

Industry 5.0: Is the Manufacturing Industry on the cusp of a new revolution?

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first industrial revolution - 1780s
- steam power



second industrial revolution - 1870s
- electrification



third industrial revolution - 1970s
- automation



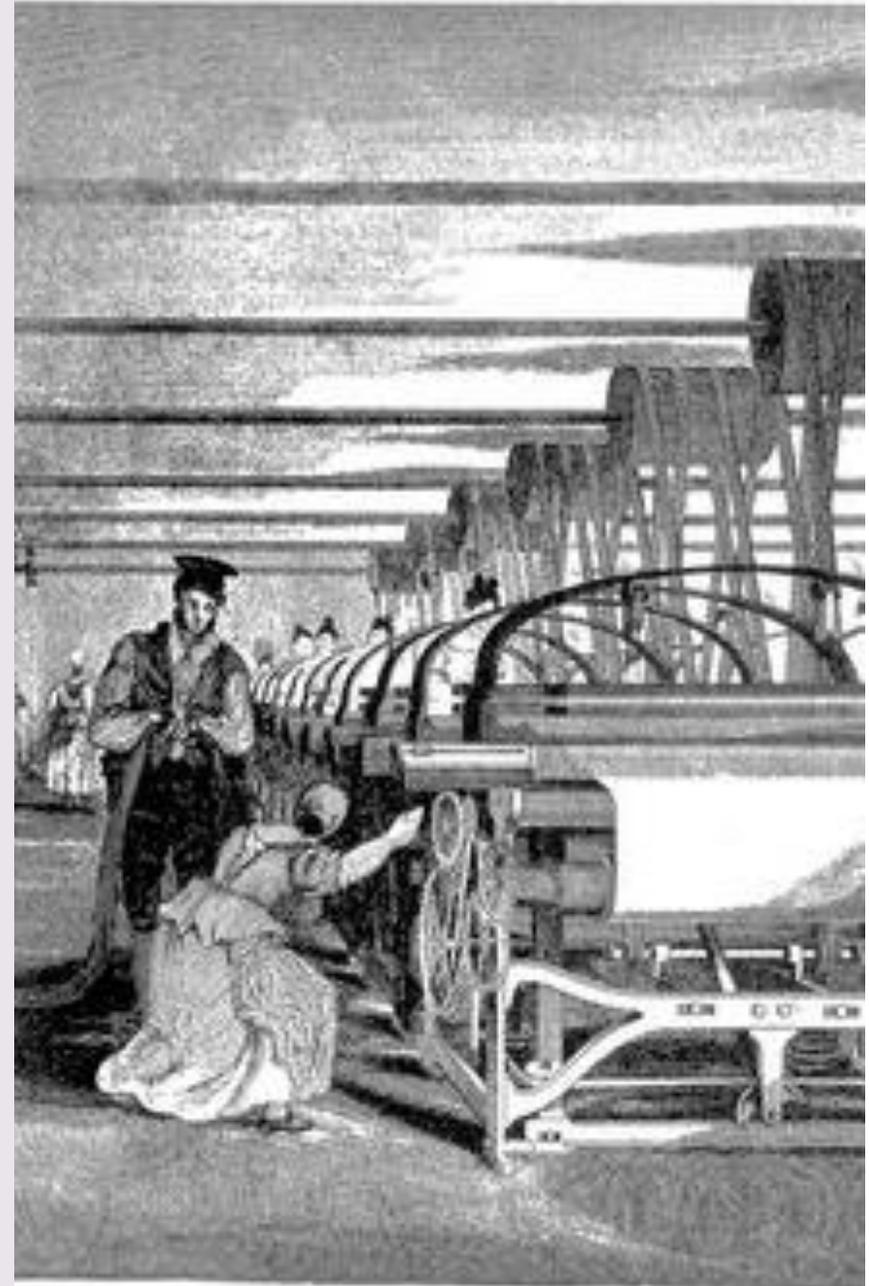
fourth industrial revolution - current
- digitalisation



fifth industrial revolution - future
- personalisation

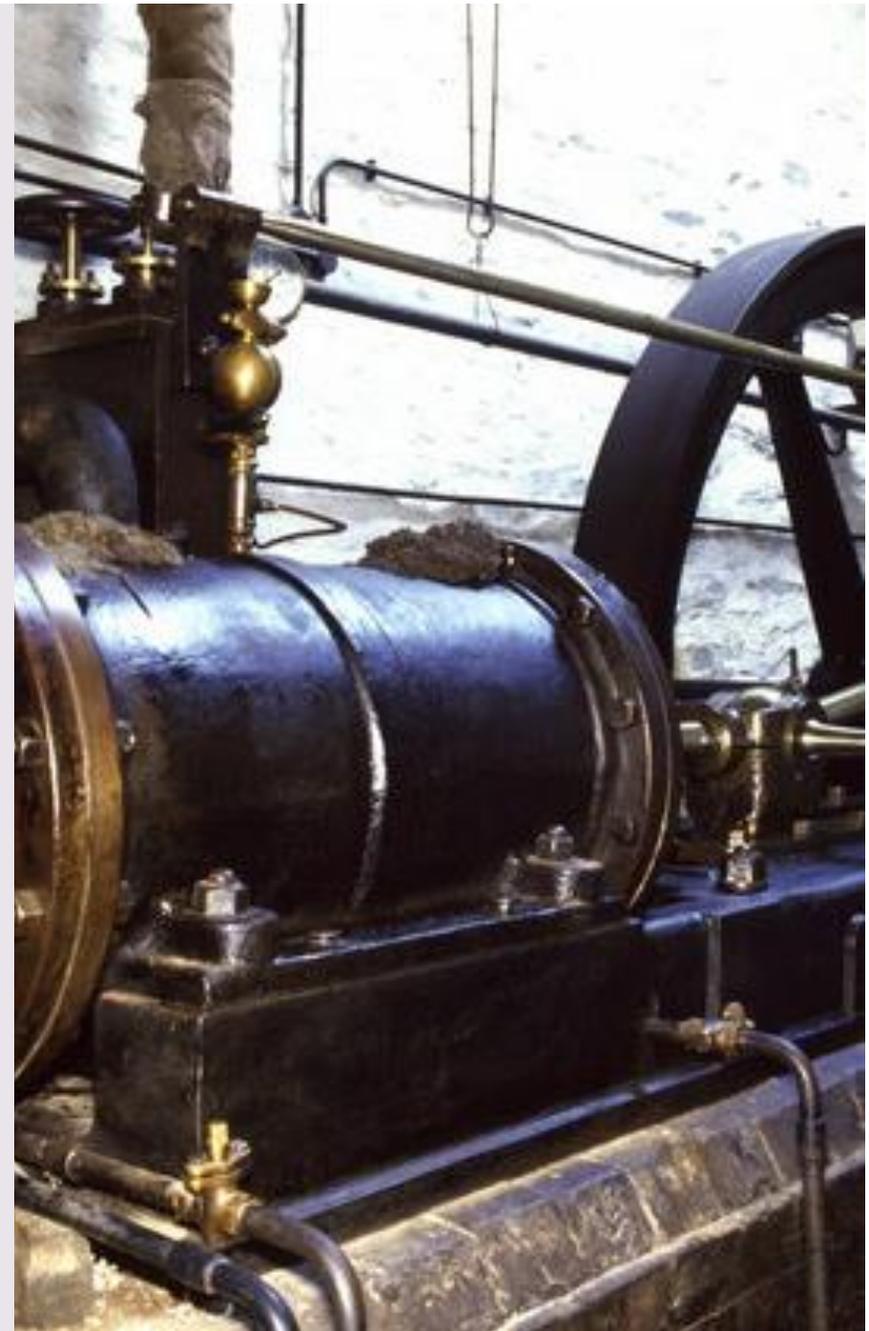
Looking backwards

A Roberts loom in a weaving shed in 1835. Baines, E., 1835.
History of the cotton manufacture in Great Britain. H. Fisher, R.
Fisher, and P. Jackson.



First Industrial Revolution: 1780s - steam power

- **United Kingdom led the way in the first industrial revolution**
- **In manufacturing hand production methods were replaced with steam and water powered machines**
- **Resultant population growth and improved standard of living for the working classes**
- **Technology meant higher wages which resulted in the population being able to afford better education and training**
- **Increased numeracy and literacy contributed to invention and innovation**
- **High real wage meant greater mass markets for goods**



Second Industrial Revolution

1870s - electrification

- **Introduction of electricity and electrification**
- **One of the most important inventions ever, with high social impact, and improvement of quality of life**
- **Manufacturing plants switched from steam and water power to electricity**
- **Efficiencies increased**
- **Both hydro electric power and chemical fuel from petroleum were also discovered at this time**
- **1880s Taylorism - scientific management - was invented - significant impact on the workforce**
- **1908 Model T Ford started production in Detroit Michigan, USA.**



Third Industrial Revolution

1970s - automation

- **Automation replaced the human where work tasks were difficult or dangerous in 1970s and 1980s**
- **First automatic machines were designed for welding, materials handling and product assembly**
- **1980s robots become less expensive and were used in more diverse applications**
- **As new technology was introduced, the workers had to upskill or they were replaced by more highly skilled workers**
- **Result of rapid technological change was the widening inequality, the slowing productivity growth and the decoupling of productivity to wage**
- **Large scale investment in capital equipment required as well as investment in the skills of the staff**



Current

The internet of things, digitisation, blockchain, advanced materials, additive manufacture, artificial intelligence and robotics, drones, energy technology, biotechnology, neurotechnology and virtual and augmented reality.



Fourth Industrial Revolution current - digitisation

- **The fourth industrial revolution extends and transforms digital technologies**
- **Information storage, processing and communication are the vital elements**
- **The digital networks facilitate the movement and manufacture of physical products by knowledge transfer**
- **Incorporates integration across core functions from production, materials sourcing, supply chain, and warehousing all the way to sale of the final product.**
- **Cyber security is vital to survival of company**
- **Workforce need to upskill to remain useful and to futureproof themselves in an ever increasing automated workplace**



Looking Forward



Fifth Industrial Revolution Future.... building on digital technologies

- **What is the next phase?**
- **Ideas and theories?**
- **Human & machine roles?**
- **Big solutions for big questions?**

- **Various ideas....**

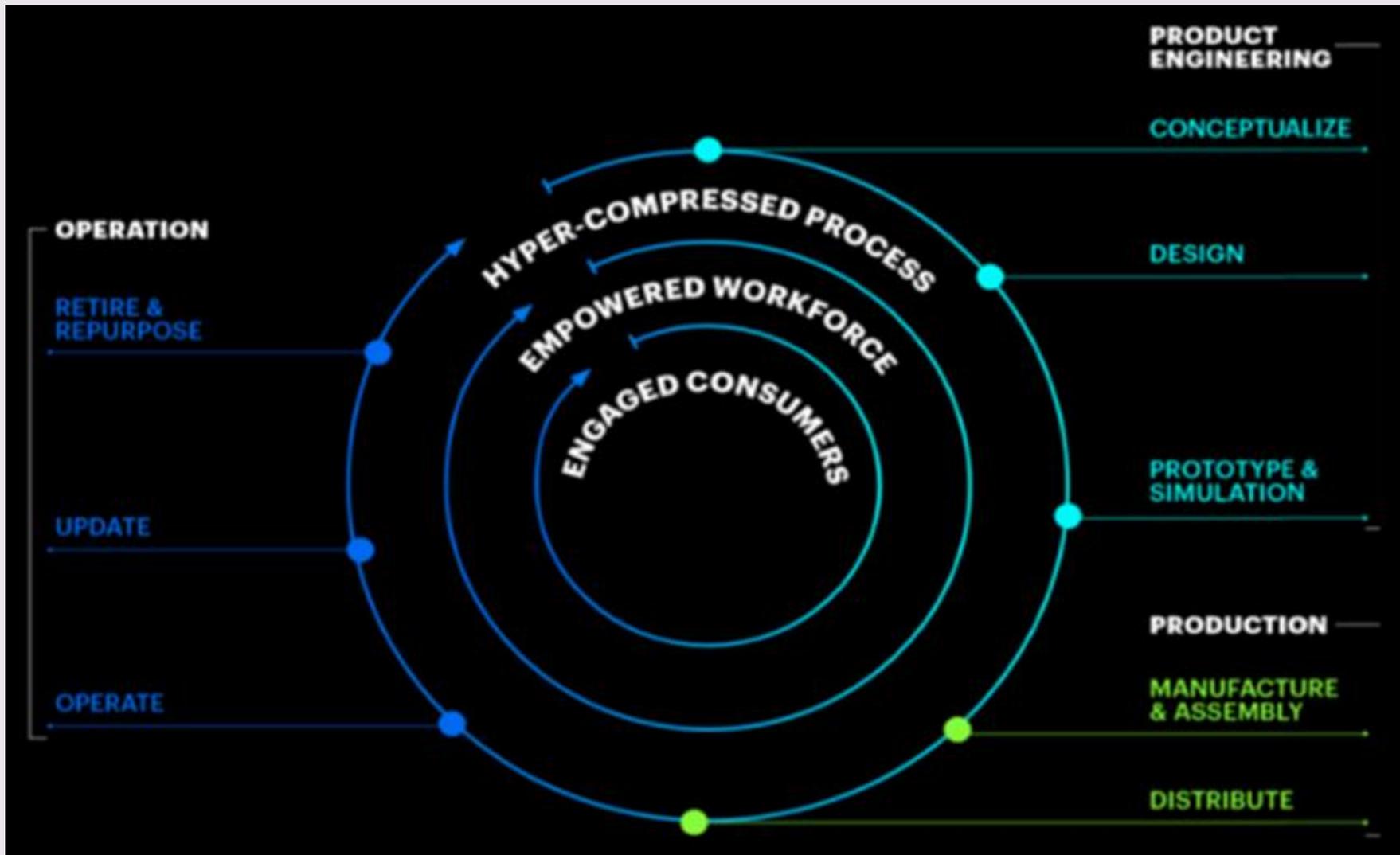


Accenture

- The final product will be designed for the individual based on their personal requirements, otherwise known as '**personalisation**'
- The product will be manufactured in an **agile** manner, taking the **digital requirements** and using radical **new manufacturing techniques and materials**
- It will bring **new technologies to the mass population**.
- Manufacturing will not be just agile and lean, but automated, digital and **data driven**
- Extremely **high quality** and available at more **affordable prices**



- https://www.accenture.com/_acnmedia/PDF-63/Accenture-Industry-X0-POV-RGB.pdf



PRODUCT MANUFACTURING REINVENTED - Accenture.

Phill Cartwright

- **Creation of high value jobs** due to freedom of design and the associated responsibility handed back to the human designer/engineer
- **The human being has more responsibility** and you end up with a bigger, lighter environment that's safer than the previous environment.
- **Freedom of design** which enables **products that are more bespoke and personal.**
- Humans will be taken out of the manufacturing but they will be more involved in **how the product is being used** and **how it can be designed** because they have more information.

○ <https://www.raconteur.net/technology/manufacturing-gets-personal-industry-5-0>

Korcomptenz

- We are “currently still in the midst of industry 4.0, where **manufacturing has become "smart"**
- Industry 5.0 is rapidly approaching, and it will bring with it **an increased human touch** back to manufacturing
- Where industry 4.0 put smart technology at the forefront of manufacturing, 5.0 will encourage **increased collaboration between humans and smart systems**
- **High speed, optimised automation** together in a meaningful way with the **cognitive, critical thinking of the human**

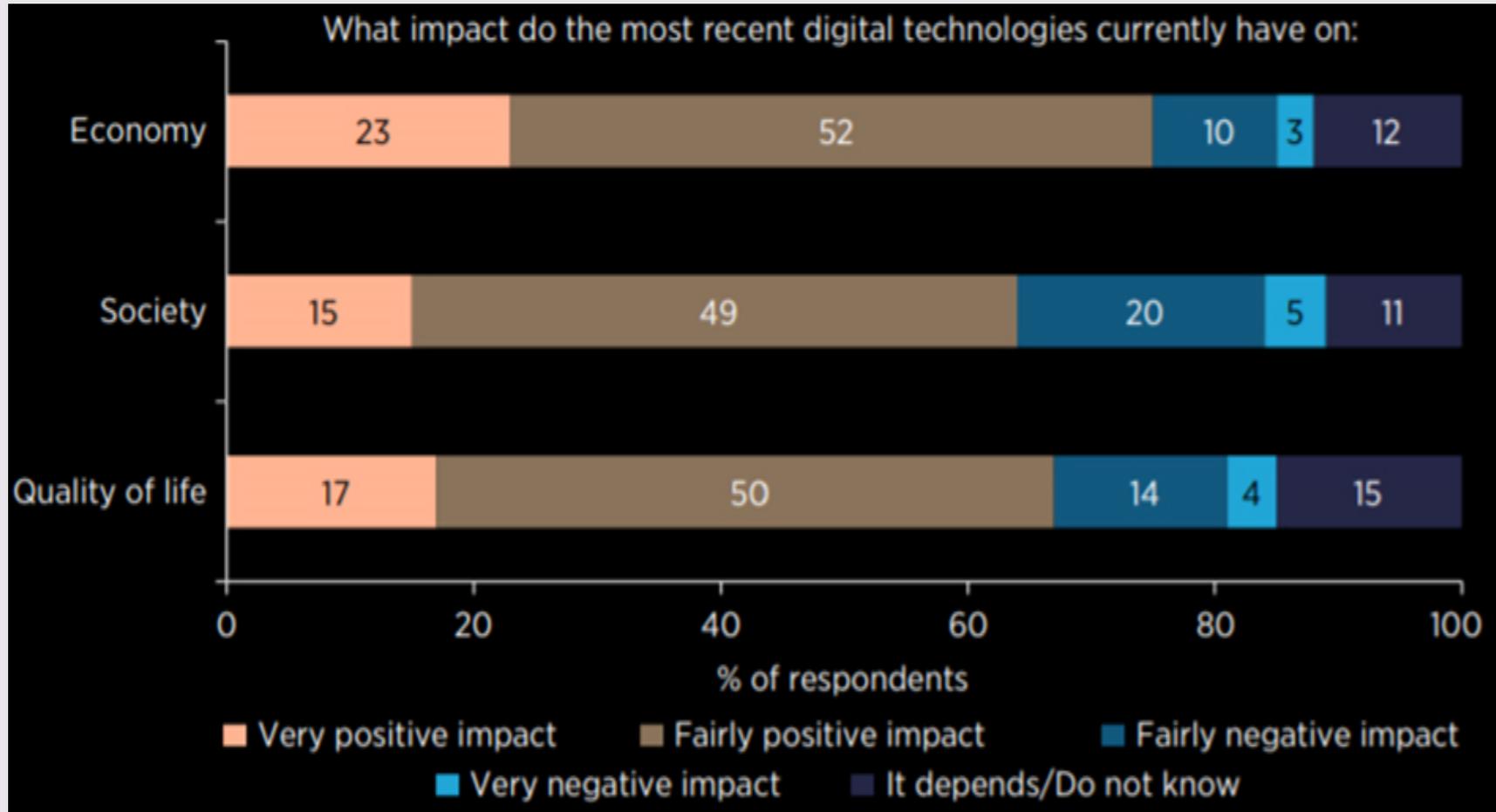
Deloitte

- 'The skills gap in **USA manufacturing 2015-2025** outlook' (2018)
- The study reveals that the skills gap may leave an estimated **2.4 million positions unfilled** between 2018 and 2028 in the **USA**
- **Humans** need to be put back in the loop
- Expanding **digital and “soft” skills**
- Leveraging the **digital toolbox”**

Martin Ford

“The rise of the Robots. Technology and the Threat of Mass Unemployment”

- 1980's with the **introduction of computers** the workforce were required to have IT skills
- 1990's **tech bubble** facilitated new jobs in technology sector
- **Wages and productivity** became disconnected
- Recession was followed by recovery, but many **white-collar jobs were erased**
- 2000 and onwards IT continued to strengthen but many jobs were **offshored**
- Computers and machines continued to **replace the worker; joblessness becomes the norm**
- Factors contributing to the “**disruptive economics**” include; IT, globalization, politics and growth of financial sector
- Ford predicts many **more jobs will be pulled into automation and robotics**. Low wage jobs will be replaced with self-service automated technology
- **Increasingly intelligent algorithms** will threaten higher skilled work.



A SURVEY INDICATING THAT TECHNOLOGY IS IMPROVING THE EUROPEAN ECONOMY, SOCIETY AND QUALITY OF LIFE.

In Summary



Education and Skills

- How to ensure that humans have a place in the highly automated workplace of the future optimizing human capital?
- Can the traditional education provider supply these skills?



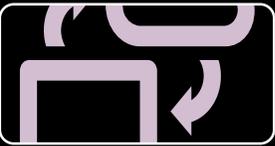
Working Environment

- How can the work of the employee become more interesting and fulfilling into the future?
- Can the workspace of the employee be safe and comfortable with the new technologies surrounding them?



Relationship between Productivity and Wages

- How can the rise of inequality be addressed in the workplace?
- How can wages keep in line with productivity into the future?



Ensuring the Best Technologies are used without making Humans redundant

- How can we ensure humans are not made redundant in this new environment?
- How can optimised decisions be made to ensure the newest and optimised technologies are used in manufacturing?



Optimum Product Characteristics

- The customer demands optimised quality, cost and delivery and how can this be ensured in an agile and connected factory?
- How can the customer be guaranteed product that is personalised and eco friendly?



Protection of the Environment

- Is the factory working in a sustainable manner meeting environmental targets set out for them?
- How can the company continuously make improvement to its environmental footprint?



Governance and Ethics

- How do we ensure that governance on new and future technologies will meet the requirements of an equitable society?
- Can moral & ethical standards be part of an engineering education and a working career, ensuring moral responsibility in future decision making?

Finally

Thank you for
your attention.

Questions?