Are European Food
SMEs ready for

Artificial
Intelligence?

2021

Writen and coordinated by:

eit Food

AI TALENTVM

AZTi
MEMBER OF
BASQUE RESEARCH
& TECHNOLOGY ALLIANCE

INDEX

HOW CAN DATA BE USED
IN THE FOOD INDUSTRY?

1

The food & beverage industry accounted for 15.2% of the manufacturing turnover in 2017, as well as for 15.6% of the investments in the manufacturing sector, according to the latest data published by Food Drink Europe. Still, the labour productivity in the European Food Industry is lower than the average for the manufacturing industry: 51,000 euros/person vs. 65,000 in the whole manufacturing industry.[1]

Digitalisation and the use of advanced technologies such as AI are crucial for increasing the overall competitiveness of the food industry.

Digitalisation and the use of Artificial Intelligence (AI) based technologies such as robotics, cloud technologies, Internet of things, big data and data analytics, can not only play a central role in improving productivity based on real data, but also open the door to new business spaces as per proven feasible opportunities.

Key technologies for the digital transformation of companies.

Robotics and automated machinery

Movile Services

Cloud Technologies

Internet of things

Cybersecurity Solutions

Big data and data analytics

Additive Manufacturing (3D Printings)

Artificial Intelligence

Social Media

The digitalisation and further processing of data can be of a great help in the decision-making process, leading to the interconnection of processes in what it is called smart processing methods.

CLICK HERE FOR FURTHER INFORMATION

For instance, a food manufacturer could source their raw materials based on the expected demand by the market, or the cooking parameters could be adjusted based on the quality of the foodstuff that enter the processes, both leading to a reduction of food waste and loss.

In order to foster competitiveness among the European food industry, several innovation communities at the European Institute of Technology (EIT) – EIT Food, EIT Manufacturing and EIT Digital- launched an activity called "End-to-end digitalised production test beds" with the goal of fostering the adoption of digital solutions by the food industry.

SET UP, METHODOLOGY & SCOPE

2

In this context, EIT Food, with the support of AZTI and AI Talentum, performed an on-line survey to understand the perception and the level of adoption of AI-based technologies among the European food and beverage enterprises.

The European food industry is mostly composed of small and medium size enterprises (SMEs), with 288,672 companies or 99.2% of the total accounting for 43% of the turnover and added value of the industry.

99.2%
of the companies are SMEs

For this reason, it was decided to focus mainly on SMEs. More specifically, the study was performed on companies with 10 to 250 employees, as currently those are where digitalization has the largest potential for expansion in the first place, and are the ones with the highest investment capacity.

The survey targeted companies established in Spain, France, Italy, Germany and Poland, working in the food manufacturing industry within the Statistical Classification of Economic Activities (NACE - Nomenclature of Economics Activities) codes indicated below. The countries were selected based on the number of companies working on those fields, and the methodology used for collecting the information combined a remote and online CATI system telephone survey.

NACE codes used for classification of different types of industries within the food & drinks manufacturing.

Fresh product manufacturing

C10 - Manufacture of food products

- C10.1 – Processing and preserving of meat and production of meat products
- C10.2 – Processing and preserving of fish, crustaceans and molluscs
- C10.3 - Processing and preserving of fruit and vegetables

Food manufacturing

- C10.4 - Manufacture of vegetable and animal oils and fats
- C10.5 - Manufacture of dairy products
- C10.6 – Manufacture of grain mill products, starches and starch products
- C10.7 - Manufacture of bakery and farinaceous products
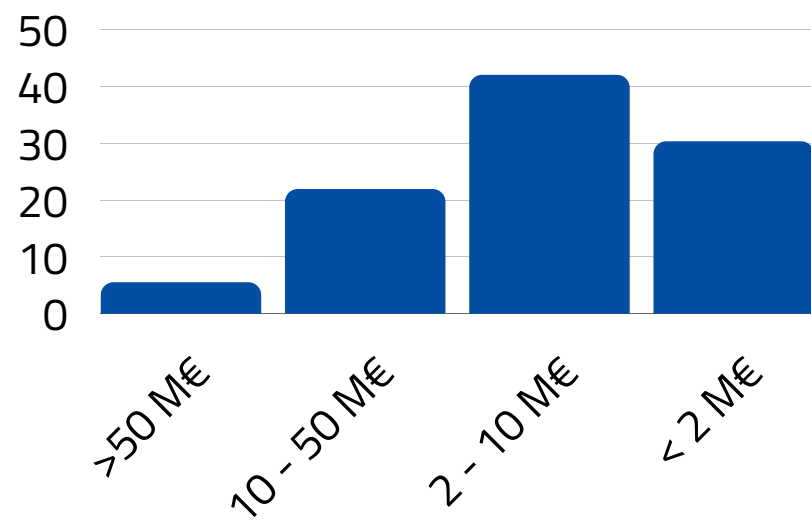- C10.8 - Manufacture of other food products

C11 - Manufacture of beverages
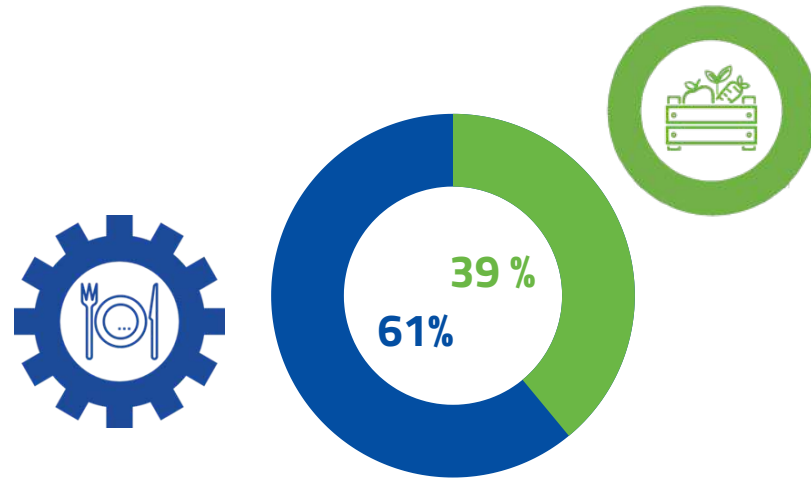
Companies by type of activity

39 %
61%

51 to 250

10 to 50

35,7%
64.3%
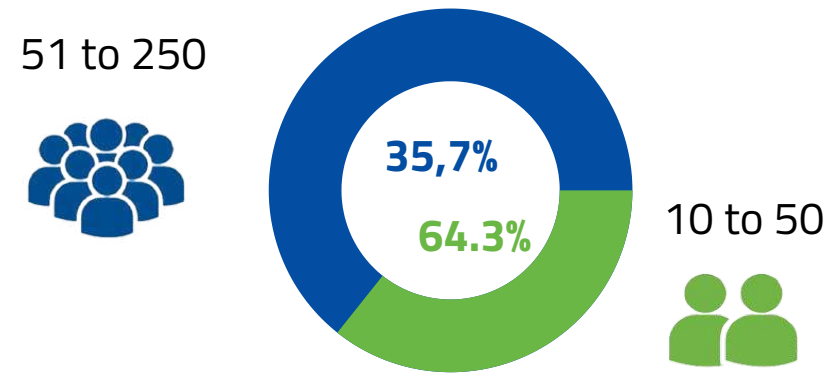
Distribution of the companies by the size

>50 M€   10 - 50 M€   2 - 10 M€   < 2 M€

Distribution of the level of incomes of the studied companies.

To ease the comparison and simplify the analysis of the data, on some occasions companies have been clustered in two categories: the "Fresh product manufacturing", including those companies that work on the preservation of the agricultural products (i.e. livestock, grains, fresh vegetables, fish, seafood) and/or its transformation into edible food (i.e. poultry meat, vegetable juices, frozen vegetables, etc.), and the "Food manufacturing", including the companies working on transforming the foodstuff into ingredients (starch, grain mill, sugar, condiments, etc.) or more complex foods (bread, pasta, fats, oil, cheese, wine, etc.).

The survey was distributed among 474 small (10 to 49 employees) and medium (50-249 employees) enterprises.

The turnover of a company is normally highly linked to the size of the company. In the current survey **84.3%** of the small-sized companies were in the low-income level (< 10 M€ turnover), versus **51.5%** of the medium-sized companies. On the opposite side, the number of small companies with incomes higher than 50M € was almost 10 times lower than in medium ones.

However, it is worth mentioning that while differences are found among the income level and size of the company, this is not the case when comparing the two clusters, fresh product manufacturing and food manufacturing. The share of the companies in the lower income level (<10 M€), where most of the selected food companies are found (**72.3%**), is similar for both the fresh product and the food manufacturing sector.

Income Level	👥	👥👥	🥬	⚙️
>50 M€	1.6 %	12.4 %	3.2 %	6.9 %
10 - 50 M€	14.1 %	36.1 %	25.9 %	19.4 %
<10 M€	84.3 %	51.5 %	70.8 %	73.7 %

Income level versus size of the food companies and type of clusters

Keys of AI Adoption process

DATA

Gathering   Storage   Analytics   AI Adoption

DIGITALIZATION PROCESSES
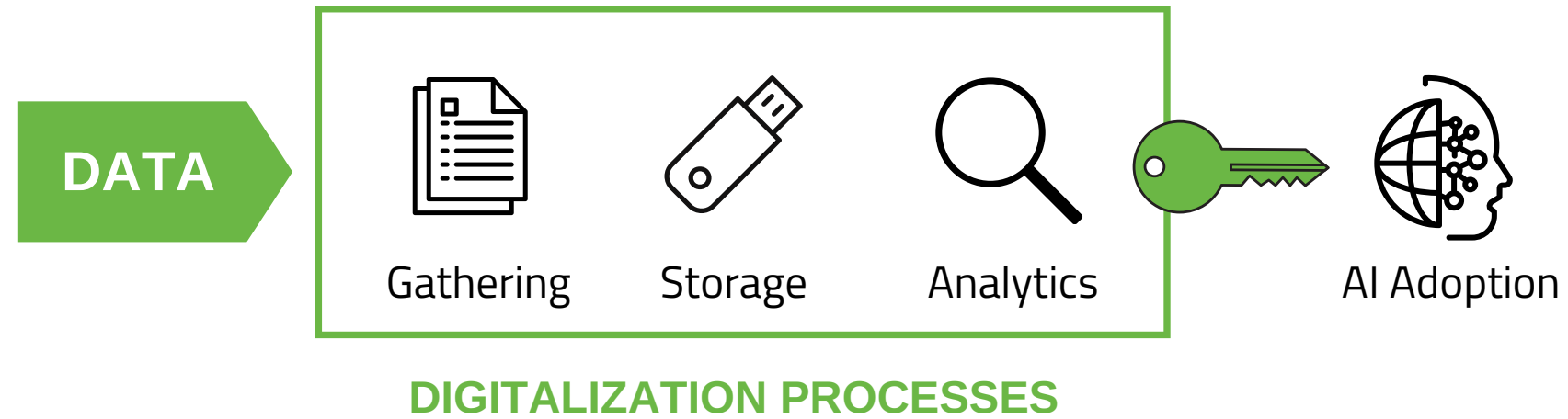
Once the boundaries were settled, the study of the current implementation status of Artificial Intelligence in the food manufacturing industry and identification of the implementation gaps and opportunities was done.

As data is the key enabler for the adoption of more sophisticated analytical tools, the analysis started by studying how the companies gather, store and analyze the data they generate in their daily operations.

KEY FINDINGS

3

"The smaller the food company, the less data storing and data analysis"

In this study 79% of European food SMEs store data in some way, mainly using basic tools such as Microsoft Excel and several enterprise resources planning systems with low level of consolidation (56.7% in case of small and 57.3% in case of medium sized companies). The differences between business segment (fresh products and food manufacturing) are not significant.

Regarding the volume of data gathered, **38.5% of the medium-sized companies** compile **high-volume data** versus **28.9 % of the small companies.**

In terms of the amount of data processed and analysed, only **20.7%** of the medium-sized companies **analyse over 50%** of the data compiled, while this is true for the **16.7%** of the small companies.

It is worth noting **that regardless of the above results, the bigger the company** in terms of employees and/or income level, **the higher the lack of knowledge on how the data is used in the organisation**: Medium companies answer "I don't know" more often than small companies to questions **regarding the use of data**. This means the results could be not conclusive, as in larger companies, workers / respondents may not know what other knowledge areas are doing. In other words, it is possible that the differences in data uses are greater than theone showed in this survey.

<50% of the data compiled is analysed by the majority of the companies
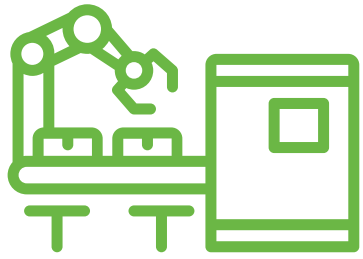
"The perception of the potential of AI is higher for the production activity than for the other areas of the company or business"
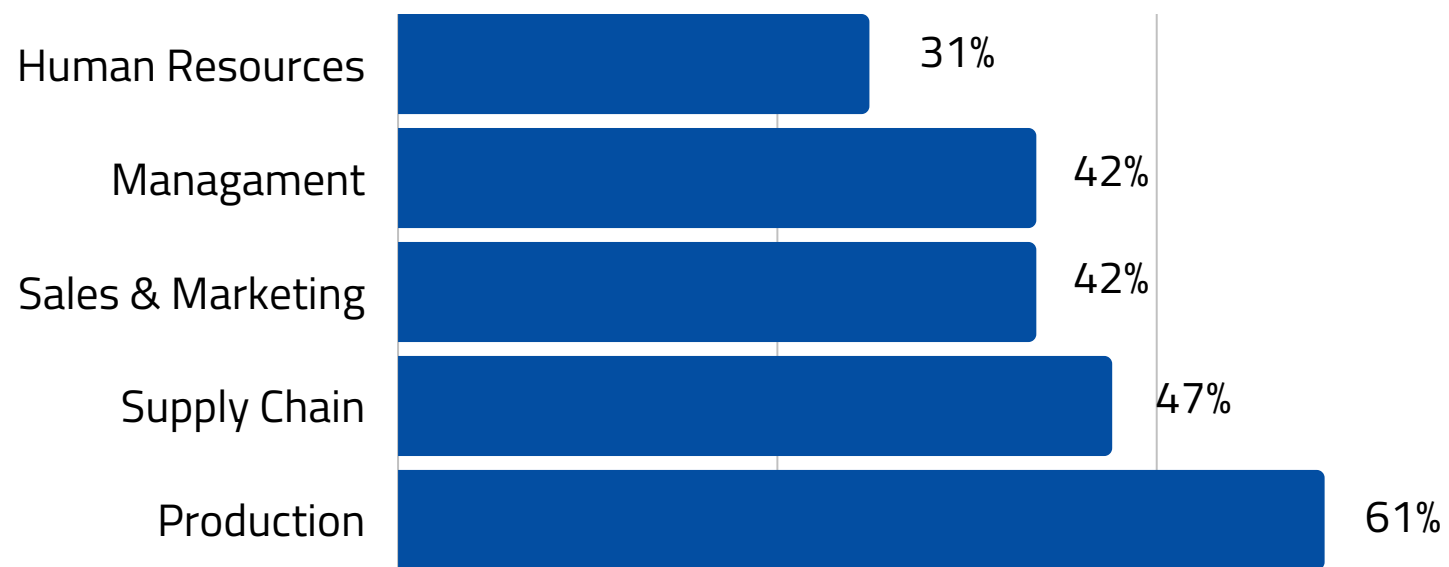
The perception of the potential of Artificial Intelligence varies among the areas of activity within the company. Even if more than **60% of the companies**, independently of the size, **understands the potential of these technologies** at food production level -for instance for the management of stock, quality assurance, resource efficiency or equipment maintenance-, the contribution in other areas of the business, especially for human resources management, is not yet fully understood. The figure in this page shows the perceived potential of AI for different areas of the company.

Why is this happening?

While the return of the investment to be made for embedding AI-based technologies at production level and even supply chain management can be easily measured in terms of resource efficiency and productivity, in the case of performance, schedules, designing capacitation plans, support the hiring process or even retaining talent, the return is not that visible and immediate. A strategic mindset, able to think in the longer term, is needed to fully reap up the benefits of the AI.
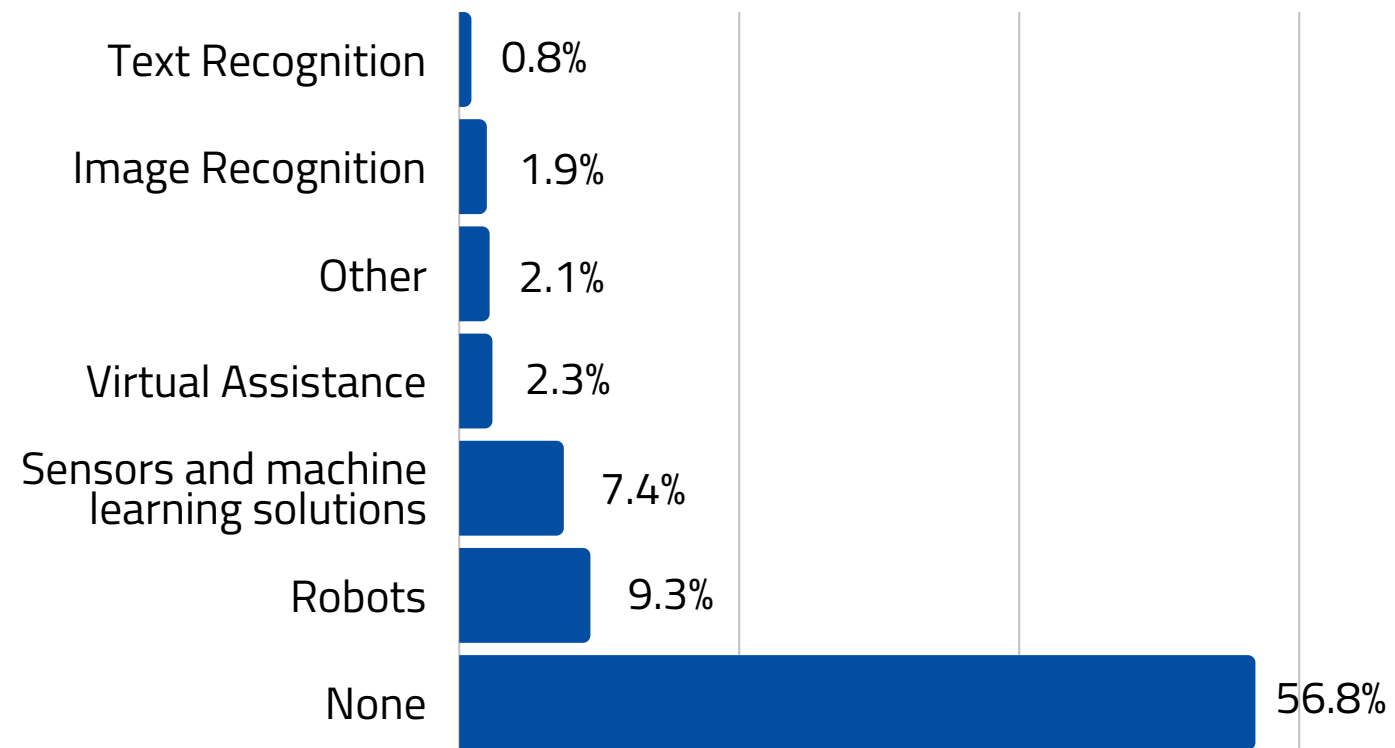
Area	Perceived potential
Human Resources	31%
Managament	42%
Sales & Marketing	42%
Supply Chain	47%
Production	61%

Perceived potential of AI for different areas of the company.

"The level of AI implementation is still low. The most widespread technologies are robotics, sensors and machine learning solutions"

Trying to grasp the very root of it, a step further was gone in the analysis of how the AI is perceived from the strategy and management of the company. Even if the understanding of the overall potential of AI-based technologies is high across sectors and company sizes, **the level of adoption is still far from optimal**: more than half of the respondents (56.8%) declared not to use any technology.

This finding might result from a basic lack of knowledge about the ubiquitous presence of AI in modern technologies (from smart sensors and robotics to bots for human-machine interaction and decision support systems, to cite a few).

Robotic systems for process automation are the most widely used technologies, followed by sensing technology and machine learning solutions. This reflects the better understanding of the potential of AI-based technologies at production stages.
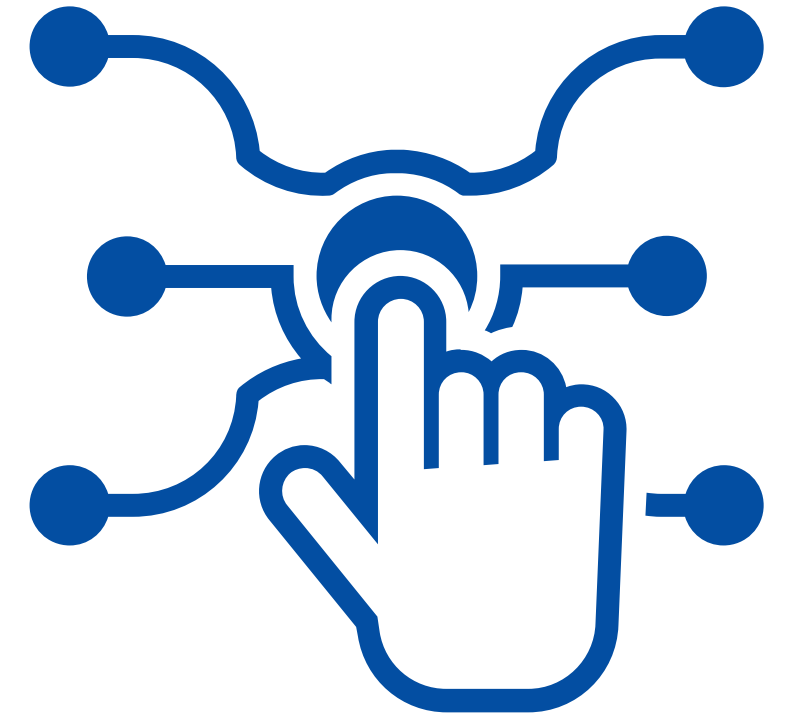
Category	Percentage
Text Recognition	0.8%
Image Recognition	1.9%
Other	2.1%
Virtual Assistance	2.3%
Sensors and machine learning solutions	7.4%
Robots	9.3%
None	56.8%

Current use of different AI solutions in companies (multiple choice)

60%

of the companies do not have any method, tool or processes to implement AI

It is worth highlighting that when asking to the companies if they have any methods, tools or processes defined to implement Artificial Intelligence and other advanced analytics in the organization, **60%** do not have any and they do not intend to do anything about it, which is coherent with the low current implementation and use of the technologies reflected by the survey.

"The companies that agree on the positive impact of the AI are, in fact, the ones pouring more efforts and resources in collecting and analysing data"

But... why the level of adoption is still far from optimal? When asked if the AI offers at the moment any advantage for their organization, **36% of the companies agreed that it would have a positive impact for them in their current situation but there is not much difference with those that do not agree (38%).** Even if the differences are not so high, fresh product manufacturing companies are the ones more hesitant about the positive impact of AI (39.5%).

The positive perception on the added value provided by AI at a company level for the present moment is substantially higher within the companies with higher income levels.

Perception of NO impact of AI

Perception of POSITIVE impact of AI

37.0%
36.3%
39.5%
34.6%
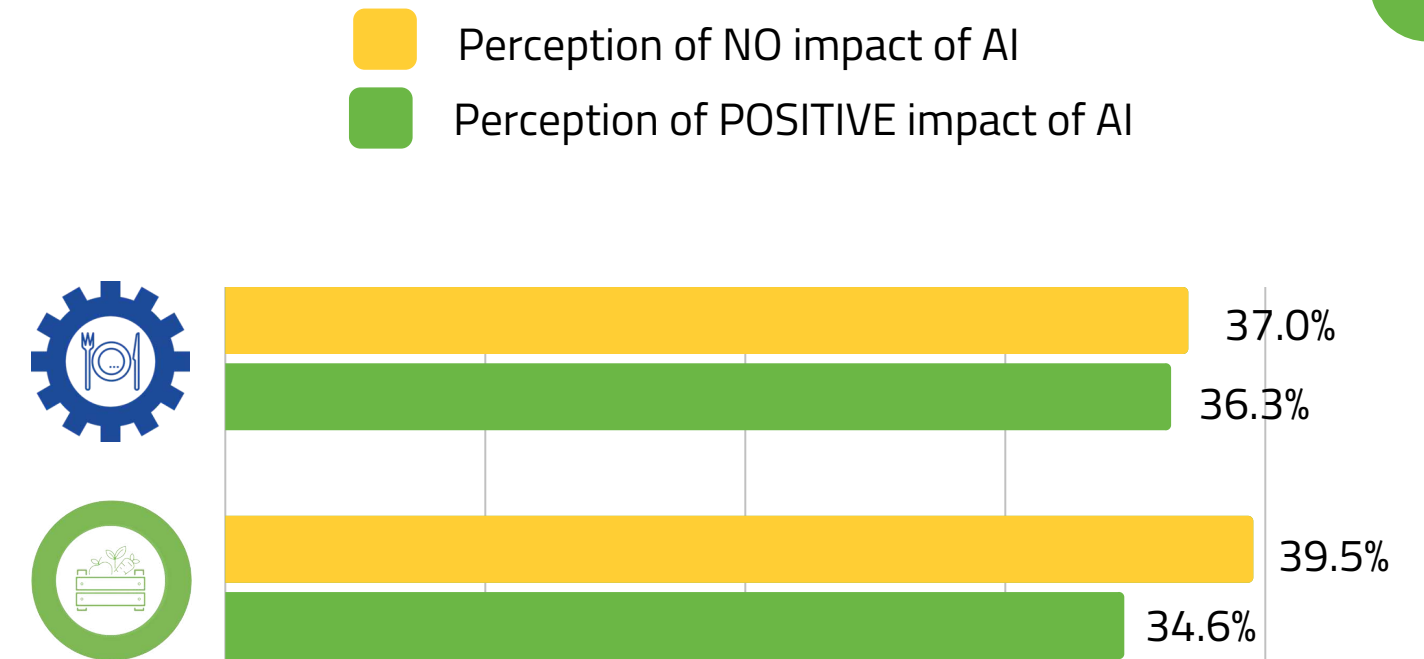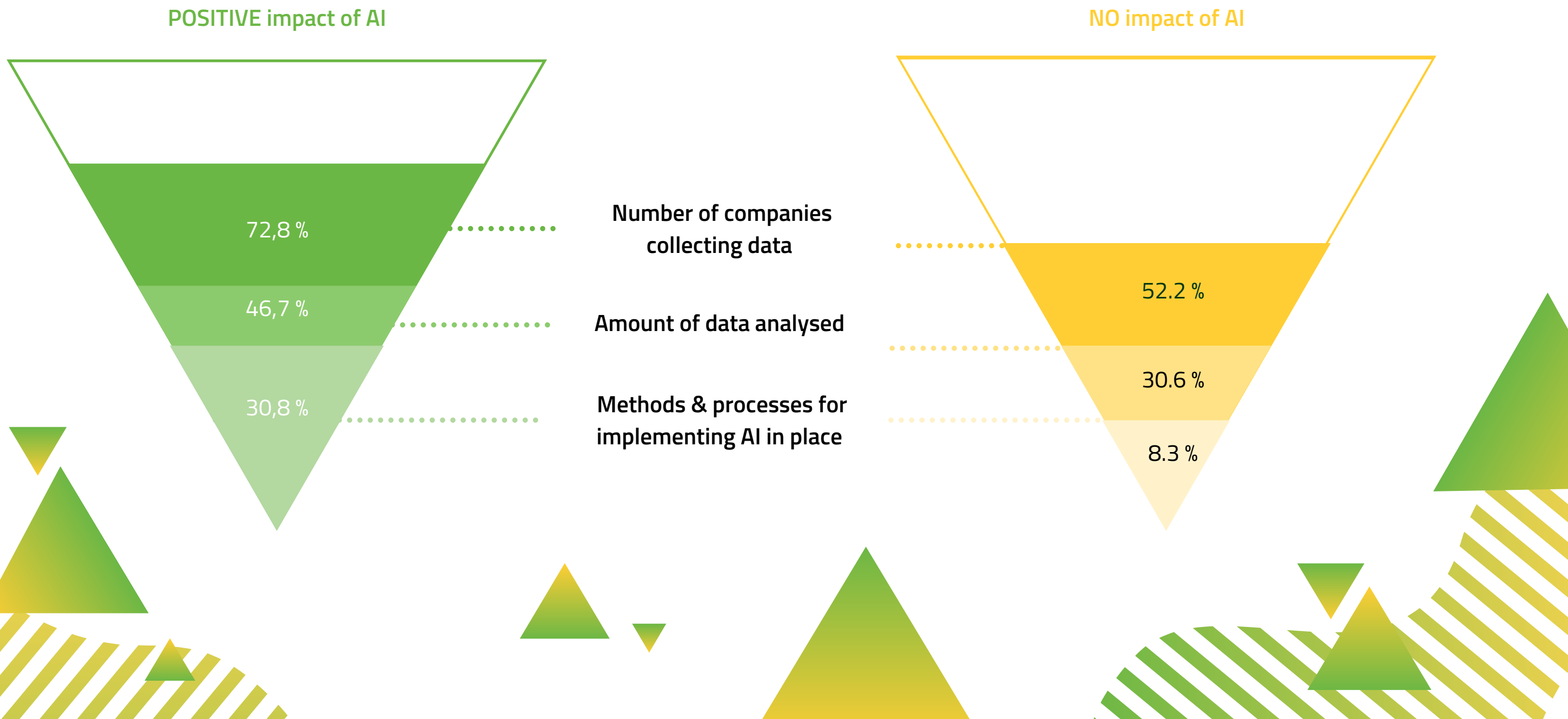
Perception of the impact of AI for the food manufacturing and the fresh products manufacturing sectors – CURRENT MOMENT

>50mill€

10 - 50mill€

2 - 10mill€

0 - 2mill€

0   25   50   75
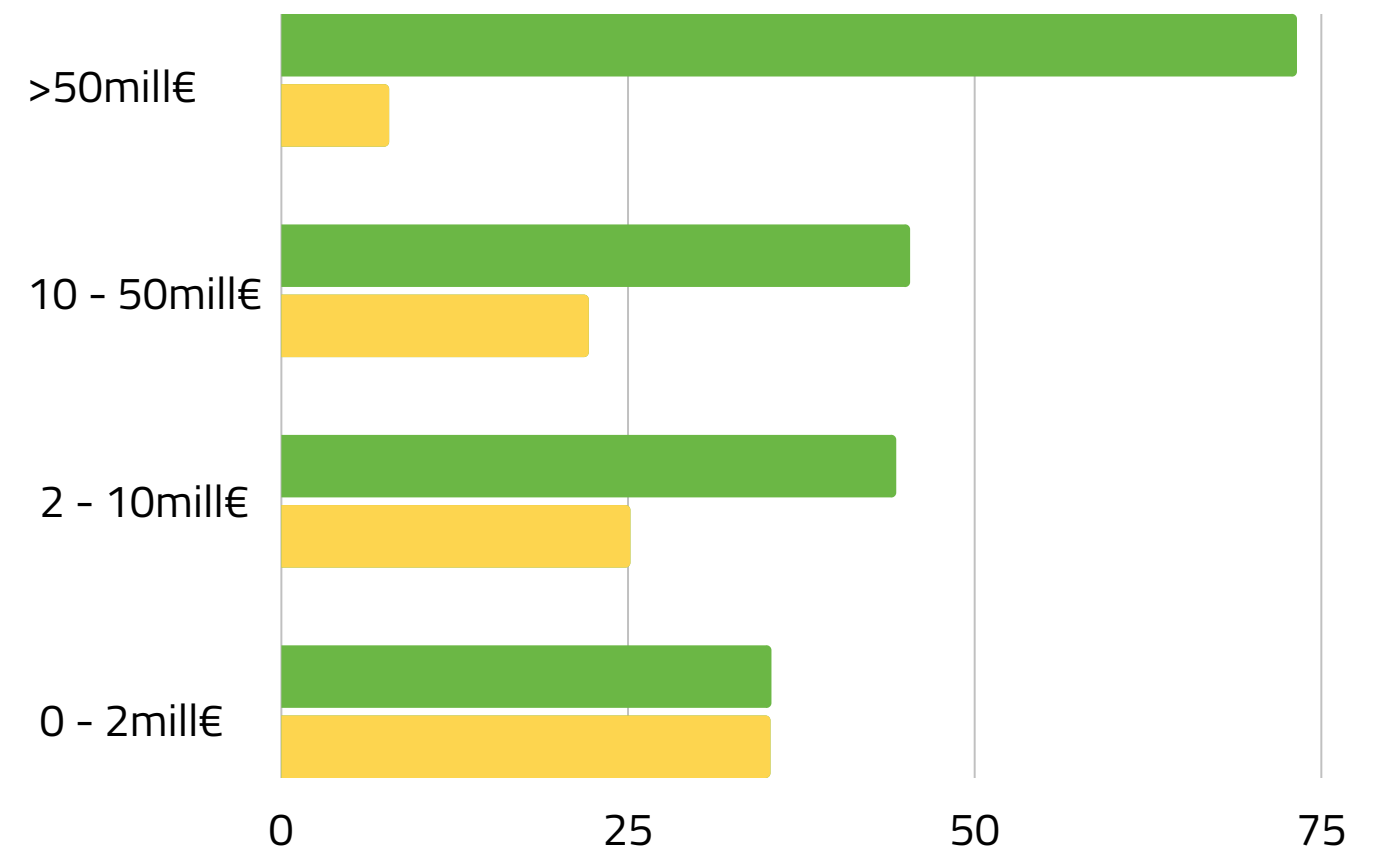
Perception of impact of AI at the moment versus companies' Income level

Among the companies that have a positive perception of the impact of AI more than 70% are collecting data, from which more than 45% is analysed . These numbers are higher than the companies that don't have positive perception about the impact of AI. But the main difference lies in the level of preparation of the companies to implement AI in terms of methods and processes, and in the level of adoption of technology itself. The ones with positive perception are much more prepared (around 31% versus 8% have methods and processes in place) and around 61% of them use some sort of AI-based technologies, namely robotics and sensing technologies.

PERCEPTION of companies

POSITIVE impact of AI

NO impact of AI

72,8 %

Number of companies
collecting data

52.2 %

46,7 %

Amount of data analysed

30.6 %

30,8 %

Methods & processes for
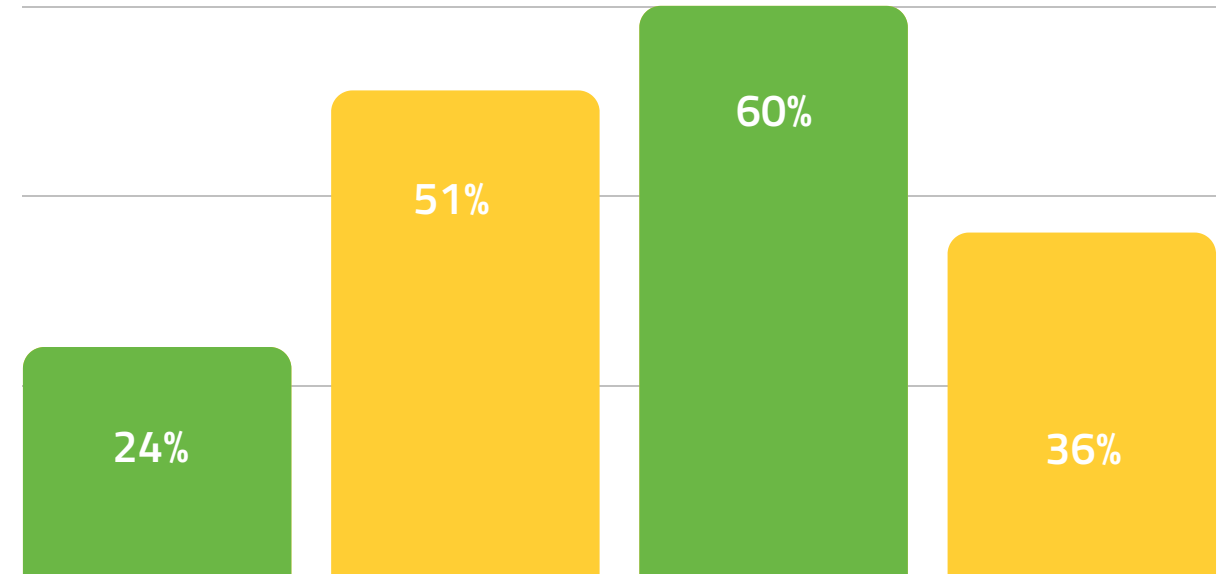implementing AI in place

8.3 %

The denial of the potential of AI-based technologies and the reluctance for adoption are also highly linked to the lack of awareness at a higher level. In average 37.1% of the food companies confirmed that the management board does not understand what AI is nor/or the value that it can offer to them.

The analysis shows that in companies where the positive impact of AI is perceived, the management board has a clear understanding on what AI is and how valuable it can be in 60% of the cases, whereas the companies that do not perceive any potential impact in their business reflect around 50% lack of understanding about AI.

The company income plays a major role in it: The smaller the company's business the higher is the lack of understanding by the management team, and therefore the implementation level. However, similarly to the awareness on the use of data in their companies, the bigger the company the higher the lack of knowledge of the respondents about some strategical aspects. In this case, 35% of the companies on the higher income level (>50 million euro) did not know what to answer in this question and therefore the result might not be fully conclusive.


Legend: ■ Positive Impact   ■ No Impact

Categories: Low/No understand (24% Positive Impact, 51% No Impact); Some/High Understand (60% Positive Impact, 36% No Impact)

Knowledge & understanding on AI by the management board respect the Perceived potential/impact of it in their companies

0 - 2mill€ 46% | 2 - 10mill€ 38% | 10 - 50mill€ 31% | >50mill€ 12%
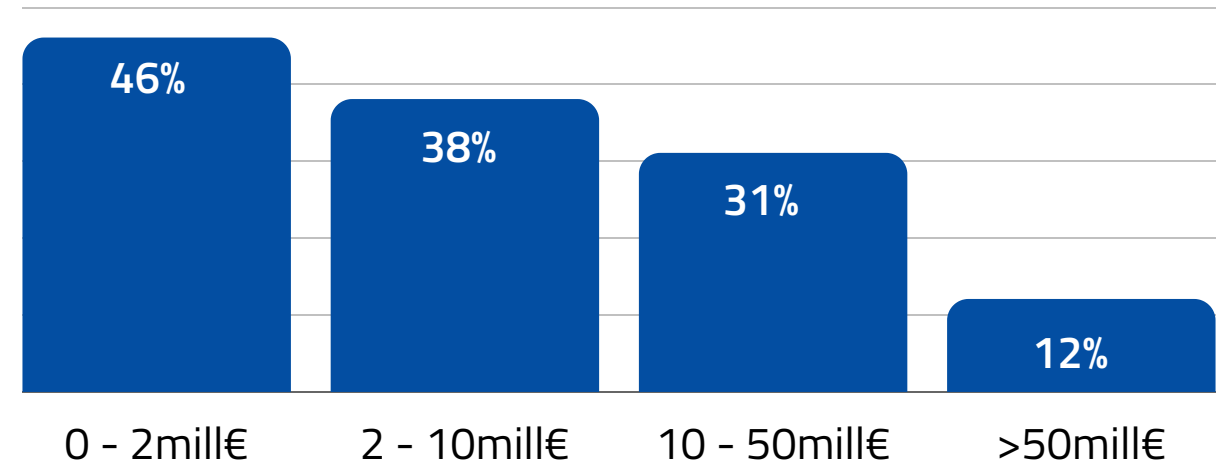
Lack of implication and understanding (%) of the Management of the company about the importance and impact of AI depending on the incoming level.

3

"Food companies have a positive perception of the impact of AI in the future (medium-long term). However more than half of the respondents have no intention to invest in AI in the next 2 years"

When talking about the added value that AI will bring to them **in the future**, there is a more positive perception. Food companies believing that AI will have a positive impact in the future are more numerous (43.2%) than those thinking that AI is going to have an impact at the present moment (35.7%). The ones that do not agree are reduced from 38% to 26.6%
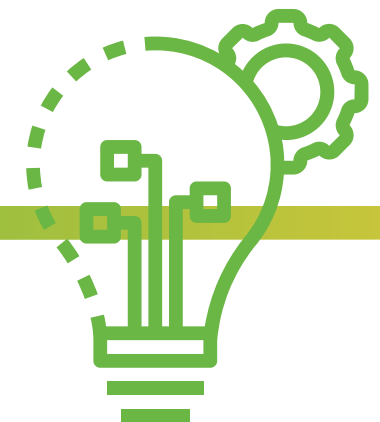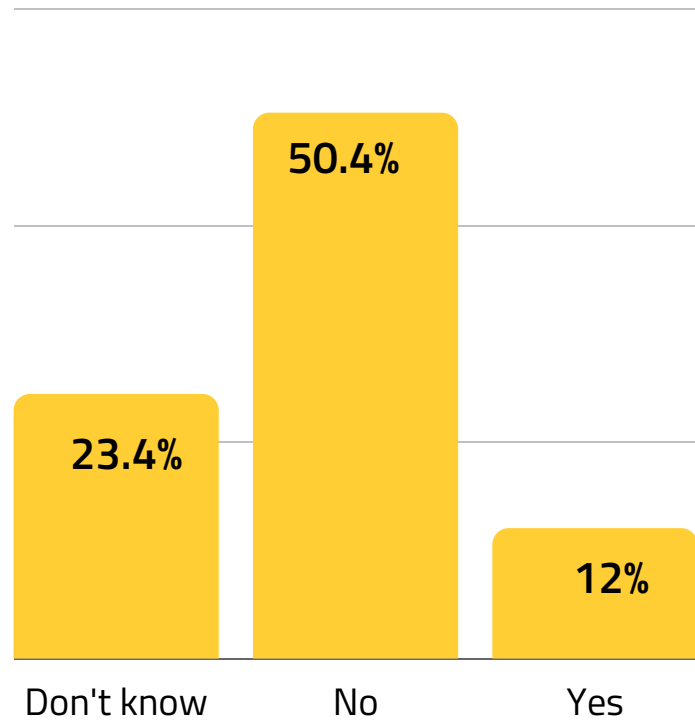
■ Perception of NO impact of AI

■ Perception of POSITIVE impact of AI

24.2%

44.3%

30.3%

41.6%
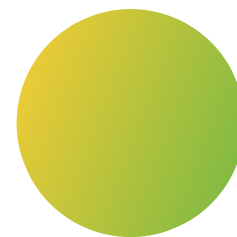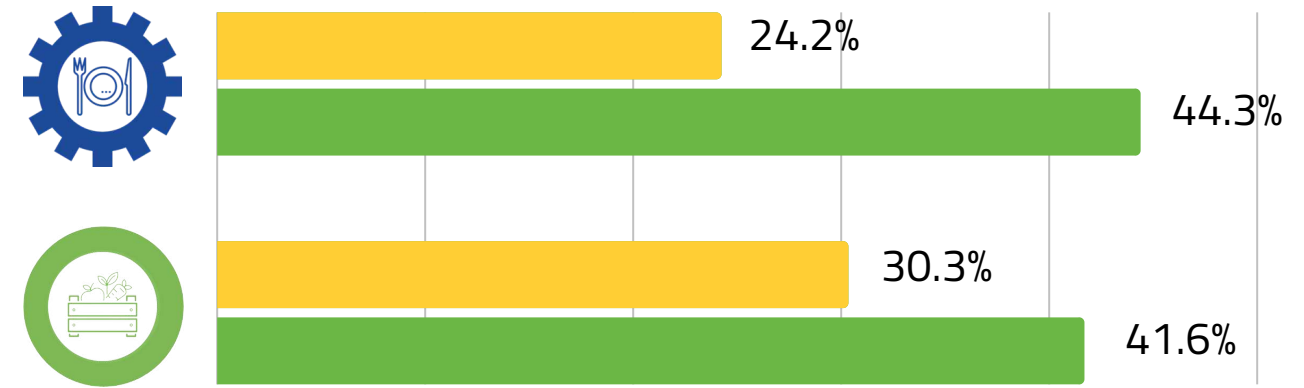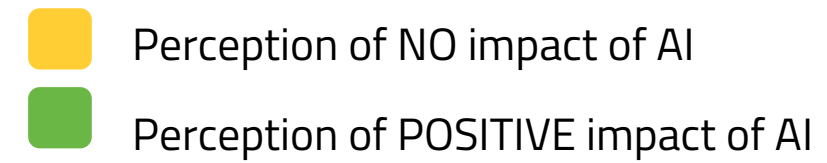
Perception of the impact of AI in the medium-long term for the Food manufacturing and the fresh products manufacturing sectors.

This shift on the perception of AI-based technologies' potential could be related to the fact that 32.5% of the companies consider that not jumping onto the AI bandwagon will leave them behind their competitors. Still, out of those that have a positive view on the use of AI in the near future, 41% confirms that their company is not planning to invest, probably also due to the lack of use cases that can prove the return that the investment on AI-based technologies can bring to their organisation.

In this case, both sectors (primary and manufacturing) have a similar and positive perception on the added value AI will bring to their companies in 2 years' time, while still the companies with higher turnover are more prone to see the potential.

Still only 12% of the total food companies have clear that they will invest in the near future in AI, against the 50.4% which they definitively don't have any plans to do so. In terms of sectors the Primary food manufacturing shows more reluctancy to invest than the food manufacturing one.

Intention of investment in AI of food companies in the coming 2 years

- Don't know — 23.4%
- No — 50.4%
- Yes — 12%

In terms of sectors the Primary food manufacturing shows more reluctancy to invest than the food manufacturing one.

Comparison of Intention of investment on AI of the companies by food clusters

- Don't know — 22.7% / 23.9%
- No — 56.2% / 46.7%
- Yes — 8.6% / 14.6%
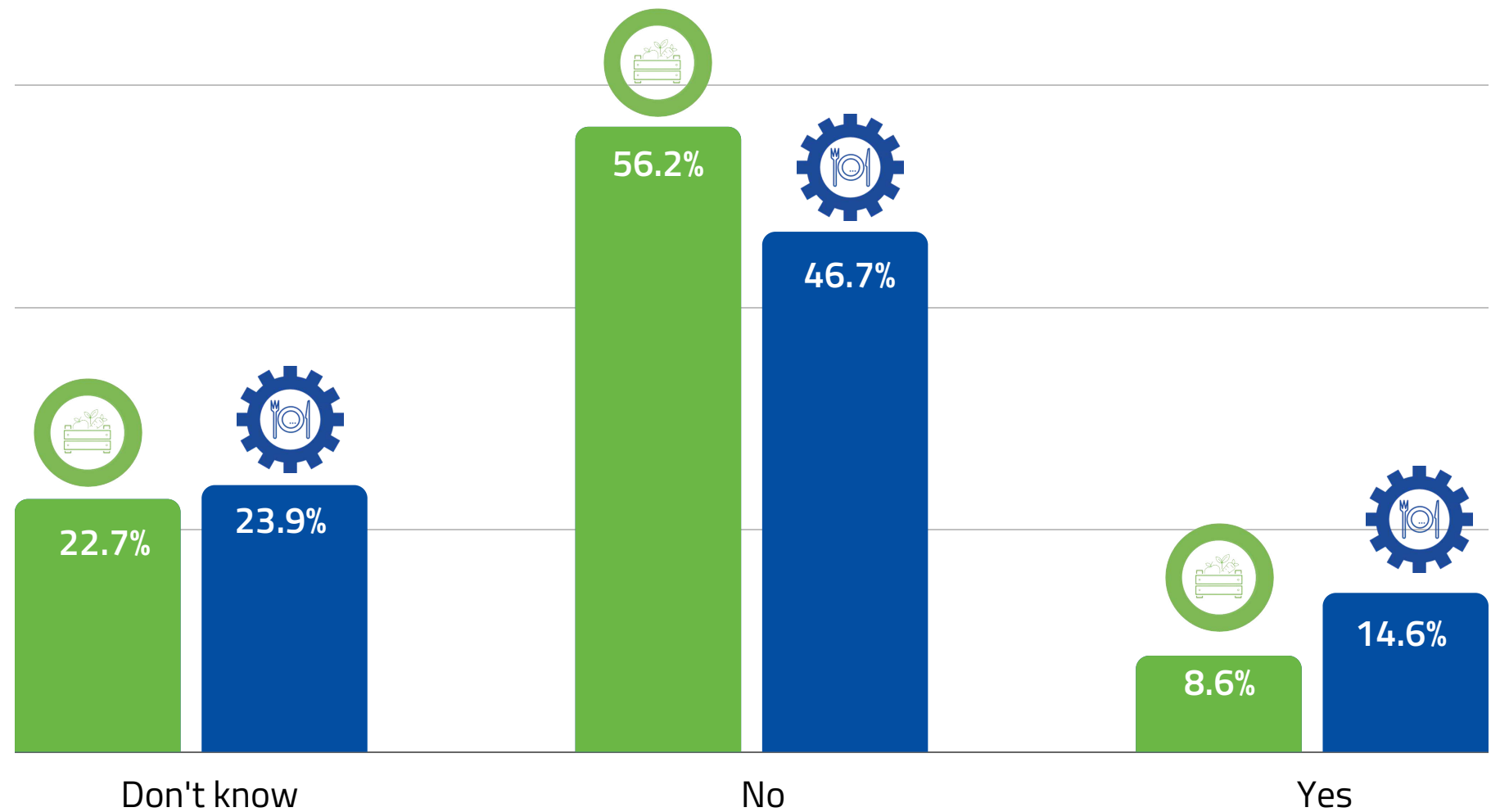
"Lack of personnel with the required digital skills and difficulty in acquiring the know-how is the most important barrier for AI adoption"

From the survey to European food SMEs, we have corroborated that the lack of personnel with the required digital skills in the food processing and manufacturing sector as well as the difficulty in acquiring the know-how needed for the implementation of AI-based solutions are two of the main limitations for a wider adoption.

MAIN OBSTACLE (% PER OBSTACLE)

1

54%

Our organization is lacking staff with the required expertise/knowledge on the subject

2

49%

Learning about AI, its potentials, benefits and risks is challenging

3

48%

Our organization does not have the knowledge on how to approach the subject

Almost 50% of the companies declared to have less than 5% of employees able to understand the benefits of AI or machine learning, a situation which is both a possible cause and consequence of this barrier. Moreover, the lack of skills can also be reflected in the type of profiles available in a company for the processing of data: only 4% of the companies declared to have data engineers in their team, 6% had data architects and 7% had data scientists.
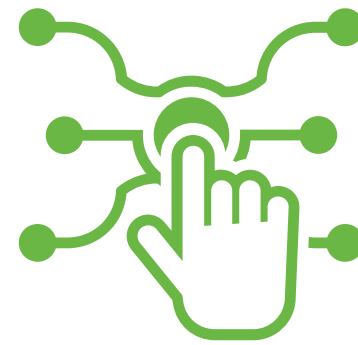
One of the big issues for SMEs within the food industry to recruit and retain staff with sufficient digital skills is that those profiles are highly valued in the market, so oftentimes they prefer to go to larger companies offering higher salaries, on the range of 65-100,000 euros annually. Another reason would be that many of the food SMEs are located in rural and sometimes isolated areas with limited variety of leisure activities.
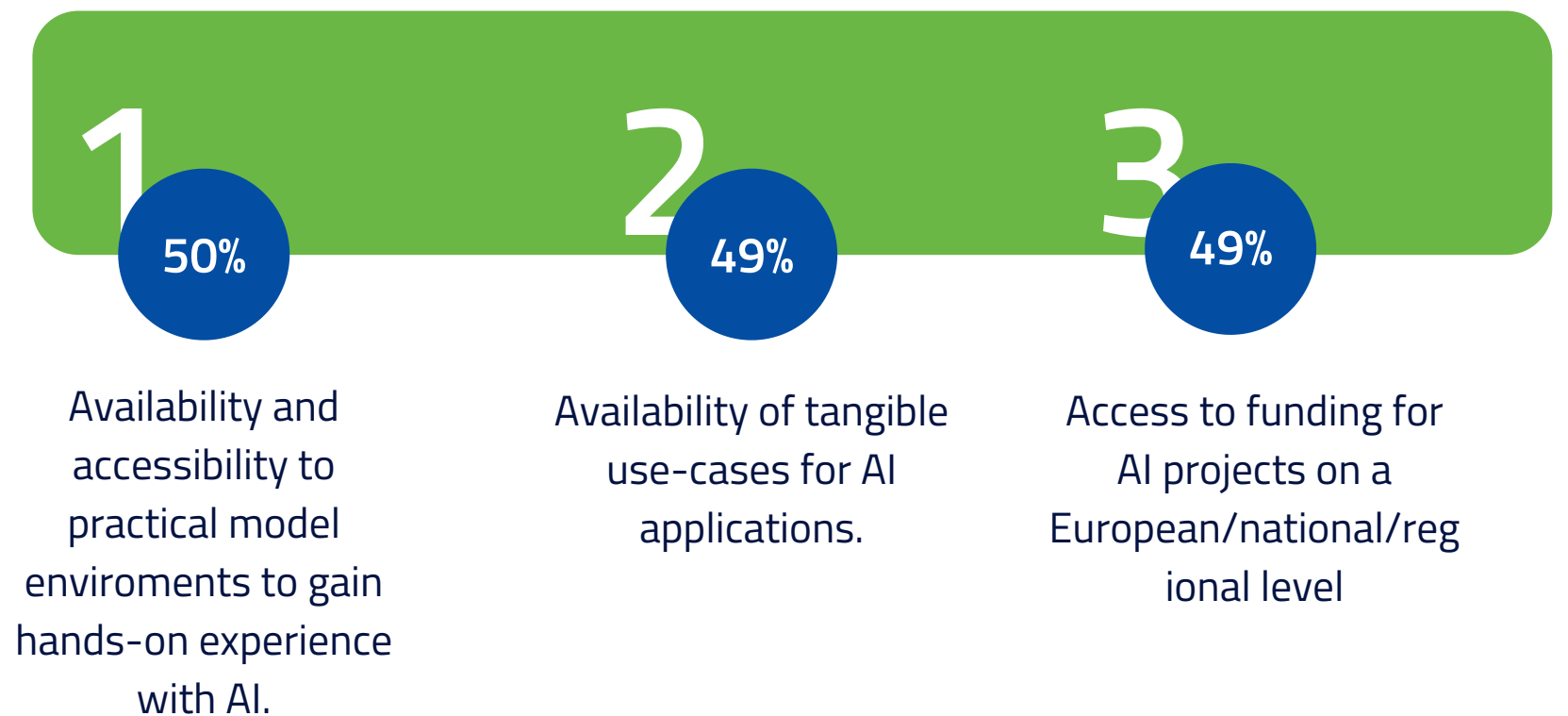
The uncertainty on how to approach the subject, as a consequence of the lack of information, makes the enterprise unwilling to undertake the adoption of AI or, in the best scenario, outsourcing the implementation of advanced tools, rather than developing their own tailored mechanisms. A high percentage (33.8%) of the companies that have some sort of advanced technologies in place have implemented it through collaboration with external providers or universities.

While outsourcing the implementation of certain tools and technologies might be beneficial or cheaper for the organisations, the incorporation of personnel with the relevant skills is key to better identify which areas are worth digitalising and which are the benefits the process can bring to them and ensure that all the processes and data are organised in a way that can ease the adoption of other technologies in the future.

"Access to practical learning environments to gain hands-on experience and get to understand the potential return on investment is a key driver for adoption of AI"

MAIN DRIVERS (% PER DRIVER)

1

50%

Availability and accessibility to practical model enviroments to gain hands-on experience with AI.

2

49%

Availability of tangible use-cases for AI applications.

3

49%

Access to funding for AI projects on a European/national/reg ional level

Granting access to practical environment where the benefits and the return on investment can be tested or proved are seen as one of the main drivers of adoption of AI by the food industry (50% of the answers). These can be a key to fasten the digitalisation process and the adoption of AI solutions in the European food industry, as they can become a playground where companies can experience first-hand the potential of different technologies, understand how they work and how can they be applied to their specific industry or processes. In the same vein, the distribution of success cases by other players in the food industry has been identified as a key driver for adoption by 49% of the respondents.

Finally, **49% of the interviewed** believe that larger or more numerous funding plans at the European or national levels would lower the barriers for the adoption of AI, as the lack of economic resources to invest in the implementation of AI solutions represents another serious limiting factor. This is, indeed, the reason why, independently on the level of perception and understanding on AI's potential for the business in the near future, most companies do not have the plans to invest in AI in the near future.

TAKE AWAYS & REMARKS

4

Europe is well placed to benefit from the potential of artificial intelligence, as it has developed a robust computing infrastructure (e.g., high-performance computers, high-speed data networks), which is essential for the operation of artificial intelligence. However, investment in artificial intelligence in Europe still represents a smaller proportion than that in other regions of the world: around € 3.2 billion in Europe, compared to around € 12.1 billion in North America and € 6.5 billion in **Asia**.[3] When we focus on European food SMES, the levels of adoption of AI technologies are still relatively low.

AI adoption is highly linked to business's choice of management board.

The level of understanding of the management board about what AI is and the added value that it can offer to them predetermine the current level of digitalisation of their companies, in terms of amount of data collected and analysed, as well as the type of analytic **methods in use**. Moreover, the higher the level of awareness of the management board, the keener they are to invest in the near future in AI-based solutions. However, awareness is only the first step towards adoption of AI within a company.[4]

Food companies believing that AI will have a positive impact in the future are more numerous than those thinking that AI is going to have an impact at the present moment. This is believed by more than 1/3 of the companies surveyed. The perception on the potential of AI is directly connected with the level of digitalization of the companies and their income level. The higher the income level of the company, the higher the level of digitalization and the higher the perceived positive potential of AI. Data from other sources, such as the European Commission,[4] suggest the same pattern across other sectors in Europe. It could be due to the fact that bigger companies embrace the AI in their process given their larger economies of scale and potential return on investment.

In general, the main factors perceived as an obstacle to the adoption of AI-based technologies and even the digitalisation of the companies, are related to the lack of proper skills and, consequently, the lack of understanding about AI, its potential, and the challenges it poses. However, the lack of skills amongst existing staff is a common barrier that is not related to a specific sector or industry. According to the DESI report on Human Capital (2019),[5] 53% of enterprises that recruited or tried to recruit ICT specialists reported facing difficulties. Also, the growing number of ICT vacancies suggests a widening gap between demand and supply of ICT specialists in the EU. Therefore, it seems a universal barrier faced by all sectors, not just by the food industry.

Importantly, no qualitative differences were found between sectors (fresh product and food manufacturing) or company sizes in terms of barriers and drivers for adoption, which demonstrates how the barriers identified represent a common factor limiting the spread of AI across the entire food industry.

On the other hand, the difficulties to understand AI and its potential is the second major obstacle to AI adoption faced by food sector. Similar results were reported by European Commission:[4] 48% of food sector companies regard the difficulty to understand AI techniques as a major barrier compared to 40% of enterprises from all sectors. In this regard, the access to use cases by other market players or to even testbeds, where they can see first-hand the return on investment that the application of advanced technologies might bring to their companies, are perceived as the main drivers for the digital transformation within the industry. In this sense dissemination activities and the organization of sponsoring events promoting interconnections and knowledge transfer play a crucial role.

Being aware of this important and key barrier, the EIT communities engaged in the "end-to-end digitalised production testbeds" – EIT Digital, EIT Food and EIT Manufacturing- proposed a special topic for funding the implementation of several testing environments. The call was launched in October 2020 and resulted in the selection of 3 testbeds that will be implemented during 2021. The objective of such testbeds is to prove the effectiveness of different AI-based solutions in different processes of the food value chain and, overall, fostering the adoption of digital solutions by the food industry.

As a final remark, the potential of AI must not be seen for isolated activities or processes within a company, as only through connectivity of the full chain can a smart process with a real impact be built. In fact, a report published from the Boston Consulting Group [6] where market leaders were interviewed about their strategy on deploying AI showed that only those that used AI as a strategic tool for decision making and execution had a clear return on the investment. Market leaders do not consider AI as a tool for process automation. They use it to shape every single aspect of their corporate strategy: collecting data, implementing technology and getting the required talent.

REFERENCES

1. FoodDrinkEurope (2020) – *Data & Trends of the European Food and Drink Industry 2020.* Available here.

2. Bluespecs (Oct 1, 2020). *Artificial Intelligence and digital skills – a European dilemma.* Available here.

3. McKinsey (2017) – *10 imperatives for Europe in the age of AI and automation.* Available here.

4. European Commision (2020). *European enterprise survey on the use of technologies based on artificial intelligence.* Available here.

5. The Digital Economy and Society Index (2019). *Human Capital - Digital Inclusion and Skills.* Available here.

6. BCG GAMMA (2020). *Is Your Company Embracing Full Potential of Artificial Intelligence?* Available here.

EIT Food is Europe's leading food innovation initiative, working to make the food system more sustainable, healthy and trusted. To this end, EIT Food works with entrepreneurs, startups, scaleups, students, businesses, academics and policy makers to support the ideas that are going to transform Europe's food system.

EIT Food divides its activities into 4 key areas to help us achieve our mission:

- Help big businesses to change their practices and innovate,
- Make studying agrifood more attractive
- Engage consumers around the topic of the food system
- Ensure the success of the agrifood innovators that are transforming the food system.

eit Food

Funded by the
European Union