Sustainability 4.0





Research by OpenText found that 92% of manufacturers consider corporate social responsibility (CSR) to be important for their overall reputation. Yet, according to <u>Forbes</u>, manufacturing currently uses one third of the world's energy, with even lower-intensity sectors like refining, chemical and paper causing considerable strain on the environment. How can manufacturers better fulfil their CSR obligations, and contribute towards a more sustainable and resilient future?

Deloitte defines sustainable manufacturing as "the creation of products through economically-sound processes that minimise negative environmental impacts while conserving energy and natural resources." This implies that manufacturers must reconsider the entire manufacturing and industrial system, transforming how they design, source, manufacture, deliver and service their products.

How can this daunting prospect be achieved? This white paper explores how emerging Industry 4.0 technologies — like artificial intelligence (AI), machine learning, edge computing, simulation, additive manufacturing (AM), data analytics, the Internet of Things (IoT) and more — are the keys to more sustainable manufacturing.



The challenges

Sustainability creates a triple bottom line of people, planet and profit for manufacturers, yet they are expected to emerge as leaders of this change by developing and implementing sustainability strategies. We can also expect legislators to increasingly enforce sustainability rules around emissions, waste and labour over the coming years.

Here are the some of the most common sustainability challenges manufacturers face today:



Inside Climate News reports that steel, cement and ammonia production emits around 20 per cent of all human-caused carbon dioxide (CO2) emissions — steel manufacturing alone accounts for 11 per cent. Waste product is the main culprit here, as carbon in the coal combines with oxygen in the ore. It's estimated that 2.2 tons of CO2 is generated for every ton of steel produced.

Fear of change

Some manufacturers are reluctant to step away from their established way of doing things because any change invites risk — whether it's a production process, communication method, machine or tool. Another issue is mismanaged manufacturing operations, leading to a lack of producer responsibility or production processes that are designed without considering their environmental impacts.

Waste management

The linear economy – where manufacturers take resources from the earth, use only what's needed and then throw away what's left into landfills – has underpinned manufacturing for over 200 years, and continues to fuel the climate emergency. Moving away from the linear model towards a circular one, where resources are kept in use for as long as possible, requires a mindset shift from manufacturers, with the risk that such a change won't yield direct or imminent business value or impact.





Depleting resources



As global demand for fossil fuels peaks and global energy consumption gets higher each year, the use of fossil fuels is increasing too. According to **MET Group**, the world will run out of non-renewable fossil fuels this century: "We simply do not have enough renewable energy to supply our industries' and populations' full demand." Renewable energy isn't yet popular enough to counter this trend. Oil can last up to 50 years, natural gas up to 53 years and coal up to 114 years, reports MET.

Climate disruptions

Harsh weather conditions can majorly impact supply chains that facilitate the production of everything from computers and cars to food and medicines and are worth almost \$20 trillion annually <u>according to</u> <u>McKinsey</u>. This is one cause of the current semiconductor shortage as, along with disruptions caused by the COVID-19 pandemic, severe weather conditions have impeded the delivery of electronic chips around the world.

Water shortages

Manufacturing accounts for 16 per cent of global water demand. This is expected to rise to 22 per cent by 2030, warns the engineering company **Aurecon**, with food and beverage facilities and fast moving consumer goods (FMCGs) being the main culprits. Meanwhile, **World Bank** reports agribusiness accounts for 70 per cent of all freshwater withdrawals globally, on average, with an even higher share of consumptive water use. Emerging regions with developing manufacturing facilities are the most water-stressed.





Energy breakdown (73% of the total)





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The solutions

Manufacturers aren't only expected to overcome the sustainability challenges, the most successful will be looked to as leaders in developing a successful sustainability strategy. Fortunately, there are gains to be made for manufacturers that seize the challenge. The Digital Factories 2020 report by Pricewaterhouse Coopers (PwC) recommends that "companies must make smarter decisions using predictive analytics and machine learning." Indeed, 98 per cent of manufacturers surveyed by PwC said they expect to increase their efficiency through the use of predictive maintenance.

Before we delve into viable solutions for sustainable manufacturing, we must first consider technology as a necessity for sustainable manufacturing. With robots, AI, machine learning and more, industry will see a convergence of environmental sustainability goals (ESC) with Industry 4.0 – all through automation.

Here are the solutions manufacturers should consider:



Smart factories

Predictability is becoming increasingly important to modern manufacturing, specifically by collecting data using connected devices and by implementing cloud computing for real-time analysis and decision making for predictive maintenance. The rise of smart factories coincides with increasingly limited human supervision, unmanned and lights-out production.



Rise of the cobots

Market Data Forecast predicts the global cobot market will grow from \$ 981 million in 2019 to \$ 7.172 billion by 2025. Cobots have numerous advantages over traditional industrial robots. They are smaller and therefore easier to relocate, install and integrate in a production's layout. They are also a cost-effective investment, bringing a fast return on investment (ROI). Humans and robots will increasingly coexist in automated manufacturing.









Simulation technologies

Simulation technologies like digital twins are growing more advanced as data acquisition becomes more sophisticated, using IoT technologies to gather information about real-time equipment usage SCADA (Supervisory Control and Data Acquisition) control systems, sensors and more. Simulation technologies will prove vital to increasing efficiency and sustainability by helping to reduce energy consumption and identifying process improvements in machine run times, operating speeds and more.

Circular economy

The Ellen MacArthur Foundation estimates that circular economy activities could yield up to \$700 million in annual material cost savings for manufacturers by changing the way products are designed, made, sold, used and reused. For example, Swedish tooling specialist Sandvik Coromant has embraced its **own circular economy**, buying worn carbide tools back from its customers and recycling them into the new products. This requires 70 per cent less energy and emits 40 per cent less carbon dioxide. Sensors and the IoT can play a vital role, here, by collecting specific data on the use of products.



Leveraging renewable energy

Smart technologies help factories embrace green and renewable energy sources like solar panels, wind turbines and geothermal pumps to power factories. In these cases, an IoT device is deployed to send information on electric power, water, or fuel usage to help spot and remedy power inefficiencies. Sophisticated plant production management software can allow the real-time monitoring of water use and water loss.



Supply chain transparency

With IoT technology, companies can know the availability, location and condition of goods in the supply chain. Sensors attached to packaging can transmit real-time data on temperature, humidity or any shocks. Buyers can avoid receiving damaged goods, or suppliers can alert their driver or shipping company to take corrective action.

These are all examples of how Industry 4.0 and IoT technologies can help accomplish sustainability goals in a less expensive and smarter way.



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The benefits

The most outstanding benefit of automation and Industry 4.0 is predictability. Put simply, predictive data analytics and machine learning allow manufacturers to make better operational decisions. As stated in PwC's Digital Factories 2020 report, "Connecting the dots inside the factory and within the company ecosystem, as well as intelligent use of information, will be a "must-have" to stay competitive.



The main benefits of using automation in a sustainability strategy are:

- Better operational efficiency
- Enhanced brand reputation and public trust
- Access to new customer segments
- Long-term business viability

However, companies shouldn't forget the importance of people power. As a paper published by Brazil's renowned Federal University of Technology – Paraná (UTFPR), **Human Factor in Smart Industry: A Literature Review**, put it: "Human work will be indispensable in smart industries, both for the development of this concept as the management and for the operationalization of advanced production systems, technologies and processes."

By embracing digital transformation and empowering the human workforce manufacturers will drive efficiency, improve processes and ultimately enable the supply chain team to perform at an entirely new level of sustainability.



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Examples from around the world

Oslo, Norway

<u>Vestre</u>, which manufacturers urban furniture, has embraced a number of Industry 4.0 solutions such as robots and self-driving trucks. That includes using automation systems to control its factory's HVAC systems, which are operated by tablet device. The company has reported higher efficiency and increased utilization-per-unit carbon emission as a result.

Helsingborg, Sweden

Johnson & Johnson, the global medical device manufacturer, has set-up its first-ever **carbon dioxide-neutral facility**. The plant uses automated systems, smart energy management and green technology. The site's overall equipment effectiveness increased by 14 per cent through the use of robotic apps and digital twins.

Hautapu, New Zealand

Aurecon and Fonterra, a dairy company, have jointly-implemented a smart mechanical and automation design for a new lactose evaporation plant. The new evaporation system reduces the number of clean-in-place (CIP) automated cleaning regimes required per unit of lactose production, minimising the amount of water and chemicals used while simultaneously increasing lactose yield.



Conclusions

From COVID-19 and growing market demand to depleting resources and climate disruptions, manufacturers face a myriad of challenges in their sustainability journey. To overcome these and fulfil their CSR obligations, manufacturers should take a multifaceted approach to green operations with automation and Industry 4.0 technologies. But sustainability is about more than the triple bottom line. Manufacturers must also reassure partners, customers and communities around the world that they are helping to tackle global environmental issues.

Even though manufacturing still accounts for a third of the world's energy consumption, at the same time, more and more companies are getting on-board. 61 per cent for manufacturers interviewed in PwC's Digital Factories 2020 report cited sustainability — specifically, improving sustainability by reducing their raw material consumption — as a top reason for expanding digital factories.

So, we can be hopeful that more manufacturers will do their part to help create a more sustainable and resilient future.

For more resources on industrial automation and smart manufacturing, visit EU Automation's online **Knowledge Hub**.

