Editorial Note

Industry 3.5 for Sustainable Migration and Total Resource Management

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This special Issue aims to provide a platform in which various studies employing Industry 3.5 as a hybrid strategy between Industry 3.0 and to-be Industry 4.0 via disruptive innovations to address the needs for humanizing industrial revolutions and total resource management for sustainable migration. Indeed, new business models and manufacturing solutions will impact global resource utilization and the environment. International manufacturing firms are battling for dominant positions in this newly arena via providing smart manufacturing platforms. However, most of emerging countries may not be able to directly migrate for Industry 4.0. Industry 3.5 approach is proposed for phased migration for smart manufacturing and green production in the existing facilities (Chien et al. 2016; Chien et al., 2017; Chien et al., 2020b). Indeed, increasingly tight resource constraints and severe environmental pollution have made sustainable resource utilization and environmental protection worldwide (Tseng et al., 2018). Sustainable resource utilization seeks to achieve both economic growth and environmental sustainability by catalyzing innovations that underpins sustainable development in high-tech manufacturing. Prior studies are lacking to address flexible decisions and sustainable resource utilization before ready for industry 4.0 migration (Jomthanachai et al., 2020; Tseng et al., 2019).

This SI collected practical approaches for achieving concrete, measurable progress across economic and environmental pillars to ensure the sustainable resource utilization via novel solutions that facilitate successful and sustainable migration of industrial revolutions. The Industry 3.5 framework is to stimulate the smart manufacturing systems that efficiently utilize available resources and leads to disruptive innovations in the paradigm of manufacturing systems. For instance, Chien et al. (2020a) developed an approach that integrates a cooling load forecasting prediction model for the operation efficiency of the chillers to optimize the combination of operating chillers to fulfill the cooling load demand and minimize the electricity consumption for total resource management.

Industry 3.5 focuses on total resource management and digital transformation for maintaining competitive advantages in the existing infrastructures. For example, Ozen et al. (2020) indicated that lack of knowledge about data management among stakeholders and Lack of understanding of decentralized organizational structure for supplier collaboration are most concern in the Industry transition process. Jomthanachai et al. (2020) proposed total resource management in the rubber wood processing industry to prepare it towards a sustainable transition to industry 4.0. Big data analytics are employed for yield enhancement and smart production (Kuakifirooz et al., 2018). A sustainable transition is attributed to total resource management since the achieved performance improvement enriches effectiveness in production, material, labor and service resources.

The manufacturers make decisions and allocate common parts strategically to enhance its customers’ fulfillment rate by using the proposed hybrid Industry 3.5 strategy under dynamic and updated information sharing of customers' periodic forecast demand. For instance, Kuo et al. (2020) proposed a material resource management and allocation approach in the members of supply chain networks and discussed consumer procurement behaviors and demand patterns are significantly influenced by high Internet penetration, ubiquitous information availability, and rapidly growing social networks. Huynh (2020) proposed an online defect prognostic model to predict defects online and to prevent the waste and improve the quality of products for decision making due to the textile manufacturing companies only detecting defect products at the end and the defect products cannot be reworked that causes a huge problem for firms.

Industry 4.0 is challenging manufacturers to maintain growth and competitiveness. There are approaches to propose intelligent facilities and it may be difficult to employ intelligent facilities directly. Hence, block-chain technology adoption barriers and revealed that lack of government regulation and lack of trust among agro-stakeholder to use block-chain are significant adoption barriers in Indian agriculture supply chain (Yadav et al., 2020). In order to maintain the competitiveness, Tsao et al. (2020) claimed the energy-efficient single-machine scheduling problem in which the job processing time depends on the quantity of allocated resources and makes the resource allocation cost is efficient under differential electricity pricing.

In sum, Industry 3.5 humanizing industrial revolution for sustainable migration requires cross-discipline research efforts for integrating total resource management and circular economy for smart production. Indeed, Industry 3.5 that is a practical hybrid strategy to enhance the resource efficiency consists of various approaches proposed in this special issue including AI, big data analytics, and optimization for profitability and sustainable migration. More studies should be done to enable Industry 3.5 migrations and digital transformation for upgrading existing factories in various industries, while enhancing total resource management and circular economy for sustainable growth.

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