Robotisation in Belgium

The next steps in unlocking its full potential

a study from .AGORIA pwc

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FOREWORD

Every day, the manufacturing industry is dealing with increasingly more complex challenges. Think mass customisation with lot size one on the one hand, and a shortage of skilled resources on the other hand. How do we address these issues?

There are no two ways about it: if we want the industry to remain an essential cornerstone of the Belgian economy (**and we do!**), given its contribution to exports and prosperity, it is clear that **we need to explore the potential of robotisation**.

Truth be told: Robotisation as such is not new but do you know whether it has already proven to be successful across different sectors?

To gain a better understanding of where it has been (successfully) implemented (and where not), best practices and lessons learned, Agoria and PwC have conducted **a survey involving more than 120 production companies** in Belgium.

As a conclusion, we can say that **the robot has gained in importance in production environments in Belgium**; it is also a valuable partner in helping operators and workers handle more complex or repetitive tasks.

If you have not yet started your journey of robotisation, we hope to inspire you today. Not only do we, in this whitepaper, provide an overview of the **different robot applications and infrastructure that is needed** but we also provide insight into the type of robot that is best suited for a specific application. We reflect on the potential of each, explore some of the pitfalls and outline the steps that are necessary to successfully implement robotisation in your company.

Furthermore, **we provide guidance on how to get started and who could help you**. Who are the stakeholders, what are the trends today and what evolution is expected? And let's not forget: **how do you create support and buy-in from the employees** and how can you help their skills to evolve?

In other words, read on to learn all about the robotics landscape in Belgium and how you can create a roadmap to successful implementation for your own company.

Embrace and cherish the robot as it's an opportunity that's here to stay and will grow even further as robot technology and tools evolve!

Jochen Vincke
PwC Belgium
Partner Sustainable Manufacturing

Ben Van Roose
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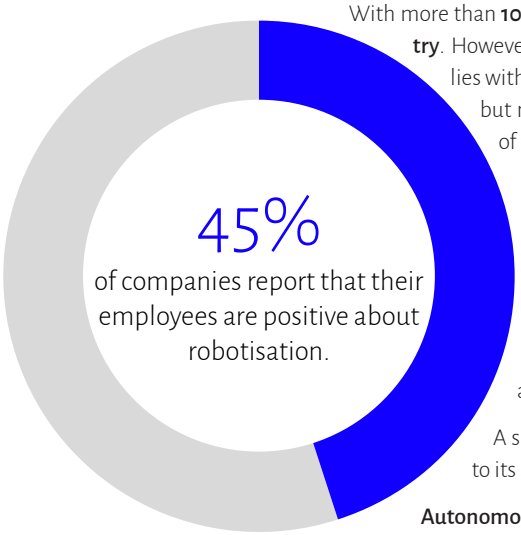
Manager Manufacturing

EXECUTIVE SUMMARY

For many companies, automating production processes is vital to remain competitive in the global marketplace and to increase productivity.

The implementation of robots can play a crucial role in this. 36% of the companies surveyed which already use robots saw a clear increase in growth and 45% reported that employees are positive about robotisation. However, Belgian companies still have some way to go in realising the full potential of robotisation, especially SMEs.

Today, robotisation is a technology mostly used by large companies



With more than **10,000 robots installed, Belgium is in the world top twenty of robots per employee in industry**. However, it's mainly the large companies that are investing in robotisation. The greatest potential lies within manufacturing SMEs with almost 40% of them recognising the potential that robots offer, but not yet using them. The main obstacles are a shortage of internal robot expertise and a lack of trained employees.

Advances in robot technology unlock robot application potential

The **six-axis or articulated robot is the most commonly used robot** due to its versatility. Before choosing which robot type to use, the robot integrator must conduct a thorough and in-depth analysis to make the right choice. There are many pitfalls in a robot integration project, and choosing the wrong type of robot is just one of them.

A significant newcomer in the world of robots is the cobot, which is rapidly gaining ground due to its ability to work together with the operator.

Autonomous mobile robots (AMRs) are also appearing on the robot landscape with applications on the shop floor, mainly in logistic functions where they are equipped with an arm, enabling them to grab and place items. Both types are taking an important place alongside traditional robots, offering new opportunities for companies and sectors where few, if any, robots are currently used.

Recent years have seen an increase in the robot's ability to handle larger products and varying production volumes. Smaller production volumes are possible due to the fast changeover times of current robot types. Robots can now be used where previously it was not possible or profitable.

Don't underestimate the robotisation journey and involve all stakeholders

The multidisciplinary and complex nature of automation and robotisation remains a major challenge for companies. **Robot integration is more than simply the installation of a robot**. The choice of gripper, sensors and the installation of protective fencing all require thorough preparation and research with the various players in the ecosystem.

The introduction of robots into production processes not only frees up operators from dull, dirty and sometimes dangerous tasks, but also provides a solution for labour shortages. By cleverly and consciously looking at which activities robots can take over, the operator's time is freed up to focus on more qualitative job content. Man and machine complement each other, leading to growth and employee retention, and even an increase in employment in the long run.

Seven steps to success

Based on our in-depth interviews with end users, robot integrators and suppliers, we've devised a 7-step plan with keys to success to get you started with a successful robotisation integration project.

Recommendations to government

We've also incorporated recommendations on how the government could support industry on its road to robotisation and industry 4.0, based on the main challenges Belgian industry faces today.

SEVEN STEPS TO SUCCESS

Based on our in-depth interviews with end users, robot integrators and suppliers, we've devised a 7-step plan with keys to success to get you started with a successful robotisation integration project.

We've also incorporated recommendations on how the government could support industry on its road to robotisation and industry 4.0, based on the main challenges Belgian industry faces today.

Seven steps to implement a successful robotisation project*

Step 1 - Know your product

Determine how many product variants you plan to make and how this will evolve in the future.

Step 2 - Scope the task

It's always important to carefully scope what needs to be done. Decide for which part of production you want a robot and which task is to be robotised.

Step 3 - Think about the required facilities

Take into account technical and safety aspects such as power supply, compressed air supply, space and protective fencing. Check whether these are available and include these considerations in the project planning.

Step 4 - Consider the environment

Choose the desired layout of the robot and base the layout on the task(s) to be carried out.

Step 5 - Involve all stakeholders

As well as selecting the right partners to work with, include your operators in the choice of robot type and design of the robot cell.

Step 6 - Think, with others, about critical details

Choose the appropriate tooling (gripper, vision etc.) geared to the product to be handled or the task or operation to be carried out.

Step 7 - Connect your installation

Analyse the possibility of integrating the robot into the periphery IT systems, such as SCADA or MES and other software applications for production and maintenance.

**A detailed description of the seven steps can be found on pages 21 to 22.*

Seven statistics you should know about robotisation

1. Seven out of ten manufacturing companies deploy or experiment with robots and two out of ten (**17 %**) are already using robots as a strategic asset.
2. The most commonly used type of robot (**70%**) is the articulated robot, otherwise known as the multi-axis robot.
3. Robots are no longer a mass production technology, about **44% of our respondents** say they use robots on small batches (<100 pieces/day). Robots of today can handle almost any volume, shape or weight.
4. **34%** of the surveyed companies are already using robots in specific champion departments and are setting an example for the rest of the company.
5. **Four out of ten** SMEs are not applying robotics in their manufacturing process or do not have basic or testing experience with regard to robotization in their business.
6. **78%** of companies rely on outsourced knowledge and expertise for robot integration, only two out of ten have in-house robotisation expertise.
7. **60%** of companies report that the main reason for failed robotisation projects is due to underestimating the complexity of the integration.

Seven drivers to start with robotisation in your company

1. **Maintain and increase your competitiveness** by automating and robotising the right activities.
2. **Increase growth** by expanding robot capacity (this is confirmed by 36% of the companies surveyed which already use robots).
3. **Expand the potential application areas** of robotisation enabled by peripherals, such as machine connectivity, advanced data analysis, 3D-printing and vision systems.
4. **Ensure continuity of production capacity** by implementing reliable robots.
5. **Ensure repeatable and highest quality production** by supporting your employees with complementary robot technology.
6. **Improve the ergonomic conditions of operator jobs** by taking over the tasks which are dull, dirty, dangerous and difficult (4D).
7. **It is seen as an indispensable partner on the shop floor** by one out of two employees.

RECOMMENDATIONS FOR THE GOVERNMENT

More initiatives to accelerate the adoption of robots and cobots

The importance of robotisation for the resilience and the competitiveness of our companies today is certain. The regions have **successfully developed several programmes to increase the adoption of technologies** by our companies. In Flanders, with the help of the workability cheque, companies can receive financial support to identify bottlenecks around workable work within the organisation in order to sustainably improve working conditions. Furthermore, there is also an Industry 4.0 Living Lab "Technology for Workable Work", which demonstrates the use of technological tools to reduce physical workloads. The Factory of The Future initiative created by Agoria-Sirris and today being developed with multiple partners is also a good example of this type of initiative.

The results of this study highlight the importance of such initiatives but also the need to go further. The average level of robotisation in our SMEs and the big differences between sectors show that we certainly have room for improvement. We need **more initiatives to support and incentivise companies to adopt technologies, such as robots and cobots**.

This can help our companies find the right partners and their way through what remains a difficult journey.

STEM profiles: we need you !

One of the main obstacles to the implementation of robotisation is the shortage of STEM profiles.For years, the shortage of STEM talents in the Belgian labour market has been a barrier to the growth of the sector. To address this challenge, it is now **essential to develop and implement a comprehensive STEM action plan**.

The initiatives taken over the last few years at the regional levels are going in the right direction. But we need **to go further** and see how, on a national scale, together with the different actors, **to put in place an ambitious strategy and make it a reality**.

Governmental support to investments in robotisation should be more adapted to the reality of our companies

Investments in robotics are important for companies. In addition to improving the manufacturing process, it frees up time within the teams and allows them to be more focused on innovation and creativity rather than on repetitive tasks. Robotisation is a first step in the journey of our companies towards tomorrow's business models.

Well aware of the importance of such investments for the competitiveness of our companies, public authorities have created mechanisms to support them. However, to get access to such support, one of the criteria is the number of jobs created. Even **if the number of jobs remains an important indicator, it is essential in the current context to consider it from a more global perspective**.

Indeed, the pandemic, the energy crisis, the war in Ukraine on the one hand and the challenges of the twin transition on the other hand require a rethink of the position of our companies in globalised value chains and in full reorganisation.

In this context and considering the challenge for our Belgian industry to remain competitive, **we have to develop a long term vision and integrate not only the short term job creation** but also the future perspectives that robotisation brings for our companies. Without this longer-term vision, we will not enable the development of sustainable Belgian industry.

Training and orientation are key

In our rapidly changing world, training is an essential component. Reskilling and upskilling are not only key for workers but also for student and jobseekers to give them new opportunities. The **presence of major training centres associated with industrial federations** (and also supported by the trade unions) **is definitively an asset for our regions**. Some of these training centres are wellequipped and can respond to the demanding needs of our companies.

Regarding job seekers, we are convinced that stronger policy to encourage training for shortage occupations would be a win-win. Firstly, for the job seekers themselves, with the guarantee of joining innovative and promising sectors, then for our companies which have been fighting a war for talent for years, and finally for the regions which, in one move, could both reduce their social costs and increase their revenues through the creation of private jobs.

1/ KEY FINDINGS

1a/ ROBOTS IN BELGIAN INDUSTRY

Industrial automation and robotisation go hand in hand

Since the beginning of the last century, industrial production has been looking to automate industrial processes. There are various reasons for this, but the main one is to increase the production of finished products and to optimise the quality of the delivered production. Industrial automation was already implemented at the beginning of the 20th century in the automotive industry, among others. This was to optimise the internal logistics chain and reduce unnecessary travel to a minimum. Machines were also developed to support the operators and to take over some of the tedious repetitive work. Industrial automation has constantly evolved through the use of new technologies and insights. These include the emergence of industrial computers also named Programmable Logical Controllers (PLCs) and the rise of mechatronics, where mechanical components and electronic systems were combined.

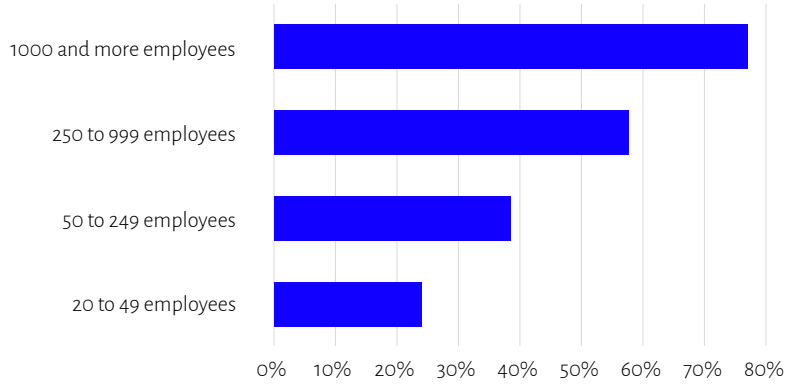
Robots are also one of these important components that has claimed its place in industrial automation and can no longer be imagined without it. Thus, we must see the robot as an important key to the realisation of an automation process in industry.

What exactly a robot is, is not such a simple question. **A robot is a programmable machine that performs tasks independently**. But according to this definition, an ATM and a washing machine would also be robots. What these devices cannot do is react to environmental factors. Robots can. They are often equipped with sensors such as cameras, thermometers and light meters to adjust their programme as necessary based on their environment. In this study, we limit ourselves to industrial robots. This type of robot consists of a robotic arm whose joints are controlled by a motor. The endpoint of the robot arm, which is equipped with an actuator, is brought to a desired location in a room. The actuator performs a specific task such as a gripping, welding, painting, grinding, gluing, measuring, screwing, etc. Today's modern robots have sensors that make it possible to make the robot more intelligent, and are like the robot's senses. With vision systems, the robot recognises parts. With feel sensors, it will be able to notice if it is pushing against something and thus adjust its behaviour. This **turns the formerly rather "dumb" robot into an intelligent component** in an industrial automation environment. An overview of the different types of industrial robots can be found in **appendix I**.

Essential for increased productivity in a competitive market

Productivity in Belgium is high, but it has nonetheless stagnated in recent years[1]. If Belgian industries are to remain competitive in the global market place, increasing productivity is vital. Automation and robotisation have a key role to play in achieving this objective. According to an EU analysis[2], backed up by our own research (Figure 1), larger companies have been quicker to adopt these new technologies while small and medium-sized production companies (SMEs) are lagging behind. Many use robotics only to a very limited extent, others not at all. So what's holding them back? A lack of training and in-house knowledge are the main factors, but there are also residual beliefs that hamper progress. Outdated preconceptions of the environments in which robots can be used and misconceptions around the impact of robotisation on employment need to be addressed to oil the cogs of acceptance and integration.

Figure 1 Larger companies implement industrial robots more often in their production processes than smaller companies.



Share of Firms using industrial robots, by company size

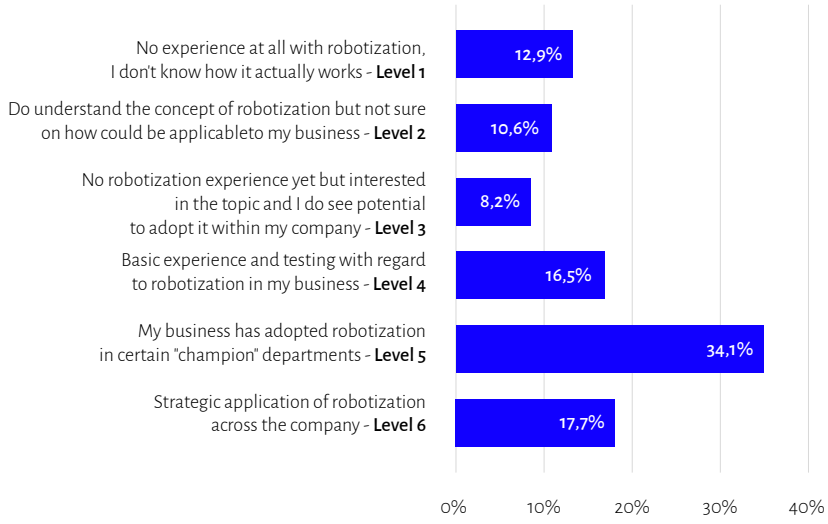
Source: Analysis of the impact of robotics on employment in the European Union[2]

Where does Belgium stand in robot use globally?

Belgium currently ranks fifteenth in the world in terms of robot density at 198 compared to the average of 141[3]. Robot density refers to the number of robots per 10,000 employees in the manufacturing industry. This puts us alongside the European countries, between Italy with 217 robot density and Austria with 196, largely due to the strong presence in Belgium of the auto-motive industry and its first-line suppliers.

In terms of actual numbers there are currently more then three million robots in use worldwide, 10,380 of which are in Belgium. This number has increased by an average of 5.2% per year since 2010[4].

Figure 2 Level of knowledge and deployment of robotics in Belgian industry



7 out of 10 manufacturing companies in Belgium deploy or experiment with robots

1 https://www.agoria.be/en/themes/tomorrows-manufacturing-industry/manumatters/manumatters

2 Analysis of the impact of robotic systems on employment in the European Union – 2015 – source

3 World Robotics 2022 IFR – Industrial Robots

4 World Robotics 2020 IFR – Industrial Robots

Five sub-sectors in Belgium that account for 84.5% of robotisation are[5]:

47% Car industry	17% Metal industry	10% Food and beverage industry	7,5% Plastics, pharmaceutical and chemical industry	3% Electronics and electrical engineering industry
4,731 installed robots	**1,745** installed robots	**1,031** installed robots	**770** installed robots	**281** installed robots

5 Source: World Robotics 2019 IFR – Industrial Robots

Why companies are embracing robotisation

Companies give three main reasons why they have started using robots:

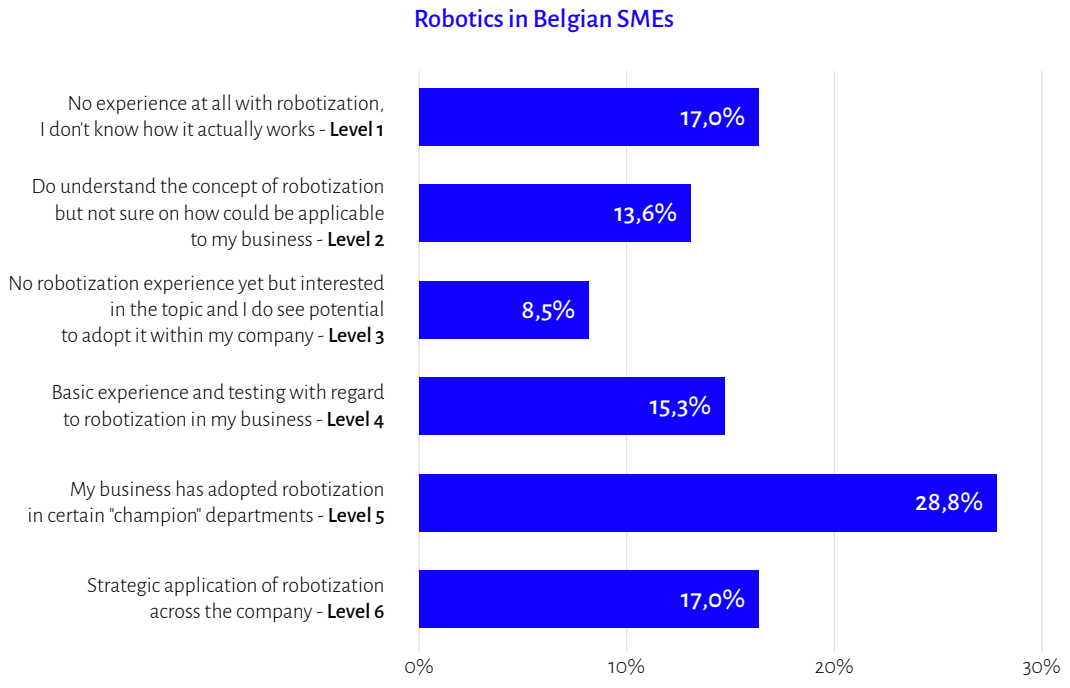
1. **Reliability, quality and repeatability of (robot) technology**
2. **Maintaining competitiveness:** This means not only lower prices, but also higher quality, faster response time, shorter delivery time, less failure of basic goods, flexible production (lot size one production or mass customisation) with products adapted to the customer's needs.
3. **Reduced workload:**
   - Taking over the 4 Ds: dull, dirty, dangerous and difficult tasks
   - Responding to a shortage of specialised and skilled labour

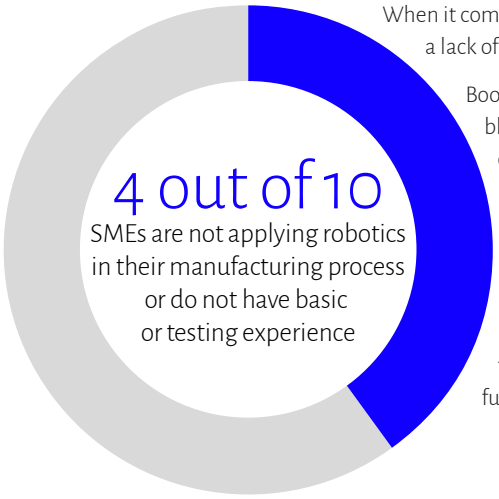
Knowledge is key for boosting adoption by SMEs

Although Belgium is relatively high on the global table of robot density, there's a clear disparity between the use of robots in large companies (85%) and their smaller counterparts (61%) (Figure 3, level 4, 5 and 6). 74% of companies surveyed are SMEs and **3 out of 10** (Figure 3 level 1 and 2) don't have any experience or are having doubts about the applicability in their operational business.

This brings us to the conclusion that **4 out of 10 of the SMEs** (Figure 3 Level 1, 2, and 3) are not applying robotics in their manufacturing process environment or do not have basic or testing experience with regard to robotization in their business.

Figure 3 Levels of knowledge and deployment of robotisation in SMEs



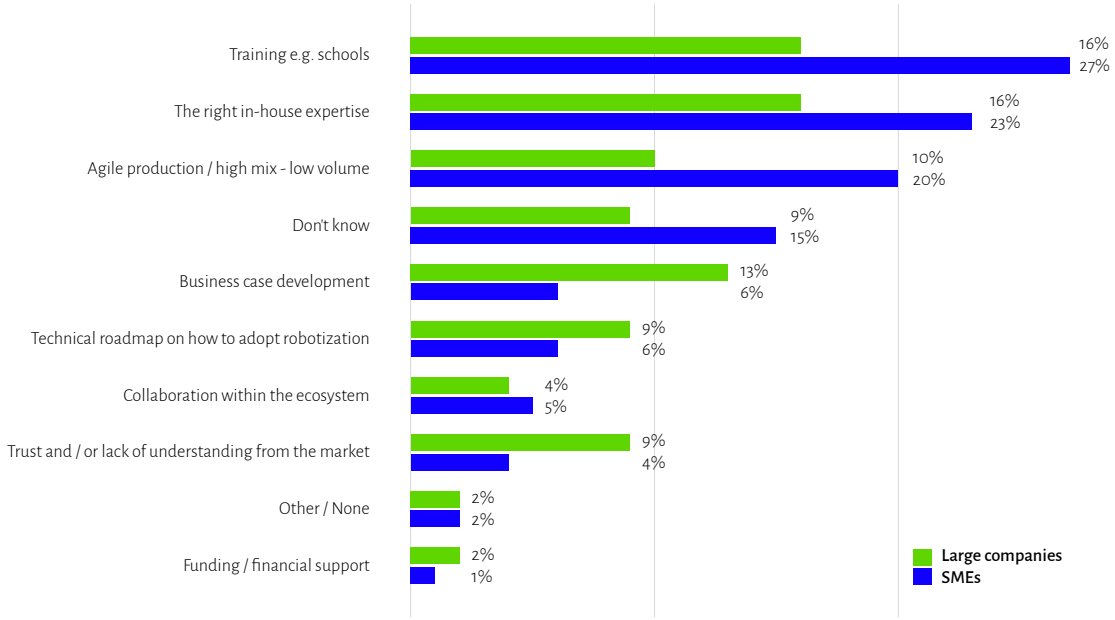


When it comes to applying robotisation within SMEs the main obstacles are insufficient training (27%) and a lack of the right in-house knowledge (23%) (Figure 4).

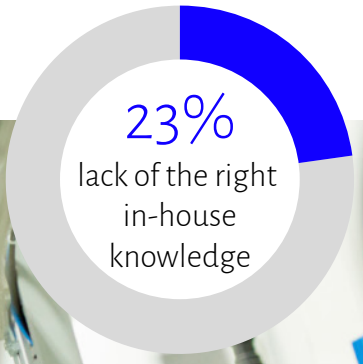
Boosting the knowledge of employees through training and hands-on experience will in turn enable improved assessment of the potential for robotisation within the company, thus bringing it one step closer to implementation.

Although every robot manufacturer or integrator offers customised solutions for their customers, when it comes to the digital upskilling of the population it's important to offer 'manufacturer neutral' training tailored to various target groups (job seekers, operators with some experience, system engineers, maintenance staff, etc.). Government institutions such as the VDAB, Le Forem and Actiris (public employment service of Flanders) have an important role to play, and the government can lower the threshold by providing the necessary resources for further training or retraining.

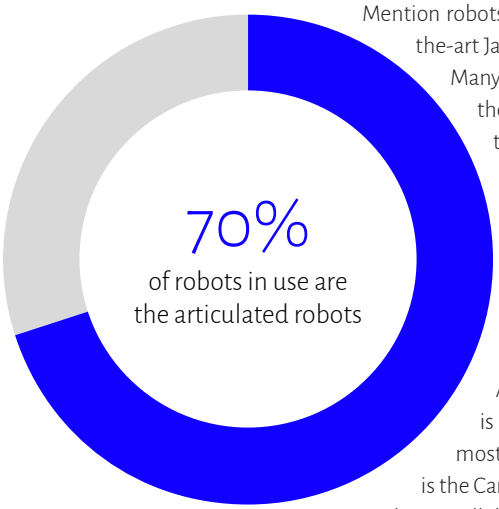
Figure 4 What are the missing robotic capabilities or items for large companies and SMEs



Main obstacles to implement robotisation at SMEs



From expensive to affordable – the commodification of robots



Mention robots and most people will think of the automotive industry. 1980s newsreels showcased state-of-the-art Japanese car assembly lines 'manned' by robots, putting together cars, faultlessly and efficiently. Many other industries followed suit and yet there's still a lingering idea that robotisation is primarily the preserve of mass production industries, with little scope or application for smaller and customised production lines. While the basic technology behind a robot is the same as when they first appeared, the development of peripherals has increased robots' versatility enormously. Combined with a relative drop in cost, robots now have the potential to handle small batches and customisable products, making them accessible to a wider range of businesses.

Cobots – the new kid on the block

Across all industry sectors, based on our survey, the most commonly used type of robot (70%) is the articulated robot, otherwise known as the multi-axis robot. For the articulated robot, the most used robot are the six-axis robot and SCARA robot with almost 30% usage, in second position is the Cartesian or portal robot with 27% usage and in third place, the cobot. Relatively new on the scene, cobots - collaborative robots - are set to turn the tables on how we use and interact with robots. Designed to work alongside humans or even to perform tasks with them, cobots offer opportunities to robotise processes that were previously out of reach due to the limitations of the six-axis robot.

Reasons for not using the classic six-axis robot in certain processes include:

- **expense** as the total project cost is more than the robot alone
- **inflexibility in adapting to changes in production** due to the difficulty of programming robots
- **high complexity** involved when learning and training new target points

In contrast to the six-axis robot, cobots are easier to install and use in the production line. Without the need for protective fencing, it's easier for people to move around them. The cobot market is growing rapidly and the adoption rate by companies is high. Due to their specific applicability, cobots are more likely to find their place alongside traditional robots, rather than replacing them.

Putting robots to work

'Pick and place' and machine tending (loading and unloading work pieces) are the most common robotisation applications today, together with welding and soldering. This is true for all the companies interviewed, with potential users also indicating that these would be their three main applications for robots. We've noticed in recent years that the application areas for robots and cobots continue to expand. No longer the preserve of large-scale mass production, such as the automotive industry, cobots are being used

Most robots today are used in the processing and automotive industries and the opportunities for further optimisation in these sectors are the smallest. On the other hand, we see great potential for companies in the food and pharmaceutical industries, where the low-hanging fruit is mainly in packaging and logistics applications.

Like many industries, the food sector struggles to find new employees while concurrently lagging behind in robotisation and automation. This problem can in part be solved by the continuous development of peripherals and robots, such as adapting robots to wet conditions.

***Benjamin Parent**, Segment Expert Belux Pharma/Food, Stäubli*

There's still a lot of hesitation in companies, especially SMEs, to use robots. Choosing the right integrator for robot or cobot installation is vital.

The integrator must have a good knowledge of both the robot and application, because only then can a project be successfully completed. Advancements in sensor and gripper technology are widening the range of applications for robots and cobots.

Peripherals increase their flexibility, enabling them to perform different tasks.

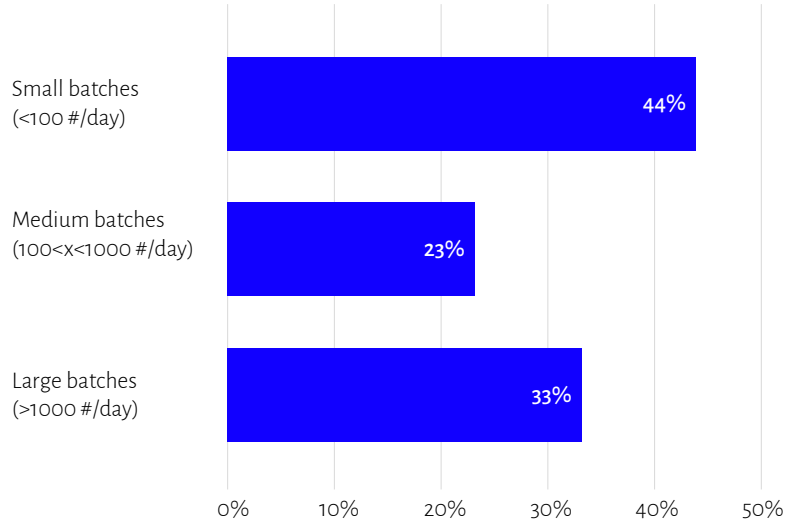
***Kris Huyck**, Manager Robotics Benelux, ABB*

When it comes to product weight and size, traditional robots have the edge

Looking at the current processing capabilities of industrial robots, we see that they are used for a wide variety of products and production volumes. This refutes the notion that robots are only suitable for large production volumes. Our survey reveals that 44% of the current robots process small batches (<100 pieces per day) (figure 5).

The classic industrial robot can handle most products, in terms of size and weight. This is not the case for cobots, where weight especially is a limiting factor. As they have been developed to work with people, most cobots are not designed to carry the loads of traditional industrial robots.

Figure 5 Breakdown per production size

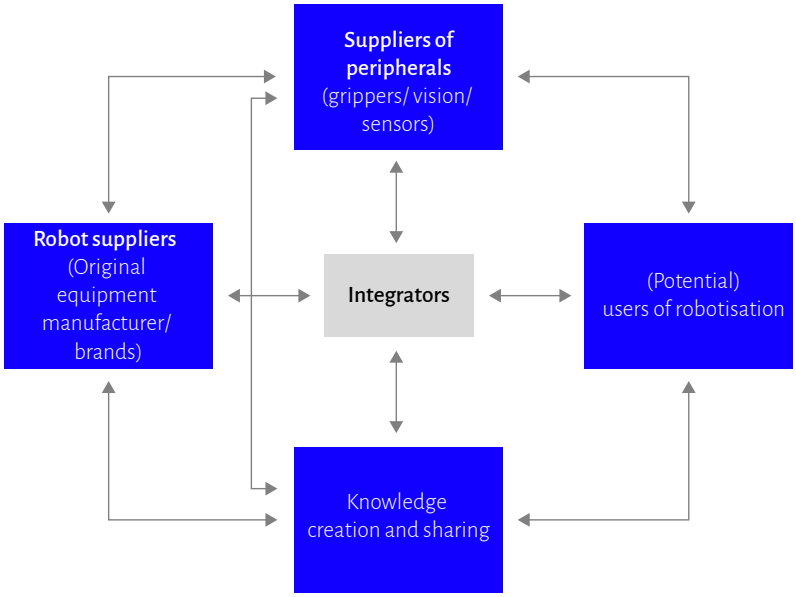


The ecosystem for robot implementation

The robot ecosystem consists of robot suppliers, suppliers of peripherals (grippers, vision systems, software applications for robots, sensors, etc.) and system integrators (figure 6). Only two out of ten companies have in-house robotisation expertise. Most companies work with a partner to develop their automation and robotisation projects.

In Belgium, well-known robot brands are directly represented by their local importers. They work mostly together with integrators who have specific knowledge of the application to be developed. We also have local robot producers which develop and build robots for specific applications, such as gardening, social robots for care centres, robots for underwater applications and drones.

Figure 6 Visualisation of the entire ecosystem



Many production environments work with legacy machinery. By adding camera technology and training AI models based on acquired production imagery, one can extend the shelf life of these production lines while giving line operators a future-proof job, by integrating them into the AI creation loop.

If one ensures that AI models can be easily trained and maintained by operators, the integration of these systems into today's production facilities quickly proves its value.

***Jonathan Berte**, CEO, Robovision*

Developments in related technologies improve robot performance and broaden usability

Alongside the developments in robot technology itself, advancements in related fields are increasing the versatility and application of robots in industry. Peripherals, connectivity, data processing, hardware and software supply and cybersecurity are all areas having a positive impact on the potential of robots in industry.

Peripherals

- Gripper technology is one of the most important aspects of greater robot integration. The technology is advancing, enabling robots to pick up products which were previously out of scope. An example of this is picking up an item in wet conditions. The complexity of this relatively small part of the whole installation can sometimes require most attention during integration. Robots are not humans and so can't feel how hard they need to squeeze an object to pick it up without breaking it.
- Vision systems is another peripherals that dramatically improves robot capabilities. As computers become more powerful and calculation methods evolve, more data, such as images, can be processed during the production process. The robot is able to see the object it needs to pick up and so can determine how to grasp it, just as a human instinctively knows how to pick up one object, avoiding the other items around it.

Connectivity

- We're gathering increasing amounts of data from production systems and lines, including robot systems. With the advent of industrial IoT applications and wireless data transmission, including WiFi and 4G, this connectivity makes it possible for data to be captured without expensive cabling.
- Cybersecurity in production is crucial. Machines and robots are connected to each other and also the IT production systems up to administration level, making them vulnerable to cyber attack. Sufficient measures need to be in place to anticipate and prevent such attacks.

The complex nature of automation and robotisation remains the biggest challenge in the workplace

- One third of integrators and users have at one time or another had a negative experience when integrating robots in the workplace.
- 60% of companies report that the main reason for failed robotisation projects is due to underestimating the complexity of the integration.
- 78% of companies rely on outsourced knowledge and expertise for robot integration.

Government can help

Many robotisation projects lose speed or overshoot their budget due to underestimating the complexity of the project. We recommend that the government continues to support related business projects, ensuring that applications are assessed by reviewers experienced in robot projects. Integrating a robot and a camera may not be considered innovative, but setting up a high-performance vision-based autonomous robot for many applications is certainly not yet commonplace or easy.

The current testing grounds focus mainly on how recent robot technology can be deployed in the manufacturing industry, and how to integrate cobots, work instructions, stress measurements, and so on, seamlessly into one whole. Our recommendation is to not only demonstrate research results, but also mature technology through living labs and (virtual) demonstrators such as testimonies, videos and company visits.

Future trends for robotisation and Industry 4.0

New technologies are increasingly making the working environment smarter. This trend certainly applies to robotisation systems. Production machines and lines are becoming integrated into all operations, so that assets such as robots can operate ever more independently.

- The advent of 5G will give peripherals for robots such as grippers and vision a boost, by speeding up communication between machines significantly (up to 100 times faster than 4G). As a result, robots will be even more connected to their environment, with the possibility of machine-to-machine communication on the production line. 5G will also enable the deployment of autonomous mobile robots (AMRs) in a more flexible way, such as changing course when they detect obstacles in their pathway.
- The emergence of cobots means that big steps are being taken in human-machine interaction, making it easier for operators to programme or adjust systems.
- As data generated by robots is increasingly collected and combined with data generated by the rest of the operational technology, we can move towards an automated production environment, Industry 4.0 and factories of the future. For example, think prescriptive instead of predictive maintenance and condition monitoring.

The first signs of these trends are already visible today. Slowly but surely, robotisation will evolve into a 'Robot as a Service' model (RaaS) similar to many other 'as a service' offerings.

At Fanuc, we can already access our robots' data via an IoT package and use this information to enable applications such as predictive maintenance or digital twin simulations.

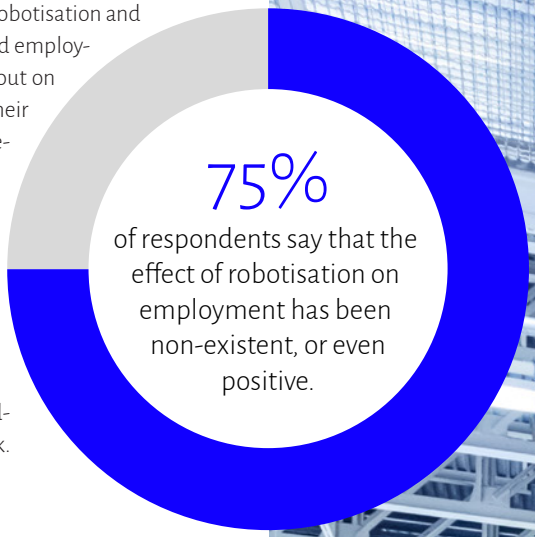
Demand for robot as a service remains relatively low however, as many companies are concerned about data security and ownership. But we're convinced that this is the future.

***Paul Ribus**, Managing Director, Fanuc Benelux*

Friends not foes

If there's one topic that sparks strong debate on the subject of robotisation and automation, it's the impact of these technologies on people and employment. Readers will recall news reports of angry workers going out on strike in protest at what they perceived as robots stealing their jobs. In fact, according to our survey, 75% of respondents believed that the effect of robotisation on employment has been non-existent, or even positive.

But that still leaves 25% who are yet to be persuaded that far from threatening livelihoods, the integration of robots into the workplace can actually do the opposite, by providing a partial answer to manpower shortages, for instance. With people freed up from mundane and repetitive tasks, they can use their uniquely human gifts of creative problem-solving, adaptability and flexibility, while robots get on with the dirty work.



Involve your people right from the start

If management is to convince its workforce of the positive impact of a robot integration project, the key is to involve them right from the start. They'll be more likely to develop a sense of pride in the project and will be happy to share this experience with colleagues. Our research showed that companies which took this approach benefited from a workforce that perceived robotisation and automation as a positive thing, relieving them of dull, dirty, dangerous and difficult work (the 4 Ds).

From operator to problem-solver

When tasks falling under the 4 D category are shifted to robots, the working environment for an operator improves enormously and their role evolves towards problem-solving and quality control.

Just like humans, robots also have problems from time to time and it's precisely here that the task of the operator is indispensable.

***Jérôme Marmignon**, Sales & Business Development Manager, JTEKT TORSEN*

Robotisation will keep manufacturing in Belgium

Robotisation detractors (or companies hesitant to invest in robotic technology) should heed the clear message coming out of our interviews: if manufacturing jobs are to stay in Belgium, robotisation, automation and digitisation are necessary.

This shift will have an impact; moving towards industry 4.0 will certainly change the way we manufacture.

- The total cost of labour will go down: as an operator's role moves towards a supervisory function, only intervening when something goes wrong on the production line, they no longer need to be present at all times. This is similar to maintenance workers today.
- Job content will change significantly, with the traditional work of an operator being replaced by more maintenance-related tasks. This leads to the question whether the current workforce is able to adapt to this new role or if companies will have to recruit a new type of worker, with different expectations and requirements, such as level of education.

The jobs are there – but what about the workers?

The war for talent rages on, with companies struggling to find new hires with the right skills, knowledge and education. This is confirmed in the Agoria study, *Be the Change*[6]. Since 2021 the demand for skilled workers has outstripped supply and this gap will widen until at least 2030. Take into account all these factors, and industry faces a major challenge. With many new graduates having never even seen a robot in real life, companies are turning towards their existing staff to face the challenge ahead. Companies like Audi Vorst, Atlas Copco and Danone are ahead of the game in this regard, having long since recognised that no one knows their production better than their current workforce. They invest in the continuous training of their staff, such as engineers, operators and maintenance technicians.

Upskilling is only part of the answer to a skills shortage

But will upskilling the current workforce be enough? As stated, robotisation and automation lead to increased productivity and improved competitiveness, and, if well executed, could even result in the reshoring of previously off-shored jobs. The flip side of this potentially positive development is that the current workforce would be insufficient and skilled people at all levels of the organisation would be needed. Another challenge industry is facing is the amount of students following a STEM direction at school and university.

According to a report and action plan on STEM in the Flanders region, although teachers, on average, are positive about STEM they feel they lack the knowledge to get started with it. Within the student population itself 40% have never heard of it and 45% of secondary education students see STEM as having no added value for finding a future job. And yet, about half of the students surveyed (especially those in primary education) want a STEM-related profession[7].

6 Be the change: Shaping the Future of Work – a study by Agoria

7 https://onderwijs.vlaanderen.be/sites/default/files/2021-07/Aanbevelingen%20voor%20het%20STEM-actieplan%202020-2030.pdf

At Audi we decided to tackle the challenge of a lack of skilled graduates head on. Working together with neighbouring schools, we've created a lab environment where students can experience what working with robots is really like. Students get some basic knowledge and expertise and if they're interested to learn more, they can do an internship at Audi, giving them a head start when they graduate.

***Peter Vloeberghs**, Manager Bodywork, Audi Brussels*

The impact of robotics on employment in the EU – the facts

- The use of industrial robots does not have a significant negative effect on employment in companies.
- Companies that intensively use industrial robots show significantly higher efficiency in the form of labour productivity.

A strong plea to industry and government for sustainable productivity growth is made in the Agoria study entitled Be the Change, so that Belgium can improve its competitive position and create employment. This is necessary in order to achieve an employment rate of 80% by 2030 and thus remain in line with the rest of the EU Member States and our most important trading partners.

The study puts forward three strategies.

First of all,

intensive activation, because there is a clear macroeconomic threat of a shortage of workers and because we want to get more than 600,000 people into work in order to raise our employment rate to 80%.

Secondly,

a strong and increased focus on skills to keep up with new, rapidly changing skill expectations. This applies especially to workers who have only completed secondary education. We need to create upward labour mobility whereby each professional is progressively educated during his or her career and can take on broader roles.

And finally,

working on sustainable productivity growth where the outcome of our work is determined by the right combination of efficient production methods with high working comfort, and the right attention to the human added-value in the various processes. Be the Change demonstrates with clear figures that the Belgian economy will in this way create jobs and see a rise in productivity.

Find out more about this study, download the complete ***Be the Change*** report.

At Atlas Copco in Wilrijk, compressors are designed and manufactured. Specialised, technically trained employees are crucial in the production process. Despite the high need for such STEM profiles, there has been a scarcity on the labour market for many years and the inflow remains too limited. We therefore decided to expand our talent pool to non-technically trained employees and to re-skill them to a technical profile.

We also invest in the future! Together with education and industry partners we actively invest in our youth, to make STEM education attractive and help them explore the exciting career opportunities in STEM.

***Annick De Bakker**, VP Human resources, Atlas Copco*

2/ GETTING DOWN TO WORK: ROADMAP TO IMPLEMENT A SUCCESSFUL ROBOTISATION PROJECT

Users, potential users, robot suppliers, integrators and providers of peripherals all took part in this survey. As a result of the interviews we conducted, we gained clear insights into what determines the success - or not - of a robotisation integration project.

Sound preparation is crucial, as is ensuring that everyone knows what the project entails and what is expected of them. Understanding that this kind of project does not stand alone but is part of a broader automation project is also important. We've identified seven steps to prepare and implement a robotisation project and for each step, we've pinpointed the key factors for success, based on our interviews. Following these steps will help maximise the success of your robotisation integration project.

STEP 1

Know your product

Determine how many product variants you plan to make and how this will evolve in the future. Clearly define how these products differ in terms of dimensions, shape, weight etc.

Key to success – consider technical aspects for good robot integration

- In some cases, the added value of robotisation is only maximised when the entire production line and process, or even the entire production environment, is considered. This increases the investment significantly, but also offers the greatest opportunities.
- Everything must be considered in the long term, including product design. A change to the product may affect whether the gripper or tool can handle it or not.

STEP 2

Scope the task

It's always important to define the job that needs to be done. Decide for which part of production you want a robot and which task needs to be robotised. Take the 80/20 rule into account, bearing in mind that part of the operations can, and perhaps will, still be done manually.

Key to success – start small, scale up fast

- If you've little or no experience in robotisation integration, don't be overly ambitious and start with the low-hanging fruit. Test the complex parts of the integration before you go ahead, such as, can the robot pick up your product?
- Or do adjustments need to be made to the gripper or product design?
- You will learn with every integration project. Increase complexity step by step so as to maximise the return.
- Share your experiences and learn from your successes and failures. This will help you in future projects.
- Don't be disappointed if at first things don't go as expected.

STEP 3

Think about the required facilities

Take into account technical and safety aspects such as power supply, compressed air supply, space and protective fencing. Check whether these are available and include these considerations in the project planning.

Key to success – dare to invest, dare to start from scratch

- Base yourself on the total cost of ownership and the increased resilience of your people instead of just return on investment. This gives a more realistic picture.
- Deciding to embark upon a robot integration project is a strategic process. SMEs especially need to give it sufficient thought.

STEP 4

Consider the environment

Choose the desired layout of the robot cell (the complete system including the robot, controller, and other peripherals). Base the layout on the task(s) to be carried out (including loading and unloading the cell), taking into account the weight to be handled and the range. Get support from a robot integrator if you don't have the necessary knowledge in-house.

Key to success – the right partners

- Surround yourself with the right partners and you've nothing to be afraid of when you embark on robotisation!
- Choose a robot integrator with experience in your particular application and wishes.

STEP 5

Involve all stakeholders

As well as selecting the right partners to work with, involve your operators in the choice of robot type and design of the robot cell.

Key to success – get everyone onboard and share best practices

- Involve not only the technical and project departments but also the operators and unions from the very beginning of the development of robotised production.
- Learn from other companies about their experiences with robotisation and share best practices with your peers.

STEP 6

Think, with others, about critical details

Choose the appropriate tooling (gripper, vision etc.) geared to the product to be handled or the task or operation to be carried out.

Key to success – Invest in your people

- The war for talent is a fact.
- Invest in lifelong learning. Do not underestimate the value of an operator's process knowledge.

STEP 7

Connect your installation

Analyse the possibility of integrating the robot into the periphery IT systems, such as SCADA or MES and other software applications for production and maintenance.

Key to success – Persevere and keep an open mind

- Think about what you can do with the generated data rather than just storing it.

3/ CONCLUSION

Robotisation is not new and has been part of the automation of production processes for decades.

Seven out of ten companies in the survey have already implemented robotisation or are experimenting with it. Yet we see that 4 out of ten of the SMEs surveyed still have a long way to go to implement more robots in their production process. The impression that robots are only for large companies with assembly and line structure production is strongly present among these SMEs. With the development of the current technological state of the art and the evolution towards smart robot systems, there are many opportunities here for SMEs.

In the future, robots will become the operator's partner. Yes, a robot takes over a workplace but it is also a solution to fill in tasks for which no one can be found or where there are shortages of jobs that no one wants to do anymore. Through these recent developments, robots also have more opportunities in large companies or in companies from sectors that were previously somewhat reluctant to robotise. There are, therefore, no longer any reasons not to start investigating how robots can provide added value in your company, and better now than too late.

4/ ABOUT THE STUDY

For this study, a broad online survey was conducted during the Q4 2020 and Q1 2021 and complemented with in-depth interviews with end users, potential users, robot suppliers, accessory suppliers and integrators in first half of 2021. 127 companies took part in the survey.

The aim of the study was to gain insight into the acceptance and integration of robots into the Belgian manufacturing industry. We aimed to obtain a deeper understanding of:

- robotisation's contribution to Belgian industry and the road towards industry 4.0;
- why companies choose, or not, to embrace the technology, and;
- what we can learn from others in terms of introducing robots on the shop floor.

We conducted interviews with the following companies:

End-users

- Karl Mast – Atlas Copco
- Paul Van Medegael – Bosch Tienen
- Sébastien Verbal – Jtekt
- Stefan Camps – Danone
- Peter Dhoore – Audi Vorst

Integrators of robotic systems

- Helmut De Roovere – Robojob
- Johan Potargent – AMS
- Joris Ceyssens – VINTIV

Providers of Robotic systems

- Peter Kiekens – Industrial Cobotics
- Laurent Mattheys – Staubli
- Paul Ribus – Fanuc
- Kris Huyck – ABB

Providers of peripherals

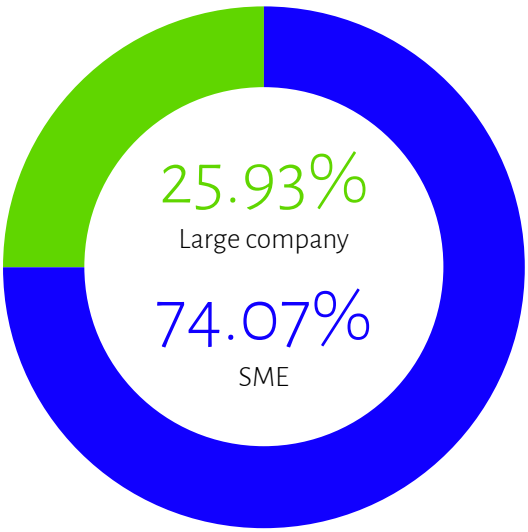
- Jonathan Kesteloot – Robovision
- Werner Deridder – Schunk
- Rob Verbeek – Omron
- Johan Adriaens – Festo

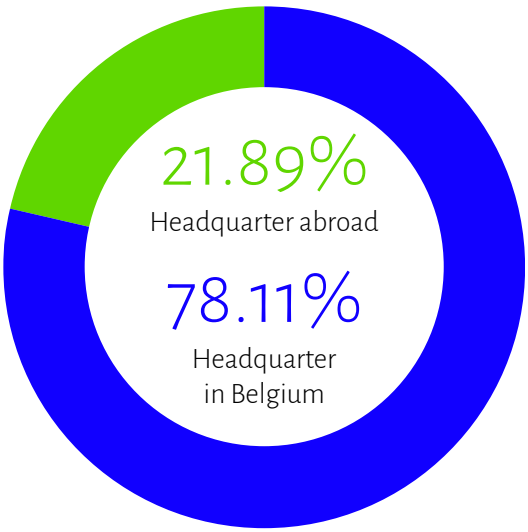
Potential users

- Peter Reynaert – SABCA

The survey:

- Number of companies surveyed: 127
- Size of companies:





APPENDIX I

Robot types and their areas of application

Industrial robots are commonly classified by their mechanical build, known as their kinematic skeleton.

What follows is a short descriptionof the main robot types and their principle application.

The articulated robot, often called the 6-axis, is the most widely used and is made up of linked rotating joints where the rotations are not all in parallel planes. This type has six degrees of freedom and the end effector can theoretically reach any position and orientation within a given working area. Robots with six axes are therefore used when a large number of different positions must be reached.

Areas of application: welding, milling, assembly, machine loading and/or unloading.A 4-axis variant exists for pick and place applications where a fifth and sixth axis is not required.
The 7-axis robot can manoeuvre in tight working spaces due to the additional degree of freedom an extra axis offers.

The cartesian robot is also known as a linear robot or portal robot. Its simplicity allows it to bebuilt to suit the application. Its disadvantages is that it is more sensitive to dirt and takes up a lot of space compared to other types of robots.

Areas of application: xy-cutters (laser, plasma, etc.), 3D printers, engraving machines, pick and place (line in and outfeed, pallet handling, etc.).

Cylindrical robots have a rotating joint at the base and a prismatic joint to connect the links. These robots have a cylindrical working environment, which is achieved with a rotating axis and an extending arm that moves in a vertical and sliding motion. Compared to a Cartesian robot, a cylindrical robot can generally move faster between points in the work area. Due to its compact design cylindrical robots are often used in tight working spaces for simple assembly, machine control or coating applications.

Polar robots are also called spherical robots because they have a spherical work area and the axes form a polar coordinate system. These robots have a central rotating axis and an extendable rotating arm, and have been used in some of the most basic robotic applications. The configuration of polar robots covers a large volume of space, but the access of the arm is limited within its working range. Nowadays they are not used very often, but can be considered the forerunner of the articulated robot.

Areas of application: injection moulding, welding and material handling.
Cylindrical and polar robots are often found as part of a machine or installation and somewhat less in general applications. These types of robots are often customised by machine manufacturers when not all the features and options of standard robots are required.

The scara-robot (Selective Compliance Articulated Robot Arm) consists of two or three coupled rotating joints that rotate in x-y parallel planes and one linear joint that creates a movement in the z-direction. They are generally easy to program and make fast movements with high repeatability. Scara robots are characterised by their compactness and limited space requirements.

Areas of application: pick and place for packaging or line feeding.

The delta robot, also called the spider or parallel robot,is known for its speed and repeatability. The disadvantageis that the working area is small. It is designed for very high speed pick and place applications of light products. It is usually mounted above a conveyor belt and therefore takes up little space.

Areas of application: packaging applications in the food, pharmaceutical, cosmetics and electronics industries.

Collaborative robots or cobots are robots that can work directly and safely with humans in a shared workspace.A cobot is usually a 7-axis articulated robot that has additional force detection capabilities (sensors and control algorithms). With some exceptions, cobots usually havea limitation on the weight they can handle.

Areas of application: pick-and-place, palletising, quality inspection and machine tending, operator support, welding.

AMR or an autonomous mobile robot is an AGV (autonomous guided vehicle) combined with an industrial robot type or cobot. New models have a variety of construction types where robot functions are fully integrated into the driving system.

Area of application: in logistics to transport goods to and from the warehouse.

		Articulated Robot	Cartesian Robot	Scara robot	Delta Robot	Cylindrical Robot	Polar Robot	Cobot	AMR
									
Assembling activities	Combining parts to form a new product (e.g. automotive industry)	✓	✓	✓	✓	✓		✓	
Machine Tending	Loading and unloading of workpieces from production machines	✓		✓		✓		✓	
Material Handling	Moving of parts, across a limited distance, e.g. from one workstation to the next	✓	✓		✓		✓	✓	
Dispensing	Application of liquids, e.g. gluing	✓						✓	
Finishing	Finishing of surfaces or surface operations, e.g. grinding, laser cutting, cutting, etc.	✓	✓			✓		✓	
Quality inspection	Performing quality checks on produced parts and products	✓						✓	
Welding	Welding of parts (spot welding, arc welding)	✓					✓	✓	
Surface treatment	Surface treatment, e.g polishing							✓	
Packaging	Packaging of goods, e.g. placing cookies in a box	✓		✓				✓	
Palletizing	Stacking of goods, boxes on pallets	✓		✓					
Picking & Placing operations	More general term for taking (picking), repositioning and placing a part or product		✓	✓	✓				
Semi-conductor industry	Industry-specific operations	✓		✓				✓	
Painting	Spray painting of parts								

APPENDIX II

Companies active in the robotisation ecosystem in Belgium

This list gives you an overview of the companies active in robotisation technology in Belgium and who are members of Agoria. As this list is subject to change, please contact Alain Wayenberg via e-mail alain.wayenberg@agoria.be to obtain the most recent list.

Company/Name	Robot Supplier	AGV Mobiles	Robot Integrator	Robot Peripherals	Industrial Robots	Special Robots	Human Robots	Description
ABB	✓	✓		✓	✓			Robot supplier
Absolem			✓					Robot integrator
Actemium			✓					Robot integrator
AgiNtech			✓					Robot integrator
AMS Belgium			✓					Robot integrator
Arcobel Embedded Solutions				✓				Components for robotics
Arkite				✓				Vision for robotics
Averna			✓					Machinebuilder with robotics
AVT		✓	✓					Machinebuilder with robotics
Axymatic			✓					Machinebuilder with robotics
Balluff				✓				Vision for robotics
Beckhoff				✓				Software for robotics
Buhlmann			✓					Robot integrator for machine tools
Cegelec			✓					General robot integrator
Cilyx (Ciseo & Citius Engineering)			✓					Machinebuilder with robotics
Cobotracks				✓				Extending reach - 7th axis solutions
Contec		✓	✓					General robot integrator
Datasar			✓					General robot integrator
De Roeve Automation			✓					General robot integrator
Desimone		✓	✓					Machinebuilder with robotics
dotOcean								Special robots for naval applications
ECA Robotics Belgium						✓		Special robots for naval applications
ESAB			✓					Robots for welding solutions
Eutomation			✓					General robot integrator
Fanuc Benelux	✓			✓	✓			Robot supplier
Festo Belgium	✓			✓				Robot supplier
Fixar			✓					Controle robots / measure
Flexible Robotic Solutions			✓					General robot integrator
FT Group		✓						Mobile robot solutions

Company/Name	Robot Supplier	AGV Mobiles	Robot Integrator	Robot Peripherals	Industrial Robots	Special Robots	Human Robots	Description
Gima Machines			✓					Robot integrator for machine tools
Hahn Robotics Belgium			✓					General robot integrator
Heliovision				✓				Vision of robotics
IFM				✓				Vision of robotics
Industrial Cobotics	✓	✓		✓	✓			Robot supplier
Kapernikov				✓				Vision for robotics
Kuka Automatisering + Robots	✓	✓		✓	✓			Robot supplier
Lambrechts Konstruktie			✓					Machinebuilder with robotics
Mabo	✓	✓						Mobile robot solutions
Mema Machines			✓					Robot integrator for machine tools
Motiv			✓					General robot Integrator
Multiprox				✓				Vision for robotics
Octinion						✓		Agricultural robotics
Omron	✓			✓				Robot supplier
Pepperl+Fuchs				✓				Vision for robotics
Phoenix AI				✓				AI voor robotics
Pilz				✓				Robot safety
Robojob			✓					Robot integrator for machine tools
Robovision				✓				Vision for robotics
Rovi-tech				✓				Vision for robotics
Scott Automation			✓					Machinebuilder with robotics
SEW		✓						Mobile robot solutions
Sick				✓				Grippers & periferie
Siemens				✓				Software for robotics
Socabelec		✓						Machinebuilder with robotics
Space Application Services			✓			✓		Robot for space applications
Stäubli Benelux	✓	✓		✓	✓			Robot supplier
Technord			✓					General robot integrator
Valk Welding			✓					Robots for welding solutions
Van Hoecke Automation			✓					General robot integrator
Vansichen Linear Technology				✓				Extending reach - 7th axis solutions
VINTECC				✓				Vision for robotics
VINTIV			✓					Machinebuilder with robotics
Wenglor				✓				Vision for robotics

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About Agoria

Agoria, the federation of the technology industry, brings together 2079 technology companies and all those who are inspired by technology. With more than 321,000 employees, the technology sector is the largest sector in Belgium and Agoria is the largest federation within FEB. Some 70 percent of Agoria's members are SMEs. Agoria has more than 200 employees.

Agoria's services and positions focus on digitalization, the manufacturing industry of tomorrow, talent management policy and training, market developments, regulation, infrastructure, climate, environment and energy. Agoria aims to connect all those inspired by technology and innovation, increase business success and shape a sustainable future.

For more information, please go to:
www.agoria.be

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www.pwc.be

About Sirris

As the collective centre of the technological industry, Sirris is the trusted reference for technology adoption in Belgium. Our all-round, neutral and futureproof services give companies of all sizes access to the necessary skills, expertise and equipment to innovate successfully. At the heart of those services stand over 150 multi-disciplinary experts, spread over 8 state-of-the-art sites throughout the country and backed by a leading partner network. They ensure about 1,300 organisations a year reap the benefits of technological innovation.

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