DLG Trend Monitor 2023

Robots in the Food and Beverage Industry

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Foreword

We live in a time of big headlines like double whammy, global circulation systems and comprehensive sustainability. In the technical field as well, rather “hyped” topics such as AI/ChatGPT or smart writing tablets dominate the discussion. On the other hand, real and politically induced resource shortages slow down not only the development of new, innovative solutions, but also the management of day-to-day business. At the trade fairs - which can finally be experienced again after far too long a Corona period - the most exciting questions are no longer: “Who can do that?” or “How does it work?”. Even “What does it cost?” takes a back seat to the question “When can they or we deliver?”, which can hardly be answered seriously.

While it can be optimistically expected that the availability of control chips, AD converters and other components that have often been taken for granted but are currently hard to procure will sooner or later increase again, there are two resources with a finite nature that will painfully persist: energy and human labour.

While the former is a serious challenge even in the robotics sector, despite lightweight construction and optimised movement functions, automation is indisputably an essential “part of the solution” with regard to the increasing labour shortage. New collaborative systems are constantly coming into view here. However, these often present themselves more as an interesting bridging technology until full automation is achieved. This is due to the extreme safety requirements and the tightly limited output, which cause the costs in the upper production range to rise unprofitably.

It’s a good thing that complex and autonomous complete systems offer excellent alternatives in terms of both cost and production. The basic know-how for the selection and operation of such solutions is not only available from all suppliers, but increasingly also from many users in the food sector. A trend monitor can be a statistical indication and motivation, but of course it cannot show all real efforts and relevant progress in detail.

The challenges for complex system planning, including the peripheral systems that now determine success and go far beyond the basic kinematics, are growing exponentially. However, the decision-making reliability required for this can be effectively supported by simulation and innovative calculation algorithms up to and including AI. And in this respect, it’s good that the major topics mentioned at the beginning - such as AI - at least have the potential to advance development in the long term.

Matthias Weiß
Spokesman of the DLG Working Group Robotics in Food Production

Introduction and objective

In 2014, the first DLG Trend Monitor “Robots in the Food and Beverage Industry” was published. Almost ten years have passed since then and much has changed - not only in the food industry. One aspect that is becoming increasingly important economically is the automation of production processes. Robot systems play an important role here. That’s why robots, after being the subject of a DLG Expert Knowledge publication last year, are to be the focus of a DLG Trend Monitor again this year. The objective of the Trend Monitor survey was, as always, to obtain an overview of (future) areas of application and developments of robots as well as to compile objectives and reasons for an application of robots in the food industry. A special focus this year was also on the education and training of professionals who handle robots in their everyday work.

As a result, with this publication the DLG is presenting the fourth trend monitor “Robots in the food and beverage industry”, which answers questions on the above-mentioned topics based on their status in 2022.

Study design and participant profile

The survey was conducted from October to November 2022 and in January 2023. The companies surveyed were selected exclusively on the basis of their affiliation to the food industry. Other criteria had no influence on the choice of respondents. The 65 participants came from the DACH region.

The comparability of this trend monitor with the previous versions is limited, as some of the questions were formulated differently than before. In addition, the survey was answered by different companies than in previous years. This should be taken into account when interpreting the data.

It should also be noted that not every question was answered by all respondents, as some questions were specifically directed only at companies that use robots and others at those that do not. If the entire group has not answered a question, this will be pointed out at the appropriate point.

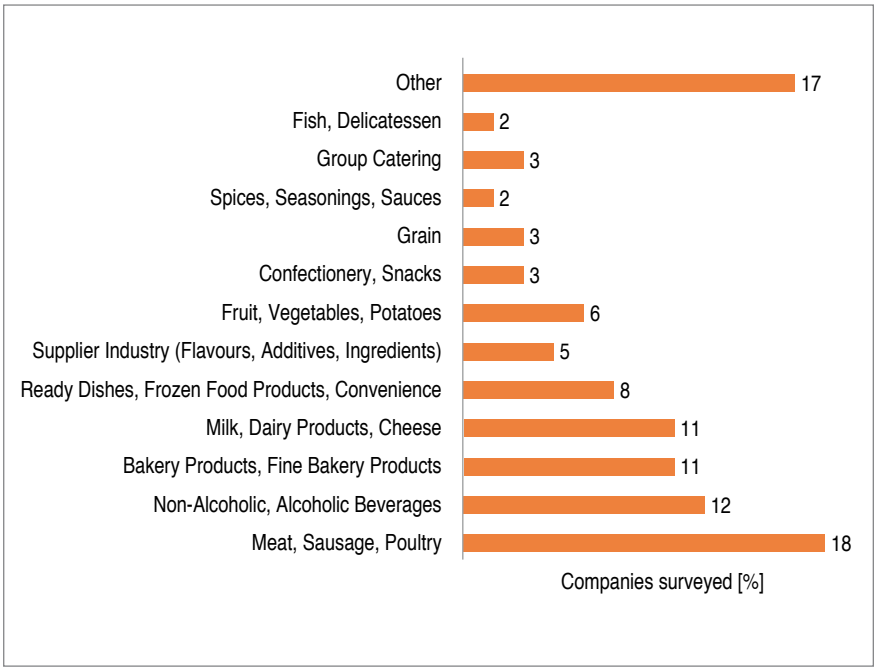

Figure 1: *Industry affiliation of the participants' companies*

General information on the participants

The participants in the survey belong to many different sectors of the food industry. The questions in this Trend Monitor were most frequently answered by members of the meat, sausage and poultry sector (18 %), followed by employees in the beverage (12 %), (fine) bakery products (11 %) and milk, dairy products and cheese sectors (11 %) (Figure 1).

Figure 2: *Business sector affiliation of the participants*

If we look at the areas of the company in which the respondents work, as shown in Figure 2, we can see that most of the participants are part of the management (28 %), of quality management/assurance/hygiene/analytics (23 %) or of production, manufacturing and technology (20 %).

Furthermore, based on the results illustrated in Figure 3 and Figure 4, it can be seen that, in addition to a smaller number of large companies, the majority of participants come from small and medium-sized companies, as was also the case in the 2020 Trend Monitor. These have between 1 and 249 employees (69 % in total) and achieve an annual turnover of up to € 49 million (48 % in total).

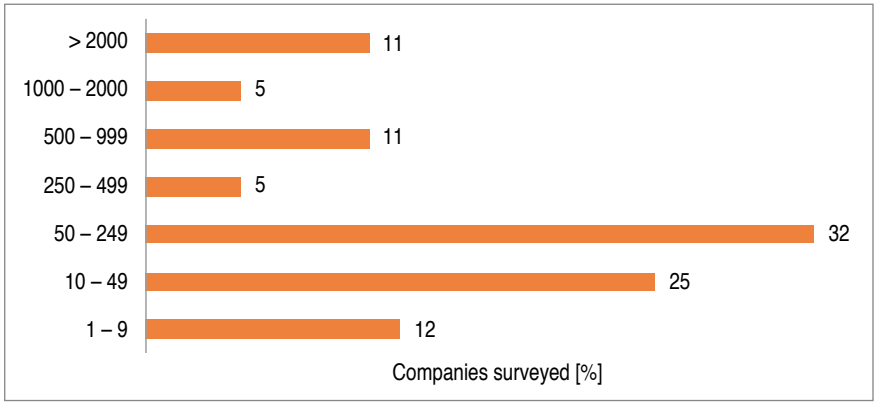

Figure 3: *Size of the respondents' companies according to number of employees*

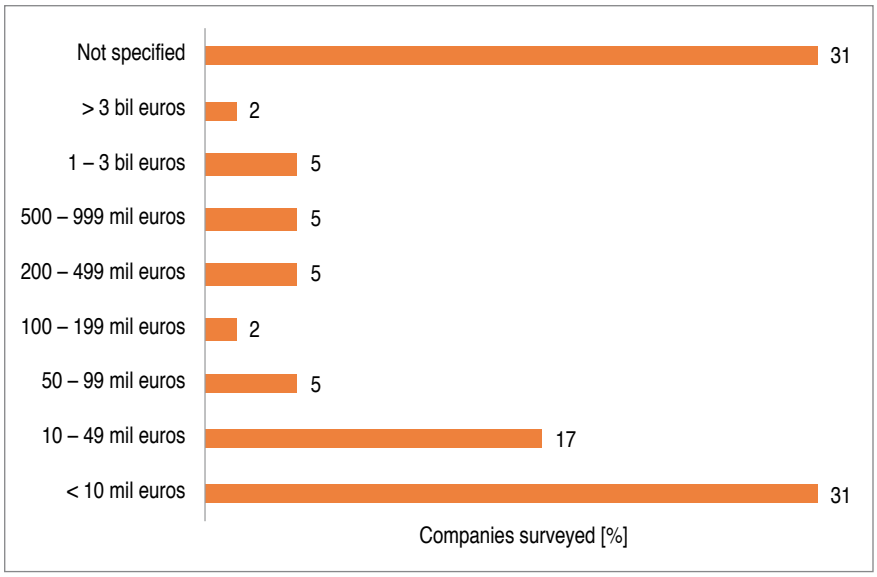

Figure 4: *Turnover classes of the participants' companies according to turnover [€]*

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Use of robots

By looking at the survey results on the number of robots in the surveyed companies (Figure 5), it can be seen that with 33 companies, slightly more than half of the participants (51 %) do not own any robots. Of the remaining 49 % of participants, most companies own five to ten (12 %), one (9 %) or two (11 %) robots. More than 100 robots are not in use at any of the companies surveyed.

Figure 6 and Figure 7 show the relationship between company size and robot ownership based on the number of employees and turnover. It can be seen that companies of all sizes and turnover figures use robots.

Participants who stated that their company does not use robots gave different reasons for the lack of application so far (multiple answers possible). Most of the companies (19 mentions) stated that robots are currently not economically interesting for them.

Other frequently cited reasons are insufficient experience (7 mentions), lack of information about possibilities (6 mentions), the space issue (6 mentions) and a lack of robot applications (6 mentions) (Figure 8). When asked whether they would like to acquire robots in the future, the largest percentage answered “don’t know” (49 %). 30 % of the companies still do not want to use robots in the future, while the smallest part with 21 % intend to do so (Figure 9).

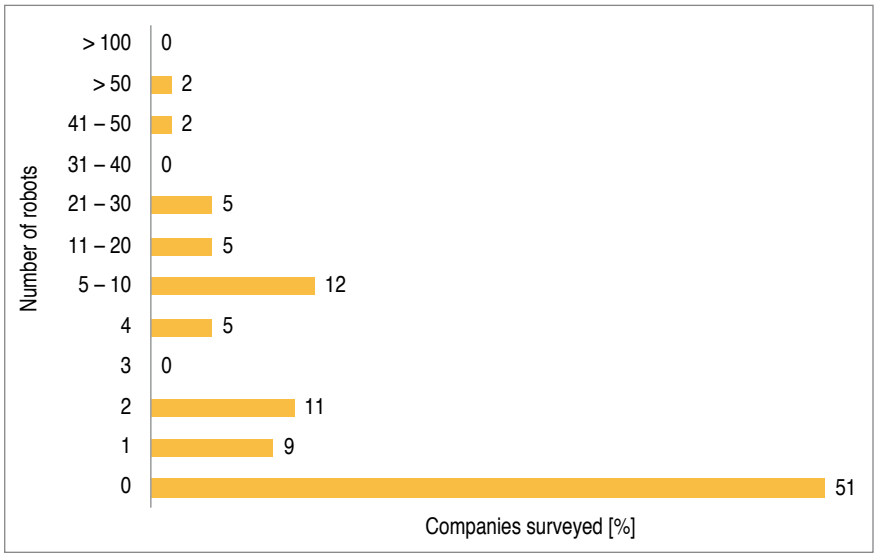

Figure 5: *Number of robots in the companies of the participants*

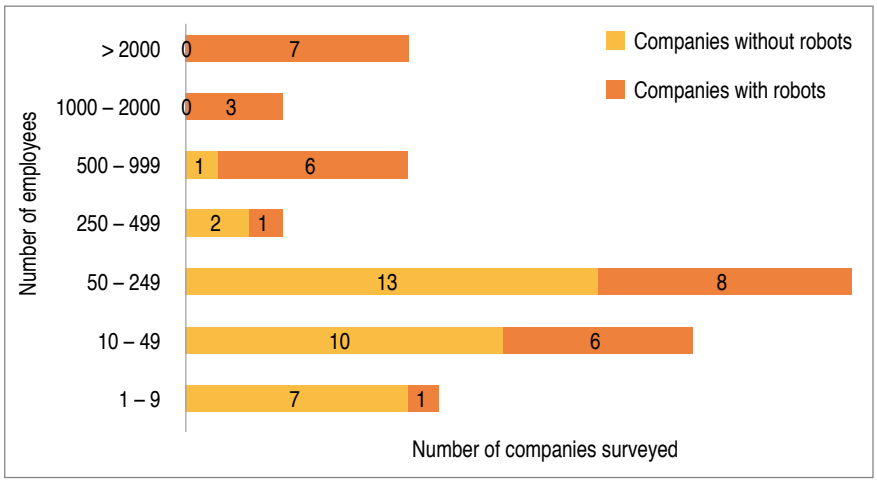

Figure 6: *Number of companies with robots depending on number of employees*

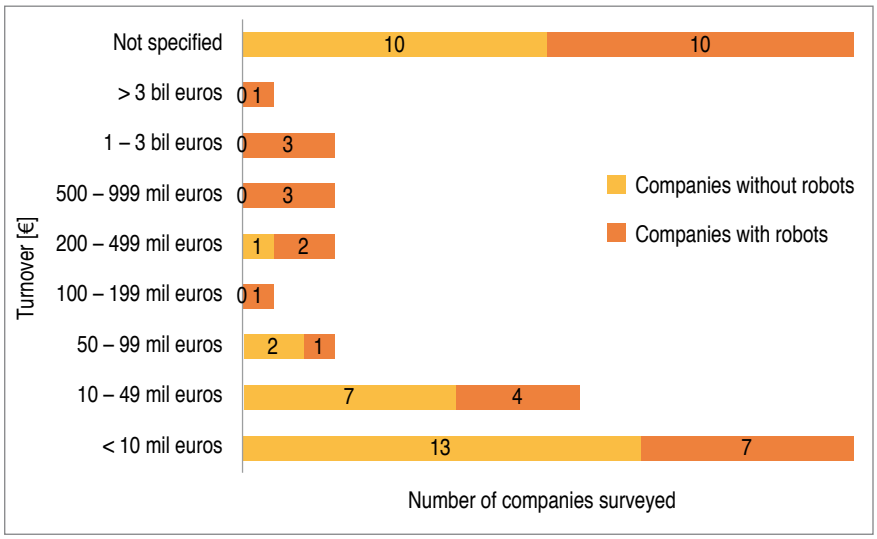

Figure 7: *Number of companies with robots depending on turnover [€]*

The situation is somewhat different for companies that already use robots. Among these, almost two thirds (62 %) plan to purchase more robots. In contrast, 22 % have no plans to purchase more robots, while 16 % are not sure (Figure 10).

This shows, as was also evident in the 2017 and 2020 Trend Monitors, that companies with robot experience are more likely to acquire more robots than companies that do not have robots are to do so for the first time.

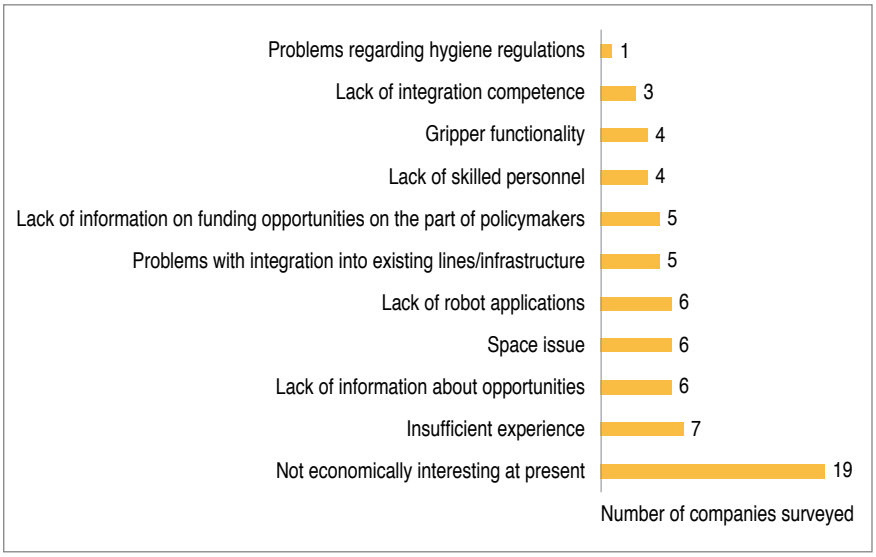

Figure 8: *Reasons for lack of robot use*

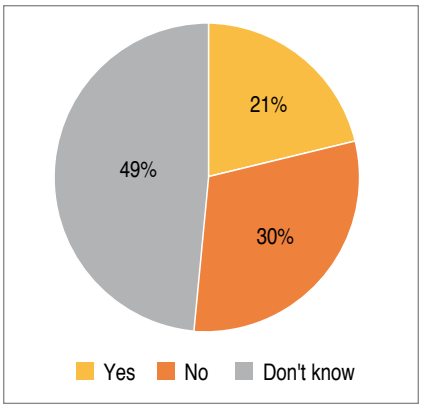

Figure 9: *Intention of companies without robots to acquire robots [%]*

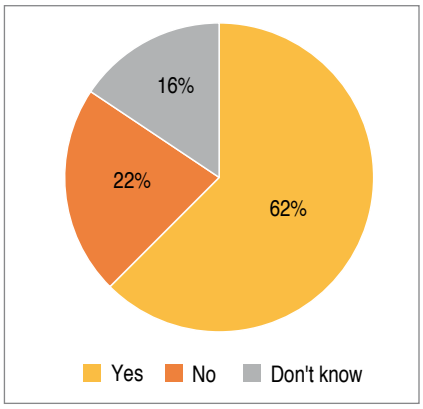

Figure 10: *Intention of companies with robots to increase their number [%]*

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Types of robots used and applications of robots in different process areas

Only companies using robots provided information on the type of robots used and their areas of application and objectives. Multiple answers were possible for all questions in this part of the survey. The survey revealed that articulated-arm robots (20 mentions) are used most frequently in the companies surveyed. In addition, gantry robots and delta robots (both 12 mentions) are frequently used.

This can be explained by the wide range of possible applications for articulated-arm robots, which result from their three-dimensional movement capability as well as their high payload and reach. Due to their high speed but low payload, delta robots are mainly used for pick and place applications (Figure 13) or also for packaging (Figure 14). Gantry robots are crane-like systems that are often used for palletising due to their large possible payload (Figure 12) (Expert Knowledge on Robotics, 2022).

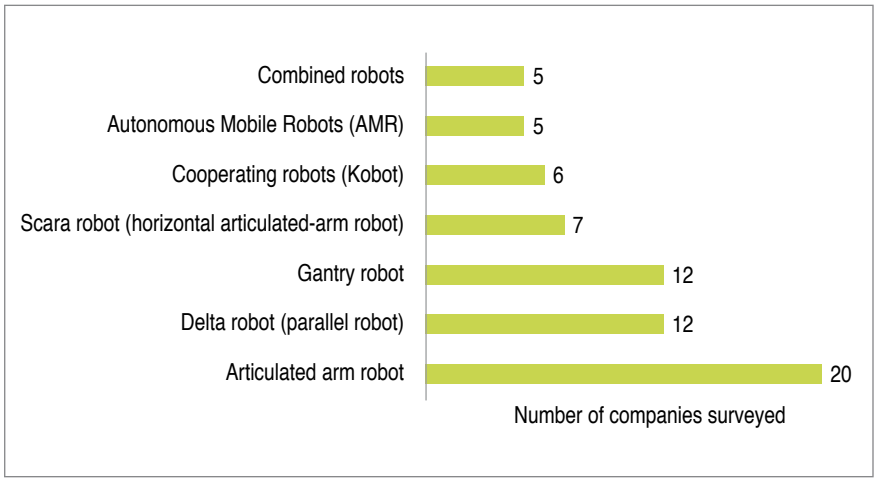


Figure 11: *Kind of robot types used*

The companies participating in the survey mostly use their robots in logistics for palletising (26 mentions), order picking (12 mentions) and depalletising (11 mentions). Only one company did not use any of its robots in logistics (Figure 12). This shows that robots in logistics often take on tasks that physically stress employees and endanger occupational safety. As a result, companies can create better working conditions at the workplace through the use of robots (Figure 16).

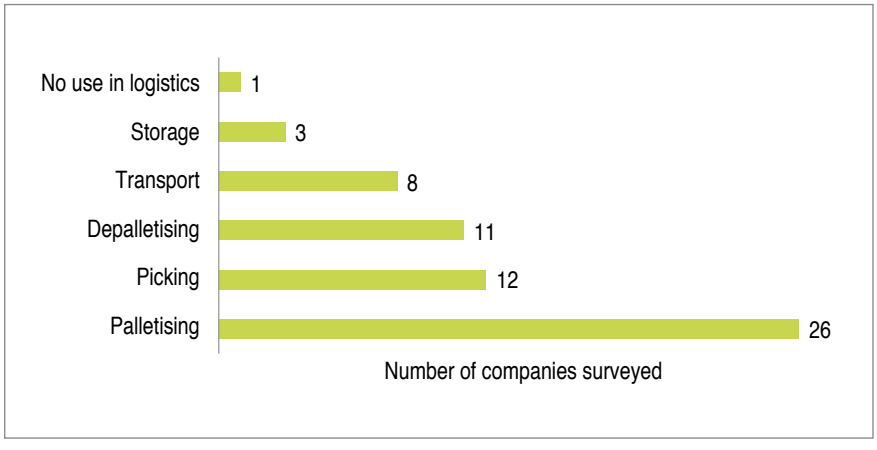


Figure 12: *Applications of robots in logistics*

In the area of processing, the robots of the companies are mainly responsible for positioning (14 mentions), sorting (12 mentions), checking and dosing (7 mentions each). However, 9 of the companies with robot experience, and therefore a large proportion, do not use robots in processing (Figure 13). Here it can be seen that robots often take on so-called pick and place tasks where precision is required on the assembly line. The use of robots can replace unattractive, monotonous work and save personnel through automation. This reduces costs and, in view of the shortage of skilled workers, secures production processes.

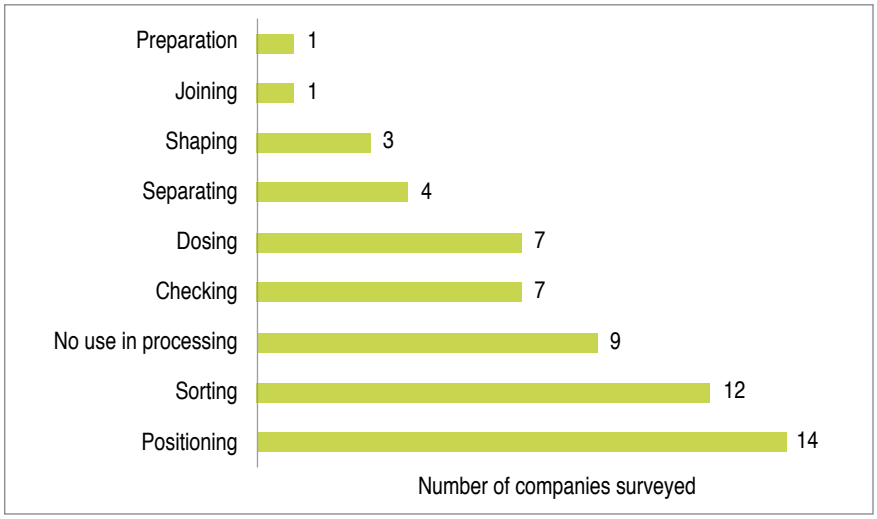


Figure 13: *Applications of robots in processing*

In packaging, the companies surveyed use robots primarily for repackaging (14 mentions). They are also used in primary packaging (12 mentions), labelling (7 mentions) and closing (6 mentions). Here as well, there are 8 companies that do not use robots for packaging (Figure 14).

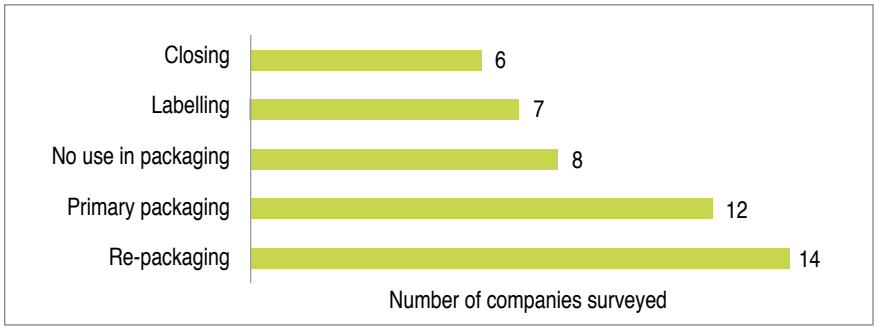


Figure 14: *Applications of robots in packaging*

In addition to logistics, processing and packaging, robots are also used in catering and cleaning (Figure 15).

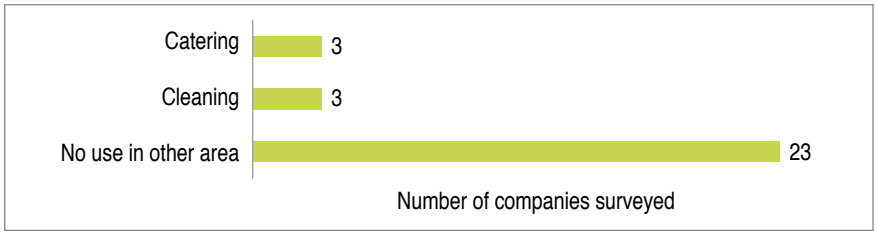


Figure 15: *Other applications of robots*

Furthermore, the participants were again asked in this survey about the objectives they want to achieve with the help of robots. The most frequently mentioned aspects were facilitation of working conditions at the workplace (23 mentions), improvement of effectiveness (22 mentions) and personnel reduction (automation) (20 mentions), as can also be seen in Figure 16. This shows that, in addition to staff health and satisfaction, the focus of the companies is primarily on cutting costs in view of rising raw material and energy prices.

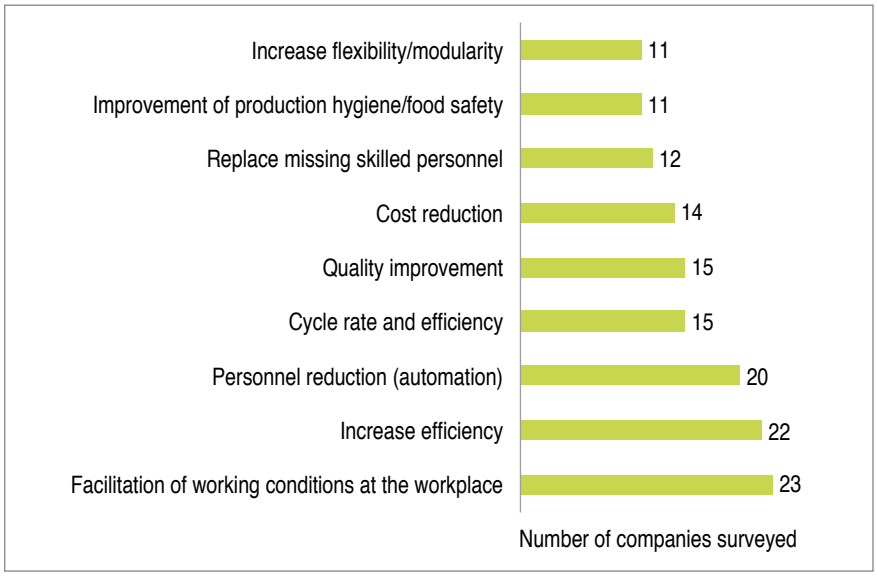


Figure 16: *Objectives of the use of robots*

Training

As in previous years, another major part of the Trend Monitor was devoted to the training of people in a company who have to deal with robots either through their decision-making authority or their area of responsibility in everyday work. All participants were able to answer the first question in this section on the adequacy of existing further training opportunities. All other questions were answered exclusively by companies that owned robots at the time of the survey.

First, the participants were asked to what extent they considered the currently existing training opportunities in the food and beverage industry to be sufficient for effective management of the robotic systems. At 35 %, more than a third of the respondents assessed the training opportunities in relation to robots as insufficient, while 22 % could not identify any lack of such opportunities. However, 43 % were not sure how to evaluate the existing offers for further training (Figure 17).

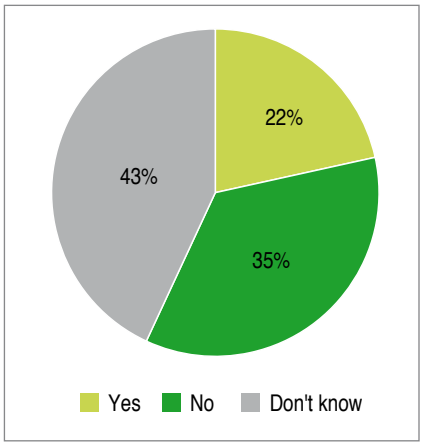


Figure 17: *Assessment of the current further training opportunities for sufficiency*

In order to be able to assess the need for and scope of further training, it is essential to know the training levels of both the people who decide on the use of robots in a company and those who operate the robotic equipment.

In the companies surveyed, people with very different educational backgrounds are responsible for making decisions about the use of robots (multiple answers possible). In most of the operating companies, people who have completed or received a university degree (23 mentions), a master craftsman's examination (20 mentions) and/or a technical college entrance qualification (13 mentions)

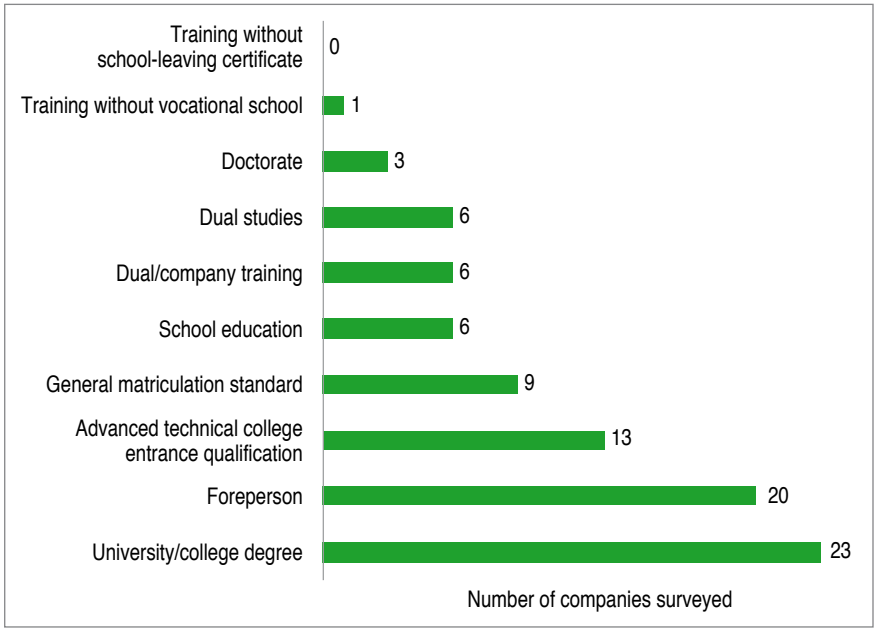
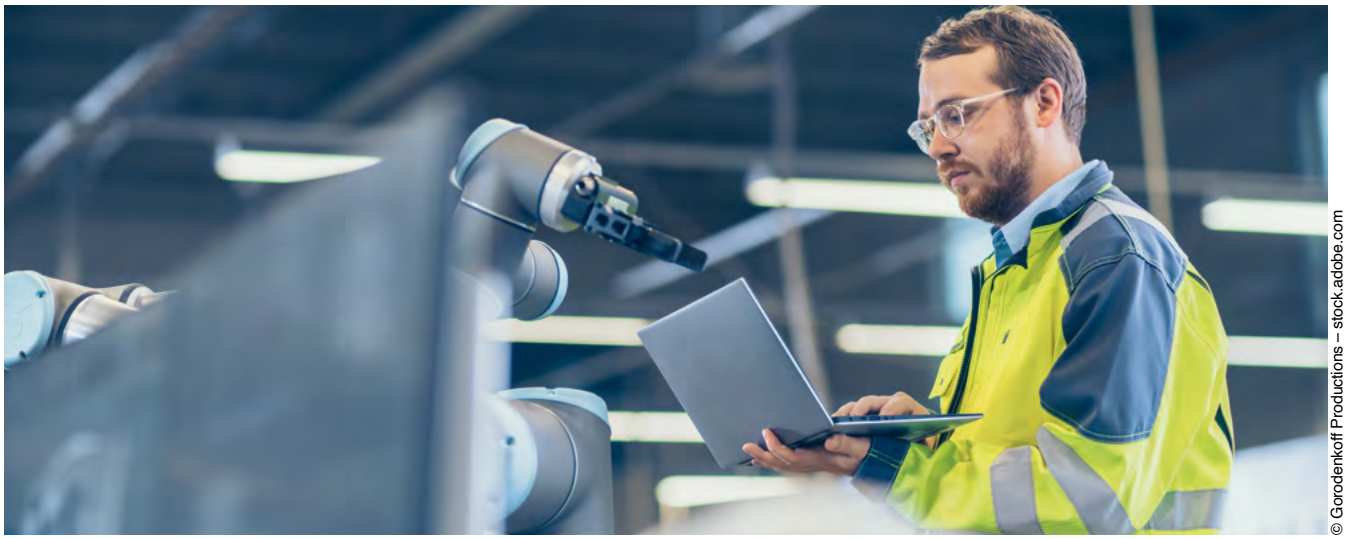


Figure 18: *Type of training for decision-makers on robot use*



are the decision-makers regarding the use of robots (Figure 18).

The situation is somewhat different, however, for the people who operate the robots. People who have passed a master craftsman's examination (19 mentions) were also frequently named here, but people with dual/company (18 mentions) and/or school-based training (12 mentions) are also employed (Figure 19).

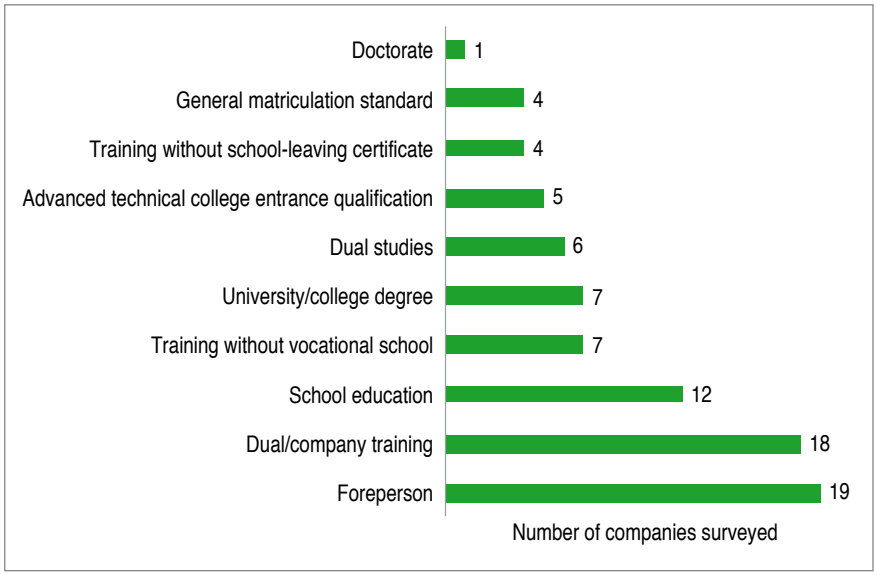


Figure 19: *Type of training of the persons operating the robot systems*

Therefore, it would be desirable to integrate robotics into the training curriculum in the above-mentioned types of training in order to better prepare workers technically for their tasks in professional life and to give them a certain degree of security in this subject.

Although when asked whether existing training opportunities are sufficient, the largest proportion of those who could give a clear answer felt that they were insufficient (35 %, Figure 17), it can be seen in Figure 20 that the largest proportion of companies with robot experience (59 %) see no need for a "robot driving licence" for robot operators. However, 38 % also think that such a "robot driving licence" is necessary (Figure 20).

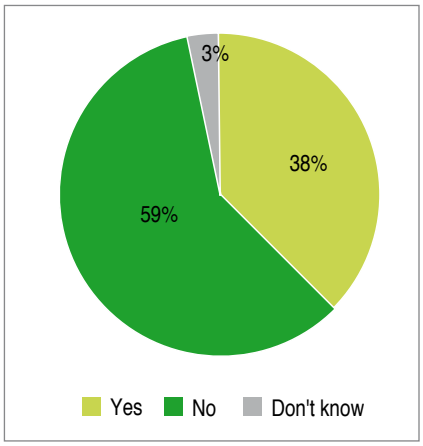


Figure 20: *Need for a "robot driving licence"*

If something like a "robot driving licence" were to be introduced, most companies with robot experience believe that such a "driving licence" should include content on occupational health and safety systems (29 mentions), basic technical knowledge (27 mentions), food safety and quality (21 mentions), and guidelines, standards and legal regulations (21 mentions) (Figure 21).

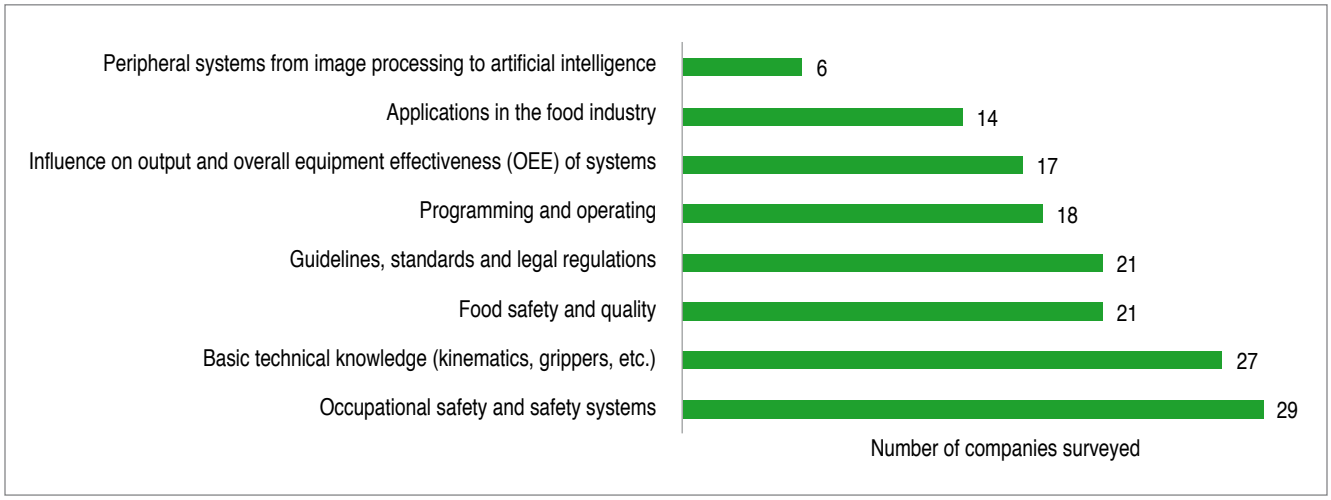


Figure 21: *Potential contents of a "robot driving licence"*

Summary and outlook

In summary, it can be said that robotic systems are becoming increasingly important in the food industry. At 49 %, about half of the respondents said they use robots in their processes. If companies already have robots, most are willing to continue investing in robots in the future. For most companies, the reason for using robots is to improve working conditions, increase efficiency and save on personnel. These goals can be achieved by using robots, as robots can perform heavy as well as monotonous work precisely and quickly without the need for a large number of additional personnel. The other half of the companies surveyed did not own any robot technologies. Here, there was also less willingness to invest in robots in the future than among companies that use robots. The reasons for this are usually a lack of expertise or experience in the field, but also the characteristics of the company's processes and systems.

In the food industry, articulated-arm robots (jointed-arm robots) are still mainly used. The robots' tasks are mostly in logistics, but also in packaging and processing. With regard to the training of robot-operating personnel, it becomes apparent that employees with very different educational backgrounds have skills in using robots. In this context, companies place particular emphasis on knowledge of occupational health and safety, technology, food safety and legal guidelines.

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In cooperation with the DLG Working Group Robotics in Food Production

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