



Manufacturing Excellence 4.0

Smart manufacturing

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Introduction

In the manufacturing industry there is always a battle between effectively producing against demand and maintaining a sustainable cost base. This battle was fuelled by the globalisation of manufacturing causing price and quality competitiveness driven by customers demanding cheaper, more customised products. All while maintaining high safety standards. The example cited the most was that of the automotive revolution in Japan, with the need to out compete the American giants such as GM and Chrysler - a search for efficiency brought about concepts that are still deployed today. The most widely respected of these being Lean manufacturing.

The challenge that we now face is that these ideas that brought forward the move to agile manufacturing and the birth of the faculty of industrial engineering are cumbersome to implement. There are a few elements that are of highest concern when it comes to transforming using these traditional methods:

1. Availability and trustworthiness of information to make decisions and perform problem solving
2. Waste created through the process of implementing manufacturing excellence
3. Change management and buy in from all stakeholders across the organisation
4. Alignment of the Manufacturing Excellence (ME) programme with the overarching business strategy and objectives
5. Integration between core manufacturing processes and support functions

This forces manufacturers to think about how to create an orchestra of all these moving parts while still maintaining a balanced production environment. This process is generally challenging to visualise and the value of a Manufacturing Excellence programme can be difficult to illustrate.

It is widely accepted that, from all the types of industries, manufacturing (be it discrete or process) has always been ahead of the curve when it comes to digital transformation. The gap that exists today is the marriage of factory physics and commerciality. This document describes this relationship as it relates to how the ideas of ME are evolving in the new digital world – and how the search for efficiency is no longer only a human problem.



Key drivers for efficient manufacturing

The trade-offs of optimisation

In a pure mathematical context optimisation is defined as the maxima or minima of a particular fitting function. The fitting function in the case of manufacturing supply chains is usually defined as the maximisation of profit (through the sale of products) and minimisation of costs across the supply chain. What is usually misunderstood or overlooked is the need to have some losses in the system in order for global optimisation to be reached. What we are faced with today in manufacturing is siloed teams working to locally optimise their individual units, in the hope that they will reach a state where costs and profit constraints are balanced. When dealing with simple manufacturing processes (such as standard assembly line processes) it may be easy to establish what the bottlenecks are and how to balance the line to meet the takt time* objectives set out by the customer. However today, with the level of complexity that comes with meeting customer needs, this becomes challenging as most manufacturers run highly complex line designs. This is further complicated by the fact that in Southern Africa we are faced with ageing equipment, labour related challenges, paper-based processes and reliance on institutional knowledge to run and maintain our facilities.

The traditional methods of lean manufacturing or six sigma can only take you so far to reach the nirvana of optimisation and you will be lucky to be able to fully implement a manufacturing regime in the turbulence of an ageing plant environment. The widely accepted view is that, in order to be able to take advantage of your assets, you need to start by making them visible and in parallel introduce the still sound philosophies of the traditional manufacturing methodologies.

This allows the plant (and wider supply chain) to better understand the trade-offs that occur and can problem solve as a single unit. Rather than attempting to optimise different parts of the supply chain independently.

Uncovering the hidden truths of your plant

The process of gaining visibility is one that is top of mind for most manufacturing executives - even when information is available it is sometimes disconnected and focused on one part of the value chain. The hierarchy of information that should be available should be wide enough to encompass tactical decision making as well as strategic - but also be a singular source for all functions of the business. The interesting part about creating visibility and uncovering actual performance of a plant is that a common truth is created and less valuable time is spent on the mundane activities that go along with creating and formulating this image. The creation of visibility, being one of the first stages in maturing along the O.E 4.0 curve, immediately starts to remove waste from the system. In the past, when visualisation was put onto the table and implemented correctly, two behaviours emerged immediately from the shop floor:

1. Immediate reliance / dependence on the new information
2. The need to improve on the current system (engineers and management immediately start asking questions like: What additional savings can be generated by making changes in the value chain? How can manufacturing systems be made more robust? Where do the highest failure rates occur?)

The process of creating transparency is a liberating exercise and one that will continue to enhance the efforts to create balance against the fitting function of demand.

Armed with this visibility, the business has a clearer picture of the manufacturing space and the possibilities are endless. What will follow is a pending avalanche of innovation (examples include the need for digital twins, scenario-based modelling, predictive modelling) brought forward by the engineers and management teams that are now spending their time adding value rather than trying to understand what the truth is. This all comes down to the availability of information married to the ideas set out by the transformation programme.

*Takt Time – the rate at which you need to complete a product to meet customer demand

What exactly is Manufacturing Excellence (ME) 4.0?

What is ME

Manufacturing Excellence is a generalised term that is used to describe the overarching improvement programmes that businesses deploy to extract value. This usually consisted of the more traditional terminology of lean thinking, six sigma or continuous improvement. The term was coined because businesses felt that the hard and fast methods of the day did not meet the ever-changing needs of the factory floor - and yes, when implemented to the letter the value they hold is unmatched. However, with the need for flexibility, Manufacturing Excellence is a better term as it can be moulded into the shape of the need directly, improving the way the initiatives are adopted and executed. This also means that, when it comes to digital transformation, the ME programme can be shifted to meet those needs directly.

What are the benefits for marrying ME with Digital

At the end of the day, any improvement initiative needs to deliver tangible value to the customer. This is generally viewed as a method to either develop the value proposition through enhanced services or a reduction in cost. This idea is widely recognised as the product's ability to meet the quality specifications. The incentive for doing this in the most effective way possible is an improvement on the top and/or bottom line of the organisation. This is generally what the business believes is the objective of a Manufacturing Excellence programme. However, for low maturity factories, implementation of these methodologies is slow and benefits are only realised in the long term. The objective is in fact to induce a culture of continuous improvement and innovation that sustains businesses' ability to innovate against a quality fitting function.



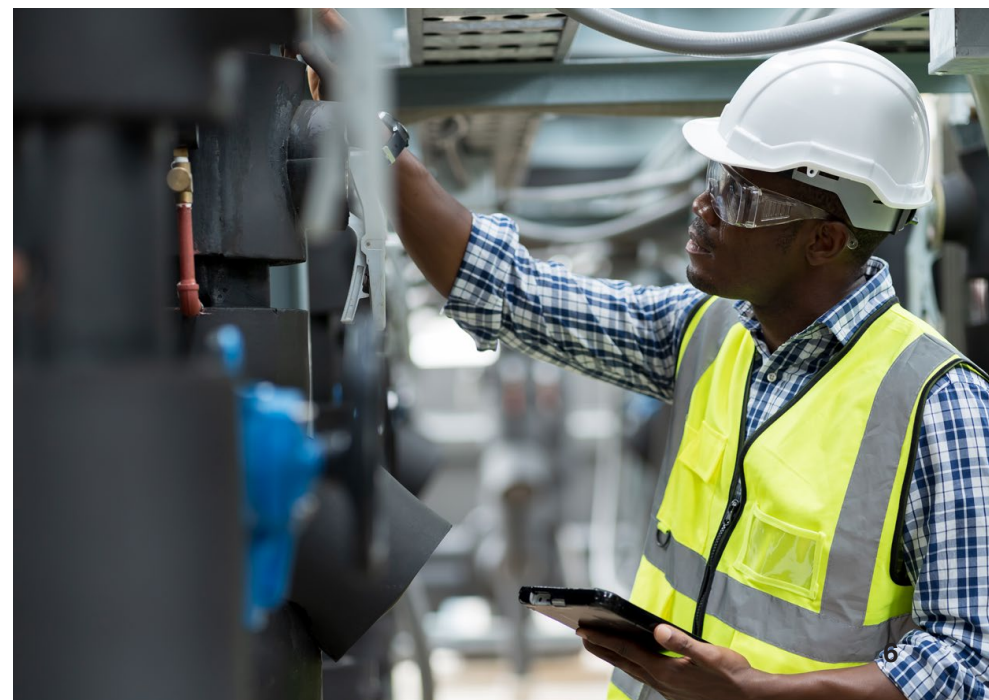
Current challenges with implementing traditional ME programmes	How ME 4.0 addresses the gap
No support from leadership – hampering accountability and sustainability	Visualisation and the implementation of solid foundational ME practices delivers the shop floor realities directly to the boardroom. Improvements can be seen and tracked immediately. This bolsters accountability of the delivery team and ensures performance improvements are sustained.
Lack of training	The human elements are a main contributor to the successes and failures of a performance excellence programme even in the face of the digital revolution. However, digital tools can provide a means to be more proactive in tracking the progress of process adoption and the successes of improvements. These tools can be deployed to do on the job training and bring the workforce along the digital journey while delivering on the objectives of the project.
Focusing on tools, not culture	Embracing the digital revolution on the shop floor is more important than the tools themselves and thus the aims of the programme must be aligned to the overarching strategy of the business. The change must be driven from the people, process and governance angles.
Fear of redundancy	The idea that a system will replace the management team in a plant environment is a common misconception. In the most successful deployments of ME 4.0 projects - digital elements are introduced to enhance the jobs of the management team and increase the rate at which problems are identified and resolved. It is therefore important to ensure that this fear is mitigated at the start of the programme and that the people who are responsible for implementing the change are also the same people designing the solutions.
Thinking there is an end	The digital journey is both a cultural and process change. However as good ME practice teaches - there is always room for improvement and so the journey to reduce waste and manage costs is ongoing. Digital helps with setting this culture as tools will always need to be adapted and improved as technology moves forward. Project specific tools can help a business track the change, monitor the health of the project and ensure that the improvement plans are maintained and are ongoing.

The introduction of digital tools has to be used to assist in mitigating these common challenges. There is always an inherent risk that the use of technology can hamper or even exacerbate these issues. However when technology is applied in conjunction with strong cultural and process efficiency fundamentals can be used to smoothen the transition to a culture of continuous improvement.

ME maturity and acceleration

Manufacturers in South Africa are currently under strain to deliver at a globally competitive standard. The pressure to sustain performance (never mind growth) is so strong that the industry faces a catch 22 scenario - where on the one hand the current requirements by the customers are increasing, while on the other they are becoming more challenging to meet the current standard. This is further compounded by an array of ageing equipment, heavy reliance on institutional knowledge and global forces (such as stronger competition from the Far East and the global COVID-19 pandemic).

Accelerating in this environment is far more complex. Finding the right balance in transformation requires deep conviction from the management teams and smarter thinking when constructing and implementing solutions. The key to implementing a holistic continuous improvement programme is ensuring there is an understanding of the journey required to implement the change, irrespective of the tools used to achieve the goal. There is a need to appreciate the maturity of the business and evaluate what is the achievable target to reach in the short, medium and long term. Rapid growth is achievable, but given the constraints most manufacturers are facing - nine times out of ten - the logical movement is incremental.



Conclusions

1. The need for manufacturing excellence is stronger than ever in the South African context and it is imperative that manufacturers understand their maturity to chart a course to performance excellence
2. The effort required to institute change and optimise processes has been reduced significantly since the introduction of digital tools to monitoring and sustaining manufacturing excellence solutions
 - Majority of the common challenges faced by organisations can be addressed or assisted by the use of technology
 - Implementation of data acquisition tools and visualisation has become cost effective and has benefits outside of just the shop floor
3. Business trade offs can be understood by the wider organisation bringing the top management closer to the realities of the shop floor
4. The creation of a single source of truth has the ability to break functional silos and dispel myths about the performance of the shop floor

Factory blindness

In order to remain globally competitive and uphold a high Manufacturing Excellence maturity level, manufacturers have to remain lean, fit and ready to react in the best possible way to meet targets. As many manufacturing facilities inhibit a low manufacturing maturity, old ways of working progressively evolve which creates hindrances to continuous improvement. There seems to be an inert comfortability that is associated with conducting activities the way they have always been conducted - which makes you blind to the fact that there are improved, safer and more efficient ways of working in your factory.

Factory blindness is a turn of phrase used to describe the normality that is felt by factory workers in their daily routines such that they do not perceive an environment that is out of order or that needs improvement. This phenomenon typically occurs when workers have been conducting the same routine activities for many years and have become resistant to adapting them to become more efficient and effective.

**Gemba – Japanese for ‘site’ or ‘scene’, which is the place where the action is happening.*

This is a particularly dangerous culture to foster as it becomes increasingly difficult to unweave the bad habits as time elapses and is often associated with organisations operating in firefighting mode. An example of this is shop floor workers routinely conducting a change over process to a duration that was always averaged throughout their tenure however not being able to identify a better way to conduct the activity. They fail to realise that if they simply move the stack of change parts that they have constantly kept in a certain area around the machine, to a location that clears their walkway in between the change, then that would immediately save them time but, more so, the frustration of laboured ways of working.

It is often the case that when a new employee joins a company management seeks out new ideas and a fresh perspective from the ‘new eyes’ in that person. This is the concept of the effects of Factory Blindness in a manufacturing perspective and is important to be aware of it to identify corrections that need to be made and, more so, to have the ability to adapt and follow industry leading practices.

In order to address this issue, there are few steps that can be adopted by manufacturers:

1. Management should promote interdepartmental shop floor reviews to gain fresh perspective on routine activities within the business.
2. Recording of key activities (duration, workforce, challenges) within a production cycle so that it can be reviewed for improvement at a later stage.
3. Benchmark key process steps in the manufacturing process to leading industry best practices to develop an improvement plan.
4. Daily *Gemba* walks to ensure continuous improvement initiation across the shopfloor.

The unfortunate consequence to Factory Blindness is that manufacturers become stagnated in their thinking from an innovative and improvement perspective, which ultimately leaves them behind in the race for global competitiveness. Senior management in manufacturing organisations need to be cognisant of this phenomenon in industry and need to keep up to date with new ways of working with an ever-expanding people component.

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