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Supply chain resilience in the UK during the coronavirus pandemic: A resource orchestration perspective

Maciel M. Queiroz [a,*], Samuel Fosso Wamba [b], Charbel Jose Chiappetta Jabbour [c], Marcio C. Machado [a]

[a] Paulista University - UNIP, Postgraduate Program in Business Administration, 04026-002, Sao Paulo, Brazil
[b] TBS Business School, Information, Operations and Management Sciences, 1 Place Alphonse Jourdain, 31068, Toulouse, France
[c] Emlyon Business School, Lyon-Écully, France

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ABSTRACT

The COVID-19 pandemic caused significant disruptions to global operations and supply chains. While the huge impact of the pandemic has nurtured important literature over the last couple of years, little is being said about the role of resource orchestration in supporting resilience in highly disruptive contexts. Thus, this study aims to this knowledge gap by proposing an original model to explore supply chain resilience (SCRE) antecedents, considering supply chain alertness (SCAL) as a central point to support resilience. This study focuses on the resource orchestration theory (ROT) to design a conceptual model. The partial least squares structural equation modeling (PLS-SEM) served to validate the model, exploring data from the UK supply chain decision-makers. The study reveals a number of both expected and unexpected findings. These include the evidence that supply chain disruption orientation (SCDO) has a strong positive effect on the SCAL. In addition, SCAL plays a strong positive effect in resource reconfiguration (RREC), supply chain efficiency (SCEF) and SCRE. We further identified a partial mediation effect of RREC on the relationship between SCAL and SCRE. Surprisingly, it appeared that SCAL strongly influences SCEF, while SCEF itself does not create any significant effect on SCRE. For managers and practitioners, the importance of resource orchestration as a decisive approach to adequately respond to huge disruptions is clearly highlighted by our results. Finally, this paper helps to grasp better how important resource orchestration in operations and supply chains remains for appropriate responses to high disruptions such as the COVID-19 impacts.

1. Introduction

The COVID-19 pandemic outbreak severely affected supply chains (SCs) and firms operations management around the globe (Alam et al., 2021; Queiroz et al., 2020a; van Hoek, 2020; Schleper et al., 2021; Narayanamurthy and Tortorella, 2021), bringing about complex and challenges faced by organizations and their networks. The reaction of scholars (Chesbrough, 2020; Choi, 2020; Dwivedi et al., 2020; Govindan et al., 2020; Ivanov and Dolgui, 2020b; Sarkis, 2021) and industry practitioners (Deloitte, 2020a; Forbes, 2020; World Economic Forum - WEF, 2020) have resulted in meaningful efforts to understand the disruptive effects of this unprecedented crisis that is being scrutinized from every angles and perspective, and in all regions. The COVID-19 has hit virtually all industries and production systems (Singh et al., 2020), creating significant distortions in stocks (Ivanov, 2021a) and seriously disrupting operations in global supply chains. This inevitably led to considerable shortages in supplies and bottlenecks in logistic channels (Wang et al., 2020).

This situation calls for an urgent need to reconfigure the production systems, their operations, and the supply chains, notably by using some strategies aimed at ramping up production (Ivanov and Dolgui, 2021; Malik et al., 2020; Queiroz et al., 2020a) and minimizing shortages (Chowdhury et al., 2021; Ivanov, 2020a). From this perspective, under the current circumstances marked by the COVID-19 crisis, a need to shed more light on how supply chains may enhance their resilience has captured the attention of scholars and industry experts (Choi, 2021; Deloitte, 2020b; Ivanov and Das, 2020; McKinsey, 2020; van Hoek, 2020; Sarkis et al., 2020).

* Corresponding author.
E-mail addresses: maciel.queiroz@docente.unip.br (M.M. Queiroz), s.fosso-wamba@tbs-education.fr (S. Fosso Wamba), cjcjabbour@gmail.com (C.J. Chiappetta Jabbour), marcio.machado@docente.unip.br (M.C. Machado).

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This crisis surpasses the unpredictability elements of resilience (Ivanov and Dolgui, 2021; Scholten et al., 2020), thus fueling the debate about supply chain resilience and the literature about the limitations and adherence of the traditional aspects of resilience to face an unprecedented, colossal crisis such as the coronavirus pandemic (Gu et al., 2021; Ivanov, 2021b; Katsaliaki et al., 2021; van Hoek, 2020). In addition, the literature concerning supply chain resilience during the COVID-19 (El Baz and Ruel, 2021; Gunessee and Subramanian, 2020; Guo et al., 2021; Ivanov, 2020b; Quayson et al., 2020; van Hoek, 2020; Schleper et al., 2021) is not extensive on the role of resource orchestration in order to foster or improve the resilience of logistics channels during and after the COVID-19.

Yet, some scholars have drawn attention to their importance. For instance, Wieland and Durach (2021) recently reiterated a call for a debate on the two main approaches, and sometimes controversies, that could favour the resilience of supply chains. On the one hand, there is a view that explores resilience as a system with a capacity to recover to the normal state after a disruption. On the other hand, there is a view focusing on the adaptation and transformation capacities. The integration of these perspectives (Wieland and Durach, 2021) can be an important aspect to consider in case of severe disruptions such as the ones resulting from the COVID-19. In this sense, Ruel et al. (2021) reported that the supply chain resilience should not be seen only from the traditional perspective, as a closed system (back to normal), but rather as an open system that can adapt and survive severe-disruptions changes. This perspective for supply chain resilience can demand different approaches for the management of the scarce resources of firms during radical changes imposed by a severe crisis.

Furthermore, while the extant literature reporting the role of resources for the supply chain resilience during the COVID-19 is in its infancy stage (El Baz and Ruel, 2021), the singular characteristics of the COVID-19 (protraction and unpredictability) make it necessary to review the way the scarce resources of firms and organizations should henceforth be managed (Giunipero et al., 2021). Accordingly, resource orchestration approaches can successfully contribute to resource management (Giunipero et al., 2021).

However, operations and supply chain management (O&SCM) and related fields offer little input regarding the antecedents of supply chain resilience, especially from the resources orchestration perspective, considering the tremendous impacts of the COVID-19 on the whole economy. Accordingly, the orchestration of resources (tangible, intangible, and human) by managers during severe disruptions need to be deeply examined and better understood. Therefore, such efforts should enable us to fully grasp how resilience capabilities such as alertness, resource reconfiguration, and supply chain efficiency can play a key role in disruption times. This is why we aim to make up for the insufficiencies existing in the literature on the issue. To sort it out, we propose investigating the influence of alertness, resource reconfiguration, and efficiency on supply chain resilience, bearing in mind the resources orchestration perspective as the background, to drive managers to convert a set of resources into capabilities to support the resilience. In this sense, our paper is guided by the following original research questions (RQs).

RQ1. Does supply chain disruption orientation improve the alertness level of supply chains during a highly disruptive crisis such as the COVID-19?

RQ2. How can supply chain alertness influence supply chain resilience during a highly disruptive crisis such as the COVID-19?

RQ3. Can resource reconfiguration and supply chain efficiency mediate the relationship between supply chain alertness and supply chain resilience?

To answer these questions, we designed our work as the theoretical background, considering the resource orchestration theory (Sirmon et al., 2011). It emerged as an advanced version of the well-known resource-based theory (Sirmon et al., 2007, 2011). Predominantly, it focuses on the manager's roles and required actions to support the deployment and arrangement of a bundle of firm resources and effective management. In other words, the firm's resources by themselves are not enough to create performance and competitive advantage. Consequently, specific actions by the managers are required to orchestrate a set of resources to assist the value creation by the firms (Hitt, 2011; Sirmon et al., 2011). Since then, resource orchestration theory has been successfully used in different supply chain and operations management approaches (Gong et al., 2018; Liu et al., 2016; Rojo Gallego Burin et al., 2020).

We developed a conceptual model which was validated and measured in the UK supply chains, using partial least squares structural equation modeling (PLS-SEM) (Hair et al., 2017a, 2017b; Kalaitzi et al., 2019). As a reminder, this paper intends to bring useful contributions and directions to the operations and supply chain, notably by identifying some antecedents of supply chain resilience during a highly disruptive and prolonged crisis, like the case of the coronavirus pandemic. In the same vein, helpful insights and directions should come up to the benefit of practitioners, governments and decision-makers involved in the management of scarce resources during extraordinary contexts.

In terms of key contributions, this paper is one of the first that, based on ROT, proposes a novel model in the context of a severe disruption such as the COVID-19 for exploring supply chain resilience. It shows the importance of alertness to supply chain resource reconfiguration, efficiency, and supply chain resilience. On the one hand, in this model, we identify that resource reconfiguration plays a substantial effect as a mediation variable in the relationship between supply chain alertness and supply chain resilience. On the other hand, we show that supply chain efficiency has no significant contribution to resilience in severe disruptions.

This paper is organized as follows. In Section 2, we provide the theoretical background highlighting the resource orchestration theory. Section 3 presents the hypotheses and the conceptual model. Section 4 points out the methodology approach, followed by the results and analysis in Section 5. Next, in Section 6, we present the discussion and implications. In Section 7, the limitations and research directions are highlighted. Finally, in Section 8, we give the main concluding remarks of this paper.

2. Theoretical background

This section deals with the basic approaches of the resource orchestration theory and some applications examples in O&SCM contexts.

2.1. Resource orchestration theory

The Resource Orchestration Theory (ROT) arose as an extension of the Resource-Based Theory (RBT) (Sirmon et al., 2011). One of the main criticisms about and limitations of the RBT approach is the lack of explanation about the manager's role in the processes and practices leading to the transformation of the resources into the firm's capabilities (Hitt, 2011; Sirmon et al., 2011). The ROT refers to the role of managers in effectively structuring, bundling and, when possible, leveraging firms' resources so as to add value and thus gain performance and competitive advantage. In general, ROT is shaped using three perspectives (firm's scope, hierarchy levels, and stage of maturity) (Sirmon et al., 2011). In this vein, ROT considers that, within the framework of the firm's scope, managers play a decisive role in orchestrating resources and transforming resources into capabilities while taking into account business and corporate strategies. Regarding the hierarchy levels, ROT points out the need for an effective synchronization by the different managerial levels for firms to orchestrate their resources successfully. The last element, the stage of maturity, posits that managers should consider and trigger measures to ensure that the different stages of the firm (life cycle) are provided with the necessary resources, management tools and decisions (Sirmon et al., 2011).

Despite its recent emergence (Sirmon et al., 2007, 2011), ROT has appeared as an effective approach not only for organization studies but also for its adherence to other several areas, including the O&SCM (Hughes et al., 2018; Kristoffersen et al., 2021). ROT was successfully used in different O&SCM contexts. For instance, Ahmed et al. (2020) employed ROT to investigate the supply chain analytics capability (SCAC), considering the value from the different relationships. They highlighted the role of suppliers in leveraging the SCAC, taking into account the impact of improving the value of relationships. Besides, Liu et al. (2016) found evidence about the interrelationships between supply chain integration and information technology competency in the manufacturing context. Similarly, Rojo Gallego Burin et al. (2020) applied ROT to investigate improvements in IT competence's supply chain flexibility. The authors discovered that high IT competence largely contributes to facilitating the orchestration.

Additionally, ROT was used in other O&SCM contexts. For instance, Gong et al. (2018) proposed a framework considering how multinational organizations orchestrate their resources to support sustainability knowledge learning through multi-tier relationships. The authors pointed out the importance of changes in the supply chain structure, taking into account the firm's scope, hierarchy levels and stage of maturity. Hughes et al. (2018) also relied on ROT to investigate the contribution of individual resources and several configurations to the maximization of profits among manufacturing firms. Furthermore, The role of ROT was also evidenced for supply chain traceability (Malik et al., 2021), as well as for understanding shortfalls in supply chain recalls (Ketchen et al., 2014) and e-commerce fulfilment (Zhang et al., 2021), among others.

From the O&SCM resilience lenses, the three key perspectives of ROT (scope, hierarchy levels, and stage of maturity) are related as follows. In the scope, managers act with a set of key and scarce resources (i.e., personnel, technology, infrastructure, etc.) to convert them into capabilities to support resilience. For instance, well-trained workers with adequate technologies can identify potential vulnerabilities of the supply chain, and, consequently, managers can reconfigure the resources (i.e., workers, machinery, vehicles, etc.) to provide an adequate response. From the hierarchy levels perspective, the synchronization of the hierarchical levels of the firms can provide an in-depth view of the resources available for managers to orchestrate.

Accordingly, the resources available can be fully used in order to support resilience. Lastly, in the stage of maturity outlook (i.e., start-up, growth, maturity, and decline stages), the life cycle of the firm exerts an influence on the availability and prioritization of the resources (Sirmon et al., 2011). Consequently, it may affect resilience. In each of these stages, managers have a different set of resources and objectives to reach. Consequently, the resilience capabilities can vary according to the maturity of the firm. In this sense, managers should understand the stage of the firm to orchestrate and combine the resources in a better way to accomplish high levels of resilience.

3. Hypotheses and research model

Based on the ROT perspective, in this section, we develop a model with eight hypotheses, considering the importance of the resources management based on ROT in the O&SCM to tackle the COVID-19 to achieve resilience. Accordingly, we posit that the orchestration of key resources by the managers in their firms and O&SCM can enable the capabilities related to disruption orientation, alertness, resource reconfiguration, efficiency, and resilience. Table 1 points out the constructs and definitions, and Fig. 1 presents the research model of this study.

It is important to note that our study focuses on the firm as a unit analysis, similar to Kristoffersen et al. (2021). In this vein, the orchestration of the firm resources is made by managers. To firms and supply chains orchestrate their resources it is necessary at least a manager convert the plans into reality. That is, following the three perspectives of ROT aligned with the resilience, which posits that in the scope, they should transform the resources (workers, systems, machinery, etc.) into capabilities (i.e., alertness, reconfiguration of the resources, etc.) to face the disruptions and help the resilience. Also, they should be able to optimize the availability of the resources by synchronizing and mobilizing the hierarchical levels of the firms and considering the prioritizations imposed by the life cycle of the firm.

Table 1
Constructs and definitions.

Construct	Definition	Adapted from
Supply chain disruption orientation (SCDO)	Refers to the awareness and recognition of a firm about imminent disruptions and their learning and knowledge accumulated from previous disruptions, focusing on actions related to the disruption before and after they happened in the O&SCM	(Ambulkar et al., 2015; Bode et al., 2011)
Supply chain alertness (SCAL)	Refers to the firm's capability to discover changes in the O&SCM that they operate, or in their business environment, in a prompt manner, by focusing on the detection and monitoring of the changes	(Li et al., 2017; Shin and Park, 2021)
Resource reconfiguration (RREC)	Refers to the firm's capability to reconfigure, rearrange, and restructure a set of resources to respond properly to the changes imposed by the environment	(Ambulkar et al., 2015; Parker and Ameen, 2018; Wei and Wang, 2010)
Supply chain efficiency (SCEF)	Refers to the firm's ability to exploit and manage its resources in the best manner possible to reach sustainability and viability through its O&SCM	(Purvis et al., 2016; Shin and Park, 2021; Yang et al., 2021)
Supply chain resilience (SCRE)	Refers to the abilities and capabilities of the firm to disruption's resistance, as well as to building adaptation and recovering, considering the vulnerabilities of the environment, to assure the operations and meet the demand	(Ivanov, 2021b; Kahiluoto et al., 2020).

3.1. Supply chain disruptions

Supply chain disruption is defined as unexpected events that disrupt the normal flow of materials, goods, services, and information through the O&SCM (Craighead et al., 2007; Son et al., 2021). One of the disruptions' main side effects is the exposition, vulnerabilities, and severe consequences to the O&SCM (Craighead et al., 2007; Polyviou et al., 2020). Keeping in mind the highly disruptive crisis caused by a prolonged pandemic outbreak such as the COVID-19, the negative consequences can affect the O&SCM globally, with unprecedented ripple effects and disruptions through the network (Butt, 2021; Chowdhury et al., 2021; Ivanov, 2021a). The disruptions provoked by the COVID-19 imposed huge challenges to the supply chain managers, especially concerning the development of strategies to cope with the effects, as well as to build viable responses to the resilience of the O&SCM (Ivanov and Dolgui, 2020b; van Hoek, 2020; Schleper et al., 2021).

In this light, the supply chain disruption orientation carries out a decisive capacity for the O&SCM alertness. It means that the managers should orchestrate the firm's resources to leverage the SCDO capabilities. Thus, managers should use a set of resources to learn from the disruptions experiences in order to support their alertness level

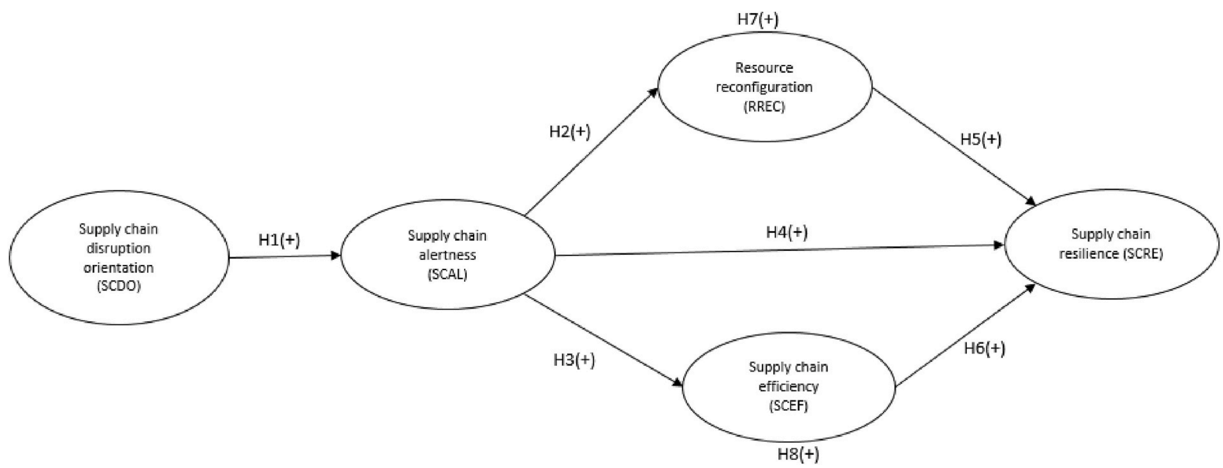

Fig. 1. Research model.

(Ambulkar et al., 2015).

That is, SCDO is related to the actions of managers should take care of before and after the disruptions and its analysis to improvement. It can evolve the orchestration of different types of resources such as analytics tools, skills of the personnel, etc. For example, with the digital supply chain twins (Ivanov and Dolgui, 2020a), managers can monitor effectively and in real-time, the network dynamics, simulate and develop predictions about the disruptions and the necessary firm's resources to face the crisis. Therefore, we hypothesise that:

H1. Supply chain disruption orientation positively affects supply chain alertness during a highly disruptive crisis such as COVID-19.

3.2. The role of supply chain alertness

The alertness in the O&SCM can effectively provide enhanced visibility and a monitoring capability (Li et al., 2017; Mandal, 2019). From the ROT lenses, the alertness of the firms and the supply chains are a result of the orchestrated resources by the managers, such as tools for real-time detection and monitoring of possible disruptions. In this sense, alertness plays an essential role in enabling O&SCM resilience. For instance, Li et al. (2017) found that supply chain alertness positively impacts the firms' financial performance as a dimension of resilience. In a recent study, Shin and Park (2021) reported the importance of the leadership responsibility in managing the relationships through the O&SCM, considering disruptions context. The authors identified that the alertness exerts a positive effect on the supply chain resilience improvement.

Moreover, it should be noted that alertness is one of the fundamental components to understand the challenges and opportunities of the external and internal environments, supporting the supply chain agility (Gligor et al., 2013; Li et al., 2009) and, consequently, the resilience of the O&SCM. Thus, considering the resource orchestration perspective, managers need to employ different actions and strategies to leverage the alertness of firms. For instance, by using big data analytics (BDA) tools, the alertness and the resilience of the O&SCM can be substantially enhanced (Mandal, 2019). In this sense, the orchestration of the resources can support the level of the alertness of the firms, which in turn can enable a more adherent, responsive, and efficient use of the resources by reconfiguring them according to the alertness signals. Consequently, the efficiency of the O&SCM could be leveraged in all stages of the disruption (i.e., before, during, and after). Hence, we hypothesise that:

H2. Supply chain alertness has a positive effect on resource reconfiguration during a highly disruptive crisis such as COVID-19.

H3. Supply chain alertness positively affects supply chain efficiency during a highly disruptive crisis such as COVID-19.

H4. Supply chain alertness positively affects supply chain resilience during a highly disruptive crisis such as COVID-19.

3.3. Resource reconfiguration and supply chain efficiency

The reconfigurability of the supply chains is considered one of the key mechanisms to face severe disruptions, such as the COVID-19 case (Ivanov, 2021b). In that context, resource reconfiguration can bring more agility to the O&SCM responses during and after the disruptions. In view of the ROT, managers are challenged to realign the resources of the firms according to the evolution of the disruption (Ambulkar et al., 2015). Scholars have highlighted that the reconfigurable O&SCM can be considered a result of lean, agile, resilient, sustainable, and digital O&SCM (Dolgui et al., 2020). In this connection, Parker and Ameen (2018) found that resource reconfiguration exerts a strong positive effect in the relationship with resilience to tackle disruptions. Consequently, requiring and effective management of the resources by the managers in order to provide a good and quick response of the firms and the O&SCM, with to the resources restructured accordingly to the changes imposed by the environment. Thus, we hypothese that:

H5. Resource reconfiguration has a positive effect on supply chain resilience during a highly disruptive crisis such as COVID-19.

The efficiency of the supply chain can be improved by the orchestration of the resources by the managers by minimizing the costs of resources in different activities such as inventory, transportation, re-work, etc. Recently, Kalaitzi et al. (2019) found that resource efficiency can support the competitive advantage in medium and in large firms. In another recent study, Shin and Park (2021) reported the positive influence of the supply chain efficiency in improving the firm's resilience, derived from the quality of the managers in the leadership collaborative capabilities outlook. The management orchestration of the firm's resources, including intangible resources, such as leadership, is an important feature of the O&SCM efficiency, which in turn positively affects the supply chain resilience. Thereby, the following hypothesis emerges:

H6. Supply chain efficiency positively affects supply chain resilience during a highly disruptive crisis such as COVID-19.

3.4. The mediation effect of resource reconfiguration and supply chain efficiency

Resource reconfiguration can be considered one key aspect to firms operating in scarcity scenarios due to disruptive events. From a ROT perspective, the realignment of the resources considering the changing business environment is critical in disruptions (Ambulkar et al., 2015). However, Ambulkar et al. (2015) report that resources by themselves are not enough to support resilience. Besides, they found that it fully mediates the relation between supply chain disruption orientation and resilience. In our study, we propose that it will mediate alertness and resilience. Thus, the following hypothesis emerges:

H7. Resource reconfiguration, as a mediator, has a significant positive effect on the relationship between supply chain alertness and supply chain resilience.

Furthermore, recently, Shin and Park (2021) reported the mediation effect of efficiency in the relationship between supply chain leadership and resilience under disruptions contexts. In this vein, considering ROT and the COVID-19 context, we argue that while the orchestration of alertness resources to monitoring the environment can improve the efficiency of the supply chain, and consequently the resilience, the alertness can achieve resilience indirectly via efficiency. It can occur due to the improvement of the contingency plans, which were possible because of the alertness tools to detect environmental changes (Shin and Park, 2021). In this line of thought, the following hypothesis emerges:

H8. Supply chain efficiency, as a mediator, has a significant positive effect on the relationship between supply chain alertness and supply chain resilience.

4. Methodology design

4.1. Sample and data collection

In this work, we collected data using a web-based survey approach from supply chain decision-makers, which their firms are operating in the UK. We choose the UK for two main reasons. First, the UK is one of the most global economies, achieving the 5th position considering the GDP in 2020 (World Bank, 2020). And, second, the UK ranks in the top 10 economies globally, considering product imports and exports (Observatory of Economic Complexity, 2019).

We performed the survey using a market research firm (Fosso Wamba and Akter, 2019). In this case, we utilized Prolific (https://www.prolific.co/), which is considered one of the most transparent platforms for panels and surveys (Palan and Schitter, 2018). Before sending the questionnaire to the panelists, we carefully pre-tested it with five scholars and five practitioners. We screened the potential participants by using the following restriction: to be eligible as a participant; they needed to be working (or worked) in a decision position (c-level, president/VP, director, or manager) in the supply chain context during COVID-19. Thus, we sent an invitation to the potential panelists in April 2021.

This type of panel receives responses until criteria stop reaches (i.e., number of responses). Thus, of 183 questionnaires collected, we received 151 valid responses (fully answered). After removing 14 questionnaires from sectors that are not directly linked to the supply chains, the final sample comprised 137 responses. This sample is in line with the extant literature (Kristoffersen et al., 2021). In addition, by using the G*Power tool (Skipworth et al., 2015; Faul et al., 2007), with a medium effect size $f^2 = 0.15$ (Cohen, 1988), and power = 0.80 (Aharonovitz et al., 2018), we found 85 as the total sample required (Appendix A). Furthermore, we follow the sample size requirements reported by Hair et al. (2017a), which describe that the minimum sample size estimation can be based on the 10 times rule (Hair et al., 2017a). Accordingly, "*the minimum sample size should be 10 times the maximum number of arrowheads pointing at a latent variable anywhere in the PLS path model*" (Hair et al., 2017a, p. 24). In addition, although the excellent progress made by the literature concerning the resilience capabilities (Pettit et al., 2013) and scale development (Chowdhury and Quaddus, 2017), the survey constructs were adapted from previous literature that fits better our context (COVID-19). We employed a seven-point Likert scale that considered the ranging (1) 'strongly disagree' to (7) 'strongly agree'.

In Table 2, we present the constructs, indicators, and the reference to which they were adapted. In this sense, following the ROT perspective, we show that the indicators refer to the actions of the managers in structuring and orchestrating the resources of the firms considering the dynamics of the supply chains. For instance, in Supply chain disruption orientation (SCDO), managers orchestrate the resources to understand the disruption before and after they happened to improve the analysis to support the firm's plan. In Supply chain alertness (SCAL), they focus on resource orchestration to detect and monitoring of changes in the supply chains. Regarding Resource reconfiguration (RREC), managers orchestrate the resources to respond to the changes in the business environment. Finally, in Supply chain efficiency (SCEF), managers orchestrate the resources to minimize the operations costs due to the crisis.

In Table 3, we highlight the respondent's profile. In relation to the age distribution, the age brackets 26–33 (32.85%) and 34–41 (24.82%), accounting for more than half of the responses. About the gender, the participation from the male was the majority (57.66%). With respect to education, a greater part of the respondents fell in the undergraduate degree (46.71%), followed by secondary qualification (23.36%) and postgraduate degree/MBA (16.79%). Regarding the company size, the largest part of the respondents belongs to firms with less than 50 employees (29.20%), followed by firms with 1000 or more employees (28.47%). In terms of segment of the firms, the food/beverage and healthcare sectors accounted for 19.71%, each. In sequence, retail and logistics/transportation were responsible for 18.98% and 7.30% of the responses, respectively. Ultimately, the respondent's occupation was predominantly shaped by managers (77.37%) and directors (13.14%). Moreover, it is important to note that all the occupations (jobs) refer to SCM positions. Thus, because the first screening was about whether the participant currently worked in a decision position (VP/President, Director, Manager, and CEO) in the supply chain during the COVID-19 to be eligible to participate, we did not ask about the years of experience in the position.

4.2. Non-response bias

Table 4 reports the non-response bias (NRB) by comparing the early and late respondents (Armstrong and Overton, 1977; Pu et al., 2021; Um and Oh, 2020). We performed independent samples *t*-test (Dubey et al., 2021). To perform the *t*-test, we used IBM SPSS v.27. We compared the early and late respondents (Armstrong and Overton, 1977) (first wave $N = 100$, second wave $N = 37$). We found no differences between the groups at a 5% of significance. Thus, NRB was not a concern in our model.

4.3. Common method bias

Common method bias (CMB) can appear when researchers use self-report surveys, in which both dependent and independent variables are collected by the same procedure (Jordan and Troth, 2020; Podsakoff and Organ, 1986). We evaluate if our model suffers from CMB by using the full collinearity VIF criteria (Kock, 2015, 2020). The results (SCDO = 1.563; SCAL = 2.269; RREC = 2.168; SCEF = 1.311; SCRE = 1.605), are in line with the recommendation of the literature, which is acceptable if ≤ 5, and being ideally ≤ 3.3 (Kock, 2015, 2020). Additionally, we used Harman's single factor (Podsakoff and Organ, 1986; Pu et al., 2021). The result, 41.76%, is less than the threshold of 50% and confirms that the CMB was not a problem for the model.

5. Results and analysis

In this study, we employed the Partial Least Squares Structural Equation Modeling (PLS-SEM), which is considered a popular variance-based approach of SEM (Hair et al., 2017a). Due to its capacity and adherence for exploratory studies, PLS-SEM is one of the most adherent

Table 2
Constructs and indicators.

Constructs	Items	Indicator	Adapted from
Considering COVID-19, to what extent do these statements apply to your context?			Ambulkar et al. (2015)
Supply chain disruption orientation (SCDO)	SCDO1	We feel the need to be alert for possible supply chain disruptions at all times	
	SCDO2	Supply chain disruptions show us where we can improve	
	SCDO3	We recognise that supply chain disruptions are always looming	
	SCDO4	We think a lot about how a supply chain disruption could have been avoided	
	SCDO5	After a supply chain disruption has occurred, it is analysed thoroughly	
*Considering COVID-19, to what extent do these statements apply to your context? Our Supply Chain …. **			Shin & Park (2021)
Supply chain alertness (SCAL)	SCAL1	Tracked macroeconomic changes (i.e. structural shifts in markets caused by economic progress, political and social change, demographic trends, and technological advances)	
	SCAL2	Detected threats to supply networks (closely monitor deviations from normal operations, including near misses)	
	SCAL3	Detected sudden changes in demand (via the demand-forecasting method)	
	SCAL4	Detected unexpected changes in the physical flow throughout SCs	
	SCAL5	Detailed contingency plans and regularly conduct preparedness exercises and readiness inspections	
Considering COVID-19, to what extent do these statements apply to your context?			Ambulkar et al. (2015)
Resource reconfiguration (RREC)	RREC1	We realign our firm resources and processes in response to environmental changes	
	RREC2	We reconfigure our resources and processes in response to the dynamic environment	
	RREC3	We restructure our resource base to react to the changing business environment	
	RREC4	We renew our resource base in response to the changing business environment	
Considering COVID-19, to what extent do these statements apply to your context? Our Supply Chain ….			Shin & Park (2021)
Supply chain efficiency (SCEF)	SCEF1	Decreased distribution costs (including transportation and handling)	
	SCEF2	Decreased manufacturing costs (including labour, maintenance, and re-work costs)	
	SCEF3	Decreased inventory costs (including inventory investment and obsolescence, work-in-progress, and finished goods)	
Considering COVID-19, to what extent do these statements apply to your context?			El Baz & Ruel (2021)
Supply chain resilience (SCRE)	SCRE1	We are able to cope with changes brought by the supply chain disruption	
	SCRE2	We are able to adapt to the supply chain disruption easily	
	SCRE3	We are able to provide a quick response to the supply chain disruption	
	SCRE4	We are able to maintain high situational awareness at all times	

Table 3
Demographic profile of the respondents.

	N = 137	Percentage of respondents
Age		
18–25	18	13.14
26–33	45	32.85
34–41	34	24.82
42–49	23	16.78
50+	17	12.41
Gender		
Male	79	57.66
Female	58	42.34
Education		
Secondary qualification	32	23.36
Undergraduate degree	64	46.71
Postgraduate degree/MBA	23	16.79
M.Sc	12	8.76
Ph.D	6	4.38
Company size		
1–49	40	29.20
50–99	22	16.05
100–499	26	18.98
500–999	10	7.30
$\geq$ 1000	39	28.47
Segment		
Food/beverage	27	19.71
Healthcare	27	19.71
Retail	26	18.98
Logistics/transportation	10	7.30
Consumer goods	9	6.57
Telecommunications	8	5.84
Machinery and equipment	6	4.38
Oil and gas	3	2.19
Import/export	3	2.19
Ports/airports	2	1.46
Construction	2	1.46
Others	14	10.21
Occupation		
President/VP of Supply Chain	2	1.46
C-level	11	8.03
Supply Chain Director	18	13.14
Supply Chain Manager	106	77.37

approaches to deal with small sample sizes and non-normal data distribution (Fosso Wamba and Akter, 2019; Hair et al., 2017a; Queiroz et al., 2020b). In this respect, we applied WarpPLS software, which is gaining momentum among scholars (Bag et al., 2021; Dubey et al., 2019; Wamba et al., 2020). More precisely, we used WarpPLS 7.0 (Kock, 2020). Besides, we employed the resampling Stable3 method, which, when compared with bootstrapping techniques for small sample sizes, WarpPLS performs with higher statistical power (Fujita et al., 2020; Kock, 2020). Appendix B and C highlight the model fit and the general elements of the model.

5.1. Measurement model

Because we used a reflective model, we followed the four steps

Table 4
Nonresponse bias test (Independent samples test).

Construct	Levene's Test for Equality of Variances		*t*-test for Equality of Means				
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
SCDO	0.832	0.363	1.093	135	0.276	1.099	1.005
RREC	1.511	0.221	0.954	135	0.342	0.807	0.846
SCEF	0.489	0.485	1.097	135	0.275	1.002	0.914
SCAL	0.145	0.704	1.548	135	0.124	1.842	1.189
SCRE	0.448	0.505	0.508	135	0.612	0.485	0.955

recommended by the literature (Hair et al., 2019). Table 5 reports the values of the main reliability metrics. First, we evaluated the reliability of the items by the values of the loadings. The recommended cut-off is loadings higher than 0.708, which means that the construct explicates at least 50% in the variance of the indicator and, consequently, ensures the reliability of the item (Hair et al., 2019). In this sense, all loadings outperformed the cut-off except SCDO3 (0.686). However, by following the recommendations from extant literature (Hair et al., 2017b), we opted for maintaining this item to perform the rest of the analysis without any prejudice. We evaluated the consistency reliability with Cronbach's alpha and composite reliability in sequence. Both Cronbach's alpha and composite reliability outperformed the 0.70 literature cut-off values (Hair et al., 2019; Nunnally, 1978). The next step was to measure the convergent validity of the constructs by using the average variance extracted (AVE) metrics. Our values were higher than the 0.50 cut-off (Hair et al., 2019), denoting that the construct explicates higher than 50% of items' variance.

Ultimately, in Table 6, we measured the discriminant validity in order to ensure that each construct was distinct from the others in the model. We followed the Fornell-Larcker criterion, which uses the AVE of each construct compared to the squared correlation of interconstruct (Fornell and Larcker, 1981). The diagonal values (bold) highlight that they outperformed all the correlations from an individual construct to the other. Hence, we can see that the constructs are distinct from each other. In addition, due to some criticisms regarding the Fornell-Larcker criterion, we performed an additional metric to assess the discriminant validity. Thus, Table 7 shows the Heterotrait-Monotrait Ratio (HTMT) metrics. HTMT reports the mean of the correlations of the items over the constructs in relation to the average correlation's mean, considering the items that assess the same construct (Hair et al., 2019; Henseler et al., 2015). The cut-off for HTMT are values less than 0.90. In this regard, all values reported in Table 7 align with the literature recommendation (Hair et al., 2019; Henseler et al., 2015) and confirm that the constructs are distinct in relation to the other.

Table 5
Measures of the internal consistency reliability and convergent validity.

Construct	Items	Loadings	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
SCDO	SCDO1	0.777	0.828	0.880	0.596
	SCDO2	0.804			
	SCDO3	0.686			
	SCDO4	0.730			
	SCDO5	0.852			
SCAL	SCAL1	0.824	0.888	0.918	0.691
	SCAL2	0.805			
	SCAL3	0.841			
	SCAL4	0.877			
	SCAL5	0.806			
RREC	RREC1	0.816	0.869	0.911	0.718
	RREC2	0.891			
	RREC3	0.861			
	RREC4	0.821			
SCEF	SCEF1	0.896	0.896	0.935	0.828
	SCEF2	0.933			
	SCEF3	0.901			
SCRE	SCRE1	0.902	0.928	0.948	0.822
	SCRE2	0.909			
	SCRE3	0.919			
	SCRE4	0.896			

Table 6
Discriminant validity using AVE.

Construct	SCDO	SCAL	RREC	SCEF	SCRE
SCDO	**0.772**				
SCAL	0.483	**0.831**			
RREC	0.565	0.657	**0.848**		
SCEF	0.146	0.432	0.397	**0.910**	
SCRE	0.367	0.592	0.486	0.344	**0.906**

Note: Square roots of average variances extracted (AVEs) shown on diagonal.

Table 7
Discriminant validity using Heterotrait-Monotrait Ratio (HTMT).

	SCDO	SCAL	RREC	SCEF	SCRE
SCDO					
SCAL	0.563				
RREC	0.667	0.748			
SCEF	0.175	0.485	0.453		
SCRE	0.425	0.651	0.543	0.377	

Note: HTMT ratios (good if < 0.90, best if < 0.85) (Kock, 2020).

5.1.1. *Endogeneity assessment*

Endogeneity is related to the structural error of the correlation between an endogenous construct with any other construct predictors (Kock, 2020). Thus, before the hypotheses test is essential to assess the causality relationship between variables (Dubey et al., 2019). Because of this, we performed the nonlinear bivariate causality direction ratio (NLBCDR) (Kock, 2020). According to Kock (2020, p.81), "The NLBCDR index is a measure of the extent to which bivariate nonlinear coefficients of association provide support for the hypothesised directions of the causal links in a model". The cut-off values equal to or greater than 0.7 show that "at least 70 percent of path-related instances in a model the support for the reversed hypothesised direction of causality is weak or less" (Kock, 2020, p.81). Due to our NLBCDR being equal to 1.0, we can conclude that our model does not suffer from any endogeneity concerning.

5.2. *Structural model*

We measured our model's predictive relevance (power) by using the classic Stone-Geisser's Q^2 test (Mitrega et al., 2017; Stone, 1974). This test is calculated via a blindfolding algorithm, which in turn performs a determined number of resamples (Kock, 2020). Values greater than zero is sufficient to show the prediction power of the model (Hair et al., 2019; Kock, 2020). Accordingly, the Q^2 value (0.39) of the overall model is in line with the extant literature (Hair et al., 2019; Kock, 2020), in which the higher the value, the better the predictive power of the model. Besides, the explained variance of the endogenous variables was SCAL (0.26), RREC (0.44), SCEF (0.19), and SCRE (0.37).

These values are in line with the literature (Dubey et al., 2019; Kock, 2020). In this sense, we can see that the overall model has its variance explained in 37% by the previous variables. In a recent study of supply chain resilience during the COVID-19, El Baz and Ruel (2021) reported that supply chain risk management practices explain 28.5% of the variance of supply chain resilience. Thus, although the usage of different constructs, our result is an important finding to the resilience in O&SCM fields. Table 8 points out the values of the Q^2 and R^2.

5.2.1. Hypotheses testing

As highlighted previous, we employed the WarpPLS 7.0 software (Kock, 2020) by performing the resampling Stable3 method, similar to bootstrapping techniques, but with greater statistical power (Fujita et al., 2020; Kock, 2020). In Table 9, we provide the standardized path coefficients for the hypotheses (H1-H6). The findings show the positive effects of SCDO on SCAL ($\beta = 0.517$, $p < 0.001$), SCAL on RREC ($\beta = 0.663$, $p < 0.001$), SCAL on SCEF ($\beta = 0.443$, $p < 0.001$), SCAL on SCRE ($\beta = 0.451$, $p < 0.001$), and RREC on SCRE ($\beta = 0.153$, $p = 0.033$). These results confirm the hypotheses H1-H5. Regarding the H6, the results ($\beta = 0.106$, $p > 0.05$), show a positive but non-significant effect of SCEF on SCRE. Consequently, H6 was not supported. Furthermore, Table 10 presents the results for the mediation effect. While in H7, we found a partial mediation effect that RREC exerts in this relationship (SCAL - > RREC - > SCRE; $\beta = 0.101$, $p = 0.037$). In H8, we found a non-significant effect of SCEF as a mediatior in the relationship between supply chain alertness and supply chain resilience (SCAL - > SCEF - > SCRE; $\beta = 0.047$, $p > 0.05$).

The results of the hypotheses H1-H5 show important aspects of the role of resources for supply chain resilience during a severe disruption such as the COVID-19. These results confirm the importance of orchestrating a set of resources to respond adequately to the disruptions imposed by the environment. Surprisingly, although the improvement of efficiency by the alertness, efficiency has not a significant positive effect on supply chain resilience. Consequently, this result shows that efficiency does not play a mediation effect in the relationship between alertness and resilience. In addition, alertness contributes to the resilience of the supply chain directly and indirectly via resource reconfiguration.

6. Discussion and implications

Our first hypothesis theorized that 'supply chain disruption orientation has a positive effect on supply chain alertness during a highly disruptive crisis such as COVID-19'. The path SCDO - > SCAL ($\beta = 0.517$), shows a strong effect of this relationship. This result is an important finding that is in line with the related literature that explored the role of supply chain disruption orientation. For instance, Ambulkar et al. (2015) found that SCDO plays an important role in the firm's resilience in highly disruptions contexts. However, they report that SCDO operating in a single manner is not sufficient to generate resilience. That is, SCDO requires other important variables to support the path to resilience. Therefore, our H1, modelled and validated, points out the importance of the supply chain disruption orientation as an antecedent variable of the supply chain alertness in highly disruption scenarios, which positively affects resilience.

For the second hypothesis, we argued that 'supply chain alertness positively affects resource reconfiguration during a highly disruptive crisis such as COVID-19'. This relation was strongly supported, as highlighted by the path SCAL - > RREC ($\beta = 0.663$). In light of this, alertness represents a valuable capability that positively impacts resource reconfiguration in high disruptions. The extant literature virtually does not explore this relationship in-depth in disruptions contexts. For example, supply chain alertness was used as an antecedent of the supply chain resilience (Shin and Park, 2021), as a dimension of the supply chain agility (Gligor et al., 2013), also, as an influential dimension of the supply chain resilience, which in turn positively affects the financial performance (Li et al., 2017). Our novel result underlines that for high disruptions, supply chain alertness, mainly designed by the orchestration of the firm's resources, is one of the most important variables for strategies related to the usage of the resources in an optimized manner.

Regarding the third hypothesis, we proposed that 'supply chain alertness positively affects supply chain efficiency during a highly disruptive crisis such as COVID-19'. We found a positive significant effect in this connection SCAL - > SCEF ($\beta = 0.443$). Accordingly, this is a new outcome for the literature exploring high disruptions. Specifically, it suggests that the orchestration of tools to detect the changes in the environment (e.g., BDA, Artificial Intelligence, etc.) by the managers can be an important aspect of contingency plans and, consequently, support the firms' efficiency and supply chains.

In the fourth hypothesis, we considered that 'supply chain alertness positively affects supply chain resilience during a highly disruptive crisis such as COVID-19'. Again, the prominence of the supply chain alertness for resilience in high disruption scenarios was found by the relation SCAL - > SCRE ($\beta = 0.451$). This result is in line with the literature (Shin and Park, 2021) and reinforces the need for different approaches for monitoring the risk of the supply chain (El Baz and Ruel, 2021).

In the fifth hypothesis, we examined if 'resource reconfiguration positively affects supply chain resilience during a highly disruptive crisis such as COVID-19'. The result evidenced by the path RREC on SCRE ($\beta = 0.153$) confirms this hypothesis. This finding is in line with related literature on disruption (Parker and Ameen, 2018). That is, the

Table 8
Values for Stone-Geisser's Q^2 and adjusted R-squared.

Dependent Variable	Q^2	R^2 (adjusted)
SCAL	0.27	0.26
RREC	0.44	0.44
SCEF	0.20	0.19
SCRE	**0.39**	**0.37**

Table 9
Hypotheses and path coefficients.

Hypotheses	Path	Beta	Standard errors	t-statistics	p-values	Decision
H1	SCDO - > SCAL	0.517	0.076	6.830	<0.001	Accepted
H2	SCAL - > RREC	0.663	0.073	9.046	<0.001	Accepted
H3	SCAL - > SCEF	0.443	0.077	5.745	<0.001	Accepted
H4	SCAL - > SCRE	0.451	0.077	5.862	<0.001	Accepted
H5	RREC - > SCRE	0.153	0.082	1.860	0.033	Accepted
H6	**SCEF - > SCRE**	**0.106**	**0.083**	**1.276**	**> 0.05**	**Rejected**

Table 10
Results for the mediation.

Indirect effects	Path	Beta	Standard errors	p-values	Decision
H7	SCAL - > RREC - > SCRE	0.101	0.083	0.037	Partial mediation
H8	**SCAL - > SCEF - > SCRE**	**0.047**	**0.083**	**> 0.05**	**Rejected**

reconfiguration of the resources by supply chain managers is an important aspect for firms, and their supply chain responds to the disruption.

In relation to the sixth hypothesis, we proposed that 'supply chain efficiency has a positive effect on supply chain resilience during a highly disruptive crisis such as COVID-19'. Surprisingly, the findings showed a non-significant positive effect, and consequently, this hypothesis was rejected. This finding contrasts the result reported by Shin and Park (2021), which found that the level of supply chain efficiency positively impacts supply chain resilience. Also, it contrasts the study from Pettit et al. (2013), which showed that efficiency is an important aspect of resilience in supply chains disruptions contexts. The authors explored some huge crises such as an oil spill in the Gulf of Mexico, the tsunami in Japan, a volcanic eruption in Iceland, etc. However, our findings suggest that managers prioritize other types of resources to enable resilience for a huge global disruption imposed by the COVID-19 (i.e., resources reconfiguration and alertness). It could be justified because of the resources scarcity during a severe global crisis. Also, this result suggests that resilience can vary sensible from the country.

Finally, by a mediation analysis, we found a partial mediation that resources reconfiguration plays in the relationship between supply chain alertness and supply chain resilience. Previous research explored mainly the RREC as a mediator of SCDO on SCRE (Ambulkar et al., 2015). This outcome emphasizes the role and influence of the resources reconfiguration for supports resilience in highly disruption crises. Accordingly, our results suggest that RREC can be leveraged by the orchestration of alertness resources (tools to detect and monitor the changes in the supply chains), consequently impacting the supply chain's resilience positively. This result reinforces the finding reported by (Ambulkar et al. (2015)), which highlighted that resources reconfiguration are critical to face disruptions, but it cannot ensure resilience. Thus, the resources should be leveraged. In our case, they are leveraged by alertness tools. Regarding the mediation effect of SCEF in the relationship between SCAL on SCRE, the non-significant effect suggest that in highly disruptions contexts, the supply chain efficiency is not sufficiently leveraged by the orchestration of the alertness tools.

6.1. Implications for theory

The findings of this study bring important implications to the literature. Firstly, we show that the resource orchestration theory (ROT) is a robust and adherent approach (Sirmon et al., 2011) for understanding and proving an adequate response by orchestrating the firm's resources in highly disruptions crises such as the COVID-19. Our proposed and validated model supported by the ROT advances the literature focused on disruptions (Ambulkar et al., 2015; Yu et al., 2019), more specifically about the COVID-19 disruptions in O&SCM (Dubey et al., 2021; El Baz and Ruel, 2021; Xiong et al., 2021).

Thus, following the literature on supply chain resilience that reported the direct and indirect effects of supply chain alertness (Shin and Park, 2021), our work found that supply chain alertness exerts direct and indirect effects in supply chain resilience considering highly disruptive scenarios. Regarding the direct effects of supply chain alertness, our study reports new important relationships considering huge disruptions. That is, while supply chain alertness is essential to supply chain efficiency, we found that supply chain resilience is not sensible to the efficiency in high disruption scenarios. This is an intriguing result that requires more exploration.

Remarkably, for the resource reconfiguration variable, we found a medium direct effect on supply chain resilience. This result is a little bit different from previous research. For instance, Parker and Ameen (2018) reported a strong effect that resource reconfiguration exerts on firm resilience, taking into account disruptions in power supply. Besides, we identified that resource reconfiguration partially mediates the relationship between supply chain alertness and supply chain resilience. Previous literature reported the full mediation that resource reconfiguration exerts in the relationship between supply chain disruption orientation on resilience (Ambulkar et al., 2015).

Particularly, our findings also confirm the robustness and importance of resource reconfiguration in supporting supply chain resilience, as well as its role as a mediator to achieve resilience in a highly disruptive crisis. In addition, on the one hand, while supply chain efficiency is influenced by alertness, on the other hand, we found that for the UK supply chains during the COVID-19, it does not contribute to the resilience of the supply chain. This is one intriguing result that the extant literature approaching COVID-19 in O&SCM had not yet reported. Furthermore, the recent and influential literature on supply chain resilience already reported efficiency as one important dimension of resilience (Pettit et al., 2013; Chowdhury and Quaddus, 2017; Shin and Park, 2021). However, our findings suggest a different behavior in a deeper and prolonged disruption. Ultimately, the ROT was proved as a good approach for support and integration with O&SCM in huge disruptions for understanding resilience.

6.2. Managerial implications

For managers and practitioners, our results bring important implications and insightful directions. A resource orchestration perspective is a notable approach for managers to respond to severe disruptions, which impose a parsimonious usage due to the scarcity. For example, by employing cutting-edge technologies (resources) like big data analytics, managers can improve the firm's capabilities in tracking and monitoring the environment, and consequently, the overall supply chain with more agility, alertness control and coordination (Mandal, 2019). In addition, with digital twin technologies (Ivanov and Dolgui, 2020a), managers can gain a more in-depth view of their firm and the supply chain behavior during the disruption. That is, digital twin approaches can enable a digital copy of the supply chain of the firm and improve the alertness level. Consequently, the management of the resources can be better orchestrated towards resilience. Moreover, it can contribute to supporting more realistic predictions and resource allocation according to the disruption unfolding. Besides, it is essential for a firm's disruption orientation culture that supports the managers in reconfiguration resources activities according to the evolution of the disruption.

Also, our results suggest that managers involved in O&SCM contexts, considering highly disruptive scenarios, should invest more time in understanding the role of resource reconfiguration and its contribution to resilience (Ambulkar et al., 2015; Parker and Ameen, 2018). Accordingly, resource reconfiguration is an important capability that supports resilience in disruptive scenarios, by contributing directly and as a mediator. Lastly, in huge disruptions contexts, our results suggest that there is a trade-off concerning strategies focused on supply chain efficiency and others. It suggests that due to the scarcity of resources, managers focus on alertness and the resources reconfiguration to enable resilience. Thus, considering the COVID-19 context, the relationship between efficiency and the resilience of the supply chain is weak and not significant. This implies that strategies that focus only on efficiency may not fully contribute to resilience. For example, many O&SCM efficiency strategies consider the minimization of the costs through some resources. It could make unfeasible the orchestration of key resources, mainly related to cutting-edge technologies. In this sense, the focus should be on strategies that support key capabilities of the firms, such as resource reconfiguration, disruption orientation, and alertness. That is, in huge disruptions scenarios, it highlights that there is a complex trade-off involving strategies focused on the efficiency of the supply chain and strategies related to resources orchestration to enable key capabilities to support the resilience.

7. Limitations and research directions

This study presents some limitations that could be addressed in future research. Due to the fact that we employed a cross-sectional approach to collect data from O&SCM professionals (Fosso Wamba and Akter, 2019), the data collection limits the analysis of the sample basically at a specific point in time. Future research can consider longitudinal data collection to understand if the evolution of the disruption requires different approaches in the resources orchestration by including new resources to enable new capabilities. Besides, our sample considered only O&SCM professionals that their companies are operating in the UK. Future research has a great opportunity to develop cross-country studies to compare the differences between countries, considering the resource orchestration approach in highly disruptive contexts. Finally, we did not ask the participants about their years of experience in O&SCM. Future research can consider this aspect and analyze if it can influence the model.

8. Concluding remarks

Our study can make insightful contributions for fields that explore resilience in highly disruptions scenarios, such as the COVID-19. Our findings show evidence that the resource orchestration perspective is an adherent and powerful approach for O&SCM fields to provide adequate responses during severe disruptions. In addition, our proposed and validated model also represents a contribution to scholars interested in advancing the model and practitioners to gain a more in-depth understanding of the resources and capabilities enabled by the ROT approach. Finally, the model found the importance of the supply chain disruption orientation as an antecedent of the supply chain alertness, which in turn positively affects resource reconfiguration, supply chain efficiency, and supply chain resilience. Besides, we reported two more novel results in huge disruptions contexts. First, we found evidence of the mediation effect of resource reconfiguration in the relationship between supply chain alertness and resilience. Second, and unexpectedly, in high disruptions crises, supply chain efficiency showed no significant contribution to the supply chain resilience. It implies that the supply chain's efficiency (i.e., focus on costs minimization) during severe disruptions with limited resources is not a priority when the supply chain is looking for resilience.

Appendix A. G*Power parameters and output

F tests - Linear multiple regression: Fixed model, R^2 deviation from zero.
Analysis: A priori: Compute required sample size.

Input:	Effect size f^2	= 0.15
Output:	α err prob	= 0.05
	Power (1-β err prob)	= 0.80
	Number of predictors	= 4
	Noncentrality parameter λ	= 12.7500000
	Critical F	= 2.4858849
	Numerator df	= 4
	Denominator df	= 80
	Total sample size	= 85
	Actual power	= 0.8030923

Appendix B. Model fit and quality indices

Average path coefficient (APC) = 0.389, P < 0.001
Average R-squared (ARS) = 0.322, P < 0.001
Average adjusted R-squared (AARS) = 0.314, P < 0.001
Average block VIF (AVIF) = 1.632, acceptable if ≤ 5, ideally ≤ 3.3
Average full collinearity VIF (AFVIF) = 1.783, acceptable if ≤ 5, ideally ≤ 3.3
Tenenhaus GoF (GoF) = 0.485, small ≥ 0.1, medium ≥ 0.25, large ≥ 0.36
Sympson's paradox ratio (SPR) = 1.000, acceptable if ≥ 0.7, ideally = 1
R-squared contribution ratio (RSCR) = 1.000, acceptable if ≥ 0.9, ideally = 1
Statistical suppression ratio (SSR) = 1.000, acceptable if ≥ 0.7
Nonlinear bivariate causality direction ratio (NLBCDR) = 1.000, acceptable if ≥ 0.7

Appendix C. General model elements

Missing data imputation algorithm: Arithmetic Mean Imputation
Outer model analysis algorithm: PLS Regression
Default inner model analysis algorithm: Warp3
Multiple inner model analysis algorithms used? No
Resampling method used in the analysis: Stable3
Number of data resamples used: 100
Number of cases (rows) in model data: 137
Number of latent variables in model: 5
Number of indicators used in model: 21
Number of iterations to obtain estimates: 6
Range restriction variable type: None
Range restriction variable: None

(*continued on next page*)

(*continued*)

Missing data imputation algorithm: Arithmetic Mean Imputation
Range restriction variable min value: 0.000
Range restriction variable max value: 0.000
Only ranked data used in analysis? No

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