LEAWARE

Software Development for Industry 4.0

Present and future

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WHAT IS CUSTOM DEVELOPMENT?

Custom software development is the design of software applications within an organization for a specific user or group of users, designed to precisely meet their needs compared to traditional and broad-based off-the-shelf software.

Custom software is created by a company through a third-party contract or an in-house team of developers and it is not packaged for resale. At Leaware, we are specialists in software development and we develop high quality digital products for our clients.

Advantages of Custom Software Development

Custom software provides functionality that off-the-shelf software cannot. Bespoke software is created to support business needs, which increases productivity. Having a software application that is designed to increase productivity and satisfy needs offsets its cost through increased efficiency. If your organization has unique needs, it would be wise to invest in a customized solution. Leaware carries out rigorous research to determine exactly the characteristics that your digital product must have to meet the needs of your organization and the product's users.

Convenience of Use

The software product is based entirely on the company's requirements and the user's needs. For some workflow programming, users only need to have basic computer knowledge and do not need training to use the software.

More Efficient

Customized software is targeted to a specific user and purpose. The functions of off-the-shelf software are complex and may offer additional functions that the user does not need. For customized software, the functions are concise and can be adjusted at any time to meet the user's needs.

High-Cost

The software industry often copies existing software. The more frequently software is replicated, the cheaper it becomes. Customized software is designed for a specific application which means that the replication capability is limited. As the software cannot be replicated, the development cost is high.

WHAT IS INDUSTRY 4.0?

Industry 4.0 is a series of technological changes aimed at creating a coherent framework that is being introduced in the manufacturing process. The backbone of Industry 4.0 is how products are made, a phenomenon that is likely to have a global impact and has implications for all types of businesses. Industry 4.0 is the application of IoT, cloud computing, cyber-physical systems (CPS), and cognitive computing in the manufacturing and service industries. At Leaware, we fervently believe that the future of industries lie with Industry 4.0.
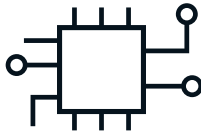
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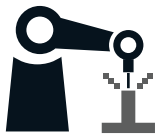
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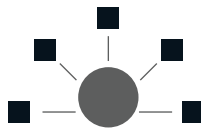
Connection

Cloud Computing

IOT

**Big Data**

System Integration

Automation and connectivity in manufacturing is not new. For years, manufacturing has been transitioning from physical to digital (taking real actions and converting them into digital records) and digital to digital (using AI to share insights). However, with IoT, cloud computing, cyber-physical systems (CPS), cognitive computing, and robotics, manufacturing can become fully connected and flexible, increasing value in factories and the supply chain.

The transition from digital to reality – the application of algorithms to translate decisions in the digital world to effect changes in the physical environment – is at the heart of Industry 4.0. The concept falls under the Industry 4.0 umbrella because it follows the third industrial revolution of the computer age and goes further to self-running computers powered by data and machine learning, aspects that Leaware have successfully developed.

Industry 4.0 provides a connected workflow that automates processes to improve quality and machine availability. The combination of the physical and digital world enables collaboration between departments, partners, and people.

Industry 4.0 will evolve factories into self-running systems using automation, data virtualization, wireless connectivity, and IoT sensors. The manufacturing process is faster and more efficient with Industry 4.0 because of the analysis of production data, application of machine learning, and AI. Companies and organizations like Leaware have applied these concepts which caused a significant increase in productivity.

With low-cost sensors that can be retrofitted to older machines, data storage, big data analytics, smart devices, and cloud technology, manufacturers have real-time granular visibility into manufacturing operations of equipment, people, suppliers, processing lines, and manufacturing sites. Without analyzing large sets of data and taking proactive action when emergencies arise, there is little room for product improvement.
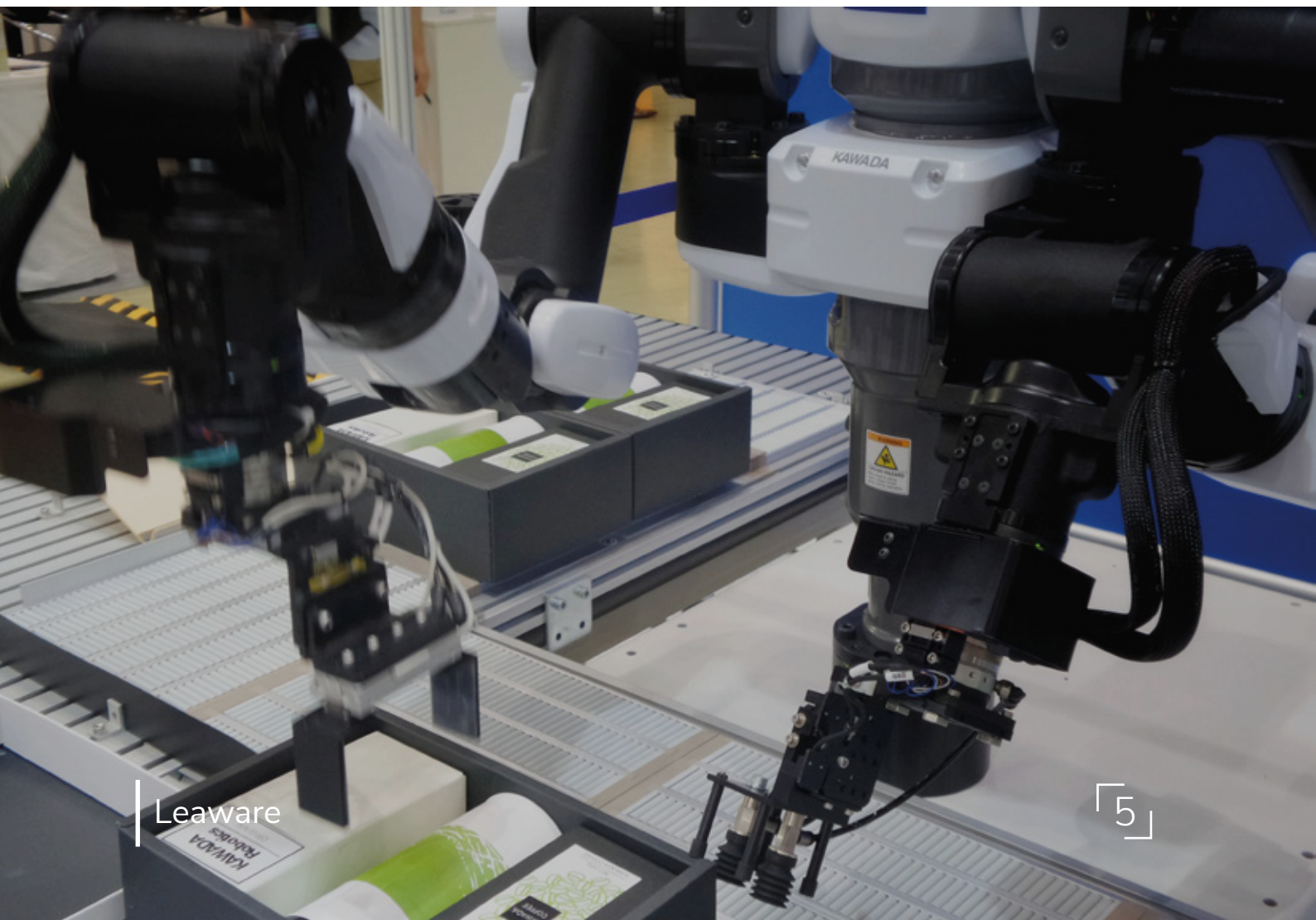
TECHNOLOGIES THAT HELP WITH INDUSTRY 4.0
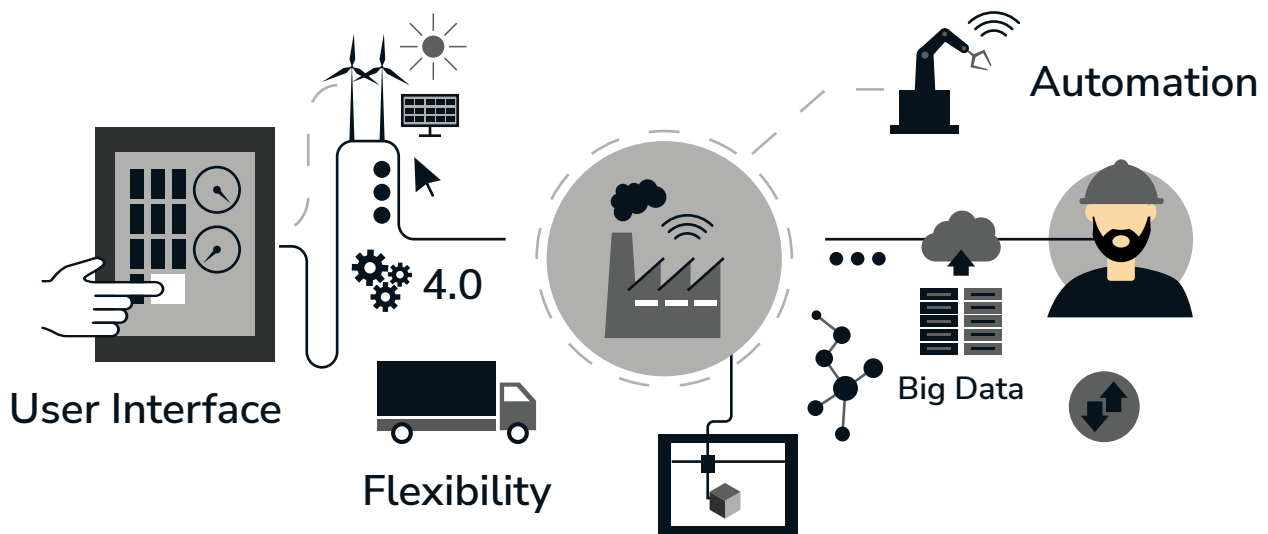
Main Features of the Proposed Guidelines for the New High-Tech Strategy

Interoperability: Cyber-physical systems (software embedded in hardware such as sensors, processors, and communication technologies) allow people and factories to communicate with each other.

Virtualization: Creates a virtual replica – otherwise known as a digital twin – of a factory by linking sensor data with virtual factory models and simulation models.

Decentralization: With technologies such as 3D printing, cyber-physical systems can make their own decisions and produce items locally.

Real-time capabilities: The ability to collect and analyze data to provide immediate insights.

Modular: Flexibility to adapt the plant to changing needs by replacing or expanding individual modules.

Service orientation: These services are available through the Internet of Services (IoS) and can be used by other participants. We call IoS an API for exchanging information between B2C and B2B.

To be successful, break down the silos of information that have been created in the past. Connecting to multiple data sources, unifying underlying data, and avoiding redundant information enables manufacturers to connect multiple departments and companies to leverage data across the plant. At Leaware we have looked for innovative ways to meet our objectives through these technologies

IT is increasingly integral to the manufacturing process and the role of the IT department in supporting the manufacturing process has changed. IT has changed because it is increasingly becoming more automated. IT provides support and plays a major role throughout the manufacturing process.

KEY USES FOR INDUSTRY 4.0

Predictive Analytics

McKinsey's research confirms this prediction: "Big data/advanced analytics approaches can increase production by 20% to 25% and reduce downtime by up to 45%" (**www.industr.com**). Downtime is expensive and reduces overall equipment efficiency KPIs. Switching from a passive to an active approach is the key to enhancing competitiveness.

Machine Learning

Advances in machine learning have led to increased adoption of Lean manufacturing and Six Sigma techniques. Machine learning techniques employ an emerging class of algorithms that learns from the data provided and automatically builds the best model for each dataset. As a result, analysts who lack expertise in statistics and modeling can solve complex problems.

These developments lead directly to improved product quality and reduced waste or product rework and this is something that we have achieved at Leaware. Data analysis of production parameters helps to understand the optimal machine setup for a specific order and avoid machine setups that may produce poor quality outcomes.

Interoperability and AI

The maturity of cyber-physical systems enables humans, the products themselves, and smart factory machines to communicate with each other and gain insights in real-time. In addition to human-computer interaction, machines make decisions with the help of decentralized cyber-physical systems. A good example of human-computer interaction comes from the automotive industry.

As a further example, in warehouses, highly specialized workers can wear bracelets that track their movements and alert them when they are moving in the wrong direction or when the torque applied during assembly is at optimum level. Not only does this reinforce safety objectives, but it also avoids actions that can lead to work-related injuries.

GOALS FOR INDUSTRY 4.0

By introducing data analytics, machine learning, and AI capabilities, an Industry 4.0 factory is often defined as a smart factory or smart manufacturing. In a smart factory, equipment learns to predict anomalies and make decentralized decisions in real-time in response to events. Many manufacturers such as Leaware are already using smart factory components, such as augmented reality, to help repair machines. However, a more comprehensive effort is required to truly establish a smart factory.

Key Application Areas for the Principles of Industry 4.0

• Manufacturing operations
• Overall equipment efficiency and plant productivity
• Predictive maintenance.
• Real-time equipment and process monitoring.
• Process optimization.
• Real-time quality monitoring.
• Product yield and root cause analysis.
• Reliability and warranty.

With a smart factory system, all relevant data is aggregated, analyzed, and actioned. In a modularly structured smart factory, cyber-physical systems monitor physical processes, create virtual copies of the physical world, and make decentralized decisions.

In IoT, cyber-physical systems communicate with each other and humans in real-time through IoS. Sensors, devices, people, and processes are part of a system that does the following:

-Reduces downtime.
-Minimizes residuals and defects.
-Has a deep insight.
-Has end-to-end real-time visibility.
-A digital twin of the factory.

SOFTWARE DEVELOPMENT TECHNOLOGIES THAT CAN HELP COMPANIES REACH INDUSTRY 4.0

With globalization and digitization, Industry 4.0 has been given more meaning. In this process, robotics is key. Automated processes, networked systems, and smart machines make production processes faster and more efficient, ensuring optimal flexibility throughout the supply chain.

It also enables real-time sharing of manufacturing process information between factories around the world. This means that a global intelligent virtual factory of the future can be built.

The Evolution From Industrial Robots to Collaborative Robots

The data shows an upward trend in robotics: in 2016, the overall global robotics market reached $40 billion and is expected to reach $87 billion in 2025. MRF's report, Industrial Robotics Market Information by Type, by End-Users, by Application and Region, predicts that the sector will have a compound annual growth rate of 10.32% by 2026 **(www.roboticsandautomationnews.com)**. Today, this trend is transforming from a traditional industrial robot to a collaborative robot (cobot) evolution. In the early days of robot development, robots were mainly used in industrial mass production.

Today, traditional industrial robots are being gradually replaced by cobots or upgraded to cobots. Cobots are expected to grow by 28% by 2025, making them one of the fastest growing robot categories.

Personal Safety

Previously, traditional industrial robots were expensive and process integration times were long as only experts could program them. It was almost impossible to modify its function and scope of tasks. Due to the lack of sensitivity, the application range of the robot was limited by safety measures such as fences or other obstacles. To prevent factory employees from being injured, people and machines needed to be strictly separated.

Human-Computer Interaction

A cobot can move freely and its touch is human-like, so it can achieve safe human-robot interaction. Built-in collision recognition and prevention simplifies otherwise complex programming. The simple and intuitive programming interface takes only a few minutes to complete. The use of sensors provides a high degree of flexibility for interactive learning. Therefore, cobots can handle specific tasks independently.

Cobots: Infineon as a User and a Developer

Infineon occupies an outstanding position in the field of robotics. Infineon uses robots for production and supplies components for this technology due to its extensive product portfolio. This gives Infineon a unique perspective as both a customer and a user. That's why Infineon not only has a deep understanding of new products but also offers complete integrated solutions.

As a producer and supplier of semiconductors, Infineon can provide customers with key elements for Industry 4.0. It is applied in multiple ways:

• **The sensor captures the data, the microcontroller processes the data, and the power semiconductor device puts the data into practical applications.**

• **Chip-based security solutions protect critical data like robot calibration information.**

• **A 3D camera radar system simplifies human-machine interaction through intelligent target localization, environment scanning, gesture, and voice recognition.**

Automobile Industry

Automation has increased the factory's productivity at Infineon by 70%. Despite this high level of automation, the workforce has stayed at 2,000 employees. The increased level of automation enables the company to continuously optimize process design and innovate. Low-skilled jobs are replaced by new high-skilled jobs, such as data analysis and product development. In short, humans and robots work together, rather than one being replaced by the other.

Programs and Cooperation Agreements With Startups: Infineon and Cobots

Europe's largest research initiative in Industry 4.0, the Productive 4.0 initiative, was launched in 2017. Coordinated by Infineon, more than 100 partners from 19 European countries are working to digitize and network industries. These companies include BMW, Bosch, Philips, and Volvo, as well as leading research institutions such as the Fraunhofer Institute and the Technical University of Dresden.

Even in the future, the personal experience and creativity of employees cannot be replaced, so they will continue to advance and optimize the fields of innovation, quality management, and system failure resolution. At Leaware, we have always sought the integration of software and people to achieve effectiveness and productivity.

Advantages of a Partnership Agreement With a Startup

To keep pace with the development of Industry 4.0, cobots, and play an active role in shaping the digital future, Infineon is gradually strengthening its cooperation with startups. Startups are a preferable option for Infineon because they have qualities that mature companies lack. Mature companies may have strict processes, which makes it challenging for them to keep up with the pace of Industry 4.0. Further advantages of Infineon collaborating with startups are:

• **Strong creativity.**

• **New ideas for increasing the level of digitalization.**

• **Fast and pragmatic approach with short coordination processes.**

• **Breakthrough thinking.**

SOFTWARE DEVELOPMENT FOR INDUSTRY 4.0

Industry 4.0 has the potential to create substantial growth opportunities for manufacturing and national economies. Due to Industry 4.0's concepts and applications advancing, individuals need more IT and analytical skills. These skills are necessary for the successful conception and implementation of an Industry 4.0 project. This can be in-house, as part of your team, or through knowledgeable suppliers and system integrators.

If an organization's in-house resources can manage an Industry 4.0-based project, retraining is likely to be required to help close the emerging IT skills gap that has grown between technology and Industry 4.0. Higher employment levels in Industry 4.0 related roles will depend on how successfully organizations apply their learning to create greater efficiencies, develop new products or solutions, and reduce costs. These features have been developed and tested with great success at Leaware and we look forward to 100% implementation in the future.

Innovative Technology and Software

The advancing digitization of business processes increasingly focuses on how the customer will benefit, which can result in the combination of previously independent systems. As Industry 4.0 becomes increasingly popular, these processes and systems must be continuously developed and nurtured to meet the needs and requirements of stakeholders.
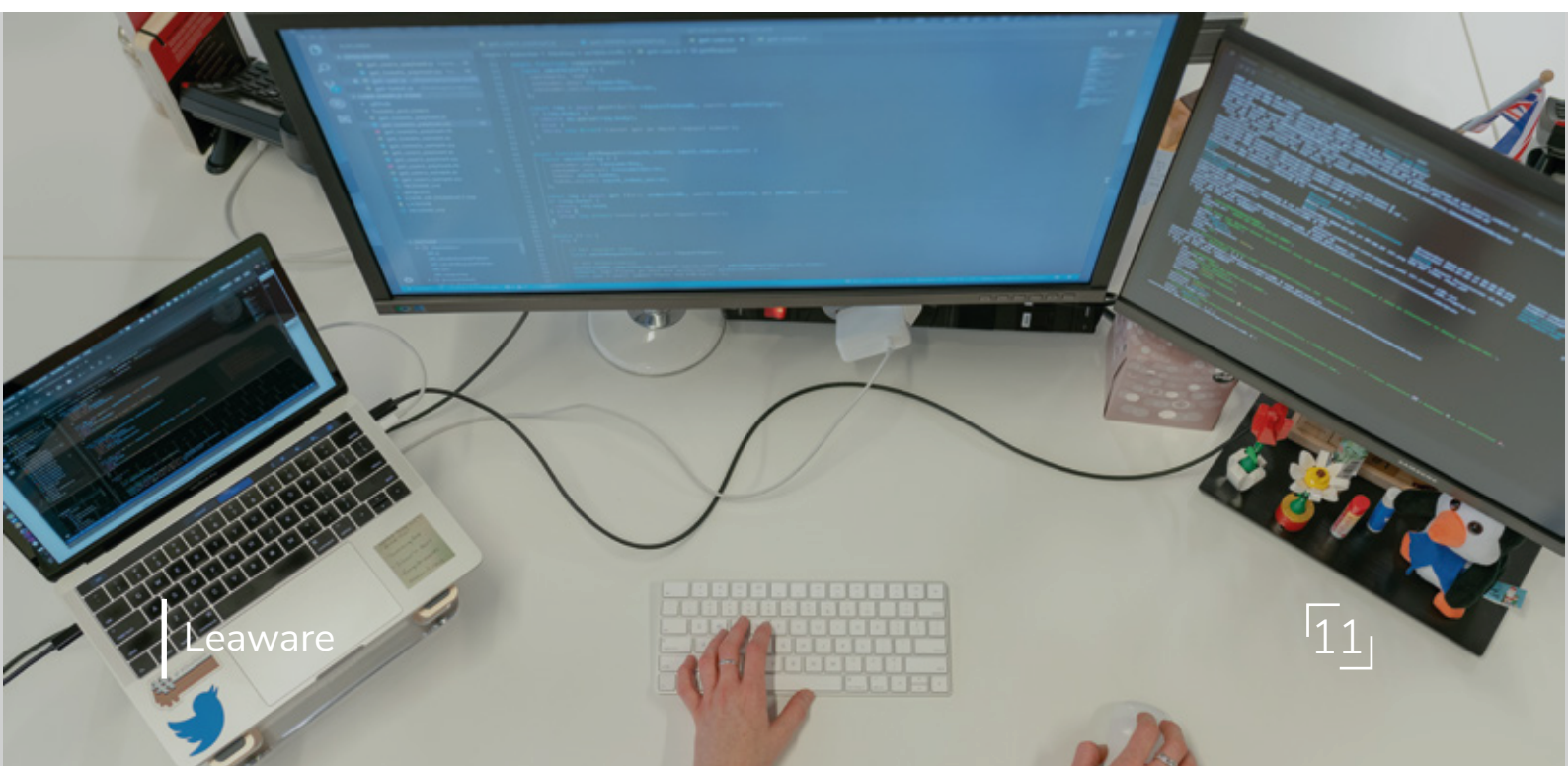
Industry 4.0's growth could have a major impact on the transformation of several different markets, including rail, energy, transportation, automation, manufacturing, and software development.

Challenges in Implementation

With advancements in digital technology, the integration of Industry 4.0 is theoretically simple but practically challenging when being applied in real-life settings. A major challenge is getting new devices to be compatible with the software needed to make integration seamless.

There is a particular lack of existing tools that would make it easier for hardware to integrate into a software environment that spans different manufacturers and different technologies.

Open-source software solutions can help overcome this obstacle but in many cases, a lack of standardization in the industry and a lack of understanding of what is available can cause additional issues.

Another challenge that organizations can face is that they tend to follow a specific route to suppliers to adopt the control principles they have historically used rather than exploring other routes. This results in the company being locked in, which limits their access to an Industry 4.0 environment and alternative solutions.

For Leaware, it has not been easy to integrate and implement these technologies, but thanks to the hard work of our team, we have accomplished our objectives effectively. Primarily, our success can be seen in the continuous evolution of our digital products, which have become more innovative and successful, and the increased satisfaction of all our clients.
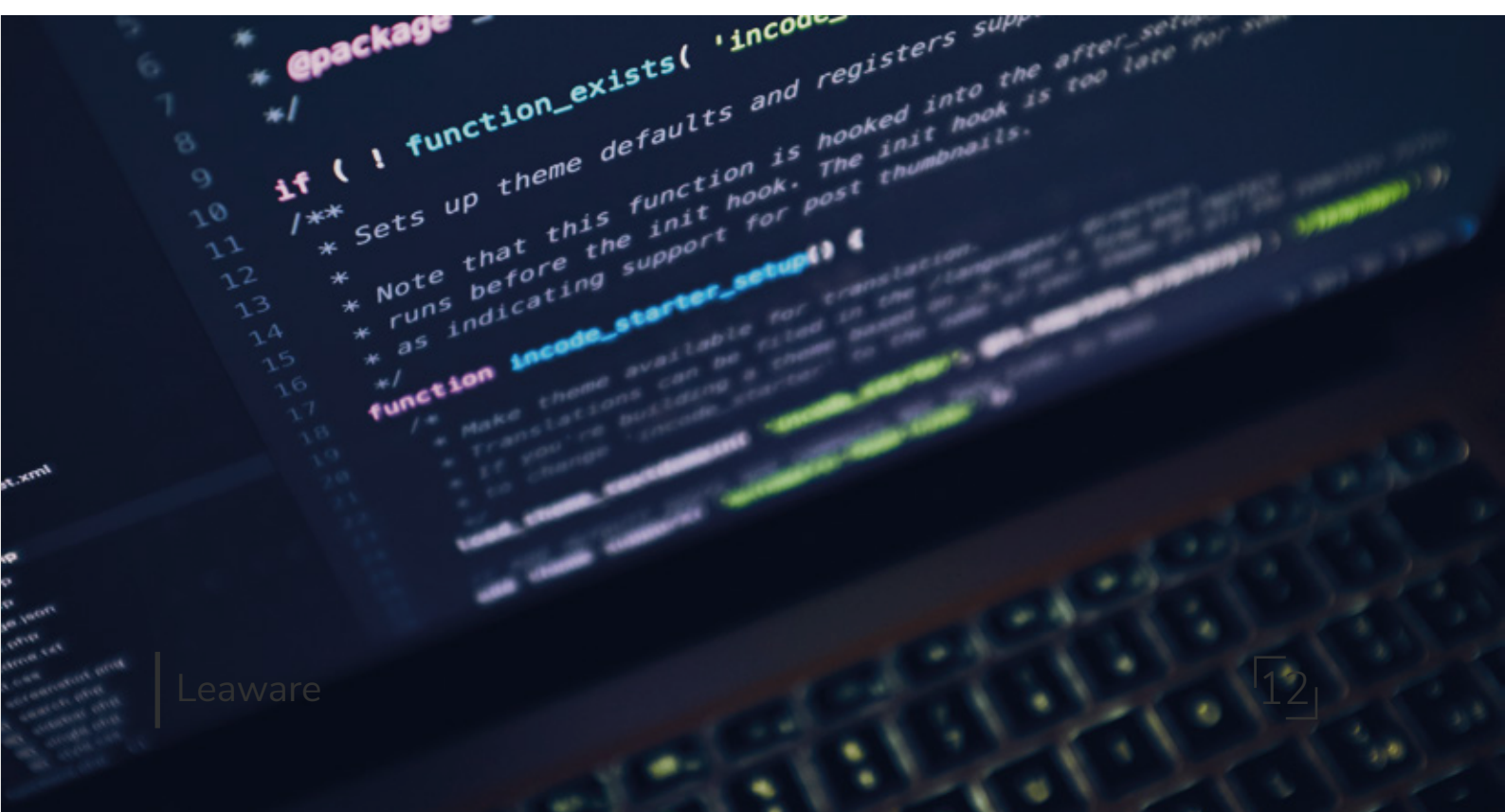
ABOUT THE AUTHORS

Since 2010, LEAWARE has been helping start-ups and already established companies build and develop their digital solutions, making them grow, boost their businesses, and succeed.

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