

# Increasing resilience in humanitarian supply chains through 4PL adoption

*Matthew Tickle ([m.tickle@liverpool.ac.uk](mailto:m.tickle@liverpool.ac.uk))*

*University of Liverpool Management School, Liverpool, United Kingdom*

*Sarah Schiffling*

*Business School, Liverpool John Moores University, Liverpool, United Kingdom*

*Guarav Verma*

*University of Liverpool Management School, Liverpool, United Kingdom*

## Abstract

The COVID-19 pandemic has heightened awareness of supply chain fragility in an increasingly vulnerable, uncertain, complex and ambiguous (VUCA) world. One proposed approach to enhance supply chain resilience is the use of fourth party logistics providers (4PL). This study identifies enablers and inhibitors of 4PL adoption, as well as the critical success factors (CSFs) of 4PL adoption. Semi-structured interviews were conducted to gain insights into 4PL adoption in the challenging environment of humanitarian supply chains (HSCs). Participants suggested factors that enable and inhibit 4PL adoption, as well as the CSFs that would increase 4PL adoption in HSCs.

**Keywords:** Humanitarian Logistics, Fourth-party Logistics, Humanitarian Supply Chains

## Introduction

The COVID-19 pandemic demonstrated the fragility of many supply chains (SCs) and showed how unprepared many organisations were, lacking the capacity to respond to large-scale disruption effectively (Worley and Jules, 2020). In an increasingly vulnerable, uncertain, complex, and ambiguous (VUCA) world (Mack et al., 2015), outsourcing SC activities may become increasingly appealing. Fourth-party logistics (4PL) provides a sophisticated outsourcing solution for SC coordination, seeking to deliver a high performing, comprehensive, and integrated SC by combining the various resources, capabilities, and technologies of several organisations with complementary service providers (Abidi et al., 2015).

This study focuses on organisations that routinely deal with disruptions in their SCs as part of their core operations. Humanitarian supply chains (HSCs) are systems that are “responsible for designing, deploying and managing the processes necessary for dealing with not only current but also future humanitarian/disaster events” and operate under extreme conditions to do so (Day et al. 2012). HSCs are gaining increased attention (Tatham and Pettit, 2010), and have been shown to be highly complex systems (Schiffing et al., 2020a) that often face issues with visibility, poor information sharing, and a lack of collaboration (Dubey et al., 2021).

The adoption of 4PL in HSCs has the potential to significantly improve HSC performance (Abidi et al., 2015). The complex and context-dependent challenges of humanitarian coordination and SC performance are well documented in the literature (Jensen and Hertz, 2016). These challenges are becoming increasingly common in commercial SCs, suggesting there is significant learning potential from HSCs for all other supply chains (Day et al., 2012).

This study aims to investigate the use of 4PL in HSC. The research questions are:

1. What are the factors that enable or inhibit 4PL adoption?
2. What are the CSFs required to successfully adopt 4PL?

## **Literature Review**

The trend of outsourcing supply chain management (SCM) functions to logistics service providers (LSPs) has increased and evolved over the past two decades, from outsourcing single functions towards outsourcing the entire logistics function (Bowersox et al., 2007). This has allowed organisations to focus more on their core competencies and expertise in order to enhance their competitive advantage (Mangan et al., 2012). Traditional LSPs, sometimes known as third-party logistics (3PL) providers, usually specialise in (and are responsible for) a single function or component of the SC; as a result, client organisations must coordinate among many different 3PL providers (Vivaldini et al., 2008).

Given the time and resources required for this coordination, a more sophisticated LSP relationship has emerged in recent years, that of fourth-party logistics (4PL). Essentially, 4PL is an "elaborated form of outsourcing", whereby 4PL service providers provide a bundle of services that aim to design, coordinate and manage the entire SC in an integrated and holistic manner (Zacharia et al., 2011). As a result, 4PL can be considered a 'total' provider (similar to a coordination agency or 'hub') that improves SC governance and performance (Kasperek, 2013).

The benefits of using 4PL providers are numerous; they include optimised product, information, and material flow, reduced inefficiencies, increased SC agility, increased cost-effectiveness, improved competitive advantage, and increased SC performance (Vivaldini et al., 2008). 4PL service providers also reduce the transaction costs associated with buyer-seller relationships through use of advanced technologies for information exchange and communication (Bourlakis and Bourlakis, 2005). The subsequent improvements in strategic collaboration among SC stakeholders not only facilitate synergies and efficiencies, but also reduce inter-organisational conflict and competition among stakeholders (Nicovich et al., 2007). This promotes trust, cooperation and longer-term relationships critical to sustaining competitive advantage (Wong and Karia, 2010).

There is limited evidence of utilising 4PL to minimise the extreme SC disruptions of the COVID-19 pandemic. It is difficult (and highly unethical) to replicate such disruptions for the purpose of research. However, one extreme example of SC disruptions that occur regularly are those that occur in humanitarian supply chains (HSC). Investigating how 4PL could be utilised within HSCs may go some way to understanding how the approach could be utilised to help minimise SC disruption issues more generally.

When comparing HSCs to commercial supply chains (CSCs), several important differences are worth noting. In CSCs, the demand for products and services is generally predictable, there are usually well-defined mechanisms, and the use of advanced technology for determining and controlling inventory and managing information is commonplace (Nagurney and Qiang, 2012). In contrast, demand for products and services in HSCs is based on events that are unpredictable in terms of need, scale and location, and the lack of standardisation across all actors usually leads to information being either unreliable or incomplete (Holguín-Veras et al., 2012). Objectives also differ; CSCs aim

to maximise profit, whereas HSCs aim to save lives and meet the needs of the affected populations in a timely manner (Dubey and Gunasekaren, 2016). As a result, HSCs must consider a multitude of dimensions; cost and quality are obviously important, but so are considerations over the 'last mile' distribution to reach the victims of the disaster, even if it proves to be costly and high risk (Nagurney and Qiang, 2012). Furthermore, many non-commercial stakeholders influence the HSC, including donors, non-governmental organisations (NGOs), governments and military actors, which is obviously not the case in CSC settings (Maghsoudi et al., 2018). All of these differences highlight the complexity of the HSC operating environment, and show why some have described them as a 'wicked problem' (Tatham and Houghton, 2011).

These issues have triggered a more focused attention on the need for better coordination among humanitarian actors (Moshtari, 2016). Many researchers have turned to the private sector to identify relevant experiences and best practices that could minimise these issues (Abidi, de Leeuw and Klumpp, 2015). One such solution is that of 4PL which has been proven to increase CSC performance, including improved horizontal collaboration and cost-efficiency, as well as increased competitiveness through innovation and flexibility (Kasperek, 2013). Although the actual use of 4PL service providers in an HSC setting has not yet been observed in practice, many scholars have deemed the application of 4PL concepts to HSCs worth investigating (Abidi et al., 2015; Tatham and Pettit, 2010). This study aims to investigate the use of 4PL in HSC as an example of 4PL usage in SC contexts that are significantly impacted by VUCA factors to further the understanding of the possibilities 4PLs might offer to enhance SC resilience.

## **Methodology**

Semi-structured interviews were used in order to uncover issues and relationships that have not yet been explored or documented in the literature. Open-ended questions allowed for a free-flowing discussion around predefined concepts (VanScoy and Evenstad, 2015), and enabled theoretical elaboration by using real-life insights and experience to identify themes and behaviours (Yin, 2014).

Non-random, purposive sampling was used to select participants; this method was chosen to ensure that participants who were most likely able to contribute to the research questions were interviewed (Staats et al., 2011). Bias was controlled by implementing clear selection criteria (Robinson, 2014). To identify which persons met the sample criteria, a database of humanitarian logistics personnel from the staffing list of an NGO (in this paper, the NGO will be referred to as 'NGO X'). NGO X is a large international NGO with over 7,000 employees worldwide and operations in over 30 countries, mainly in humanitarian and conflict areas. Out of 28 persons listed on the databases, 10 individuals responded positively and were willing to be interviewed. Interviews lasted on average one hour each and were carried out over Skype. The interviews were transcribed word-for-word without any editing, and the researchers' shared the transcription files with the respective participants to confirm the accuracy of the researchers' understanding (Easterby-Smith et al., 2012; Halldorsson and Aastrup, 2003).

Thematic analysis was used to analyse the interview data, allowing the research team to identify patterns, themes and relationships within the data (Braun and Clarke, 2006). The research team manually coded the data before using the NVIVO Pro 12 software tool, as recommended by Bazeley (2013). To further increase the validity of the findings, the primary interview data was triangulated with secondary data in the form of internal and external documents and reports gained from NGO X, as recommended by Saunders et al (2019). The documents reviewed included evaluation reports, strategy documents, job descriptions of key logistics staff, relevant meeting minutes, and field reports.

## **Results and Discussion**

This section will present the inhibiting and enabling factors for 4PL adoption in HSCs and then detail the CSFs in this context based on the data collection and analysis as detailed above. Inhibiting factors are those that either make 4PL adoption difficult, or are those that are necessary but not available in the current HSC climate. Enabling factors are those that, if present, would help facilitate or strengthen the HSC's ability to adopt 4PL.

### *Inhibiting factors*

In total, 5 inhibiting factors were identified by participants. These include the funding environment in which HSCs operate, human resources issues, bureaucracy within the HSC, corruption and conflict of interest, and the perceived risks of 4PL.

#### Inhibiting Factor 1 – Funding

Funding continuity in HSCs is notoriously difficult, as the majority of funding arrives in bursts in the immediate aftermath of high-profile disasters (Oloruntoba and Gray, 2006). Participants mentioned that donor funding is decreasing globally and highlighted 'donor fatigue' in many countries. The competition for funding, fragmented funding environment and high insecurity, are seen to hamper inter-agency collaboration and coordination. Due to this funding environment, participants felt that 4PL adoption would be incredibly difficult, as the need for preparedness activities and longer-term solutions is not appreciated by funders who favour more visible activities over SC optimisation.

#### Inhibiting Factor 2 – Human Resources

This short-term, restricted funding means staff are provided with short-term contracts, leading to high staff turnover. This has a negative impact on the HSC in terms of leadership, coordination and engagement between stakeholders, all of which require long-term relationship building activities in order to build trust and confidence between actors, something that is difficult to achieve if personnel keep changing. Participants remarked that some personnel do not have adequate SC expertise, and lack the interpersonal skills to lead their organisations and engage with other actors in the SC (particularly with host governments). Not having personnel with perceived credibility has been found to negatively impact the level of trust and confidence within the HSC (Stephenson and Schnitzer, 2006). This high-turnover could negatively impact the work of any 4PL provider, making it difficult to maintain strong relationships with stakeholders working across the HSC and losing a sense of continuity and sustained direction.

#### Inhibiting Factor 3 – Bureaucracy

Bureaucracy, mainly within the UN (who coordinate and chair the various humanitarian clusters), was found to inhibit timely decision making, which in turn makes SC coordination even more difficult. Participants felt that this bureaucracy would have a significant impact on the ability of a 4PL provider to effectively and efficiently manage the HSC over a period when time is of the essence in order to save lives. For example, in a follow-up discussion, one participant (#6) stated that the UN's requirement for multiple signatures via their approval process can make contracting for logistics service provision a "long-winded process"; in many cases, this process can take up to two months, even though all stakeholders agree that emergency responses should occur within two weeks of a crisis if the response is going to be deemed effective.

#### Inhibiting Factor 4 – Conflict of interest

Conflict of interest was identified by participants as the most significant barrier to effective engagement and collaboration with other stakeholders within the HSC, especially with regard to government and private sector organisations. Participants felt that personnel within their organisations tended to avoid these stakeholders to avoid corruption and bribes, maintaining the humanitarian principle of neutrality, therefore ensuring they complied with their organisational mandates and values. This mindset will be detrimental to the whole idea of 4PL, which requires all parties within the SC to be open and honest in terms of the information they provide. Should a HSC stakeholder be seen to act in an inappropriate manner, all other stakeholders could become increasingly cautious, especially if they felt their information could be used against them. The increased competition between humanitarian organisations reduces trust among them and is likely to lead to some stakeholders pulling out of the 4PL agreement, potentially causing a domino effect whereby 4PL becomes unfit for purpose.

#### Inhibiting Factor 5 – Perceived risks

While 4PL providers offer benefits, they also create risks. Participants were concerned about the 4PL taking control of all logistics activities across the HSC. A major concern was the perceived “monopoly” the 4PL provider would have, especially given that all stakeholders would be dependent on the provider for all logistics services. Furthermore, should something go wrong with the 4PL provider, the entire HSC would be affected, leading to a potentially detrimental impact on victims of the disaster. Some participants were concerned about data privacy and security should the 4PL provider be in control of the HSC’s information management, fearing that potentially sensitive information may be made widely accessible to all stakeholders. Some felt that this increased information transparency would be a huge benefit in terms of increasing equality throughout the HSC.

#### *Enabling factors*

Participants consistently mentioned two main factors when discussing factors that would enable 4PL adoption within HSCs: Technology and trust.

#### Enabling Factor 1 – Technology

Most participants felt that the current use of technology in HSCs was sub-standard, and that better and more appropriate options were available that would greatly improve the HSC. Information management in particular was seen as a major concern in current disaster response scenarios, especially when attempting to reach victims in remote areas. Participants felt that adopting newer technologies within the HSC would empower 4PL providers with increased visibility across the SC, thereby allowing them to manage and coordinate its logistics services more effectively. Participants admitted that implementing such technology would not be easy for 4PL providers in the HSC climate due to the short-term, limited donor funding, as well as the trust issues limiting the level of engagement with private sector organisations. However, many felt that the new technologies available could enable a 4PL provider to move into the HSC field.

#### Enabling Factor 2 – Trust

Although the inter-agency competition apparent in HSCs has been shown to be detrimental to both trust and confidence between stakeholders (Schiffing et al., 2020b; Balcik et al., 2010), participants suggested that trust was largely dependent on the personal relationships between the different personnel involved in the HSC. An individual’s competence and interpersonal skills were considered important factors that could ensure credibility and respect, leading to an increase in trust between stakeholders.

Participants suggested that the more trust they have in the person representing an organisation, the more the individual stakeholders will engage, contribute and support each other. Participants suggested that if 4PL providers can portray an image of credibility and trustworthiness, they are likely to be embraced by all HSC stakeholders.

#### *What are the CSFs for 4PL adoption in HSCs?*

Once participants had identified the various enablers and barriers toward 4PL adoption within HSCs, they were asked if they felt 4PL could realistically be adopted. All participants felt that 4PL could realistically be adopted and five critical success factors (CSFs) were identified; leadership, coordination, services provided, information management, and engagement with stakeholders.

#### Leadership

Effective human resources (HR) are critical to ensuring strong and stable leadership within organisations (Pollack and Pollack, 2015). For any 4PL provider to take on the leadership role within the HSC, participants believed that careful recruitment of humanitarian personnel to the provider would be required. Participants felt there should be specific job descriptions and terms of reference for 4PL provider employees, to hold them accountable for actions that support effective leadership. Having the right people with the right skills is of the highest importance, with particular emphasis on people skills being repeated across multiple participants. Participants also suggested that improving recruitment and contract conditions should first be considered in countries with active, acute, large-scale humanitarian crises. To address short-term restricted donor funding, NGOs should conduct joint advocacy to donors in favour of longer-term funding, or pool their funding and resources in order to support the 4PL. Participants agreed that the 4PL provider needs the authority to take decisions and enforce them, meaning that the 4PL terms of reference should be explicit about their leadership role, including a definition of the scope in which decisions can be made. Some participants mentioned that current terms of references are vague and actions are dependent upon the goodwill of participating organisations. To overcome this, one participant suggested that.

#### Coordination

Other key barriers to coordination identified by participants included bureaucracy, and competition issues between all stakeholders in the HSC. However, all participants were in agreement that effective coordination between the various parties is essential for any successful humanitarian response. To combat bureaucracy (in particular the extensive amount of time taken for approvals), participants suggested introducing 'fast track' measures for the 4PL, such as simplified request requirements and one designated person at a senior level to authorise all requests. Giving the 4PL provider this degree of autonomy when making key decisions was seen as a huge benefit by all participants. One participant (#2) referenced the World Food Programme's (2012) evaluation of the Global Logistics Cluster, which recommended simplified measures and faster processing activities that can be 'activated' based on the scale, urgency and complexity of the humanitarian situation. The same participant stated that benchmarking the 4PL provider's performance would be important when, for example, agreeing on the minimum number of days required for a particular process or function. To deal with the issue of competition for donor funding.

#### Services Provided

The amount of services offered by the 4PL provider will depend on numerous factors, including the adequacy of the funding given to them, and the amount of autonomy other

stakeholders in the HSC allow them to have. Many participants suggested the 4PL provider should focus on the procurement and SC activities that contributed towards the major issues affecting all organisations. Participants suggested that during acute, large-scale humanitarian emergencies, additional resources should be allocated to the 4PL provider so that they can offer further services. This may mean that donors and UN agencies must re-allocate funding between countries, such as from those with chronic situations to those with acute crisis situations. Participants were concerned about losing control of resources to the 4PL provider, as well as the impact on beneficiaries if the consolidated HSC were to be disrupted. To manage these risks effectively, participants suggested that a risk management strategy should be put in place, which includes a thorough risk assessment of the services that might be provided by the 4PL provider for a given context. Indeed, risk-based programming has been identified as a gap in current HSCs (WFP, 2012). More specifically, participants suggested a method of ensuring the 4PL provider did not monopolise all HSC decisions; ensuring there is a minimum quorum of stakeholder organisations achieved for major decisions and actions concerning the 4PL would guarantee that different organisations' concerns and views were reflected and addressed. Finally, participants felt that adopting more advanced technology, particularly those innovative tools and practices utilised in the commercial sector, would enable the 4PL provider to deliver an increased number of more efficient services, as well as allowing them to overcome last mile distribution issues.

#### Information Management

Many participants felt the 4PL provider would benefit from tools that: i) offered access to real-time data, ii) had the ability to be easily adapted to any country's infrastructure, iii) were full accessible to all stakeholders, and iv) ensured robust security and privacy of all data. To make this a reality, participants suggested the 4PL would require appropriate donor funding and human resources to manage these improved systems, as well as increased engagement with the private sector, which is discussed in more detail in section 4.2.5. For better affordability and accessibility, participants suggested that the 4PL provider could consider cloud computing using the Software-as-a-Service (SaaS) model. Allowing information to be stored in this manner would open up the possibility of improved information sharing between parties, thereby alleviating some of the coordination issues identified earlier. However, some participants stated that data security and confidentiality issues were often cited as reasons why cloud solutions were not appropriate, particularly as some humanitarian data (for example on refugees or vulnerable persons) is highly sensitive; in this scenario, participants suggested the 4PL may have to manage this data separately in a specialised database that has increased security measures. Participants felt that many NGOs have less IT capability than the commercial sector and are more risk averse when adopting innovative tools such as SaaS. This again emphasises the need for the 4PL provider to have a risk management strategy and have sufficient funding to invest in both IT and public-private partnerships.

#### Engaging with Stakeholders

Engagement with stakeholders is critical to improve HSC performance (Fontainha et al., 2017). Many participants noted that the right personnel were key in building trust between stakeholders, thereby fostering collaboration. Participants previously noted that conflict of interest and corruption issues would inhibit the 4PL provider's engagement with stakeholders. One suggested method for overcoming this would be to consider them as risks that could be managed by a strong and comprehensive risk management strategy; rather than minimising and avoiding certain stakeholders, risk management techniques

could be used to increase engagement at a more strategic level. One participant noted that the WFP's evaluation of the Global Logistics Cluster suggested that the main reasons for NGOs not engaging with governments were i) a lack of awareness, and ii) the unavailability of government officials given their commitment to various other coordination mechanisms and meetings. This participant suggested that, where feasible, the 4PL provider should consider integrating, or piggybacking off existing government coordination bodies, to minimise the number of meetings and platforms and ensure optimal participation by governments in 4PL activities. As a minimum, the 4PL provider should try to influence the agenda of national coordination meetings to ensure that key HSC issues are tabled and discussed regularly. Finally, public-private partnerships were discussed as something that could leverage the resources and knowledge needed from the commercial world to boost 4PL functions, particularly around information management and service delivery. There may be conflict of interest issues to such partnerships, but participants felt these could also be addressed with strong risk management.

## **Conclusion**

This study has shown that utilising 4PL can be of huge benefit for organisations within HSCs and CSCs alike. This research has identified factors that can either inhibit or enable 4PL adoption within supply chains. Using HSC as an example, the study investigated 4PL usage in SC contexts that are significantly impacted by VUCA factors to further our understanding of the possibilities 4PLs might offer to enhance SC resilience. By using opinions of those in the field, the results have highlighted that enabling factors include the use of more advanced technology, and the development of trusting relationships between all involved in the HSC. Inhibiting factors include the uncertainty associated with funding a humanitarian operation, the availability of human resources (particularly the high-turnover of personnel within the HSC), the level of bureaucracy across the HSC, conflict of interest within the HSC, and the perceived risks of using a 4PL provider to manage the entire HSC's logistics activities.

The study has also identified CSFs that suggest the actions required to ensure successful 4PL adoption in highly dynamic SCs. These include leadership, coordination, services provided, information management, and engaging with stakeholders. The study has both theoretical and practical implications. It adds to the literature on 4PL by offering an insight into the main inhibitors and enablers of using the 4PL model within extreme SC environments, something that has not been given significant attention in the literature so far. It also contributes to the HSC literature by showcasing how 4PL adoption could improve the performance of these supply chains. In terms of practical implications, the study's suggested recommendations are likely to offer performance benefits to all stakeholders within highly dynamic SCs, and could also act as an important move towards universal 4PL adoption within these SCs. Further work will develop a framework as a potential method of improving the 4PL adoption rate, as well as the efficiency and effectiveness of highly dynamic SCs (particularly disaster relief operations).

## **References**

- Abidi, H., de Leeuw, S. and Klumpp, M., (2015), "The value of fourth-party logistics services in the humanitarian supply chain", *Journal of Humanitarian Logistics and Supply Chain Management*, Vol. 5, No. 1, pp. 35-60.
- Balcik, B., Beamon, B.M., Krejci, C.C, Muramatsu, K.M. and Ramirez, M., (2010), "Coordination in humanitarian relief chains: Practices, challenges and opportunities", *International Journal of Production Economics*, Vol. 126, No. 1, pp. 22-34.
- Bazeley, P. (2013), *Qualitative data analysis with NVivo*, 2nd edition, SAGE, London.

- Bourlakis, C. and Bourlakis, M. (2005), "Information technology safeguards, logistics asset specificity and fourth-party logistics network creation in the food retail chain", *Journal of Business and Industrial Marketing*, Vol. 20, No. 2, pp. 88-98.
- Bowersox, D.J., Closs, D.J. and Cooper, M.B. (2007), *Supply Chain Logistics Management*, 2nd edition, McGraw-Hill: New York.
- Braun, V. and Clarke, V., (2006), "Using thematic analysis in psychology", *Qualitative Research in Psychology*, Vol. 3, No. 2. pp. 77-101.
- Day, J. M., Melnyk, S. A., Larson, P. D., Davis, E. W., & Whybark, D. C. (2012). Humanitarian and disaster relief supply chains: a matter of life and death, *Journal of Supply Chain Management*, 48, Vol. 2, pp. 21-36.
- Dubey, R., Altay, N. and Blome, C., (2019), "Swift trust and commitment: The missing links for humanitarian supply chain co-ordination?", *Annals of Operations Research*, Vol. 283, pp. 159-177.
- Dubey, R., Bryde, D. J., Foropon, C., Tiwari, M., Dwivedi, Y., and Schiffling, S., (2021), "An investigation of information alignment and collaboration as complements to supply chain agility in humanitarian supply chain", *International Journal of Production Research*, 59, No. 5, 1586-1605.
- Dubey, R. and Gunasekaran, A., (2016) "The sustainable humanitarian supply chain design: agility, adaptability and alignment", *International Journal of Logistics Research and Applications*, Vol. 19, No. 1, pp. 62-82.
- Easterby-Smith, M., Thorpe, R. and Jackson, P. (2012), *Management research*, 4th edition. London: SAGE Publications.
- Fontainha, T.C., Leiras, A., Scavarda, L-F. and de Mello Bandeira, R.A. (2017), "Public-private-people relationship stakeholder model for disaster and humanitarian operations", *International Journal of Disaster Risk Reduction*, Vol. 22, pp. 371-p386.
- Halldorsson, A. and Aastrup, J. (2003), "Quality criteria for qualitative inquiries in logistics", *European Journal of Operational Research*, Vol. 144, No. 2, pp. 321-332.
- Hofman C., and Roubtsova E., (2020), "A Reference Model for a Service Level Agreement", In: Shishkov B. (eds) *Business Modelling and Software Design. BMSD 2020. Lecture Notes in Business Information Processing*, Vol 391, pp. 55 – 68, Springer
- Holguín-Veras, J., Jaller, M., Van Wassenhove, L. N., Pérez, N., and Wachtendorf, T. (2012), "On the unique features of post-disaster humanitarian logistics", *Journal of Operations Management*, Vol. 30, No. 7, pp. 494–506.
- Huang, M., Tu, J., Chao, X. and Jin, D., (2019), "Quality risk in logistics outsourcing: A fourth party logistics perspective", *European Journal of Operational Research*, Vol. 276, pp. 855-879
- Jahani, H., Abbasi, B., Hosseinfard, Z., Fadaki, M. and Minas, J.P., (2021), "Disruption risk management in service-level agreements", *International Journal of Production Research*, Vol. 59, No. 1, pp. 226-244
- Jensen, L.M. and Hertz, S. (2016), "The coordination roles of relief organizations in humanitarian logistics", *International Journal of Logistics: Research and Applications*, Vol. 19, No. 5, pp. 465-485.
- Jensen, L.M. (2012), "Humanitarian cluster leads: lessons from 4PLs", *Journal of Humanitarian Logistics and Supply Chain Management*, Vol. 2, No. 2, pp.148-160.
- John, L., Gurumurthy, A., Soni, G. and Jain, V., (2019), "Modelling the inter-relationship between factors affecting coordination in a humanitarian supply chain: a case of Chennai flood relief", *Annals of Operations Research*, Vol. 283, No. 1/2
- Kasperek, M. (2013), "Operating model of a 4PL providers", *Journal of Economics and Management*, Vol. 12, pp. 24-44.
- Kumar, K. S., Narahari, H. K. and Wright, N., (2014), "Development of Proactive Risk-Predictive Model for 4PL Transaction Center Using PLS Regression and Neural Networks", *IUP Journal of Supply Chain Management*, Vol. 11, No. 1, pp. 36-51
- Lenfle, S. and Loch, C., (2017), "Has Megaproject Management Lost Its Way? Lessons from History", in Flyvberg, B. (ed.) *The Oxford Handbook of Megaproject Management*, Oxford, UK: Oxford University Press
- Mack, O., Khare, A., Krämer, A., & Burgartz, T. (Eds.). (2015). *Managing in a VUCA World*, Springer.
- Maghsoudi, A., Zailani, S. Ramayah, T. and Pazirandeh, A., (2018), "Coordination of efforts in disaster relief supply chains: the moderating role of resource scarcity and redundancy", *International Journal of Logistics Research and Applications*, Vol. 21, No. 4, pp. 407-430.
- Mangan, J., Lalwani, C., Butcher, T. and Javadpour, R., (2012), *Global logistics and supply chain management*, 2nd edition. West Sussex, UK: John Wiley and Sons.
- Mehmann, J. and Teuteberg, F., (2016), "Understanding the 4PL approach within an agricultural supply chain using matrix model and cross-case analysis", *International Journal of Logistics Research and Applications*, Vol. 19, No. 5, pp. 333-350

- Moshtari, M. (2016), "Inter-organisational fit, relationship management capability, and collaborative performance within a humanitarian setting", *Production and Operations Management*, Vol. 25, No. 9, pp. 1542-1557.
- Nagurney, A. and Qiang, Q. (2012), "Fragile networks: identifying vulnerabilities and synergies in an uncertain age", *International Transactions in Operational Research*, Vol. 19, No. 1-2, pp. 123-160.
- Nicovich, S.G., Dibrell, C.C. and Davis, P.S. (2007), "Integration of value chain position and examination of upstream and downstream activities", *Journal of Business and Economic Studies*, Vol. 13, No. 2, pp. 91-106.
- Oloruntoba, R. and Gray, R. (2006), "Humanitarian aid: an agile supply chain?", *Supply Chain Management: An International Journal*, Vol. 11, No. 2, pp. 115-120.
- Pollack, J. and Pollack, R. (2015), "Using Kotter's Eight Stage Process to Manage an Organisational Change Program: Presentation and Practice", *Systemic Practice and Action Research*, Vol. 28, No. 1, pp. 51-66.
- Robinson, O.C. (2014), "Sampling in Interview-based qualitative research: A theoretical and practical guide", *Qualitative Research in Psychology*, Vol. 11, No. 1, pp. 1-25.
- Saikouk, T., Fattam, N., Angappa, G. and Hamdi, A., (2021), "The interplay between inter-personal and inter-organizational relationships in coordinating supply chain activities", *The International Journal of Logistics Management*, Vol. 32, No. 3, pp. 898-917
- Saunders, M., Lewis, P. and Thornhill, A. (2019), "*Research Methods for Business Students*", 8th edition, Harlow, England: Pearson
- Slack, N. and Brandon-Jones, A., (2019), *Operations Management*, 9th edition, Harlowe, UK: Pearson
- Schiffing, S., Hannibal, C., Tickle, M., and Fan, Y., (2020a), "The implications of complexity for humanitarian logistics: A complex adaptive systems perspective", *Annals of Operations Research*, pp. 1-32.
- Schiffing, S., Hannibal, C., Fan, Y. and Tickle, M. (2020b), "Coopetition in temporary contexts: examining swift trust and swift distrust in humanitarian operations", *International Journal of Operations & Production Management*, Vol. 40, No. 9, pp. 1449-1473.
- Staats, B.R., Brunner, D.J. and Upton, D.M. (2011), "Lean principles, learning, and knowledge work: evidence from a software service providers", *Journal of Operations Management*, Vol. 29, No. 5, pp. 376-390.
- Stephenson, M. and Schnitzer, M.H. (2006), "Inter-organizational trust, boundary spanning and humanitarian relief coordination", *The Centrality of Values, Passions, and Ethics in the Nonprofit Sector*, Vol. 17, No. 2, pp. 211-233.
- Tatham, P. and Houghton, L., (2011), "The wicked problem of humanitarian logistics and disaster relief aid", *Journal of Humanitarian Logistics and Supply Chain Management*, Vol. 1, No. 1, pp. 15-31
- Tatham, P.J. and Pettit, S. (2010), "Transforming humanitarian logistics: the journey to supply network management", *International Journal of Physical Distribution and Logistics Management*, Vol. 40, No. 8/9, pp. 609-622.
- VanScoy, A. and Evenstad, S.B. (2015), "Interpretative phenomenological analysis for LIS research", *Records Management Journal*, Vol. 71, No. 2, pp. 338-57.
- Villena, V.H., Revilla, E. and Choi, T.Y. (2011), "The dark side of buyer-supplier relationships: a social capital perspective", *Journal of Operations Management*, Vol. 29, No. 6, pp. 561-576.
- Vivaldini, M., Pires, S.R.I. and de Souza, F.B. (2008), "Collaboration and Competition between 4PL and 3PL: A study of a fast-food supply chain", *Journal of Operations and Supply Chain Management*, Vol. 1, No. 2, pp. 17-29.
- World Food Programme (2012), "Joint Evaluation of the Global Logistics Cluster" [Online], Available at: [http://documents.wfp.org/stellent/groups/public/documents/reports/wfp251775.pdf?\\_ga=2.257324492.675018675.1513431775-399356469.1488209227](http://documents.wfp.org/stellent/groups/public/documents/reports/wfp251775.pdf?_ga=2.257324492.675018675.1513431775-399356469.1488209227) (Accessed on 1 May 2017).
- Worley, C. G. and Jules, C., (2020), "COVID-19's Uncomfortable Revelations About Agile and Sustainable Organizations in a VUCA World", *The Journal of Applied Behavioral Science*, Vol. 56, No. 3, pp. 279-283
- Wong, C.Y. and Karia, N. (2010), "Explaining the competitive advantage of logistics service providers: a resource-based view approach", *International Journal of Production Economics*, Vol. 128, No. 1, pp. 51-67.
- Yin, R. K. (2014), *Case study research: design and methods*. 5th edition. Thousand Oaks: Sage Publications, Inc.
- Zacharia, Z., Sanders, G.N.R. and Nix, N.W. (2011), "The emerging role of the third-party logistics provider (3PL) as an orchestrator", *Journal of Business Logistics*, Vol. 32, No. 1, pp. 40-54.