Article:
Genovese, A. orcid.org/0000-0002-5652-4634, Ponte, B., Cannella, S. et al. (1 more author) (2023) Empowering the transition towards a circular economy through empirically-driven research: Past, present, and future. International Journal of Production Economics, 258. 108765. ISSN 0925-5273

https://doi.org/10.1016/j.ijpe.2022.108765

Empowering the Transition Towards a Circular Economy through Empirically-Driven Research: Past, Present, and Future

[**Editorial** of the International Journal of Production Economics' Special Issue "*Empowering the Transition Towards a Circular Economy: Empirically-Driven Research in Closed-Loop Supply Chains*"]

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Abstract: In this introductory paper, we discuss the importance of empirically-driven research on sustainable production and distribution systems to accelerate the transition towards the circular economy of modern societies. To this end, we first identify some deficiencies in the current state of knowledge that need to be addressed to design efficient and resilient sustainable supply chains. Later, we summarise recent works that, with an empirical emphasis, deal with real-life industrial problems of these supply chains, which have been disseminated through the Special Issue "*Empowering the Transition Towards a Circular Economy: Empirically-Driven Research in Closed-Loop Supply Chains*" of the International Journal of Production Economics. Finally, we suggest some important directions for future research in this area with the aim of facilitating the implementation of circular economy practices, strategies and systems.

Keywords: Circular economy; closed-loop supply chain; empirically-driven research; sustainable production; supply chain management.

1. Introduction

The *circular economy* can be defined as a "*closed-loop, restorative, and regenerative economic system*" that aims to optimise resource and waste use by "*slowing, closing, and narrowing material and energy loops*" (Bocken et al., 2016; Ranta et al., 2020). It may also be interpreted as a "*systems solution framework*" to tackle critical global challenges that is based on three principles: *"(i) Eliminate waste and pollution; (ii) Circulate products and materials (at their highest value); and (iii) Regenerate nature*" (Ellen MacArthur Foundation, 2022).

The importance of making the world economy more circular is beyond any doubt at this point in history. This can be illustrated in many different ways. For instance, moving towards a more circular economy is a strategic priority for the European Union. Indeed, the European Commission released in March 2022 an ambitious package of measures aimed at speeding up this transition, as a key part of the circular economy action plan. The proposals include empowering consumers for the green transition, promoting sustainable products, and creating a sustainable textile strategy, among others. These are expected to contribute to achieving a carbon-neutral, environmentally sustainable, toxic-free, and fully circular economy by 2050, including tighter recycling rules and binding targets for materials use and consumption by 2030 (European Parliament, 2022).

To guide the transition towards the circular economy, it becomes essential to design, test, and implement circular economy practices and strategies in production and distribution systems. In this scenario, the operations management community is facing unprecedented new challenges, such as those derived from the need to understand new supply chain paradigms that are characterised by increasing uncertainties and additional flows of materials and information (Bouchery et al., 2016). To this end, research undoubtedly plays a key role. In this sense, researchers need be able to observe the current circular economy implementations adopted by real-life supply chains, model the most characteristic complexities and uncertainties that these systems face, and provide solutions that contribute to improving their management.

In this article, we first discuss the need to design efficient and resilient sustainable supply chains to accelerate the transition towards a circular economy as well as the role of empirically-driven research in this process. We also summarise recent works that adopt an empirical focus to investigate real-life industrial problems of these supply chains. These works have been disseminated through the Special Issue "*Empowering the Transition Towards a Circular Economy: Empirically-Driven Research in Closed-Loop Supply Chains*" of the International Journal of Production Economics. Finally, we propose some important avenues for additional research in this area.

To meet our goals, the rest of this article has been structured as follows. Section 2 details the background and motivation for designing efficient and resilient supply chains that are well-aligned with the principles of the circular economy. Section 3 stresses the need for empirically-driven research on circular supply chains to facilitate knowledge-transfer for the development of environmentally, economically, and socially sustainable production and distribution systems. Section 4 provides an overview of the Special Issue that this paper introduces. Section 5 discusses the main objectives and findings of its research papers. Finally, Section 6 provides a critical analysis

of the current state-of-art in theory and practices of sustainable supply chains and proposes some further research directions to facilitate the transition towards a circular economy.

2. Background and Motivation: Designing Efficient and Resilient Circular Supply Chains

For a very long time, the economic growth and social development of civilisations has been propelled by the depletion of natural resources and the degradation of ecosystems. This has also resulted in negative consequences on humans, which have become more prominent since the start of the new century. Under these circumstances, seeking ways to design and implement production systems inspired by alternative economic principles has become critical with the aim of extending the boundaries of environmental sustainability (Govindan and Hasanagic, 2018).

In this fashion, the economy of modern societies is now undergoing a crucial process of evolution. This goes from the traditional *linear model*, which extracts resources from nature and manufactures goods that are disposed of after use, to a *circular model*, which aims to keep resources in use for as long as possible by collecting and recovering the value of products at the end of their lifecycle (Stahel, 2016). By way of illustration, Figure 1 shows the worldwide interest of Internet users in the 'circular economy' from January 2010 to December 2021, where the data is normalised in the 0-100 range to facilitate the comparison. The 12-month moving average curve clearly shows the steady growth in the popularity of this concept —with a noticeable stop around 2020, probably due to the overall focus on the COVID-19 pandemic—, a way of showing the universal transition towards a more sustainable economic model.

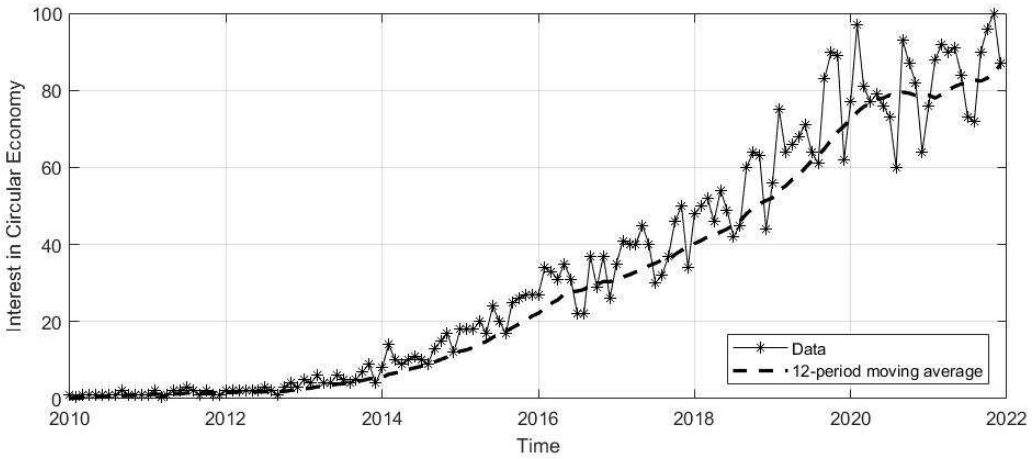

Figure 1. Worldwide interest in the 'circular economy' concept from 2010 to 2021. (*Source of data*: Google Trends)

To facilitate this important transition, national and international bodies launched large-scale measures in the last decade. For example, the evolution of the economic model has been driven by new legislations and directives that responded to the said environmental concerns, such as the Waste Electrical and Electronic Equipment Directive (2012/19/EU) (Ylä-Mella et al., 2014). These bodies have also funded ambitious programmes that resulted in many research projects that have aimed at 'closing the loop' of product lifecycles through greater recycling, remanufacturing and reuse. By way of example, we mention a few projects, in which this team of co-authors have participated: "*Realising the Transition to the Circular Economy: Models, Methods and Applications* (ReTraCE, funded by the European Commission, 2018-2023), "*Resilient Remanufacturing Networks: Forecasting, Informatics, and Holons*" (ReRuN, funded by the UK's Engineering and Physical Sciences Research Council, 2017-2019), and "*Advanced Support for Smart Operations & Remanufacture*" (ASSORT, funded by the Spanish Ministry of Science and Innovation, 2020-2023).

Within this context, the area of *sustainable supply chain management* has gained momentum both in the academic literature and in industrial practice (Bouchery et al., 2016). This includes different subareas, such as green logistics (e.g. Ubeda et al., 2011) and closed-loop supply chains (e.g. Battini et al., 2017), that are united under the goal of pursuing environmental gains. Nevertheless, while these environmental gains are clear, the implementation of production systems inspired by the principles of a circular model is often challenging from an economic perspective due to different reasons, such as the high uncertainty involved in the return of used products (Goltsos et al., 2019). Also, some scholars have argued that organisations might have already captured most of the profitable opportunities to recycle, remanufacture and reuse. Therefore, reaching higher circularity levels may involve an economic cost that many firms are not willing to cope with in economic contexts that are dominated by free-market ideologies (de Man and Friege, 2017).

These economic aspects are particularly relevant nowadays, as they are slowing down the much-needed transition towards the circular economy (Genovese et al., 2017). As such, this transition would be accelerated by better synchronisation of the environmental and economic gains of sustainable supply chain practices and strategies. From this perspective, we highlight that increasing the efficiency of supply chains that are built on the principles of the circular economy is a strategic steppingstone.

However, in today's world, being efficient is not enough for supply chains (see, e.g., Nieuwenhuis, 2016). Disruptive events of different nature have recently implied significant challenges to the operations of supply chains in nearly all industries. This emphasises their need for building resilience, which refers to the ability of the supply chain to respond to these harmful events

(Ponomarov and Holcomb, 2009). The COVID-19 pandemic is arguably the strongest example, but we may also refer to Brexit, the grounding of the Ever Given in the Suez Canal or, just now, the economic consequences of the Russian invasion of Ukraine. Gaining resilience is indispensable to make survival of supply chains certain, which is, in turn, essential to ensure that the (sometimes urgent) needs of modern societies are addressed. The need for resilience applies, of course, not only to traditional supply chains, but also to those that incorporate the principles of the circular economy, with the aim of gearing up for the big challenges ahead in the post-COVID-19 era.

3. Objectives and Methods: Empirically-Driven Research

In the literature, some cases of successful implementation of practices and strategies inspired by the circular economy paradigm can be identified. For example, we may refer to Hewlett–Packard. While they used to consider consumer returns as a problem rather than an opportunity, this company integrated the reverse flows of materials as a natural —and profitable— part of their business, and now views remanufacturing as a strategic weapon (Atasu et al., 2010). Other large companies that serve as good examples are Xerox, Caterpillar and Toyota, who incorporated circular economy practices in their supply chains and use them as a strategic tool to improve profitability (Zhou et al., 2017; Abbey and Guide, 2018). A good recent example is IKEA, which has launched a Circular Hub aimed at remarketing second-hand furniture in good conditions (IKEA, 2022).

In line with discussions in the previous sections, research plays a key role in increasing the actual number of industrial implementations of supply chains that are compatible with the circular economy. This perspective highlights that expanding the knowledge of the management of these systems is fundamental to pushing forward our levels of circularity in the 2020 decade significantly. The importance of research can be illustrated by the fact that '*connecting economic and environmental gains*' was one of the four focus areas in the final work programme (2018-2020) of Horizon 2020 (European Commission, 2017), endowed with a budget of almost €1 billion.

While many research efforts have already been conducted in the area of sustainable supply chain management, leading scholars have often highlighted that the advancement of research and practice has suffered from a noticeable gap. For example, Guide and van Wassenhove (2009, p. 17) observed that "*many assumptions […] are rapidly becoming institutionalised [in this area], and this can reduce modelling efforts to elegant solutions addressing non-existent problems*". Although this was identified more than a decade ago, more recent reviews of the literature have achieved similar conclusions,

including those by Souza (2013), Govindan et al. (2015), Goltsos et al. (2019), and Khan et al. (2021). In this sense, the lack of empirical focus may lead to erroneous conceptualisations and to research whose impact on real-world operations is quite limited. Under these circumstances, empirically-driven research represents a viable and powerful methodological approach to link sustainable supply chain management research and practice.

4. Overview of the Special Issue

In the light of these concerns, this team of co-authors identified a fundamental need for empirically-grounded research in the area of sustainable supply chain management. This motivated us to propose and launch, in November 2019, the Special Issue "*Empowering the Transition Towards a Circular Economy: Empirically-Driven Research in Closed-Loop Supply Chains*" in the International Journal of Production Economics with the approval, support, and help of the Editorial Board.

We wanted to motivate practitioners and researchers to pose and investigate industrially-relevant research questions with the aim of facilitating knowledge transfer for the development of environmentally, economically, and socially sustainable supply chains. Specifically, in the call for papers, we defined the aims of the Special Issue as follows: "*The purpose of this Special Issue (SI) is to advance the limited knowledge of the practical problems arising in closed-loop supply chain settings and to suggest solutions for better managing such systems. We aim to publish high-quality research pieces addressing the opportunities and challenges associated with real-world closed-loop supply chain management issues*". Specific areas of interest, which were mentioned in the call for papers, included:

- Product acquisition management and design of an appropriate transportation channel for efficient closed-loop supply chain management;
- Pretesting, quality grading, and selection of the appropriate recovery option for the products collected from the market;
- Production planning of remanufacturing and recycling facilities and inventory control of recoverable inventories;
- Forecasting the quality and quantity of returns in closed-loop settings;
- (Re)marketing of remanufactured and recycled products, and the interplays with the demand of new products;
- Application of systemic paradigms, like Lean, and collaborative solutions, like CPFR, to the management of closed-loop production and distribution systems;

- Synchronisation and coordination of closed-loop supply chains, including incentive alignment considerations between the different partners involved;
- Implications deriving from the structure of the remanufacturing process (e.g., third-party centralised remanufacturing, hybrid manufacturing/remanufacturing systems, etc.);
- Risk and relationship management in closed-loop supply chains and distribution systems;
- Supply chain coordination mechanisms for fostering the implementation of circular economy practices;
- Supplier selection in closed-loop supply chains;
- Economic, environmental and social assessment of closed-loop supply chains.

Our Special Issue attracted the interest of the industrial and research communities, with more than 100 submissions. Out of these, 25 were selected for publication after a thorough review process. This has resulted in a set of contributions with a strong empirical basis that employ a wide range of methodologies, including both quantitative and qualitative approaches. All these research works are motivated by practical problems of sustainable supply chains. Some of them are supported by real-world data, while others are based on interactions with stakeholders involved in closed-loop supply chain settings. In addition, all these research works have clear value for industrial practice and/or policymaking, with most of them having a specific section devoted to discussing these implications. In the following section, we briefly discuss the objectives and main findings of the papers that make up this Special Issue.

5. Overview of the Accepted Papers

Even if the call for papers specified a preference for empirically-grounded papers, four *literature reviews* were accepted for publication in this Special Issue. We made this decision given their great effort to systematise the current state-of-the-art and their potential to set an ambitious research agenda, based on industrially relevant problems, that should be explored by researchers in the field.

Simonetto et al. (2022) review the main operational risks connected with closed-loop supply chain activities, also describing the impact of Industry 4.0 technologies on mitigating identified risks. A conceptual framework and a new cross-sectional matrix are proposed to summarise the findings and to support future managerial initiatives in the closed-loop supply chain domain.

Darshana Hettiarachchi et al. (2022) explore the integration of additive manufacturing and circular economy. The conceptual elements are identified through a systematic review, further enhanced by a contingency analysis and a causal loop diagram. The study highlights the circular economy of

the customer and the maturity of the technology as cornerstones when adopting additive manufacturing in the circular economy context, also highlighting the impact of manufacture location, the rapid prototyping legacy and workforce skill for sustainability outcomes.

Sudusinghe and Seuring (2022) perform a systematic literature review to examine how collaboration may improve sustainability performance in implementing circularity in supply chains. Constructs related to supply chain collaboration practices, circular economy implementation strategies, and sustainability outcomes have been derived from the literature; furthermore, a contingency analysis has been conducted to understand the associations among constructs. A conceptual framework is developed in order to identify appropriate collaboration practices to enhance symbiotic relationships internally and externally in closed-loop supply chain to improve sustainability performance.

Do et al. (2022) create a taxonomy of food loss and waste within the transition towards a circular economy. The main research themes, along with a rich research agenda are then discussed.

Another set of papers is concerned with *modelling approaches* (based on mathematical programming, multi-criteria decision-making, and statistical methods). The accepted papers in this set presented very strong applications to real-world case studies and clear managerial implications.

In particular, Bruno et al. (2022) propose a systematic approach to evaluate the users' spatial access to Waste Electrical and Electronic Equipment recovery networks. Specifically, they introduce a dashboard of quantitative indicators to assess the presence of sufficient collection centres compared to the demand in a given area (availability) and at measuring the proximity between consumers and collection centres (accessibility); an extensive application to a real-world case study is performed.

Choudhary et al. (2022) develop a comprehensive decision-making framework, based on linguistic modelling and TOPSIS, in order to overcome issues related to uncertainty and incomplete information in managing returns for products of different life cycle length. The industrial applicability of the proposed model is validated using real-world data collected from the Indian electronics industry.

Dutta et al. (2022) develop a probability function to model consumers' willingness to accept a promotional offer depending on the discount offered to them when returning their used products. The study's findings aid in framing an effective incentive mechanism that could be employed by decision makers to improve the performance of the product return management process.

Liu et al. (2022) propose models to deal with alternative closed-loop supply chain configurations with fuzzy demand and different quality levels for second-hand products. Optimal pricing, collection ratios, and profit allocations for each model are determined through a combination of a Stackelberg game and a fuzzy cut-set method. The model is also successfully applied to a case from the automotive components industry. Results allow drawing important management implications concerning the degree of centralisation, integration and collaboration of supply chains.

Jabbour et al. (2022) develop a self- assessment model to evaluate the level of integration of circular economy and Industry 4.0 within organizations using a dynamic capabilities perspective. The model uses a conceptual framework that classifies the most relevant integration practices across eight dimensions derived from the literature. The model also uses a graph-theoretic approach to evaluate the level of integration between circular economy and Industry 4.0 through a standardized index, allowing organizations to be grouped into three categories.

Fan et al. (2022) develop a suite of game-theoretic models aimed at evaluating the impact of carbon tax policy on manufacturing and remanufacturing decisions in a closed-loop supply chain consisting of a manufacturer and a retailer. To maximize profits, decisions are made based on two scenarios, namely no investment in carbon reduction technology and with investment, in the centralized and decentralized closed-loop supply chain, respectively; multiple collection strategies for end-of-life projects are evaluated. Useful implications in terms of product pricing, taxation options and subsidies are drawn.

Another set of papers was concerned with the application of *impact assessment* methods to real-world supply chains in order to understand the viability of circular economy solutions.

Specifically, Paraskevopoulou et al. (2022) develop a study in the canned fruit industry, looking at the valorisation of by-products across the supply chain through relevant circular economy interventions. A set of circular economy practices are then assessed in terms of economic viability. From an environmental point of view, a Life Cycle Assessment is performed; results are then critically discussed in terms of potential social impacts.

Mayanti and Helo (2022) look at the environmental and economic implications of bale wrap collection and recycling within the Finnish context. Two different collection scenarios, once a year and twice a year, were assessed. The research applied vehicle routing problem and environmental life cycle costing to quantify the cost and environmental impact per ton of granulate recycled

material produced. The study demonstrates that recycling bale wrap can provide environmental and economic savings.

Finally, the largest set of papers was concerned with *empirical studies*, mainly based on large-scale surveys and case studies, which were able to investigate in detail the state of implementation of circular economy practices and strategies in real-world industrial settings.

Through a multiple case study of seven circular supply networks, Braz and De Mello (2022) characterise economy supply networks as complex adaptive systems, identifying three different configurations: closed loop, open loop, and hybrid. Authors also identify two types of leverage points in such configurations, one upstream and another downstream, in which agents with different roles might be responsible for coordinating and initiating reverse flows.

Bressanelli et al. (2022) study the potential role of circular economy practices in revitalising an industrial district that is undergoing a decline phase; in particular, an analysis of the changes required in terms of supply chain structures and relationships is performed.

Through a large-scale survey, Cerchione et al. (2022) highlight the role of supply chain relationship management and sustainable supply chain design to improve the circular economy capabilities of SMEs. Furthermore, they show a positive effect of social pressures on environmental commitment and green economic incentives.

Drawing upon the resource-based view and complementarity theory, Choi et al. (2022) develop a survey of supply chain managers working for companies operating in Brazil in order to assess the individual and joint effects on sustainability and operational performance of adopting circular economy and Industry 4.0 technologies. Their findings show that circular economy and Industry 4.0 practices have a potential synergistically positive effect.

Through a generalised structural equation modelling analyses on a longitudinal sample of German firms, Cricelli et al. (2022) test four hypotheses grounded on institutional, resource dependence, and absorptive capacity theories. Their results show a positive impact of vertical collaboration, horizontal collaboration, and collaboration with research institutions on the likelihood of introducing reverse logistics innovation. On the contrary, the breadth of collaboration has a negative impact on the adoption of reverse logistics practices.

Do et al. (2022) empirically investigate the implementation of circular economy practices, along with associated drivers and barriers, in the context of seafood processing by-products management

in a developing country. A multiple-case design is used on a sample of five firms that engage in seafood processing by-products treatment in Vietnam. Findings are interpreted through the lens of extended institutional theory in order to derive a holistic framework capturing the dynamics of circular economy practices diffusion.

Dey et al. (2022) examine the adoption of circular economy practices in small and medium-sized enterprises (SMEs), and the associated impact on sustainability performance. A mixed-methods approach is adopted to collect data from around 100 SMEs in four different European countries (France, Greece, Spain and the UK) employing resource-based view as a theoretical lens. Findings reveal that the adoption of circular economy practices (especially at a product design level) can result in superior environmental performance, while results in terms of economic and social dimensions are less clear.

Drawing upon the resource-based view and complementarity theory, Lopes de Sousa Jabbour et al. (2022) perform a survey of supply chain managers working for companies operating in Brazil. The individual and joint effects of circular economy and Industry 4.0 practices on sustainability (including economic, environmental, and social measures) and firms' operational performance are examined. Findings indicate that there is indeed a synergistic effect on performance across all sustainability dimensions resulting from joint adoption of circular economy and Industry 4.0 technologies

Morone et al. (2022) conduct an artefactual field experiment in Italy, that demonstrates the existence of a "green premium", which refers to increased consumer willingness to pay for bio-based over conventional products, and a "certified green premium", which refers to an additional increase in consumer willingness to pay for certified bio-based products over and above other bio-based products. Moreover, authors show that, across different product typologies (i.e. hand soap, food bags, colored pens), demand for conventional products is generally more elastic than demand for bio-based and certified bio-based ones.

Prosman and Cagliano (2022) explore how to configure circular manufacturing activities in alignment with supply characteristics. Building on a sample of 96 successful circular start-ups, a Qualitative Comparative Analysis (QCA) reveals the existence of three manufacturing configurations used by successful circular start-ups to extend product value, extend resource value and process used products. Each configuration is applied under different supply characteristics. As such, the research highlights the contingency factors for when, when not and how to adopt a given manufacturing configuration in the context of the circular economy.

Rodríguez-Espíndola et al. (2022) analyse the impact of external factors on the implementation of circular economy and technology, and their influence on sustainable-oriented innovation and sustainable performance. Responses from 165 Mexican SMEs have been collected and analysed using structural equation modelling; results reveal that while both governmental support and customer pressure facilitate the adoption of circular economy, only governmental support contributes directly to technology implementation.

Wang et al. (2022) investigate barriers to circular product design from a stakeholder perspective. Using thematic analysis and data collected from 15 semi-structured interviews in New Zealand, the authors identify four prominent barriers (financial constraints, inadequate infrastructure, government inaction, and global market barriers) and potential strategies to overcome these.

Zerbino et al. (2022) deal with the role of scavengers – actors who collect and redistribute waste into circular ecosystems to reuse or recycle it – in closed-loop Supply Chains. A case study from an Italian pulp & paper firm that operates in closed-loop settings and that integrated one formal scavenger into its own business to feed its paper mill is illustrated. Findings show that the introduction of the scavenger entailed four benefits: procurement risk mitigation, lower environmental impact, lower procurement costs, and better quality assurance.

6. Unaddressed Research Challenges and Key Avenues for Future Works

The collection of papers included in this Special Issue constitute a first and important step towards the bridging of some of the research gaps that were mentioned in the original call for papers. Especially the papers leveraging upon empirical research methods offer a wealth of real-world evidence into the mechanisms that are driving the transition towards circular supply chains. However, despite the wide coverage provided by this collection of articles, many research gaps are still unaddressed, with some additional ones explicitly arising from recent progress in the field.

One of the main issues that has not been addressed is the one of the 'circular economy rebound' effect. Adopting an economic view of circular economy as a system of interconnected markets, Zink and Geyer (2017) attributed the occurrence of rebound effects to two general mechanisms, namely the effect of secondary goods on prices and their insufficient substitutability for primary goods. This might mean that the implementation of circular economy strategies might not cause the desired displacement of primary resources extraction, thus resulting in sub-optimal environmental performance. Still, the assumption in much of circular economy research linked to supply chains is that the implementation of circular economy practices might almost achieve a

perfect displacement of primary resources. In this fashion. methods for estimating the likelihood of rebound effects need to be devised, along with strategies for mitigating the possibility of such unintended consequences.

Also, the feasibility of ambitious circular economy strategies within growth-oriented economic frameworks has become questionable. Indeed, the possibility of a decoupling of economic growth from environmental degradation has been judged as unlikely by many authors (Giampietro, 2019). As such, supply chains that are designed in order to operationalise ambitious circular economy principles (based, for instance, on intense servitisation strategies and on reuse principles) might exhibit tensions with the orientation to quantitative growth, which is the most common economic objective in the current economic system. The emergence of alternative supply chain orientations, inspired by post-growth organisational principles, should be investigated. This is aligned to the acknowledgment of the fact that the transition towards a circular economy might take multiple forms: a plurality of plausible circular futures has been identified by Bauwens at al. (2020) and Lowe and Genovese (2022). As such, research could also explore the different supply chain implications under each future circular economy scenario.

A good number of papers has leveraged upon well-established theories and constructs, from the supply chain management domain, in order to formulate hypotheses and explain research findings. However, most of employed constructs —such as supply chain collaboration and integration— have been conceptualised based on traditional linear supply chains, and might not be entirely adequate to represent the complexities of entities that are transitioning towards circular networks. Early attempts to the reconceptualisation of these key constructs are being developed, and might be a promising area of further research in the coming years (de Vasconcelos Gomes et al., 2022; Bimpizas-Pinis et al., 2022).

It is also convenient to highlight that most of the literature that optimises the management of closed-loop supply chains focuses on analysing and enhancing the efficiency of these systems. However, optimising efficiency generally stands in contradiction with building resilience, which may lead to high-performing supply chains in the short term, but highly vulnerable to disruptions. Thus, an important avenue for future research emerges from addressing in further detail the resilience of sustainable supply chains, with the aim of finding the optimal trade-off between both (efficiency and resilience). This would entail analysing how the ripple effect —a phenomenon that explains how disruptions propagate in supply chains, which has been greatly investigated in the recent years, but almost exclusively in the context of traditional systems (Ivanov et al., 2019)— behaves in circular supply chains as well as countermeasures that are specific to these systems.

A further gap is represented by the limited integration between the current circular supply chain literature and the most recent legislative initiatives in terms of circular economy. Recently promoted schemes —such as the Extended Producer Responsibility (EPR) and Right-to-Repair (R2R) ones, the circular economy standards adopted by several countries, along with other initiatives aimed at reducing planned obsolescence (e.g. Dalhammar et al., 2021)— might have the potential to transform supply chains. As such, scholars should pay attention to this rapidly changing landscape, investigating in a clearer way the impact of policy initiatives onto the shaping of supply chains. Work aimed at analysing the readiness of existing supply chains to adapt to new legislation could be of great interest.

Finally, we highlight that, albeit addressing circular economy from a plurality of perspectives, the papers published in this Special Issue seldom incorporate metrics aimed at fully evaluating the economic and environmental potential behind the circulation of resources. The most frequently employed metrics are carbon emissions, the use of energy, and the economic cost. Most of studies still sow simplified and superficial consideration of social implications in measuring the transition towards the circular economy in supply chains, which also represents an important avenue for future studies.

Acknowledgements

This team of co-authors deeply appreciates the confidence, help, and support provided by the Editorial Board of the International Journal of Production Economics throughout the whole process of designing, managing, and finalising this Special Issue. We also would like to express our sincerest gratitude to all the authors that submitted their work as well as the reviewers for their valuable contributions to this Special Issue.

In addition, we truly appreciate the financial support of several funding bodies since the early stages of this Special Issues: *European Commission* (H2020-MSCA-ITN-2018 scheme, grant agreement 814247 - ReTraCE project; H2020-MSCA-RISE-2018 scheme, grant agreement 823967 - ProCEedS project; H2020-SC5-2020-2 scheme, grant agreement number 101003491 - JUST2CE project); *Spanish State Research Agency* - MCIN/AEI/10.13039/50110 0 011033 (grant ref. PID2019-108756RB-I00, ASSORT project; grant ref. PID2020-117021GB-I00, SPUR project); *Junta de Andalucia* (ref. no. P18-FR-1149, DEMAND project; ref. no. US-126451, EFECTOS project); and University of Catania (PIACERI programme, GOSPEL project).

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