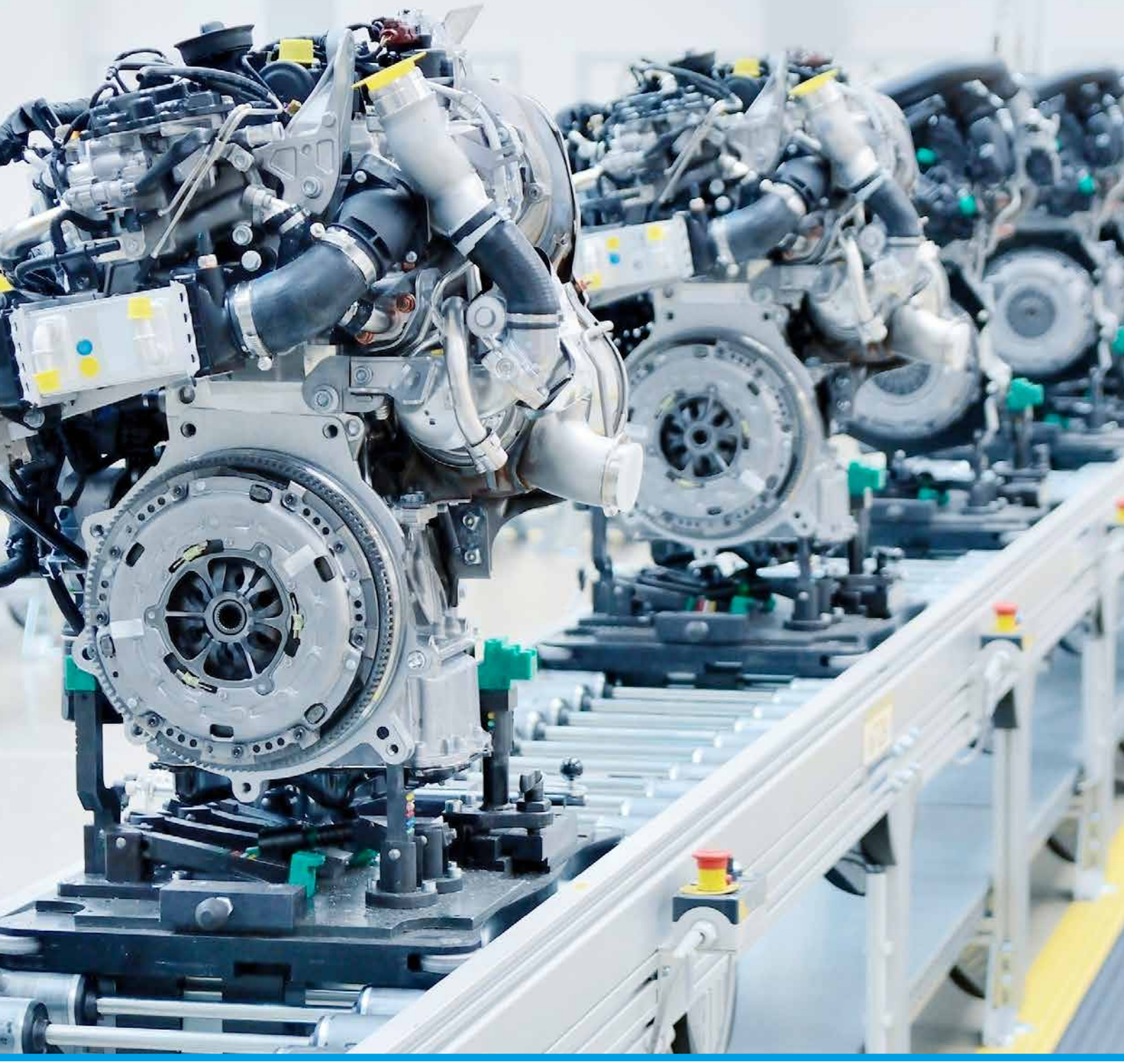
COMARCH
Technologies

White Paper



INDUSTRY 4.0

THE ROLE OF IIoT IN DIGITAL TRANSFORMATION OF THE MANUFACTURING SECTOR

Estera Włodarczyk

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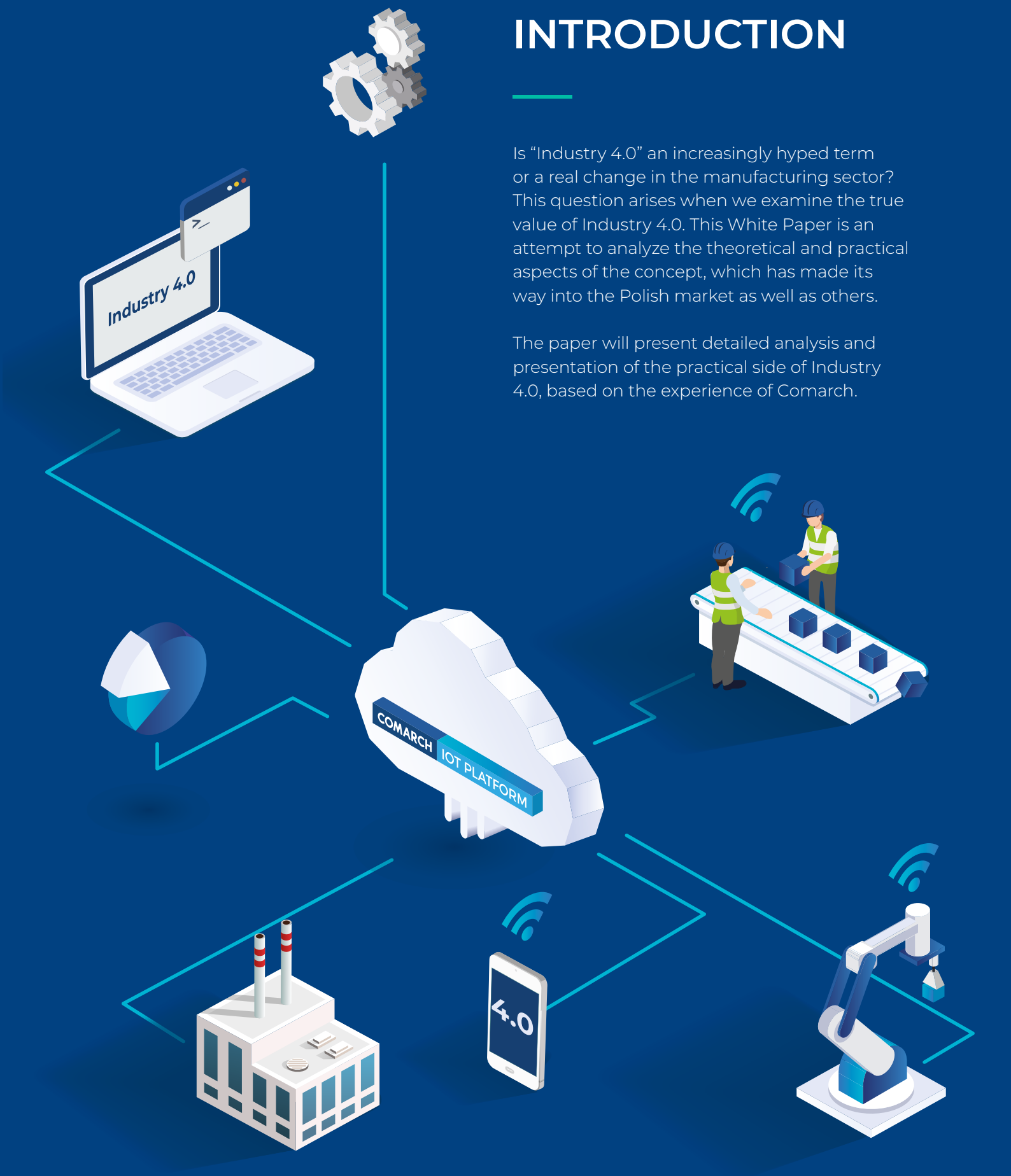
INTRODUCTION

Is “Industry 4.0” an increasingly hyped term or a real change in the manufacturing sector? This question arises when we examine the true value of Industry 4.0. This White Paper is an attempt to analyze the theoretical and practical aspects of the concept, which has made its way into the Polish market as well as others.

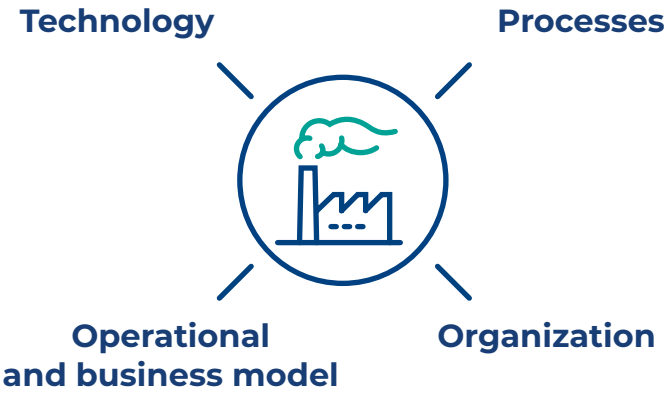
The paper will present detailed analysis and presentation of the practical side of Industry 4.0, based on the experience of Comarch.



INDUSTRY 4.0

INDUSTRY 4.0 – PRESENTATION OF THE CONCEPT

As with any new concept, Industry 4.0 has an official beginning. The term was first used on April 1, 2011, during the Hannover Messe trade fair announced by the German working group which initiated the project of digitization of manufacturing processes called *Das Zukunftsprojekt Industrie 4.0*. As the concept of Industry 4.0 gained popularity, governments outside Germany engaged in projects aimed at transforming the manufacturing sector. These included the Polish Ministry of Entrepreneurship and Technology working on project so called Fundacja Platforma Przemysłu Przyszłości (Foundation Future Industry Platform).

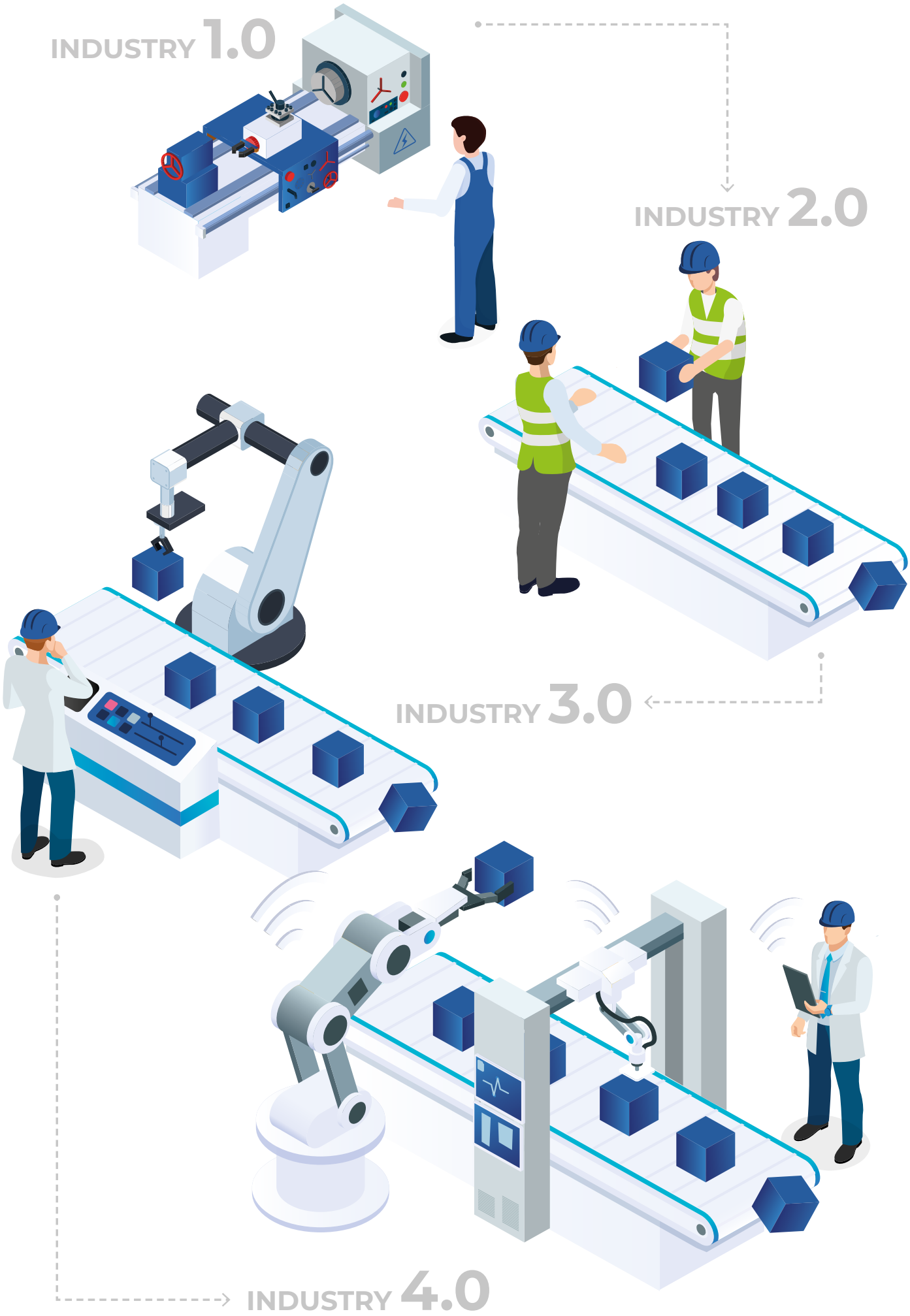


The concept of Industry 4.0 refers to digital transformation in the areas of technology, processes, organizations, operational and business models. There are also significant economic aspects. It has been estimated that the global Industry 4.0 market (including the market for products and services associated with connected industry and supporting technologies) will reach a value of USD 310 billion by the year 2023[1].

REVOLUTION OR EVOLUTION?

Due to the many-faceted nature of Industry 4.0, the concept is very difficult to define theoretically. Contrary to popular opinion, Industry 4.0 does not consist only of the implementation of modern technologies, but also involves changes in the models of management and organization of manufacturing companies. Another important element of the concept of Industry 4.0 is its link to the fourth industrial revolution. It could be stated that Industry 4.0 is part of an evolutionary process. Why? According to Klaus Schwab (founder of the World Economic Forum), the revolutions which have taken place so far, and which affected the development of the global industrial sector, were always aimed at a single, ground-breaking technology. They gave rise to mass production, among other things, and stimulated only technological change. But this time it's different, as we are introducing a whole range of new technologies which aim to combine the digital, physical and biological worlds, influencing general economic growth and the transformation of business management models[2]. Therefore, we are dealing with an evolution of innovation. We are pursuing the goal of automating manufacturing processes and the introduction of connectivity between systems, machines, people and even robots.

[1] IoT Analytics, Matthew Wopata, New market report uncovers 9 disruptive trends and ranks 12 key use cases transforming smart manufacturing, November 14, 2018.
[2] The Fourth Industrial Revolution, by Klaus Schwab, https://www.weforum.org/about/the-fourth-industrial-revolution-by-klaus-schwab, dostęp: 26.02.2019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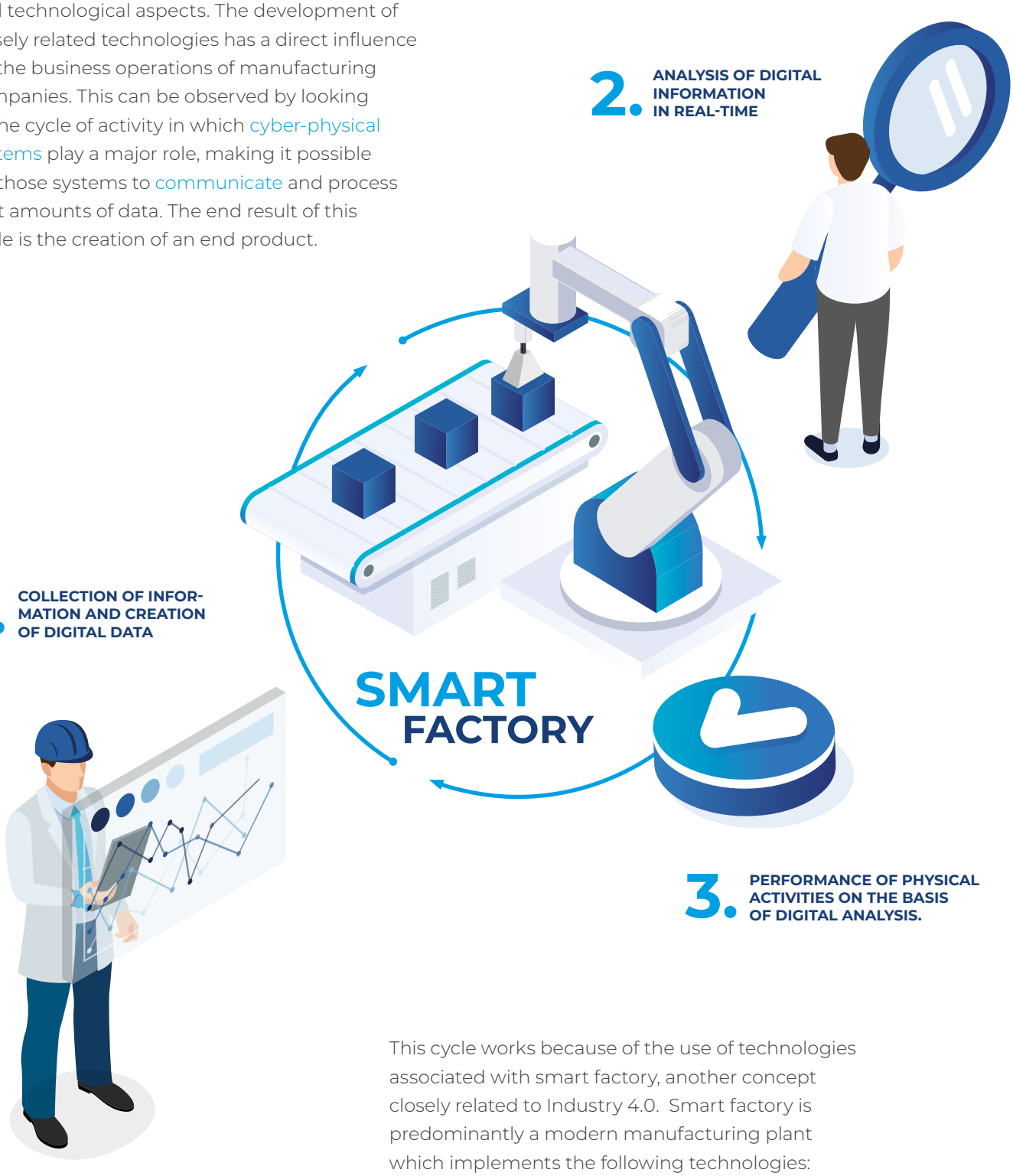
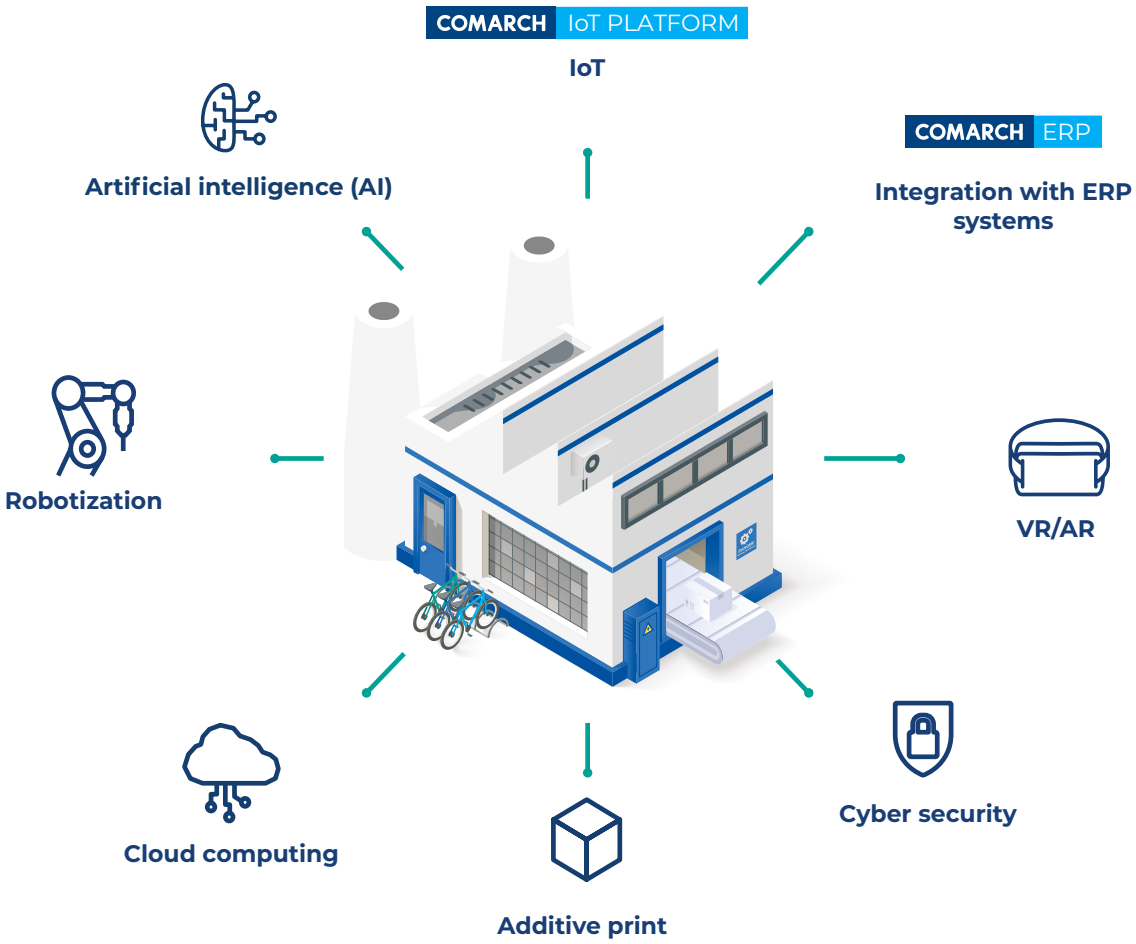
SMART FACTORY

In discussion about Industry 4.0, it is difficult to draw a clear distinction between business and technological aspects. The development of closely related technologies has a direct influence on the business operations of manufacturing companies. This can be observed by looking at the cycle of activity in which cyber-physical systems play a major role, making it possible for those systems to communicate and process vast amounts of data. The end result of this cycle is the creation of an end product.



This cycle works because of the use of technologies associated with smart factory, another concept closely related to Industry 4.0. Smart factory is predominantly a modern manufacturing plant which implements the following technologies:



In the case of Comarch, the heart of the smart factory is the IoT Platform where all data are stored and analyzed. Such a solution enables easy control and management through the determination of rules and alerts to be applied at each stage of manufacturing.

DIGITAL TRANSFORMATION

The complexity of the Industry 4.0 concept is reflected in the diversity of areas it covers. One of those areas is digitization, and, in a broader context – digital transformation of enterprises. When we look at market expectations of manufacturing companies, it's not only the production process that is transformed, but also the entire organizational strategy and maintaining customer relationships. The significance of digital transformation is shown in data presented in the report The Industry 4.0 Paradox by Deloitte, which indicates that 94% of the respondents declared that digitization processes are among their companies' strategic priorities[3].

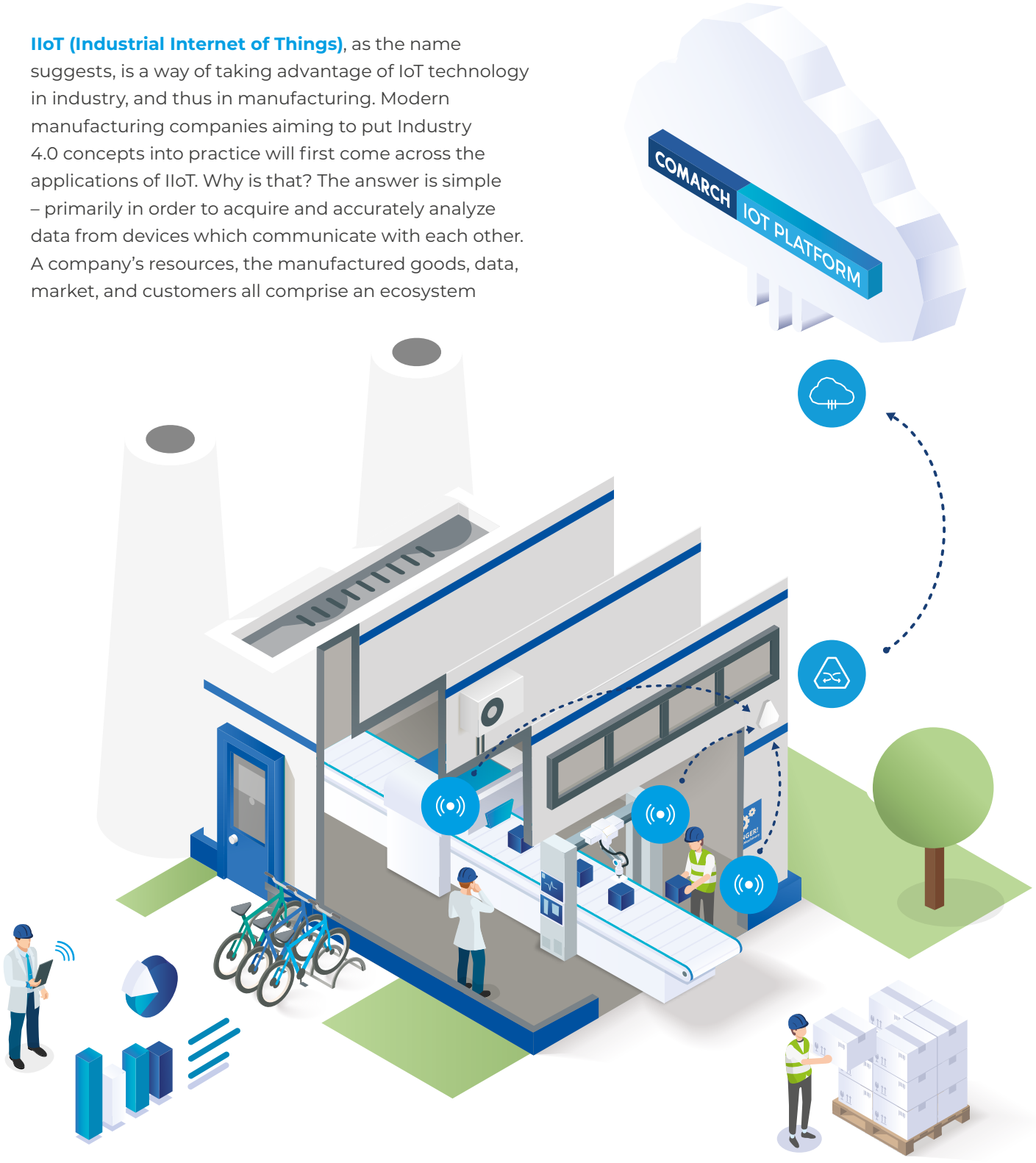
Digital transformation also leads to the implementation of new business models such as "product as a service". Going beyond just manufacturing a product makes it possible to offer a new array of services. This, in the case of the manufacturing sector, leads us to another new concept, digital data. The collection of vast amounts of data in the manufacturing sector is nothing new, but analysis and segregation of that information is the real issue. Processing, selection and replacement of digital data affects business decisions and serves as the source of crucial information for the customer (for example, concerning the current stage of manufacturing of the ordered goods).

[3]Deloitte Insights, The Industry 4.0 Paradox. Overcoming disconnects on the path to digital transformation.

IIoT – IoT IN THE MANUFACTURING SECTOR, BASED ON THE EXAMPLE OF COMARCH

INDUSTRIAL INTERNET OF THINGS (IIoT)

IIoT (Industrial Internet of Things), as the name suggests, is a way of taking advantage of IoT technology in industry, and thus in manufacturing. Modern manufacturing companies aiming to put Industry 4.0 concepts into practice will first come across the applications of IIoT. Why is that? The answer is simple – primarily in order to acquire and accurately analyze data from devices which communicate with each other. A company's resources, the manufactured goods, data, market, and customers all comprise an ecosystem



which requires efficient means of access and information exchange. The connectivity of IoT technology makes this possible.

In the case of Comarch, we are talking about creating an IoT ecosystem of solutions which are characterized by a wide range of development possibilities in terms of both hardware and software. The main component of that ecosystem is the IoT Platform. By combining the IoT platform with network components, including IoT Hubs (receivers), Beacons and RFID tags (transmitters), it is possible to ensure real-time communication and collect data from machines and sensors. Thus, we ensure control over and on-going access to data in the entire manufacturing chain, from communication between devices through the assembly line to management processes and product distribution to the customer.

APPLICATION OF IIOT IN THE MANUFACTURING SECTOR

The fact that IIoT has a major impact on the activity of manufacturing companies is also indicated in economic forecasts. One of the indicators in this case is the share in global GDP. In the long term (until 2030), IIoT is projected to generate USD 15 quintillion in global GDP[4]. IIoT has the potential to become the driving force behind economic growth. With such economic forecasts it is possible to see numerous benefits for manufacturing and business activity as a whole. So, what can we gain by using IIoT technology in both these areas?

Benefits for manufacturing processes	Business benefits
Maximization of manufacturing processes	High return on investment (ROI)
Manufacturing intelligent, high-quality products	Consistent fulfilment of business goalsh
Comprehensive monitoring of manufacturing processes	Customer-centric approach owing to personalization of manufacturing
Reduced production and transport time	Application of new business models and introduction of new services
Detection and elimination of stoppage and human error	New source of revenue
Integration with existing systems	Reduction in operating costs
Real-time analysis of production data	Possibility to rely on data in making business decisions

[4] 2019 Manufacturing Trends Report, Microsoft.

COMARCH – I4.0 SOLUTIONS FOR MANUFACTURING

INDUSTRY 4.0 VS. ISSUES IN MANUFACTURING

Cooperating with customers in the manufacturing sector gave us the opportunity to learn about the problems they encounter on a daily basis. Some of them are similar irrespective of the type of manufacturing activity. Implementation of the Industry 4.0 concept means using solutions to enhance all processes, from the production hall to product distribution. That is why here in Comarch, we are able to provide comprehensive products, services and solutions in the area of Industry 4.0.

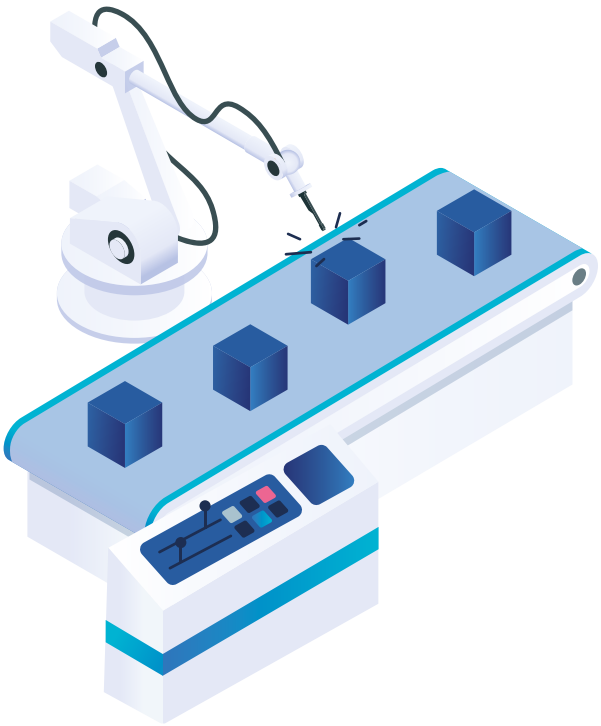
Below are just a few examples of the most frequent problems encountered by our customers in the manufacturing sector.

COMARCH IN RESPONSE TO MANUFACTURING PROBLEMS

PRODUCTION STOPPAGE

This results in decreased efficiency and a slowdown of the subsequent processes in the manufacturing chain. This type of problem occurs most frequently when the people responsible for the particular stages of manufacturing are not capable of monitoring the condition of machines and other equipment on the shop floor on an on-going basis. The machines, which are not equipped with sensors monitoring their condition, do not exchange information with each other or send appropriate data to the cloud computing platform. This makes it difficult for employees to evaluate their condition and plan maintenance work, or prevent sudden failures which could halt the entire production chain.

How to prevent stoppage and unexpected failures? In Comarch we were able to develop a system of predictive maintenance. By integrating IoT with business intelligence (BI) and field service management (FSM), it is possible to control the condition of machines and plan maintenance in order to prevent unwanted stoppage. We utilize the existing infrastructure or retrofit with sensors, such as Beacons (Bluetooth Low Energy) detectors or RFID tags using radio frequency identification. These sensors collect information from connected machines which is then passed on by IoT Hubs to the IoT Platform. By integrating with BI, it is possible to analyze the collected data and prepare analytical modules which will, in collaboration with FSM, be provided to technicians. The technicians can then plan the necessary maintenance activities. In this way, the problem of stoppage is mitigated, productivity rises and the supply chain remains intact.



MANUFACTURING OF LOW QUALITY/ INCOMPLETE PRODUCTS AND POOR COMMUNICATION

The process of manufacturing the product itself and the management of its lifecycle is important for the entire supply chain. The customer expects the highest quality of both the product and the services associated with it. Meeting the expectations of market participants is possible only when managers have an effective system of controlling the quality of manufacturing processes (MES systems). Lack of control or monitoring of particular production stages, the possibility of human error and ineffective data analytics are reasons for producing low quality and often incomplete products which only generate waste and lead to financial losses. Assembly line workers are not able to inspect each manufactured product in terms of its quality and completeness. A problem that appears at a very early stage of production then causes a snowball effect. The completion of the order is delayed, and so is distribution which, in turn, harms relations with customers and hinders strategy and operations, not to mention the damage it causes to the company's market standing.

So, what is the best way to ensure the highest quality of production processes and manage the supply chain effectively? We are able to provide a solution which will facilitate complete product lifecycle management. Integration of IoT with ERP systems allows monitoring of the consecutive lifecycle stages of a product from the moment an order is placed, and also provides a means for delegating tasks on particular positions. ERP generates a production order which is then forwarded to the appropriate employee assigned to a given workstation. Owing to the application of an intelligent assembly line, workers can be instructed to follow specific steps in the manufacturing process via dedicated industrial displays. The displays feature assembly instructions and tools for verifying quality and completeness, which are distributed by means of the IoT Hub. Feedback from the assembly line is transmitted to the ERP system. Additionally, the shift manager can monitor the entire production process, including the work of each employee. Access to data and messages is possible owing to the IoT Platform, which is connected to the ERP system. As an added value, a business model is created. This allows the product to become a comprehensive service – the customer is able to track all the stages of their order using real-time access capabilities.

IMPRECISE POSITIONING AND LACK OF ACCESS TO DIGITAL RESOURCE DATA

Industrial premises are places of storage of tangible resources, including specialized and often very expensive equipment and machines and, in particular, assembly lines. The manufacturing chain also involves various types of vehicles, including fork lifts and heavy goods vehicles used for the purpose of distribution. Employees operating such equipment are also important assets of the organization. Having no control of the human and material resources is a serious problem for the efficient functioning of the enterprise. Managers are not able to identify employees assigned to particular workstations, or monitor the effectiveness of their work. Furthermore, locating vehicles and devices is a significant challenge. With no access to automatically generated location data, it is difficult to effectively manage the supply chain. As a result, product surpluses and machinery shortages can arise.

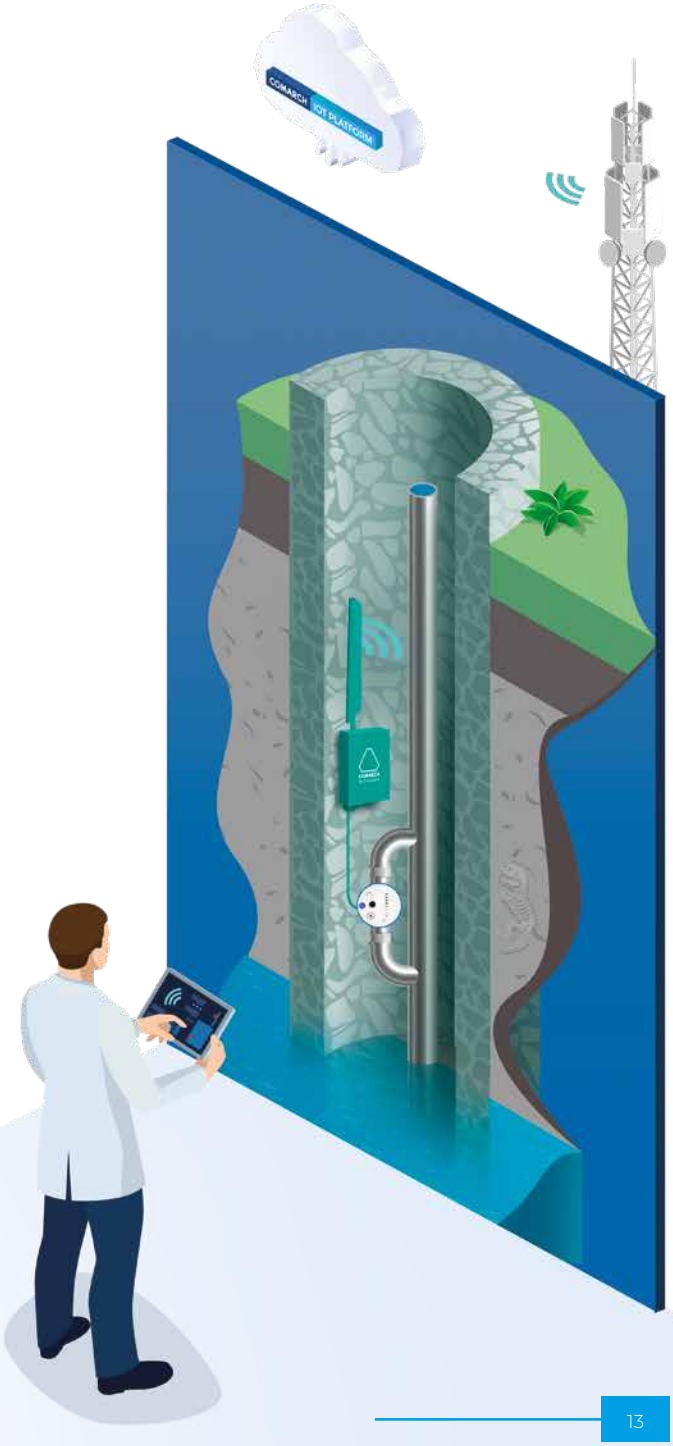
Modern factories should manufacture intelligent products which are monitored at every stage of production and distribution. Data obtained from such monitoring should be available in real time for the employees and the customer. Here at Comarch, we have developed a solution which addresses the problems related to controlling, monitoring and managing resources. The Comarch Asset Tracking system uses a combination of sensors (such as beacons, BLE Bracelets and RFID tags) connected to receivers (IoT Hubs) communicating with an IoT Platform to enable resource tracking at every stage of the supply chain. A fully automated system operating in the cloud allows to reduce operating costs and increase productivity.

HIGH POWER CONSUMPTION AND LACK OF CONNECTIVITY WITH AND BETWEEN DEVICES

Maintenance of a manufacturing plant is inevitably associated with high consumption of electrical energy, which generates significant costs. According to the Energy Information Administration (EIA), the industrial sector accounts for 54% of worldwide power consumption[5]. This could be reduced if manufacturers were able to monitor energy losses and identify the root of the problem. Unfortunately, energy bills provide no clue as to which particular devices are responsible for excessive energy costs. Due to the specific nature of the sector, various energy resources, such as electricity, water or gas, are used for production, assembly, heating, air conditioning, and so on. With no possibility to collect and analyze data about device condition or manner of use, and lack of measurement systems, additional costs and various environmental problems arise. Irrespective of whether a given factory is equipped with modern machinery, the management and measurement of energy consumption without a professional monitoring system will not bring a satisfactory return on investment.

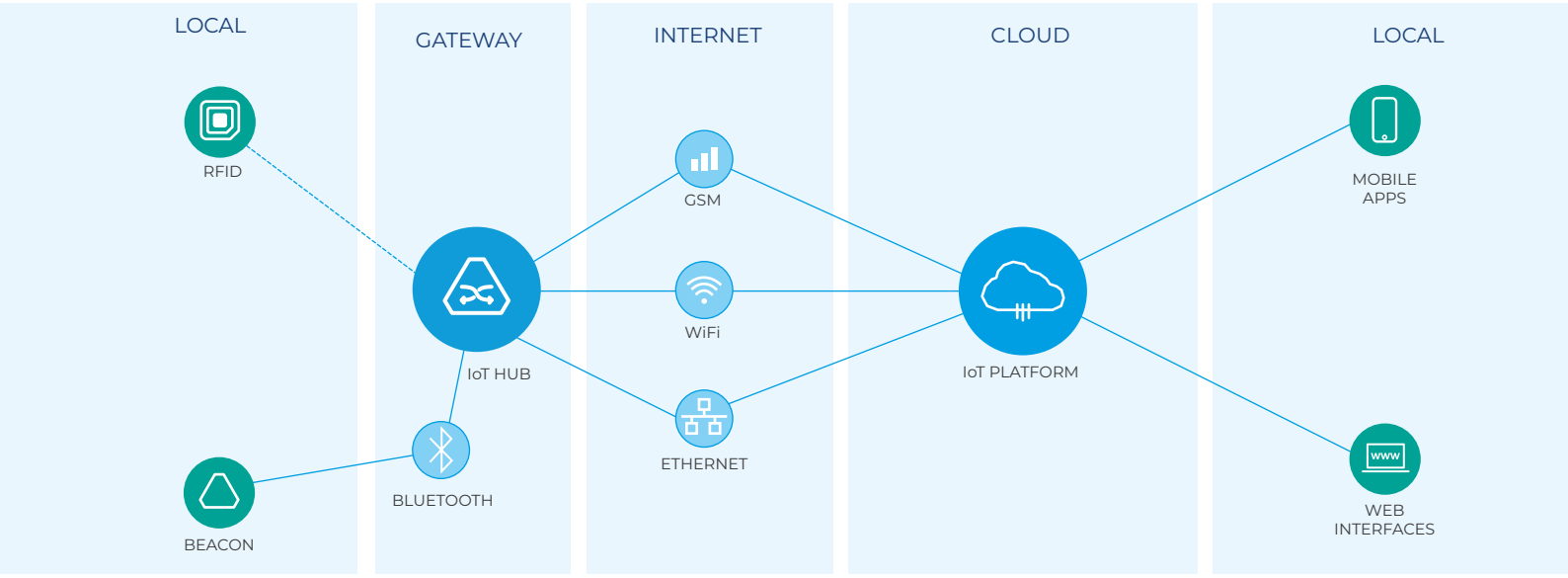
Here at Comarch, we are working on solutions which will allow reduced maintenance costs and make it possible to retrofit existing machines and measurement devices. Owing to the use of IoT sensors collecting data from the machines and sending that information to the IoT platform, managing energy in the factory results in continuous control of each of the processes. By retrofitting retrofitting, manufacturers are not forced to replace the existing machines and systems, but only to equip them with appropriate IoT sensors which enable connectivity between the machines, systems and employees.

By facilitating the measurement of energy consumption, we make Smart Metering (based on NB-IoT or LteCatM) possible, which in turn enables remote monitoring of meter indications and the transmission of data to the IoT platform. In the event that any of the machines function abnormally, the system generates an alert. With access to measurement data and the ability to analyze this information, factory energy consumption is optimized. This leads to a reduction in energy costs.



[5] U.S. Energy Information Administration | International Energy Outlook 2016

PRACTICAL APPLICATION OF COMARCH SOLUTIONS FOR INDUSTRY 4.0



ABNOX AG

The solutions we implemented with one of our customers prove the wide application of Industry 4.0 in the manufacturing sector. We were able to supply our Swiss customer with solutions in the areas of IoT and ERP.

Abnox AG is a Swiss company which manufactures specialized devices for dispensing lubricants used in several types of industry. These products are often made in small batches or in multiple versions. The specific nature of production focused on diversity causes numerous problems, such as frequent changes in the production documentation. As a result, mistakes are hard to avoid and there is a risk that employees will miss some components or steps in the process. Abnox's specific style of production makes the processes more complicated. Issues arise at the stage of setting up workstations, designing tools and collecting and verifying the data needed at each manufacturing stage. Owing to the integration of IoT solutions with the ERP system, Abnox was able to transition successfully to Industry 4.0. The solution was based on dedicated industrial displays which were connected to the LAN network already existing in the plant. The displays present assembly instructions for, employees, to ensure that no steps of the process are missed and to maintain the highest quality standards. Production data are collected by means of IoT Hubs, which then stream information to the IoT Platform. Communication with the ERP system enables particular production stages to be tracked, generating alerts and messages and completing each customer's order in an appropriate manner. The digitization of manufacturing made possible by IoT and ERP reduced the problem of delegating tasks at workstations, made the production processes more efficient, and brought better communication between the machines, systems and employees.

We have been using Comarch ERP for many years now, which has allowed us to optimize our processes. Now we want to go forward towards digitization. This is why we introduced the Industry 4.0 solutions provided by out ERP supplier – Comarch. This enables continuous exchange of information between employees, machines and ERP systems. We were also able to almost completely eliminate errors which were commonplace in our manufacturing processes due to their complexity – explains Matthias Iseli, CEO of Abnox AG..

RWTH AACHEN

In our experience, Industry 4.0 does not only mean cooperation with business customers. We have also implemented our solutions at a well-known German technical university – RWTH Aachen. Here, we set up a showcase smart factory. In the Aachen University, electric vehicles are designed and produced as part of the “e.GO Life” project. As participants of an innovative research project, we created software controlling the process of manufacturing the cars with the use of one of our solutions (Comarch Asset Tracking). This solution enables components used in the showcase factory to be tracked. Owing to integration with the ERP system, we are able to monitor the production process from the placement of the order to its distribution to the customer. The application of IoT also allows participants of the project to “identify” the employees assigned to the relevant workstations. As with the implementation in Abnox, the solutions applied at RWTH Aachen include special industrial displays which show assembly instructions and information concerning the quantity and type of components needed to assemble a product. Additionally, the system generates an alert in the event of errors in the production process. And, should any shortage of resources arise, relevant orders are placed automatically to replenish stocks. The implementation at RWTH Aachen is an example of the optimization of manufacturing processes and enhancement of the entire supply chain.

CONCLUSION

Manufacturing companies are facing a huge challenge in terms of the implementation of Industry 4.0 solutions. Failure to adapt to the changes brought by the digital revolution will cause them to lag behind and lose their competitive edge. Digital transformation is not only about enhancing current production processes. It is a long-term investment and opportunity for constant development. Industry 4.0 facilitates the development of new technologies, and enables retrofitting of existing systems to bring them up to par with modern market requirements.

The key to successful implementation of the Industry 4.0 concept and its particular solutions is the automation of processes and improvement of communication. Each of these elements translates directly to effective business operation. Here at Comarch, we offer IoT solutions which will bring companies to the fourth industrial revolution.

Each of the solutions we offer is adapted to the individual needs of customers aiming to implement Industry 4.0 in their company. Contact our experts to learn more.

COMARCH
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ABOUT US

Comarch is a leading Central European IT business solutions provider specializing in forging business relationships that maximize customer profitability while optimizing business and operational processes.

Comarch Technologies draws from a wide expertise Comarch has accumulated during 25 years of its business activity in the field of delivering comprehensive IT solutions. Its main concern is to provide the customers with the most reliable and secure solutions that consist of advanced software along with innovative hardware infrastructure supported by professional services.