Executive Summary - Celestica - Strategic Management and Design Considerations for the Factory of the Future

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By tradition, manufacturing has been thought to be a process that turns raw materials into physical products, and the factory, in managing fragmented communications protocols and automation practices, is the structure where manufacturing happens. Today, drivers such as technology, sustainability, optimization and the need to meet customer demands have necessitated the transformation of the manufacturing industry, to become adaptive, fully connected and cognizant of its own power quality. This transformation is characterized by the globalization of value chains in organizations, with the goal of increasing competitive advantages, creating more value add-ons and reducing costs through comprehensive sourcing.

The significant trend in manufacturing is the makeover to improved information technology (IT) solutions involving the union of conventional automation with cyber-physical systems combining communications, Information and Communication technology (ICT), data and physical elements and the ability to connect devices to one another. This IT transformation, which shifts the manufacturing process from a patchwork of isolated silos to a nimble, seamless and fully integrated system of systems (SoS) matching end user requirements in the manufacturing process,is known as the Factory of the Future. The advantages of having automated systems have been quickly recognized by industry. Due to the rapid evolution of IT in the second part of the 20th century, engineers are able to create increasingly complex control systems and integrate the factory floor. The ultimate goal of the factory of the future is to interconnect every step of the manufacturing process. Factories are organizing an unprecedented technical integration of systems across domains, hierarchy, geographic boundaries, value chains and life cycle phases.

This integration will only be a success if the technology is supported by global consensus-based standards. Internet of Things (IoT) standards in particular will facilitate industrial automation, and many initiatives (too many to list here) in the IoT standardization arena are currently underway. To keep up with the rapid pace of advancing technology, manufacturers will also need to invest in both digital technologies and highly skilled technical talent to reap the benefits offered by the fast paced factories. Worker safety and data security are other important matters needing constantly to be addressed. Implementation of factory of the future concepts highly depends on the readiness of involved stakeholders to adopt the appropriate technologies.

This project provides a framework in analyzing the design and strategic considerations that need to be followed in adopting the Factory of the Future idea. One of the priorities of this project is to develop a model to monitor the energy consumption of energy intensive equipment on the PCB manufacturing line of Celestica. This provides means

to better understand how energy is being used on Celestica' plant floor and what could be done to reduce its use and cost to the company. Going beyond power consumption this project draws a parallel between the data abstracted from the model and the different levels of organizational management. Adding a data virtualization layer along with the Power consumption model, brings together a complete energy picture that includes IT devices, Operation Technology devices and IoT sensor data into a single enterprise-wide energy focused view.

This delivers an extensive ROI model based not only on energy costs but data driven opportunities to improve operational workflows that help to cut costs. This initiative will help manufacturing supply chains greatly, reduce their energy consumption and save tens of millions of dollars in the process. Energy efficiency in the manufacturing domain goes beyond simple stand-alone approaches e.g. peak load avoidance, single process / machine optimization etc, and must be seen in a more holistic form, where local vs. global optimizations are supported by an Information and Communication Technologies based infrastructure that dynamically adapts to conditions and business plans/goals, thereby aiding organizations in thinking strategically and making informed decisions.