

KUKA

Stronger, faster, more
productive_automation
for the new normal



#WeAreOrange



Robot sales, global and UK and Ireland, 2017-2019

Installation figures (robot units)	2017	2018	2019
Global:	399,640	422,271	373,240
UK:	2,380	2,415	2,021
Ireland:	155	151	201

Source: IFR

Note: The main reason for the declining numbers of new installations is the low demand from the biggest customer industries, in automotive and electronics. Car production declined in 2018 and 2019 (OICA production statistics) and electronics was presumably affected by the trade conflict between China and the US. Both affected by Covid. (Comment from IFR, International Federation of Robotics)

It's time for robots to solve industry's biggest challenges

At KUKA, we understand technology. We understand manufacturing and the business case for investing in automation. We understand the reasons for the reluctance to deploy automation solutions: time, cost, skills and short-term contracts with customers.

What we offer are real solutions to some new and critical challenges in our fast-changing world. Growing pressures from Brexit (labour), Covid-19 (operator safety), competition (Asia and reshoring), and food supply and prices are now driving much keener analysis of robots and automation.

We believe the time has arrived for robots to prove they can solve these challenges.

Covid-19 is forcing industrial operations to safely distance employees. In many cases, robots can replace every second or third human operator to maintain this distance whilst increasing productivity – an ideal solution for food sorting and packing operations, for example. Also consider the risk to industry of a new virus pandemic: fully automated operations can run 24/7/365 remotely, with no breaks. KUKA believes, largely for this reason, the food and beverage sector will be among the biggest growth markets for robots in 2021 – see the future of British and Irish manufacturing on page 4.

Brexit and stronger economies in Eastern Europe are removing our access to low-cost labour; for many businesses, this is a serious problem. Robots can help future-proof an operation from the vagaries of labour supply. It is often said that robot investment is a net job creator, rather than destroyer, as more high-skilled jobs are created. The proof is not always there but this report has hard evidence; for a clear example, read our customer story on ZND UK – page 36.

There is compelling, apolitical argument that the UK and Ireland need to increase productivity to compete globally and increase wages.



The International Federation of Robotics reports in September that there are 2.7 million robots in factories globally, an increase of 12% on 2018. UK robot sales dipped in 2019 while they rose elsewhere, including Ireland (see box). KUKA is committed to improving this, by showing industry how robots can help.

Consultancy McKinsey says that “automation could raise productivity growth globally by 0.8 to 1.4 percent annually” – read more on page 6. Our report has some real examples of this – from pages 24 to 37.

Our system partner model is KUKA's greatest strength. These specialist integrators 'deep dive' into customers unique technical needs and work with KUKA, delivering the very best solution – read more on page 12.

Robots are proliferating in novel areas, even where they had not been considered viable, until recently. As an example, several KUKA system partners and customers use our robots to make props, structures and statues for theatre and film. They need flexible, fast, accurate and bespoke solutions.

“We work in a very fast-paced industry,” says Mark Maher at Odyssey Studios in Limerick. “Often we have pieces that might take months to make by hand and with multiple changes to get right, they spurred us to go with automation.” (see page 26).

We believe it's time for robots to fulfil their potential for British and Irish industry. We hope you get a lot of useful information and value from this industry report.

The future of British and Irish manufacturing

Will Britain and Ireland's industrial estates be swarming with robots and automated machines in the near future, replacing thousands of assembly jobs? That is unlikely, but real change in automation is coming from macro- socioeconomic drivers.

The UK and Ireland rank low in the robot density global league table (robots per 100,000 workers), outside the world's top 15. That's partly down to cultural resistance to automation but also because these nations don't have the mass electronics and car-making industries of, e.g., South Korea, Singapore, Japan and Germany. The UK's manufacturing base is widely dispersed and SME-heavy; small companies traditionally have not bought robots, to the extent of industrial giants like Samsung and BMW.

Covid has had a devastating effect on manufacturing in Britain and Ireland. In Ireland, even with a strong post-Covid recovery, a best prediction for unemployment by the year-end is about 10%, more than double the rate pre-March.

But globally, the number of robots operating in factories in full-year 2019 hit 2.7 million, 12% up on 2018. Ireland is buying more robots but from a low base. While in the UK sales have dipped, the stars are aligning in 2020 that should see a big rise in robots in Britain and Ireland in the coming years, and KUKA is working hard to support this. Covid-19 has forced "safer distancing" at work. Companies are adjusting to this new normal; workplaces with high worker density, like meat packing and low-cost assembly, will look to robots to replace some workers and maintain safe distances between others.

KUKA believes the food and beverage sector will be the biggest growth market for robots in 2021. The future of manufacturing is also about being flexible and agile. KUKA has observed that those companies with robots were able to react better and faster to the crisis by being able to scale production up or down as a reaction to market demands.

Automation: changing the game

E-commerce is the standout success of the Covid crisis. Amazon UK sales surged 26% to £13.73bn in 2019; revenues that would place a UK-listed company comfortably in the top half of the FTSE-100. E-commerce means more robots. More of the cube-like order picking type for grocery orders, but also industrial robots and cobots for other packing and loading operations; all are in hot demand, simply to shift the greater volumes that are now being seen.

Logistics companies have also benefitted. According to McKinsey, in the US, logistics firms or in-house logistics units were estimated to collect \$12 to \$20 of every \$100 in e-commerce sales in 2019; a massive increase from the \$3 to \$5 from a typical "bricks-and-mortar" retail operation. Logistics firms are using some of this cash to automate, with more AGVs (automated guided vehicles) and more robotic warehouse stacking. Drones will also play a part; Tesco is about to trial a drone delivery service.

While the attraction of cheap labour in China, Vietnam and elsewhere will remain, manufacturing industries are seeking to shorten supply chains – which means more local production. Consider a large UK Midlands-based OEM needing approved parts that it currently buys from Asian suppliers.





An engineering firm in e.g. Wolverhampton doesn't need an automated, repeatable and zero-defect robotic process to win that business but, if it has one, its unit price will be much more competitive; plus, it is only a few miles down the road. But labour costs in the UK and Ireland mean that automation is essential in reshoring manufacturing at scale.

A more radical change in the make-up of supply chains in Europe and the UK is a very real prospect with three forces working in concert: Brexit, Covid-19 and environmental pressures. At present the factories of several big companies are heavily embedded in the UK; Vauxhall's Luton plant, BMW's MINI and engine factories, Airbus's wings in Broughton and more. Could these companies – and other multinationals – pull out of the UK, to avoid WTO tariffs if there were a No Deal Brexit and to shorten their own supply lines to sites in Munich, Toulouse and Galicia, as the environmental footprint of their supply chain is reassessed? Each one, and other automotive and aerospace companies, have specific reasons to be here, such as the work share agreement Airbus has with its four European countries, but these reasons are being put to the test by Covid-19 and possibility of a hard Brexit.

Medium- to long term, automotive manufacturing in Britain and Ireland (for components) will change forever as we transition from mainly internal combustion engines (ICE) to hybrid and electric vehicles, where the Nissan LEAF is the only electric car to be manufactured at scale in the UK.

The London Electric Vehicle Company and Arrival are about to manufacture electric vans in volume, and buses in Arrival's case (see page 34), but it's too early to say whether electric vehicles will replace the jobs and GVA of ICE vehicles.

Try before you buy

The High Value Manufacturing Catapult and other technology innovation centres are helping more companies to prove robot applications before industry adopts them. In parallel, more UK and Irish universities are using robots and cobots in research at the lower Technology Readiness Levels. Both are helping accelerate robot adoption. KUKA has the biggest collaboration footprint in low and high level research of the major robot suppliers, with c.35% market share in the last five years. More on the work of these technology centres is on pages 8 to 11.

Ireland is in a similar place to Britain. It is the second biggest exporter, after Germany, of medical technology in Europe and the second for med-tech jobs. The food industry is also very important. Covid is having a big effect and investment has weakened. Low-cost labour from Eastern Europe has helped keep Irish manufacturing competitive but Brexit and stronger Eastern Europe economies bring unavoidable change. Smart robot technology and advances in robotic end effectors and grippers, means that complex medical parts, for example, that were once only made by humans, can now be automated.

Manufacturing is being tested by big and very complex macro-economic issues but we expect robots to become more prevalent in industry, academia and society – especially with a new younger generation that readily embrace the technology.

Why robots and automation matter

Since the First Industrial Revolution, automation has boosted output, productivity, employment and national wealth. Robots and advanced automation, including artificial intelligence, have never been more accessible than they are now. Arguably, they have never been more vital, either.

It is a message that bears repeating: automation boosts productivity.

According to a 2015 London School of Economics report¹, which studied the impact of robotics on productivity across 14 industries in 17 countries between 1993 and 2007, robots raised those countries' average GDP growth rates by about 0.37 percentage points and productivity growth by about 0.36 percentage points respectively. Small numbers – but they add up. Over the 14-year period, additional growth amounted to 12% of total GDP growth and 18% of labour productivity growth in the countries studied.

McKinsey is even more positive. It believes that “automation could raise productivity growth globally by 0.8 to 1.4 percent annually”². If that is the impact across the whole economy, the transformation that could be achieved by individual businesses should be similar, and in many cases greater.

The proof is already here

There are ample examples of companies, especially SMEs, transforming their competitiveness, quality, productivity and profitability by investing in appropriate automation. This publication highlights several businesses for whom automation has been

transformational, including cider brewers Thatchers, who cut forklift truck movements by 50% while improving consistency and output in its palletisation/depalletisation cell, and Odyssey Studios in Limerick and Dublin, Ireland, which automated the production of scaled and full-size models for film, theatre and TV, enabling it to win bigger contracts across the world.



On a larger scale, UK automotive has invested the most of all industrial sectors in automating production lines but headcount, in most cases, has increased³ – showing that robots do not always mean job losses. ZND in Rotherham, manufacturers of temporary fencing, installed robots, increased capacity and sales and hired more people in sales and engineering (see more on page 36).

Automation: an opportunity for SMEs to grasp

In 2018, NatWest-sponsored research by Cebr⁴ said that SMEs could add up to £57bn a year to the UK's economy if they were as productive as similar-sized enterprises in Germany.

The research shows UK SME employees generate £147k worth of output per year on average – less than half that of their German counterparts' £335k/worker/year.

Automation can help transform even the very smallest companies. A UK business with 10 employees could increase annual turnover by £1.9m if they worked at the same productivity level as a German business; the figure rises to £4.7m for businesses with 25 employees⁵.

Small is beautiful – and productive

Automation need not involve large pieces of machinery or large investment. KUKA's KR3 Agilus robots have payloads of just 3kg and operate in cells just 600 x 600mm. It is ideal for businesses assembling small components that are tight on available space. Even more simply, a palletisation cell can free up staff from repetitive manual labour to conduct more productive tasks, while a robot palletises perfectly, time after time, 24/7 and year-round. It never gets bored or takes time off sick.

Technological advance under the heading of “Industry 4.0” has been a topic of discussion since 2011 when Germany's federal government launched the term. It is high time it moved off the lower reaches of the agenda and onto the shopfloor. Although automation and Industry 4.0 are not the same thing, an automated connected process is a big part of it.

Archie McPherson, CEO of High Value Manufacturing Catapult at Warwick Manufacturing Group, asks the simple question: “if you don't automate, where will you be in five years' time?”

¹ Graetz & Michaels, CEP Discussion Paper No 1335, March 2015: “Robots at Work”. London School of Economics/Economic & Social Research Council

² McKinsey Global Institute, 2017

³ <https://www.statista.com/statistics/387104/jaguar-land-rover-global-workforce>

⁴ Productivity in focus: Germany vs. the UK. NatWest Bank, 2018

⁵ *ibid*



Change is unavoidable: seize the time

If that question had been posed five years ago, it is doubtful that anyone would have forecast what has happened this year: Covid-19 has dominated 2020. The pandemic has shown the vulnerability of globe-spanning supply chains and has stimulated discussion of reshoring or “nearshoring” – bringing manufacturing back from low-cost countries and closer to the marketplaces. Controlling labour costs and maintaining competitiveness requires automation. Covid-19 has accelerated what was a rising trend; Richard Wilding OBE, Professor of Supply Chain Strategy, Cranfield University, said that discussions were already under way.

“We were starting to see increases in nearshoring; the current crisis has created the ultimate “burning platform” and we have been seeing, in some organisations, the equivalent of five years of implementation within a three-month period,” he says⁶.

Breakthrough technologies like 3D printing and automation of customised production are in their infancy. This provides British and Irish businesses with a golden opportunity to leapfrog a couple of generations of automation and catch up with Germany and other competitors – but it must be done the right way. Wasting money on confusing and expensive “tool proliferation” and what McKinsey describes as the “IT fallacy” – the idea that sustainable automation can be driven by IT alone – must be avoided.

With a range of products that extends from benchtop models like the KR3 Agilus to the 1300kg payload KR1000 Titan and its system partner program, KUKA is ideally placed to provide the right tools and advice to automation newcomers and improvers alike.

⁶ Quoted in eureka! 36 CatLiftTrucks Europe, 2020. Interviewed by R McCallion

Our commitment to British and Irish manufacturing

KUKA is a strategic partner of the Catapult centres (UK), Irish research centres and many British and Irish universities. This helps to get more working, system-proven automation solutions into the hands of nearly every manufacturing industry.

The iconic image of the industrial robot is welding body-in-white panels on a noisy car production line, sparks flying.

See beyond the car plant though, and robots are everywhere; packing product into bags, loading pallets, removing defective food from a conveyor, drilling holes in aircraft wings, blending sauces and soups, guiding parts to shopfloor assembly points. Look further and more exotic applications abound: medical robots assist surgeons with complex surgery, cube robots pick customer orders in fulfilment centres, service robots help the infirm, milling robots carve statues, and so on. More niche and enigmatic uses are constantly being devised, as researchers also experiment with affordable collaborative robots.



Image: Example of KUKA robots used in blood sample handling

How robots are applied by industry often begins in universities, at the lower Technology Readiness Levels, then in the higher TRL technology innovation centres – Catapult centres and others – where the new process is proven-out for commercial use. Britain and Ireland are especially good at both.

Every engineering-centric British and Irish university and the high value manufacturing research centres use robots in research. KUKA provides fully supported robots, integrated automation and consultancy to many of these institutions.

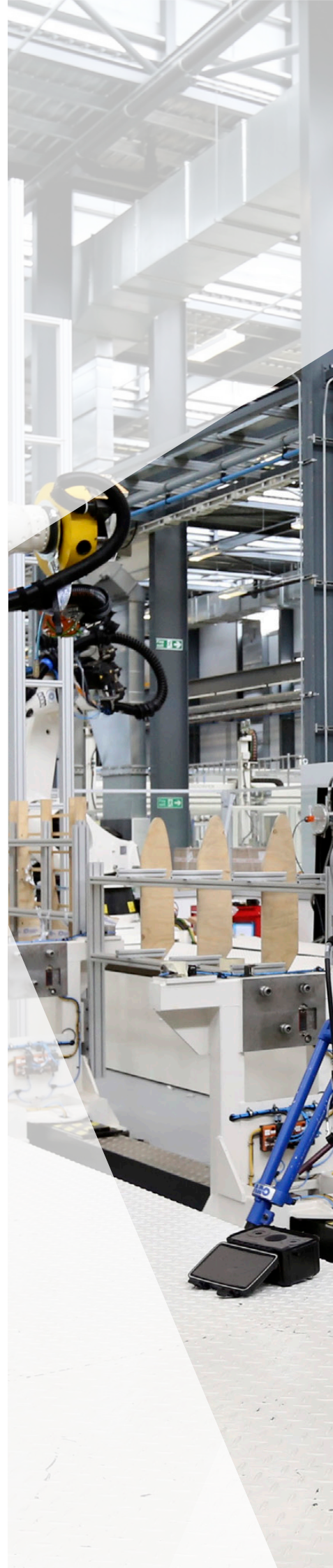
KUKA robots are installed in 19 of the 30 universities making up the UK-RAS Network, a connected group of robot and autonomous system research funded by the engineering council, EPSRC. Examples include the Edinburgh Centre for Robotics, a joint venture between the University of Edinburgh and Heriot-Watt University, and Cranfield University, which has a focus on human factors, ethics and safety in Human-Robot Interaction. The work of UK-RAS spans applications from space and aerospace to bioengineering, collaborative robots, autonomous systems and more, underlining that robots in Britain and Ireland today have moved far beyond the car factory gates.

In Ireland, University College Dublin, National University of Ireland in Galway, Technical University Dublin and the other big engineering schools are doing similar work – see page 11 for an example at the University of Limerick.

Proving for industry, derisking investment

Industry often needs to trial a new process before it incurs the cost and risk of installing it in a factory, where it might not run optimally, or even fail.

The High Value Manufacturing (HVM) Catapult centres help both big and small companies experiment with new technology before they scale-up for production.





Robots and experienced engineers are available to trial processes over-and-over, like an advanced technology playground, offline to industrial operations.

KUKA robots are working in projects at six of the seven HVM Catapult centres. All four of the Advanced Manufacturing Technology Centre (AMRC)'s franchises, in South Yorkshire, North Wales, Preston and Broughton, have KUKA robots involved in research, as have Irish Manufacturing Research, CONFIRM and QUB in Ireland. Much of the research is for aerospace and non-automotive industry R&D, further proving that robots today have a much broader remit than automotive.

Speeding up aerospace manufacture

The VIEWS project at the Advanced Forming Research Centre (AFRC) in Strathclyde has helped Spirit AeroSystems increase the rate of cost-effective, non-destructive evaluation and testing of the geometries and material properties of composite components in aircraft winglets. This accelerated their manufacture and helped Spirit select the Glasgow-based facility as its European R&D base.

Working with an aerospace company, the team at Factory 2050 has commissioned an automated cleaning and sealing system, using a KUKA KR60 on top of a KMP1500 AGV. This project will eventually demonstrate the flexibility of robots when mounted to an autonomous platform that is able to navigate using Simultaneous Location and Mapping, aka SLAM, technologies.

Image: High Value Manufacturing Catapult
KUKA robots in use at the National Composites Centre in Bristol

Nuclear finds that robots can't be beat

At the Nuclear Advanced Manufacturing Research Centre in Rotherham, robots are used in bulk additive manufacturing (BAM) research. The centre is developing techniques for leveraging robotic technologies for large-scale additive manufacturing applications.

AMOS, SafeG and NUCOBAM Horizon2020 are three projects that have or will be implemented using the centre's BAM capabilities.



The Safety of the Gas-cooled fast reactor (SafeG) project, funded under the European Horizon 2020 Euratom Work Programme, will support the development of nuclear CO₂-free electricity and industrial process heat generation technology, by developing innovative materials, technologies and processes, including additive manufacturing. Robots are used in these environments for repeatability, productivity and (especially) safety, as nuclear engineering can be a hazardous environment.

Machining and much more at AMRC

Factory 2050, part of the AMRC in Rotherham, is involved in virtually all aspects of robotics, including collaborative robotics, autonomous guided vehicles (agvs), cognitive robotics (AI applications in robotics), robot machining and drilling, fixturing and assembly, and applied in most manufacturing sectors.

One of the stand out installations at Factory 2050 is the KUKA Titan Accurate Robotic Milling System – ARMS – a collaboration between the AMRC, KUKA, Siemens and Electroimpact to create an accurate robotic machining platform capable of positional accuracies of less than 0.1mm. Its large working volume and flexibility opens up opportunities for new machining processes.

Food and beverage: The next automotive?

Automation professionals think that food and drink could be about to enter a golden era for robotic automation, due to Covid-19 measures and a shortage of low-cost labour.

At the National Centre for Food Manufacturing in Holbeach, Lincolnshire, a giant orange robot lifts and mixes huge vats of ingredients quickly and precisely, far faster than a team of people. The Titan is part of an ongoing research project by KUKA partner OAL to develop automated, accurate blending processes for high-volume liquid foods, like soups and sauces. The system is now commercially available and in use by food companies.

One high-volume food operation that has always foxed automation is sandwich making. KUKA partner Active8 has got one step closer to preparing sandwiches automatically, perfecting a skilleting line using two KR Agilus HM robots – taking and packing halved sandwiches in triangular packs. Tens of thousands of sarnies a day are prepared by some companies; the ability to package them automatically will be transformative.

Composites need speed = automation

For composites to reach their full potential, automation is crucial. In the automated preforming cell at the National Composites Centre (NCC), in Bristol, two KUKA robots work together using digital manufacturing principles to rapidly pick, form and place composite parts onto complex geometries. The plethora of end effectors and manipulators that are available to the robots enables the engineers to do everything from manipulate and stack the materials, trim to net shape, inspect, surface treat, monitor and form.

The NCC's Ultra High Rate Deposition Cell is a prime example of where advances in robotics and cell automation are enabling manufacturing throughput of composite wing structures that satisfy rate, performance and cost criteria for future build programmes.



Irish Manufacturing Research, CONFIRM and University of Limerick: Ireland's bedrock for smart factories

Ireland's manufacturing base is smaller than the UK's but companies are typically high tech. The country hosts a high number of medical technology engineering firms, for example. Irish Manufacturing Research based in Rathcoole and Mullingar and CONFIRM, a Science Foundation Ireland-funded research centre for smart manufacturing, based at the University of Limerick, are Ireland's equivalent to a Catapult centre. Both have several robot projects, including one that is evaluating human-machine interfaces for remote robotic arm operation.

KUKA has delivered two robotic systems to the Bernal Institute at University of Limerick, both for use in researching advanced materials joining. The first cell uses a KR210 with a KP1 single-axis positioner to perform Automated Tape Placement (ATP) of composite fibres. Attached to this robot is a sophisticated tape dispenser, which uses a high-powered laser to cure the thermoplastic prepreg material. The twin robotic system offers big advantages in manufacturing composite components, such as superior accuracy with high volume capability and the ability to produce more complex geometries.

In 2019, KUKA Ireland teamed up with KUKA Systems in Bordeaux to deliver a composite and plastics robotic joining suite. KUKA's Quantec KR210 R2100 Ultra is fitted with an ALEMA multifunctional end effector, used in the aerospace industry to perform drillings, riveting and sealing operation on fuselages.

Much research at the University of Limerick revolves around the drilling and fastening of composite alloy materials, along with ultrasonically welded composite, alloy and hybrid joints.

The university recently acquired a "PrePro 3D" system from CONBILITY GmbH that will help the team's capabilities in composite tape laydown and allow it to accomplish IR-assisted thermoset prepreg placement, including unwinding of the tapes' backing paper and dry fibre placement.

KUKA's technologies and knowledge are helping the University of Limerick take a lead in the research of joining composite materials.

Pharma and electric vehicles complete a full house

Pharmaceutical manufacturing is already very heavily automated; tablet production is designed for almost zero human intervention.

But even here, KUKA is helping industry find efficiency gains. AstraZeneca's work with the CoLAB (collaborative laboratory) High Throughput Screening system, supplied by HighRes Biosolutions, incorporates a KUKA LWR iiwa medical robot.

It is used for scientific research at the start of AstraZeneca's drug discovery process. The robot tests millions of compounds against the diseases the company is addressing and ultimately identifies and selects the best potential drugs as starting points for future medicine development in its R&D laboratories.

KUKA believes that industry must change to lower carbon emissions. One clear route is the electrification of transportation. "Unicorn" (£1bn-plus valued) automotive company Arrival is about to start building electric vans and buses and plans to develop a whole intelligent transport system. KUKA is delighted to announce it has secured the first robot contract for Arrival's first production facility. Read more about Arrival and KUKA on page 34.

From Agilus to Titan

KUKA has a solution for all

KUKA's robot range extends from bench-tops and cobots to the heavy-duty KR 1000 TITAN, which can lift loads of up to 1300kg.

They are used in industries from food and beverage to space satellite construction and advanced engineering. They are integral to Industrial Internet of Things and are instrumental to the progress of Industry 4.0. Key to KUKA's success is how it delivers its broad range of solutions, either directly or through its System Partner program.

KUKA has been at the heart of robotics and automation in manufacturing since it launched FAMULUS, the world's first six-axis industrial robot, in 1973.

Since then, it has innovated with the first offset wrist robot (IR 6/60, 1976) and, the KUKA LBR 3 in 2004, the world's first collaborative robot – a robot that could operate alongside human workers without cages or protective equipment. KUKA broke further new ground with its **TITAN** robot, which gained an entry in the Guinness Book of Records as the largest and strongest six-axis industrial robot in the world. Recent additions include the **KR QUANTEC** robot family and the **KR AGILUS** small robot series.

Innovation, experience and collaboration

KUKA has also innovated in the way it sells its products to the market. While it maintains its direct connection with automotive OEMs, including running an entire Jeep assembly plant in Toledo in Ohio, USA, all other segments are served by the System Partner program, in which KUKA actively collaborates and does not compete with systems integrator segment specialists. Its Platinum Partners in the UK and Ireland include CNC Robotics, DesignPro, Loop Technology, SCM Handling, Tricon Automation,

Pilz Automation Ireland and WestRock Automation – many of whom have projects featured on pages 24 to 33 – and another 22 firms, making 26 partners altogether. They all have a depth of expertise of their core markets that, combined with the knowledge of the world's leading innovative robot manufacturer, gives the customer the best solution possible.

A range beyond the familiar

Industrial robotic assembly lines, typically with a series of cells performing welding, joining and other repetitive tasks, are now a familiar sight via movies and the internet. But automation has reached far beyond dirty, difficult, dangerous, routine and repetitive tasks. They have now been joined by bespoke manufacturing, detailed finishing (as with model making for movies), advanced composite construction, packaging automation and more.

It is becoming as common to see a small, bench-mounted cobot working alongside a human, without a protective cage, as it is to see production lines made up of fully-enclosed, heavy-duty welding, filling and packing cells. The availability, suitability and falling costs of robots and automation systems means that they are realistic considerations for all sizes of business, from SMEs to global OEMs.

From small, fast cycle to large, heavy duty

KUKA's **KR3 AGILUS** range is an ideal solution for the manufacture of small components and products in restricted spaces. Its footprint is just 600x600mm and it shares a common mounting base hole pattern across the whole AGILUS family – a feature that makes it easy for users to relocate their existing robot equipment and to renew and upgrade, as their needs evolve.

These robots have a very low moving mass, which allows for high-speed operation that means shorter cycle times. It is a versatile machine that is suitable for applying parts, painting and gluing; assembly of small components; palletising and packing; handling of small components and measuring/inspection.

For many companies, palletisation is one of the first processes to be automated. AGILUS robots are suitable for small and light packaging tasks but larger and heavier operations require something more, such as the **KR 700** series.

As its name indicates, it has a 700kg capacity and the reach is 3200mm. A separate story in this report describes how the acquisition and installation of a dual-function palletising/depalletising cell at the Thatchers Cider plant in Somerset helped to cut forklift truck movements by 50% and improved productivity and quality, compared with the previous manual operations. The cell is composed of two KUKA robots: a KR 700, which lifts up to six cider kegs at a time, either full or empty. The second robot, a **KR QUANTEC 120**, lifts or places intermediate layer boards, positioning them precisely, time after time. As with a convoy, the speed of operation is determined by the slowest element; the KR 700 is capable of 17 work cycles per minute.

The **KR QUANTEC** series is not just an assistant. With a payload range of 120kg-300kg and a reach of up to 3901mm in the KR QUANTEC Ultra, it is quite capable of being used in cells and to perform tasks in its own right.



Fit for the flexible future

Manufacturing does not fit into neat, compartmentalised boxes. Operations and functions overlap. As the UK has seen during the Covid-19 crisis, a Formula One Grand Prix racing team can be called upon to design and deliver urgent medical equipment and a garment manufacturer can turn their hand to the production of personal protection equipment.

Production lines aren't static; they have to be agile and adapt to the manufacture of different SKUs or finished products. Batches-of-one are becoming more normal.

Similarly, KUKA robots often overlap, in size, payload and function. The KR AGILUS range at the smaller reach/payload end of the spectrum is complemented by the **LBR iiwa** for small spaces. It is a human-robot collaboration (HRC) unit, or cobot, designed for lightweight and highly sensitive tasks, performed in close proximity to human workers. It is the world's first series-produced robot of its type. It is available in two versions, with payload capacity of 7kg to 14kg and 800mm-820mm reach.

The **KR CYBERTECH** range is a multi-role workhorse for low to medium applications. With a payload of 8kg to 22kg and reach of 1612 to 2013mm, it has a compact footprint but is capable of handling large components. It can also be equipped for machining, assembly, palletising and arc welding. These robots can be mounted on the floor, ceiling, wall or installed at an angle.



The smaller **KR CYBERTECH nano** has a lighter payload (up to 10kg) and reach (1420-1840mm) and has the same spectrum of application as its larger sibling, but its compact dimensions – with the smallest in-line wrists in its class – means that it can function within tighter operational envelopes.

The **KR CYBERTECH ARC** product family is specifically designed for continuous-path applications, such as arc welding or the application of sealants or adhesives. It can be set to a fully-horizontal reach of 2101mm.

The next level up is the **KR IONTECH** family, designed for medium payloads of 30kg-70kg, with 2100-3100mm reach. It has a small footprint for optimising space and the Foundry option is specially protected for operating temperatures of up to 55°C.

Beyond the QUANTEC range, in payload and reach, is the **KR FORTEC** cluster of six-axis robots, which are particularly suited for heavy-duty assemblies. The name is a combination of force, or strength in operation, and technology. It is already a familiar sight in automotive assembly plants, having been selected by a number of carmakers because of its suitability for intelligent system concepts.

The latest KUKA addition is the new range of SCARA (Selective Compliance Assembly Robot Arm) horizontal jointed-arm robots. With a reach of 500-700mm, they are ultra-compact and have an extremely short cycle time: 0.36 to 0.38 seconds. They are designed especially for automation in cost-sensitive markets, like pick-and-place applications.

Equipped for connected factories

Technology and connectability are key features for manufacturing now and even more in the future, as artificial intelligence gains ground and fully-connected Industry 4.0 factories become reality.

Every KUKA robot is delivered with controllers and a software package for basic operations. But they come with something else, which doesn't have a price tag but is invaluable: expertise.



“Before we deliver a robot to first-time users, especially, we undertake an audit,” says Alan Oakley, Head of Business Development – Education and Research with KUKA. The objective is to ensure that the customer is getting the right equipment for their needs. KUKA wants to sell robots but it also wants to build long-term relationships with customers – and that means making sure that the product is 100% right for its purpose, will do what the customer needs, and at the right price.

In all manufacturing sectors except for automotive, the next step will be to introduce a system partner – third-party businesses that have been vetted and trained by KUKA – who will specialise in systems integration, including the appropriate software, tools and support.

These partners are an essential part of the KUKA offer (see from page 24).

“Eighty per cent of our sales are through system partners,” says Alan. “We work as a team, as a family. It's not all about competition, even between KUKA system partners, who may indeed compete for business from time to time. It is about shared resources and sharing problems.”

Working together for comprehensive support

Competition improves the breed but working together can help solve challenges, as well. The KUKA range is nothing without expert, integrated support. KUKA makes sure that its system partners are fully immersed and informed about all aspects of its equipment.

“We provide comprehensive training to our system partners and also to organisations like the High Value Manufacturing Catapults in the UK, and their equivalent in Ireland, and encourage systems integrators we work with to engage with the Catapults and encourage SMEs to do so as well,” Alan says. “We also provide robot training for customers, and the systems integrators undertake the cell training on the total solution, including PLCs, conveyors and ancillary systems.”

In summary, whatever robot a customer begins with, the relationship with KUKA is not sales-centric. With a very comprehensive range and support infrastructure, owners and operators can be confident that there is a solution and system that will be right for them, whatever their circumstances.





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