

## Guest Editorial Preface

# Special Issue on Smart Supply Chain Network Design to Empower Industry 4.0

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Shorter product life cycles, changing customer demands, technological changes and policy changes are increasing complexity and uncertainty in supply chains. This increases information processing needs for sustainability of supply chains. Few decades' back organizations' used to reduce its information processing needs by adoption strategies such as maintaining of slack resources at all levels in the supply chain. However, in current times, organizations focus on increasing information processing needs to develop information processing capability and cope up with the environmental uncertainties. Environmental uncertainty can be of two forms i.e. demand and supply uncertainty. These two types of uncertainties can give birth to other forms of uncertainties like manufacturing uncertainties which increases risks and can lead to business losses. Industry 4.0 enabled tools provide supply chain solutions which aid to increase visibility and further mitigate risks.

Industry 4.0 is based upon four key pillars such Internet of things, cyber-physical systems, Cloud computing and Big Data analytics. Industry 4.0 is adopted to integrate all the functions in the organization for a seamless flow of information. However, organization faces certain challenges while adopting Industry 4.0. The challenges can be overcome by developing proper Industry 4.0 delivery system (digital culture and training programs, retaining talents, attracting more financial investments, clear digital operations vision, clear economic benefit of digital investments) and adapting to environmental dynamism (collaborate with partners around digital solutions, expansion of basic infrastructure technologies, improved data security and data privacy, setting up digital standards, norms and certification).

The purpose of this special issue is to understand how smart supply chain can be designed to empower Industry 4.0 projects in small-medium firms and large corporations. The first article titled *Industry 4.0 and Supply Chain Management: A Methodological Review and Bibliometric Analysis* presents an extensive review of past publications using BibExcel and Gephi for bibliometric and network analysis. The second article titled *Digitalisation of interlocking system to optimise logistics in railway transportation* examines modernised technology that presents new configuration setup and improves processes that can potentially replace traditional methods in railway transportation. The third article titled *Different flexibilities of 3D scanners and their impact on distinctive applications: An analysis* conducts an extensive review of the available literature for identifying various flexibilities of 3D scanners and its applications. The fourth article titled *Logistics Optimisation: A Cyber Physical Model* seeks to present value addition relative to business process optimisation model based on 4IR (Fourth Industrial Revolution) implementations, specific to multinational logistics optimisation. The

fifth article titled *A Review on the Research Growth of Industry 4.0: IIoT Business Architectures Benchmarking reviews one hundred sixty five research articles from leading academic journals and conference proceedings*, specific to IIoT-BRs such as I<sub>4</sub>-Business Growth (BG), I<sub>4</sub>-Business Optimization (BO), I<sub>4</sub>-Operational Excellence (OE), I<sub>4</sub>-Enterprise Resource Planning (ERP), I<sub>4</sub>-Manufacturing Executive system (MES), I<sub>4</sub>-Process Control Network (PNC), I<sub>4</sub>-Functional Excellence (FE), I<sub>4</sub>-Business Strategy, (BS), I<sub>4</sub>-Human Resource Management (HRM) and I<sub>4</sub>-Integration (I). The sixth article titled *Logistics 4.0 Energy Modelling* develops a logistics 4.0 architecture comprising of Industry 4.0 technologies and associated enablers.

## Future Research Directions

The research community is currently discussing about application of Industry 4.0 technologies to transform an organization from linear economy to a circular economy. Therefore, directions of future research can include the following.

- Monitoring of operational process and product history tracking using sensors.
- Improving process control through machine learning methods.
- Developing smart tooling for remanufacturing production.
- New digital remanufacturing models from I4.0.
- The hybridization of physical and virtual remanufacturing operations from Industry 4.0.
- Design of smart factory for remanufacturing production using sensor strategy.
- Using cloud technology for real time data collection and analysis from remanufacturing production.
- Information and communication technologies for human-machine interface in circular economic-based production environment.
- Developing cyber physical systems for the advanced circular economic-based manufacturing facility.
- Ethical and legal issues in managing I4.0 technologies for a circular economic-based manufacturing environment.
- Big data application for managing resources in circular economic-based manufacturing from I4.0.

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