

# THE FUTURE OF AGRIBUSINESS INVESTING PRESENTATION OF THE FOURTH YEAR RESEARCH ACTIVITY

**Marianna Lo Zoppo**  
AGRI Lab Coordinator

22 SEPTEMBER 2022



Università  
Bocconi  
MILANO

ANTIN  
INFRASTRUCTURE PARTNERS

# AGENDA

## Project overview

- Research objectives

## Forces affecting agribusiness: between challenges and opportunities

- Driving forces
- Trends impacting the agribusiness industry
- Agribusiness industry challenges
- An overview of innovation trends

## Innovation trends in the agribusiness supply chain

- Technological innovations scorecards
- Innovations' technical and business development
- Innovations' technical and business development vs legitimacy
- The link between agribusiness challenges and innovations
- The future of agribusiness investing



# PROJECT OVERVIEW



Università  
Bocconi  
MILANO

ANTIN  
INFRASTRUCTURE PARTNERS

## Research objectives

1. **Providing an updated overview of those forces of change (i.e. megatrends) that are impacting all sectors, including agribusiness,** and that are providing both challenges and opportunities.
2. **Describing innovation trends in the agribusiness industry, with a focus on new technologies.** The analysis has the aim of making order among the existing innovations, clustering them in several levels.
3. **Outlining the most promising technologies and related businesses opportunities (i.e. investment “themes”)** by analysing each technological innovation from a systemic perspective and assessing its potential according to technical and business development and institutional and social indicators.



# FORCES AFFECTING AGRIBUSINESS: BETWEEN CHALLENGES AND OPPORTUNITIES

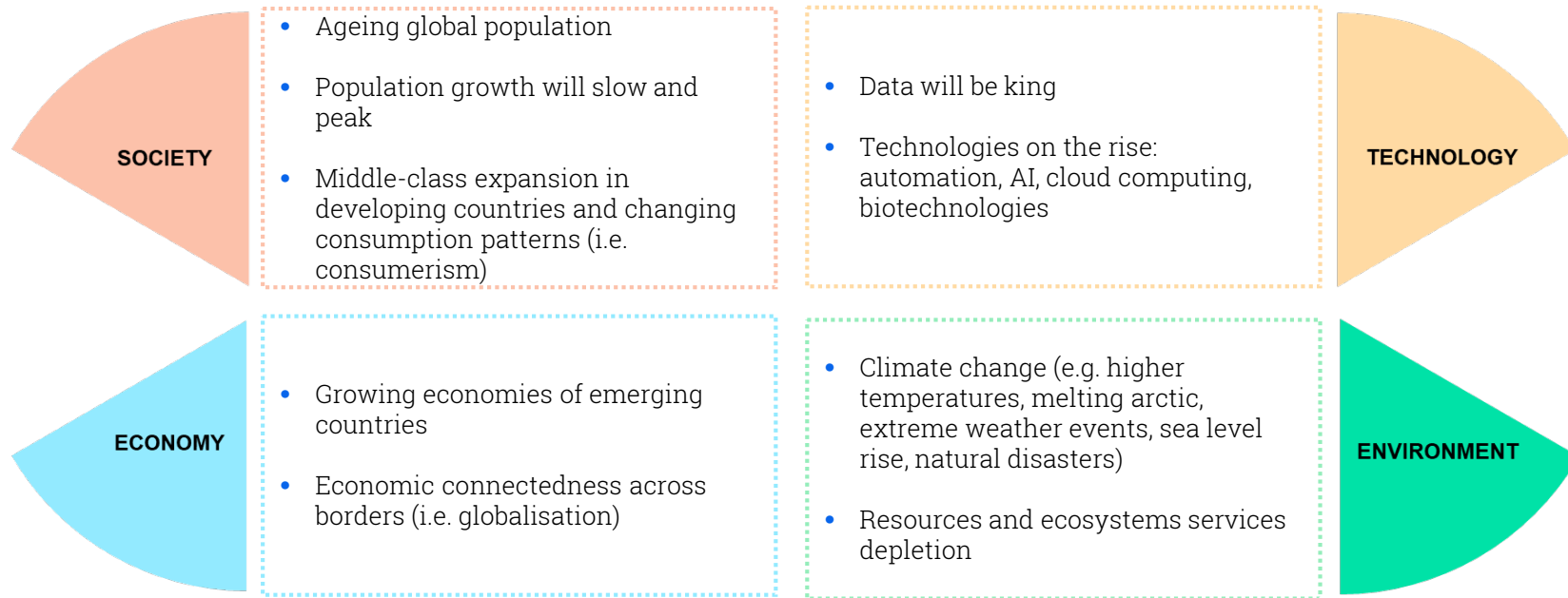


Università  
Bocconi  
MILANO

ANTIN  
INFRASTRUCTURE PARTNERS

## Driving forces

Driving forces are “mega-trends that exert an influence on an above-average number of other global phenomena”. They have been derived by including the previously identified mega-trends into a cross-impact matrix aimed at assessing the influence of each mega-trend on the others.



# Trends impacting agribusiness industry



## Growing demand and changing dietary preferences

The expected growth of the world population, and of its average income, together with the ongoing urbanisation will determine a **rise in the food demand and changes in the dietary preferences of many countries.**



## Climate change and resource scarcity

**Agri-food systems account for 31% of the global GHG emissions.** Tackle climate change and resource (water, land etc.) scarcity starting from emissions reduction are among the priorities of all political agendas.



## Technological innovation and hyper-connectivity

Technology could determine up to a 30% growth in yields, and it could improve processes efficiency and environmental footprint, and enable innovative business models along the entire agri-food value chain.



## Integration of global trade

In face of the increasing demand for food, **trade has a key role to play as imports may counterbalance domestic lack of food supply due to limited natural resources or supply chains disruption.** However, globalisation may entail entry barriers and unfair trade practices.



# Agribusiness industry challenges



## Agriculture productivity and management of food loss and waste

To respond to the expected food demand growth and to the new dietary preferences, **a 50% increase in food and feed production with respect to 2019 levels is required**, other than a reduction in the current degree of food loss and waste.



## Efficient use of resources and enhancement of ecosystem services

**Agribusiness needs** to renovate its processes, and to encourage new diets **to ensure food security while reducing its environmental footprint**. At the same time, it needs to tackle climate change with more resilient processes and supply chains.



## Improvement of public nutrition and health

While about 821 mln people is undernourished, about 1.9 bln people is overweight. **Beyond producing enough food to feed the world population, the agri-food system is required to reduce its imbalances to improve public nutrition and health.**



## Better distribution of value along the supply chain

**Long and complex food supply chains are often characterised by an unbalanced distribution of value among operators.** Due to their dimensions manufacturers and retailers hold most of the value added produced in the supply chain.





# An overview of innovation trends



**RENEWABLE ENERGY IN  
AGRICULTURE**



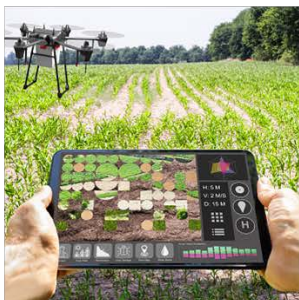
**CHEMISTRY AND  
BIOTECHNOLOGY**



**NOVEL FARMING SYSTEMS**



**INNOVATIVE  
AQUACULTURE**



**AGRI TECH**



**ALTERNATIVE PROTEINS**



**FOOD SAFETY AND  
TRACEABILITY**



**E-COMMERCE**



**Università  
Bocconi**  
MILANO

**ANTIN**  
INFRASTRUCTURE PARTNERS

# An overview of innovation trends

## AGRI TECH



Agri-Tech

Fuel  
efficiency

Farming  
automation

Data collection  
and analysis

Hybrid and pure  
electric vehicles, fuel-  
cells hydrogen and  
autonomous vehicles

On-field and post  
harvest robots ,  
precision irrigation  
technology, IoT, AI

Climate forecasts,  
farm management  
software, UAV,  
satellites, IoT, AI

>

- Each innovation trend consists of two or more applications that can be defined as combinations of technologies for specific purposes. If Agri-Tech is the trend, farming automation, fuel efficiency and data collection and analysis are the applications. **Technologies instead contribute to applications' enabling.** Robots, AI, IoT, farm management software, aerial drones and satellites enable farming automation and data collection and analysis.
- All these technologies support the farmer in the **operational management** of the company and make it possible to **make targeted use of the main input** with direct positive impacts on the surrounding environment.



# An overview of innovation trends

## NOVEL FARMING SYSTEMS



### Novel farming systems

Vertical farming

Algae farming

Insect farming

Hydroponic, aeroponic or aquaponic growing systems, HVAC systems, IoT, AI

Harvesting from wild stocks (mechanical or by hand), aquaculture

Rearing system, food processing technologies

>

- **Novel farming systems** are new methods of farming living ingredients, many of which are traditionally grown outdoors. These **systems are considered sustainable** by innovators and start-ups that adopt them **as they use fewer natural resources to produce the same (or more) quantity of food** compared to traditional farming systems. Since they could change the paradigm of traditional agriculture novel farming systems have also emerged as an attractive solution for investors and governments who try to respond the food security challenge.
- In this study novel farming systems represent a trend that encompasses three applications that are **vertical farming, insect farming and algae farming**.



# An overview of innovation trends

## ALTERNATIVE PROTEINS



### Alternative proteins

Cultivated  
meat (fish,  
leather)

Plant-based  
products

Fermentation  
derived  
proteins

Cell culture media  
technology,  
bioprinting/ polymer  
spinning  
technologies

Extrusion technology,  
extended shelf-life  
processes,  
bioprinting

Cell engineering,  
Traditional/Biomass/  
Precision  
fermentation

>

- **Alternative proteins** is a term that encompasses a series of protein-rich ingredients sourced from plants, insects, fungi, or through tissue culture to replace conventional animal-based sources. Applying the latest technologies from biotech, tissue engineering, artificial intelligence, and food science, inventors and entrepreneurs worldwide are **trying and succeeding in creating novel foods that are animal-free and**, according to them, even more affordable, healthier, and sustainable than traditional ones.
- In this study alternative proteins represent a trend that comprehends three applications that are **cultivated meat, fermentation derived products, and plant-based meat.**



# INNOVATION TRENDS IN THE AGRIBUSINESS SUPPLY CHAIN



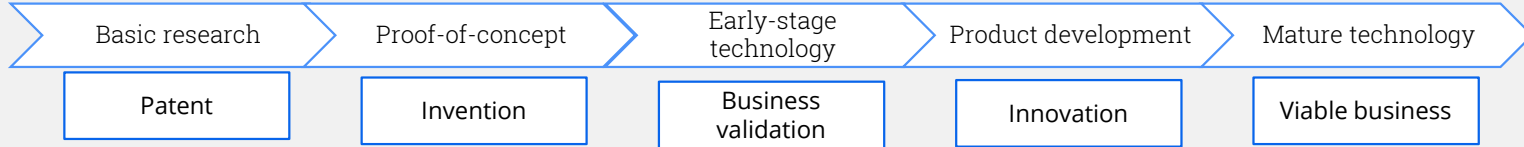
Università  
Bocconi  
MILANO

ANTIN  
INFRASTRUCTURE PARTNERS

# Technological innovations scorecards

## Technical and business development

Technical and business development were assessed through interviews and experts' responses were traced back to a 5-points Likert scale.



## Legitimacy

Technology legitimacy was split into 4, as per literature. Each legitimacy was assessed through interviews and experts' responses were then traced back to a three-points Likert scale, ranging from absent to full legitimacy, represented in the scorecard by a traffic-light.



**Cognitive legitimacy** can be defined as the spread of knowledge regarding a technological innovation to social audiences.



**Normative legitimacy** regards judgements about whether an innovation is right for society. These judgements are based on norms and values that are socially constructed over time.



**Pragmatic legitimacy** is about the utility that a technological innovation has for its potential adopters.



**Regulatory legitimacy** concerns the alignment of new practices with existing rules, laws, and regulations issued by governments, credential associations, professional bodies, or powerful organizations.

## Functionality

Each application/trend has been traced back to the industry challenges identified in the first part of the research to verify the coherence of the technological innovations of the sector with the major challenges it is going to face in the next years.



Agriculture productivity and management of food loss and waste (ensuring food security)



Efficient use of resources and enhancement of ecosystem services

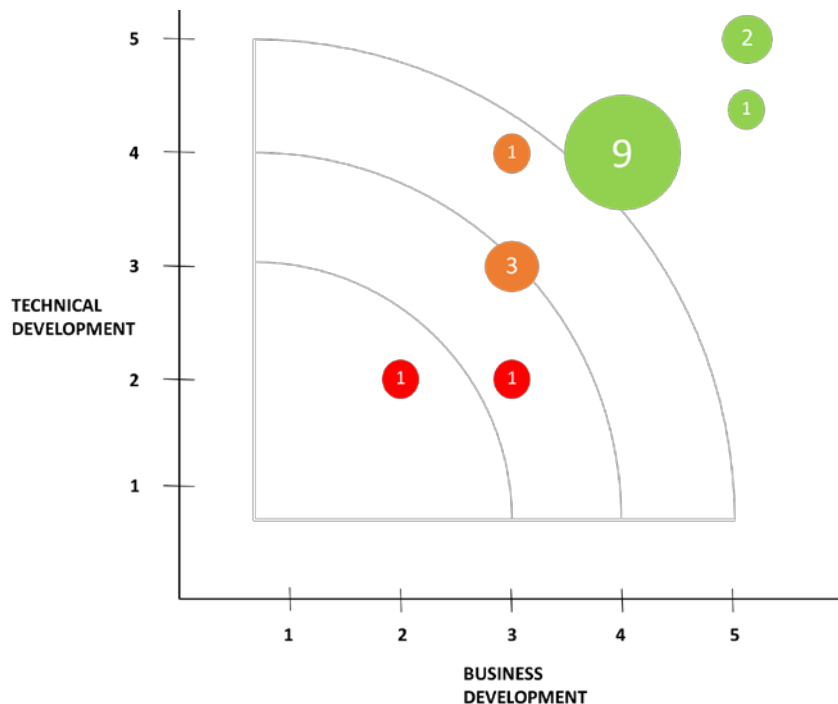


Improvement of public health and nutrition



Better distribution of value along the supply chain

# Innovations' technical and business development



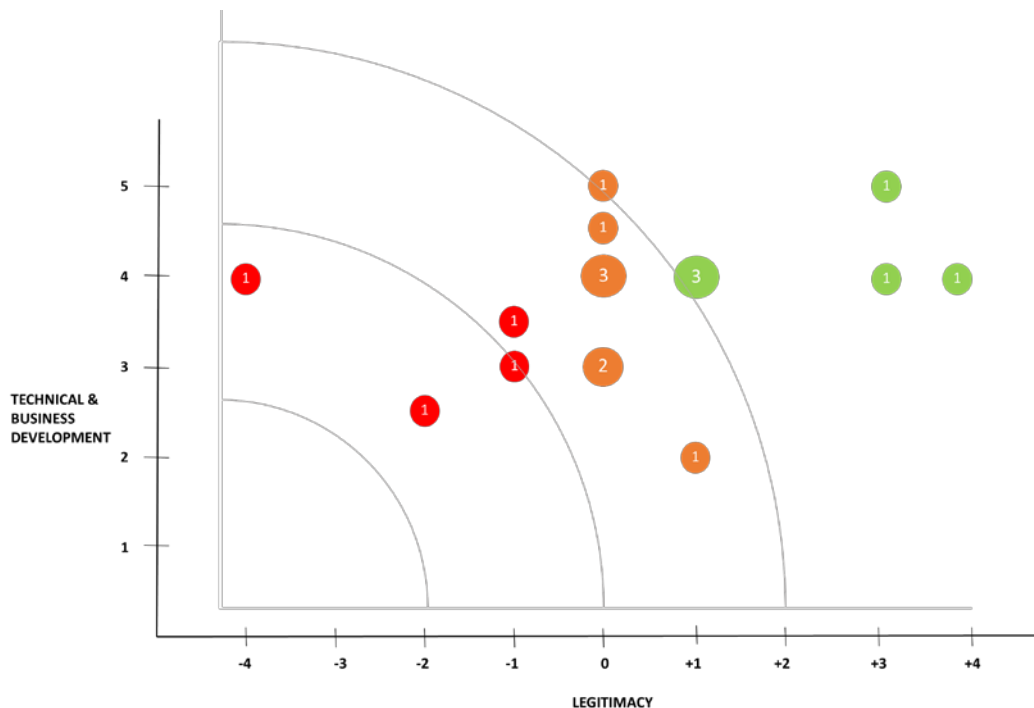
The chart shows that **the innovation in the agribusiness industry is driven by technologies that have entered successfully the market, but are still subject to continuous improvements, and viable businesses** (highlighted in green).

Innovations that are **at the level of the “invention”** and from a technical standpoint **are at the proof-of-concept stage** are **more rare** and they tend to represent a branch of technologies and know-how already developed in other sectors / businesses.

- Bioenergy production, intelligent agrovoltatics, solar desalination for irrigation, NBT for plants and livestock, algae farming, innovative aquaculture, agri-tech, plant-based products, smart packaging, food preservation technologies and food delivery.
- Vertical farming, insect farming, cultivated meat and smart packaging.
- Fermentation-derived proteins and NBTs for fishes.



# Innovations' technical and business development vs legitimacy



The **green cluster** identifies technological innovations that have entered successfully the market and, at the same time, benefit from a widespread legitimacy.

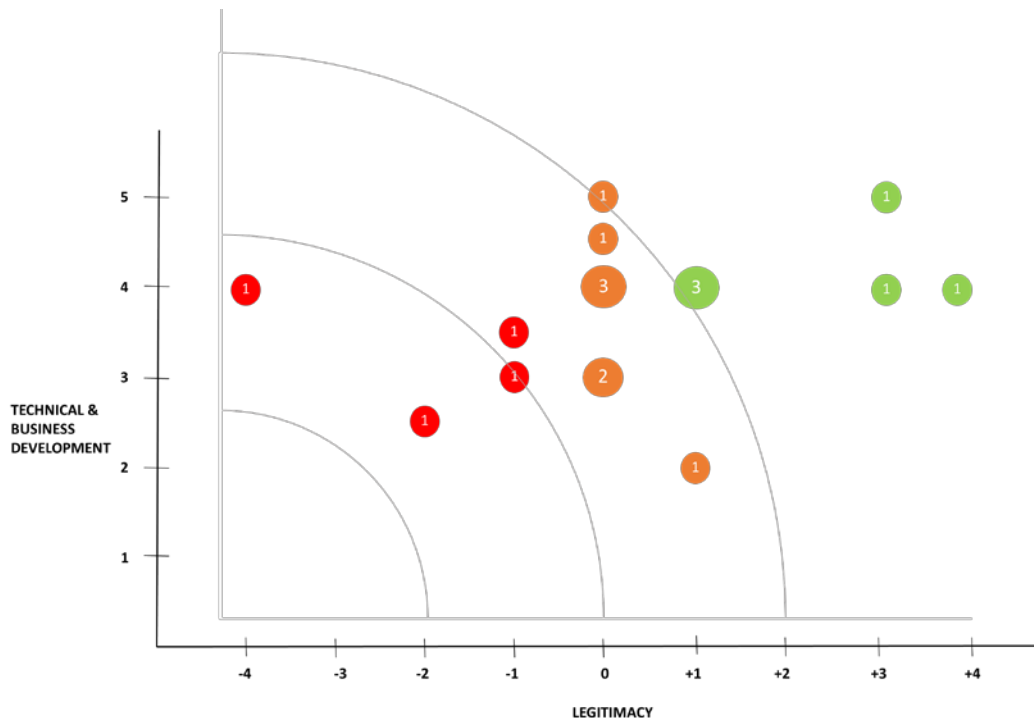
If on one hand the social audience's comprehension of technological innovations (cognitive legitimacy) is rare for almost all identified innovations, the technologies included in the green cluster are considered **aligned with societal norms and values** and, on average, are supported by rules, laws, and regulations because they answer to key challenges of the agribusiness industry.

Algae farming, innovative aquaculture, agri-tech, plant-based products, smart traceability, and food delivery





# Innovations' technical and business development vs legitimacy



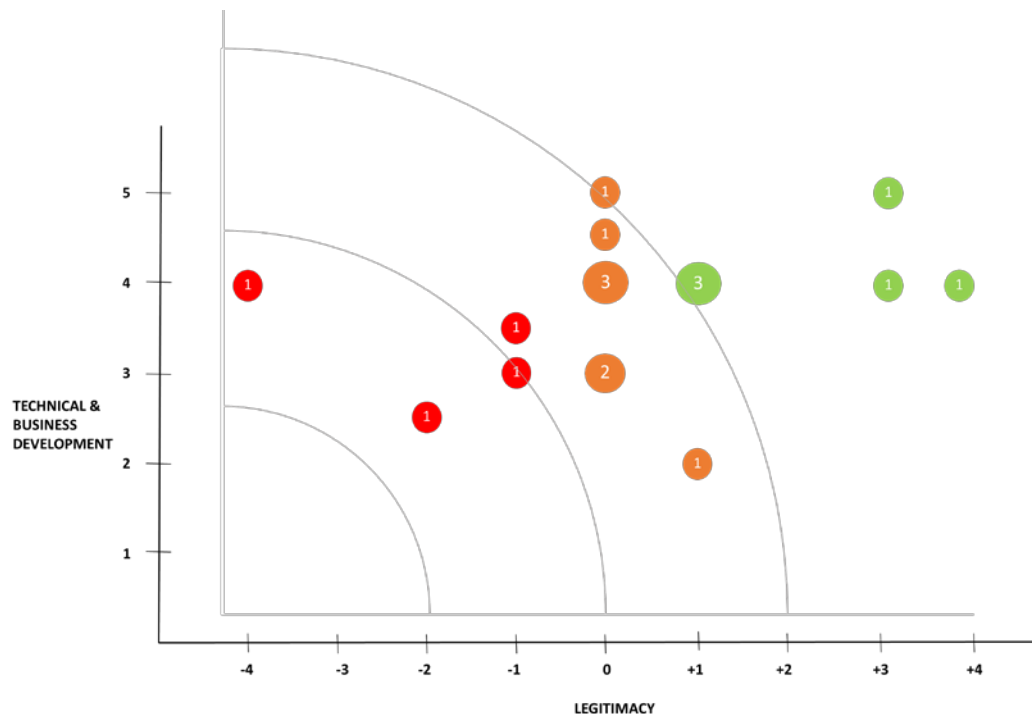
The **orange cluster** identifies technologies that have a low level of legitimacy among the social audience or are limited by a regulatory gap.

NBT for plants, for example, has a great potential limited by the global regulatory framework: in fact, there are countries with a clear normative positioning, while others such as EU and China that still lack a clear normative framework. On the other hand, there are technologies such as bioenergy production or NBT for livestock that are supported by legislation but hindered by ecological and animal rights concerns from the public, and not-in-my-backyard attitudes.

NBTs for pants and livestock, bioenergy production, solar desalination for irrigation, food preservation technologies, insect farming, cultivated meat, fermentation-derived proteins




# Innovations' technical and business development vs legitimacy



The **red cluster** identifies technologies that suffer from a lack of legitimacy and on the other hand need to make progress from a technical and commercial point of view.

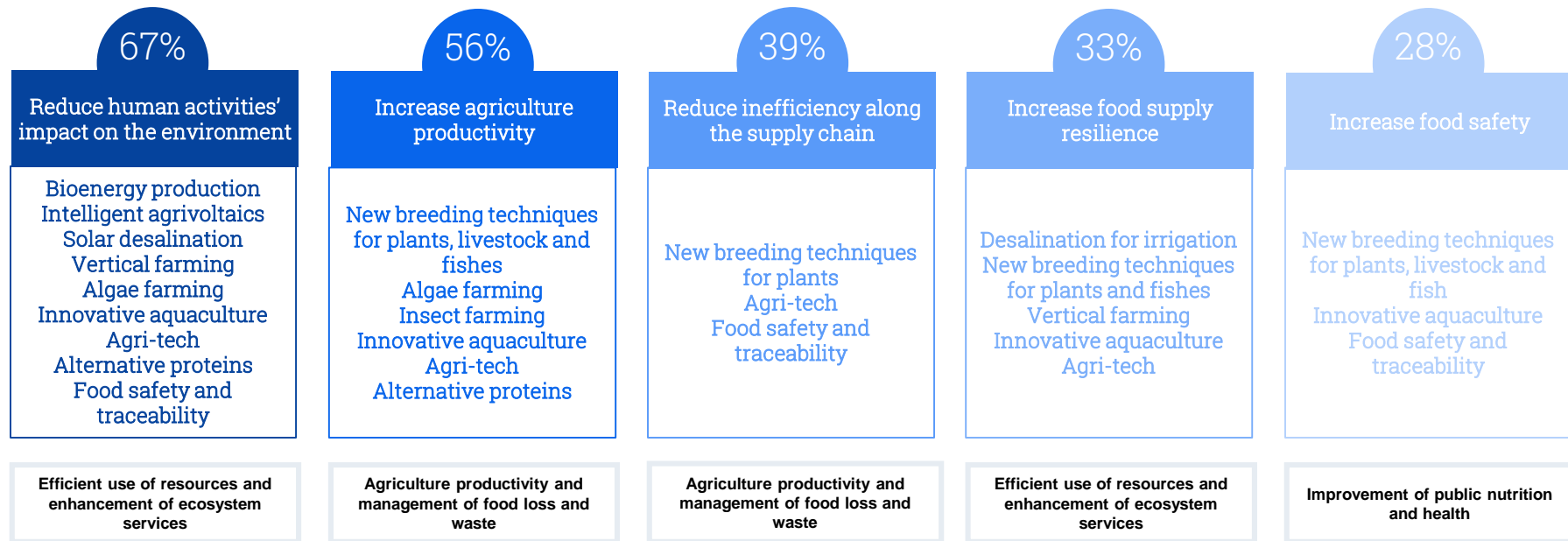
Vertical farming for example, is not yet entered in the public discourse and from a technical point of view it is still necessary to reduce the cost of energy which has a considerable impact on the gross margin. Similarly, smart packaging is not understood by consumers and suffers from the widespread diffusion of its cheaper alternative represented by biodegradable packaging. As for intelligent agrovoltatics, it represents an exception as the technology is quite mature but it trigger local communities' protests concerning the aesthetic damage to the natural landscape and overall there is a regulatory gap concerning these innovative systems.

 Intelligent agrovoltatics, NBTs for fishes, vertical farming, and smart packaging



# The link between agribusiness challenges and innovations

Analyzing the innovations' scopes, namely the objectives that they serve, it emerges a clear link to the agribusiness industry challenges.



# The future of agribusiness investing

Four major innovation clusters can be identified according to their future diffusion and of the key factors needed to enable it.

## NEXT EPISODE



**Technologies expected to be widespread within the next ten years**, although there is still some **uncertainty about full-scale adoption** of their most advanced versions.

Aquaculture, agrovoltatics, innovative packaging, agri-tech

## INCREMENTAL INNOVATION



**Technologies expected to be increasingly adopted**, but technological **advances** are still required to **reduce their costs**.

New breeding techniques for livestock, desalination for irrigation, vertical farming

## ACCEPTABLE BUT NOT (YET) ACCEPTED



**Technologies with a significant diffusion potential**, but **legitimacy and normative factors** may **undermine their extensive deployment**, confining some of them to niche markets.

Alternative proteins, food preservation techniques, insect farming, NBT for plants

## TECHNOLOGY LEAP NEEDED



Technologies whose **potential of diffusion is tightly connected to the rate of adoption of other**, alternative or complementary, **technologies**.

Bioenergy, algaeculture, new breeding techniques for fish, food delivery



THANKS.



Università  
Bocconi  
MILANO

ANTIN  
INFRASTRUCTURE PARTNERS