Editorial Corner

Industry 4 and the Future of Smart Manufacturing

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A few days ago, at 10 p.m. in the evening, my printer failed as I was working from my office at home in the UK. A repair would have cost more than a replacement and taken several days. I spent the next hour researching on line the model I wanted to buy. It was out of stock locally, but was available from the manufacturer. At 11:30 p.m., I placed an order. By 11:35 p.m., I received an automated acknowledgement. At 11:40 p.m., I received an email from an international carrier in the USA saying they had been instructed to pick up the computer. At 8 a.m. the next morning I received a further notification from the carrier to tell me that they had picked up the computer from a manufacturer location in Holland and it was on its way. The next morning I took delivery. I was able to track every step of its journey.

This level of service has become commonplace, but the availability of real time information, the communication and integration throughout the supply chain from order to delivery, and the automation of the information and decision making processes would have been unthinkable just a few years ago. The unprecedented development of IT and communication technologies, often referred to as the 4th Industrial Revolution, has opened up amazing opportunities to create smart factories, smart manufacturing and smart value networks, limited only by a business's ability to imagine the possibilities.

Powerful, configurable and intelligent computing allows multiple sensors to be integrated into the design of mechanical and electronic devices at little cost. This enables the development of cyber-physical production systems in which machines communicate with each other, and with handling, transport and storage devices; and that can be networked with internal planning systems and, via the internet, with external information systems in a so-called "Internet of Things". Such intelligent machines can monitor their own performance to improve quality and productivity, and can interact dynamically with scheduling and control systems throughout the value chain.

Sifting through the quantity of data that can now be produced routinely, requires "big" data analytical systems to sort, store, extract and manipulate the data to achieve the necessary management information and integration. Many software companies now offer big data platforms so that companies no longer have to invest in developing their own software; and the availability of 4G and 5G allow high volumes of data transfer through the internet at rates that may permit real time control and decision making. Companies no longer have to struggle to build and maintain their own IT capability to keep up with the exponential increase in data generated, but can store all their information and manage their inter-operablity through the cloud, which enables value added networks of producers and service suppliers to be created quickly, easily and at relatively little cost. Future developments in computing and IT, such as developments in quantum computing, will vastly increase still further the speed and capability for data interchange.

Creating the computing, IT and sensor technologies that underpin and enable the manufacturing systems of the future needs to be supported by developments in artificial intelligence, simulation and decision support systems. Data is not an end in itself but the means to higher efficiencies, faster product development, a reduced time to market, sustainable manufacturing, environmental protection, the elimination of waste, and lower cost. Understanding the interaction between products, processes, information and people in a smart factory can lead to many routine decisions being

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delegated to the technology and associated systems, and to the improved capability of decision makers to visualise and evaluate alternative actions before choosing and implementing solutions. "Business at the speed of light" is becoming closer than ever and the advantages are available to organisations of any size.

There are many challenges to the wider adoption of smart manufacturing. Equipment designers must design-in data and communications facilities to satisfy a range of international standards. Businesses must create decision-making capabilities that can co-ordinate across value chains. Engineers and managers must be educated to have an understanding of the technicalities of implementing advanced computing and communication technologies, and the imagination to visualise novel and innovative solutions.

There is a sequel to my opening computer story, with an important warning to us all. As I attempted to download the printer drivers from the manufacturer's internet site I received a "fatal error" message, giving me a manufacturer's helpline to ring. The service engineer was polite, but I became suspicious when he instructed me to delegate control of my computer to him to fix the problem. He rang off abruptly when I questioned him. Further investigation revealed that I had logged onto a clone site and was being scammed, with a view to installing malware on my computer. When I logged on to the genuine site, the printer connected without problem. The lesson is that as we make increasing use of cloud computing, shared platforms and internet connectivity, we expose ourselves to hacking and cyber-crime with all its attendant disruption and disastrous consequences. We must ensure that developments in cyber-security at all levels keep pace with the technical developments in Industry 4, to stay ahead of the cyber-criminals and be at the forefront of protecting smart manufacturing systems from threat.

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