Industry provides jobs for one in five European citizens, but increased competition from emerging markets poses a major challenge for this crucial pillar of the economy. The OPTIMAI project aims to create a new European industry ecosystem, focused on the development of new solutions to optimise production, reduce defects and improve training to safeguard European industry for generations to come. We speak to project coordinator Dr Nikolaos Dimitriou of CERTH-ITI

Boosting human performance in industry

Much has been said about the seemingly limitless potential of AI and new technologies to carry out the jobs we currently pay people to do. Understandably, this has come alongside concerns that many of these jobs – factory work in particular – could soon be a thing of the past. But although it may be true that some types of jobs will become less necessary, it is also true that people will still be needed to do new kinds of jobs. So, with the limited appeal of much current factory work, is it possible these new technologies may in fact be transforming manufacturing jobs for the better?

Dr Nikolaos Dimitriou, a postdoctoral research associate at the Centre for Research and Technology Hellas (CERTH-ITI) and project coordinator of the OPTIMAI project, certainly thinks this is the case. "Manufacturing, with its central role in the history of automation going all the way back to the first industrial revolution, is a particularly interesting example when thinking about how jobs might change in the coming years. For my part, I believe the significance of manual labour will decrease, while cooperation between humans and AI will increase.

"This collaborative aspect is important. There are some unique features of human experience that AI cannot really learn from – it cannot generalise nearly as well as humans can. Therefore, I think there will be an increasing demand for people who – while not necessarily understanding exactly how AI works – understand how AI operates and can provide feedback."

It is hard not to agree that manufacturing jobs are

about to get a lot more interesting when looking at the technologies employed in the OPTIMAI project. For instance, the project's augmented reality glasses, which are used for data visualisation and decision-making support, can provide real-time assistance on production lines and facilitate defect detection and reconfiguration of systems on-the-fly. A sleek user interface and intuitive gestures allow operators to interact easily with the glasses while maintaining their focus on the tasks at hand.

Other technology avenues being pursued include a multimodal sensor network allowing for smart and secure data collection on production lines, AI methodologies to allow for the early detection of defects in the manufacturing chain, an intelligent marketplace for the profiling, indexing and repurposing of defective parts, and digital twinning technologies to allow for the virtualisation of the production process.

"The aim of OPTIMAI is to combine AI, augmented reality and other technologies to optimise manufacturing processes," says Dimitriou. "By this, we mean we want to prevent defects, or identify defects and mitigate them, but also enhance worker capabilities and perception and help them do their jobs more easily."

Led by CERTH-ITI, the OPTIMAI consortium consists of experts in technology, research, ICT, hardware, software and manufacturing from across the EU, with 16 partner organisations representing 8 countries throughout Europe. Together, the technologies they are working on, alongside the OPTIMAI Decision Support Framework which the technologies are connected to, have been put to the test in three demonstration pilots in industrial settings.

Antenna manufacturing: Televés

Televés is a company in Spain that manufactures antennae. The OPTIMAI solution was introduced to optimise the manufacturing processes by reducing scrap, predicting and preventing upcoming defects, cutting the setup time (through simulation and testing using digital twins), and speeding up human-machine interaction and decision-making using AI.

"Televés has this process where they bend the antennae into the correct shape, but they had an

issue with where a number of the antennae would break when being bent in the press," explains Dimitriou. "We designed a system with cameras that can both predict and prevent these defects before they occur. The system is connected directly to a robotic arm on the production line which can then remove the unit in question. Of course, although this all happens very quickly and could not be done by a human, the human operator also receives this information so that they can see if multiple defects are occurring and can decide whether interventions or recalibrations are needed. In this way we are enabling the operators to do their jobs more efficiently, provide them with the tools to monitor the information and reconfigure the production if needed."

Microelectronic assembly: Microchip Technology Caldicot Ltd

Microchip Technology Caldicot Ltd is a company in the UK that builds microchips. The pilot study here aimed to demonstrate how the OPTIMAI solutions can be applied to such high-value manufacturing by reducing the process failure rate through automated quality control, speeding up the machine setup time by simulating production scenarios using digital twins, and increasing production capacity through increased understanding of production bottle necks.

"One of the processes we have been considering is the glue dispensing on to printed circuit boards before the integrated circuits are attached," says Dimitriou. "After a while, debris can begin to accumulate on the nozzle of the dispenser, after which the flow of glue changes and leads to defects on the final product. We have designed an AI system that works alongside a computer vision system to identify trends in how the glue dispensing process is changing, and make suggestions such as increasing air pressure that will ensure the amount of glue dispensed remains the same. These suggestions are first run by a human operator who can either verify or correct the AI's initial decision."

Lift manufacturing: Kleemann

The final OPTIMAI pilot is at Greek company Kleemann, demonstrating how the OPTIMAI solutions can be applied to the manufacturing of fully customised modern lifts. The focus is on the hydraulic lift power units testing, with the

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PROJECT INFORMATION

Project Title
OPTIMAI – Optimising Manufacturing Processes through Artificial Intelligence and Virtualisation

Project Objective
To create a new European industry ecosystem by introducing new technologies designed to reduce scrap, eliminate defects, enhance workers' performance and satisfaction through AR and human-centric AI, maximise the productivity and improve the quality of shop floor processes; to bring the highly adaptable solutions to market across Europe.

Project Duration and Timing
42 months: Jan 2021 – June 2024

Project Funding
€8 359 087,50

Project Partners

Centre for Research and Technology Hellas, CERTH-ITI, Greece (Coordinator)

Foundation for Research and Technology – Hellas, FORTH, Greece

Future Intelligence Limited, Cyprus

EVT – Eye Vision Technology GMBH, Germany

Visual Components Oy, Finland

Youbiquo SRL, Italy

Panepistimio Thessalias – University of Thessaly, Greece

Engineering – Ingegneria Informatica Spa, Italy

Unimetrik SA, Spain

Universitat politecnica de Valencia - Spain

Carr Communications Limited, Ireland

Universitat Autonoma de Barcelona, Spain

Trilateral Research Limited, Ireland

Kleemann Hellas SA, Greece

Televes SA, Spain

Microchip Technology Caldicot Limited, UK

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OPTIMAI

aim of automating and speeding up the quality inspection process, improving final product quality by identifying defects that slip through manual inspection, reducing calibration time through automation, and reducing the defect rate through improved unit design and the use of digital twins.

"Around two years ago, there was a shortage of electronic components which affected a number of industries," says Dimitriou. "Nowadays, most of the valve units that control the flow of oil in lifts are electronic, but this shortage saw Kleemann experience a huge rise in demand for their analogue units which do the same job mechanically. The catch with these analogue units is that they have to be manually calibrated, which is not easy – I tried it myself! To help with this, we developed an AI system that directly plugs into the unit and helps to calibrate it, which again keeps the human operator directly in the loop by notifying them about changes it is doing or is going to do."

Beyond the OPTIMAI project

One of the overarching aims of OPTIMAI is to develop a flexible underlying platform that will allow its technologies to be used in many different industrial environments. They have developed a network layer that will connect with almost all IoT devices, sensors and actuators that are found in factories. On top of this, a decision support module will enable factory workers to monitor the information collected from these, and will allow them to annotate the data which will enable AI models to be trained and then deployed in the production line.

Moving forwards, the project has a dedicated team who are working on a roadmap for the future utilisation of the project results. The flexible and adaptable OPTIMAI solutions have been developed to meet the needs of the market. With the potential to generate significant benefits to employees, employment and the environment, they will play a key role in Europe's transition towards a greener industrial future that retains a focus on people at its heart.