Micromatic Grinding TECHNOLOGIES LTD.
In the Pursuit of Zero

Equilibrium

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Smart Manufacturing Begins with Smart Leadership

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N K Dhand
Chairman
Micromatic Grinding Technologies (MGT)
nkdhand@micromaticgrinding.com

Supporting the Vision

The Indian manufacturing industry is undergoing metamorphosis on a colossal level. The benefits of this transformation, however, will only be realized when our domestic players get equipped with what is needed to ride the next wave, which is the introduction of smart technologies, a pot pourri of technologies such as automation, robotics, IoT, data exchanges, data analysis, cyber-physical systems (digital twin) and machine learning, in their processes.

Although many a large enterprise in the country has already made its move towards Digitalization or Smart Manufacturing, it's the SMEs that are yet to put the digital technologies to work for either due to lack of enough awareness regarding the benefits it promises or the myths of it being a complex and costly affair.

Smart Leaders are the ones who are constantly surveying the landscape to discover, find and try the way, go the way and show the way. They are quick to recognize the kinks in the system and know the best possible ways to timely address those issues.

In this issue of Equilibrium, six such Smart Industry Leaders have put forth their views on Smart Manufacturing – VS Kasbekar, Executive Director – Operations, Hero MotoCorp Ltd (HMCL); VK Jayaswal, Executive Director, Shriram Pistons & Rings Ltd; Kultar Singh, Sr Vice President, Bharat Forge Ltd – Pune; KG Mohan Kumar, Managing Director, Toyota Kirloskar Auto Parts Pvt Ltd (TKAP); Prashant Pareek, Senior General Manager, Bosch Nashik plant; and Satish Hebbar, Head - Engineering, Nexteer Corp. We extend our heartfelt gratitude to them and Dr K Subramanian of STIMS Inst., USA, for their valued contribution to our magazine.

Our players – large, medium, and small – all can enhance efficiency, reduce cost of production, minimize manufacturing defects, and shorten production time by using smart technologies. The reaped benefits can then be passed on to the customers and will help in the mutual growth of the manufacturers and the end users.

At this juncture when India holds a vision for its manufacturing sector, such smart leadership seems to be the only answer. We need such people at the helm who can support that vision by helping in creating the right understanding and implementation of the concepts of Smart Manufacturing.

MGT believes in leading by example. We have begun our journey of Digitalization and in the current issue of Equilibrium, we are compiling our initiatives in this direction. It is our bit towards the cause of getting our fellow industry players and customers aware and started since it's only together that we can win.

MGT welcomes Mr SK Kakkar as an Independent Director of the MGT Board. He has worked for 20 years in BEL and later joined CII to serve the industry for 17 years, leaving as the Head of the Institute of Quality. Mr Kakkar will be helping MGT move towards ZED - 'In the Pursuit of Zero' – zero defects, zero downtime and zero emissions – in the company's endeavor to deliver reliable products and services to its valued stakeholders.

Kapil Dhand
Managing Director
Micromatic Grinding Technologies (MGT)
kdhand@micromaticgrinding.com

Creating New Opportunties

Dear Reader,

This issue of Equilibrium focuses on Innovation, a concept we hear and talk about frequently. However, Innovation today is multi-faceted; it's no more possible within the confines of the Design and R&D offices. It has to be Co-Created with the Customer to achieve the desired impact and value.

Our this time's Case Study talks about how MGT partnered with the Varroc Group to co-create value by developing new products and solutions.

I am happy to share the opening of Ace Micromatic Group's China Technology Center in Shanghai, which is spread over 1,600 sq mt. This new office cum technology center demonstrates our resolve to provide strong service and technical support to our international customers in China the same way we do it at home in India.

MGT will also showcase various new technological developments at IMTEX 2019. One of the key attractions would be the 'Technology Corner' where our young team of R&D Engineers would be presenting various advanced solutions and concepts in the area of machining with Abrasives. Also on display would be IoT-enabled machines. We look forward to welcoming you at IMTEX 2019.

Caring for the environment has been at the heart of MGT's corporate philosophy and vision. In order to reduce the impact of business on the nature and meet local norms, MGT has invested in an STP for water recycling and has replaced the 11 tank pre-treatment process for powder coating with shot blasting process.

2018-19 would be a landmark year in MGT's history as we would surely be achieving a new milestone of the highest ever sales turnover in the last 45 years. This has been possible only because of our Customers who have shown continued faith in our products and services. I take this opportunity to thank them on behalf of the whole MGT Family. I also would like to thank all our suppliers who, despite the sudden increase in global demand, supported us to overcome inadvertent delays. I also would like to thank my 500 strong Team of MGT Family members who continue to drive the organization to new heights.

We look forward to 2019 with renewed vigor to face the new challenges that digitalization, increasing global protectionism, and elections in home country will throw at us. I wish all readers a Happy & Prosperous 2019.

Words that Empower

We at Micromatic Grinding Technologies are profoundly humbled at our customers' satisfactory experience with us. Their words of appreciation help us stay focused at meeting their needs as efficiently as possible and better our relation with them.

"It is our pleasure to extend appreciation towards Micromatic Grinding Technologies (MGT) team for completing the project for our company in a short span of time and that too in an efficient way. We must say that MGT has got a team of gems who are highly professional in their approach and work with sheer dedication and sincerity. We want you to know that we are very pleased with the quality of service your company provides and sincerely appreciate your responsiveness and the way you conduct business. We look forward to doing business with MGT for years to come."

Sunil Joshi
General Manager
Shriram Pistons and Rings Ltd

"It has been a pleasure to work with MGT over the long years. We appreciate your co-operation and prompt response in the times of exigencies. Kudos for implementing changes suggested by us in your product. Your support has helped us keep our operations running smoothly and has led to a synergistic relationship between us. We wish your company success in the future and look forward to many more years of working together."

Subhash S Joshi
Head - Plant Engineering
Hero MotoCorp Ltd
Halol, Gujarat

"MGT's service team has been highly supportive in keeping our machines healthy. Timely preventive maintenance as per AMC contract and readiness of spares at the company's stores has resulted in a minimum downtime of our cylindrical grinding machines. We look forward to our continued association."

Nitin Gupta
Managing Director
Sharp Industries

"It has been one long pleasurable journey with MGT. You have always been extending your utmost support and have been equally responsive whenever we have needed you to immediately tend to an issue. We had a particularly praise-worthy experience with you in June 2018 when we approached you regarding a Fine Boring Guideway Grinding machine. Your commitment and the quality of work was highly commendable. We wish to continue being a partner in your success going forward."

Sanjeev Rajput
Head - Plant Maintenance
Honda Motorcycle & Scooter India Pvt Ltd
Gurgaon, Haryana

Towards Customer Delight

With the aim to offer an excellent customer experience, MGT ensured not just to meet Sharp Industries' expectation but exceed it.

Established in 1989, Sharp Industries has been a leader in Design, Manufacturing and Reconditioning of Carbide, PCD and PCBN Cutting Tools for over two decades. The company provides cutting tool solutions for almost all kinds of machining applications.

The company has been using Cylindrical Grinding machines supplied by Micromatic Grinding Technologies for preparing Carbide and Steel blanks of its tools within 0.002 mm accuracy.

It currently has six machines from MGT out of which two, which the company has been using for the past 12 years, were no more performing optimally. Sharp Industries approached MGT if the machines could be refurbished and reconditioned to their original accuracy standards.

MGT took up the challenge by providing this value-added service to its highly regarded customer. Sharp Industries received a nearly new machine at around 60 percent of the cost of a new machine.

Additionally, timely preventive maintenance as per AMC contract and readiness of spares at MGT stores has resulted in a minimum downtime of Sharp Industries' cylindrical grinding machines.

Source: MGT

Before Reconditioning

- Size Variation
- Chattering Marks on OD & Face
- Ovality on Dia
- Poor Surface Finish
- Spindle Runout
- Repeatability Slip in Wheel Slide

Source: MGT

After Reconditioning

- OD Size within 2µm
- No Chattering Marks on OD & Face
- Ovality within 1µm
- Good Surface Finish 0.4Ra
- Runout within 1µm
- Repeatability within 2µm

Rendering a Human Touch to Smart Manufacturing

Dr K (Subbu) Subramanian
President
STIMS Institute Inc., USA
subbukdg@gmail.com

If we can visualize physical processes on the manufacturing floor as living human beings, then much of the information-management practices of the healthcare may be applicable to the manufacturing sector as well. Such humane treatment of machines and manufacturing processes could be the next phase of Smart Manufacturing.

Throughout our life span, we invest an inordinate amount of time and effort on taking care of our health. For a fit and healthy lifestyle, we put in the effort to go the extra mile and adopt healthy habits. We get enrolled in fitness programs, look out for any undue changes, get any apparent symptoms diagnosed and administer medicines as per the illness identified. To prevent any possible ill-health, medical care starts with:

- Health Record Maintenance
- Routine Health Checkups
- Diagnostics
- Health or Medical Report
- Prognosis and Preventive Maintenance

Similarly, if we can visualize the physical processes on the manufacturing floor as living human beings then much of the information-management practices in the healthcare may be applicable to the manufacturing

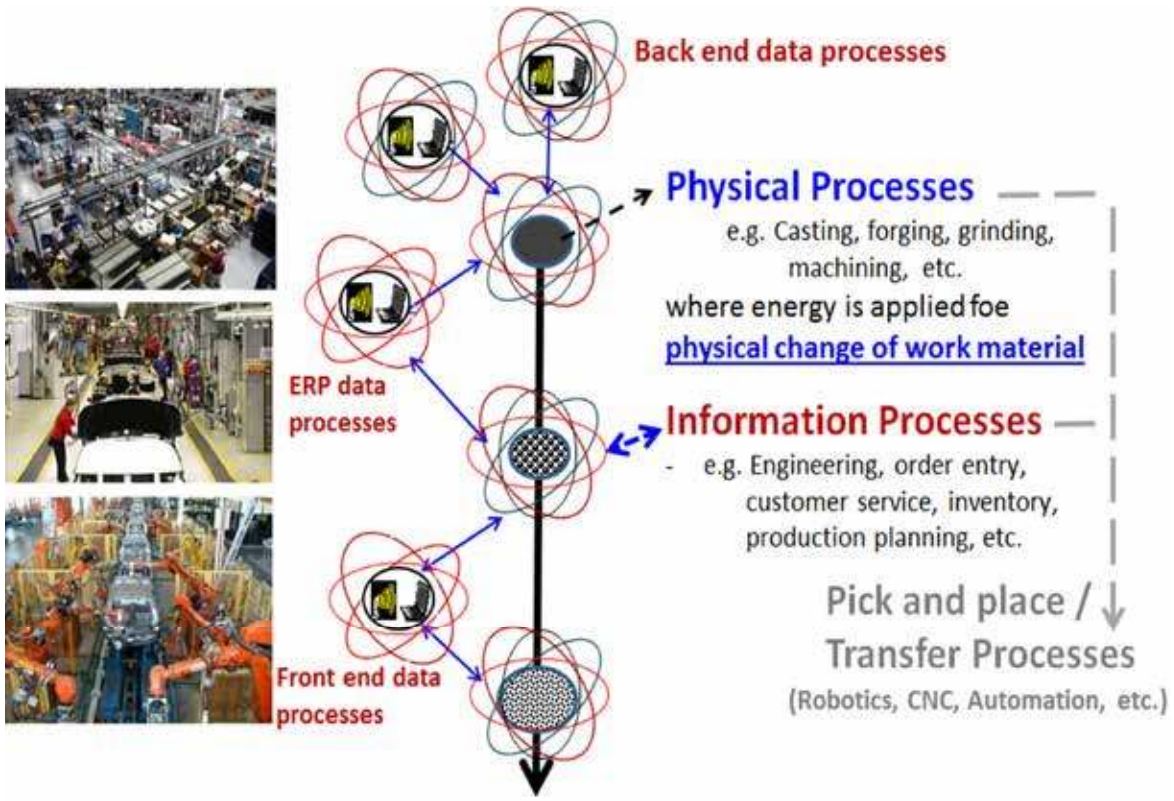


Fig. 1: Manufacturing: An organized use of physical and information processes

sector as well! Such humane treatment of machines and manufacturing processes could be the next phase of Smart Manufacturing.

WHAT IS MANUFACTURING?

Manufacturing is an organized collection and repetitive use of physical processes such as grinding, cutting, welding, ECM, EDM, thin film coating, forging, forming, heat treating, etc. together with a large number of Information Processes. In manufacturing, there are devices such as CNC systems, Robotics, Automation, etc. that intrinsically combine information / data manipulation together with physical activity.

It is the repetitive use of physical processes that distinguishes 'manufacturing' from research, design, product development, sales and marketing, etc.

Such use of physical processes requires a large array of Information Processes (relevant to Supply Chain, Logistics – inside and outside the manufacturing plant, Lean, Six Sigma, ERP, Order entry, Customer support, etc.) to create a product at the required quantity, quality, time and place. These are also described as 'Front end' or 'Back end' operations. This recurring activity invariably creates large sets of data / information. Much of the Smart Manufacturing attempts to exploit this data and its manipulation to gain efficiency and better economics in manufacturing.

PHYSICAL PROCESSES IN MANUFACTURING VS. HUMAN BEINGS

This approach to compare physical processes as living human beings may appear unconventional. It may not be seen favorably by some. However, our goal is to point out that much of the digital solutions and procedures already available in the healthcare sector may be readily applied to the manufacturing sector to advance Smart Manufacturing in leaps and bounds in a short period of time. All that is required is out-of-the-box thinking.

Every physical process used in manufacturing is also a system. It starts with the machine tool. When the new machine tool is shipped out of the machine tool company, the entire process can be documented as a system. In many respects, the 'System Document' generated when the process is installed corresponds to the 'birth certificate' of that manufacturing process.

Healthcare Management	Smart Manufacturing
Patient Record	System Document (See Fig. 3: STIMS Diagram)
Data from Routine Checkups	Process history, QC Data, Production Data
Vital Signals (Body temperature, Blood pressure, etc.)	In-process Signals (GrindTrak™ data: Grinding power consumed, MRR, etc.)
Advanced Diagnostics (EKG, MRI, CAT Scan, etc.)	Machine Tool Condition Monitoring (Vibration Signals, Acoustic Emission Signals, etc.)
Analysis and Treatment	Rule-based Algorithms and Problem-Solving
Medical Report	Manufacturing Process Health Check Report
Advanced Treatment (Level varies depending on Patient Record, Routine Checkup Data, Diagnostics and Health Check Report)	• Daily Production Management • Process Engineering / Problem Solving • Maintenance Protocol (Machine Tool age dependent) • Line-level Production Management • Plant Management • General Management
Data for Healthcare Management	Data for Prognosis and Performance Analysis (Across plants, locations, geography and other industries)

Fig. 2: Data Protocol for Smart Manufacturing (Analogous to Healthcare Data Management)

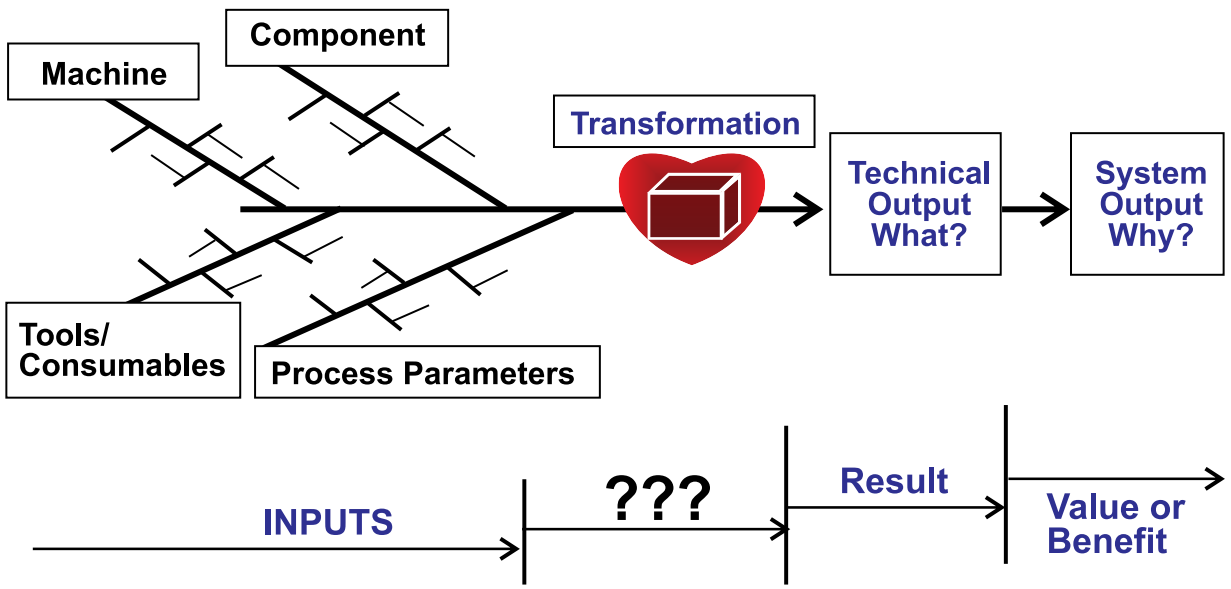


Fig. 3: STIMS Diagram: Treatment of the physical process in manufacturing as an Input / Transformation / Output System

System Document - Element	Source of Information or Data	
	Supplier	Manufacturer
Machine Tool	Machine Tool Supplier	• Purchasing Department • Advanced Process Engineering • Maintenance Department • Design Department
Tools / Consumables	Suppliers of: • Tools • Coolants • Jigs and Fixtures • Gauges • IT services	• Purchasing Department • Process Engineering • Tooling Department • Maintenance Department • ERP Data, SAP Data, etc.
Component	Raw Materials Supplier	• Purchasing Department • Design Data • ERP Data, SAP Data, etc.
Process Parameters	• Machine Tool Supplier • Tooling Supplier	• Process Engineering • Tooling Department • Maintenance Department • ERP Data, SAP Data, etc.
Transformation (In-Process Signals and Data)		
Technical Output	• Machine Tool Supplier • Tooling Supplier	• Production Engineering • Quality Control Department
System Output		Plant Management

Fig. 4: System Document – Digital data that represents the details of the physical process viewed as a system

Similarly, further comparing of the manufacturing process data to healthcare management is shown in the table (Fig 2).

Every physical process is also a 'live' unit, consuming energy and its use for transformation of raw material (or input) into a finished good (output). This input/transformation/output scheme of any physical manufacturing process – as a system – is illustrated in the STIMS (Science Based Technology, Innovation and Management Solutions) Diagram (Fig 3).

From the table in Fig 4, it is obvious that while relevant data exists to deal with the manufacturing process as a system, such data is today spread across various resources both inside the manufacturing company as well as with their many suppliers. Some of the information such as the System Outputs (e.g. Total Cost/Part) is not even documented at the unit process level. It should not come as a surprise to anyone that the 'Transformation' in most of the physical processes are treated as 'black box' without any relevant infor-mation pertaining to the in-process signals. These basic ailments must be addressed immediately to move towards new directions for a meaningful Smart Manufacturing.

A NEW BEGINNING

At MGT and AMTDC (Advanced Manufacturing Technology Development Centre), IIT Madras, initial efforts are underway to explore the above possibilities towards Smart Manufacturing as applicable to precision grinding processes. This endeavor with leadership from STIMS Institute may provide a new pathway in our quest for the 21st Century Smart Manufacturing.

Smart Manufacturing Begins with Smart Leadership

With manufacturing getting complex and competitive by the day, there is an acute need for smart leaders who can take stock of the situation and step up the game by embracing the changes required to lead the pack. Equipped with expertise and experience and a honed foresight, these leaders strongly support Smart Manufacturing to be the answer to existing and future challenges.

The present-day manufacturing scenario demands the adoption of cutting-edge technologies such as the Internet of Things (IoT), Robotics & Automation, 3D Printing, Artificial Intelligence (AI), etc., that make up Smart Manufacturing, to meet the needs of the modern consumer.

Attesting to it is the McKinsey Global Institute report, 'The Internet of Things: Mapping the Value Beyond the Hype' that states that Smart Manufacturing will generate a total economic impact of $3.9 trillion to $11.1 trillion a year by 2025.

To deliberate upon it, we have gained insight from some smart leaders of our Indian industry who from their vantage point can foresee the benefits Smart Manufacturing can bring to the table for our business goals to get accomplished.

"There are a number of ways that Smart Manufacturing can be of advantage to manufacturers. This includes lending transparency in overall manufacturing-related activities, availability of real-time data, enabling the early warning system and quick decision/solution on problems, overall speed in the information flow, and reduction in non-value added activities," sums up **Prashant Pareek, Senior General Manager, Bosch Nashik plant.**

VK Jayaswal, Executive Director, Shriram Pistons & Rings Ltd, states, "Real-time performance management systems enhance the visibility and feedback on deviating from the ideal operating conditions, in turn optimizing efficiency on parameters like power consumption, material consumption, rejections and process deviations etc. Smart Manufacturing also enables manufacturers to move towards reduced variability in S&Ps. This enables the organization to focus on innovation and improvements than just meeting the standards."

OPTIMIZING RESOURCES

According to **Kultar Singh, Sr Vice President, Bharat Forge Ltd – Pune,** "Many in the Indian industry are highly enthusiastic about this trend and are putting in a lot of resources. The idea is to further reduce the human interface at the front end of manufacturing by using Data Analysis and Artificial Intelligence (AI)."

"Stock validations, product level stock keeping units (SKU), inventory accounting, transportation reservations, scheduling overhauling activities or health check-ups by

❝ Traditional practices of monitoring and management are failing to give manufacturers a competitive edge. Ever-increasing customer demands are creating pressure to build a better product at a better service rate and provide at a lesser cost to the customer than ever before in volatility, uncertainty, complexity, and ambiguity (VUCA) conditions.❞

VS Kasbekar
Executive Director Operations
Hero MotoCorp Ltd

❝ Smart manufacturing optimizes the production planning process to ensure product availability according to customer consumption patterns on real-time basis. The manufacturer can integrate production input in the Smart Manufacturing system, manage raw material inventory and other inputs to suit the dynamic production schedules and ensure continuous running of production lines.❞

VK Jayaswal
Executive Director
Shriram Pistons & Rings Ltd

❝ The idea behind Smart Manufacturing is to further reduce the human interface at the front end of manufacturing by using data analysis and artificial intelligence. Many in the Indian industry are highly enthusiastic about his trend. However, we must customize this concept based on our industrial ecosystem, else it may create new challenges.❞

Kultar Singh
Senior Vice President
Bharat Forge Ltd - Pune

service team, ordering and managing machines' spares, creating reports on the day to day operations and many more activities which are interlinked and carried out by several agencies and teams can be automated by single manufacturing execution system and when automated, it provides increase in operating efficiency," explains **V S Kasbekar, Executive Director – Operations, Hero MotoCorp Ltd (HMCL).**

Satish Hebbar, Head-Engineering, Nexteer Corp, says, "The use of the Information Technology to monitor, control, acquire and analyze the data to optimize the use of resources is need of the hour. The present market norms are very stringent and would require the manufacturers to keep a check on the waste to be very competitive."

"By driving efficiency throughout the manufacturing process, smart technologies help eliminate waste. Better scheduling prevents idling of machines and manpower. Fewer human errors strengthen quality and customer delight. Real-time monitoring of product quality and process parameters facilitates the line supervisor to take pro-active action before any defects occur," points out **K G Mohan Kumar, Managing Director, Toyota Kirloskar Auto Parts Pvt Ltd (TKAP).**

INCREASING BUSINESS AGILITY

Smart Manufacturing ensures the availability of the right product at the right place and the right time in the entire value chain. It helps in preventing shortages with suppliers, parts availability on the premises, their transportation and installation to keep the production line in the manufacturing company up and running.

Mohan Kumar explains it well, "Smart manufacturing using IoT helps in driving efficiency in the entire supply chain. Technologies like bar code, RFID and GPS can help track parts in the entire supply chain. At any point of time, manufacturers can get data like when and where the item was produced, how long it took in transit and even how long it took to fly off the shelf. This type of data can help manufacturers get a tighter grip on quality control, on-time deliveries and forecast sales."

"Through real-time digital information across the supply chain, it is now possible to shorten the lead time to customers and also ensure accurate control of inventories to be maintained. Manufacturers can move from conventional monthly or weekly supplier schedules to daily order by real-time information transfer from the line and thereby ensure the required part is supplied in the required quantity at the required time in the most efficient way, thus optimizing costs," he adds.

Putting forth his view, **Kasbekar** adds, "The tools provided by smart manufacturing within the subset of the interconnected system can ensure that a typical occurrence of an unprecedented event does not impact the

❝ Manufacturers are already leveraging components of Smart Manufacturing in areas like advanced planning and scheduling using real-time production and inventory data. This results in a more efficient and agile system, less production downtime and a greater ability to predict and adjust to changes in the facility.❞

KG Mohan Kumar
Managing Director
Toyota Kirloskar Auto Parts Pvt Ltd

❝ For embracing smart manufacturing, upskilling of personnel is important so they get competent in digital manufacturing and data analytics skills for problem solving. This, however, will happen only when there is a shift in the mindset from manual data handling to digital data handling.❞

Prashant Pareek
Senior General Manager
Bosch Nashik Plant

❝ The use of the IT to monitor, control, acquire and analyze the data to optimize the use of resources is need of the hour. A manufacturing facility requires to integrate all the process steps that a product has to follow, sub-contract till the final goods to create a database for the desired level of traceability and outcome.❞

Satish Hebbar
Head – Engineering
Nexteer Corp

continuous movements of components down the value-chain sequence."

"Many manufacturers are already leveraging components of smart manufacturing in areas like advanced planning and scheduling using real-time production and inventory data. The result can be a more efficient and agile system, less production downtime and a greater ability to predict and adjust to changes (flexibility) in the facility leading to quicker response in a competitive market-place," adds **Mohan Kumar**.

CHALLENGES ACCOMPANYING THE BENEFITS

Embracing smart manufacturing is such a big leap which can alter manufacturing processes like never before. Hence, along with the guaranteed benefits, the manufacturers must also brace themselves for the challenges that they might encounter on the way.

"With smart manufacturing, it is possible to connect multiple lines and factories and to manage with minimum supervision, thus empowering people. It sounds extremely promising but the biggest challenge for manufacturers is human resource development to upskill on new tools like IoT, Big Data, Analytics, Automation etc.," points out **Mohan Kumar.** Hence, to ensure that they keep pace with this digital disruption, manufacturers need to proactively upskill shop floor employees by collaborating effectively with academia and industry bodies, he adds.

Seconding Mohan Kumar's view, **Pareek** stresses on the shift in the mindset from manual data handling to digital data handling.

"This brings the management up to the task to make provisions in terms of learning curve to get the in-house teams equipped with the new skills required not only by the operation's personnel, but also by the managing staff," states **Kasbekar.**

With smart technology, it is now possible for shop floor personnel to pursue machine troubleshooting far more easily, thereby freeing up maintenance engineers to take up higher level jobs.

"However, one needs to take care of data security; any breach of network can result in machines getting potentially hacked, confidential data lost or stolen and in the worst case, production halted. Poorly handled data security in an industrial IoT environment could result in a severe lack of trust between partners, upstream and downstream, leading to potential litigation. International regulations such as GDPR will help mitigate this issue though," **Mohan Kumar** cautions.

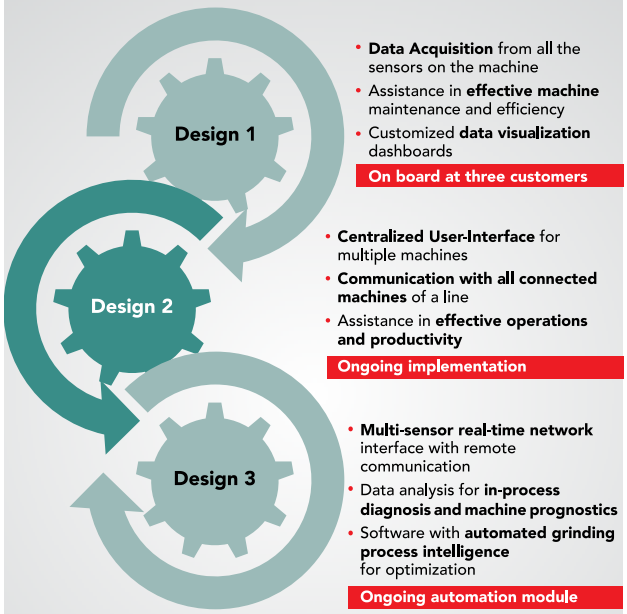
"It is highly important to carefully define the scope of Smart manufacturing so that today's changes act as a stepping stone for future changes and incremental changes are facilitated. This is to avoid disruptive changes which are tougher on systems and all its stakeholders, besides normally having a bigger cost footprint than incremental changes," concludes **Jayaswal.**

MGT's Contribution to Smart Manufacturing

MGT's IoT-enabled grinding machines enable the monitoring of the machine status and process status for error diagnostics, troubleshooting and prognostics as well predicting possible failures for adaptive maintenance, leading to improved process-cum-machine efficiency and enhanced productivity.

Digital revolution that is deemed as third industrial revolution is now pushing us forward to fourth industrial revolution being commonly referred in various short forms such as 4IR, Industry 4.0, etc. This is what brings the buzzword Internet of Things (IoT) for using digitization to connect sub-units and multiple units for non-intervened to and fro communication with controls to make manufacturing smart.

MGT's Stepping Stones towards Industry 4.0



Design 1: Has already been delivered to a customer and it's working efficiently.

Design 2: Is being delivered shortly to another customer.

Design 3: AGI machine has already been delivered to IIT Madras. Further work is under progress jointly by MGT and AMTDC (IITM) through a DHI-sponsored project.

END-USER PERCEPTION OF IoT

Smart Factory is the future now, looking for automation of various monotonous and hygienic activities associated with machines that will reduce manual labor and promote mankind's time towards skill enhancement and intelligent applications.

Through IoT of sensors on grinding machines, visualization of the critical parameters becomes possible not only after the process but even during the process and predict the behavior as well through analytical tools (before the process). This, thereby enables users of our IoT-enabled grinding machines in monitoring the machine status and process status for error diagnostics, troubleshooting and prognostics as well to further predict possible failures for adaptive maintenance. Thus, it helps in improving process-cum-machine efficiency with enhanced productivity.

HORIZONTAL INTEGRATION OF IoT INTO GRINDING MACHINES

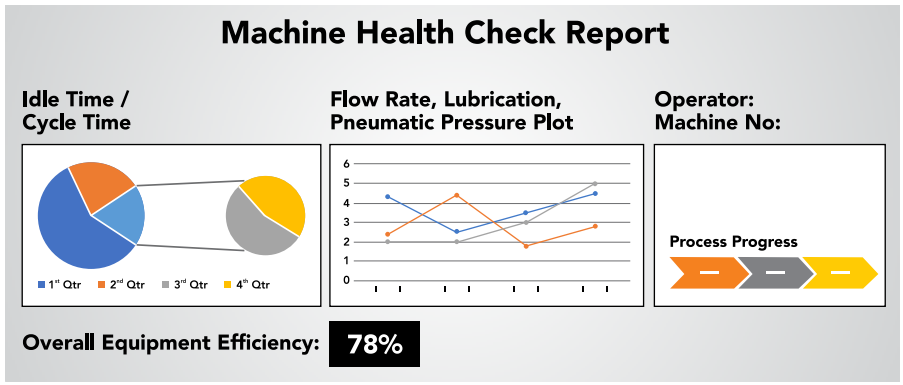
In order to meet these diverse requirements of customers, we have come out with three possible solutions, designed in terms of the scope as well as affordability (See Design 1, 2 & 3).

BUSINESS MODEL FOR THE LEGACY MACHINES

It is alright to design the IoT-ready machines but there already exist many old machines in the field. Keeping that well in mind, all our designs proposed and developed as mentioned above are capable of direct retrofitting on the old machines as well. Even conventional non-CNC machines can be fitted with these features with the provision of smart sensors and controllers. This is how legacy is carried forward to advancing future by Micromatic Grinding, calling it Horizontal Integration of IoT.

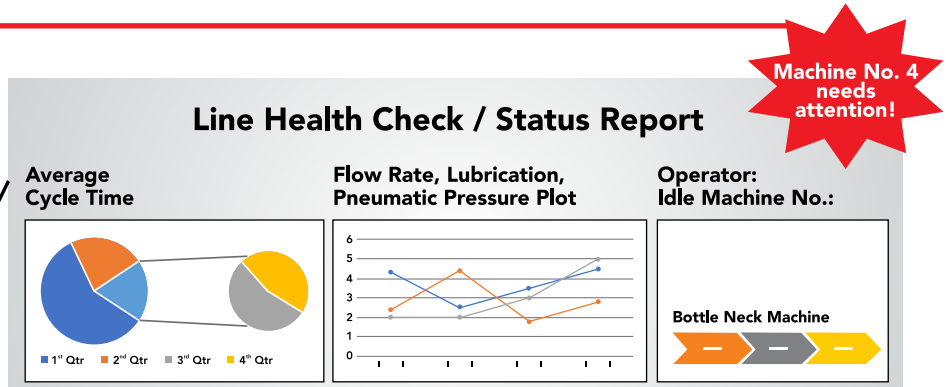
DESIGN 1

Monitors a set of essential operational parameters for a single machine to enhance the effectiveness of the operation and maintenance that displays Mean Time to Repair (MTTR), Mean Time between Failures (MTBF), Original Equipment Efficiency (OEE), Overall Productivity, Program Management and Quality Assurance Reports



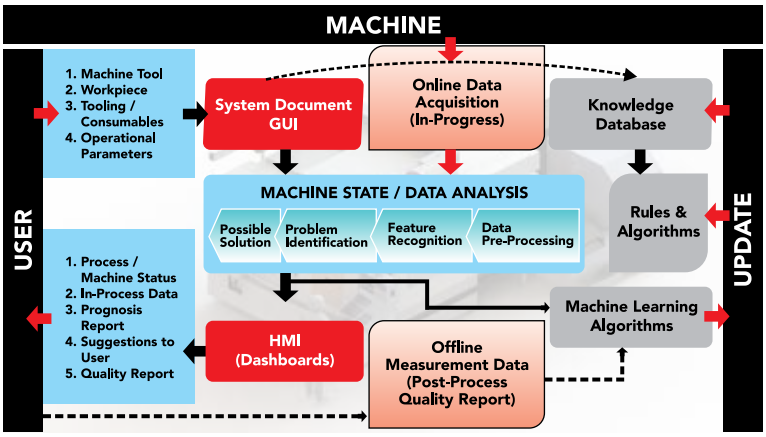
DESIGN 2

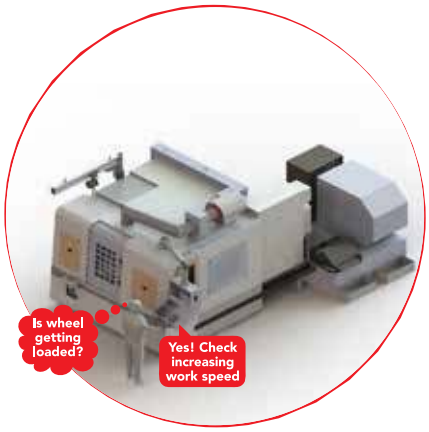
Extending Design 1 to multiple machines is a centralized integration and customized solution that offers greater number of parameters of user's interest to altogether be visualized for each machine.



DESIGN 3

MGT has developed a machine for IIT Madras with proven high-speed I/O communication, remote connectivity and real-time data acquisition from multi-sensor network for effective machine/process status realization. With that, IIT-M aims to provide Automation of Grinding Intelligence (AGI), a solution targeted to instil years of MGTians' grinding process experience into a machine-integrable software.





In Conjunction with the Customer

For MGT, customer-driven innovation is a philosophy it is rooted in. The company considers its customers as its partner in the process of innovation and takes into account their requirements to deliver a delightful customer experience. Ahead is the example of how it helped Varroc Group upgrade from a normal valve seat grinder (33 mps) to a high-speed CBN valve seat grinder (70 mps)...

Founded in 1988, Varroc Group is a leading manufacturer and supplier of auto components including engine valves to leading OEMs in India as well as the global market.

In engine valve business, the metallic valves division has two manufacturing plants and one R&D center in India. Its R&D centers are involved in the development to realization of high-performance technologies like sodium filled valves, hollow engine valves and titanium valves and provide developmental support to customers in North America, Europe and Asia.

REQUIREMENTS

To innovate successfully, it's important to listen to the customer and understand his needs with a utmost clarity. Gurunathan R, Head - R&D, Engine Valve Division, Varroc Group, approached MGT with a highly precise requirement on the productivity and quality front. He not only discussed the company's needs, but also extended its full support to develop a high-performance grinding solution to existing and newly developed high performance products.

Following were the Varroc Group's requirements:

- Highly productive machine
- With a cycle time (FTF) of less than 7-8 sec with dimensional precision
- Seat height ±0.07mm with cpk ≥ 1.67
- Capable to ground high-strength alloy material.

Challenges

However, the requirements had some challenges too:

- The required machines must offer 30 percent reduction in cycle time than the existing machines.
- Improvement in the seat height parameter from 100% within tolerance to achieve 1.67 cpk on the given specification.

MGT solution

- Micromatic Grinding took up the challenge to develop a high-speed valve seat grinder Model GVS CNC 60 MPS to meet Varroc's productivity and quality parameters. The model was equipped with all the required features to meet the challenges:
- High oscillation cycle
- Servo axis for loader vertical slide to reduce loading time
- Higher surface speed of grinding wheel '60 m/sec'
- Auto wheel balancer
- Auto valve positioner and compensation (flagging).

Fig. 1 Benefit of the high-speed CBN machine over Alox machine

Parameter	Unit	Option-1	Option-2	Difference	% age diff.
Label		GVS-60 MPS Aluminium Oxide	GVS 60 MPS - CBN		*(Opt-2 vs. Opt-1)*
No. of parts per wheel	parts	85,000	5,31,250	4,46,250	525%
Dressing skip	parts/dress	25	2000	1975	7900%
Total Abrasive cost/part	₹/part	₹0.42	₹0.33	-₹0.09	-21%
Total cycle time Incl. Dressing Time	seconds	10.54	8.05	-2.49	-24%
Production per hour	parts/hr	342	447	105	31%

Source: MGT

Closeup View- Grinding Zone

Source: MGT

Machine View- GVS 70MPS-CBN

SECOND PHASE OF PRODUCT DEVELOPMENT

In the second phase of product development, the customer came up with the requirement to develop high-speed CBN valve seat grinder to improve the productivity and consistency in the output quality.

Two major benefits with CBN wheel were visible: increase in productivity due to drastic reduction in dressing frequency and better consistency in the output quality (See Fig 1 & 2).

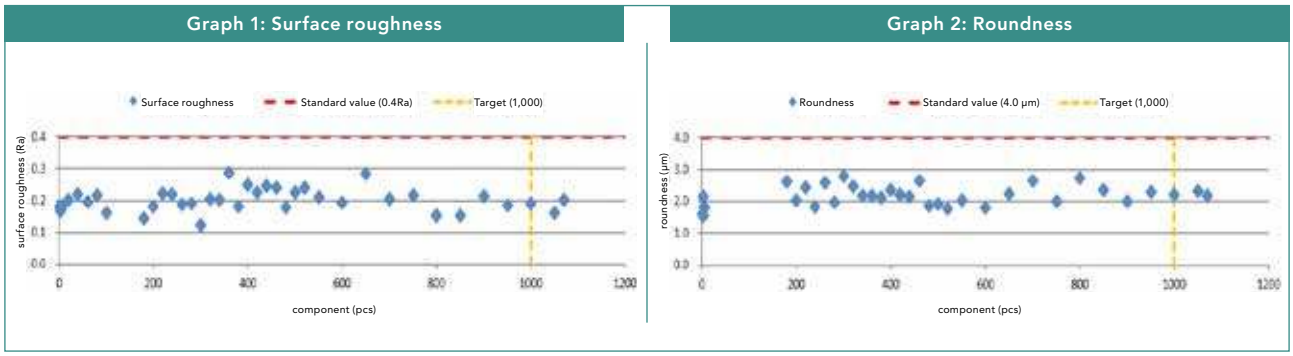
Challenges

- CBN performs effectively on higher surface speed for a desired performance. Hence, 70 m/sec wheel surface speed was selected and the machine was designed for the corresponding stiffness and stability.
- A suitable dressing system was required for CBN wheel truing and dressing.
- High-pressure coolant system was also needed to clean the wheel to achieve the desired performance.

MGT solution

- MGT developed a high-speed CBN valve seat grinder model GVS CNC CBN with the below features to achieve the desired results:
- Machine with 70 m/sec wheel surface speed
- High-speed spindle for CBN application
- Motorized disc dressing unit
- High-pressure coolant nozzle for wheel cleaning.

Fig. 2 Better consistency achieved throughout the valves produced in a single dressing



> “It has been an exciting two-decade long journey with MGT, and equally interesting was being part of the development of high-precision special purpose Grinding machines. Engine valve being a critical component in IC engines, quality can never be compromised. We are highly thankful to the MGT team for working its best to get this challenging task done.”
>
> **Gurunathan R, Head - R&D, Engine Valve Division, Varroc Group**

GCU 100 or ECO 200, as the machine is known today, at Micromatic's UK distributor, Master Abrasives' showroom.

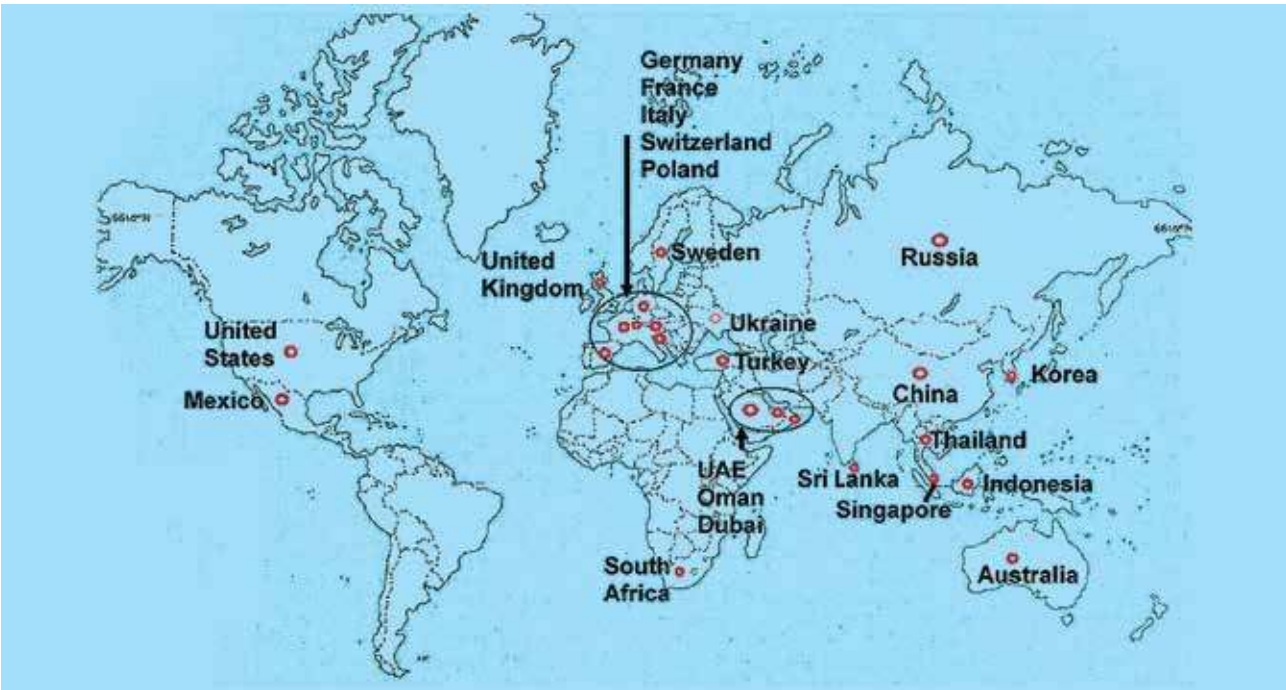
It's Not Easy Being Difficult

For Micromatic Grinding Technologies, its philosophy of being difficult has been a driving force behind its endeavor to consistently perfect its product offerings. With a thorough understanding of the emerging trends, a keen gaze on the market opportunities and a global perspective, the company has made the world its playground.

"It's not easy being difficult. Difficult to please. Difficult to compromise. Difficult to persuade. Sometimes indeed, difficult to do business with. And at all times very difficult to find fault with. Yes, it is always difficult for us. Taking the easy way out, compromising here, adjusting there is always tempting but we've chosen never to take the short cut."

A poster in a meeting room at Micromatic Grinding Tools divulges the company's philosophy that it embraced 45 years back. The only aim it had then was to serve the nation by producing top-quality grinding machines not being produced by many in the country at the time.

This philosophy then served as an inspiration to make use of the available opportunities that kept making way for more. MGT developed its first Hydraulic Universal Grinder which boasted a guarantee of 2 micron out of round accuracy in live grinding on a standard test piece. The only other producer for these machines then was HMT Machine Tools Ltd that guaranteed a



Population of MGT machines around the world

5 micron out of round accuracy. Today, it is possible to guarantee an out of round tolerance of <0.5 micron in live grinding with special variants.

Since then the company has never looked back. With the guiding philosophy enabling it to never rest on its laurels, MGT kept at it relentlessly, striving for perfection, consistently bettering its product, and competing with bigger players in more competitive markets.

The result of which is that today, the company not only sells these machines in India, but also caters to the machine's high demand globally. Its hydraulic grinders are highly sought after for precision grinding work in tool rooms from small job shops to corporates alike. They are the entry-level machines for any new business requiring precision grinding work.

IMTEX 2019, ANOTHER SUCCESS MILESTONE

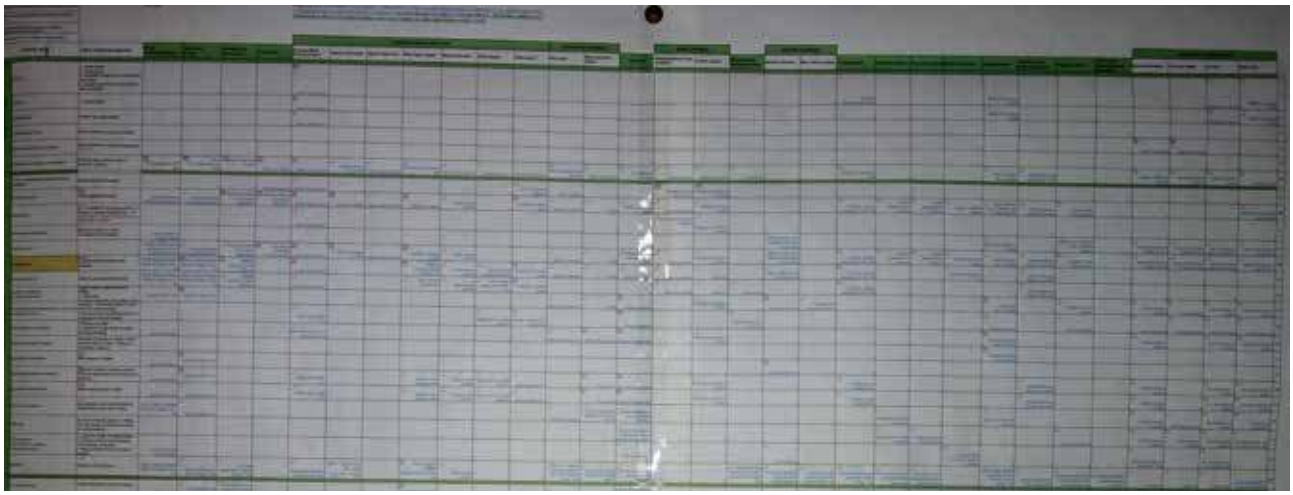
The forthcoming IMTEX holds a special significance for the company since it marks the 40th anniversary of the Hydraulic Universal Grinder and also of the introduction of Micromatic Grinding Technologies to the Machine Tool world. Model GCU 100, the first Grinder built by MGT, also known as 2M, was first unveiled at IMTEX in the year 1979 from where it went on to create history by winning two 1st prizes – CMTI - PMT Best Design Award and the FIE Best Product Award. Going ahead, GCU 100, on its long global journey, kept making its presence felt at various other machine tools exhibitions including the Machine Tool Indonesia, Jakarta in 1981 and Metalex Singapore.

CHALLENGES INVOLVED

However, producing these machines is not an easy task as they need to be highly precise yet cost-effective since 90 percent of the machines cater to the SME sector and start-up shops. Comprising more than 1000 precision parts and over 15 model variants, the Precision Hydraulic grinders are today more difficult to make than the CNC Grinders. With such unparalleled spread and quality in the industry, these machines have gained popularity all over the world.

Hence, MGT has had a considerable number of takers from all parts of the world. So far, it has sold more than 300 hydraulic grinders globally to companies including Gühring KG, Germany; Brazil; France; South Africa; Indonesia; Thailand; China; Marposs – Mexico; Nissan Powertrain – Thailand; Earlsdon Technologies, the UK; TaeguTec, Turkey; to name a few.

Despite the challenges in cost-effectively producing these machines without any compromise on quality, their success serves as a motivation for MGT to keep producing them to meet the global need for these High Precision Grinders.



System document of a new product showing relationship between customer voice and sub-system level requirements

System Approach to Design

Aristotle's phrase of the whole being greater than the sum of its parts rings all the more true in the machine tool space where things are complex and disparate. Taking heed of the need for a synergy between the elements involved, the Design Team at MGT has come up with a solution…

R K Guleria
AGM
Design & Development
Micromatic Grinding Technologies

Manufacturing machine tools is a complex business requiring thousands of parts, several different speciality functions, skilled labor and years of experience. They all need to align with each other to create a good machine tool. Hence, synergy within people, systems, functions, skills etc. is a necessity and a challenge in order to achieve First Time Right (FTR) and Reliable Product realization.

This concept of synergy within the elements was adopted by the Design Team at MGT when it created the 'System Approach to Design' document. This document, by way of design, ensures that the System is visualized and acted upon in order to meet the requirements of the customer. Fig. 1 is the framework of the system document.

On an average MGT develops five to six new products every year. By creating and following such a systematic process, the company's Design team has been able to reduce the lead time and optimize the costs associated with the new product and the development of its features.

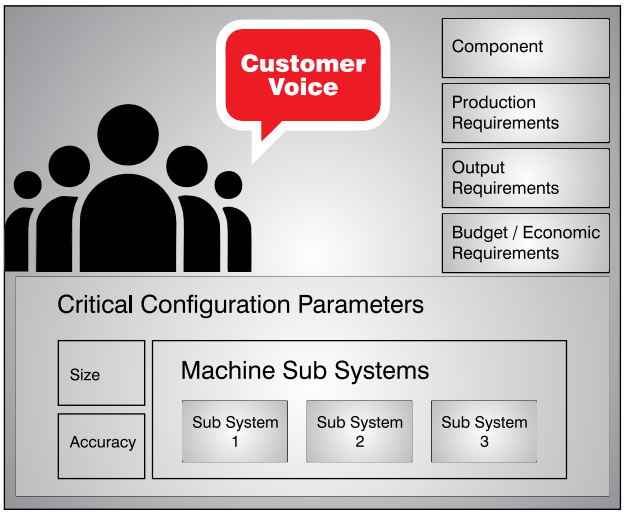


Fig. 1 It shows how the customer voice is cascaded down to sub-system level requirements to achieve the FTR results

Eliminating Waste

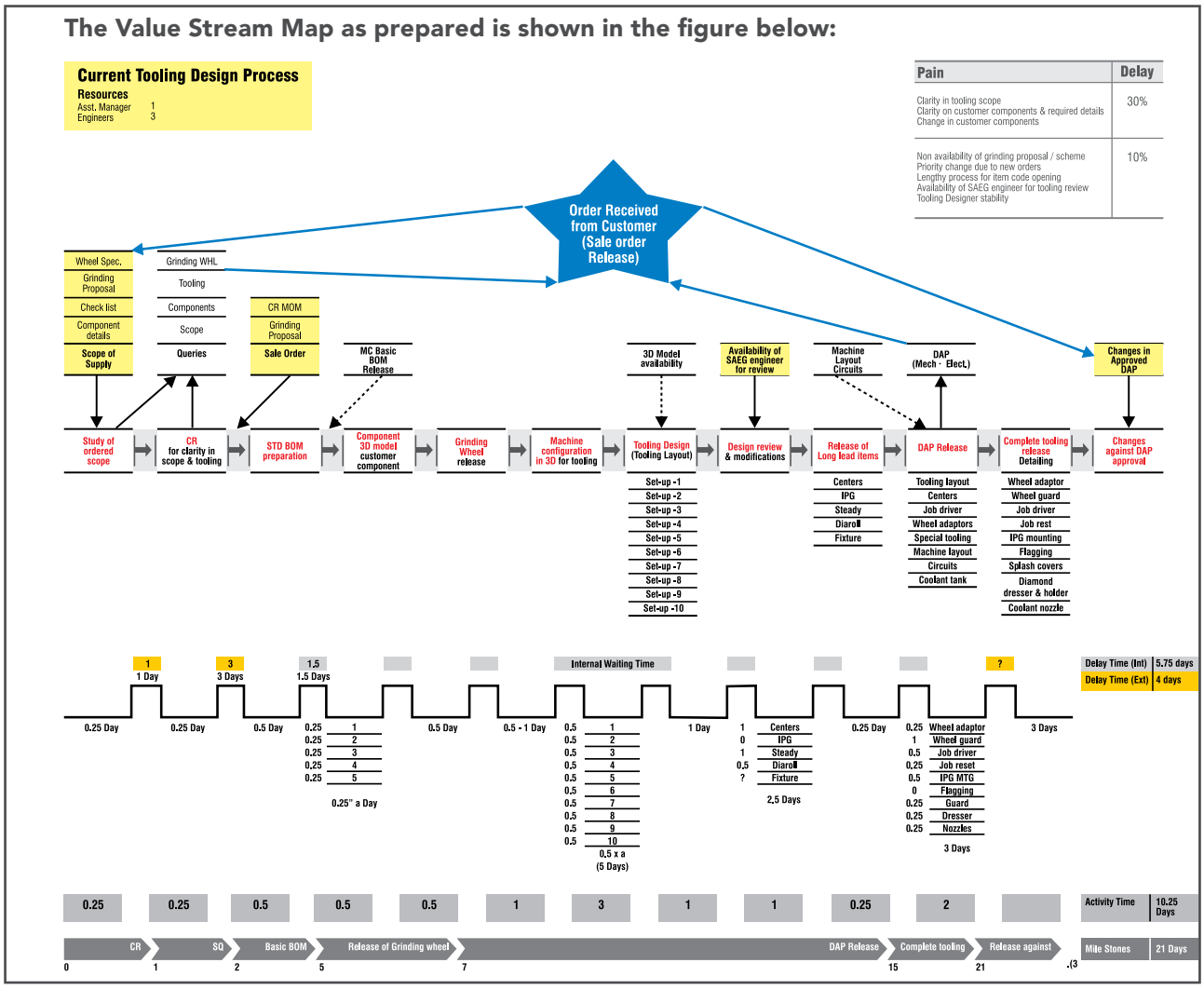
MGT's Design & Development team made use of a lean tool to identify the non-value adding (NVA) activities in its process and took action to do away with them. The results obtained were a big eye-opener.

In today's digital age, the only way to survive is to keep pace with the unpredictable demands of the market. At MGT, Design & Development is one of its key processes that faces an ever-increasing challenge of faster design and development times in order to meet the customer requirements.

Since continual improvement and Pursuit of Zero (Zero Defect, Zero Delay, Zero Breakdown) is the guiding philosophy at MGT, the Design Department came forward to apply Value Stream Mapping (VSM), a well-known Lean Tool to its process for the tooling design.

Using the tool, the team was able to identify the non-value adding (NVA) activities in the process and take actions to eliminate them. An immediate reduction of four days in the overall process was achieved by visualizing the process using the VSM tool. Further NVA activities were identified which could further reduce five to six days in the overall process.

The Value Stream Map as prepared is shown in the figure below:



Source: MGT

Mr NK Dhand, Chairman, MGT, with the students and care givers of Anand Training Institute with the Maruti OMNI van provided by the company.

Making a Difference

With an ardent belief in the power of giving and sharing, MGT engages in the following CSR initiatives with the aim to contribute to the well-being of the immediate community, asserting the adage that it is only by giving back can we move forward.

MGT acknowledges that a firm's success is impossible in isolation. For it to grow and prosper, it has to work in tandem with the society in which it operates and ensure the society's economic, social and environmental development.

SHARING THE BREAD

- With the support of a charitable organization, MGT employees provide food for at least 400 people twice a month in Ghaziabad.
- The food distribution happens in dense areas such as railway stations, Metro station and bus stands around the city.
- Around 60 percent of the employees at Micromatic Grinding Technologies voluntarily contribute either by financing the project or getting cooked food from home.
- Retired employees and those who have left the organization still remain associated with the cause.

Source: MGT

GNK undertook MGT-sponsored wall writing in two villages for social awareness.

Source: MGT

Women of Rahispur village holding self-made baskets and pencil boxes

Source: MGT

(L-R) MGT employees Ramji and Raju who oversee the project of reducing hunger epidemic.

EMPOWERING DIFFERENTLY-ABLED

- To help facilitate specially-abled children get equipped with necessary skills and knowledge, MGT has associated itself with Anand Training Institute in Nandagram, Ghaziabad.
- The company has supported the institute with a Maruti Suzuki's OMNI van, which the institute was in need of to shuttle the children between the institute and other skills learning centers and hospital.

TEACHERS BUILD THE NATION

- To ensure that its CSR initiatives are headed in the right direction, MGT, for the last many years, has joined forces with the NGO, Gram Niyojan Kendra (GNK).
- The NGO organized a training for the Balwadi teachers of Rahispur and Sadarpur villages of Rajapur Block in the Ghaziabad district to ensure that the teachers remain in sync with the changing teaching methods.
- The training focused on Children's Group Activities and their Time Table and provided the teachers Teaching and Learning Materials (TLM) for the activities.

SUSTAINABLE LIVELIHOOD INITIATIVES

- GNK organized a unique community initiative of bringing together MBA students of IMT Ghaziabad, a premier Business school to sensitize them on a rural platform to impart skills useful to augment the earning capacity of women.
- The students trained them in the skill of making baskets and pencil boxes.
- Three training sessions were held with each of three hours and comprising 10 women.
- The training helped Krishna Self-Help Group (SHG) members prepare 95 baskets and 97 pencil boxes from the materials provided by the students.
- The products were purchased by the students themselves with the basket and the pencil box costing ₹150 and ₹100 each, respectively.
- A total of ₹23,950 was earned by the women through the newly-learned skill.
- Carrying the initiative forward, the students identified three women SHGs during the training and provided them with woolen material and biodegradable polymer materials to make socks, sweaters, caps and other products out of them.

IEC ACTIVITY FOR RAISING AWARENESS

- GNK undertook a wall writing initiative under the Information, Education, Communication (IEC) activities, which are primarily for generating awareness.
- Empowering slogans on the issues of education, health, girl child and environmental sanitation were written on the walls of two villages.
- Altogether 20 walls were covered in both the villages.

Micromatic Grinding TECHNOLOGIES LTD.
In the Pursuit of Zero

Head office & North India Plant

Micromatic Grinding Technologies
C-27 & 28, Industrial Area,
Meerut Road,
Ghaziabad,
Uttar Pradesh - 201 003, INDIA
T: +91 120 2712137/69/79, 2723216
E: sales@micromaticgrinding.com

Bengaluru – South India Plant

Micromatic Grinding Technologies
5/A, Servey No.74, 103, 106, 107,
KIADB, Industrial Area, Dobaspet,
Nelamangala Taluk, Bangalore,
Karnataka - 562 111, INDIA
T: +91 080 27735383/85/86/87, 27702449
E: sales@micromaticgrinding.com

/micromaticgrindingtech

//tinyurl.com/z7264wo

micromaticgrinding.com

Ace Micromatic Group
www.acemicromatic.net