HOW BIG DATA IS CAUSING BIG SHIFTS IN HI-TECH AND MANUFACTURING

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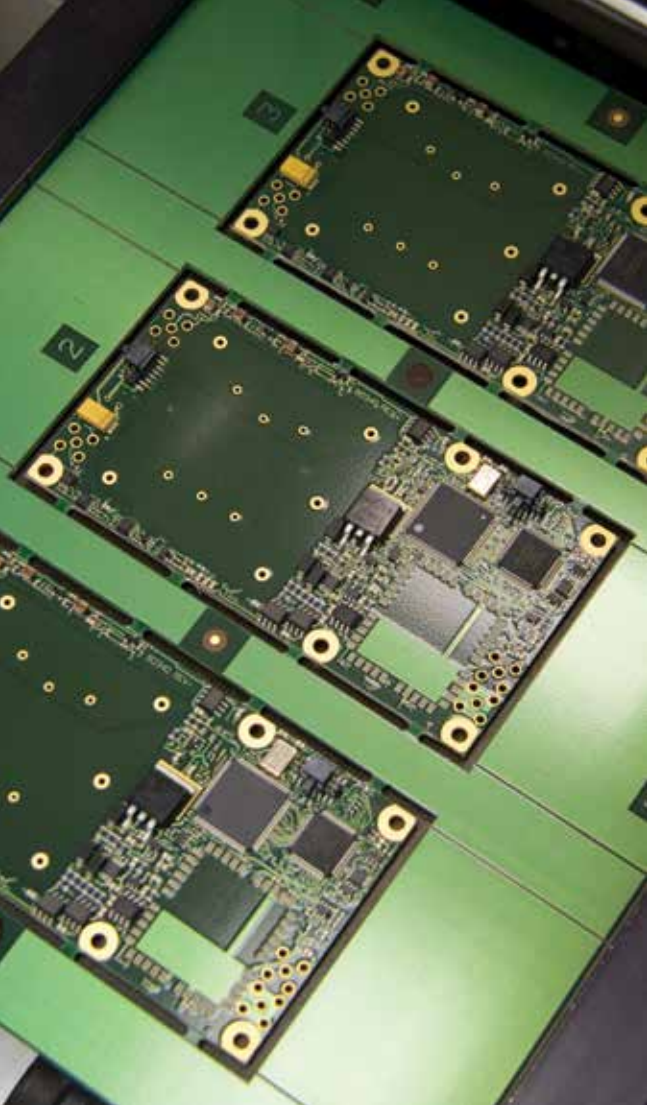
Every industrial revolution has improved the quality of life through fundamental changes in process engineering and product manufacturing. Over the years, discrete and process manufacturers as well as high technology and semiconductor companies have adopted lean techniques and Six Sigma to accelerate production, maximize throughput, rationalize costs, and minimize variability in finished products.

With the emergence of the Industrial Internet of Things (IIoT) or Industry 4.0 framework, the production environment is undergoing a transformation. Big data generated through connected cyber-physical systems is driving simulation and machine learning which in turn is simplifying operations.

Moreover, big data models are combining any type of data from anywhere – structured and unstructured sources, internal and external systems, and statistical processes — rendering manufacturing 'boundaryless'.

Advanced analytical tools consume data from operational systems, such as manufacturing execution and ERP, business applications including CRM and SCM; machine data from process instruments and sensors, and external data about consumers, suppliers, and other stakeholders. The tools distill granular insights to enhance every aspect of manufacturing — from product life cycle management to customer service.

Product design

- **Research & Development (R&D):** Big data boosts productivity of R&D activities significantly. Access to real-time information promotes collaboration across the ecosystem, which helps manufacturers accelerate product innovation.

- **Feedback data:** Feedback on products enables incremental improvements for product upgrades. Real-time access to customer feedback enables redesign of products and facilitates a range of testing scenarios.

- **What-if analysis:** What-if analysis optimizes development projects in situations where adequate samples cannot be produced cost-effectively or when feedback does not suffice. Manufacturers can engage with consumers and use personalized analytical data to develop innovative products.

Production

- **Internet of Things (IoT):** IoT solutions complement Six Sigma frameworks and lean management techniques to optimize production, reduce waste, and drive continuous improvement. Big data platforms serve as early warning and prevention mechanisms by offering insights into how each phase of the manufacturing process or assembly line can be reengineered to streamline product flow, increase energy efficiency, or improve production. In addition, data-driven manufacturing minimizes scrap and rework.

- **Real-time visibility:** Real-time collaboration with suppliers offers visibility across the supply chain. It helps manufacturers improve planning as well as supplier performance.

- **Algorithms:** Algorithms help in discovering anomalies in raw materials, work-in-progress, and finished products, thereby preventing the launch of defective products.

- **Production planning and waste management:** An analytical R&D approach helps manufacturers improve production planning and scheduling by sharing lists of materials in advance. Further, it can accurately estimate the expiration date of legacy products. Data around product usage environment, maintenance history, and status of similar or equivalent products is combined with big data techniques to evaluate product recovery options. This is useful in planning obsolescence of products, reuse or recycling of parts, and dismantling / disposal of components.

Sales

- **Value-based pricing:** When manufacturing and hi-tech enterprises identify potential markets, they undertake segment-specific analysis of business opportunities, competitive strength, and customer sentiment. The data generated from this research leads to value-based pricing. Besides, data mining can also open up new sales models.

- **Statistical tools:** Statistical tools provide a detailed analysis of production data, supplier constraints, market growth rate, and price elasticity of products to create micro-segments of the customer base. It supports high-margin strategies, targeted pricing programs, and discounting policies to boost sales. Moreover, it enables manufacturers to maximize the performance of sales and marketing teams.

Maintenance

- **Predictive and preventive maintenance:** A predictive maintenance approach, powered by big data analytics, enables the maintenance team to predict requirements accurately. Analytical solutions for predictive maintenance use inspection data from condition-based monitoring programs and live operating data to identify patterns that indicate imminent failure. Preventive maintenance of equipment and process devices ensures industrial safety and maximizes resource utilization.

- **Multivariate analysis:** Multivariate analysis supports enterprise asset management systems to minimize non-productive time of production equipment.

Through improved use of information, big data and machine learning algorithms are renewing the hi-tech and manufacturing ecosystem, touching almost every part of the product life cycle. Big data also accelerates innovation and commercialization of products embedded with intelligence.

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