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**Excellence**

**Factories of the Future  
are Setting Today's  
Standards in  
Manufacturing**

Article Courtesy of NGEN

Changing customer expectations, rapidly evolving market conditions, and new applications of technology are transforming the business of manufacturing in Canada and around the world. Standards for assessing manufacturing capabilities are also changing. How should excellence in advanced manufacturing be judged today? Let's start with the capabilities most likely to define a Factory of the Future – the practices that will set the benchmarks for manufacturing performance over the next five to ten years.

Now, some may say that advanced manufacturing is really about the products that go out the door, that excellence depends on continuous innovation of new and enhanced goods and services. There is some truth to that, but it's not the whole picture.

Some may point to the adoption of state-of-the-art technologies as the defining feature of advanced manufacturing. Digitally connected factories, multi-axis CNC machines, robots and automation, additive manufacturing, virtual engineering all feature prominently in depictions of Industry 4.0 while AI and machine learning, cobots, 5-G networks, and smart materials are setting the stage for Industry 5.0, the next revolution of manufacturing capabilities. It's hard to keep up!

The deployment of state-of-the-art technologies is also part of the picture, but isn't it the adoption of the most appropriate, rather than the newest, techniques and technologies that really counts? And, the ability of companies to manage their technologies in a productive and ultimately profitable way?

Advanced manufacturing capabilities involve more than just products and processes. They really depend on how people in an enterprise work together, using technology, to deliver value-adding solutions to customers on a timeline, at a price point, and at a level of quality that their customers expect and are themselves able to manage.

It's really the ability to continuously improve business processes and to keep just ahead of changing customer expectations that defines excellence in manufacturing. That's nothing new. What is new are the possibilities for improvement and the business opportunities that technologies and associated skill sets offer companies today – not to mention the impact they are having in shaking up entire industries and supply chains.

Factories of the Future deploy agile business strategies that take these changing conditions into account. They focus on the unique value proposition the company delivers to

customers, how it exceeds that of competitors, and how innovations in products, services, production and business processes can contribute to enhancing solutions for customers. They have a clear vision of how technology and data are to be used for gaining competitive advantage, and their vision is incorporated in their strategies and roadmaps for implementation. Their business plans are well articulated, understood, and acted upon throughout the enterprise. They are complemented by effective execution enabled by a Lean culture and management systems that continuously improve processes by minimizing non-value-adding activities. Performance is benchmarked regularly against industry best practices.

Factories of the Future also have the capability to deploy and optimize the use of advanced technologies. Employees are equipped with the skills required to manage the technologies they operate. And, maintenance practices are based on real-time monitoring of critical components, enabling high levels of overall equipment effectiveness through focused interventions when required to prevent productivity loss.

Factories of the Future are digital factories. They use digital technologies and data to transform products, systems, or services. Employees are supported by integrated digital processes. Shop floor systems are smart, interconnected, and autonomously share information. Control of digital information enables virtual design and simulation of new systems prior to implementation. Data systems are secure. The accuracy of data is guaranteed. And, data analytics are incorporated into decision-making systems, supported by machine learning and artificial intelligence.

Factories of the Future use end-to-end engineering to maximize customer value while managing risks and costs throughout product life cycles. Products and their related manufacturing processes, use, servicing, and disposal requirements are designed and developed simultaneously involving cross-functional project teams, customers, suppliers, and other stakeholders. Data collected throughout product life cycles are fed back into the design and engineering process to improve performance, productivity, and customer satisfaction.

Factories of the Future enable and engage employees in product and process innovations. They invest in supporting the skills, expertise, and competencies of their employees. They stimulate life-long learning and individual growth paths based on open communications. Knowledge is shared and accumulated based on problem solving experience. Project teams are agile. They work with authority and responsibility in autonomously managing processes and resolving operational problems.

Factories of the Future design their shop-floor processes so that they can exploit the full potential of user-friendly, automated, intelligent, efficient, and flexible human-machine interactions. Self-managed quality and process control systems enable them to adapt quickly to changing orders and customer requests without jeopardizing quality levels. Knowledge of the relationship between manufacturing parameters and final product quality enables first-time-right, lot-size-one production and rapid changeovers.

Factories of the Future are environmentally and socially responsible. They systematically reduce their dependency on non-renewable energy resources, water, and raw materials.

They systematically identify, assess, and mitigate operating risks. They are considered leaders in shaping and complying with new rules, regulations, and standards.

Factories of the Future operate on the basis of cooperation, collaboration, and partnerships in order to accelerate innovation, manage risks, and adapt rapidly to changing business conditions. They participate in international innovation networks and demand-driven value chains. Internally they work as innovation networks. Their operations are regularly informed by external knowledge of best practices and technology, industry, and market trends.

Factories of the Future already exist. Capabilities such as these are already being deployed by industry leaders around the world. They apply regardless of company size, sector, type of product, or production process. They do, however, reflect the fact that advanced manufacturing is a knowledge-based industry. Today, standards of manufacturing excellence need to be assessed in light of these capabilities. They provide a good roadmap for business success in a world of constant change.