Japan's New Trends in Promoting Lean Smart Manufacturing and Prospects for Japan-Taiwan Cooperation

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In recent years, influenced by the COVID-19 pandemic and the implementation of carbon neutrality goals, the simultaneous promotion of "Digital Transformation" (DX) and "Green Transformation" (GX) has become a crucial issue for the sustainable development of global enterprises. By advancing DX, companies can reduce waste and improve operational efficiency, which aids in energy conservation and carbon reduction, forming a vital foundation for promoting GX. Conversely, the net-zero emissions targets set by GX will accelerate the implementation of DX measures. Therefore, DX and GX are interdependent and mutually reinforcing.

Compared to major European and American companies that often adopt a "leapfrog" approach by massively implementing advanced equipment and purchasing carbon credits, Japanese industries adhere to the "Lean Smart Manufacturing" concept, which emphasizes "lean improvement first, supported by smart technology." Through deeply ingrained "mutual cooperation," they create a work environment that realizes the substantial benefits of DX and GX. This article explores Japan's "Lean Smart Manufacturing" strategies from the perspectives of large enterprises, small and medium-sized enterprises (SMEs), and public associations, and proposes suggestions for Taiwan-Japan industrial cooperation.

First, in terms of large enterprises, companies like Daikin Industries have built on their long-standing "variant production systems responding to diverse and small-volume market demands." They have integrated "human-machine collaborative automated production systems that enhance operational value," "digital twin virtual factories that accurately predict production issues," and "smart air conditioning management systems that create comfortable and energy-efficient work environments." These integrations aim to reduce inventory waste, prevent downtime, and achieve energy conservation and carbon reduction goals in factory operations. Future cooperation could facilitate exchanges between Taiwanese professional software companies and large

Japanese firms to explore potential collaboration opportunities, jointly developing "Lean Smart Manufacturing systems with digital twin functions" that meet the needs of major Taiwanese manufacturers.

Second, regarding SMEs, companies like Asahi Tekko emphasize "data-driven precise on-site waste issue inventory" due to constraints on capital and human resources. They develop and apply "low-investment" remote monitoring systems for production lines, which collect and analyze equipment operation and electricity usage data in real-time. This enhances the "visualization" of factories while implementing improvements that contribute to waste reduction and energy conservation goals. Future cooperation could promote deeper exchanges and collaboration between Taiwanese industry-academia alliances and leading Japanese SMEs on "data-driven visualization and improvement" topics, refining Lean Smart Manufacturing systems to better meet the needs of Taiwanese SMEs and assisting them in achieving rationalized operations, carbon auditing, and energy conservation.

Third, in terms of public associations, organizations like AOTS aim to promote exchanges and experience sharing between production technology talents from emerging Asian markets and Japanese industry personnel through training and inspection activities. This would establish an international learning mechanism for the Lean Smart Manufacturing model. Encouraging Taiwanese-Japanese industrial cooperation units and Japanese public associations with bases in Taiwan to collaborate and recruit Taiwanese manufacturing technology talents to participate in training activities in Japan could facilitate the dissemination of "energy conservation and carbon reduction technologies and management systems" derived from the Japanese Lean Smart Manufacturing model to the Taiwanese industry.