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Editorial

Water Footprint in Supply Chain Management: An Introduction

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Abstract: The aim of this Special Issue is to explore water-related risks and challenges, as well as water management opportunities, in the modern globalised production landscape from an end-to-end supply chain perspective. As environmentally sensitive consumers press for water-friendly products, freshwater resources' preservation has emerged as a major challenge for leading corporations that are incorporating water management initiatives into their social responsibility agendas to foster the sustainability of their supply chain networks. With respect to the scientific community, although research on water footprint assessment is increasing rapidly, the lack of a systemic integration of the water footprint aspect into the whole spectrum of the supply chain operations is evident. In this context, this Special Issue focuses on the investigation of the impact of water stewardship policies on water use and scarcity minimisation, sustainability performance and supply chain configuration.

Keywords: water footprint; freshwater resources; sustainability; supply chain management

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Freshwater is a fundamental constituent of major production systems. Specifically, the agricultural and industrial sectors utilise 70% and 22% of the global freshwater supplies, respectively [1]. Furthermore, a growing world population, climate change and continuing industrialization pose additional stresses to freshwater availability [2]. In this context, projections highlight that more than 40% of the world population will be living in regions facing severe water scarcity in 2050 [3]. To this end, the European Union [4] has enacted the Water Framework Directive (Directive 2000/60/EC) to set targets to the member states in terms of freshwater resources' preservation. Regarding the business sector, the identification, evaluation and management of water-related risks have emerged as major concerns for companies [5]. Empirical evidence clearly documents that leading corporations have already integrated water stewardship initiatives into their corporate responsibility programmes, further fostering their profitability [6]. However, transparency issues regarding corporate water use entail that significant efforts should be made before companies contribute to efficient water management at a supply chain scale [7].

To capture water usage, the scientific community introduced the water footprint (WF) concept as a key performance indicator of freshwater appropriation at national, corporate and product levels [8]. Specifically, the WF of a product is defined as the total volume of freshwater consumed and polluted directly or indirectly across the product's end-to-end supply chain [9]. WF is a multidimensional indicator that comprises three components, namely the green (i.e., rain water absorbed by plants), the blue (i.e., surface or groundwater consumed) and the grey (i.e., freshwater required for assimilating pollutants) WFs [8]. Based on this approach, Hoekstra et al. [8] developed the WF Assessment Manual, including the stages of: (i) goal and scope determination, (ii) volumetric WF accounting;

(iii) WF sustainability assessment; and (iv) WF response formulation. On the contrary, Ridoutt and Pfister [10] proposed a life cycle-based method for WF assessment, investigating the impact of freshwater utilisation on local water stress. In terms of standardisation, the water-related ISO 14046 contains all principles, requirements and guidelines for WF quantification, impact assessment and reporting at a corporate level [11].

In fact, although research on product WF assessment has rapidly increased during the last decade [12], there is an absence of systemic integration of the WF aspect into the entire supply chain spectrum [13]. As the concept of circular economy, referring to the minimisation of the consumption of natural resources for improving the value chain performance, is emerging as an increasing trend [14], the need for mitigating the use of freshwater resources through wastewater recycling and reuse across agrifood or industrial supply networks has become even more imperative. However, balancing the trade-off between water use efficiency and economic viability of the related water management practices still constitutes a major challenge [15]. Notably, as WF labelling could drive consumers' purchasing decisions towards more sustainable products [16], the implementation of a water-friendly corporate strategy is a unique opportunity to increase the profitability of all supply chain stakeholders.

In this context, this Special Issue aims at investigating all water-related risks and challenges and identifying opportunities in order to follow the contemporary trends that dictate the management of freshwater resources from an end-to-end supply chain perspective. Specifically, the Special Issue is comprised of four high-quality articles that try to cover the wide scope of this research effort, each from a different point of view:

- Naranjo-Merino et al. [17] assess the green and blue WF of a cocoa supply chain in Colombia, discussing how the results could improve freshwater resources management, especially regarding food security and water scarcity at both local and global levels;
- Miglietta and Morrone [18] investigate virtual water flows and economic water productivity related to the wine trade between Italy and the Balkan countries, evaluating water losses or savings achieved through bilateral trade relations;
- Tsolakis et al. [19] explore the freshwater dynamics in the processed food industry, developing a System Dynamics model to capture the blue WF and the profitability of a U.K. poultry supply chain, in case water-related regulatory constraints are applied;
- Yatskovskaya et al. [20] evaluate the progress of water scarcity mitigation practices in the pharmaceutical industry, proposing a conceptual maturity model under alternative supply network configurations, network structures, process flows and product architectures.

Overall, the contribution of this Special Issue lies in capturing the impact of water stewardship policies on the minimisation of water use and scarcity, the improvement of sustainability performance and the reconfiguration of the supply chains. All research papers are anticipated to support the process of corporate decision-making concerning the identification of water-related risks and the development of water-saving strategies across end-to-end supply chains of diverse production sectors in the circular economy era.

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