of AI and machine learning deals in the crop science sector (2017– August 2025)

Data compiled October 2025.
Source: S&P Global Commodity Insights;

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Major crop science company investments and partnerships

	Investment		Collaborations	
	Company	**Objective**	**Company**	**Objective**
BASF	Computomics (2021) EAVision (2021) Ecorobotix (2018) Equinom (2019) Groundwork BioAg (2022) WayBeyond (2023)	R&D Robotics Robotics R&D Biologicals FMS	AGCO (2023) Bosh (2020) NEWGREEN (2025) Tecnalia (2014)	Targeted spraying Tech partner Soil tech R&D
Bayer	Apollo Agriculture (2019) Atomwise (2018) ChrysaLabs (2023) EarthOptics (2021) Oerthbio (2019) Pairwise (2017)	FMS R&D FMS FMS R&D R&D	AWS (2023) EY (2024) Ginkgo Bioworks (2022) IBM (2024) Iktos (2023) Microsoft (2024)	Tech partner — ML for R&D Tech partner Tech partner — Biologicals R&D Tech partner R&D Tech partner
Corteva	Micropep (2024) Pairwise (2024)	R&D R&D	Annogen (2025) Google Micropep (2025) Phytoform (2025) Profluent (2025)	R&D Tech partner R&D R&D R&D
FMC	Micropep (2021) Niqo Robotics (2021) Trace Genomics (Now Miraterra) (2020) Traive (2022)	R&D Robotics FMS Fintech	Cyclica (2020) Optibrium (2024)	R&D R&D
Syngenta	Decibel Bio (2025) EA Vision (2021) Greeneye Technology (2021) Phytech (2016) Stable (2022) Tarfin (2021) Traive (2021)	R&D Robotics Robotics FMS Fintech FMS Fintech	AWS (2024) Enko (2021) Ginkgo Bioworks (2024) Heritable Agriculture (2025) IBM (2024) InstaDeep (2024) TraitSeq (2025)	Tech partner R&D Tech partner — Biologicals R&D R&D Tech partner Tech partner — LLM for R&D Tech partner — Biologicals R&D

Data compiled October 2025.

Source: S&P Global Commodity Insights;

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Research and development

R&D process

- R&D process has long been characterized by high costs, lengthy timelines.
- It often involves the screening of countless microbial strains and molecules, followed by expensive and time-consuming formulation and field trial phases
- By leveraging vast datasets, from genomic and proteomic information to soil health and weather patterns, AI enables scientists to model complex biological interactions with unprecedented speed and accuracy, thereby reducing the time and capital required to bring novel biological solutions from the lab to the field

Company	Year founded	Latest fundings	Details
Aphea.bio	2017	2024 — secured € 1.9M in VLAIO funding 2023 — secured €70M in series C funding	APEXbio R&D platform → bundles several technologies together to create a high-throughput pipeline for discovering new biocontrol and biostimulant products for a variety of crops
Enko	2017	2023 — secured $80M Series C round 2022 — secured a $70M Series C round 2020 — raised a $45M Series B round	ENKOMPASS AI and Machine Learning discovery platform → identifying modes of action (MOA) and lead molecules 75% faster and at 90% lower cost than traditional R&D methods
Ginkgo Bioworks	2008	2021 — company goes public 2019 — raised $290M in Series E round	Discovery platform offering third-party R&D services to accelerate product development
Lavie Bio (now part of ICL)	2019	2025 — acquired by ICL 2022 — raised $10M in Series A round	Leveraging MicroBoost AI technology from Evogene, a tech-engine platform promoting discovery and development of microbial products, to accelerate biological R&D
Micropep	2016	2024 — raised $29M in Series B round 2022 — raised €8.75M in Series A1 round 2021 — raised $4.94M in Series A round	developed a platform that leverages the power of computational biology and artificial intelligence to browse genomes and identify potential micropeptides sequence candidates

Data compiled October 2025.
Source: S&P Global Commodity Insights.

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Regulatory, manufacturing, supply chain and logistics

- Regulatory activities:
  - Worldwide diversified rules and regulations
  - Data collection, summarization and analysis
- AI can also be used to improve the manufacturing process formulations
  - real-time collection and monitoring of biological data, which AI models will process accurately
  - digital twins will enable the testing of biomanufacturing processes in a virtual environment and experiments on organisms behavior in different environments and outside the laboratory
- Supply chain and logistic activities can be enhanced by a better understanding of demand dynamics related to changes in the forecasted consumption of a specific product

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Demand generation and in-field activities

Company/entity	Details
US University of California, Davis	Developed an AI-based digital tool to assess plant health. The Leaf Monitor can be used through a smartphone and leverages a spectrometer alongside technologies such as predictive modelling. The institute claims that the innovation offers "real-time nutrition and trait information in the field"
CropX	Acquired peer agronomic intelligence business Acclym. The development marks CropX's seventh acquisition in the space following the takeover of US farm sensors business EnGeniousAg in 2024, as well as Australian irrigation solutions business Green Brain and US precision irrigation business Tule Technologies in 2023
Ecorobotix	Expanded the capabilities of its AI-driven precision smart spraying system, ARA. The solution has been equipped with an algorithm to enable "plant-by-plant" lettuce thinning without additional equipment or manual labor, says the company
FarmQA	Raised $4M in seed funding from a host of investors, including Florida-based US venture capital firm O'Leary Ventures. The proceeds are to fuel the company's expansion activities and strategic acquisitions, besides aiding the development of its artificial intelligence (AI)-based analytics and "enhanced" data integration capabilities
Ceres AI	Partnered with Bayer's Crop Science division's, The Climate Corporation, to integrate its "advanced" data analytics with the latter's FieldView digital platform
Iunu	Raised $20M to fuel its expansion into North American and European markets. The capital is to be leveraged to foster the adoption of its artificial intelligence (AI)-derived Luna imaging platform across the high-value vine crop segment featuring cucumbers, peppers, and tomatoes, and to expand the company's workforce
Koppert	Looking to expand the functionality of its AI-driven agronomic support tool, Digital Assistant. The business describes the expansion as a "new stage of development" enabling the application to deliver "broader, context-aware answers". These will include detailed product information, tailored advice on IPM strategies, data on past and upcoming order details, as well as insights into historical and scheduled product usage

- Another significant impact of AI on the biologicals sector is in the field, where it helps answer the critical questions of what product to apply, how to apply it and when. This addresses the core challenge of biologicals' variable efficacy, and lack of knowledge turning them into a precision tool.

- Major agricultural companies are already deploying digital farming platforms that leverage AI to guide input decisions (Bayer's Climate FieldView; BASF's xarvio Digital Farming Solutions; Syngenta's Cropwise; FMC's Arc Farm Intelligence)
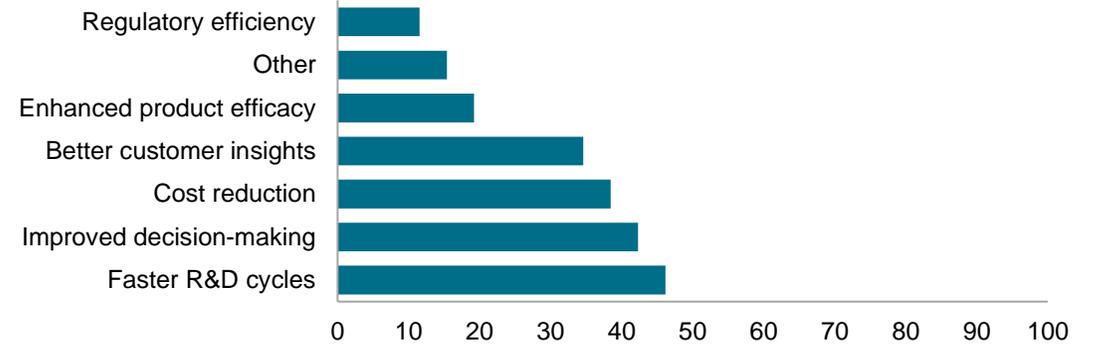
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Source: S&P Global Commodity Insights.

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The Role of AI in Revolutionizing Agricultural Practices

Current use of AI - Areas
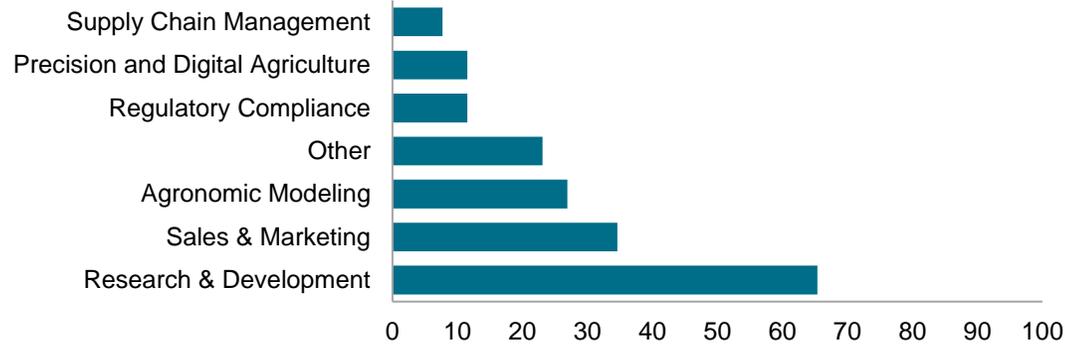
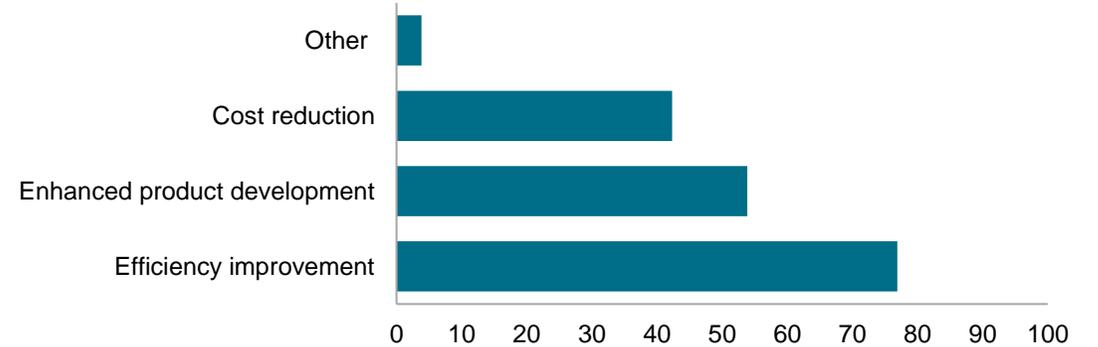**Current use of AI - Main benefits**

Future impact

Future advantages in R&D

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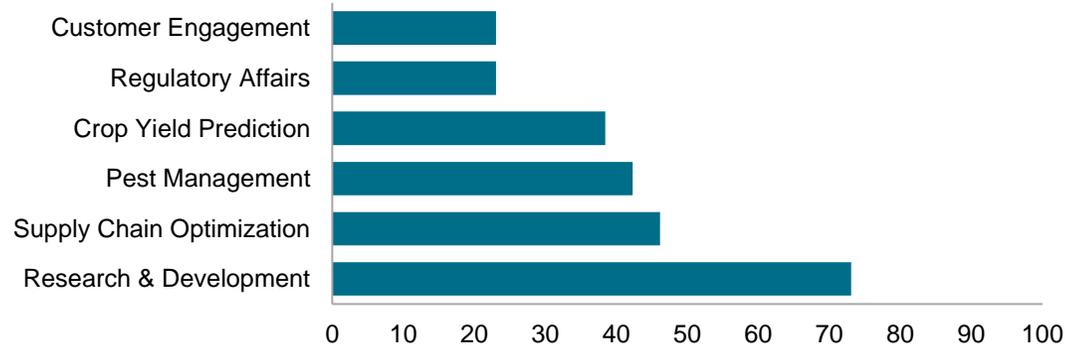
Conclusions

- There are plenty of opportunities for the successful application of AI in the agricultural, and more specifically crop science, sector
- There will be an **increasing number of collaborations** and **partnerships** among leading biological companies, startups, and technology providers
- AI will continue to reduce the timeline and costs of R&D activities, **empowering innovation** and increasing the rate of new products coming to market
- **Data Availability, Accuracy, Protection, and Ownership** will remain crucial to ensure access to high-quality datasets
- Investing in **workforce training and upskilling** is essential to equip workers with the necessary skills to leverage AI technologies effectively
- **Profitability for downstream applications** remains critical for AgTech success
- Overcoming skepticism and resistance among farmers for widespread implementation and improving **acceptance**
- Leveraging AI for **training farmers** on product usage and benefits can foster greater acceptance and effective application of biologicals
- In agriculture, a higher degree of precision is required than in other fields; thus, maintaining a **human-in-the-loop** approach is critical to ensure accuracy and context

Streamlining the path to market for biologicals not only **boosts profitability** but also **makes sustainable solutions more attractive.** By alleviating farmer challenges, we **pave the way for widespread adoption of innovative biological solutions** in the field

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We value your insight!

We have designed a survey to gain insights into the industry's current adoption of AI and to gather expectations for future developments in the biocontrol sector.

Your insight and expertise are vital to the success of this study!

Please scan the QR code on this slide to take part and share your thoughts…

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Contact us

Primary contact(s)

Luca Volontè

luca.volonte@spglobal.com

Contact us

Americas	+1 800 447 2273
Japan	+81 3 6262 1887
Asia-Pacific	+60 4 291 3600
Europe, Middle East, Africa	+44 (0) 134 432 8300

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