Operations

Optimize workflows, use materials, energy and water efficiently and monitor and control processes to reduce costs and improve productivity and quality

Pursue efficiency in every part of your business to earn more from losing less in your operations. Are your workflows efficient in the context of new COVID-19 workplace requirements? Can you do with less material, energy or water and generate less waste, effluents and air emissions? Do you use production data effectively? Practice lean manufacturing and resource efficiency, review your industrial monitoring and automation and instill continuous improvement as the norm for your business.

Background

MSMEs are extremely diverse and operate across manufacturing, services and related sectors. In manufacturing segment, MSMEs range from heritage or artisanal home-based industries to technology driven start-ups. Among and between sectors there are large differences, in regard to: labor intensity and skills requirements; technology deployment and innovation; occupational health and safety; use of natural resources (energy, water, materials, land and chemicals) and impacts on environment. Despite many good examples, overall, the MSME segment underperforms large industry segment in terms of productivity, technology, quality, energy and environment, health and safety and employment, giving rise to often negative public perceptions. This is largely related to planning, execution and monitoring of business operations, particularly manufacturing operations. Improvement of operations is key to unlock development and growth of MSMEs. The current crisis has made efficiency improvements in operations even more pertinent. With stalled product demand, companies cannot earn more by selling more and instead need to focus only on earning more by losing less from inefficiencies.

The basic idea for improving operations is to eradicate everything in day-to-day business operations that does not create value for the customer. In manufacturing and related sectors this stands for – manufacturing – excellence. This improves business performance in all spheres and eliminates wasteful processes. Pertinent questions include: Are your workflows efficient for the new COVID-19 workplace requirements? Can you do with less material, energy or water and generate less waste, effluents and air emissions? Do you use production data effectively?

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Approach

Practice lean manufacturing and resource efficiency, review your industrial monitoring and automation and instill continuous improvement as the norm for your business

Manufacturing excellence is the common aim for operations, regardless of size and sector of business. In the practice of MSMEs though, excellence is not routinely achieved typically in at least following three areas: workflows, (natural) resource use and data utilization. Workflows pertain to the movement of raw materials and other inputs through your business to a final product or service. Suboptimal workflows result in additional effort, idle time, etc., which can be addressed through established lean manufacturing practices. Resource use covers the use of materials, chemicals, water, energy, etc. for your processes and operations. Inefficient resource use increases actual resource consumption with its associated costs and additional generation of wastes and effluents, which can be reversed with established industrial resource efficiency techniques. Data are observations of process parameters that can be used to control and optimize processes. Under-collection and under-utilization of data presents a lost control and optimization opportunity, that could be addressed through appropriate industrial automation.

Lean Manufacturing

Lean manufacturing is a methodology that focuses on minimizing waste within a production system, while simultaneously maximizing productivity. Waste is seen as anything that customers do not believe adds value and are not willing to pay for. Lean manufacturing can reduce set up and change over times between products, reduce operating costs and improve product quality. Lean makes inefficiencies visual. There is a clear work flow that is marked and signed, so deviations are immediately observed. Factory, machinery and working and storage areas are routinely kept clean and in order, so there are no obstructions to the main workflow that generates value and cash flows.

Following five principles underpin lean manufacturing:

1. *Identify value from the customer's perspective:* companies need to understand the value the customer places on their products and services, and strive to avoid doing anything that does not contribute to creating such customer value;
2. *Map the value stream:* this involves recording and analysing the value of information and materials as you produce a specific product or service with the intent of identifying unnecessities (or wastes) and methods of improvement;

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3. *Create flow:* eliminate functional barriers in information flows and decision making to identify ways to improve leadtime. Likewise, eliminate barriers that slow down or prevent flow of materials and work in progress through your manufacturing plant;
4. *Establish a pull system:* ensure that nothing is bought or made until there is demand. Pull relies on flexibility and communication; and
5. *Pursue perfection with continual process improvement, or Kaizen:* lean manufacturing rests on the concept of continually striving for perfection, which entails targeting the root causes of quality issues and eliminating waste across operations.

Lean targets the reduction of waste, which is everything that is unnecessary and does not contribute to value for the customer. It is common to consider eight types of waste:

1. *Defects*: efforts caused by rework, scrap and incorrect information;
2. *Overproduction*: production that is more than needed or before it is needed;
3. *Waiting:* wasted time waiting for next step in a process;
4. *Non-Utilized Talent*: underutilizing people's talents, skills and knowledge;
5. *Transportation*: unnecessary movements of products and materials;
6. *Inventory:* excess products and materials not being processes;
7. *Motion:* unnecessary movements by people (e.g. walking); and
8. *Extra Processing*: more work or higher quality than is required by the customer.

Extra Processing: more work or higher quality than is required by the customer.

Continuous improvement leas at the heart of lean manufacturing. It is the relentless pursuit of reducing, or rather zeroing out, anything that does not add value to a product, meaning waste. Continuous improvement is embedded in 5S:a set of practices for organizing workspaces to create efficient, effective and safe areas for workers and which prevent wasted effort and time. 5S emphasizes organization and cleanliness.

(Industrial) Resource Efficiency

(Industrial) Resource Efficiency targets improvements in the efficiency of use of all-natural resources, to produce more product or service with lower consumption of materials, chemicals, water and energy. It can be measured and monitored in terms of resource productivity - the amount of product produced per unit of product or service, for example the number of bricks produced per ton of raw materials, the number of T-shirts washed per m^3 of water use or the kilograms of rice milled per kWh energy used. The aim is to increase resource productivity. This has direct economic benefit - you use less materials, water and energy hence you pay less for procuring these. Energy efficiency is a common starting point for broad based resource efficiency initiatives.

As resources are used more efficiently, less is being wasted and that results in lowering of pollution intensity, which is an indicator for pollution caused per unit of production. For example: kg of CO_2-eq emitted per ton of finished casting, m^3 of waste water per m^2 leather tanned and kg of waste fabric per 1,000 garments stitched. The aim is to reduce pollution intensity.

Resource productivity and pollution intensity are closely interlinked, hence industrial resource efficiency is also known as waste minimization, pollution prevention and/or Resource Efficient and Cleaner Production. They both contribute to reducing wastage and presence of hazardous materials, chemicals and fumes in workplace, and hence improve working conditions, that in turn contribute to workers productivity.

Resource Efficiency as an overarching outcome can be achieved through operational, administrative and technical interventions, that typically fall in either or a combination of the following approaches:

- ✓ *Good Housekeeping:* take appropriate managerial and operations actions to prevent leaks, and spills and also to enforce existing operational instructions;
- ✓ *Input Substitution:* substitute input materials by less toxic or by renewable materials or by adjunct materials which have a longer service life-time in production;
- ✓ *Better Process Control:* modify your operational procedures, equipment instructions and process record keeping in order to run the processes more efficiently and at lower waste and emission generation rates;
- ✓ *Equipment Modification:* modify the existing production equipment and utilities in ;order to run the processes at higher efficiency and lower waste and emission generation rates;

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- ✓ *Technology Change:* replace technology, processing sequence, synthesis pathway in order to minimise waste and emission generation during production;
- ✓ *On-site Recovery/Reuse:* reuse of the wasted materials in the same process for another useful application within the company;
- ✓ *Production of Useful By-product:* convert previously discarded waste into a by-product that can be used by other companies or organizations; and
- ✓ *Product Modification:* modify the product characteristics in order to minimise the environmental impacts of the product during or after its use (disposal) and to minimise the environmental impacts of its production.

Industrial Automation

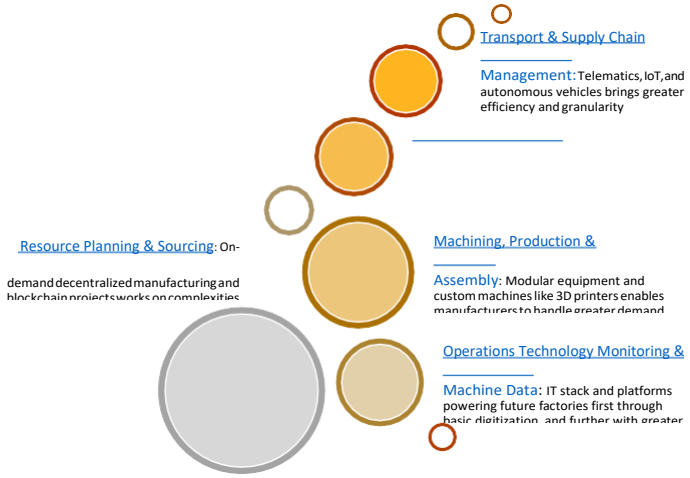
Industrial automation involves the use of sensors, switches, control systems and information and communication technologies for operating different processes and machineries in an industry with a view to achieve and maintain optimal conditions at all times. Industrial automation reduces process variations which in turn improve quality, enhance efficiency, reduce operating costs and also reduce risks to people.

Automation can achieve different levels of control. Basic levels of automation involve sensors and switches to execute and control pre-determined sequences ('programmes') of operations, embodied in Programmable Logic Controls (PLC), Variable Frequency Drive (VFD), etc.A next level involves communication between machines and objects through solutions involving Internet of Things (IoT). Artificial Intelligence(AI) has ability to make predictions relating to machine performance and health, early detection of safety issues, often known as machine learning. Combination of AI and IoT can create autonomous manufacturing systems that monitor conditions across multiple machines/workstations and determine and execute appropriate response to achieve best outcome – utilization of machinery, quality and quantity of production, costs and efficiency.

Applications of industrial automation can be found in different areas, including:

- ✓ *Resource Planning & Sourcing:* on-demand decentralized manufacturing and block chain projects works on complexities of integrating suppliers;
- ✓ *Operations Technology Monitoring & Machine Data*: IT stack and platforms powering future factories first through basic digitization, and further with greater predictive power;
- ✓ *Machining, Production & Assembly*: modular equipment and custom machines like 3D printers enables manufacturers to handle greater demand for variety;
- ✓ *Quality Assurance (QA)*: computer vision finds imperfections, and software and block chain tech enables quick identification of problems; and
- ✓ *Transport & Supply Chain Management:* telematics, IoT, and autonomous

vehicles brings greater efficiency and granularity.



Continuous Improvement

There are different ways and means to move towards manufacturing excellence in operations, particularly through the application of lean manufacturing (to improve workflows), resource efficiency (to improve efficiency of use of natural resources) and industrial automation (to reduce process variations). These approaches overlap and synergize, whilst there is also no best sequence for their implementation. Instead it is important to create a culture and practice for continuous improvement throughout all business processes, activities and operations.

Continuous improvement benefits from being systematic. It makes no sense to pursue well-meant suggestions without first ground-truthing that these will indeed address the root source and cause of the problem(s) to be solved. Following main steps are to be undertaken:

- ✓ *Problem definition and quantification*: an appropriate description and quantification of the observed problem, preferably in both physical/technical and economic/business terms;
- ✓ *Root source and cause diagnosis:* a comprehensive identification and diagnosis of all possible sources (where does the problem show up) and causes (why does it happen) for the observed problem;
- ✓ *Solution selection*: comprehensive identification and assessment of possible solutions to eliminate the diagnosed causes, leading to selection of most appropriate solution; and
- ✓ *Solution implementation*: plan for execution of the selected solution and monitor its performance.

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Despite being intuitive and logical at the same time, it is often observed that under pressure of day to day operations critical steps are not given sufficient attention and consideration, resulting in selection of suboptimal solutions. Investing in teams and making data available are hence important to benefit fully from continuous improvement in your operations.