Interreg
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QRM4.0

EUROPEAN UNION
European Regional
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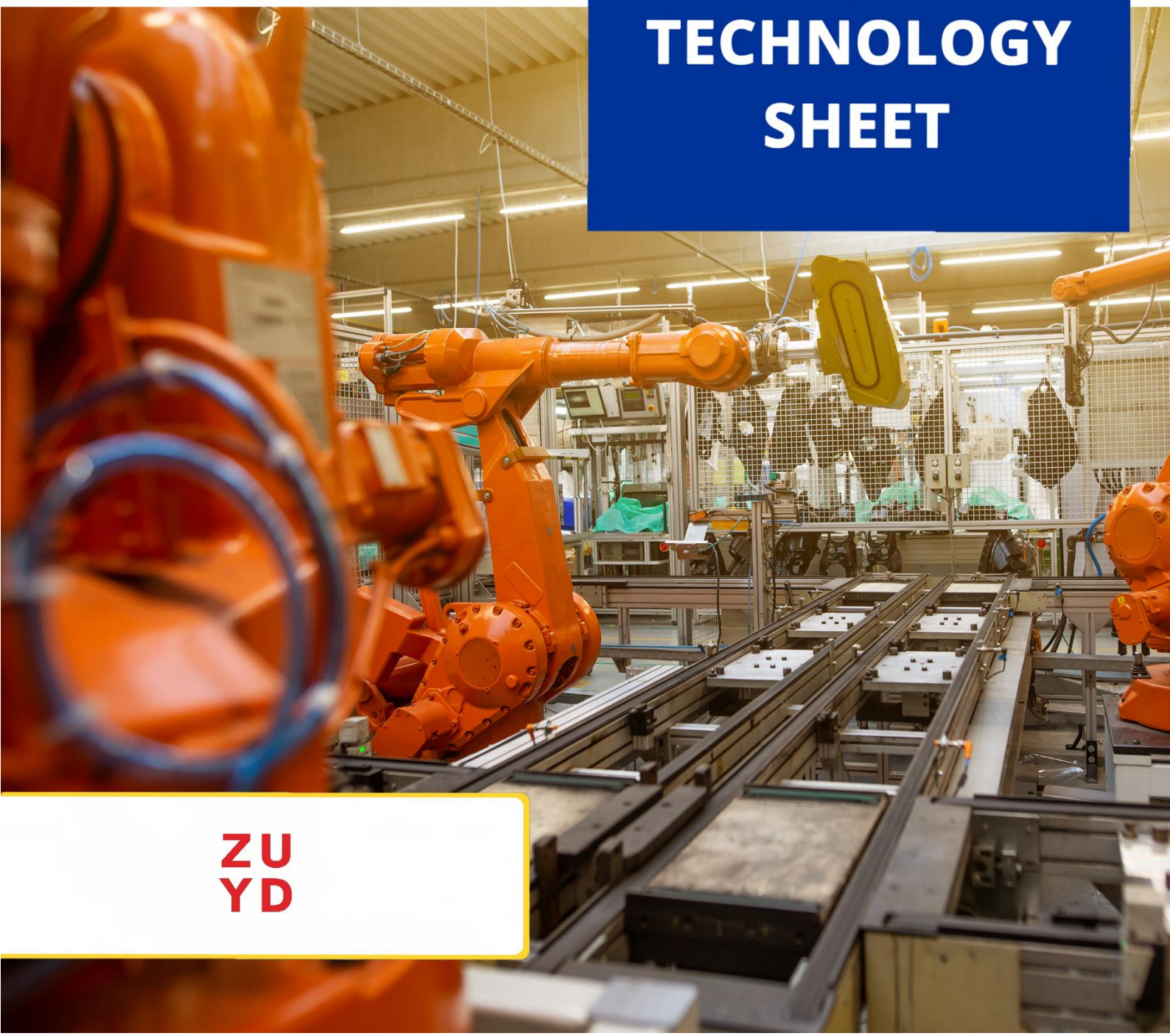
Possibilities of technology in Industry 4.0

TECHNOLOGY SHEET



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Technological possibilities in Industry 4.0

Factories have been making improvements to their production processes for centuries now, starting with the invention of the steam engine. Until then, fabrics were woven by hand, but with the advent of this new technology, that was no longer necessary. From then on, it became increasingly common to use sometimes complex machinery. The arrival of the conveyor belt, for example, meant that products could be manufactured even faster, while also making work less physically demanding on the human body.

We are now in the midst of a new industrial revolution, known as 'Industry 4.0'. As with the invention of the steam engine, this is bringing about a new wave of mechanization and automation. Companies can increasingly use smart machines, storage systems and production facilities. All these systems work together: machines can – by using sensors – independently collect and exchange information. Such information is exchanged through the Internet of things (IoT), a network in which humans and machines can talk to each other. Of course, this also requires an effort from workers on the shop floor. While they need an ever evolving skill set to do their job, they are also supported by technology in their activities much more than in the past.

For example, the data collected by sensors and systems can be used to very closely monitor production processes. Predictive models can even be used that can help the process go even more smoothly: for instance, you can see in good time when machinery parts need to be replaced or when a machine needs to be refilled.

Therefore, the developments involved in Industry 4.0 are enabling companies to shorten production times and to work much more efficiently. Cutting lead times is crucial with the rise of *batch size one*, i.e. the increasing move towards customized products, making the manufacturing of large volumes of identical items unprofitable. For many companies, the fourth industrial revolution may still seem a long way off, but how can these companies continue to develop in line with technological trends? Which new and emerging technologies could be significant for the organization? And which technologies are we actually talking about here?

To get an idea of exciting technological advances, here, based on research, is a 'top eight' of promising technologies that will have a major impact in the years ahead:

1. Renewable Energy
2. Artificial Intelligence
3. Internet of Things
4. Robotics
5. Transport Systems
6. Nanotechnology
7. Biotechnology
8. Nuclear Energy

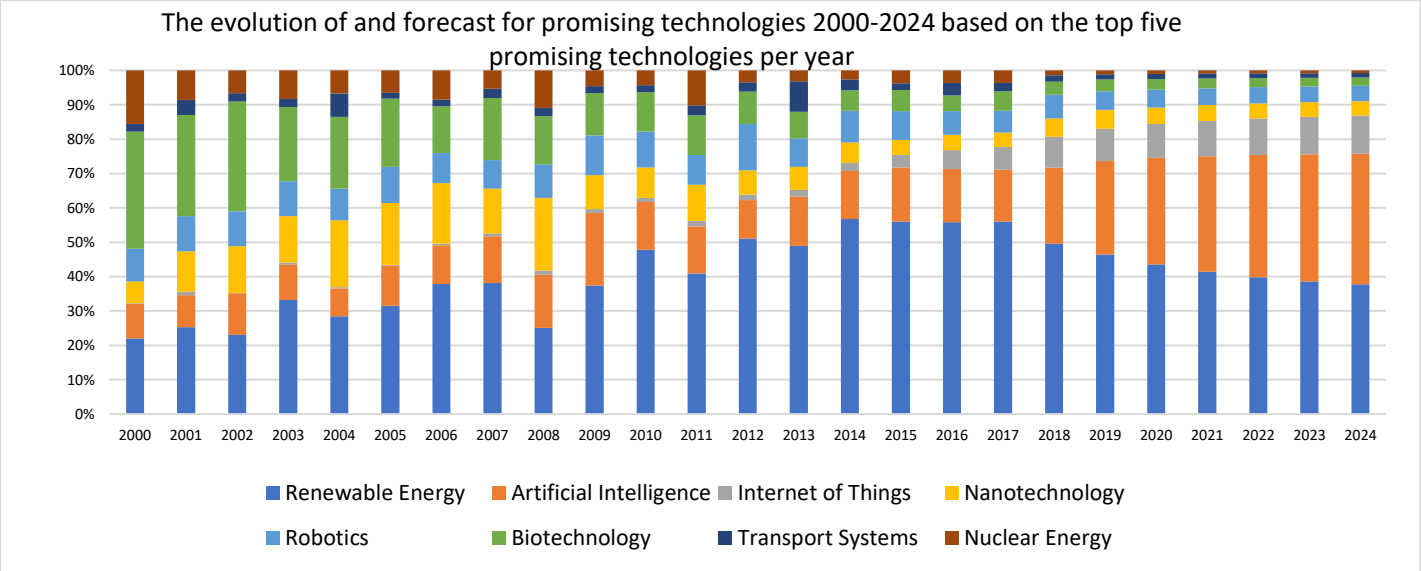

Figure 1: Trending promising technologies

Significant technologies for reduction of lead time

Looking at streamlining business processes, what are these technologies' potential implications for organizations? Among other things, *quick response manufacturing* (QRM) cuts lead times, which in turn reduces costs. It also boosts an organization's competitiveness, thereby increasing employees' job security.

It also means that organizations can serve their customers faster and more effectively, given that a cornerstone of QRM is highly integrated system dynamics, with humans and machines working seamlessly together, ensuring that machines can run at full tilt, which leads to faster lead times and higher production capacity. Various technologies can help reduce the manufacturing critical-path time (MCT). Take, for example, the use of smart robots, the Internet of Things and artificial intelligence:

Customers now ideally want to receive their customized products the same day. Smart factories have good system dynamics, with extensive automation ensuring that customer demand can be met. Robots can be deployed quickly and flexibly and work together in a larger network (IoT) bringing together humans and machines. Smart factories are fitted out with multiple sensors that closely monitor the various processes going on there. The collected data are analysed in near real time (artificial intelligence (AI)) and provide the insights required to further optimize/reduce lead times. Once the product is ready, it is delivered to the customer as quickly and efficiently as possible (transport systems).

Fields op application

Cars have been produced in Born, a town in Limburg in the Netherlands, for over 50 years now. Automotive manufacturer VDL Nedcar has responded very effectively to the ever-growing demand for *customized cars*. Its plant is a pioneer when it comes to flexibility, as it makes three different vehicle models at the same time by deploying more than 1,400 smart robots. The whole production process is closely monitored, with a host of sensors keeping the entire production line and all its processes under surveillance in real time and promptly identifying any problems. Maintenance is absolutely vital to ensuring that the complex system dynamics works harmoniously and with as little disruption as possible: faulty components are detected quickly, allowing the technical department to quickly get to work on repairing the machine, thereby slashing downtime.

Figure 2: Smart production line at VDL Nedcar: https://www.kivi.nl/uploads/cache/article_detail_image/uploads/media/5c9c84687fa53/vdl-born.jpg

Amazon, the world's number-one online retailer, is also a good example of a company boasting effective system dynamics. Amazon owes its success to high levels of customer satisfaction. Online shoppers want to be able to enjoy their new purchases as soon as possible, and so short production times and fast delivery are crucial. In large sorting centres there is a golden rule that there must be a place for all parcels and all parcels must be in their place. Specially designed warehouse robots use for order picking a signal emitted by special chips affixed to the parcels. All this leads to fast delivery of parcels and therefore high customer satisfaction levels.

Figure 3: Robots in an Amazon warehouse: https://roboticsandautomationnews.com/wp-content/uploads/2020/01/amazon-robotics-units-copy.jpg

Need some help?

The Interreg project QRM4.0 supports production companies in improving their lead times by providing practical advice and granting financial support to companies that want to take steps to implement digital tools on their shop floor. Would you like to know more? Contact dominique.nijssen@zuyd.nl.