

# Excellence on the agenda

Automobile manufacturing demands extreme complexity and sophisticated technology. It requires state-of-the-art advanced manufacturing processes. To improve product quality and efficiency in production, auto-makers invest a huge amount of time, efforts and money into developing and improving the manufacturing processes, and rely heavily on research and technological innovation. ■ Soumi Mitra

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Over the last few years, significant technological developments have taken place, changing and reinventing how vehicles are produced. While cars are produced at faster rates, auto-makers must continue to balance increased productivity and efficiency with quality and innovation, to remain competitive. In this context, we sought views of industry experts such as Raj Kishore Naik, Head, Manufacturing Practices, Defiance Technologies Ltd; Rajabhadur Arcot, Director, South &

South-East Asia, ARC Advisory Group and Deepak Krishnan S, Engineer, Test & Verification, Vestas Technology R&D Chennai Pvt Ltd on how manufacturing systems and processes have changed over the years and how those could be further improved and productivity enhanced without disrupting operations.

## The changing face

In the last few decades, the automotive industry has gone through a paradigm

shift. The demand centres have shifted from developed countries to developing countries and new automotive centres of excellence and clusters have emerged outside the traditional places. Rajabhadur Arcot, Director, South & South-East Asia, ARC Advisory Group, elaborates, “emerging economies are driving the demand for compact and affordable cars and the demand for eco-friendly automobile are expanding. Automotive companies are trying to reduce their dependence on oil by considering alternative sources of energy,

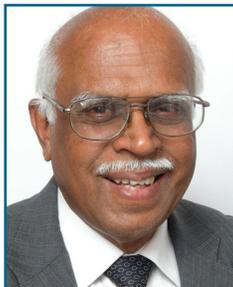
which are also environment-friendly, such as electric, gas-electric hybrids, ethanol, and bio-diesel.” He adds, “as the industry expands and industry participants scale up production, design, and engineering operations, there is a need to automate all their operations to achieve cost reductions and improve demand fulfillment. Automotive companies are extensively leveraging manufacturing IT solutions to gain competitive advantages, reduce time-to-market, improve productivity and supply chain efficiencies, etc.”

Presenting his perspective on increased competition and strong customer demands that have changed the face of manufacturing systems and processes over the years, Raj Kishore Naik, Head, Manufacturing Practices, Defiance Technologies Ltd, explains, “gone are the days when we used to produce 1-2 cars per day. Cars which were a luxury earlier have become the biggest need of all. The production tact time is challenged every day and is counted in terms of seconds. Quality being the key parameter for sale is checked at every stage of manufacturing. The biggest challenge is to hit high volumes besides meeting the quality aspirations of the customer.”

### Trends in automotive manufacturing

Talking of the modern manufacturing trends, Naik points that it is the use of ‘more machines than men.’ He explains, “in contrast to our past manufacturing practice, most of the modern manufacturing companies are moving towards use of more robots and automated machines for the assembly of the vehicle. The biggest advantage of using the robots and automated machines is to meet the tact time with the accuracy of assembly. This reduces the re-work and avoids line stoppages.”

Worldwide, the trend is to reduce dependence on oil, which is depleting and a highly polluting source of energy. Therefore, the automotive industry, which traditionally contributes to a significant share of oil consumption, is under pressure to increase efficiency and consider alternative fuels, such as electric, gas-electric hybrids, ethanol, and bio-diesel. In this regard, Rajabhadur orients, “environment-consciousness is propelling auto



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Director – South & South-East Asia, ARC Advisory Group*



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Head, Manufacturing Practices, Defiance Technologies Ltd*



**“In today’s era, every process depends upon the following ‘E’s or E5 – eco-friendly, efficiency, effectiveness, economics and employment. When we develop any process, we must keep in mind the above factors.”**

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Vestas Technology R&D Chennai Pvt Ltd*

manufacturers and customers to look for sources of energy that are non-polluting and eco-friendly; so at the forefront are green technologies. The demand is for cleaner and more efficient vehicles.” He puts, “historically, the automotive industry has always leveraged technology for achieving business excellence and this in turn has played a significant role in the growth of manufacturing IT solutions, such as programmable logic controllers, programmable automation controllers, robotics, supply chain solutions, product-lifecycle management solutions, and manufacturing execution systems. This trend will gain further momentum. The industry has been in the forefront in adopting digital manufacturing and virtual commissioning technologies. Virtual simulations of production systems could provide the means to identify performance deviations and test potential remedies. They could help optimise production and drive continuous improvement. By modeling

the changes, they could speed innovation where new products require modifying production equipment. Automotive industry will play a crucial role in ushering the era of smart manufacturing.”

According to Deepak Krishnan S, Engineer, Test & Verification, Vestas Technology R&D Chennai Pvt Ltd, some of the modern techniques adopted in automotive manufacturing are rapid prototyping, also called layered manufacturing or 3D printing. It physically constructs or manifests 3D geometries from 3D CAD. Mass customisation is a way of using flexible computer-aided manufacturing systems to produce custom output. These systems combined with mass production, can create custom products with high economics. There are many other techniques adopted in the automotive sector such as lean manufacturing, agile manufacturing which enables to bring about maximum productivity with minimum losses. ▶

## Common system & centralised IT

Collaborative automation and IT solutions empower manufacturing companies to generate, manage, analyse, and disseminate actionable information across the organisation to get the product, price and timelines right. Companies can achieve effective direct information sharing between engineering and manufacturing processes, supply chain partners, internal and external teams of an enterprise. Sharing his views, Rajabhadur opines, “vertically integrated enterprises, operating within its four walls, do not dominate the automotive industry any longer. The industry comprises conglomerates of original equipment manufacturers (OEM), tier 1, 2, and 3 suppliers. These conglomerates collaborate, but in the past, the collaboration was mostly along the supply chain. The collaboration now extends to research, design, and engineering operations.”

Giving a contemporary picture Naik avers, “the manufacturing of vehicle needs synchronisation of many activities. Starting from planning the variants of the product, the paint shade of the product to the supply of the right parts to meet the feature requirement of the planned variant is very important. Any mis-operation during the assembly will lead to loss of valuable assembly time which will throw the tact time out of gear. In order to have a smooth production flow an integrated manufacturing system which is IT enabled is very useful.”

Automating the manufacturing process is one of the rapidly growing sectors. Putting his point across, Krishnan illustrates, “automation works with artificial intelligence (AI) and intelligence comes with knowledge. The question is how intelligent are these systems? The systems’ intelligence is proportional to the knowledge incorporated. Knowledge gaining is a continuous process and the newly gained knowledge must be used to evolve the automatic systems. Just gaining a lot of knowledge wouldn’t cut the chase in today’s world. The knowledge accumulated must be organised and must be presentable so as to make something out of it. This is possible by collecting the knowledge in a centralised knowledge database where it will be organised. By collecting vast

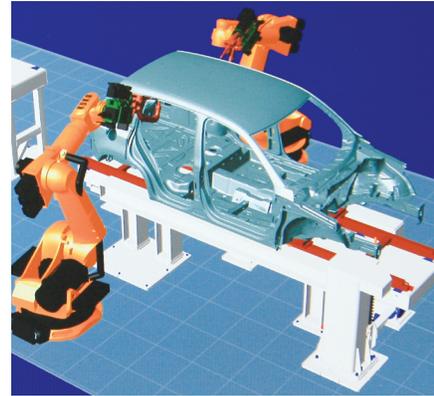
knowledge and organising them, the automation systems can transcend to the next level.”

## Integrating suppliers into business processes

Suppliers and manufacturers must work in close collaboration and be totally in sync to improve material inventory management and delivery scheduling. For example, if the supplier is aware of what the manufacturer’s bottlenecks are he should be able to customise solutions; or the manufacturer should state what he expects from his supplier. In this context ,Rajabhadur elucidates, “in today’s volatile marketplace companies must collaborate and effectively deploy plant level automation systems, enterprise resource planning and supply chain management solutions, manufacturing execution systems, and such others.” He further adds, “consumers in India have become more discerning and are looking not just for superior products but products benchmarked to global standards, while at the same time being cost competitive. This compels India’s automotive companies to bring new products faster to market, ensure greater efficiency in their operations and create superior consumer value. All this is possible only if there is a symbiotic partnership between suppliers and manufacturers.”

Echoing on the similar lines, Naik states, “without the help of all suppliers, it is not possible to produce a vehicle. The vehicle cannot go to the customer’s hand unless every supplier contributes towards the assembly of the vehicle. The role of the suppliers is the most important action in the assembly of the vehicle. They should be seamlessly integrated to the OE team from the start of the design and development of the vehicle.”

Putting his view, Krishnan says, “today, we are interdependent on our suppliers for our manufacturing processes. It would be wise to implement an online inventory management system such as SAP. The suppliers can be given access to this information on a need to know basis so that better planning and delivery schedules can be made. This would also make the follow-up process easier.”



New approaches, such as smart manufacturing must be adopted

## Quality with safety & reliability

It is a challenging task to stay focused on consistent quality with safety and reliability, considering the changing market place and shifting production locations in the global automotive manufacturing space. These three factors rank among the most important in the automotive industry and there can be no compromises. Although new demand centers have emerged and production hubs are relocating, centralised control systems and enabling technologies, such as PLM and virtual commissioning help maintain consistent quality, safety and reliability. Rajabhadur says, “automakers realise that to remain globally competitive it is mandatory to adhere to international standards. Recently, Honda Motor in India said that it will recall over 70,000 of its city sedans to replace a power window switch, the firm’s second recall since 2010. In the worst-case scenario, the switch could partially melt and its cover could catch fire; this has not happened so far, but the company is carrying out the part replacement to ensure adherence to stringent quality standards.” “Carmakers are also paying considerably more attention to systems engineering and mechatronic development. With a strong and steadily increasing amount of telematics becoming integrated into vehicles in the form of infotainment, navigation systems, and other embedded software, these supporting technologies will grow dramatically in the next decade. Moreover, carmakers for next generation vehicles have already begun to apply telematics and smart systems ■

in actual driver controls (drive-bywire), functional systems (braking), and safety systems (driver awareness and autonomous vehicle response).”

Naik shares, “a company’s success depends on how it adopts manufacturing practices of any global locations. Focus on safety and reliability should be the DNA of the company. While designing and development of the vehicle, it should comply with the prevailing world standards on the safety and reliability standards. It should execute enough futuring in the designing stage and design protects all the regulations and customer requirements which are expected in future.”

“Quality, safety and reliability are three links of a successful business. It is essential that one must make conscious effort to keep all three in its highest standards in order to stay on top. Shifting the production locations globally is the rule of the game today. This must not let us compromise on the links,” points Krishnan.

### The future ahead

On a concluding note we took a stock on how operational costs, product development, manufacturing process development, use & access to advanced technologies & systems, flexibility, facilities/equipment, research & engineering, interfaces, logistics & supply chain, workforce and organisation as-a-whole can contribute to better manufacturing.

Manufacturing companies must take a holistic view of all their operations and not as disparate islands. They must seek excellence in all their operations and look at enabling technologies for empowerment. As Rajabhadur sums up, “new approaches, such as smart manufacturing must be adopted. Smart manufacturing/factory of the future integrates technology, information, and human skills to develop and apply manufacturing intelligence at all levels – from concept to market. It will revolutionise the way products are manufactured and shipped; and at the same time it will ensure worker safety and remain environment-friendly. To make this initiative work there has to be cooperation and coordination, entailing a public-private partnership; fresh investments must also be made in R&D.”



It is a challenging task to stay focused on consistent quality with safety and reliability

Giving his impressions on the subjects, Naik puts, “operational cost should be kept minimum. It can be achieved by outsourcing the sub-assembly operation to the supplier. Part commonisation, platform concept adoption would enhance product development cycle. Integrated manufacturing system (IMS) with usage of more robots and automation would make a very efficient manufacturing process. Flexibility in manufacturing system will enable more variants of vehicle to be produced in the same manufacturing line leading to profitable business. This will ease the product validation process and also minimise the iteration thus saving on the development time and cost. We should have a strong research and engineering wing for better products and quick response to the market’s requirement. It is very important to have a seamless team. After all manufacturing is a show piece of a good teamwork. Without the support of an efficient logistic and supply chain, we can’t expect an efficient manufacturing system. Finally workforce and organisation as-a-whole are the real backbone for a good manufacturing system.”

Krishnan explains, “operational cost also called Earned Value Management (EVM) helps to improve, and let know where we need more resources, etc. The motive must be to minimise the cost variance and schedule variance. Creating an awesome product is one thing and having repeatability and reproducibility during

manufacturing is another. Repeatability means when one task is done by the same person many times, it must not have deviation / defects beyond certain limits. Reproducibility means when a process is done by more than one person, it must not have deviation beyond a limit. Hence, we must ensure minimum or nil defects in our product development. In today’s era, every process depends upon the following ‘E’s or E5 – eco-friendly, efficiency, effectiveness, economics and employment. When we develop any process, we must keep in mind the above factors. To achieve these we can depend on techniques such as lean systems, frugal management, etc. By gaining better understanding of these techniques and implementing them, we can even transcend their limitations and evolve a new customised technique. The facilities and equipment that are being used in the manufacturing process keep evolving based on the needs and changing scenario. We need to focus on the ergonomics of the equipment. Regarding facilities, automation and smart systems are the game of the day. One more buzz is the modular facilities that can be altered on need.” He concludes, “in terms of workforce and organisation as-a-whole there needs to be a collaborative approach. The workforce needs to be motivated. There must be alignment with the organisation’s motives and the work force’s activities.” ■

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