A Review on the Use of Artificial Intelligence in Reverse Logistics

Abhishek Kumar Sinha
National Institute of Technology, Calicut, India

Sajan T. John
Viswajyothi College of Engineering and Technology, India

R. Sridharan
https://orcid.org/0000-0002-0186-6442
National Institute of Technology, Calicut, India

INTRODUCTION

Logistics has a long and illustrious history. The phrase "logistics management" was initially used by the United States to control the transit and supply of munitions during WWII (Zhang et al., 2020). Following WWII, the term "logistics" expanded and gained a foothold in fields such as business, procurement, distribution, reverse supply chain, green logistics, domestic logistics, humanitarian logistics, and so on. The physical distribution of commodities is the emphasis, which includes order fulfilment, product distribution, storage, production planning, and customer support. Logistics, as described by the Council of Logistics Management, is the process of planning, implementing, and regulating the efficient, effective movement and storage of products, services, and associated information from point of origin to point of consumption in order to meet customer expectations (Swamidass, 2000).

The closed-loop supply chain (CLSC) is an emerging topic of research in terms of sustainability in different dimensions of environmental, economic, and social, in connection with the circular economy (Islam & Huda, 2018). "A circular economy is a regenerative system in which resource input and waste, emission, and energy leakage are minimized by slowing, closing, and narrowing the material and energy loops," (Geissdoerfer et al., 2017). This can be accomplished by long-term planning, maintenance, repair, reuse, remanufacturing, refurbishment, and recycling (Geissdoerfer et al., 2017). CLSC management, according to Guide and Van Wassenhove (2009), is the design, control, and operation of a system to optimize value creation across a product's complete life cycle with the dynamic recovery of value from various types and volumes of returns over time (Guide et al., 2009). CLSC's research includes a wide range of topics, including the return of products, product maintenance, product refurbishing, component reuse, prefabrication, and waste (Jaehn., 2016).

Stock (1992) defines RL as the term typically used for the function of logistics in recycling, waste disposal, and hazardous material management; a broader view covers all concerns pertaining to logistical actions carried out in source reduction, recycling, substitution, reuse, and disposal (Stock., 1992).

"Reverse logistics is the process of planning, implementing, and controlling the efficient, cost-effective flow of raw materials, in-process inventory, finished goods, and related information from the point of consumption to the point of origin for the purpose of recapturing or creating value or proper disposal," according to Rogers and Tibben-Lembke (1999).

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Due to a growth in e-commerce firms that allow quick and free product returns and businesses that manage end-of-life/reusable products, RL has lately gained increased interest and relevance among scholars and practitioners. Firms are using it as a strategic strategy for gaining economic advantages and improving their company's social image (Kannan et al., 2012). Wang et al. (2017) describe the content of reverse logistics, which includes transportation, storage, product recovery, recycling, remanufacture, redistribution, and discarding. The concept of RL or CLSC as a component of the Circular Economy has long piqued the interest of supply chain researchers. However, the present decade's technological development has made it difficult to integrate its tools with supply chain operations.

BACKGROUND

Artificial Intelligence (AI)

Artificial Intelligence is a multidisciplinary field that includes mathematical methodologies, computer science, and associated engineering disciplines. Intelligence simply refers to the ability to learn and solve problems, whereas AI is concerned with the development of algorithms and systems that are intelligent in the same way that humans are. Artificial intelligence is the result of the theory and idea underlying the invention of the artificial brain in the 1940s and 1950s. Companies and the government have invested money into research and development since then. As a result, the Checkers chess programme (skilled enough to challenge a respectable amateur), geometric and algebraic problem solvers, intelligent humanoid robots, IBM's Deep Blue computer (which defeated the world chess champion) were born. Storage and processing limits have hindered AI growth. The recent technological boom, on the other hand, has accelerated the development and deployment of AI-based applications. Image, audio, or video processing, business decision making, forecasting or predictions, creation, solving a complex problem, systematic search, natural language processing, decision making, pattern recognition, and other applications can be found in a wide range of industries, including healthcare and pharmaceuticals, supply chain and logistics, agriculture, education, security, defence, and humanitarian work.

Computational search and optimization methods, deep learning (neural network-based approaches), and methods based on statistics and probability are some of the instruments utilized in AI. In the supply chain area, optimization methods are commonly utilized for planning, inventory management, scheduling, routing, packing, and loading. These approaches provide the best optimum approach or answers that are close to ideal. For optimization, Heuristics, and Meta-Heuristics search strategies are used, giving AI systems cognitive capacity. Heuristics programming is a method for finding optimum or near-optimal solutions at a low cost of computation. These are intended to discover good, approximate solutions to challenging combinatorial problems that the present optimization technique cannot handle. The greedy search rule, which finishes the search at the local optimum when no more improvements are conceivable, is used by classical heuristics. Meta-heuristics are a type of non-traditional, high-level algorithmic process for locating a suitable answer. They are inspired by nature and assist in escaping local minima. Genetic algorithms, Simulated Annealing, Tabu search, Ant Colony Optimization, and, Particle Swarm Optimization are few examples of meta-heuristic models (Zhang et al., 2001; Pradhan & Kumar, 2019; Taha., 2017; Sokolov, 2019).