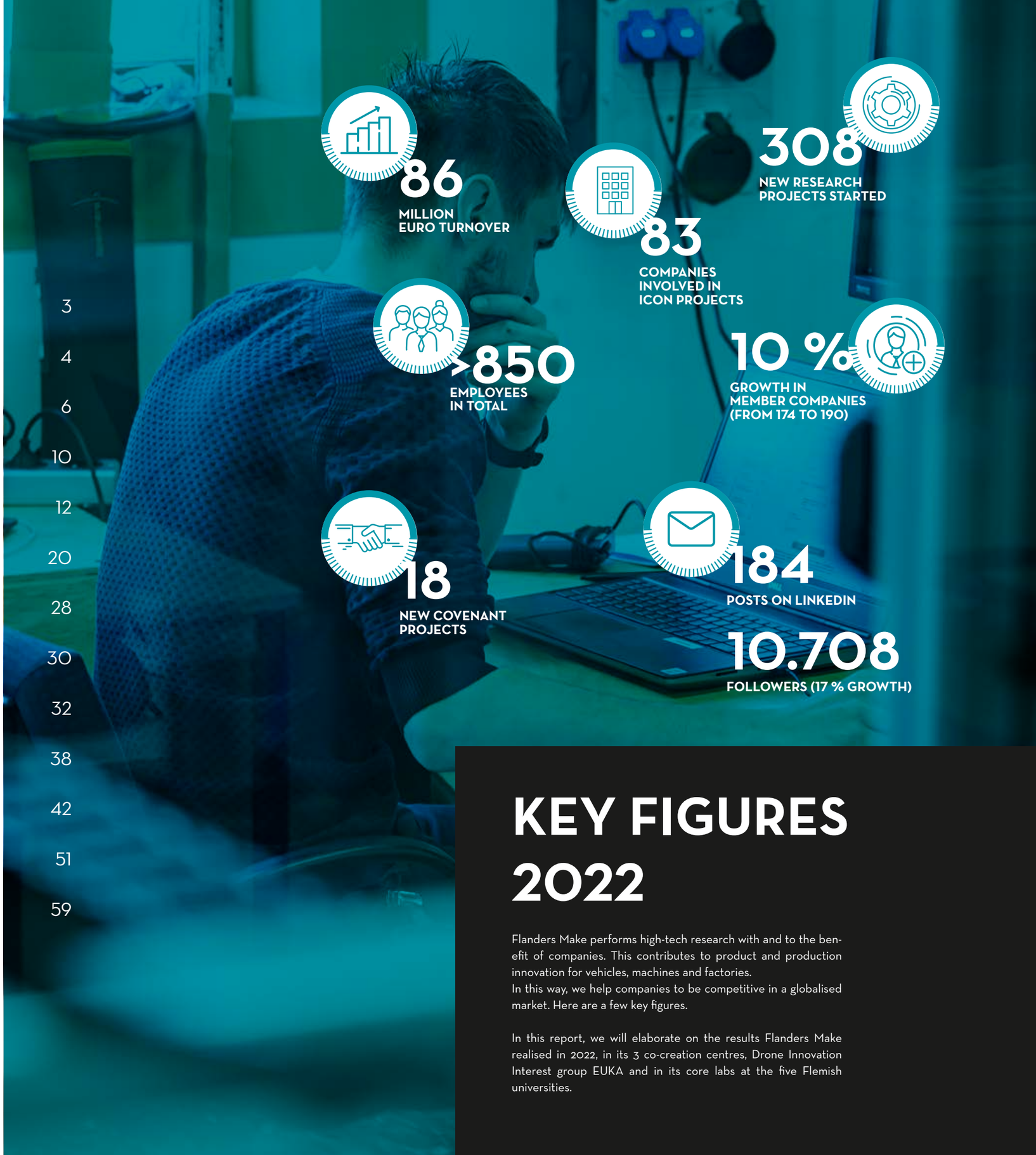
ACTIVITY REPORT 2022

FLANDERS MAKE

DRIVING INNOVATION IN MANUFACTURING

CONTENT



KEY FIGURES 2022

Flanders Make performs high-tech research with and to the benefit of companies. This contributes to product and production innovation for vehicles, machines and factories.
In this way, we help companies to be competitive in a globalised market. Here are a few key figures.

In this report, we will elaborate on the results Flanders Make realised in 2022, in its 3 co-creation centres, Drone Innovation Interest group EUKA and in its core labs at the five Flemish universities.

PREFACE OF THE CHAIRMAN

As we look back on 2022, we can only conclude that we are at a clear turning point after decades of intensive globalisation. This change in direction was triggered by geopolitical tensions and the collapse of the global economy, resulting in disrupted supply chains, a problematic energy supply and historically high prices. Despite these challenges, our manufacturing companies continued to find their way to Flanders Make, giving us a strong 16 percent growth. It is clear to our companies that innovation is crucial to remain competitive and enhance their resilience.

2022 IN RETROSPECT

Once the biggest impact of the corona crisis had subsided, we recorded a solid recovery in the second half of 2021. A lot of companies have clearly shown great resilience over the last two years, partly thanks to the much appreciated government support. Just when everyone believed the global market situation would move further in that direction in 2022, suddenly the war and accompanying crisis in Ukraine broke out. Energy prices went through the roof and supply chains were once again disrupted, resulting in rapidly escalating prices. An additional negative impact in Belgium was that high inflation caused a sharp rise in labour costs, due to the automatic wage indexation we have here. This caused an additional competitive disadvantage compared to neighbouring countries. Due to this polycrisis and an unprecedented cost explosion, our companies were once again under great pressure and forced to adapt to exceptional circumstances.

In this difficult market situation, Flanders Make is even more motivated to support our companies in their innovation processes. Companies are already making many efforts to reduce their energy bills and thus accelerate the transition towards a more sustainable production. But they are focusing even more on digitalisation and automation to counter higher labour costs. And yet there is hope as we see that companies are not scaling down their medium- and long-term investments in innovation. As a result, we at Flanders Make managed to realise a strong growth of 16 percent in 2022: an achievement that, considering the enormous challenges, our team can be very proud of.

EUROPE AT A TURNING POINT

With the large-scale conflict in Ukraine, Europe is losing its important 80-years of peace dividend. In addition, geopolitical tensions between the US and China were high in recent years and 30 years of intensive globalisation came to an end. The corona crisis and the war in Ukraine clearly exposed the vulnerability of low-cost, just-in-time supply chains. The energy crisis also showed that Europe has become far too dependent on cheap energy supplies, both from the Middle East and Russia.

> "THE AMBITION FOR THE COVENANT OF THE NEXT FIVE YEARS IS CLEAR: WE WANT TO ACCELERATE THE DIGITAL TRANSFORMATION OF OUR INDUSTRY AND MAKE IT MORE SUSTAINABLE AND WE WANT TO ACTIVELY SUPPORT EVEN MORE COMPANIES IN THEIR INNOVATION EFFORTS."
>
> – Urbain Vandeurzen, chairman of the Board of Directors

There is a growing realisation that the era of extreme globalisation with cheap energy and supply chains is over. Europe knows that it will have to take responsibility for ensuring strategic technologies such as computer chips and protecting its own security. Apart from this, also the strategic digital and sustainability transitions remain high on the agenda. Add to this the fact that all central banks – including the European Central Bank – accelerated interest rate increases to keep inflation down, and you can see that Europe has entered a new market environment.

THE FUTURE OF MANUFACTURING IN FLANDERS IS UNDER PRESSURE

The challenging market situation requires a joint approach from governments and companies. In Belgium, quite a few policies are not adapted to the current challenges, such as the labour market policy and the health insurance and pension system. The quality of our education system has also been deteriorating alarmingly for years. Moreover, Belgium is Europe's worst pupil in terms of the 2023 budget deficit. Companies must constantly adapt and reinvent themselves and this is something our governments urgently need to do as well.

Innovation is the solution. Together, we must – more than ever – commit to a broad and deep innovation strategy. Now, let that be precisely what Flanders Make's mission is all about: helping our companies to remain competitive by boosting their innovative strength. We want to use sustainability and digitalisation to the benefit of our manufacturing industry. This is how we strengthen our ecosystem, which not only includes the mechanical engineering and automotive sectors, but also the food and pharmaceutical sectors and all companies with similar production systems and innovation challenges.

TOP TECHNOLOGY MADE IN FLANDERS

As an example of our innovative strength, I would like to highlight two Flemish high-end technologies. On the one hand, we can be enormously proud of top technologies developed for generating green energy, more specifically wind power and solar energy. Flanders has innovative wind farms in the North Sea and we need to maximise their efficiency. Such high-tech projects at sea are an important key to a sustainable future as well as a promising export opportunity for their developers.

On the other hand, Flanders Make is also hugely involved in innovations in the Flemish agricultural sector. Through many years of collaboration with top companies, we've helped to develop world-class machines and processes. In a previous annual report, we already mentioned CNH, an agricultural machinery manufacturer that recently won five international innovation awards. For years now, we have been supporting them with research and developments related to Industry 4.0, smart sensors and data. Together, we're developing high-tech agricultural equipment, such as more efficient baler systems, soil tracking, smart controls and numerous upgrades for their customer products.

NEW FIVE-YEAR COVENANT WITH THE FLEMISH GOVERNMENT

Our ambitions are clear: we want to help our industry to remain competitive in this extremely difficult market environment and continue supporting product and process innovations. This is reflected in an ambitious proposal for a new five-year covenant, with which we want to send a positive signal to the industry and manufacturing companies. With the financial support of the Flemish government, we aim to strategically strengthen our manufacturing industry. Through a continued growth path, we will focus in the coming years on a more competitive, digital and sustainable manufacturing industry.

URBAIN VANDEURZEN
Chairman of the Board of Directors of Flanders Make

PREFACE OF DIRK TORFS, CEO FROM 2014 UNTILL 2023

2022 IN RETROSPECT

In 2022, Flanders Make launched quite a few new initiatives once again. This has strengthened our open innovation ecosystem with partnerships between companies, governments and knowledge institutions.

Some strong pillars:

- By programming and conducting industrially relevant strategic research, we created levers and strengthened the scientific base for achieving global critical mass and excellence.
- By capitalising on new knowledge through research, stimulating broad knowledge dissemination and implementing research results, we accelerated technological innovations in the Flemish manufacturing industry.
- We created and strengthened an open innovation environment, searching for synergies that led to close and structured research partnerships.

Flanders Make further developed its ecosystem in 2022, building on the momentum of previous years and continuously focussing on the actual needs of companies. We were able to connect even more companies and innovation leaders and realise impactful innovations. We also engaged more companies (both large companies and SMEs) in our research operations. Meanwhile, we are working with numerous innovation actors to reach even more sectors and support and accelerate the implementation of Industry 4.0 throughout the Flemish economy. We are also bringing more and more companies into contact with innovative solutions through living lab projects and multiple collective knowledge dissemination projects (COOCK).

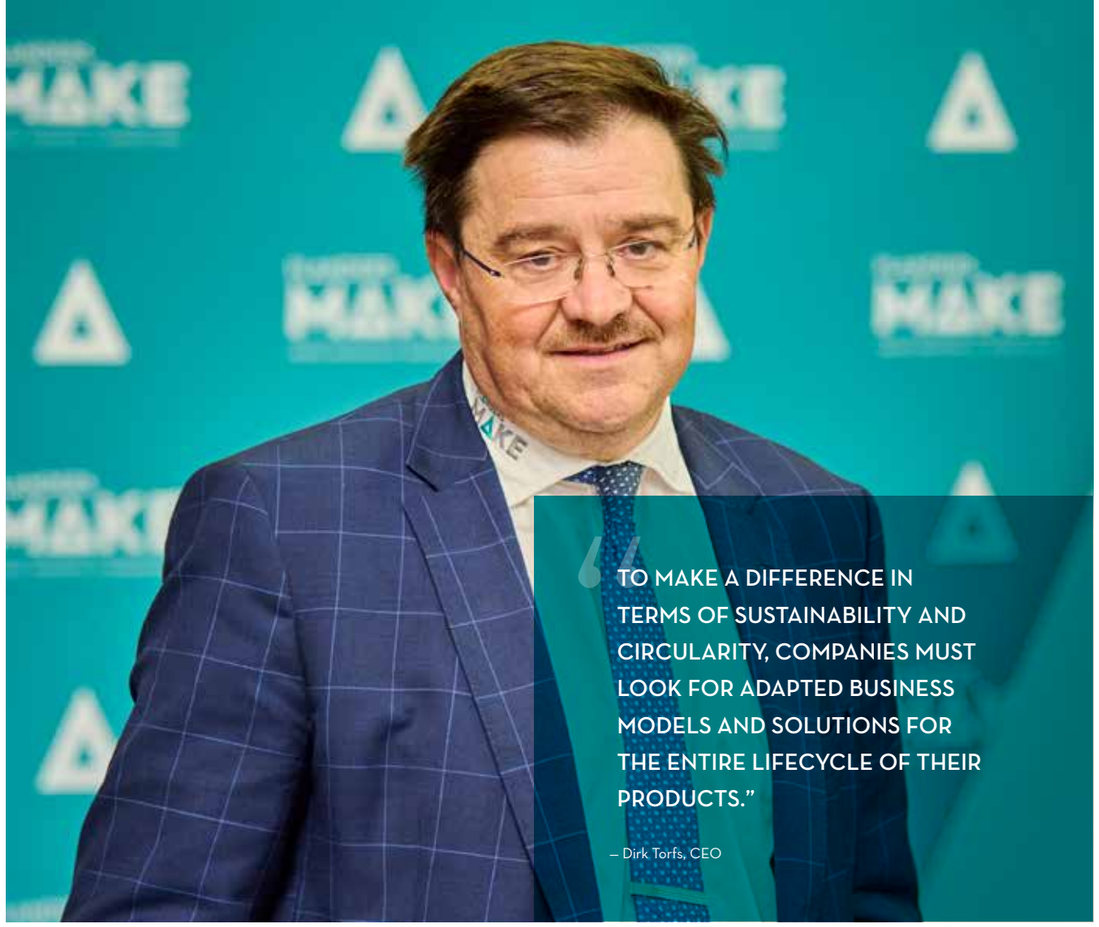
We increased our expertise with additional core labs within our ecosystem: two core labs run by university economics departments now support product and production cost and lifecycle analyses, respectively. These labs are important for research into circularity and sustainability issues. We also added a lab with AI expertise to bring existing knowledge and complementary expertise together. The research part of the ecosystem thus grew to more than 850 researchers.

In line with this increase in research activities, the business part also continued to grow. The number of members will soon exceed the 200 mark (60 percent of which are SMEs), while more than 530 corporate partnerships with innovation impact or including the use of our testing and validation infrastructure have already been set up. Here as well, the right balance between large companies (55 per cent) and SMEs (45 per cent) is important. We organised 35 events with more than 3,000 participants from almost 900 organisations, of which 800 were companies. We are also proud of our partnership with SEW-Eurodrive in Germany and Leuven, which demonstrates that our research is also relevant at the European level.

Also in 2022, Flanders Make was the manufacturing industry's mainstay for research and innovation support. Thanks to all this research, more innovations are easily finding their way to companies. Technologies such as AI and digital twins are increasingly embedded in our companies' products and production processes. After a two-year absence, the 2022 symposium was a much appreciated reunion between many company representatives and researchers. Flanders Make not only brought inspiring stories from companies, but made the research results tangible through (again more) demonstrations of recognisable applications for the industry. The many positive reactions are a great recognition and encouragement for all contributing researchers.

A few examples of the many achievements of the past year:

- Development of a prototype for diesel engine-to-electric motor transformation for e-Trova.
- Multiple-machine energy management using a DC grid based on components from ABB, Siemens, etc.
- Predictive maintenance based on AI algorithms and raw datasets from sensors.
- Robot programming by way of AR/VR demonstrations.
- Hybrid AI applied to a foil processing machine.
- Transforming data and explicit knowledge into actionable insights into the production process using knowledge graphs.



"TO MAKE A DIFFERENCE IN TERMS OF SUSTAINABILITY AND CIRCULARITY, COMPANIES MUST LOOK FOR ADAPTED BUSINESS MODELS AND SOLUTIONS FOR THE ENTIRE LIFECYCLE OF THEIR PRODUCTS."

– Dirk Torfs, CEO

FLANDERS MAKE'S AMBITION

It is our ambition to continue offering full and maximum support to industrial companies with manufacturing challenges, addressing both the needs for and the challenges of end-to-end digitalisation. This requires a business transformation based on a five-pillar digital strategy:

1. product innovation
2. production innovation
3. business model innovation
4. talent & culture development
5. ecosystem developments

These pillars must be addressed in a balanced way when implementing the strategy in order to ensure long-term results.

The renewed Flanders Make strategy is based on these pillars and aims to create more and more impact on companies, their products, production, people and business (models). The scope has been expanded and new trends have been embedded in our research strategy. As such, the Flanders Make strategy has been aligned with the Flemish government's "Smart Specialisation" strategy and contributes to its Vision 2050 and Vizier 2030 objectives.

Flanders Make's core competences and capabilities regarding Industry 4.0/5.0 technologies and research will be essential to achieve the targeted impact. Activities involving digital twins and production intelligence (domain knowledge, data & algorithms throughout the entire lifecycle of products, production and operations) will be given a boost. These technologies will become dominant and create new insights for realising sustainability and ecological as well as operational efficiency.

All this should keep our region highly competitive. The strength lies in an industry that can continue to serve demanding customers, but also remains a strong innovation leader, along with the Nordic countries.

NEED FOR AN AMBITIOUS GOVERNMENT

Such a strategic plan also calls for investments in research and innovation. Therefore, the Flemish government must have the courage to honour the growth scenario with the necessary resources. This will enable Flanders Make to continue supporting numerous companies in the manufacturing industry in their various transitions and to accelerate innovations so that Flanders will be able to remain a competitive region and maintain its expert image.

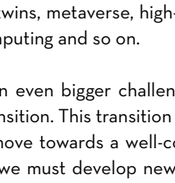
DIRK TORFS
CEO

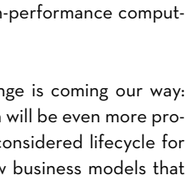
2023 AND THE FUTURE

In early 2022, Flanders Make developed a new, ambitious strategic plan for the next five years, titled "Research with impact on digitalisation, sustainability and competitiveness for products, production & workable work". The world is changing, both on a technological and geopolitical level. This calls for reflection on the strategy to be followed and adjustments to be made so that new trends, technologies and challenges have their place in our research to support companies. The digital transformation is not yet complete: we must help companies to integrate new technologies, such as digital twins, metaverse, high-performance computing, AI, quantum computing and so on.

At the same time, an even bigger challenge is coming our way: the sustainability transition. This transition will be even more profound, as we must move towards a well-considered lifecycle for products. To do so, we must develop new business models that fairly distribute collectively created value. When it comes to sustainability, we will collaborate to achieve CO_2 neutrality. We also contribute to making the industry more circular and want to create a strong impact on people-related issues. Finally, we continue to encourage collaborations leading to an ecosystem economy and stronger business models focusing on the entire value chain. For us, the transition to a circular economy is part of the sustainability transition. Ultimately, the circular economy must lead to new raw materials (from recycled fractions) that can be an important asset for a region without natural resources.

Our productivity remains stable but should be increasing. At the same time, wages are derailing compared to our neighbours, increasing the cost of products and lowering our competitiveness. Good workers are becoming scarcer, requiring more automation and efficiency efforts. Besides an outflow of older employees, we also see increased mobility of (younger) workers. Therefore, we also need systems for capturing and anchoring knowledge. Workable work is essential: technological and social scientists must join hands to provide solutions.

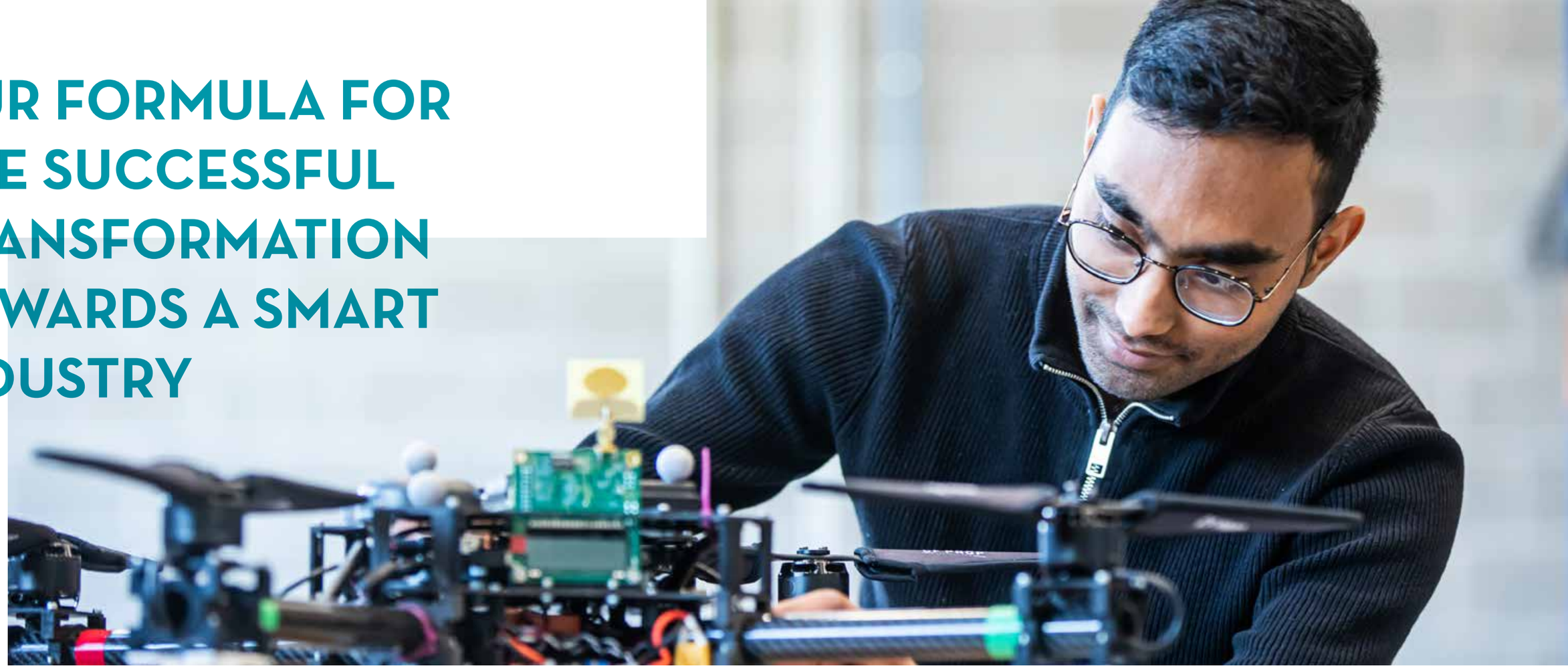




"INNOVATION REMAINS THE KEY TO FUTURE SUCCESS AND PROVIDES AN ANSWER TO THE MAJOR CHALLENGES WE FACE."

DIRK TORFS
CEO Flanders Make

OUR FORMULA FOR THE SUCCESSFUL TRANSFORMATION TOWARDS A SMART INDUSTRY



We've already read in our chairman's foreword that the global social and economic context is eventful, to say the least. This challenging post-corona period with its large-scale conflicts, crises, inflation and rising prices is forcing companies to show resilience. Numerous Flemish and federal initiatives help companies to pick up the thread after two years of corona, such as Flanders Make's 'digitalisation accelerator programme'. With this programme, we want to transform our companies – and by extension the whole economy – in a sustainable way.

A smart industry with its defined future potential is not only sustainable, but also digital and competitive. When every business transformation rests on these pillars, we will continue to be at the forefront of a globalised economy. Our CEO, Dirk Torfs, explains how this vital formula will lead to a smart industry.

1 SUSTAINABILITY

As a key factor for a smart industry, sustainability fits seamlessly into the current social and economic climate, especially with the huge fluctuations that we've seen in the fuel and energy prices over the past year.

Yet sustainability goes much further, as a smart industry rests on the following four pillars:

- **A green economy:** more focus on energy efficiency and electrification.
- **A human economy:** focusing on workable work, upskilling and reskilling.
- **An ecosystem economy:** more sustainable partnerships between companies and knowledge institutions to realise more complex processes.
- **A circular economy:** with new standards such as lifespan extension, remanufacturing and smart maintenance.

2 DATA

Data are the second driver of a successful digital transformation. Data represent the basic ingredients for digital capabilities such as cobots, digital work instructions, augmented reality, digital twins, virtual reality and so on. By combining artificial intelligence with domain knowledge and human insights, we can better manage its impact. Only then will we create the leverage we need for the integration of man and machine. Data support the organisational learning process that strengthens both man and machine. As such, data contribute to workable work and efficient production processes, which will both be decisive aspects in the future.

3 COMPETITIVENESS

Finally, the competitiveness of manufacturing companies is the third key factor for rolling out a smart industry. More than ever, customers are demanding customised products in small volumes. Companies that manage to control their design and production costs also remain competitive in the global market. End-to-end digitalisation is very important here: it allows companies to respond flexibly and automatically to the constantly changing demands of their customers and the corresponding design and production adjustments.

CONCLUSION

In conclusion, the differentiating factor for industrial players to initiate a sustainable transformation process lies in the relationship between man, machine and domain knowledge. Accordingly, the accelerated implementation of digital solutions with extra attention to sustainability and competitiveness constitutes a vital three-pronged approach. Only in this way, we will be able to further develop our prosperous economy, which is under constant pressure from international superpowers. The positive dynamic initiated by Flanders Make is evident: we cooperate intensively and create social and industrial impact with our research in each of the domains that are key for leading us to a smart industry.

> THE DIFFERENTIATING FACTOR FOR INDUSTRIAL PLAYERS TO EMBARK ON A SUSTAINABLE TRANSFORMATION LIES IN THE RELATIONSHIP BETWEEN MAN, MACHINE AND DOMAIN KNOWLEDGE.
>
> – Dirk Torfs, CEO Flanders Make

COLLABORATING TOWARDS DIGITAL TRANSFORMATION

Together with companies that are part of our ecosystem, we perform pre-competitive research into shared challenges. In addition, companies can also appeal to us for specific research issues. We can support them with our knowledge and services to develop a new concept, validate a solution of their own or perform extensive tests in our high-tech research facilities. We are happy to show some examples of successful collaborations with companies.

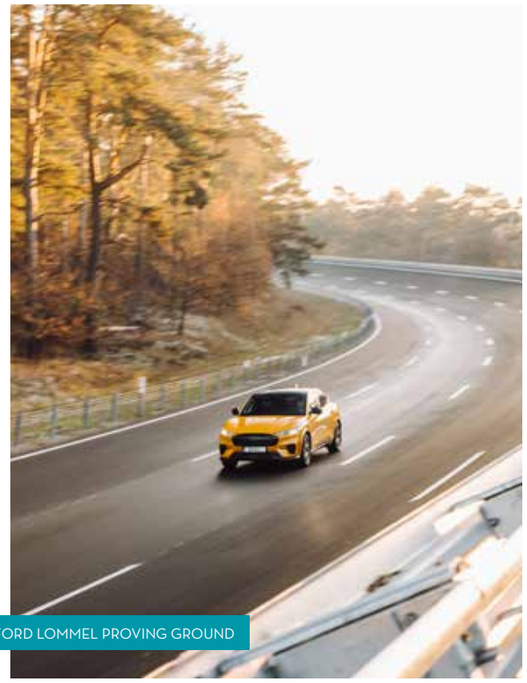
E-TROVA

Trucks from diesel to electric in 48 hours

The transport sector is among the biggest air polluters: 20 percent of all greenhouse gas emissions are attributed to it. A transition to zero-emission vehicles is therefore elementary for reducing overall CO_2 and NOx emissions. Yet this transition is proceeding very slowly, due to the high cost of new electric trucks and the limited capacity among manufacturers. Belgian company e-Trova comes with an alternative option: repowering from a diesel to an electric powertrain within a very short time (48 hours) for a wide range of existing trucks. Not only is repowering significantly cheaper than buying a new electric truck, the operating costs (TCO or Total Cost of Ownership) are lower than for a diesel truck. What's more, it extends the lifespan of an existing truck and reuses basic components such as chassis, axles and cabin.

For a first prototype, we rebuilt a Volvo FH together. We removed the thermal engine under the cabin and installed a 'cradle', which accommodates various components such as batteries, chargers, inverters, the cooling system and the steering pump. This cradle must make the solution as flexible as possible in view of its application in trucks of other makes, such as DAF or Scania. This is obviously a challenge as each make uses its own specific software and hardware. In a next step, we will work together with e-Trova to develop additional prototypes for other manufacturers. In the longer term, e-Trova is planning a site in Flanders where they want to convert 4,000 trucks per year.

> "THANKS TO THEIR EXPERTISE AND RESULTS-DRIVEN APPROACH, THE FLANDERS MAKE TEAM IN LOMMEL DEVELOPED THE TECHNOLOGY FOR D2E REPOWERING WITHIN BUDGET AND IN A VERY SHORT TIME. AS PROMISED, THE TRUCK DROVE BEFORE THE END OF 2022, PARTLY DUE TO TEAMWORK WITH OTHER COMPANIES."
>
> — Jan Bracke, CTO e-Trova



FORD LOMMEL PROVING GROUND

State-of-the-art infrastructure for testing cars

The Ford Lommel Proving Ground (LPG) is located, not coincidentally, next to our site in Lommel. Here, Ford Europe has been testing all cars developed by them since 1965 on more than one hundred kilometres of test tracks and extensive test infrastructure. Over the years, these tracks have been renewed regularly and opened up to other manufacturers: an opportunity eagerly used by Toyota, Tenneco and Punch Powertrain, among others. Flanders Make has been working with Ford LPG for many years to jointly offer an interesting service to vehicle manufacturers. Our test stands and climate chambers, complemented by all test facilities offered by Ford, make Lommel a top location for vehicle development and testing.

In the future, this service will be expanded even further. For instance, in addition to vehicle testing, Ford LPG will also offer vehicle development services.
Together with E-trucks Europe, the City of Lommel and POM Limburg, we are also planning a campus focusing on green and smart mobility, where companies can test their innovative technologies for electric and hydrogen-powered cars. This will allow us to continue offering an interesting range of services to manufacturers and attract new business activities to Lommel and Limburg. Every year, Ford LPG also opens its test tracks to cyclists for one day in May or June: definitely worth a visit!

SCANDINAVIAN TOBACCO GROUP

Flexible cobot helps to pack cigar boxes

Scandinavian Tobacco Group (STG) is a global player when it comes to cigars and pipe tobacco. From their sites in Westerlo and Lummen, they produce cigars that are distributed worldwide under several brand names. Together, these Flemish sites produce and package up to ten million cigars a day, divided among eight thousand different products. Local health warnings and unique track-and-trace codes for each product add to the complexity of the process. So for STG, flexible production and automation are essential to compete on a global level. Therefore, it shouldn't surprise anyone to find AGVs, or Automated Guided Vehicles, in their factory halls. These carry products in and out, alongside all kinds of production lines that STG built in a modular manner to be able to switch quickly within their wide range of products.

It is from this perspective that they turned to Flanders Make to help tackle a specific problem. Packing products into boxes is a difficult task due to the different sizes and materials of cigar boxes. Some of these tasks are very repetitive and could therefore be automated, allowing operators to perform other tasks with better ergonomics.

> "AUTOMATION AND INNOVATION ARE KEY TO OUR SUCCESS AND GIVE US THE OPPORTUNITY TO GROW."
>
> – Xavier Van Mierloo, Senior Group Engineering Manager STG

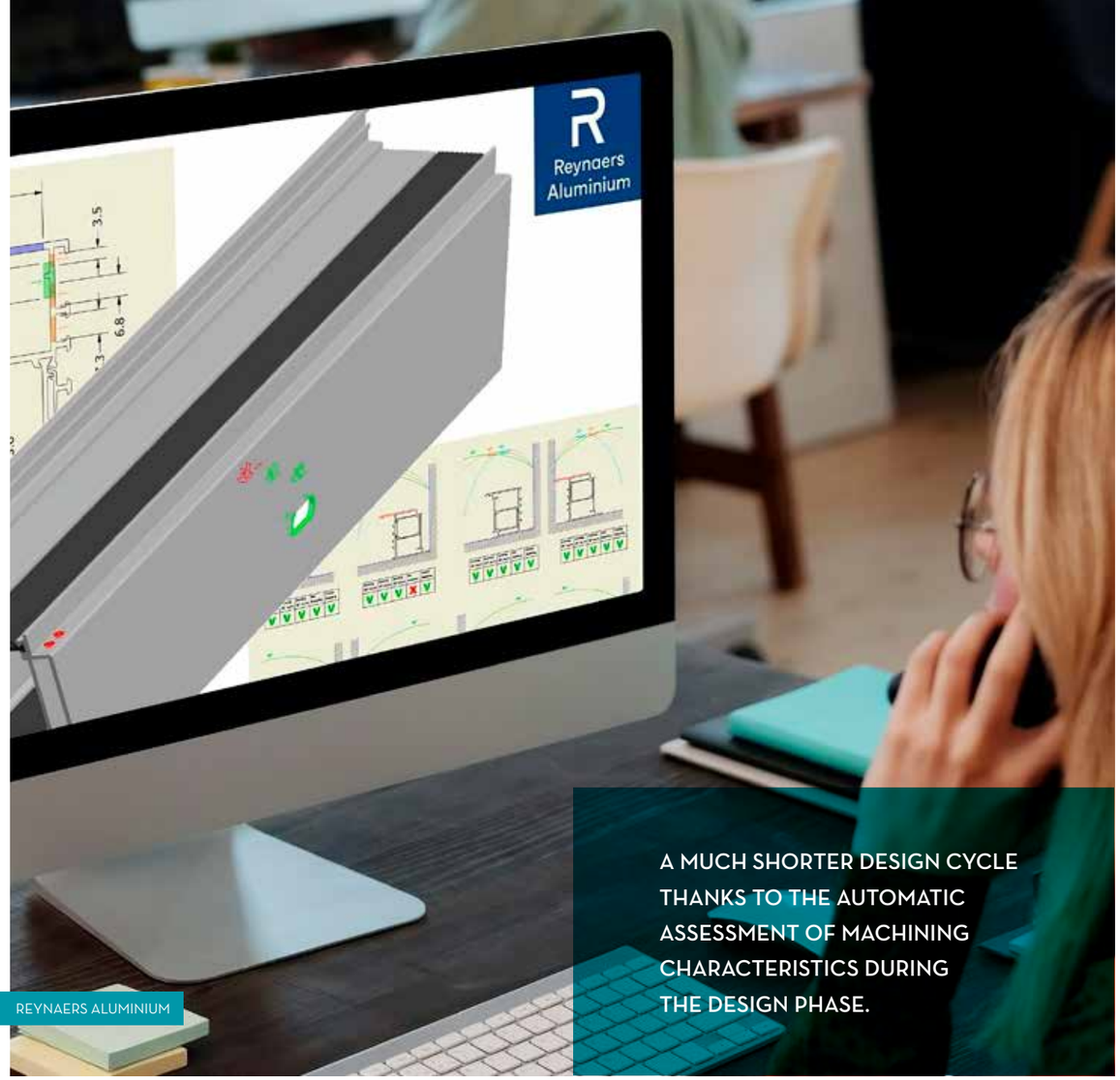
Together, we developed a cobot that can largely take over the repetitive work and also has a flexible gripper. The latter enables the cobot to simultaneously pick up different sizes and quantities of boxes and put them in the outer cardboard box. A human operator can then take charge of the further finishing of the product. The result of this joint project: STG can now handle their wide variety of products in a flexible and efficient manner.

BEKINTEX

Data-driven operational flows: towards workable jobs in agile companies

Bekintex, part of Bekaert, manufactures high-tech textiles based on metal fibres. These are used, amongst other things, in electrically conductive and heat-resistant textiles. Together with the competence centre Workitects and Flanders Make, they searched for a way to increase their productivity and customer orientation. They also wanted to reduce their lead and delivery times by organising and digitalising work smarter, and by increasing employee engagement.

In 2018, Bekintex chose to innovate its work organisation and form multidisciplinary teams. For a specific team, the production process, information flows and jobs were reviewed in detail to make sure that the right team KPIs and team roles would be implemented. The next step was digitalising the information flows. As a result, almost no paper is still being used on the shop floor and the team leader has immediate access to the right information. The team now works more result-oriented and autonomously, which is clearly paying off. Productivity increased by 23 percent and also the quality improved significantly.



REYNAERS ALUMINIUM

Profile design (for production) through CAD feature extraction

A first-time-right product design can save companies a lot of money, not only in the extra working hours for subsequent iterations, but also in the often expensive production of prototypes. To support CAD designers in their tasks, Flanders Make has developed software that rapidly assesses the machining characteristics of a design. This allows designers to automatically detect any production constraints during the design phase.

This, in turn, leads to fewer design cycles, ensures that designs are right the first time and makes technical production knowledge accessible to designers.

Our software:

1. Automatically detects the areas to be monitored.
2. Checks restrictions.
3. Visualises the result for the designer.

This assessment takes only seconds and reduces dependence on expert human assessors. At aluminium manufacturer Reynaers Aluminium, we applied this technology to evaluate their aluminium profiles. This saves time in the design cycle and prevents errors.

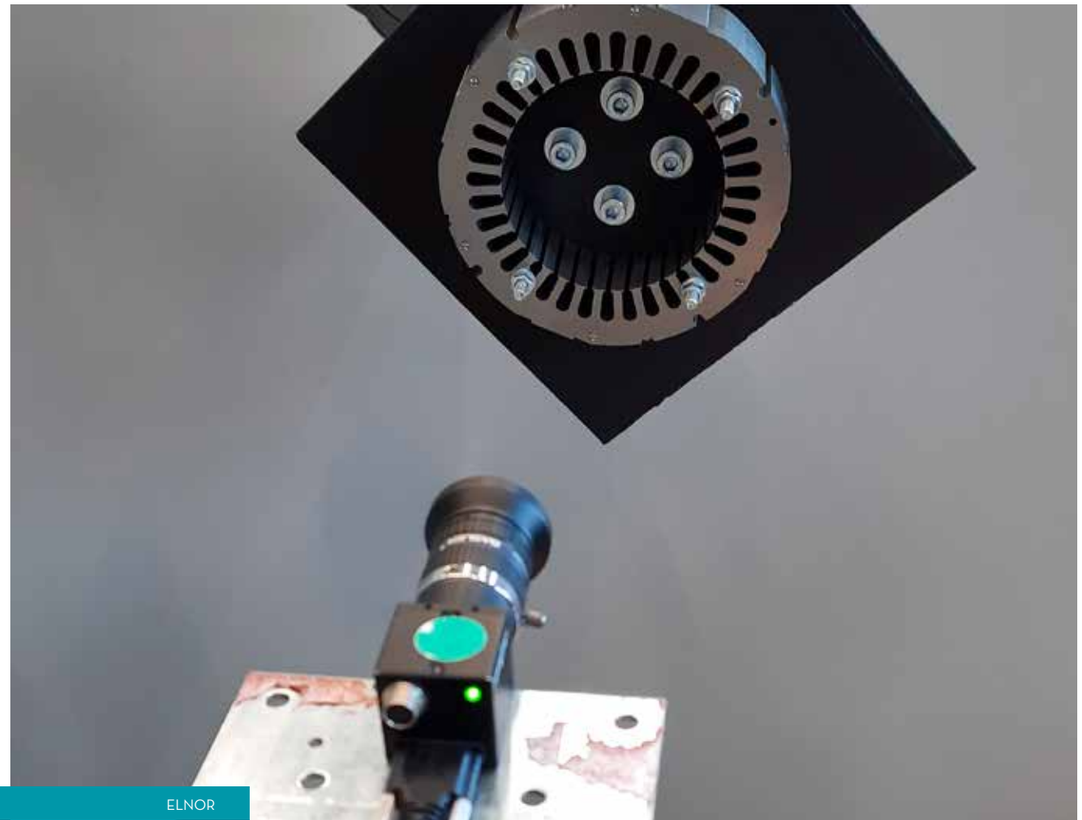
BIKEBAT

Automated assembly of bicycle batteries

The electric bike has become hugely popular in recent years and is now for many a worthy alternative to the car for short or medium-range trips. Yet, the lifespan of that electric bike is often curtailed by battery wear, and all too often new batteries are no longer available after a number of years. Consumers with a worn or defective battery can now send it to Bikebat, which will equip it with new cells as well as a new battery management system. This can breathe new life into an electric bike and can be up to 50 percent cheaper than buying a new battery, if one is even still available.

Given the ever-increasing demand, Bikebat is therefore definitely interested in streamlining the overhaul process and making it more efficient. Together, we worked out a feasibility study, where the focus came to be on the step where battery cells are placed in a grid to assemble a larger battery. A cobot lifts the grid and brings it to the machine where the batteries are sorted, then uses an auxiliary tool to press them into the cavities of the grid. The cobot can perform this task at high speed, and the employees who used to perform this repetitive task can then continue finishing the manufactured packs with, for instance, a spot welder. This process considerably increases productivity for the same number of employees.

> “THANKS TO FLANDERS MAKE, WE WERE ABLE TO PARTICIPATE IN THIS RESEARCH AND COMPLETED THIS FEASIBILITY STUDY WITH A SUITABLE PARTNER!”
>
> – Thijs De Ridder, CEO Bikebat



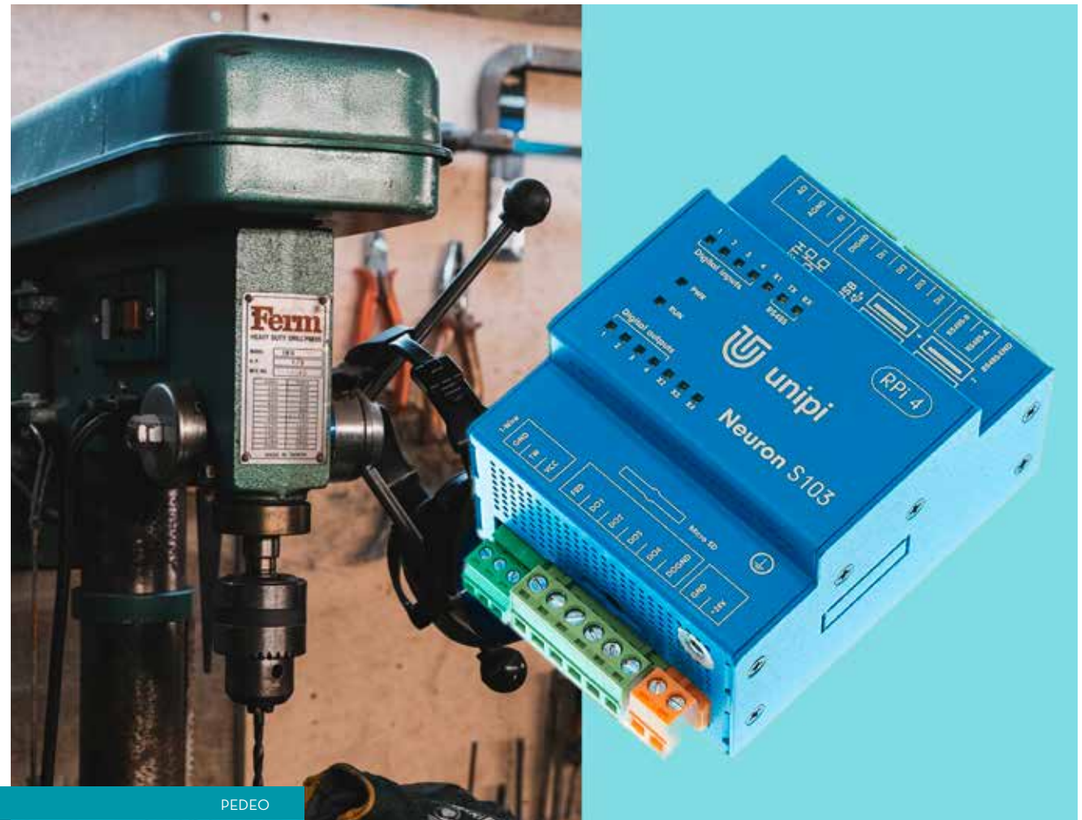
ELNOR

Cobot and vision system facilitate installation of slot insulation in stator for electric motor

For more than a century, Elnor Motors has been developing and building electric motors, always tailored to the specific needs and requirements of machine builders in terms of performance, machine integration and certification. Thanks to this approach, their motors can be found in a very wide range of appliances and machines, such as pumps, coffee grinders, bread-slicers, petrol pumps and mixers. The stator is the part of the electric motor that remains static and uses its copper windings to generate a magnetic field that causes the rotor to rotate. Elnor has already automated some steps of the production process, but placing the stator in the machine that applies slot insulation is still a repetitive and strenuous task. This task is currently still being carried out by operators, mainly because it involves an immediate visual inspection of the inserted insulation as well as verification that all preceding steps have been completed correctly.

Together with Elnor, Flanders Make worked out a feasibility study to examine whether this step could also be automated. A cobot was used as a safe tool to move the – at times heavy – stators. A 2D vision system can take over the visual inspection and checks immediately whether the stator is placed into the machine in the correct direction. The feasibility study showed that automation of this task makes sense and has positive effects on both production efficiency and operator ergonomics.

> “THANKS TO THE EXCELLENT COLLABORATION WITH FLANDERS MAKE, WE WERE ABLE TO TEST THE APPLICABILITY OF THIS TECHNOLOGY IN OUR PROCESS QUICKLY AND EFFICIENTLY.”
>
> – Tom Paesmans, Managing Director Elnor



PEDEO

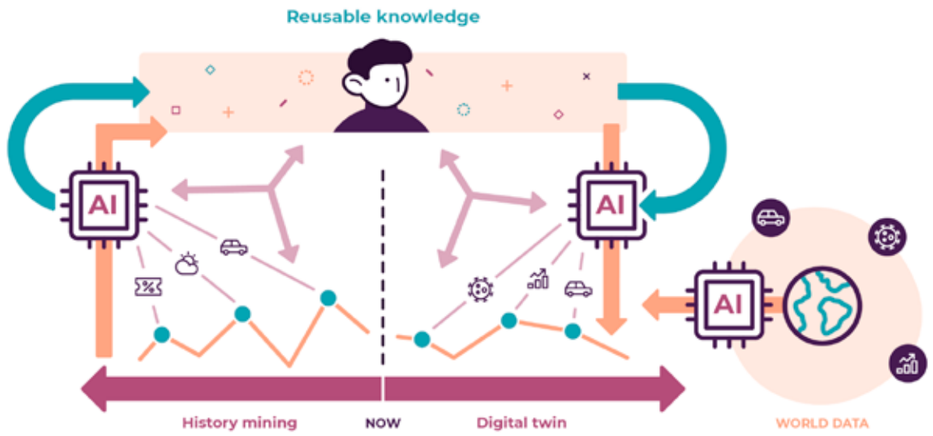
Open standards also connect non-smart machines

Connecting different industrial machines, services and software is an important cornerstone in any Industry 4.0 strategy. Data collection and sharing offers a lot of opportunities for automation, monitoring and planning, amongst other things. Yet few companies succeed in connecting their entire machine fleet, because older machines often lack connectivity capabilities or because manufacturers hesitate making it possible to connect with equipment from other manufacturers. In the end, often the most important machines are connected to a wider network, leaving the rest of the machinery lagging behind. This also proved to be the case at Pedeo, a high-pressure foundry of zinc and aluminium alloy products.

Together, we started looking for an open way to link existing hardware to their Manufacturing Execution System (MES). In the end, we selected Unipi as base platform. This is a relatively inexpensive device that offers a lot of options for connecting to all kinds of digital and analogue signals. Subsequently, open source software can translate those signals into the OPC-UA format, which in turn is an open standard for industrial communication.

At Pedeo, we connected a robotic cell to the MES system as a proof of concept and, in theory, almost any drill, press or small automation system can thus be connected as part of a broader digitalisation strategy. For this, we also worked out a manual to facilitate such integrations. This manual is also available to other companies that would like to work out similar integrations.

> “THE REAL VALUE LIES NOT IN CONNECTING THE ROBOTIC CELL BUT IN DEVELOPING A GENERIC CONNECTION SYSTEM, WITH THE ROBOTIC CELL ACTING AS A ‘PILOT’ OR ‘DEMONSTRATOR’.”
>
> – Steven Sansen, Process Engineer Pedeo



THROUGH CLEVER ALGORITHMS, THIS TOOL LINKS EXTERNAL EVENTS TO STOCK FIGURES. THIS GIVES PLANNERS A BETTER VIEW OF WHAT THEY NEED TO PROCURE IN THE FUTURE.

Up to a more accurate stock planning with the Garvis tool

GARVIS

Traditionally, stock planning is partly based on the gut feeling of planners. Based on figures from previous years, they check what stock was needed then and, adding some guesswork, predict what will be needed this year. Accordingly, unexpected events (such as wars, pandemics or a promotion offered by the competition) will inevitably lead to surpluses or shortages, resulting in huge costs. Garvis, a spin-off from University of Antwerp, has developed an innovative tool that uses artificial intelligence to work out a much more accurate forecast. Almost every company has historical data from, say, an order system or invoicing software. Garvis' tool analyses this kind of data in detail and uses algorithms to determine the impact of relevant external events on the stocks in question. These algorithms learn very quickly and show their added value almost immediately by generating more precise predictions for the near future.

Garvis has also developed additional integrations for the tool. This allows planners to use their experience to fine-tune certain recommendations, which will in turn optimise predictions even further. This cooperation between humans and AI results in up to 30 percent fewer prediction errors, which has a huge financial impact. Flanders Make also helped to optimise the tool by developing software tests that further improve the robustness of the Garvis tool. By specifically looking for exceptional situations in those tests, we succeeded in making the software more user-friendly. A year and a half after the launch, some 50 companies worldwide are already using Garvis software, including major players such as Douwe Egberts, Q8 and Johnson & Johnson.

WE PREDICT MATERIAL BREAKAGE UP TO TWO WEEKS IN ADVANCE BY MONITORING AND ANALYSING GEAR VIBRATIONS.

We predict material breakage up to two weeks in advance by monitoring and analysing gear vibrations

BOSCH

Machines that are down for maintenance operations cause downtime and high costs. However, maintenance can be done in different ways, from corrective to proactive and even predictive. Corrective maintenance is the least efficient: here, action only kicks in when breakdowns or errors occur. This leads to disrupted production schedules and may even cause damage to production systems. Many companies therefore plan most of their maintenance works proactively, scheduling maintenance at fixed intervals or after a certain period of use, while trying to predict the lifetime of components. Yet this type of maintenance is not flawless either and will in many cases be carried out too early or too late, rarely just in time.

The industry therefore needs more efficient methods. Through predictive maintenance, we at Flanders Make want to try to predict defects even better. This involves collecting extensive information about a machine (component), for instance by measuring vibrations, noise levels and temperatures or by analysing video images. By continuously monitoring machine operations, we can predict more and more accurately when certain parts must be replaced. This way, a company only needs to stop production for maintenance when it has become inevitable.

Bosch in Tienen manufactures wiper blades and wiper arms. For its wiper blade production line, the company wanted to optimise uptime by switching to predictive maintenance. Toothed belts are the critical component here. Flanders Make conducted a feasibility study to select sensors and develop the necessary algorithms to monitor the vibrations – and consequently the condition – of the toothed belts. The finally adopted accelerometer approach was validated on a number of production lines, with consistently good results. For instance, Bosch was able to detect the failure of toothed belts two weeks in advance.

GROWERS PUSH LEAVES INTO THE DEVICE WHILE THEY ARE SPRAYING AND IMMEDIATELY SEE HOW EFFICIENT THEIR SPRAYING METHOD IS.

Automatic analysis of crop spraying

AAMS

Plant protection products are important: they keep pests away and contribute to healthy, unblemished fruits and plants. Yet spraying artificial agents is an expensive practice as well as a sensitive issue among consumers. For this reason, all parties prefer to limit the use of plant protection products as much as possible. Fruit and vegetable growers are therefore constantly looking for a more effective spraying method. Traditionally, growers test the quality of the spray with a cumbersome and inaccurate analysis, based on water-sensitive paper suspended between crops. AAMS is a Maldegem-based company specialising in test equipment for agricultural machinery and parts for mainly spraying machines. Flanders Make helped them in developing a mobile device that immediately analyses the quality of the spray in the orchard or field (as opposed to in an external lab). This allows growers to make quick adjustments, even while spraying.

Thanks to an adapter, water-sensitive paper is even unnecessary and growers can simply insert leaves from the plants into the measuring system and analyse them. Besides, this system makes measurements much more comprehensive than traditional methods. It offers better insights into average coverage, droplet homogeneity and untreated surfaces, amongst other things. A next step is 3D analysis of the plants and fruits, which will make monitoring even more efficient and accurate.

OUR CONVERSION TOOL MAKES DIGITAL WORK INSTRUCTIONS INTERCHANGEABLE ACROSS PLATFORMS AND DEVICES, MAXIMISING RETURN ON INVESTMENT.

Drawing up work instructions more fluently

OPEN ATELIER

Open Atelier is an on-the-job training company that focuses on joinery, assembly, metal works, textiles and packaging. As such, it supports disadvantaged target groups who cannot immediately find work in a regular company as well as the local economy by performing services for other companies. Clear instructions are essential for Open Atelier workers, especially for more complex assembly jobs or metal works. Such instructions help them to quickly master a new task. Drawing up these instructions – including the necessary visuals – is a job that cannot be underestimated and must be repeated for every new process.

To make drawing up work instructions easier, Flanders Make has developed a conversion tool that rapidly converts digital work instructions into various file types. Accordingly, every investment in digital work instructions can yield maximum return, across different platforms and devices. For Open Atelier, this conversion tool has converted files drawn up in PowerPoint into files using the Arkite Operator Guidance Software.

The on-the-job training company uses this system to offer tailored instructions to operators, depending on the step they are in, without having to create completely new instructions to do so. This way, companies can introduce new processes quickly and new operators can hit the ground running.

> THANKS TO THIS CONVERSION TOOL, WE DON'T HAVE TO DRAW UP NEW INSTRUCTIONS TIME AND AGAIN. THIS WAY, OPERATORS GET OFF TO A FLYING START."
>
> – Koen Cools, director Open Atelier

BY PAIRING AN AI ALGORITHM WITH A HIGH-SPEED CAMERA, WE ANALYSE THE 3D PRINTING PROCESS AND AVOID PRODUCTION ERRORS.

High-speed AI camera guarantees perfect 3D printed parts

ESMA

Additive manufacturing refers to the production of 3D printed objects. This new way of manufacturing started a revolution in custom-made parts, such as medical prostheses and parts for aircraft or wind turbines. Yet things regularly go wrong, as about 10 percent of all 3D printed products eventually land in the dustbin. This not only wastes precious raw materials, companies must also completely restart the production of the object in question. Esma is a Limburg-based company that supplies (material) products to clients, using advanced production techniques such as 3D printing. The company is committed to efficiency and quality and therefore benefits greatly from perfecting the 3D printing process.

Together with a group of industrial partners and research institutes, Flanders Make has now developed a system that monitors the additive manufacturing process in more detail and adjusts it if necessary. In this process, a high-speed camera takes images of the printing process, after which an AI algorithm searches for indications of a possible defect. Instead of noticing certain defects only at the end of the printing process, they can now be detected during printing, allowing immediate intervention. This makes the production process more efficient and also saves materials. Esma is a partner in this research project and has already integrated the new technology into its products. Moreover, Esma's IoT platform Exalise automatically generates a quality report demonstrating the quality of its 3D printed product.

"USING THE CAMECAD SOFTWARE GIVES US A GOOD PICTURE OF THE MOST CRITICAL POINTS IN THE CLIENT'S DESIGN, EVEN BEFORE WE PROCEED WITH MANUFACTURING A MOULD. THIS ENABLES US TO REALISE THE DESIRED END PRODUCT FASTER.

– Gert Nelissen, Product Development Manager Borit

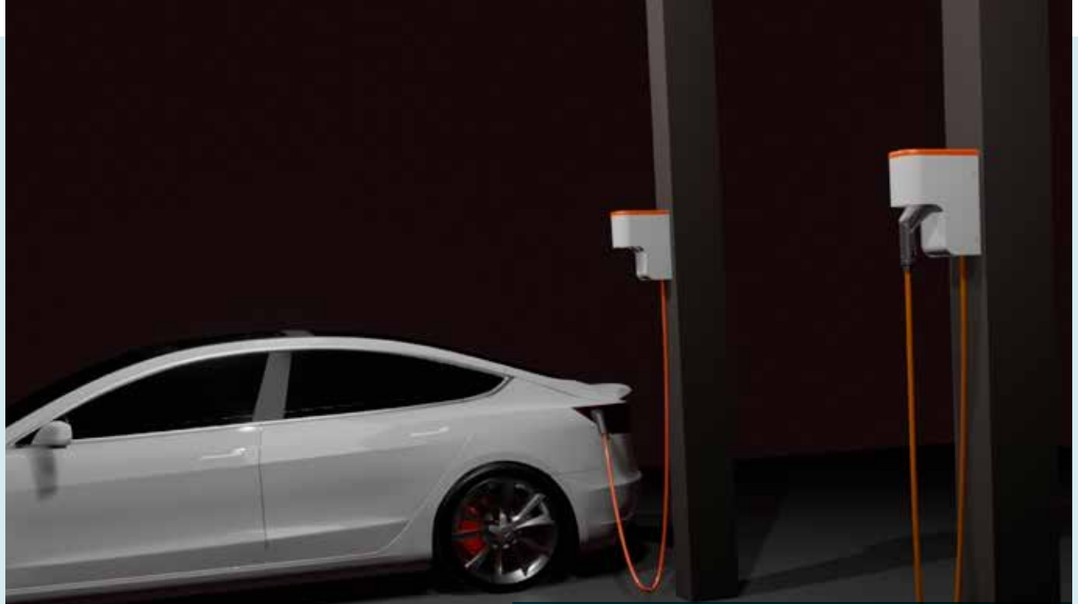
Preventing production errors with software that evaluates CAD designs for manufacturability

BORIT

To decarbonise our transport sector, next to the battery-powered electric car, there's also the hydrogen-powered fuel cell car. The emissions of such a car consist of water droplets, making it an additional weapon in the effort against global warming. Borit is a major manufacturer of metal bipolar plates for fuel cells and electrolysers. These bipolar plates produce hydrogen that can be re-converted into electricity. A range of car manufacturers use that technology, for instance, in hydrogen-powered vehicles to drive the electric motor. Fuel cells are composed of stacked, wafer-thin metal sheets typically a tenth of a millimetre thick. These cells contain specifically shaped structures and a complex network of microchannels.

For their manufacturing process, Borit uses hydroforming technology, in which a metal foil takes on the extremely precise shapes of a mould using 2,000 bars of water pressure. Their clients often bring in their own fuel cell designs, which do not always match the specific properties and limits of the hydroforming process.

To streamline this process, Borit engaged our CAMECAD software, which can evaluate a CAD design for manufacturability by testing it against a set of design rules. After having integrated the design rules applicable to Borit, the software can indicate where problems may arise and where, for instance, the material may crack during the forming process. In this way, Borit avoids costly design adjustments and corrections to production moulds. After an evaluation, the use of the software proved to be a great success. Borit will now systematically roll it out to offer a more efficient design and engineering process to its clients.



SMARTER PLANNING OF EV CHARGING SCHEDULES ALLOWS US TO MAKE OPTIMAL USE OF THE ELECTRICITY GRID.

Smart charging of our EVs

POWERDALE

Our vehicles are rapidly being electrified: a trend we don't see abating anytime soon. While this makes a lot of sense for decarbonising our society, it also brings challenges of its own, especially as regards to the limits of our electricity grid. Peak electricity consumption after evening rush hour will only increase if at that time everyone is also charging their Electric Vehicle (EV). Powerdale is a Belgian manufacturer of EV charging infrastructure, both for consumers and professionals, and is thus very much aware of these challenges. In order to make the best possible use of our electricity grid, we simply must use the available capacity smarter.

Together with Powerdale, we've developed a modular energy management system that can efficiently manage multiple chargers in and around a building. The resulting control programme can monitor the charging status of all connected EVs and calculate an optimal charging schedule based on charging preferences, grid constraints or changing electricity prices. This means that a vehicle that will be parked all day can be charged at a slower pace or even wait for when rates are low. On the other hand, a vehicle with a low battery that must leave soon will have to be charged faster. The programme is even able to simultaneously and seamlessly use separate AC and DC power sources. Powerdale has incorporated these features into its latest generation of chargers and is currently conducting validation tests to roll out the programme to more of its customers.

"WITH FLANDERS MAKE'S NEW LOGIC, WE CHECK AT EVERY STAGE OF THE DESIGN THAT EVERYTHING IS IN LINE WITH THE APPLICABLE SAFETY RULES."

– Peter Deckmyn, Systems and Functional Safety Engineer Dana

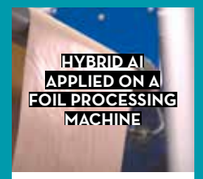
Streamlining vehicle safety requirements

DANA

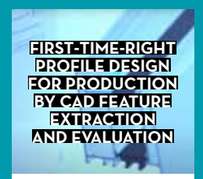
The complexity of vehicles has grown enormously in recent years, due to the combination of mechanical, hydraulic and electrical systems. An example of such a multidisciplinary system is a transmission, which delivers power from an electric motor or an internal combustion engine to the wheels at the right speed and torque. Faults in the steering or electrical part of this transmission may cause the vehicle to become uncontrollable. Therefore, a lot of rules and requirements are drawn up for all components of such a drive system: what they must do, what is required for this, what if something goes wrong with a sensor, and so on. Formally describing these requirements from the start has great advantages, as it makes the design phase go more smoothly and avoids the need to re-run phases such as certification.

At Dana, a developer and manufacturer of transmissions and engines for heavy vehicles, this matter is obviously very relevant. Formally describing all applicable requirements in the system saves them costs and increases the quality of the design, but often this is also imposed by safety standards. Together, we developed a logic and formal method to draw up, verify and track requirements. This allows us to check at every stage of the design whether everything is in line with the requirements. Dana implements this approach throughout the engineering process. Meanwhile, Flanders Make has built a package for other companies that wish to apply this technology.

DEMOS



TIP: DISCOVER ALL THESE INNOVATIONS BY SCANNING THE CORRESPONDING QR CODES.



> “WITH THESE DEMOS, PEOPLE QUICKLY DISCOVER OUR INNOVATIVE TECHNOLOGIES.”

MARC ENGELS, COO FLANDERS MAKE

Every year, Flanders Make works out a number of demonstrations that we like to show to the outside world. COO Marc Engels is happy to tell more about the most promising demonstrations.

What is the purpose of these Flanders Make demonstrations?

ME: We believe demonstrations are the best way to introduce people to new technologies. It is the perfect stepping stone to our more mature research results and their impact.

And what is that impact?

ME: Our research provides solutions to three key challenges:

1. How can we increase productivity so that we can maintain our prosperity as the workforce is shrinking?
2. How can we ensure that work remains workable for an ageing workforce?
3. How do we make the transition to a sustainable manufacturing industry?

Sustainability is an increasingly important issue for many manufacturing companies. What research results does Flanders Make demonstrate on this subject?

ME: The compressed air leak detection system is a prime example (**QR code 1**). Up to 40 percent of the compressed air in a production plant is lost through leaks. We’ve developed an automatic ultrasonic leak detection system that effortlessly detects the places where compressed air is escaping.

In the DC network demo (**QR code 2**), we show another breakthrough technology. Normally, machines are connected to the AC mains, although they often operate internally with a DC bus. By connecting these machines to a DC network, we eliminate some energy conversions, thus reducing costs and saving up to ten percent of all energy losses.

Does sustainability revolve solely around reducing energy losses?

ME: Energy consumption must always be considered in relation to productivity. We can also talk about a sustainable solution when we can increase productivity while stabilising energy consumption. In the demo on modular drives (**QR code 3**), you can see a great example of this. In a modular motion system, we replace a single drive by a long transmission with several direct drives. By eliminating the inertia of this transmission, we realise a productivity increase of 20 percent, without losing any power.

Another example of productivity optimisation can be seen in the demo showing the automatic tuning of a foil processing machine (**QR code 4**). Optimal tuning can lead to remarkable performance improvements, but this also requires estimating the material properties of the foil. Through hybrid AI, which cleverly combines data with a model of the machine, the tuning time can become up to six times shorter.

Another major focus point of Flanders Make, next to sustainability, is workable work. Can you tell us a bit more about that?

ME: With the growing number of product variants, the work of assembly operators is becoming increasingly complex. Digital work instructions can help operators to master this complexity. In our work instructions demo (**QR code 5**), however, we go one step further: we use the system to provide instructions concerning the ergonomic handling of parts, based on a real-time measurement of the operator’s posture. This system shows a 15 percent improvement in ergonomic load.

We can also increase workability by replacing human operators by a robot for unhealthy tasks, such as paint spraying. For small product series, programming these robots would be unaffordable. In our robotic paint demo (**QR code 6**), the human operator, from his experience, teaches the robot via virtual reality how it must paint a product. Here, the operator effectively becomes the robot programmer.

Does Flanders Make only have solutions for supporting production workers?

ME: No, Flanders Make also makes life easier for product designers. A great example is the demo (**QR code 7**) showing how we test a new control algorithm for the spout of a forage harvester in virtual reality. Manual control of the spout is a complex process, with errors leading to wasted harvest. Automatic control increases productivity and simplifies the driver’s work. Since a real field with crops is not always available to test the automatic control system, we use virtual reality. This allows us to speed up the development and testing of the control system.

Another example of support for product designers is the first-time-right demo (**QR code 8**). In this demo, constraints of a specific production process, such as rib thickness for injection moulding, are shared with CAD designers at an early stage. This bridges the gap between product design and production and enables developing first-time-right prototypes. This, in turn, leads to shorter design times and less material waste.

So by helping designers, we increase sustainability and productivity.

ME: Indeed, everything starts with the design of a product. All aspects and phases in a product’s lifecycle are interconnected. To find technological solutions to the above-mentioned challenges, we must look end-to-end. So I am glad Flanders Make is taking this path, which will enable us to create even more impact in the future.

INDUSTRIAL ARTIFICIAL INTELLIGENCE IN FLANDERS

Artificial intelligence (AI) has rapidly transformed the way in which we live and work, offering new and innovative solutions to everyday problems. From personal assistants like Siri and Alexa to more advanced applications in, say, the healthcare and transportation industry, AI is becoming an increasingly integrated part of our daily lives. It even generated the introduction you are currently reading through ChatGPT. In the industrial sector, AI has been instrumental in driving efficiency, improving decision-making processes and creating new products and services. The impact of AI on the economy and society is undeniable, making it an essential component for continued progress and development.

The Flemish government recognised the immense potential of this technology and has understood that Flanders cannot afford to lag behind. It launched the Flanders AI Research Programme, through which many research and knowledge institutions have joined forces. By exploring various research topics, the programme has driven innovation in the health, energy, industrial and public administration sectors.

INDUSTRIAL AI RESEARCH

As the strategic research centre for the industrial sector, Flanders Make takes the lead in many of the industrial research use cases of the AI initiative. These use cases cover, among others, the following topics:

Robots collaborating with people

Using AI as a tool to improve the way in which human operators and machines work together. Cobots that assist human operators can make better decisions, vehicles on the factory floor and in the field can navigate autonomously, and work instructions can be tailored to the individual operator – all using the power of AI.

Flexible production in the manufacturing industry

With high-mix, low-volume manufacturing on the rise, it's important that production processes are as flexible as possible. AI can help support a fast turnaround or monitor customised production.

Smart maintenance and prognostic health management of industrial assets

By collecting statistics on machines throughout their operation and analysing them with AI algorithms, it becomes possible to estimate when certain components will wear out or when maintenance has become absolutely necessary.

PRODUCT∞ION INTELLIGENCE

For using artificial intelligence in a professional setting, we must be able to trust the decisions it makes. AI algorithms are often black boxes that offer little explanation as to why they make certain decisions. That is why we're introducing **domain knowledge** in all our projects, as a way of using physics-based models, CAD files, simulations, traditional control loops or operator knowledge to offer some guidelines to the AI algorithms. This can prevent them from making decisions that might damage machines, attempting to defy the laws of physics or making costly mistakes. The following two examples highlight that approach.

"WE AIM FOR A SUCCESSFUL ADOPTION OF AI IN INDUSTRY. OUR USE CASES ARE A KEY ELEMENT IN THE FLANDERS AI RESEARCH PROGRAMME. THROUGH THESE USE CASES, RESEARCHERS AT UNIVERSITIES AND RESEARCH CENTRES ARE WORKING ON GENERIC, TANGIBLE (REAL-WORLD) AI CHALLENGES. IN THE OTHER DIRECTION, THE DEMONSTRATORS IN THE USE CASES SHOW COMPANIES VERY CONCRETELY WHAT NEW AI RESEARCH METHODS CAN HAVE IN STALL FOR THEM."

– Sabine Demey, director Flanders AI Research Program, imec

WWW.FLANDERSAIRESEARCH.BE

Want to learn more about our approach to using AI in the industry? Download our Product∞ion Intelligence white paper for an in-depth explanation and more cases.

Automated Guided Vehicles improved with AI

AGVs are rapidly gaining ground in various sectors, automating various repetitive tasks in places such as warehouses or agricultural fields. Navigating these vehicles indoors is often a challenge that is solved with detailed maps of the indoor location. However, with AI and multiple vision systems, an AGV can become very aware of its surroundings and be able to learn the layout of the site through trial and error navigation. This type of navigation also makes it safer to operate, as it can react quickly to obstacles, people and changing environments. Flanders Make has developed a proof-of-concept for navigating warehouses and even for automating an inventory analysis. Training these AGVs with reinforcement learning tends to be a dangerous approach, as they can behave erratically during the learning process. That's why we performed a lot of the training in realistic simulated settings, until we reached a point where we could be confident that it would operate safely in the real world.

Scan the QR code for a video on this subject:

High-speed AI camera ensures high-quality 3D printing

Additive manufacturing has revolutionised the production of custom-made components, products and even medical implants. The process allows each product to be different from the last with only a very short turnaround time. However, the process tends to be slower than mass production, and it becomes even slower if something goes wrong during the process. About 10% of all 3D prints end up as scrap, which means wasted resources, but also having to start the process all over again. Together with a number of companies and research partners, we have developed a high-speed camera that monitors the printing process and can predict certain defects at an early stage. An AI algorithm has been trained in detecting several common defects encountered by operators so that it knows what early warning signs & symptoms to look for. This allows adjusting process parameters during the printing process to prevent defects that would turn the product into scrap.

Scan the QR code for a video on this subject:

NEW INFRASTRUCTURE

Also in 2022, Flanders Make continued to invest in its own infrastructure. This enables us not only to continue to support our own research, but also to assist companies in their technological innovations in product and production processes by offering a wide range of services. The objective here remains the same: digitally transforming the industry and helping it move towards an Industry 4.0 approach.

Active cooling and lubrication system

To support our own research projects into innovative, cooled and lubricated system architectures, we developed an active cooling and lubrication system. The system can be used by companies to carry out feasibility studies, prototyping and performance tests related to innovative liquid-cooled and -lubricated powertrains. This infrastructure is flexible, allowing combinations of parallel and serially mounted cooling and lubrication methods. The oil cooling and lubrication circuit is adjustable in terms of temperature and liquid flow rate and includes calibrated measuring devices to accurately determine the thermal-hydraulic performance. Additional cooling units based on water-glycol mixtures can be used along with the oil circuit. This allows using various combinations for cooling and lubricating powertrains based on water and/or oil. Finally, the whole setup is compatible with our test setup for testing modular multi-load powertrains. This infrastructure can be easily connected to the tested equipment via plug-and-play and has already proven its usefulness in concrete cases for clients.

AugmentX

Our existing infrastructure for studies into ergonomics has been further expanded and pooled under the heading 'AugmentX'. By measuring forces, movement and physiological properties, we can assess ergonomics in an industrial or other professional context. This provides insights into the efforts and biomechanical risks posed by certain physical tasks. At the same time, AugmentX can also elaborate on cobot studies to alleviate certain tasks and thus create an optimal working environment for operators.

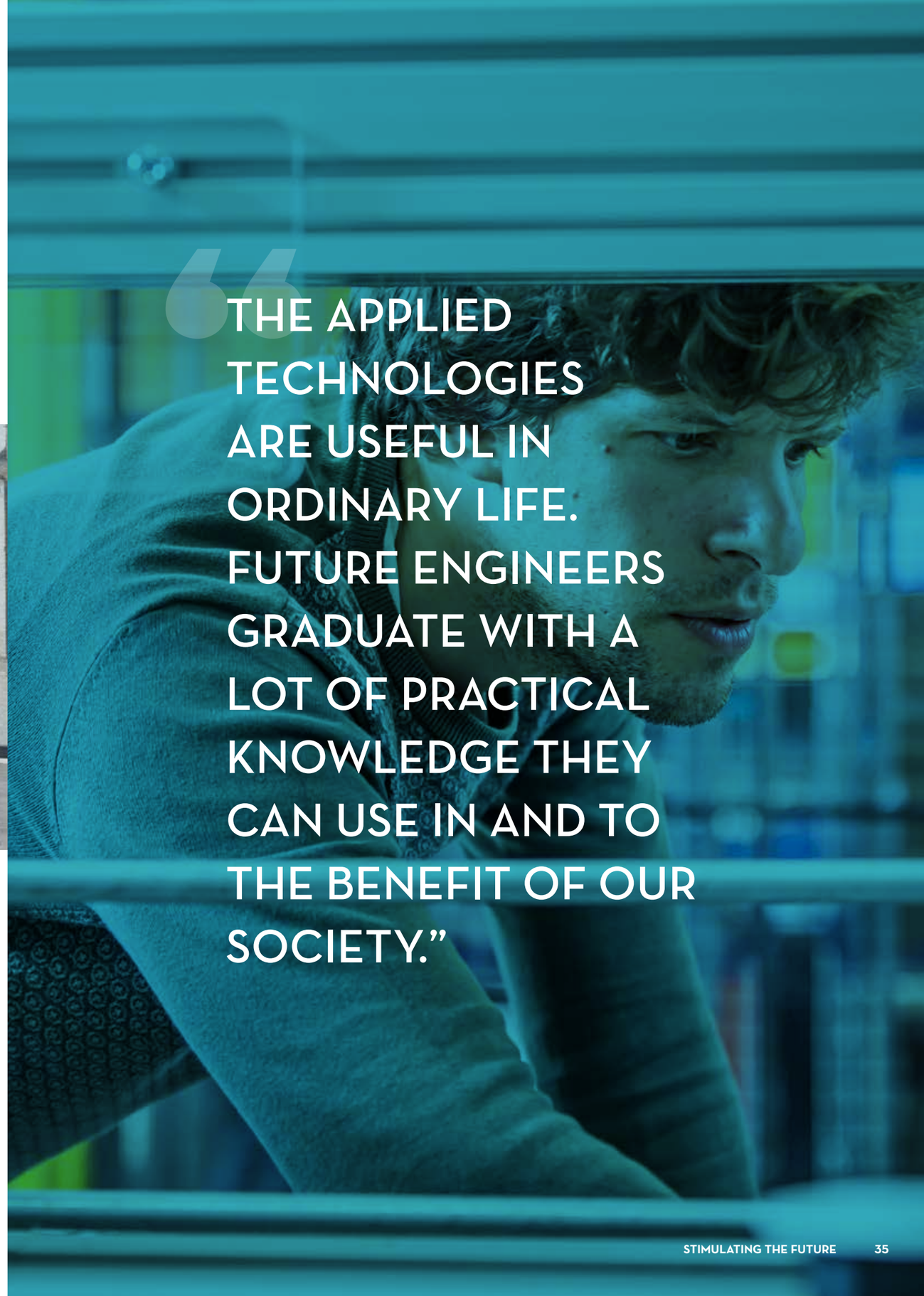
STIMULATING THE FUTURE

Flanders Make puts its weight behind a wide variety of external initiatives that introduce innovation to children, teenagers and young adults. From hyper-efficient solar cars and fast electric cars to a playful introduction into laser cutters and 3D printers: all these projects stimulate talent development and feed our industry of the future with the right technological profiles.

Innoptus Solar Team

The Belgian Solar Team needs no introduction. Time and again, this group of students from KU Leuven shows great technical ingenuity as they build competitive solar cars for international races, in which cars must drive as far as possible on solar energy. This requires an optimal balance between lightweight materials, sufficient battery capacity, an economical and powerful electric motor and sufficiently efficient photovoltaic cells as propulsion. The applied technologies are also useful in everyday applications. As a result, the group of future engineers will graduate with a lot of practical knowledge that they can apply in and to the benefit of our society.

Flanders Make has a long-standing relationship with the automotive sector and fully supports this project. Not only is the team allowed to use our infrastructure to test components, it can also rely on the expertise of our colleagues. Amongst other things, together with the new generation of students, we conducted a number of tests to determine the heat capacity of their batteries. Thanks to this important indicator, the team will have a better estimate of how far their car can get in the long stages of the race.



Formula Electric Belgium

Besides the Solar Team, yet another team of students from KU Leuven and Thomas More is working on an electric car, focusing more on speed rather than on distance. They race with their cars in the electric class of the Formula Student competition, scoring points in a variety of tests, ranging from acceleration to cost or business plan. Recently, they converted one of their race cars into a fully autonomous vehicle. During this project, the students not only have to tackle very concrete engineering challenges, they also practice important soft skills by managing a race team.

Flanders Make also supports this team as much as possible. Amongst other things, the students visited our E-powertrain lab to test the motors for their new race car and to compare them with the motors of the previous version. Here, we obviously consider the overall performance and also work on inverter settings for regenerative braking. This gives the team a good picture of their systems and the progress they are making.

STEM for children and teachers

Flanders Make is committed to promoting STEM studies (Science, Technology, Engineering, Mathematics) to young people. For example, we support organisations such as Fablab Leuven, PXL STEM Academy and De Creatieve Stem, where children and young people aged between 8 and 18 can freely experiment with tools that are not available at home. Together, we organise various workshops, whether in class, through an association or in their leisure time. In doing so, we give children the opportunity to discover in a playful manner 'new' technologies such as 3D printing, laser cutting, electronics and programming. Furthermore, teachers can borrow equipment through these organisations, allowing them, for instance, to place a small 3D printer in their classroom and get to work with it together with their students. To make this offer as accessible as possible, we support these organisations financially.

Besides these organisations, Flanders Make supports various other initiatives such as the Spark project, which promotes STEM among youth movements. Through a variety of materials, ideas for playing games and projects, supervisors in youth movements get to work with science. PXL has, in addition to its classic STEM Academy, a programme that introduces non-native newcomers to STEM activities. Finally, we also support the Voka First Lego League, where in 2022 some 1400 pupils built and programmed a Lego robot, tackling various challenges on the way.

With all these initiatives, Flanders Make contributes to the development of a new generation of engineers. By introducing them to new technologies at a young age, they develop an interest in these fields. This leads to more students in STEM-related studies and ultimately generates more innovation and progress in science and technology. Obviously, both Flanders Make and the wider industry will benefit from this.

INNOVATION ECOSYSTEM

Flanders Make works together with companies, knowledge institutions and other research organisations. Under the impulse of the Flemish Government, we join forces in one single innovation ecosystem. This significantly narrows the gap between theory and concrete applications matching the actual needs of companies.

OUR MEMBER NETWORK

ANTWERP

- A-kwadraat
- Absolem
- Acceleran
- Achilles Design
- Agfa Graphics
- Albatros
- Alberts
- Alinco
- Arteco
- Atlas Copco Airpower
- Bagaar
- Coffeeroots
- Corvus Solutions
- CuReMa
- Daf Trucks Vlaanderen
- Digi-flow
- Easy Systems
- Faktion
- Grammer Electronics
- Gumption
- Janssen Pharmaceutica
- Nalantis
- Nedschroef Machinery
- Nesko Engineering
- Ometa
- Reniver
- Reynaers Aluminium
- Scanbie
- Sego
- Signify
- Soudal
- Sumitomo Drive
- Universiteit Antwerpen
- Van Hool
- Voxdale

LIMBURG

- Aerobel
- AMS Belgium
- Arkite
- Averna
- Bewel
- Bosal Emission Control Systems
- Buseloc
- Dentsply Implants
- E-Trucks Europe
- Enginity
- Esma
- Ford Lommel Proving Ground
- Hela
- Jabil Circuit Belgium
- Kerv Automotive
- Laser Cladding Venture
- Maex Precision - Production
- Meam
- Melexis Technologies
- Melotte
- Oerlikon Balzers Coatings Benelux
- Pixelvision
- Provan
- Punch Powertrain
- Tenneco Automotive Europe
- Universiteit Hasselt
- Uperio
- Vansichen Linear Technology
- VCST Industrial Products
- Vintiv
- ZF Wind Power Antwerpen

EAST FLANDERS

- 24Flow
- Ansomat
- Augnition/Proceedix
- Automotion
- Azumuta
- Buyse Metal Works group
- C-battery
- Defawes
- Dynamic Dimensions
- Hupico
- Inverto
- Ioos
- Knapp Benelux
- ML6
- Niko
- Objective International
- Ocas
- PSS Belgium
- SupportSquare
- Universiteit Gent
- Van Hoecke Automation
- Van Hoecke Consulting services
- Volvo Car Gent
- Volvo Truck
- Yazzoom

WEST FLANDERS

- Addax Motors
- Altachem
- Assemblics
- AVC
- Balta Group
- Barco
- Bekaert
- Bombardier Transportation
- Cadcorner
- CNH Industrial Belgium
- Constructie Lambrecht
- Cronos aan de Leie
- D. Cloostermans-Huwaerts
- Daikin Europe
- Damatec
- Dana Belgium
- Deceuninck
- Dekimo
- Delaware Consulting
- dotOcean
- e-BO Enterprises
- Emerpoint
- Flagstone
- International Car Operators
- Konfidi
- Logflow
- LVD Company
- Magnax
- Mariasteen
- NiniX Technologies
- OptimaT
- Pedeo
- Picanol
- Savaco
- Squadron
- TE Connectivity
- Televic Rail
- Tremec
- Unilin
- Vandewiele
- Vaskon
- VDL Bus Roeselare
- Vero Duco
- Vintecc
- Vitalo Industries
- Waak Sociale Werkplaats

FLEMISH BRABANT

- 3D systems
- ABB
- Agoria
- Asco Industries
- Audi Brussels
- Bluways International
- Camco Technologies
- Capvidia
- Comate
- CommScope Connectivity Belgium
- Dataroots
- Eclair
- Elnor Motors
- Icare
- Intermodalics
- Ivex
- Kapernikov
- KU Leuven
- Leuven Air Bearings
- Materialise
- National Instruements
- Noesis Solutions
- Octinion
- Optidrive
- Powerdale
- Procter & Gamble Services
- RHEA System
- Robert Bosch Produktie
- Sabca
- Sentigrate
- SEW-Eurodrive
- Siemens
- Siemens Industry Software
- Siemens Mobility
- Sirris
- Spraying Systems Europe
- Terumo Europe
- Toyota
- Transport & Mobility Leuven
- Vision++
- Vlaams Gewest
- VUB
- Xenics

LIÈGE

- Ateliers Pierre Cerfontaine

INTERNATIONAL PARTNERSHIPS

2022 marked a turning point for Flanders Make's European and international activities. Ger van den Kerkhof had, as Senior Account Manager, long been responsible for European affairs, assisting our organisation since its foundation. In March, he retired and Ziga Valic succeeded him.

ZIGA VALIC

Horizon Europe

At the European level, Flanders Make continued to prove its excellence: research teams from 14 core labs successfully submitted project proposals under the Horizon Europe programme. As the European Union's (EU) largest public R&D funding programme, this project is now in its second year and will continue until the end of 2027.
One of the EU's long-awaited calls for proposals was that for the creation of digital innovation hubs (DIH). Flanders Make, along with Voka, LSEC, Howest, PXL, BPHOT, Imec and Sirris, submitted a project proposal to establish one of the European digital innovation hubs for industry in Flanders.

Digitalis

The European Commission approved funding for the Digitalis project in June, after which the consortium started in November. The project focuses on SMEs and acts as a one-stop-shop to help industrial companies – with varying levels of digital readiness – meet digital challenges and become more competitive. As such, Digitalis aims not only to assist traditional SMEs in adopting new digital technologies, but also to help technologically savvy SMEs build a competitive advantage in the globalised market through networking.

Collaboration and partnerships

One of the priorities for the coming years is to enable our member companies to participate in European consortia. Participation in EU projects ensures that companies focus on long-term solutions to their technological challenges. They gain a competitive advantage and are able to collaborate with Europe's leading innovators from both the academic world and industry. Finally, such international projects help companies to identify new business opportunities. We've therefore integrated this objective into Flanders Make's internal EU mediation system. Meanwhile, we have been testing, together with member companies, some of the pilot activities to better understand their needs and challenges for participation in European R&D projects.

Developing bilateral partnerships with leading Research & Technology Organisations (RTOs) across Europe gives us visibility outside Flanders. At the same time, this also has a local impact as the know-how and expertise of our companies are highlighted on an international scale. In this context, we welcomed in 2022 partner delegations from Spain and Ireland to our premises in Leuven and participated in numerous EU events.

Also in 2023, Flanders Make will continue to expand its European capacity in view of accelerating our companies' European ambitions!

CLUSTERS OF AND FOR COMPANIES

To help the very diverse range of manufacturing companies in their innovation efforts, Flanders Make has subdivided its high-tech research into three dedicated competence clusters. Every cluster focuses its research on specific areas of expertise.

3

This division into three clusters is a new feature that deserves a word of explanation. Until last year, our research was divided into four competence clusters: a structure that was thoroughly revised, bringing together certain specialities in view of better matching the needs of industrial companies. At the same time, we also promote more cooperation between the various competence clusters, in line with a global evolution. The division between the clusters is as follows:

END-TO-END DESIGN OPERATION

In the **End-to-End Design Operation** cluster, we look for ways to bring together knowledge and data from across the ecosystem to improve product, production and business processes. Thoughtfully adopting an ecosystem approach helps companies to make the right decisions for being economically and ecologically sustainable. In this cluster, we see this as our mission throughout the entire product lifecycle: from initial design over production and use to the – potential – reuse or recycling. This is how we realise progress in making the industry more efficient as well as more sustainable.

MOTION PRODUCTS

All kinds of moving parts in vehicles and machines, that's the focal point of the **Motion Products** competence cluster. Our services cover a very wide range: from support during the design phase to testing and validation using our comprehensive test infrastructure. Improving drive systems, making transmissions operate more efficiently or autonomous vehicles: these are just some of the domains in which the cluster sets to work for supporting the industry.

PRODUCTION

The new Production cluster has been set up to tackle all issues related to the automation and improvement of assembly and production facilities. This includes everything involving the use of robots and cobots, along with all kinds of auxiliary systems to facilitate automation. The human operator is not ignored though: creating digital work instructions and tools that increase operator efficiency is another important focal point of this competence cluster.

In addition to traditional membership, companies also have the option of joining a specific competence cluster, and this offers quite a few advantages. These companies have a say in the direction of our research so that it is directly applicable to the issues they themselves are facing. Through a number of specific events and direct contact, Flanders Make keeps these companies informed of what is going on in the research world. At the same time, we can keep tabs of the issues and challenges these companies face. Feel free to contact our cluster managers listed on the following pages to discuss the benefits for your company.

END-TO-END DESIGN OPERATION

PAOLA CAMPESTRINI

Nowadays, design problems mainly arise during the final phase of the design process, resulting in expensive adjustments. Where previously the Design & Optimisation cluster addressed this problem, most projects now fall under the new End-to-End cluster. Still, the ambitions are higher: this cluster no longer only looks at solutions within a single company, but involves the entire value chain in its research. Furthermore, we also look at the entire lifecycle of a product: from design, over production and use up to the end of its first 'life'. Only by sharing data and knowledge across the entire value chain ecosystem will we realise breakthroughs towards better performing and more sustainable products.

As products become increasingly complex, it is essential for this cluster to develop methods and tools. These not only help make the right design choices, but also facilitate other choices throughout the product's life cycle. These include production choices, maintenance strategies, choices related to reuse, recycling, refurbishing and so on. In line with the new five-year covenant, the strategy of this cluster for achieving this objective now focuses on three crucial aspects:

- Development of models (physics-based, data-driven or a combination of both) to quickly evaluate products on different criteria.
- Data management from various sources to be able to make accurate predictions.
- Knowledge capturing in view of correctly capturing, analysing and sharing the knowledge that is already available in the ecosystem.

MODELS FOR EVALUATION

One of the basic tasks of the End-to-End cluster remains the development of models to evaluate products and production processes on numerous criteria. With these models, we aim to provide very specific support to engineers, designers and other company professionals. Our models enable them to better map the concrete impact of their decisions on essential criteria such as performance, sustainability, manufacturability and energy efficiency. The ambition is now to also include business aspects in this evaluation, for instance through analyses in terms of cost, value calculations and business model. We will then combine these new data with the existing analyses.

Supply chain resilience has also become increasingly important. Companies are focusing more on the resilience of their products when facing disrupted supply chains, partly due to the war in Ukraine. That is why we will soon launch a specific project that will investigate, through a cost-benefit analysis, the best methods to choose the right resilience strategy for critical product components, all during the design phase.

ONLY BY SHARING DATA AND KNOWLEDGE ACROSS THE ENTIRE VALUE CHAIN ECOSYSTEM WILL WE REALISE BREAKTHROUGHS TOWARDS BETTER PERFORMING AND MORE SUSTAINABLE PRODUCTS."

PAOLA CAMPESTRINI
Clustermanager End-to-End Design Operation

CORRECT DATA RESULT IN THE BEST ADVICE

Besides evaluating products and production processes, the cluster also offers advice on improvements for engineers, designers and other company professionals. What adjustments should they make to achieve the optimal product and/or production process? The use of data from the entire product lifecycle, thereby combining domain knowledge and AI, leads to new insights. Yet, data exist in a wide variety of forms and are stored in various databases, so managing them correctly is still a major challenge. Today, a lot of time goes lost in finding and bringing together the right data for conducting analyses or training algorithms, amongst other things.

A concrete project in which we use knowledge graph technology to link data from different sources in a correct and reliable manner is currently in its test phase at two companies. So 'data is the new gold' is not always true: consistency is important. In addition, cybersecurity is also essential. As the need to share data within the value chain ecosystem grows, security issues remain hugely challenging, if only to ensure that data remain reliable and to respect data sovereignty. By the way, this topic is also high on the European Commission's current agenda.

CAPTURING KNOWLEDGE

Finally, we will focus more on knowledge capturing. A lot of knowledge in companies is lost when experienced employees leave the company or retire. At best, this information is contained in manuals and reports, but that is often insufficient. We explore how we can best capture knowledge and, at the same time, how we can formalise this knowledge in such a way that a computer can read it and use it in algorithms. In addition, knowledge capturing can also be used to train junior profiles.

In an ongoing project, we are formalising manufacturing knowledge and applying it in the manufacturability analysis of CAD designs. More specifically, we are structurally incorporating the well-known production design rules into a database. The tool that we developed is capable of analysing a CAD design and indicating which areas will cause difficulties during production and thus require adjustments. This is an example of how capturing knowledge that is available in a company leads to added value: it ensures fewer iterations between product design and production and, as a result, saves a lot of time and costs.

MOTION PRODUCTS

ANDREI BARTIC

Moving parts in machines and vehicles: that is the domain of work of the Motion Products cluster. The improvement of drive systems and the conversion to an all-electric fleet are the best-known examples of a cluster striving for increased sustainable efficiency of transmissions and engines in today's mobile world.

The new cluster structure brings together related activities even more, such as the design and control of and operational support for powertrains and autonomous vehicles. In fact, the new structure acknowledges the intensive collaboration that already existed between different clusters at Flanders Make. By integrating teams and combining competences, we stimulate creativity and the exchange of ideas. This is how we develop the most optimal solutions for companies.

Within the scope of the five-year covenant, continuity is important, which is why in 2023 we remain committed to key technologies, such as artificial intelligence and digital twins. Still, the increasingly wide adoption of these technologies stands out, along with the exciting new algorithms that have emerged in recent months. Furthermore, (virtual) sensors and monitoring are gaining huge importance. In terms of physical sensors, technological advances in cameras and optical fibres are promising. As for virtual sensors, we are making solid efforts to develop models that estimate the value and predict the evolution of physical properties that are not directly measurable, such as force, torque, load and temperature distribution, but also wear and fault development in mechanical and electronic components of powertrains. At the same time, we continue to work towards co-designing integrated cooling and lubrication systems, more efficient inverters and motors, and better control engineering methods.

Artificial intelligence remains central in our research. It will – more than ever – continue to support tried and trusted methods and algorithms for mechatronic products in companies, both for the integration and implementation of these methodologies and for improving tests. It is therefore imperative to roll out this technology in Belgian companies to be able to make the move to Industry 4.0 on a large scale. Collaborations with companies are essential, and in the coming period we will go even further and put extra effort into strengthening our ties with industrial partners. This will allow us to realise even more great projects and introduce companies to cutting-edge top technologies.

Numerous new, promising techniques involving AI are emerging and we are exploring their application in industry very thoroughly. Every year, we organise and host two regular events: our symposium and the more technical Heurisko seminar. In 2023, both events will focus on recent success stories. We are, for instance, proud of our cooperation with start-up e-Trova. We helped them develop a truck with a new electric drive based on the retrofit principle. We also supported Powerdale with the design of battery chargers, hardware and software, after which we also built a prototype together. We continue our research using the newly completed infrastructure to test the reliability of new technologies and designs.

Finally, we achieved solid results with AI to help companies in quickly identifying similar designs in huge libraries of CAD files. Here, AI does not search for matches in the database through keywords, but through pieces of a design drawing. At Saint-Gobain, we already demonstrated the potential in a use case. During our symposium in November, you will discover more examples of our applied engineering expertise.

“IN 2023, WE WANT TO CONTINUE STRENGTHENING OUR TIES WITH INDUSTRIAL PARTNERS IN VIEW OF REALISING GREAT PROJECTS THAT GENERATE ADDED VALUE FOR EVERY COMPANY.”

ANDREI BARTIC
Clustermanager Motion Products

PRODUCTION

WOUTER FAVOREEL

The Production competence cluster performs research into digitalisation and customised production to support assembly and manufacturing companies embracing innovation. This research focuses on four main pillars: humans (as production employees 4.0), production elements (machines and devices), the assembly lines and the (digital) connection between all devices. In line with the new five-year covenant, we put more emphasis on both AI, data and digital twins to match the new technologies for Industry 4.0 with the companies' demands.

As a general trend, we note that flexibility is needed to keep production in our country. Mass production invariably moves to cheaper countries, but the demand for low volumes with high variation is growing enormously. 'Series of one' production is also on the rise: we can keep both in Belgium by rolling out high-quality technological innovation. We also remain committed to making companies more robust against external disruptions, such as labour cost increases and material or parts shortages. For instance, sudden global crises such as the war in Ukraine and the corresponding energy crisis call for an immediate response.

We have been focusing on sustainability and the circular economy for years and are also receiving more and more questions from companies about this. Through our successful project tracks, which lead to solid proof-of-concepts, we are making the production systems of our companies increasingly sustainable. For instance, by automating the labour-intensive, manual recycling of batteries, we increase cost efficiency and speed up the circular chain. It makes recycling raw materials an interesting route for companies.

We are also thinking about a green lab: a pilot lab dedicated to knowledge, techniques and technology for a more sustainable production. Here, we want to combine all our expertise, apply it to re- and de-manufacturing and give demonstrations on this as well. This lab fits in perfectly with our new building in Kortrijk, which we will move into this summer. This site is essential to us as it provides us with the right infrastructure to play a leading role in Europe. Demonstration halls with high-tech test assembly lines offer every company the opportunity to test the flexible or semi-automatic assembly of their products. These production lines are modularly adaptable in terms of set-up, making them the ideal breeding ground for companies to extract knowledge about more efficient production methods.

The new building also contributes to our broader vision of the future: a faultless and highly flexible production process. High-mix, low-volume and customised products with one-piece series are thus realised effortlessly. Such production processes are also efficient, fast and cost-effective, which enables us to keep our production local and our companies productive. Our cluster wants to make this transition as smooth as possible. Still, not only automation, cobots and mobile robots (such as AGVs and AMRs) are key elements in this process. The focus must also be on the employee, the 'production employee 4.0'. It is not easy to find and retain good workers. Our cluster supports workable work through AI, technology and robotic assistance. We automate the boring, repetitive and unergonomic actions by using machines. But we must let humans do more of the more enjoyable and flexible tasks. This is how we speed up the production system and take good care of employees and this is how companies – through their employees – can develop towards a future-proof status: fully in line with Industry 4.0.

“WE ARE MAKING THE PRODUCTION PROCESS MORE SUSTAINABLE AND FLEXIBLE BY ROLLING OUT HIGH-QUALITY TECHNOLOGICAL INNOVATION. THIS IS THE KEY TO LOCAL CUSTOMISED PRODUCTION.”

WOUTER FAVOREEL
Clustermanager Production

COMPANIES PER COMPETENCE CLUSTER

END-TO-END DESIGN OPERATION

- Atlas Copco Airpower
- Barco
- Bekaert
- Bosal Emission Control Systems
- CNH Industrial Belgium
- Daikin Europe
- Dana Belgium
- Dataroots
- Janssen Pharmaceutica
- Materialise
- Niko
- Picanol
- Reynaers Aluminium
- Sabca Limburg
- Siemens Industry Software
- Tenneco Automotive Europe
- Vandewiele
- Voxdale

PRODUCTION

- Arkite
- Atlas Copco Airpower
- Barco
- Bosal Emission Control Systems
- CNH Industrial Belgium
- Daikin Europe
- Dana Belgium
- e-BO Enterprises
- Easy Systems
- Hupico
- Janssen Pharmaceutica
- Logflow
- Mariasteen
- Niko
- Picanol
- Pickit
- Punch Powertrain
- Reynaers Aluminium
- Sabca Limburg
- SupportSquare
- Terumo Europe
- Vandewiele
- VDL Bus Roeselare
- Vitalo Industries
- WAAK
- ZF Wind Power Antwerpen

MOTION PRODUCTS

- Atlas Copco Airpower
- CNH Industrial Belgium
- Colruyt - Smart Technics
- Dana Belgium
- Leuven Air Bearings
- Nedschroef Machinery
- Picanol
- Powerdale
- Punch Powertrain
- SEW-Eurodrive
- Siemens Industry Software
- Televic Rail
- Tenneco Automotive Europe
- Vandewiele
- VCST Industrial Products
- ZF Wind Power Antwerpen

THE ORGANISATION

Flanders Make is the research centre for the industry and its digital or Industry 4.0 challenges. We stimulate innovation, both in SMEs and large companies, through excellent research in the field of mechatronics, methods for developing products and technology to make them. The results are applicable to a wide range of companies that often face similar technological challenges. Together, they can innovate better and faster. We also take this approach across national borders. We set up international innovation partnerships and participate in European research projects. Flanders Make consists of three co-creation centres (in Lommel, Leuven and Kortrijk), the Drone Innovation Interest group EUKA in Sint-Truiden and labs at the five Flemish universities.

OUR PEOPLE

In 2022, Flanders Make grew stronger than ever, bringing with it quite a few challenges as well as additional opportunities. To support this continuous growth, we are trying to further develop our organisation in a sustainable manner: both in terms of Excellence in Research and along our path towards Excellence in Employership.

WIM TEUNEN

> BECAUSE PEOPLE ARE MORE THAN RESOURCES"
>
> **WIM TEUNEN**
> **Human Capital manager Flanders Make**

"In a labour market that after the corona crisis is facing some stiff challenges, we are proud to conclude 2022 with a positive growth of just under 20 percent", says Wim Teunen, Human Capital manager at Flanders Make. "In an organisation like ours, this comes to the credit of many people. Together, they manage to keep the quality of the recruitment process, selection interviews and onboarding at a high level.

Meanwhile, the bar for candidates remains particularly high. Given the structural shortage of highly skilled researchers, we attract skilled and experienced staff from all over the world. With some 30 different nationalities, our workplace is thus becoming increasingly international, which did not stop us from focusing even more on diversity in 2022. Europe's encouragement of topics such as gender equality and diversity has spurred our ambition to be a forerunner in this. In fact, we've been a believer in the innovative power of diversity for many years already.

> IT IS IMPORTANT TO BE VIGILANT ABOUT GENDER-NEUTRAL COMMUNICATION IN VACANCIES AND TO ACTIVELY PROMOTE EQUIVALENT AND DIVERSE IMAGES IN RECRUITMENT VIDEOS AND OTHER CORPORATE COMMUNICATIONS."
>
> — Wim Teunen, Human Capital manager Flanders Make

Of course, Flanders Make has not been immune to other issues impacting the highly volatile labour market. Our average salary costs, for instance, increased by more than ten percent. Nevertheless, we managed to attract a lot of young graduates while also offering challenging jobs to experienced professionals from both the academic and industrial worlds. We continue to believe strongly in the added value of this mix, again showing our confidence in diversity. Finally, we also want to continue paying attention to the individual needs of and corresponding support to each employee: only in this way can we guarantee the continued growth of employees and their research. Based on this service-oriented philosophy, the Human Capital team was further strengthened in 2022 'because people are more than resources'."

EMBRACING DIVERSITY

"Let's be clear: we strongly believe in the added value of diversity for the quality of our research and our innovative strength. Our presence on foreign job fairs, reinforced by our increasingly strong international position as a valued research partner, has attracted a lot of foreign candidates.

Within engineering, and thus also within research into mechatronics, gender balance remains a major challenge. Whereas in most other fields of study this balance has largely been achieved, engineering studies still lag behind, which of course also complicates the flow of sufficient female engineers into research and industry. Despite all efforts to change this, the impact within senior positions will only become apparent after many years, making recruitment for those profiles even more challenging.

With 16 percent female candidates, we are doing slightly better than the overall availability. Among starters, we achieved just under 20 percent last year, which obviously remains far from the aimed at balance. The extra focus on positioning our own strong female researchers in numerous communication initiatives has had a strong supportive effect. However, given our strong growth and focus on excellence, we are still highly dependent on the disproportion in the labour market. Only for very specific and unique positions, we can – with equivalent applicants – discriminate positively and give preference to female candidates. That is why last year we introduced more detailed scorecards with numerous selection criteria for candidates for those positions. Although our organisation is not large enough for meaningful KPIs related to diversity and gender balance, we collect relevant historical data and share these limited data during board meetings and in general HR communications."

Women at the forefront

"We've taken several actions in 2022 to show that Flanders Make embraces diversity and gender balance. Female employees deliberately stepped up to the front in our corporate communications, testimonials and events. We're also vigilant about gender-neutral communication in vacancies and actively promote equivalent and diverse images in recruitment videos and other corporate communications, such as this annual report.

By doing so, we want to take the lead in everything related to diversity and gender balance compared to similar organisations. Within our organisational structure, we appear to be succeeding in this, given that a quarter of our senior positions are held by women."

Keeping the future in mind

"Finally, we always work proactively, keeping the longer-term future in mind. We actively support the many STEM initiatives (Science, Technology, Engineering, Mathematics) through various organisations spread across Flanders. We focus here on initiatives targeting 7- to 12-year-olds and pay extra attention to guiding girls and children with unequal educational opportunities towards STEM studies. In that context, Flanders Make also signed present at the Nerdland Festival in 2022. There, we gave thousands of enthusiastic visitors, including quite a few children from the STEM target group, a glimpse of our top research. With success, we attracted quite a crowd and people were all very excited about what they had seen."

FROM JOBS TO ROLES

"Flanders Make remains a rapidly growing organisation with a horizontal structure that offers a lot of opportunities. We already notice today that many employees are seizing these opportunities and spontaneously take on additional roles and responsibilities. As an organisation, it is not easy to provide the necessary support for this within a traditional job structure. We want to retain our characteristic flexibility and therefore started developing a new job structure in 2022, fully in line with our vision of a sustainable Human Capital policy. Its implementation will be continued in 2023. By setting up an even more flexible support structure, employees will automatically find the necessary challenges to continue growing. This gives us the best guarantees for manageable recruitment, retention and promotion processes", Wim concludes.

Grisja Lobbestael succeeds Dirk Torfs as CEO of Flanders Make

Since 1 March 2023, Grisja Lobbestael is strengthening research centre Flanders Make as CEO. He succeeds Dirk Torfs, who has successfully led the organisation since its inception in 2014 and is now stepping down due to health reasons. Grisja Lobbestael has extensive industrial experience and has held several management positions at Flemish manufacturing companies of international stature.

PASSING ON THE TORCH WITH PRIDE

Flanders Make was founded in 2014 as a strategic research centre for the manufacturing industry and, under the leadership of Dirk Torfs, has grown into a broad community of more than 850 researchers. “Through a unique cooperation model with companies, academic partners and the Flemish government, we have built a strong innovation ecosystem for the transition to Industry 4.0, with the support of the chairman and members of the board of directors and together with all Flanders Make employees. I have all confidence in the further growth of our research centre under the leadership of the new CEO. Only with continued focus on research and innovation will our industry be able to achieve prosperity and a sustainable future for the generations to come”, said departing CEO Dirk Torfs.

PASSION FOR INNOVATION

Grisja Lobbestael graduated as an Industrial Engineer and Master of Science Engineering in 1995 and completed additional studies afterwards. He extended his expertise at engineering, sales and CEO level, both in the metal processing, electronics and plastics industries at Packo, Barco and Sioen respectively: all of them Flemish companies with an international presence. Building on the excellent track record and experience of his predecessor Dirk Torfs, Grisja will continue pursuing the success of Flanders Make with the same degree of passion and enthusiasm.

> “BUILDING ON THE EXCELLENT TRACK RECORD AND EXPERIENCE OF MY PREDECESSOR DIRK TORFS, I CONTINUE PURSUING THE SUCCESS OF FLANDERS MAKE WITH THE SAME DEGREE OF PASSION AND ENTHUSIASM.”

— Grisja Lobbestael, CEO Flanders Make

Word of thanks from the chairman

> “I WOULD LIKE TO THANK DIRK TORFS FOR THE EQUALLY RAPID AS IMPRESSIVE DEVELOPMENT OF FLANDERS MAKE AND FOR HIS IMPORTANT CONTRIBUTION TO MAKING OUR COMPANIES ‘INDUSTRY 4.0-PROOF’. I GREATLY APPRECIATE THAT IN THE PRESENT CIRCUMSTANCES HE HAS CHOSEN TO PASS ON THE TORCH AS CEO, BUT WILL CONTINUE HIS PART-TIME COMMITMENT TO STRATEGIC PROJECTS AND STAKEHOLDER MANAGEMENT AS SPECIAL ASSIGNEE OF THE NEW CEO.”

— Urbain Vandeurzen, Chairman of the board of directors of Flanders Make

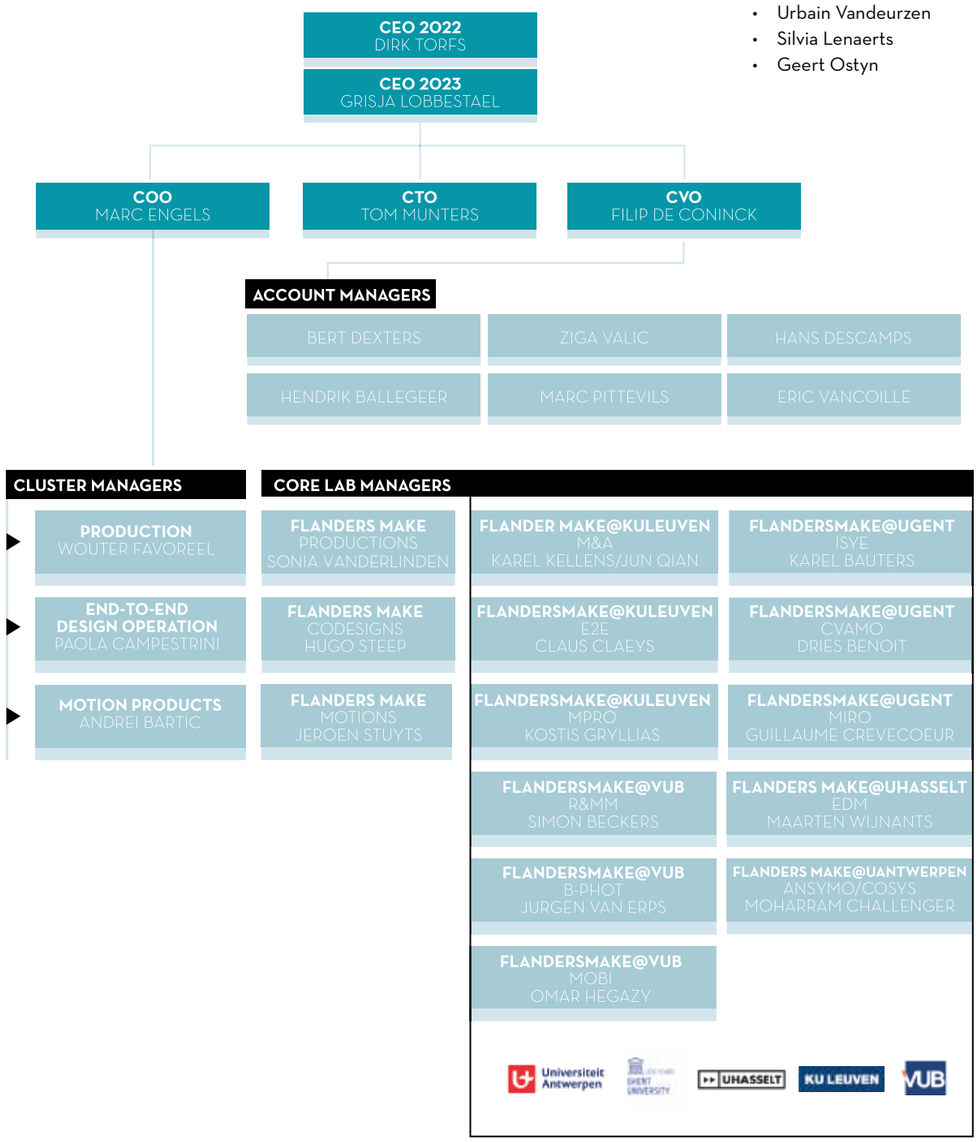
BOARD OF DIRECTORS 2022

At the back, from left to right:

- Katrien Wyckaert
- André Bouffioux
- Ignace Lemahieu
- Erwin Dewallef
- Sonia Van Ballaert
- Wim Verrelst
- Herman Derache
- Koenraad Debackere
- Paul Snauwaert
- Andy Pieters
- Inge Stoop
- Jochen Vincke

At the font, from left to right:

- Leo Van de Loock
- Dirk Torfs
- Urbain Vandeurzen
- Silvia Lenaerts
- Geert Ostyn



ADVISORY BOARDS

INDUSTRIAL ADVISORY BOARD

Ton Peijnenburg	VDL NL
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Dominique Maes	Vandewiele
Eric Verhelst	ex-TE Connectivity
Frans Van Giel	Victor Buyck Steel Construction
Hans Vande Sande	Atlas Copco
Herman Van der Auweraer	Siemens Industry Software
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Koen Maertens	Maertec, Duco
Koen Reybrouck	Reycon
Marc De Samber	Signify
Marnix Lannoije	Cargobull Telematics
Miguel Dhaens	Tenneco, Driv
Paul Snauwaert	CNHi

OBSERVER INDUSTRY

Geert Ostyn	Picanol

SCIENTIFIC ADVISORY BOARD

Anne-Lise Hog Lejre	Danish Technological Institute, Denmark
Chris Gerada	University of Nothingham, England
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Micheal Cassidy	Irish Manufacturing Research, Ireland
Minna Lanz	Tampere University of Technology, Finland
Odd Myklebust	Sintef, Norway
Russel Harris	Leeds University, England
Otto Tauno	Taltech, Estonia
Thilo Bein	Fraunhofer, Germany
Werner Kraus	Fraunhofer, Germany

OBSERVER UNIVERSITIES

Hugo Thienpont	VUB

CENTRAL OFFICE

Grisja Lobbestael	Flanders Make (since 03/2023)
Dirk Torfs	Flanders Make
Marc Engels	Flanders Make
Tom Munters	Flanders Make

OBSERVER GOVERNMENT

Leo Van de Loock	VLAIO
Erwin Dewallef	EWI

FLANDERS MAKE

Three co-creation centres, the Flemish Drone Innovation Interest group EUKA and the labs of five Flemish universities

86 MLN
Euro turnover

> 850
Specialised researchers

FINANCIAL REPORT

BALANCE AND YEAR RESULTS

ASSETS	150.804.052 €
Fixed assets	**11.426.485 €**
Intangible assets	35.191 €
Tangible assets	9.430.080 €
Financial assets	1.961.214 €
Current assets	**139.377.567 €**
Stocks and orders	29.132.792 €
Accounts receivable within maximum 1 year	9.559.656 €
Cash investments	56.835.241 €
Liquid assets	43.433.885 €
Regularisation accounts	415.993 €

LIABILITIES	150.804.052 €
Capital and reserves	**20.617.825 €**
Provisions	**31.105 €**
Debts	**130.155.122 €**
Debts falling due within maximum 1 year	72.289.167 €
Regularisation accounts	57.865.955 €

REVENUES	28.910.580 €
Turnover	**26.319.381 €**
FM covenant	16.524.719 €
FM non-covenant	9.451.264 €
Membership fees & other	343.398 €
Other revenues	**2.591.200 €**

COSTS	28.967.414 €
Salaries, social security charges and pensions	20.341.878 €
Operating costs	8.408.998 €
Other costs	216.538 €

OPERATING RESULT	- 56.834 €
Financial & extraordinary result	**- 618.100 €**
Use of reserves	**194.209 €**

RESULT OF FINANCIAL YEAR	- 480.725 €

Flanders Make achieves an operating result of -56,834 EUR for financial year 2022. This result includes the costs (194,209 EUR) linked to the approved projects for the use of historical reserves. These reserves were set aside in the past for specific research, some of which that took place in 2022. After using the historical reserves, we will end the year 2022 with a negative result of 480,725 EUR.

KPI 2022

		ACTUAL 2021	ACTUAL 2022	TARGET 2022	%TARGET 2022	TARGET ANNUAL GROWTH RATE	GROWTH 2022 VS. 2021
KPI 1.1	Publications	261	335	183	183%	5%	**28%**
KPI 1.1	Open access publications	187	241	183	132%	11%	**29%**
KPI 1.2	Conferences	280	420	233	180%	4%	**50%**
KPI 1.3	EU participation	13.228 K€	13.470 K€	4.600 K€	293%	9%	**2%**
KPI 2.1	Tech. capacity utilisation	24	24	23	104%	35%	**0%**
KPI 2.2a	Reach among direct target group	66	83	49	169%	10%	**26%**
KPI 2.2b	Whereof SME	33	45	16	281%	10%	**36%**
KPI 2.3	Industrial revenues	9.680 K€	9.238 K€	5.500 K€	168%	8%	**-5%**
KPI 2.4a	Industrial reach	203	248	111	223%	10%	**22%**
KPI 2.4b	Whereof SME	53	118	37	319%	10%	**123%**
KPI 3.1	Leverage						
	Leverage income	50.249 K€	57.577 K€	44.400 K€	130%	26%	**15%**
	Leverage	3,54	3,58	2,0	179%	19%	**1%**
KPI 3.3	Strategic partnerships	7	8	4	200%	41%	**14%**
KPI 4.1	Cross-initiative projects	9	9	4	225%	41%	**0%**
KPI 4.2	Dissemination range	593	784	44	1782%	12%	**32%**
KPI 4.3	Joint publications	31	38	23	165%	4%	**23%**
KPI Basic subsidy cooperation projects.		5	3				**-40%**
Colleagues with confirmed ORCID ID		33,90%	90,60%	20%	453%	10%	**167%**
DMP Available		12,80%	12,30%				

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