The changing face of manufacturing

Change is happening all the time and the Industrial world is no exception. Often when 'change' is being executed it is accompanied by 'fear' of the consequential unknown results. For manufacturing the current catalysts of change are the Robots, AI and Digitalization – what worries people is the potential impact on jobs, manufacturing and society as a whole.

Adding Robots and AI to the manufacturing mix is not like simply adding salt and pepper to a culinary delight – the results reach far into the future and can impact in more direct ways.

When the automobile was first introduced in the UK a man had to walk ahead of it with a red flag as a safety precaution – today, just over 150 years later we have cars that drive themselves. It's an exciting prospect to imagine what Robots and AI will be like in 20 years time.

The debate is not new, but has gained momentum thanks to increased awareness, prompting the Japanese Government to create its own vision going beyond Industry 4.0, with an all-encompassing policy called Society 5.0, which calls for a socially responsible approach to application of technology.

Robots and AI are not new; the concepts have been around for decades, but technology is now catching up rapidly to make them a reality. According to the Edelman AI Survey 2019, public awareness and comprehension of these subjects is at a similar level to that of the experts, as also awareness of what constitutes AI and its potential applications. So it is puzzling that there still exists a popular perception that by just 'adding AI' to a situation, everything will improve magically, like adding seasoning to a culinary creation. Unfortunately, it does not work like that in cooking, nor in applying technology.

The robot has numerous tasks and challenges – from determining its position, understanding parts location to managing gripper operation, creating optimal travel paths, and avoiding people and machine parts. Unlike humans who have five senses, an 'out of the box' robot is basically pretty dumb having none – no vision, touch, smell, etc. To equip this robot with such 'senses' one needs to add sensors that provide the required information. But more critical is the need to integrate all those inputs into a coherent picture of the operating environment, where the AI ecosphere could potentially help.

To see a truly amazing video please take a look here www.youtube.com/watch?v=C6FrMznGI1s

Another challenge is the lack of common rules and processes for implementing AI. Also there are more types and designs of AI and AI components than one can imagine – from neural nets to Bayesian inference, decision trees to Occam's razor and everything in between. Each has its strengths, weaknesses and purposes so combining them is how new and stronger AI processes evolve. In the final analysis, it is basically an attempt to replicate 2000 years of evolution, which has equipped humans with the ability to make rational decisions with minimal input. And the result? Just like humans, it is not infallible.

Not as easy as it looks

On 23rd March 2016, Microsoft released a new AI chat-bot called Tay, which had to be turned off 16 hours and 96,000 tweets later, because some mischievous netizens realized they could train Tay with politically incorrect and offensive phrases. More recently some reports have suggested that the critical failure of Boeing's 737 Max8 is a result of human-machine disagreement. Similarly, it has been reported that IBM's Watson had to step back from diagnosing cancer patients as it was prone to errors. These examples are quoted not to criticize or spread panic, but to highlight how difficult is the application of autonomous decision making and machine control. While the companies in question have either solved the issues or are working on it, it is better to proceed with an element of caution. History is a great teacher; if one looks back in time, the first automobile on the roads of England required a man bearing a red flag to walk in front. Some 150 years later, companies are now experimenting with autonomous cars.

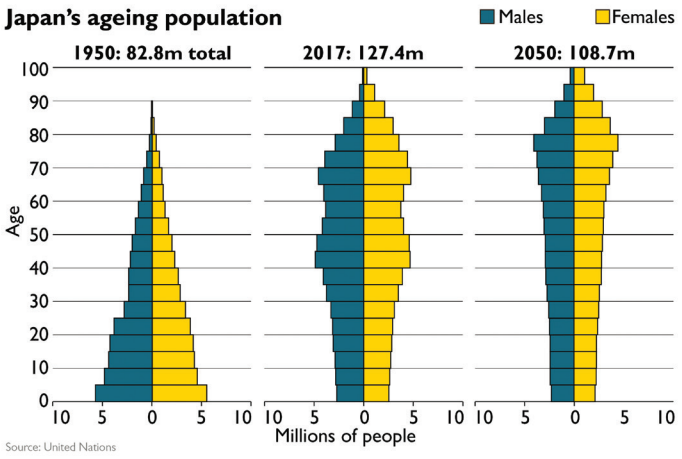
The success of AI applications is influenced by the complexity of the problem, i.e., the more complex a problem, the more computing power, energy, training, data and inputs are needed to achieve stable, reliable operation.

Coming back to the robot, one of the challenges is the ability to 'see'. It is easy to think that adding a camera will solve the problem, but sometimes seeing is not believing as appearances can be deceptive! The perception of depth remains a critical challenge. For humans, it is unremarkable to pick up a glass of water, because they can determine the physical extremities of the glass, and relate the glass form to the hand/finger positions. Image a scenario where even a human was fooled, so what chance does a robot stand?

An example of hyper realistic drawings – it is difficult to tell which egg is a drawing and which is real. There are many such amazing drawing videos from artists such as Howard Lee available online. So instead of thinking of AI as an all-encompassing answer to a problem, maybe it is more practical to think of AI as a series of tools that could enhance the manufacturing situation whether that involves machines or humans.

What is the social impact?

As seen in the Tay example, AI is agnostic; it has no inherent ability to determine right or wrong, good or bad. AI is only as good as its training, which is effectively its programming.



The changing population is not just important to statisticians – all parts of society including manufacturers are impacted.

One can also see similarities with self-driving cars, i.e., where does the legal responsibility lie? What happens in a runaway event – who steps in to stop it? Furthermore, as seen in the social media world, there will be questions around data ownership – who owns it? Tough questions, but it's best to leave the legal issues to the lawyers and take a look at the social-job aspect.

A 2018 United Nations report states there are now more people over 65 (705m) than under 4 years old (680m). Why is that important? In China the over 65 rate is 10.5%; across the European Union it is 19.7%, in Italy it is 23%, but in Japan it is almost one third of the population (27%). So it is hardly surprising that governments are debating the pensionable age and system viability. Compounding this, the average life expectancy in Japan is now 84 years; which means there are a lot of people living much longer. But the point is, even if one could work till 84, is it safe?

Japan has reacted by relaxing the laws around migrant workers. The result, according to its Ministry of Health, Labor and Welfare, is an increasing number of migrants, with the largest volume – 30% – in manufacturing jobs. That's good news. However, when they return to their home country, the investments in training and know-how acquisition will be lost. This hidden imperative suggests that manufacturing could possibly benefit from robotics and AI technologies.

Unfortunately this is actually a global problem. A recent report by Citigroup/World Bank states that developing nations have the highest risk of workers being replaced by automation. China is a case in point. As the initial numerous 'low-cost' workforce became more skilled, acquisitive and aspirational, labor costs began to rise as workers were prepared to change jobs for better salaries. This coupled with increasing quality issues related to lower worker motivation and less specialized training has led more and more companies to opt for greater automation. The more advanced countries are seeing less worker replacement by automation because they had already made those changes years earlier in order to remain competitive with China in the first instance.

Robots and AI may not be the threat that some people think and could even be essential in the future manufacturing environment.

So now the very technology, which seemed to threaten jobs, is actually instrumental in protecting them! This is especially true in today's internet driven world where consumers have more choice of products which they want faster. Traceability also becomes more important as manufacturers' have higher after sales risks due to shortened product lifecycles.

Tomorrow's automation landscape

The trend for digital home assistants provides a very good clue to the future. One can expect various platforms to utilize AI 'skills', each dedicated to solve different manufacturing problems, e.g., voice recognition to support security or the systems to augment new worker training, etc. Similarly, the perfect AI will be invisible just like an automated robotic room cleaner, which is bought to clean the floor not because it has AI. AI will be implemented at all levels of production process, from cloud systems to predict demand to device embedded diagnostics supporting fast decision making, reducing unnecessary network loads and strengthen system resilience.

But this is not the world of tomorrow – it's already happening. For example, robot augmented bearing insertion benefits from a 65% reduction in setup time; farmers operate plant nurseries with less staff and have faster product (plant) adoption; while robots that can perceive depth are 30% more successful to pick random parts from picking bins.

Mitsubishi Electric is excited about the prospects for the world of manufacturing, which is why the company is sharing the e-F@ctory concepts for digital manufacturing and applying its bespoke AI platform, MAISART, on a component level. Never has the company slogan been more prophetic, 'Changes for the Better'! ■