

## Industry 4 and Production Management Research

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So much is written about **Industry 4** that many young researchers are wondering just what direction production management is taking and what areas of research should they be pursuing to keep up with current industrial trends. The exponential growth in technologies is leading to new materials, new and improved processing techniques: additive technologies such as 3D printing, used for years in rapid prototyping, are finding their way into mainstream production; and improved sensor technologies are leading to greater manufacturing precision and product reliability. Industry 4 has become an all-embracing term incorporating **big data** and the **internet of things**. It is driven by the rapidly evolving capabilities in computing, the wireless web and information technologies to enable the interoperability of robotic, machining, assembly and planning systems combined to form a network of smart factories communicating together in supply networks operating and controlled in real time through autonomous and intelligent decision-making systems.

Whilst the development of digital technologies and IT infrastructures make such a vision of the future entirely possible (and there is no doubt that to a limited extent it will come) we should treat the current hype with caution. It will be some time before mainstream manufacturing is driven by complex integrated cyber-physical systems. The cost of developing such systems with the appropriate reliability will remain prohibitive for many years. We should also remember the lessons of the past: recent advances in manufacturing and supply chain flexibility and efficiency have not come from highly automated and expensive Flexible Manufacturing Systems (FMS) but from a low cost approach to reducing manufacturing complexity through

the introduction of cellular manufacturing, quick change tooling, just-in-time pull control, elimination of waste and inventory reductions bringing about significant reductions in manufacturing costs to the benefit of the consumer.

And so the researcher can be confident that his/her work into such traditional areas as scheduling, optimisation and supply chain management remains relevant and may form the basis of the decision support systems which will be incorporated into the cyber physical systems of the future; and that in the meantime, in addition to optimising the performance of current manufacturing systems and chasing improvements in the mathematical modelling of hypothetical and simulated micro manufacturing examples, they spare more time addressing the bigger issues confronting industrial societies such as how to develop business models which encourage resource efficiency and closed loop supply chains: integrated manufacturing models which can improve flexibility and agility; and low cost efficient supply chains and manufacturing clusters which can accelerate the industrial capabilities of developing countries.



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