

## **Learning to walk before running: how Lean Manufacturing lays the foundations for Digital Transformation**

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With the frenzy of digital transformation, many companies may be attracted to quick, short-term solutions to solve their problems and improve their performance. However, can we really achieve better results without effectively changing the way our organizational processes are carried out? Can the integration of disruptive information and communication technologies foster lasting results without first engaging the workforce and developing a culture of continuous improvement? This is a very intriguing topic in current times, and we propose that achieving better performance demands much more than simply new technology acquisition.

Automation often raises product quality, while making manufacturing processes more efficient. This is especially true when taking into account the digital transformation that many industries are undergoing as a result of the Fourth Industrial Revolution. Highly automated manufacturing may enable the production systems to be modular and changeable, which is required to produce highly customized products in mass production. Contrary to conventional belief, researchers claim that automation will not lead to less human interaction or worker-less production facilities; but the competence requirements of workers are likely to change. In fact, the individuals' skills requirements are more likely to increase and become even more specialized. The level of capital expenditure that underlies Industry 4.0 (I4.0) technologies is quite intensive, reducing its implementation attractiveness, but adding importance to getting it right (e.g. right process, product and equipment).

At the same time, Lean Manufacturing (LM), which is based on the widely acknowledged Toyota Production System, is an approach adopted across many industries since late 1990s. LM aims at reducing waste and improving productivity and quality according to customers' requirements. LM implementation means a systematic human-centered approach, comprising a low-tech, low-cost and low-risk approach that excels for simplicity and effectiveness usually aligned with a shared business vision. Additionally, LM emphasizes the need for involving and empowering employees so that they become change agents within their workplace, regardless their role in the organization. An effective problem-solving process is a fundamental capability in a lean system, since it provides the development of both the organizational processes and the individuals who perform it.

We contend that to realize the benefits of I4.0, mastery of LM is foundational. LM principles and practices are likely to become more relevant as companies advance towards the Fourth Industrial Revolution. However, the integration between LM practices and I4.0 technologies may seem contradictory, since the technology-driven approach of I4.0 can conflict with the experimental and gradual continuous improvement implied by LM, in which people involvement is key to a successful implementation. Despite the apparent contradiction, LM sets the fundamental mindsets and behaviors that support a continuous improvement organizational culture. This allows the establishment of a work environment in which transparency and openness to change are significant values that drive daily activities across the company. If such company culture is not established, the integration of novel technologies might not lead to the expected results, wasting money and managerial efforts, and generating frustration. A similar situation was observed in the 1990s, when ERP systems were flavor-of-the-month, and many manufacturers invested significant money and efforts to implement them. Although the adoption of those systems promised clear benefits to companies, the integration of information and communication technologies into ill-structured processes led to a number of issues, resulting in the digitization of waste and non-value added activities.

As LM provides a means to systematically reduce waste based on the utilization of employees' creativity, a company that extensively adopts LM is more likely to benefit from the integration of I4.0 technologies. In other words, whenever the right behaviors and processes are in place, the integration of I4.0 technologies may find a solid foundation on which to build and provide for continuous improvement. In this sense, in order to realise the actual benefits of I4.0, companies must first consider their LM maturity. If they are still struggling with simple principles (e.g. *gemba*, relentless reflection, *kaizen*) and basic practices (e.g. 5S, visual management, standardized work) from LM, this might be a sign that they should be careful about deciding on major technology investments.

As we used to say to most managers who have worked with us in either consultancy or research projects: "you may buy your son the Michael Jordan's tennis shoes, Michael Jordan's shirt and Michael Jordan's shorts. I am quite sure he still won't play basketball like Michael Jordan". In other words, good technologies inserted into ill-structured and wasteful processes will not lead to better performance results. We need to learn to walk lean, before running with I4.0.