Supply Chain 5.0: Aligning Artificial Intelligence with Human Intelligence

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Dramatic advancements in information technology and the digital industry have made significant changes to our business environment. Mourtiziz and Panopoulos (2022) believe we now have a 'dry' techno-economic vision obsessed with increasing productivity and improving efficiency along with an extreme focus on artificial intelligence and digitisation. The unprecedented growth of generative artificial intelligence (GenAI) triggered significant far-reaching changes and challenges to several industries.

But at what cost? It could be suggested that it has been at the cost of ignoring the role of humans in decision-making, sustainability and, above all, the dynamic capability to be resilient. The significant (and current) simultaneous disruptions, vulnerabilities and shortages have forced digital pioneers and supply chain managers to consider the need for a more resilient, sustainable and people-centric supply chain - to go beyond the boundaries of organisational digital transformation.

Not every organisation has been able to realise the full potential of GenAI. Information-sharing and connectivity across the extended supply chain network seem to be major obstacles. The interplay between GenAI and Supply Chain (SC) Management is still in its infancy stage and the union is met with some apprehension. Rapid technological adoption pre-GenAI was besmeared by inefficient resource utilisation and waste management practices. This creates a concern about whether GenAI supply chains will lead to a significant reduction of human involvement in decision-making. We will look at the potential to align artificial intelligence with human intelligence to affect and steer the digital transformation towards the next iteration of SC 5.0.

Industry 5.0

Industry 5.0 is an evolution designed to further collaboration between human creativity and expertise and accurate, efficient and intelligent systems; and, move towards balancing economic development with global societal and environmental requirements. Both refer to a significant shift in our society, economy and technologies towards the resolution of environmental and societal problems.

The global COVID-19 pandemic, shortages of skilled workers and disruptions in supply chains, among other challenges, have starkly emphasised the need to be more crisis resilient. The introduction of Industry 5.0 is an attempt to rectify the obsession with digitisation and AI-driven technologies to increase flexibility and efficiency of production at the expense of human-centric approaches and measures, dynamic capabilities, social fairness and sustainability. The Industry 5.0 evolution had been parallel with the development of the concept of Society 5.0, where everyone is expected to enjoy a comfortable and high-quality life through the fusion of physical space and cyberspace

The view of Zizic et al. (2022) is that Industry 5.0 recognises the power of organisations and industries to attain societal goals beyond growth and performance. Industry 5.0 is expected to promote the well-

being of workers with the aim of aligning artificial intelligence with human intelligence to help organisations and industries respond to disruptions and deliver personalised, customised and socially acceptable products and services aligned with Supply Chain 5.0 dimensions.

Supply Chain 5.0

Supply Chain 5.0 seems to be a logical leap to employ the new emphasis of Industry 5.0 on sustainability, resiliency, human-centricity and responsiveness. Let us look at how we can bring artificial intelligence and digital transformations close to enhance human intelligence and decision-making with some examples:

- GenAI can drive the bulk of the technology impact across several supply chain functions. This can help revolutionise internal knowledge management systems. GenAI can help retrieve stored internal knowledge and engage in adaptive dialogue. This can increase the effectiveness of decision-making utilising virtual expertise to scan resources. A human can then fine-tune and tailor responses towards more effective decisions. For example, accelerated customer self-service resolution during initial contact with the help of GenAI, could reduce response time, and increase data processing leading to improved logistics and supply chain disruption management.

- Digital twins can create digital replicas of warehouses, inventorying positions, logistics and assets. This can simulate the entire life cycle of supply chain management from suppliers, contract manufacturers and service providers, transportation lanes, distribution facilities and customer locations, all in real-time.

- Operational units to convert themselves into predictive maintenance (PdM) to acquire transparency. Advanced analytical methods, the Internet of Things (IoT), smart machines and smart sensor networks to perform maintenance activities can be utilised by supply chain managers to pre-empt problems instead of scheduled and planned maintenance once a problem arises.

- More priority on by applying cutting-edge technologies (GenAIs, machine learning, cognitive systems, computer vision) to real-time data to develop specific services and content for individual consumers. The integration of robots and human intelligence can help maximise offerings in bulk. This can be achieved by sharing several material variants with other personnel for multiple customisations. This aligns with the move towards a flexible, responsive and agile supply chain with increased human intervention.

- The Internet of Everything (IoE) is an interconnected link between processes, people, information and things. The IoE can provide better experiences and new functionalities and build customised experiences based on generated data. Supply chain waste is expected to be reduced with a more efficient production process and, above all, information sharing between humans with the help of wireless sensors.

- The integration of smart wearable devices with the Internet of People (IoP) and the IoT accelerated the adoption of cognitive methods in a variety of applications like smart grids, vehicular networks, environmental monitoring and stress testing. Tsang et al. (2022) introduce the latest logistics and digital supply chain transformation brought about by

developments in the IoT. It provides a useful analysis of the role of humans in IoT-empowered supply chain operations. The Internet of Medical Things (IoMT) also comes to mind.

- SC 5.0 emphasises knowledge and learning as essential components for decision-making in a human cyber-physical cognitive system (HCPCS). HCPS seeks to balance the integration of physical objects, cyber systems and humans for optimised sensing, control and analysis. GenAI decision effectiveness, for example, relies on the quality and extent of training the GenAI receives. Operational, routine level decision-making can be effectively covered within the GenAI training space. Let us keep in mind strategic decision-making, for instance, decisions about novel methods and uncertain market demands, requires empirical observations and long-term experience over several permutations.

  Industry 5.0 advocates a semi-autonomous decision-making system where GenAI training relies on a combination of digital technology and human intervention, while Industry 5.0 attempts to bring back human-robot integration to produce customised services and products along the supply chain. This includes expert knowledge and the ability for self-learning and cognition. Extended reality is also a useful visualisation and interactive tool to facilitate human-machine collaboration.

Existing supply chain strategies are inadequate to counter disruption risks and respond to increased uncertainties in market conditions. Changing customer requirements towards more sustainable products and services necessitates a more integrated approach to supply chain management. The adoption of Industry 5.0 practices could help accommodate and respond to these challenges. Supply Chain 5.0 brings back human involvement into the supply chain system and how this increased interaction between GenAI and humans across the supply chain improves trust among supply chain partners.

It is exciting, but also alarming, to know that one of the key findings from an Ernst and Young 2023 survey of senior-level supply chain executives was that the future of supply chains is leaning towards becoming fully digital. By 2035, it is expected that 45% of supply chains will be mostly autonomous (e.g. with the use of robot technology in warehouses, delivery drones, driverless trucks and forklifts, fully automated planning and integration of augmented reality). This asserts that one of the key Supply Chain leadership skills required will be the ability to align artificial intelligence with human intelligence to affect and steer the digital transformation towards the next iteration of SC 5.0. Let us proceed with caution!

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Chad has more than 15 years of lecturing and program development experience (University of Newcastle / Edith Cowan University and several International Universities). He also has extensive industry analysis and management consultancy experience helping SMEs commercialise their ideas, enhance their operations/processes/supply networks, improve project governance and management, and continuity planning and execution. Chad's areas of research interest lie in entrepreneurial best practices, operational improvement and Logistics/Supply Chain Management.