

# **COVID-19 and Supply Chain Disruption: A Conceptual Review**

## **ABSTRACT**

COVID-19 crisis has created a new set of challenges to which supply chain managers must respond. As demand for home delivery services surge, supply chains have to adapt their supply replenishment processes, their order fulfilment processes and hire new employees to be trained in the specifics of order picking and home delivery. The COVID-19 pandemic has emerged as a significant health risk, and countries around the world have responded with partial shutdowns of their economies to slow the pace of infections. These measures have reportedly led to massive disruptions in the global and domestic supply chains. The findings in extant literature show that supply chains during COVID-19 are more fragile for products that travel long distances before reaching their final point of sale. Our work highlights how online data can be used in conjunction with other data-sets for real-time policymaking. This paper conceptually examines the impact of COVID-19 on supply chain disruption and response strategies adopted.

**Keywords: Supply Chain Disruption, COVID-19 Pandemic**

## **INTRODUCTION**

Supply chain disruptions can occur owing to human-made disasters and natural calamities. Globally, several instances occurred in the past such as the Gujarat earthquake (2001), the tsunami in Japan (2011), the Indian Ocean earthquake, and tsunami (2004) (Gou and Lam 2019). Similarly, outbreak of the highly infectious, Corona Virus Disease 2019 (COVID-19) has brought a global tragedy not only for human lives, but also economic activities like manufacturing operations, supply chain and logistics, and several other sectors (Dolgui, Ivanov, and Sokolov 2020; Golan, Jernegan, and Linkov 2020; Haren and Simchi-Levi 2020; Hobbs 2020). COVID-19 pandemic has severely impacted the automotive sector, tourism industry, aviation industry, oil industry, construction industry, telecom sector, food industry, and healthcare industry (Chamola, Rajnik, Cuomo, Dulebohn & Di Napoli, 2020). Initial cases were reported in December 2019 and viewed as symptoms of pneumonia in the Wet Markets of Wuhan City in Hubei Province, China (Rothan and Byrareddy 2020), and later named as COVID-19.

The spread of COVID-19 and large-scale travel restrictions continue to wreak havoc on the global economy. Loss of lives due to any pandemic causes definite irretrievable damage to the society, apart from this, COVID-19 has severely demobilized the global economy. To restrict further transmission of the disease in the community, many of the affected countries have decided to undergo complete lockdown. Major international flights and also all types of business transports have been deferred in different countries. Due to lockdown all domestic flights, railway services (except goods trains), bus, truck, and vehicle transports are suspended with special exemption to those associated with essential commodities. In almost all the COVID-19 stricken countries, entire educational, commercial, sporting, and spiritual institutions are closed. Industries are suffering a lot as many of these, except those related to essential amenities, are closed for a long time in many countries. People belonging to the tourism and transportation industry are also facing utmost difficulties. Production level has

gone very low. The economy of many so-called powerful countries is now facing the threat of high inflation and increasing unemployment as a result of lack of productivity and excessive expenditure for the treatment and rehabilitation of the COVID-19 victims and their families (OECD Interim Economic Assessment, 2 March 2020).

The focus of the governments of various countries is to stop and control the community transmission of COVID-19 such that severe damage can be restrained, but a dynamic transmission of corona virus infection makes it an arduous task. The unavailability of clinical cure and delay in developing the vaccine further makes the situation worse than it has ever been. Meanwhile, the treatment is symptomatic, and oxygen therapy represents the primary treatment intervention for patients having a severe infection. Mechanical ventilation may be necessary in cases of respiratory failure to provide oxygen therapy, and similarly, hemodynamic support is essential for managing septic shock (Cascella *et al.*, 2020)

As the world manages to contain the Covid-19 outbreak, various countries and various firms are focusing on treating those infected, firms are protecting their employees and collectively attempting to develop vaccines, medication, and effective care mechanisms to reduce the global health impact. As the situation evolves, it is clear that economic, social, and emotional costs will be huge which will create norms and trends for “new normal”. For many countries and many firms, the inability to respond to the Covid-19 outbreak lies in its supply chain transportation of goods whether it is masks or ventilators or grocery items or even services (e.g., visiting clinic) (Ranney, Griffeth and Jha 2020).

## **LITERATURE REVIEW**

## **COVID-19 Pandemic**

The Corona Virus (COVID-19) outbreak, which originated in China, has infected millions of people all over the world. Its spread has left businesses around the world counting costs. The virus is posing a growing threat to the economy of many nations as the pandemic is moving from travel restriction of individuals to that of business organizations (Davidson, 2020). That extends the pandemic's reach into nearly every corner of commerce as many consumers avoid large gatherings of people in commercial places and beyond. The outbreak of the new corona virus infection, COVID-19 was initiated from the Huanan seafood market in Wuhan city of China in December 2019, and within a couple of months it has turned out to be a global health emergency. Live animals like bat, frog, snake, bird, marmot, and rabbit are frequently sold at the Hunan seafood market (Wang, Horby, Hayden & Gao, 2020b). Genomic analysis revealed that COVID-19 is phylogenetically related to Severe Acute Respiratory Syndrome-like (SARS-like) bat viruses, bats could therefore be the possible primary source. Although the intermediate source of origin and transfer to humans is not known, the rapid human to human spreading capability of this virus has been established. As per the latest update of WHO on 1st July 2020, the outbreak of COVID-19 had spread in more than 200 countries. Approximately 519,953 people had died after contracting the respiratory virus out of nearly 10,848,916 confirmed cases, whereas more than 6,066,672 people have recovered from the disease. These numbers are rapidly changing upwards (website at <https://www.who.int/emergencies/diseases/novel-coronavirus-2019>).

Corona viruses may be carried among animals however this type of virus does not spread among humans, although with an exception to the SARS and Middle East Respiratory Syndrome (MERS) which usually spread through close contact with infected people. This is evident in the later discovery of cases among medical staffs with no linkage with the seafood

market thus an indication that there is a human to human transmission of the virus (Liu, Hu, Kang, Lin, Zhong & Xiao, 2020).

Authorities of countries of the world resorted to lockdown strategy to prevent the spread of this virus. This is because of the routes for transmitting the COVID-19 that is, droplet transmission, contact transmission, and aerosol transmission. These modes of transmission make the spread of the virus wild and the situation that accompanies it a pandemic. The transmission through droplets occurs when someone infected with the virus coughs or sneezes and a non-infected person in a close environment inhales it. The transmission through contact is when an infected person touches a surface that is touched by a non-infected person or the infected person comes in contact with a non-infected person who ends up touching his or her mouth or nose. Aerosol transmission is when respiratory droplets mix with air is inhaled into the lungs of a non-infected person usually in a closed environment (National Health Commission of People's Republic of China, 2020).

### **COVID-19 Lockdown Impact**

Lockdown gives rise to a shortage of labour force and logistics disruptions eventually resulted in supply-side shocks to the food supply chain. Moreover, it brings a sudden surge in the demand-side of food supply chains due to the panic buying and hoarding behaviour of the people (Hobbs, 2020). Lockdown resembles an essential decision in the short run to slow down the growth of infection and restrict in a local transmission rather than community spread. Besides it, lockdown severely crippled the economy and carries the world at a screeching halt scenario.

All sectors are connected through a complex network of supply chains and logistics, but hardly any activities evidenced during the COVID-19 pandemic. Throughout the world, economic activities reached the lowest point, and an economic recession and global financial

crisis have been predicted by the World Economic Forum (WEF), World Bank, and International Monetary Fund (Lucchese and Pianta, 2020). Haren and Simchi-Levi (2020) noticed a high impact of the COVID-19 outbreak on supply chain and manufacturing operations and predicts the consequences of the global supply chain during the second quarter of 2020. It brings forth the need for a resilient supply chain and to seek innovative approaches for supply chain recovery (Remko, 2020). The logistics system is critical in managing disruptions and recovery of the supply chain (Choi, 2020). During the pandemic, the essential items include food and medical equipment calling for resilient food and healthcare supply chain. Weaknesses of the current global supply chain have been exposed resulting in revenue loss, demand and supply unfulfilment in COVID-19 (Linton and Vakil 2020). The situation is a learning lesson for the adoption of resilience and robustness in the supply chain to help a shrinking economy (Dolgui, Ivanov, and Sokolov, 2020). In this regard, a detailed analysis of the ongoing crisis as well as necessary measures needs to be highlighted.

Stringent lockdowns or a protracted epidemic can affect food supply in many ways. First, it can directly impact the transportation of food products. Second, it can impact the availability of packaged goods from food-processing industries as manufacturing activity slows down due to social distancing guidelines and labour shortages. Third, it can reduce future agricultural production by reducing current incomes. These issues are more salient in a developing country context where food supply chains are long and fragile (Reardon *et al.*, 2020; Aggarwal, 2018), and millions live under poverty.

### **Healthcare Supply Chain and COVID-19**

Key strategies to avoid human to human transmission of COVID-19 infection are via social distancing and the use of masks as well as sanitisers. There has been enormous pressure on healthcare supply chains since the general public requires masks and sanitisers. On the other hand, PPE is required by healthcare staff as well. It caused a shortage of supply of N-95 masks as the companies were unable to meet the ever-increasing demand. Rowan and Laffey (2020) deliberated a critical shortage of supply chain planning for personal and protective equipment (PPE) during the COVID-19 pandemic in the Republic of Ireland. Jamieson and Kellerman (2016) studied the challenges of the public health system for the HIV Pandemic in the global and local supply chain. The global shortage of ventilators and PPEs has become a flourishing concern as there is an increase in infections across the world. In India, the monopoly of a single government-owned agency is the bottleneck in the purchasing process for PPE. Initiatives need to be bolstered by developing efficient transportation for medical equipment, medicines, and relief material. Furthermore, WHO has recommended strategies to optimise the availability of PPEs by using them appropriately, better supply chain coordination, and minimise the waste (WHO 2020b).

### **Food supply chain and COVID-19**

All types of food supply chains have been severely affected during the COVID-19 pandemic, for example, fresh vegetables, fruits, bakery items, perishable goods, and finally, food grains (Ivanov and Dolgui 2020a). The scarcity of food items is unavoidable in such a strict lockdown where most of the logistics activities had been stopped. Previously, Manning, Baines, and Chadd (2005) addressed the impact of biological infections in the food supply chain on a regional basis, national and international food contamination problems as food terrorism.

Although the COVID-19 pandemic is seen first and foremost as a health crisis, it is also a food crisis. In the USA, the food supply system has evolved over decades from being locally and regionally based, to becoming a global network of relatively few large multinational companies (Roth *et al.*, 2008). Although research has addressed environmental and social sustainability within the food supply chain, the underlying focus of cost performance has predominated (Pullman *et al.*, 2009) with an emphasis on efficiency, predictability, and tight control of inventories (Charles, 2020). The magnitude of the COVID-19 crisis exposes the fragility of the entire food supply system, providing a rare opportunity for researchers to explore this system and its underlying dynamics in real-time.

COVID-19 has brought the food supply chain into the public arena as consumers and supply chain organizations react to the crisis. Consumers have reacted by hoarding products in the face of real and anticipated food shortages (Venuto, 2020). They have dramatically shifted their shopping behaviour to online purchase/delivery options, far outstripping the supply chain's immediate ability to cope (Dunkley, 2020; Smith, 2020). Many consumers are struggling to afford food, given the sudden loss of employment and shifting demand to food pantries (Charles, 2020). Within the supply chain, the sudden shifts in demand and health-related regulations have caused profound disruptions such as farm workers not being available to harvest crops, the collapse of the foodservice/ restaurant sector, and changing working conditions in food processing plants inhibiting productivity (Cagle, 2020; Corkery and Yaffe-Bellany, 2020a; Hall *et al.*, 2020; Yaffe-Bellany and Corkery, 2020).

### **Supply Chain Strategic Response to COVID-19**

Akintokunbo and Adim (2020) posit that today organizations are realizing that their level of innovativeness in supply chains is an integral part of strategic success and long-term survival. Supply chain innovation underpins the achievement of sustainable competitive advantage and



an ability to respond effectively to rapidly changing markets as organizations strive to be innovative despite intense technological uncertainty. Innovativeness is seen as a complex process that handles environmental and technological uncertainty to seek and adopt new processes, ideas, products, and technologies for satisfying customers. This is vital in providing the necessary strategic response to the COVID-19 impact on supply chain disruption.

The crisis response through changed service operations particular attention now turn to changes in the supply chain ecosystem related to a well-being outcome that has suddenly become paramount that of employees' and customers' health and safety. Across the supply chain, significant challenges must be overcome to keep employees at safe distances from each other to minimise disease transmission (Tuzovic and Kabadayi, 2020). While some work occurs in traditional production environments such as meat processing facilities (Parshina-Kottas, Buchanan, Aufrichtig & Corkery, 2020), much food supply chain work also occurs in service operations such as distribution centres or call centres. Organizations have responded with changed work routines, flexible hours, and work locations (work-from-home options), protective barriers between employees, to name a few operational changes.

Retail operational processes, or retail logistics, have moved from a focus on store image, satisfaction, and loyalty intentions (Bouzaabia, van Riel & Semeijn, 2013) to minimising exposure risk, from shifting shelf-restocking to off-hours; managing flow through a retail store in terms of volume of customers at a time and directional movement throughout the stores; tangibilising safety measures through floor markings, in-store signage and sanitation stations throughout the store (Bove and Benoit, 2020); checking out sneeze guards separating employees from customers; contactless payment options. Store operating procedures such as opening hours and dedicated shopping hours for vulnerable consumers have also been

enacted to protect both employees and consumers (Dietrick, Trischler, Schuster & Rundle-Thiele, 2017).

Technological solutions also allow shoppers to shop online but pick-up their pre-packed orders with minimal contact (either in designated locker locations or at kerbside), with concomitant changes in workers' responsibilities and customers' engagement in the food shopping experience. Shoppers' behaviours have also changed with mask-wearing, contactless payment procedures, or store navigation behaviours. Both shoppers and store employees are taking on co-creation responsibilities to protect their health during the shopping experience (Vargo and Lusch, 2008).

With the growth of e-commerce, home delivery logistics services have grown rapidly in the past decade (Jara *et al.*, 2018). Food retailers have been developing an online presence with home deliveries for years (Heim and Sinah, 2001) but with the COVID-19 crisis have been suddenly hit with a level of demand that has proved difficult to fulfil (Bhattarai, 2020). Scholars have been documenting the customers' expectations of last-mile logistics services since the early days of e-commerce (Esper, Jensen, Turnipseed & Burton, 2003) as well as operational service challenges that increasingly include managing crowd sourced delivery services (Castillo, Bell, Rose & Rodrigues, 2018).

The COVID-19 crisis has created a new set of challenges to which supply chain managers must respond. As demand for home delivery services has surged, supply chain organizations have had to adapt their supply replenishment processes, their order fulfilment processes and hire new employees to be trained in the specifics of order picking and home delivery (Dodds, 2020). While retailers have faced the majority of this demand, other supply chain organizations that are traditionally further upstream, such as wholesalers or even farmers, are also now providing home delivery service provision (Criddle, 2020; Rao, 2020). Some

retailers have adapted quickly to the increased demand and have innovated new operational approaches to serve customers through the development of “dark-warehouses”, which are essential distribution centres with retail store layouts catering solely to online customers with no physical customers present (Broughton, 2020).

Employees’ and consumers’ safety and health issues have become important elements of the last-mile service provision. Customer service expectations now include the desire to stay safe and healthy during the shopping experience (Esper, 2020). Thus, contactless delivery becomes an important service attribute in addition to traditional measures of timeliness and order accuracy (Wolfe, 2020). Work environments that foster healthier and more protective situations for both employees and customers will need to be incorporated into measures systems that have focused on traditional measures of order fulfilment efficiency and quality.

## **CONCLUSION**

The findings in extant literature show that supply chains during COVID-19 are more fragile for products that travel long distances before reaching their final point of sale. Our work highlights how online data can be used in conjunction with other data-sets for real-time policymaking.

## **REFERENCES**

- Akintokunbo, O.O. & Adim, C.V. (2020). Supply chain innovation and marketing performance: A review of literature. *International Journal of Business & Entrepreneurship Research*, 13 (1), 42-52.
- Bhattarai, A. (2020). Grocery delivery was supposed to be the ultimate pandemic lifeline. But it’s falling short. The Washington Post, 16 April 2020, available at: <https://www.washingtonpost.com/business/2020/04/15/grocery-delivery-corona-virus/> (accessed 17 April 2020).
- Bouzaabia, O., van Riel, A.C.R. & Semeijn, J. (2013). Managing in-store logistics: a fresh perspective on retail service. *Journal of Service Management*, 24(2), 112-129.

- Bove, L. & Benoit, S. (2020). Restrict, clean and protect: signalling consumer safety during the pandemic and beyond. *Journal of Service Management*, forthcoming, doi: 10.1108/JOSM-05-2020-0157.
- Broughton, C. (2020). Countdown supermarket converted to online store to cater for rise in orders. *Stuff.co.nz*, 7 April, available at: <https://www.stuff.co.nz/the-press/business/120865578/countdown-supermarket-converted-to-online-store-to-cater-for-rise-in-orders> (accessed 7 April 2020).
- Cascella, M., Rajnik, M., Cuomo, A., Dulebohn, S. C. & Di Napoli, R. (2020). Features, evaluation and treatment corona virus (COVID-19) StatPearls (Internet): StatPearls Publishing.
- Castillo, V.E., Bell, J.E., Rose, W.J. & Rodrigues, A.M. (2018). Crowd sourcing last mile delivery: strategic implications and future research directions. *Journal of Business Logistics*, 39(1), 7-25.
- Choi, T. (2020). Innovative ‘bring-service-near-your home’ operations under corona-virus (COVID-19/SARSCoV-2) the Outbreak: Can logistics become the messiah? transportation research part. *E: Logistics and Transportation Review*, 101961. doi:10.1016/j.tre.2020.101961.
- Criddle, C. (2020). Food wholesalers offer online orders to sell stock. Available at: <https://www.bbc.com/news/technology-52066764> (accessed 13 2020).
- Dietrich, T., Trischler, J., Schuster, L. & Rundle-Thiele, S. (2017). Co-designing services with vulnerable consumers. *Journal of Service Theory and Practice*, 27 (3), 663-688.
- Dodds, L. (2020). Amazon hires another 75,000 staff to cope with Covid-19 demand”, *The Telegraph*, 13 April 2020, available at: <https://www.telegraph.co.uk/technology/2020/04/13/amazon-hiresanother-75000-staff-cope-covid-19-demand/> (accessed 12 June 2020).
- Dolgui, A., Dmitry, I., Potryasaev, S., Sokolov, B., Ivanova, M. & Werner, F. (2020). Block chain-oriented dynamic modelling of smart contract design and execution in supply chain. *International Journal of Production Research*, 58 (7), 2184–2199.
- Dunkley, D. (2020). Cashierless stores and online deliveries are the future of supermarket shopping”, *Stuff.co.nz*, 30 March 2020, available at: <https://www.stuff.co.nz/business/better-business/120587848/cashierless-stores-and-online-deliveries-are-the-future-of-supermarket-shopping?r%20%80%A6> (accessed 7 April 2020).
- Esper, T.L. (2020). Supply chain management amid the corona virus pandemic. *Journal of Public Policy and Marketing*, published online May 28, 2020 available at:

<https://www.ama.org/theCOVID-19-pandemic-through-the-lens-of-marketing-and-public-policy/>, doi: 10.1177/ 0743915620932150.

- Esper, T.L., Jensen, T.D., Turnipseed, F.L. & Burton, S. (2003). The last mile: an examination of effects of online retail delivery strategies on consumers. *Journal of Business Logistics*, 24(2), 177-203.
- Gou, X. & Jasmine, S.L.L. (2019). Risk Analysis of Marine Cargoes and Major Port Disruptions. *Maritime Economics & Logistics*, 21, 497–523.
- Haren, P. & Simchi-Levi, D. (2020). How Corona virus Could Impact the Global Supply Chain by Mid March. *Harvard Business Review*, February 28. <https://hbr.org/2020/02/how-corona-virus-could-impact-the-global-supply-chain-by-mid-march>.
- Heim, G., R. & Kingshuk, K.S. (2001). Operational drivers of customer loyalty in electronic retailing: an empirical analysis of electronic food retailers. *Manufacturing and Service Operations Management*, 3(3), 264-271.
- Hobbs, J. E. (2020). Food Supply Chains During The COVID-19 Pandemic. *Canadian Journal of Agricultural Economics/Revue Canadienne D'agroeconomie*. doi:10.1111/ cjag.12237.
- Ivanov, D. & Dolgui, A. (2020a). A Digital Supply Chain Twin for Managing Disruption Risks and Resilience in the era of Industry 4.0. *Production Planning & Control*. doi:10.1080/09537287.2020.1768450
- Jamieson, D. & Kellerman, S.E. (2016). The 90 90 90 Strategy to End the HIV Pandemic by 2030: Can Supply Chain Handle It? *Journal of the International AIDS Society*, 19 (1), 20917.
- Jara, M., Vyt, D., Mevel, O., Morvan, T. & Morvan, N. (2018). Measuring customers benefits of click and collect. *Journal of Services Marketing*, 32(4), 430-442.
- Linton, T. & Vakil, B. (2020). Corona virus Is Proving We Need More Resilient Supply Chains.” *Harvard Business Review*, March 5. <https://hbr.org/2020/03/coronavirus-isproving-that-we-need-more-resilient-supply-chains>.
- Liu, T., Hu, J., Kang, M., Lin, L., Zhong, H. & Xiao, J. (2020). Transmission dynamics of 2019 novel corona virus (2019-nCoV). 2020; doi: <https://doi.org/10.1101/2020.01.25.919787>. Retrieved: 3/07/2020
- Lucchese, M. & Pianta, M. ( 2020). The Coming Corona virus Crisis: What Can We Learn? *Intereconomics*, 55 (2), 98–104.
- Manning, L., R.N. B. & Chadd, S. A. (2005). Deliberate Contamination of the food supply chain. *British Food Journal*, 107 (4): 225–245.

Narayanan, Latha, Mansi Pandit, Subhro Basu, Arijeet Karmakar, Vanshika Bidhan, Hrithik Kumar, and Kousheen Brar. 2020. Impact of Lockdown Due to COVID-19 the Outbreak: Lifestyle Changes and Public Health Concerns in India. Preprints, 2020060129. doi:10.20944/preprints 202006.0129.v1.

OECD Interim Economic Assessment, 2020

Parshina-Kottas, Y., Buchanan, L., Aufrichtig, A. & Corkery, M. (2020). Take a look at how COVID19 is changing meatpacking plants”, New York Times, June 8, 2020, available at: <https://www.nytimes.com/interactive/2020/06/08/us/meat-processing-plants-corona-virus.html?smid5fbnytimes&smtyp5cur> (accessed 10 June 2020).

Pullman, M.E., Maloni, M.J. & Carter, C.R. (2009). Food for thought: Social versus environmental sustainability practices and performance outcomes. *Journal of Supply Chain Management*, 45(4), 38-54.

Ranney, M. L., Valerie G. & Jha, A. K. (2020). Critical supply shortages—the need for ventilators and personal protective equipment during the Covid-19 pandemic. *New England Journal of Medicine*, 382: e41.

Rao, T. (2020). As supermarkets feel hazardous and sparse, small farms deliver”, New York Times, 3 April 2020, available at: <https://www.nytimes.com/2020/04/03/dining/csa-farm-food-deliverycoronavirus.html?referringSource5articleShare> (accessed 5 April 2020).

Roth, A., Tsay, A.A., Pullman, M.E. & Gray, J.V. (2008). Unravelling the food supply chain: strategic Insights from China and the 2007 recalls. *Journal of Supply Chain Management*, 44(1), 22-39.

Rothan, H. A. & Siddappa, N. B. (2020). The epidemiology and pathogenesis of corona virus disease (COVID-19) Outbreak. *Journal of Autoimmunity* 109: 102433.

Rowan, N.J. & Laffey, J.G. (2020). Challenges and Solutions for Addressing Critical Shortage of Supply Chain for Personal and Protective Equipment (PPE) Arising from Corona virus Disease (COVID19) Pandemic – Case Study from the Republic of Ireland. *Science of The Total Environment* 725: 138532. doi:10.1016/j.scitotenv.2020.138532.

Smith, J. (2020). Warehouse hiring surge defies crashing U.S. jobs market”, Wall Street Journal, 3 April 2020, available at: <https://www.wsj.com/articles/warehouse-hiring-surge-defiescrashing-u-s-jobs-market-11585939391> (accessed 7 April 2020).

Tuzovic, S. & Kabadayi, S. (2020). The influence of social distancing on employee wellbeing: a conceptual framework and research agenda. *Journal of Service Management*, forthcoming, doi: 10.1108/JOSM-05-2020-0140.

- Vargo, S. & Lusch, R. (2008). Service-dominant logic: Continuing the evolution. *Journal of the Academy of Marketing Science*, 36(1), 1-10.
- Venuto, D. (2020). COVID-19 corona virus lockdown: your panic buying is putting other kiwis at risk”, *The New Zealand Herald*, 23 March 2020, available at: [https://www.nzherald.co.nz/business/news/article.cfm?c\\_id53&objectid512319171](https://www.nzherald.co.nz/business/news/article.cfm?c_id53&objectid512319171) (accessed 24 April 2020).
- Wang, C., Horby, P.W., Hayden, F.G. & Gao, G.F. (2020b). A novel corona virus outbreak of global health concern. *Lancet*, 395(10223), 470–473.
- Wolfe & Brain (2020). What do consumers want from stores in the Covid-19 era? Safety, convenience and a sense of community”, available at: <https://www.mytotalretail.com/article/what-do-consumers-want-from-stores-in-the-covid-19-era-safety-convenience-and-a-sense-ofcommunity/> (accessed 12 June 2020).