Accelerating retail supply chain performance against pandemic disruption: Adopting resilient strategies to mitigate the long-term effects

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Purpose: COVID-19 has disrupted global supply chains, revealing dreadful gaps and exposing vulnerabilities. Retailers are challenged to tackle risks and organise themselves to fit into the 'new normal' scenario. This global outbreak has established a volatile environment for supply chains; it has raised the question of survival in the market, forcing organisations to rethink resilient strategies to be adopted for the post pandemic situation to mitigate the long-term effects of this virus. This study explores the priorities for Retail Supply Chains (RSCs) to align their business operations and strategies for the post pandemic world.

Design/methodology/approach: This study has utilised integrated Full Consistency Model (FUCOM) – Best Worst Method (BWM) methods for assessment of RSCs to enhance their business performance irrespective of pandemic disruptions. The FUCOM has been employed to identify the priorities of determinants enhancing business performance, whereas RSC strategies are evaluated using the BWM method.

Finding: The current study identifies 'Collaboration Efficiency' as the main criterion for accelerating the performance of RSCs in a dynamic social environment. Also, the study concludes that 'Order Fulfilment' and 'Digital RSCs' are the most appropriate resilient business strategies to mitigate the long-term effects.

Research limitations/implications: Supply-demand balancing is a challenging task at the moment, but highly significant for the future. The pandemic disruptions have placed intense pressure on retailers to deliver products as per consumers' changing behaviours towards the purchase of essentials and other products. Hence, 'Order Fulfilment' and 'Digitisation" strategies should be adopted for meeting customer requirements and to ensure sustainability in the post pandemic business world.

Originality/value: This work sets out a comprehensive framework which will be helpful for accelerating RSCs performance against pandemic disruption by adopting resilient strategies to mitigate the long-term effects.

Keywords*: COVID-19; Dynamic social environment; Digitisation; Resilient retail supply chains; Pandemic disruption; Performance; Mitigating risk.

1. **Introduction**

The COVID-19 crisis has caused huge disruption, affecting global supply chains resulting in a dearth of accessibility to markets, materials; most significantly, staff have suffered physically, socially and financially. Since February 2020, world trade has been badly affected (WTO, 2020). New regulations, changing consumer preferences and restricted working have forced stakeholders to manage their Supply Chains (SCs) more effectively (Cohen, 2020). The pandemic has short and long-term effects on Retail Supply Chains (RSCs); organisations therefore need to find ways to survive and function in this situation irrespective of the increasing rate of coronavirus spread. The pandemic has shown that global enterprises were not prepared for such an event and did not have any planning for recovery in this situation (Sarkis et al., 2020). Inadequate SCs with high numbers of intermediaries and lack of information management have been the major issues contributing to the failure to cope with the pandemic disruption (Sharma et al., 2020). In the highly disrupted environment, RSCs need to have dynamic and resilient strategies to tackle the impact of coronavirus outbreaks. Retailers have to enhance their performance to overcome financial losses and focus on readiness for the post pandemic situation. This will be achieved by collaborative working among the RSC partners. Due to the global pandemic, RSC cash flows are badly disrupted and need immediate supply-demand balancing. Thus, to enhance current business performance and achieve sustainability in the post-pandemic environment, enterprises need to build resilient RSCs through their operational and information management capabilities to follow consumer trends and technological advancements at a faster rate. Effective collaboration will reduce cost and enhance efficiency of the business (Dahlmann and Roehrich, 2019; Roggeveen and Sethuraman, 2020). Existing literature has shown that enterprises have implemented several strategies for managing disruptions such as stockpiling, diversification, crediting back up suppliers, emergency sourcing, buffer inventory, reserve capacity, flexibility and collaborative strategies (Chowdhury et al., 2020). All these strategies make SCs of the enterprises resilient, but COVID-19 is a unique type of disruption that has changed consumer living conditions and their preferences radically. Disruption is not only limited to consumers, it has changed the entire SC sourcing, procuring, manufacturing and delivering systems. Thus, enterprises need to implement various strategies that should appropriately fulfil the needs and wants of stakeholders during the pandemic and prepare them for post pandemic conditions. The fluctuating demand and supply practices need to be strengthened with advanced digital technologies, information management and data analytics during and post COVID-19 for appropriate decision-making (Cao and Duan, 2017; Lohmer

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and Lasch, 2020). The COVID-19 situation is an indication of a new world where everyday business includes a shift to e-commerce, contact lease delivery, click and collect systems and order fulfilment on time. The adoption of business strategies such as optimisation, digitisation, order-fulfilment, diversification, omni-channel marketing etc. in a dynamic environment will definitely help organisations to develop resilient supply chains for the 'new normal' situation. The organisations are adopting reactive strategies to survive and sustain during this pandemic but this will not work in the long term. A successful company will have to redesign its SC structure, network and dependencies to become proactive for the uncertain and unpredictable future to be faced.

The retail sector contribution to GDP is 10% with a 8% contribution to overall employment. The market size of retail is USD 950 billion (2018-2019) and stands fifth largest in the global market. The retail industry in India is no exception. The pandemic disruption has decimated the retail industry; since late April, the retail trade has fallen to 15 percent. SCs involved in the sale of essential goods are also bearing losses as they are not able to sell other merchandise (Roggeveen and Sethuraman, 2020). The major segments contributing to GDP are household and personal care (50%), healthcare (31%) and food beverages (19%). Moreover, there is an upsurge in the demand in each of the major segments of the market as an outcome of coronavirus outbreaks. The effect of this pandemic is visible on all industries including retail, IT, durables and others (Mckinsey, 2020). The pandemic effect can be clearly seen in the declining GDP of India, the lowest in the last six years (KPMG, 2020). The key contributors to the country's GDP *viz*., private consumption, investment and external trade have been badly affected (MoSPI, 2020).

The pressure of managing business operations has been intensified due to the changing consumption patterns of customers in the dynamic environment. An increase in online sales of essential goods is disrupting the demand-supply a function of RSCs. COVID-19 has challenged the managers of RSCs to learn and act decisively during this situation. New business strategies need to be implemented as per the volatile social and economic environments. There is no control on the pandemic right now and, if all these issues remain unresolved, RSCs may face business failure post COVID-19 due to a lack of resilient business strategies. It is important to understand in which direction RSCs should evolve and what can be the possible solutions that can resolve these issues and may facilitate RSCs to deal with the pandemic.

The answer to these questions lies in the research objectives of this study. Firstly, determinants are explored that may enhance the performance of RSCs irrespective of

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pandemic disruptions. An assessment of these determinants will impart insights that can be used during COVID-19 to enhance the efficiency of business operations of RSCs; this may also help with recovery in the post pandemic situation. Secondly, conducting comparative analysis of current business strategies designed for RSCs will help decision-makers to take immediate actions to ensure sustainability throughout COVID-19 and provide insights to become resilient in a 'new normal' situation. Currently, RSCs are assessing the environment, anticipating the demands and endeavouring to satisfy consumers through local suppliers. The business alternatives available to RSCs - demand driven, data-driven systems etc. - are important for enetrprises to become more viable, agile and resilient in future (Adivar et al., 2018; Albors-Garrigos, 2020; Sajjad et al., 2020). The following research objectives need to be addressed.

R1. To identify the most significant determinants that may accelerate the performance of RSCs post COVID-19 to mitigate the long-term effects.

R2. To explore appropriate business strategies for RSC alternatives that may enhance the business performance and develop resilience in the 'new normal' situation.

To understand the determinants and their impact on RSCs, a comprehensive review is conducted. This study has applied an integrated Multi-Criteria Decision Making (MCDM) approach i.e., Full Consistency Model (FUCOM - Best Worst Method (BWM). The integration of FUCOM-BWM in a model provides better results compared to other methods such as AHP, TOPSIS or SWARA (Stevic ́ and Brkovic', 2020). The main benefits of FUCOM and BWM methods are the lesser and consistent pairwise comparisons that can be made (Pamucar et al., 2018; Stevic ́ and Brkovic', 2020). The research contributions are as follows:

- This study provides a critical evaluation of determinants that may accelerate the performance of RSCs during and post pandemic COVID-19 to mitigate the long-term effects.
- The study findings can help organisations to adopt the most appropriate strategies for developing resilient RSCs to survive and sustain in a 'new normal' era.

The paper is organised in 6 sections. Section 2 elaborates the literature on determinants and business strategy alternatives. Section 3 defines the steps of FUCOM and BWM methods to

135 be applied in this research. Section 4 explains the phases of the research framework followed
136 by a discussion of findings and their implications in Section 5. The conclusion of the study,
137 limitations and future directions of research are discussed in Section 6.
138
139   2. **Literature Review**

140 This section throws light on the key determinants of RSCs and the multiple business
141 strategies that may be helpful in developing resilient SCs during and post pandemic. The
142 contributions by the various authors in the area of RSCs and determinants to enhance the
143 efficiency of business operations and overall performance are elaborated in this section. The
144 various determinants that may accelerate the performance of RSCs are identified from
145 existing literature. The "Scopus" and "Web of Science" (WoS) databases were selected for
146 the search process. The keywords "Retail Supply Chains" OR "Supply chain strategies" OR
147 'Business Strategies" OR "Organisation performance" were searched. The type of document
148 "articles" was selected and the years "2010-2020" were chosen for exploration of the
149 literature related to the study. Based on the first search, 82 articles in WoS and 145 articles in
150 Scopus were found. A total of 171 articles were selected after discarding duplicates. Any
151 conference proceedings and papers were excluded from the search. The articles that were not
152 related to the study were deleted, resulting in a final total of 105 articles. After a thorough
153 reading of the abstracts, only 45 papers were finally selected. From the selected papers,
154 determinants of RSCs were identified. The process involved an expert in the field thoroughly
155 reading the description of each determinant and alternative detailed in the questionnaire;
156 these were then evaluated according to their significance in the acceleration of RSC
157 performance during and post COVID-19 (Appendix I-A and I-B).
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160   2.1 *Determinants of Retail Supply Chains for Enhancing Business Performance*

161 With the emergence of multiple channels, the structure of RSCs has transformed from a
162 typical network consisting of supplier, original equipment manufacturers, distributors, retail
163 stores, retailers and end users (Adivar, 2019). Although the focal company is still the retailer,
164 the dominant process is the multiple touch-points for customers. The RSC is dependent on
165 the relationship developed with partners such as suppliers, buyers and customers. RSC
166 performance is based on partnership (Simchi-Levi et al., 2008; Obeng, 2019; Albors-
167 Garrigos, 2020). The partnership may include two or more members mutually contributing to
168 obtain competitive advantage through information management, collaboration or shared

169 benefits (Choudhary, 2014; Brandenburg et al., 2019; Kabuye et al., 2019; Nguyen and

170 Harrison, 2019).

171 The critical factor for building inter-organisational relationships is inter-dependence between

172 the members. When one of the members does not fully control the supply chain, inter-

173 dependence happens (Kamalaldin et al., 2020; Parimi and Chakraborty, 2020). When trust is

174 present in inter-organisational relationships, it facilitates coordination and capabilities (Jap,

175 1999; Pankowska, 2019; Singh et al., 2019; Liu et al., 2020). Successful relationships among

176 RSC members are also maintained by long-term commitments (Li and Jiang, 2019). Prince et

177 al. (2019) and Chen et al. (2019) have revealed that information-sharing is the key

178 requirement for collaborative inter-organisational relationships, concluding that it develops

179 competitiveness in supply chains. Sometimes, benefits are not equally shared among partners.

180 Past studies have suggested that successful collaboration among RSC partners is based on

181 centralisation (Hughes et al., 2019). Close collaboration among RSC partners reduces risk

182 and uncertainty and thus acts as a support in a disruptive environment (Madsen and

183 Petermans, 2020). Collaboration in times of uncertainty enhances the performance of RSCs

184 by reducing a firm's cost, increasing cash flow and mitigating the bullwhip effect in retail

185 chains (Bozic and Kuppelwieser, 2019). The pandemic effect on SCs is visible in their forms,

186 alliances and changes in their organisational size in order to provide relief to affected

187 communities. The available resources and information management in humanitarian relief

188 operations play an important role in the inter-relationships of all RSC partners (Pankowska,

189 2019). But, due to the temporary status of relief operations, visibility becomes a complex

190 issue to be managed (Ivanov et al., 2019). Visibility of resources such as warehouse location

191 and supplies is important for RSCs to provide help to the beneficiaries.

192 Section 3.3 elaborates the details of the experts. The experts merged determinants under six

193 criteria - Collaboration efficiency (C_1); Partnership structure (C_2); Adoption of digital

194 technologies (C_3); Humanitarian relief operations (C_4); Operational and dynamic capabilities

195 (C_5); Information and communication quality (C_6). The final representation is shown in Table

196 1.

197 **Table 1:** Determinants (Criteria) of RSCs for enhancing business performance

Criteria	Business performance Outcomes	References
Collaboration efficiency (C_1) (Collaborative	- Collaboration with suppliers in anticipating the demand to enhance resilience of RSCs that may help with survival in the post pandemic	Holgado de Hollmann et al. (2015); Basso et al. (2019) Deep et al (2019); Panahifar and

Planning, Forecasting and replenishment, Resource sharing, Network resources, Co-creation)	situation. - The resources commonly shared such as data, information, knowledge and plans etc. to enhance the efficiency of each business operation. - External sources provide strategic opportunities to RSCs to take specific actions. - Collaborative innovation brings value added products that may fulfil the needs of customers during difficult times.	Shokouhyar (2019); Ryu et al. (2019); Chtourou Ben Amar and Ben. (2019); Angulo-Baca et al. (2020), Kamalaldin et al. (2020); Parimi, and Chakraborty (2020);); Crick et al. (2020); Deep et al. (2020).
Partnership structure (C_2) (Including Flexibility, Visibility, governance structures)	- The flexible structure of partnership supports traceability and transparency in RSCs. - Product visibility increases supply chain resilience during times of uncertainty. - Helps to enhance flexibility among partners in RSCs. It supports retail organisations to quickly respond to the uncertain environment.	Bstieler and Hemmert (2015); Govindan and Malomfalean (2019); Xu and Jackson (2019); Ivanov et al., (2019); Ampe-N'DA et al (2020); Kamalaldin et al. (2020); Li et al. (2020);
Adoption of Digital Technologies (C_3)	- Artificial Intelligence (AI), IoT etc. provide real time data monitoring that aids in appropriate decision making. - Online order and delivery management accelerates the order fulfilment processes and enhances efficiency. - BDA provides insights for decision making to deal with uncertain conditions. -Saves cost and time.	Liu (2014); Griffith et al. (2019); Chai and Ngai (2020)
Humanitarian relief operations (C_4)	- Emergent stock is held by companies; severe problems to communities will result if stocks run out. - Reducing product complexity and delivering product flexibility results in reducing cost. - More options to make a delivery help retailer to avoid flow	Balcik et al. (2010); Day (2014); Çelik, (2016); L'Hermitte et al. (2016); Ransikarbum and Mason (2016); Kamalaldin et al. (2020)

	disruptions.	
Operational and dynamic capabilities (C5)	- Capabilities develop competitive advantages for retail firms. Re-designing to mitigate risk and disruption. - Developing competitive advantage for RSCs to act as differentiator for the long run.	Frasquet et al. (2013); Gupta (2014); Beske et al. (2014) Liu et al. (2014); Chen et al. (2017), Feizabadi et al. (2019)
Information and Communication quality (C6)	- Internal communication develops better communication capabilities among retailers, suppliers and customers - Exchange of information during negotiation is a key factor in managing retailer and supplier relationships.	Pulles and Hartman (2017); Song et al. (2018); Fuchs et al. (2018)

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199   ## 2.2 *Retail Supply Chain Business Strategies*

200   Due to the complexities of the dynamic environment, RCSs are operating with different

201   strategies to meet the changing requirements of consumers with growing service levels of

202   their expectations. Collaboration, digital technologies, humanitarian logistics operations,

203   partnerships, information sharing and operational capabilities facilitate a better demand and

204   balance supply, consequently reducing cost and buffer stock while generating a higher level

205   of satisfaction for customers (Pereira and Frazzon, 2020). These determinants provide the

206   facility to adopt business strategies such as order fulfilment, digitisation, demand forecasting

207   etc. that is necessary to become resilient in a post pandemic situation. Intense pressure has

208   been placed on retailers engaged in selling essentials to provide value added services during

209   COVID-19. Due to the volatile demand during the pandemic, retailers are shifting from a

210   traditional model to order fulfilment, demand-driven, data driven and omni-channel models

211   for managing RSCs (Choi et al., 2020; Chai and Ngai, 2020; Ishfaq and Bajwa 2019; Naik

212   and Suresh, 2018). Retailers are using outsourcing companies to deliver their products and

213   collaborate with local suppliers to fulfil the demands of consumers during this pandemic

214   (Baharmand et al. (2019). Retail chains such as Big Bazaar Spencer, Grofers and many others

215   are utilising digital and non-digital forms; local retail chains are also trying to develop their

216   reach with both platforms.

217   RSCs are currently focusing on value-added areas to fight COVID-19; examples of this are in

218   optimisation, omni-channel supply chains, handling volatile demand, diversified supply

219 chains, order fulfilment, financial stability and adapting hybrid channels (Mckinsey, 2020).
220 This study analyses current business strategies adopted by retail organisations with hybrid
221 channels to enhance their business performance and achieve sustainability in the future.
222 These strategies need to be compared with each other to identify the most suitable strategy
223 that may help RSCs to develop, face up to the pandemic environment and survive in a 'new
224 normal' market. The detailed business strategies adopted by RSCs are given in Table 2.

225 **Table 2:** Business strategy (alternatives) for enhancing performance of RSCs and developing
226 resilience during and post pandemic

RSCs	Performance outcomes	References
Digitisation strategy (BS_1)	E-commerce retailers are using digital technologies to provide customer services online and handle multiple requests at one time.	Day and Schoemaker (2016); Ivanov et al. (2018)
Omni-channel strategy (BS_2)	Omni-channel supply chains provide one-touch integration across all channels to deliver unified experience.	Mena et al. (2016); Saghiri et al. (2017);
Diversification and offshoring strategy (BS_3)	Retailers are extending the portfolio of services to include core and non-core services. Retailers are outsourcing services by collaborating with external partners.	Liu et al. (2010); Baharmand et al. (2019)
Order fulfilment and optimisation strategy (BS_4)	Retailers are collaborating with local suppliers/partners for order fulfilment.	Holweg and Helo (2014); Rao et al. (2011); Ishfaq and Bajwa (2019)
Inventory control strategy (BS_5)	Essential supplies retailers are facing unprecedented spikes in demand. The ability to anticipate demand has become much more significant. Demand forecasting and inventory control need to be considered to prevent stock-out situations.	Verdouw et al. (2010); Mendes et al. (2016); Chi et al. (2020)
Distribution network strategies (BS_6)	Retailers are extending their distribution networks to meet demands of customers and enhance their survivability.	Hingley et al. (2015); Naik and Suresh, (2018)
Revenue management strategy (BS_7)	Retailers are looking at overall financial stability in the context of different scenarios. Retailers are closely looking at liquidity and working capital	Ivanov et al. (2010); Selviaridis and Norrman (2014); Martin and Hofmann, (2019)
Customer relationship management (CRM) strategy (BS_8)	Retailers are finding ways to build and maintain trust among consumers.	Sukati et al (2012); Li et al. (2019)

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Dynamic pricing strategy (BS$_9$)	Due to limited supply, there is an increase in list pricing by CPC companies. Continuous evaluation of demand and supply data, coupled with sentiment analysis can help in effective pricing.	Jamali and Rasti-Barzoki (2018); Li et al. (2019)

227

228 While RSCs continuously work to increase their productivity, profits, develop competitive
229 advantages, build customer relations and fulfil orders, the dynamic environment involving
230 various factors decides the overall priorities of retail firms (Youn et al., 2017). Table 2
231 elaborates on different types of business strategies of RSCs that currently exist in literature.
232 But during COVID-19, those RSCs that will be more effective and suitable still need to be
233 identified and assessed.

234

235 2.3 *Research Gaps*

236 Researchers have discussed retailer-centric and supply chain issues, challenges, capabilities
237 and the role of determinants such as information sharing (Gandhi, 2016; Sener et al., 2019;
238 Cragg and McNamara (2018); Collaboration (Panahifar et al., 2019); partnership structures
239 (Ampe-N'DA et al., 2020; Sorkun et al., 2020), performance measurement (Iqbal et al.,
240 2019;Álvarez-Rodríguez et al., 2020a), efficiency (Ekinci and Baykasoğlu, 2019; Álvarez-
241 Rodríguez et al., 2020b), logistics (Abushaikha et al., 2020), managing risk (Wang et al.,
242 2020), coordination (Wankmüller and Reiner, 2020), corporate responsibility and sustainable
243 SCs (Carbone et al., 2012; Fantazy and Tipu, 2019). Researchers have also assessed RSCs
244 and identified the factors responsible for their success. The different types of RSCs discussed
245 previously are omni-channel RSCs (Saghiri et al., 2017), optimisation RSCs (Fares and
246 Lebbar, 2019), order fulfilment and delivery RSCs (Hübner et al., 2016; Sillanpää and Liesiö,
247 2018; Peinkofer et al., 2019). The digital advancement affecting RSCs has also been analysed
248 by a few researchers, looking at its adaptability to the dynamic environment (Gustafsson et
249 al., 2019; Iftikhar and khan, 2020). The unpredicted demand and forecasting in the changing
250 environment is also significant for RSCs i.e. demand driven RSCs (Hofmann and
251 Rutschmann, 2018; Sandberg and Jafari, 2018), dynamic business modelling for
252 sustainability (Ansari and Kant 2017; Cosenz et al., 2020), reverse supply chains (Frei et al.,
253 2020).

254 Table 3: Main contributions

Author(s)	Objective of the study	Key determinant(s)	Industry
Sener et al. (2019)	Measuring the role of	Information usage	Food Retail

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	information usage between information sharing and operational efficiency		organisations
Kamalaldin et al. (2020)	Examining customer relationships engaged in digital servitization	Collaboration; Partnership; Servitizaions; Digitization	Retail Organisations
Parimi, and Chakraborty (2020)	To find a link between green SCM and co-creation	Co-creation and Sustainability	Manufacturing organisations
Sorkun et al. (2020);	Revealing a relationship between omni-channel capability and customer satisfaction	Omni-channel capability, flexibility	Online and physical organisations;
Saghiri et al. (2017)	To develop a three-dimensional framework for omni-channel	Omni-channel strategy	Retail supply chains
Álvarez-Rodríguez et al. (2020)	Evaluation of the operational performance of RSCs	Sustainability-oriented efficiency and Sustainability benchmarking	Retail supply chains
Abushaikha et al. (2020)	Role of logistics in RSCs performance	Coordination in logistics, Supply chain resiliency, flexibility and knowledge creation	Retail logistics organisations
Wang et al. (2020)	Developing a framework for managing supply chain uncertainty and risk.	Integrtation in supply chain, Supply chain risk management	Pharmaceutical organisations
Fares and Lebbar (2019)	Analysis of the value chains and identifying solutions to improve their productivity and profit.	Optimization	Fashion Retail organisations
Ishfaq and Bajwa	Assessing the impact	Order fulfilment; e-	Multi channel

(2019)	of online order fulfilment	commerce	retail supply chains
Hübner et al., (2016);	Building an effective and efficient omni-channel (OC) distribution system	Order fulfilment and delivery	Retail supply chains
Peinkofer et al. (2019)	Current understanding of the nuances of drop-shipping operations	Order fulfilment	Supply chains
Sillanpää and Liesiö, (2018)	Modeling consumer demand with distributions	replenishment order forecasts	Retail organisations
Gustafsson et al. (2019)	Exploring Digital technologies adaptation in a dynamic environment	Demand forecasting; supply chain performance; Data analytics; technological investment; Accuracy in forecasting	Retail supply chains
Hofmann and Rutschmann, (2018)	Measuring the role of data analytics and information management	Data analytics; Information management	Retail supply chains
Sandberg and Jafari (2018)	Review of existing research on retail supply chain responsiveness	Retail supply chain responsiveness	Retail supply chains
Cosenz et al. (2020)	A conceptual framework for business modeling for sustainable business model	Dynamic business modeling for sustainability; economic, social and environmental drivers for sustainable development	Retail supply chains

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256 The contributions shown in Table 3 has addressed the determinants independently but a

257 comprehensive study on the determinants that affect the performance of the retail

258 organisations during and post COVID and their SCs is still missing; this can help managers in

259 industry to mitigate the long-term effects. Some researchers have measured the performance

260 of RSCs but during COVID-19, how these RSCs are changing their functions and surviving

261 modes to beat the pandemic disruption need to be analysed. The strategy that may be most
262 suitable in a pandemic is explored in this study. Therefore, this study aims to bridge this gap
263 and analyse the determinants for RSCs to showcase new insights to deal with COVID-19.
264

265 ### 3. **Research Methodology**

266 The study has employed integrated FUCOM-BWM methods. The FUCOM method is
267 employed to find out the weights of determinants of RSCs to enhance business performance
268 whereas a BWM method is employed to select the most appropriate business strategy for
269 RSCs to become resilient during and post pandemic.

270 For assessment of a range of factors, Analytic Hierarchy Process (AHP) has been widely
271 used, but after the introduction of BWM, researchers have generally replaced AHP. In
272 previous studies, it is integrated with Failure Mode and Effects Analysis (FMEA), Technique
273 for Order of Preference by Similarity to Ideal Solution (TOPSIS) and other MCDM
274 techniques. The FUCOM and BWM methods are more consistent than other MCDM methods
275 such as AHP, Fuzzy AHP or TOPSIS; these methods eradicate the problem of redundancy of
276 pairwise comparisons of criteria that exist in other subjective models for determining the
277 weights of criteria. In recent years, BWM has significantly emerged as the most reliable
278 MCDM method to provide relevant results for optimal decision-making. With the help of
279 FUCOM and BWM methods, optimal weights are obtained with a minimum number of
280 pairwise comparisons. Due to the small number of pairwise comparisons, inconsistencies are
281 removed. These methods provide more reliable results compared to the AHP method; there is
282 greater consistency in the results. Further, the BWM method includes reference comparisons
283 implying the advantages of best criterion over all other criteria and advantages of such
284 criteria over the worst criterion. This method is much simpler and more accurate. The details
285 of the methods are discussed in the following sub-sections.
286

287 ### 3.1 *Full Consistency Model (FUCOM)*

288 Pairwise comparisons are the basis of this method with validation of results by deviation from
289 maximum consistency. This method compares a lesser number of criteria (only $n - 1$
290 comparison), with an ability to validate results by defining the deviation from maximum
291 consistency. This method has a subjective influence of decision makers on the computation of
292 the final values of the weights of the criteria. This method has an advantage of minor
293 deviations in the obtained values of weights of criteria from optimal values. This method also
294 eradicates the problem of redundancy of pairwise comparisons of criteria that exist in other

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295   subjective models for determining weights of criteria (Pamucar et al., 2018; Stevic´ and

296   Brkovic', 2020). The steps of the FUCOM methods are:

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298   **Step 1:** Ranking of criteria/sub-criteria by experts.

299   **Step 2:** Obtaining the vectors of the weight coefficients of criteria/sub-criteria.

300   **Step 3:** Defining the conditions of a non-linear optimisation model.

301   *Condition 1: efficients of criteria is equal to the   comparative significance among the*

302   *observed criteria; this can be calculated as ($W_k / W_{k+1} = \varphi_{k/(k+1)}$)*

303   *Condition 2: The value of the weight coefficients should satisfy the conditions of the*

304   *mathematical transitivity; this can be calculated as - $\varphi_{k/(k+1)} \otimes \varphi_{(k+1)/(k+2)} = \varphi_{k/(k+2)}$.*

305

306   **Step 4:** Defining a model to determine the final values of weight coefficients of evaluation

307   criteria.

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310   **Step 5:** Computing the values of evaluation criteria/sub criteria (w_1 , w_2 ,..., w_n) ^{T}.

311

312   3.2 ***Best Worst Method (BWM)***

313   This method helps decision-makers to take decisions more accurately as results of this

314   method are more consistent (Rezaei et al., 2016). The steps for this method are specified as

315   follows:

316   **Step 1:** Determine a set of decision criteria.

317   **Step 2:** Determine the Best (B), most important, and the Worst (W), least important, based on

318   expert opinion.

319   **Step 3:** Determine the preference of the best decision criterion (B) over all the decision

320   criteria using a 9-point scale. The result is a Best-to-Others (BO) vector as follows.

321

322   Where, a_{Bj} represents the preference of B over j and $a_{BB}=1$

323   **Step 4:** Determine the preference of all decision criteria over the worst criteria (W) using a

324   9-point scale, which results in Others-to-Worst (OW) as follows.

325

326   Where, a_{jw} represents the preference of j over W and $a_{ww}=1$

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327 **Step 5:** Compute the optimal weights

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329 The optimal weights should be determined so that maximum absolute differences for all j is

330 minimised, or equivalently.

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332 for all j is minimised, or equivalently

333

334 s.t

335 .... Eq. (1)

336 *, for all j*

337 Problem (Eq. 1) is equal to the following linear problem

338 $\min \xi^L$

339 *, for all j*

340
341 *for all j*

342 .... Eq. (2)

343 *, for all j*

344 By (Eq. 2), the optimal weights (w_1^*, w_2^*,… w_n^*) and the ξ^{L_*} are obtained where ξ^{L_*} is the

345 consistency index; the values close to zero show a high level of consistency.

346

347 3.3 *Data Collection*

348 The study has involved experts from retail and supply chain industries operating in offline

349 and online formats in India. The experts include supply chain practitioners belonging to

350 different domains. The questionnaire (Appendix I-A and I-B) is shared online with the

351 experts after e-discussion on the determinants. The determinants are given in Table 1; case

352 locations and expert details are shown in Table 4.

353 **Table 4:** Details of case location and experts

RSC No.	Retail Sector	Physical store + Online store	Number of experts undertaken	Area of experts	Experience of experts
1	Household Personal care	Physical	3	Sales management	More than 10 years
2	Groceries and	Physical	4	Inventory	8 years

15

	Perishables	store + Online store		management	
3	Groceries	Physical store + Online store	2	Floor managers	8 years
4	e-commerce retailer	Online	4	MIS/Information systems/ Data analyst	8 years
5	Sports equipment (Indoor)	Physical store + Online store	3	Inventory management	8 years
6	Clothing	Physical store + Online store	2	Customer Relation Manager	More than 10 years
7	Healthcare	Physical	4	Medical equipment and healthcare products	More than 10 years

354

355   4. **Proposed Research Framework**

356   The research objectives are achieved through three phases including steps shown in figure 1.

357   During the first phase, the determinants that may affect the business performance of RSCs are

358   identified and analysed through FUCOM to compute their weights in phase second. The

359   experts/decision makers, on the basis of identified determinants, assess business strategies of

360   RSCs using a BWM method in phase three. Figure 1 illustrates the proposed research
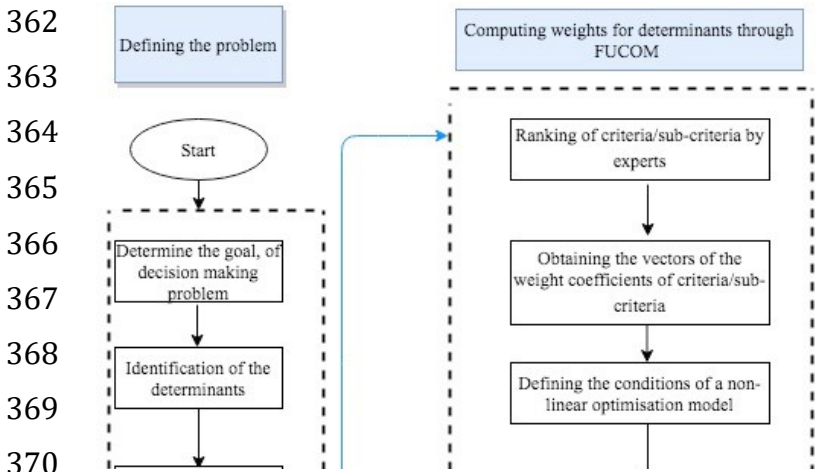
361   framework.

362

Figure 1: Proposed research framework

363

364

365 4.1 *An Application of Proposed Framework*

366

367 The focus of the study is to assess

368 RSCs to enhance their

369 performance during and post

370 pandemic. The 22 experts (E1-

371 E22) belong to operations, inventory, sales and customer relations and IT departments of the

372 retail firm. The selected managers are responsible for retail and supply chain management.

373 The experience of the experts ranges from 5 to 15 years. These experts are aware of business

374 strategies of RSCs and also the changing customer needs during the disruptive environment.

375

376 4.1.1 *Phase I: Determining weights of criteria using FUCOM method*

377 The order of criteria is obtained on the basis of decisions-makers/experts' preferences by

378 comparing the criteria on a scale 1-9 (Appendix Table I-A). Experts arrange the criteria as

379 per their importance in enhancing the business performance of RSCs. The responses by all

380 experts are shown in Appendix II-A. The mean values of the experts' responses are shown

381 in Table 5.

382 **Table 5:** Criteria comparisons (E1-E22)

Experts	C_1	C_3	C_4	C_5	C_2	C_6
	1.0	2.69	3.24	4.11	5.94	7.34

383

384 Based on the obtained priorities of the main criteria, comparative priorities are computed.

385 The obtained comparative values are as follows.

386 $\varphi C_1/C_3 = 2.69/1 = 2.69;$

387 $\varphi C_3/C_4 = 3.24/2.69 = 1.20;$

388 $\varphi C_4/C_5 = 4.11/3.24 = 1.27;$

389 $\varphi C_5/C_2 = 5.94/4.11 = 1.45;$

390 $\varphi C_2/C_6 = 7.34/5.94 = 1.24$

391 In the next step, the weight coefficient values are computed; two conditions must be fulfilled.

392 *According to condition (1):*

17

393     $w_1/w_3 = 2.69$, $w_3/w_4 = 1.20$; $w_4/w_5 = 1.27$; $w_5/w_2 = 1.45$; $w_2/w_6 = 1.24$

394   *According to condition (2):*

395     $\varphi C_1/C_4 = 2.69 * 1.20 = 3.24$; $\varphi C_3/C_5 = 1.20*1.27 = 1.53$; $\varphi C_4/C_2 = 1.27 * 1.45 = 1.83$;

396     $\varphi C_5/C_6 = 1.45 * 1.24 = 1.79$

397

398   Hence, $w_1/w_4 = 3.24$; $w_3/w_5 = 1.53$; $w_4/w_2 = 1.83$; $w_5/w_6 = 1.79$

399

400   The final model from which the final values are obtained is:

401     $\min \chi$

402

403

404

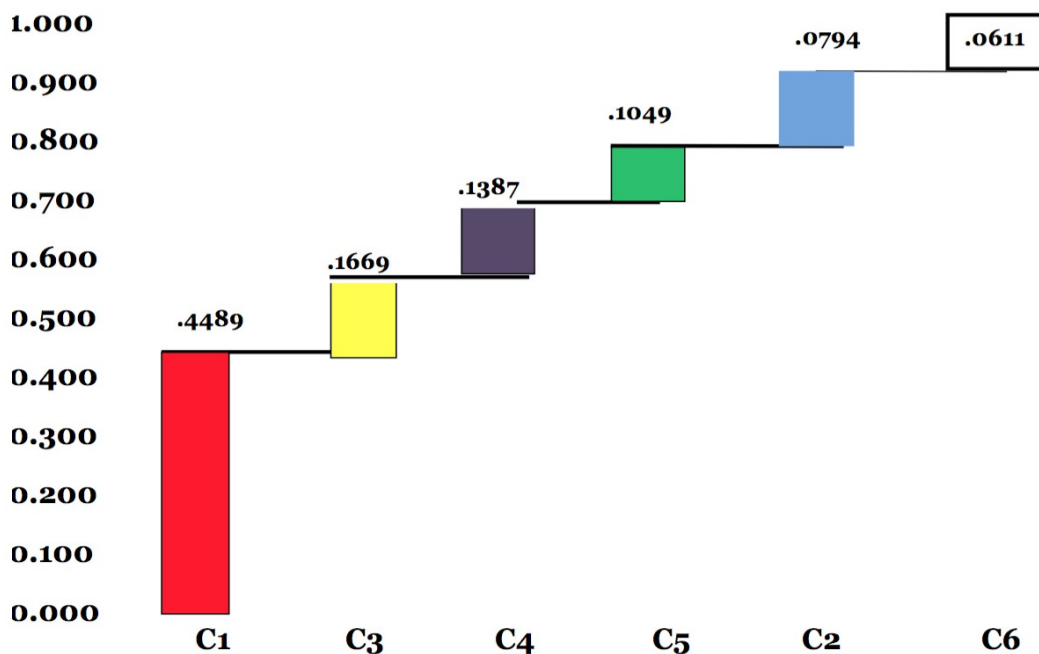405   *S.t.*

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411   Subsequently with the help of lingo software, the following model is obtained showing the

412   weights of the determinants as seen in Figure 2.

413

414

415

18

Figure 2: Weightage of determinants

417

418   From Figure 2, it is clear that the most important criterion is C_1 i.e., Collaboration

419   efficiency. It is accepted that during a pandemic, collaboration among partners of RSCs will

420   improve decision-making actions. The collaborative efforts of retailers, buyers and suppliers

421   will bring stability to RSCs and will support them post pandemic. This criterion is followed

422   by Adopting digital technology (C_3), Humanitarian relief operations (C_4) and Operational

423   and dynamic capabilities (C_5). The criteria Partnership structure (C_2) and Information and

424   communication quality (C_6) both have lower values, showing that these are less significant

425   compared to other criteria in the current situation.

426

427   4.1.2 *Phase 2: Evaluating Business Strategy (alternatives) of RSCs using BWM method*

428   The steps discussed in Section 3.2 are again followed; an initial matrix is developed as

429   shown in Table 6. The comparative evaluation of BSs is made with the BWM solver. The

430   tables completed by the experts are shown **(Appendix I-B, I-C, I-D)**.

431   **Table 6:** Best and Worst criteria (Experts E1-E22)

Alternatives	Determines as *Best* by experts	Determined as *Worst* by experts
BS_1	E1, E13, E22	E15
BS_2	E2, E6, E15	E12, E9
BS_3	E4, E9	E1, E13
BS_4	E18, E19, E21, E20	E7, E10
BS_5	E3, E7, E10	E19, E21, E20
BS_6	E11, E14	E4, E16, E17
BS_7	E5, E8	E3, E11, E14
BS_8	E16, E17	E5, E8, E22
BS_9	E12	E2, E6, E18

432

433   All experts have ranked the RSCs using a 1-9 measurement scale. The BWM optimisation

434   model developed by Razaei (2016) is employed for computing. The weights of BSs from all

435   the experts are obtained through a BWM optimisation solver. The final weights are computed

436   through the geometric mean of all responses of the experts (Appendix II-B). The results of

437   the BWM optimisation are presented in Table 7.

438   **Table 7:** Ranking of business strategies alternatives

Alternatives	Priorities	Ranking
BS_1	0.1247	2
BS_2	0.0796	6
BS_3	0.1028	4

BS$_4$	0.1307	1
BS$_5$	0.1118	3
BS$_6$	0.0789	7
BS$_7$	0.0830	5
BS$_8$	0.0782	8
BS$_9$	0.0739	9

439

5. Discussion of Findings

440

441 The determinants of RSCs are listed on the basis of prominence value obtained by FUCOM;

442 ranking of the appropriate retail chain alternatives is performed using the BWM application.

443 This study is insightful for decision-makers to manage their SCs successfully during and post

444 COVID-19. There is an urgent need for enterprises to enhance their business performance

445 during and post COVID-19. The 'new normal' environment i.e., post COVID-19, will be

446 challenging for retail organisations due to the changes in consumer purchasing patterns and

447 the social environment. Thus, enterprises need to redesign their strategies and business

448 operations to match the 'new normal' environmental needs.

449 Results show that collaboration efficiency (C$_1$) is the most crucial determinant in enhancing

450 business performance of RSCs during and post pandemic. Collaboration efficiency (C$_1$) has

451 obtained the highest weight (0.4489) followed by Adoption of digital technologies (C$_3$) and

452 Humanitarian operations (C$_4$). The main categories are ranked in order C$_1$>C$_3$>C$_4$>C$_5$>C$_2$>C$_6$

453 as shown in Figure 2. Collaboration between stakeholders has always been a significant

454 factor in managing supply chains in order to develop a resilient system that fulfils the

455 demands of customers appropriately in the changing environment (Ansari and Kant, 2017;

456 Scholten and Schilder, 2015). Collaboration brings value added products and services to retail

457 organisations who can adopt innovation strategies to cope with the way customers behave

458 and shop (Balaji and Roy, 2017; Young et al., 2018).

459 During the pandemic, customer experience and perception are fully dependent on the

460 retailers' and suppliers' contributions; co-creation for value added products and services will

461 be able to build a path to enhance the performance of RSCs post pandemic. Stakeholders

462 need to innovate and create value added products to ensure their survivability during and post

463 COVID-19. Stakeholder needs and levels of satisfaction must be monitored during the

464 pandemic; thus, determinants such as collaboration, efficiency and adoption of digital

465 technology will be hugely important to RSCs to ensure value in their business operations.

466 Added manufacturing, robotics, big data analytics (BDA) and IoT offer improved products

467 and services to customers (Nasiri et al., 2020). Retail 4.0 is utilising these digital technologies

468 and developing their supply chains to provide opportunities to develop value creation
469 (Gawankar et al., 2020). Digital technologies such as BDA provide information related to SC
470 functions in real time; this can reduce inventory costs and utilise resources optimally.

471   The other crucial determinant is Humanitarian relief operations; it obtained a weight of
472 0.1387. The pandemic has raised awareness levels in RSCs of the need to develop readiness
473 for dealing with uncertain situations like COVID-19. RSCs must understand and learn to
474 adopt the practices of keeping emergency stocks and product flexibility in order to survive
475 and sustain during uncertainty (Sajjad et al., 2020).

476 The selection of a suitable business strategy of RSCs to deal with the pandemic shows that
477 'Order fulfilment strategy' is the first choice of the experts. Order fulfilment (BS$_4$) (0.130)
478 has achieved the highest ranking in dealing with the pandemic, followed by Digitisation
479 strategy (BS$_1$) (0.124) and Inventory control strategy (BS$_5$) (0.111). As COVID-19 continues
480 to spread, retailers and suppliers have mutually stepped up their efforts to provide essentials
481 to customers. The study shows that RSCs are adopting order fulfilment, digitalisation strategy
482 and inventory control with a focus on high collaboration efficiency to fulfil the needs of
483 stakeholder during this time. In order to achieve this, RSCs are providing services to the
484 doorstep of customers as the majority of consumers are staying at home and shifting towards
485 e-commerce. This finding is in line with other research conducted during COVID-19 (Choi et
486 al., 2020; Pereira and Frazzon, 2020).

487 Order fulfilment can be appropriately met with real time information exchange between all
488 RSC partners. Currently, RSCs are trying to downsize their product lines, focusing on limited
489 orders to fulfil the demand on time and with full safety measures. RSCs are also making
490 efforts to deliver products within minimum time with the support of local partners.
491 Consumers have learned quickly how to overcome the environmental constraints imposed by
492 the government (Donthu and Gustafsson, 2020).

493 Digital technologies have offered a number of opportunities for retail organisations to attract
494 customers. The desire to remain, socialise and work at home is increasing day by day and
495 thus creates an opportunity for organisations to digitalise their SCs to reach customers. The
496 collaborative efforts of buyers and suppliers are much needed to strengthen relationships for
497 managing their digitised RSCs not only for its survival, but to develop the resilience needed
498 for sustainability post COVID-19 (Ivanov, 2020; Roggeveen and Sethuraman, 2020). Further,
499 the need of inventory planning, forecasting, demand and supply management have to adapt
500 dynamic systems that can update information in real time (Donthu and Gustafsson, 2020).

21

501 RSCs are adopting the digital technologies needed for procuring, manufacturing and
502 delivering products; as a result, demand driven supply chains are emerging during the
503 pandemic (Ivanov, 2020). The third most preferred alternative is 'Inventory control strategy'.
504 Retailers and suppliers need to leverage powerful and analytical capabilities to predict and act
505 upon dynamic baselines during COVID-19. SC partners are conducting daily meetings to
506 secure a sufficient supply of high demand products. An inventory control strategy is also
507 needed as consumers are stockpiling essentials and health care products. Demand and supply
508 management has to be taken to local level to prevent stock out situations and lack of order
509 fulfilment.

510

511 Diversification and offshore strategies plus revenue management strategies must be managed
512 efficiently to ensure survival in a pandemic. Thus, retailers, worried about their current
513 flows, are devising ways to pay their bills over a prolonged period of time. RSCs are
514 predicting current and potential liquidity, working capital dynamics and making short-term
515 cash forecasts to deal with the existing financial crisis. Retailers are also thinking about their
516 key suppliers to assess their risk and indirect exposures while developing contingency plans
517 for surviving throughout the pandemic.
518 Organisations have to observe the demand for both short and long term and need
519 Collaborative Planning, Forecasting and Replenishment (CPFR) to strengthen SCs in
520 planning for the present and future scenarios. Currently, RSCs are facing low inventory levels
521 due to consumers stockpiling of essentials. In the post-COVID-19 environment the
522 transformation to collaborative planning along with a Digital Supply Chain (DSC) will be
523 required among RSC partners for their survival and stability. Today, organisations need
524 accurate, real-time information about inventories, logistics and in-transit movement to make
525 the best decisions in the 'new normal' environment.

526

527

528   *5.1 Contributions of the Research*
529 This study has explored the assessment of RSCs during an uncertain time. Rooted in the
530 business strategy literature, the Resource-Based View (RBV) explains and predicts how an
531 organisation can achieve sustainable competitive advantage through controlling the unique
532 resources and capabilities (Nandi et al., 2020). An organisation's resources refer to those
533 assets that enable the production and delivery of goods and serves (Grant 1991). The
534 organisation's capabilities refer to the resource utilisation; that how are resources in

22

535   combination with the processes in the organisation are deployed to produce the desired output

536   (Liu et al., 2016). RBV theory is appropriate in explaining how the organisation can achieve

537   competitive advantage by transforming its unique resources into capabilities through

538   integration and reconfiguring its resources into organisational processes. Thus, the current

539   study identifies how the organisations can develop their resilience strategies based on their

540   internal processes such as collaboration efficiency, adopting digital technology and

541   humanitarian activities. The RSCs capabilities need to be strengthened for developing their

542   competitive advantage such as order fulfilment, inventory control, demand and supply

543   management, digitisation etc. to sustain during and post COVID situation.

544   The study has provided insights for retail organisations, suppliers and government

545   departments to manage their SCs more effectively and efficiently during the pandemic. The

546   study has employed advanced methods, FOCUM and BWM, to assess RSCs and identify the

547   appropriate solutions to survive during and after the pandemic. A focus is on the significant

548   determinants to enhance the performance of RSCs in a pandemic; this can support retailers

549   and suppliers to redesign their present strategies for the 'new normal' situation. The study has

550   made suggestions to organisations to adopt business strategies that consider and take actions

551   based on changing consumer behaviours due to a pandemic. This paper has identified the

552   significant determinants that drive the performance of RSCs and provide support for optimal

553   decision making. The study has contributed in determining the emerging significance of

554   order-fulfilment and digitization strategies in developing resilient RSCs during and post

555   COVID-19.

556

557   5.2 *Implications of the Research*

558   The COVID-19 pandemic has revealed the significance of collaborative partnerships with

559   third party service providers such as AI based or cloud-based management solutions to ensure

560   the handling of products efficiently and effectively. This study makes the following main

561   implications for managers and policy makers that can help RSCs to recover from the

562   pandemic and support SCs in the post pandemic world.

563   1) *Developing a collaborative culture*

564   The pre-pandemic market has been generally dominated by SCs that are transactional in

565   nature. However, such practices are not beneficial during a pandemic or in a post pandemic

566   environment. The findings suggest that SC partners need to be engaged in the sharing of data

567   and joint problem solving to enhance collaboration efficiency. The collaboration efficiency

23

568 will help SC partners to share data in real-time that support scenario planning and
569 organisations to take more appropriate decisions.

570   *2) Developing digital supply chains for building resilient organisations*

571 The findings of this study are insightful for the managers. The study suggests that the
572 adoption of digital technology will help organisations to develop intelligent and resilient SCs
573 to enhance transparency and responsiveness. The transparency and responsiveness are the key
574 focus areas for developing resilient strategies during and post COVID-19 situation. DSNs
575 will enhance collaboration among SC partners and support them to assess the environment
576 and make them better prepared for the changing demands of consumer and markets. The
577 nature of current organisations in the market place is fragmented; this can be overcome with
578 the help of DSNs. SC partners should know what is being produced, moved and stored at any
579 particular time.

580   *3) Digitalisation strategy for flexible systems*

581 Organisations need to develop agile SCs to fight against disruption; this can be made possible
582 through flexible systems that can adjust in real-time for managing a fluctuating capacity. Real
583 time data is a life saver for organisations and will support them during and post COVID-19.
584 The organisations should harness advance digital technologies that can capture relevant data
585 and develop prescriptive insights to help them to manage disruption. Apart from information
586 management, good working relationships with manufacturers will remain a cornerstone of
587 RSCs; flexibility to source from multiple suppliers will regain significance. Organisations
588 need to enhance the usage of emerging technologies such as IoT, blockchain, augmented
589 reality, robotics and big data analytics. These technologies will support organisations to
590 overcome the vulnerabilities of existing SCs caused by COVID-19.

591   *4) People-are-first ethos*

592 During the COVID-19 pandemic, delivery on time has become a key differentiator. With the
593 support from digital tools and collaborative planning, organisations will be able to fulfil
594 orders on time. The current study has revealed that order fulfilment is the need of the market
595 and the consumers as well. During COVID-19 the organisations have been challenged to
596 fulfil orders on time.

597   *5) Align demand, capacity, supply and operations execution*

598 The COVID-19 situation has witnessed the fluctuations in the demand and supply of various
599 products in the personal and healthcare range. The study has identified that inventory control
600 and demand-supply management are the determinants that drive the performance of the
601 RSCs. Thus, to deal with the uncertainty, the organisations need to adapt and modify their

602 plans to continuously adjust demand, supply, capacity and operations execution. The

603 organisations that implement optimisation technologies can adapt and modify their plans

604 according to the changing needs.

605   6) *Shift to e-commerce*

606 A 'new normal' environment will consist of online orders, contactless and quick delivery

607 options. Most countries, including India, are living under restrictions; therefore RSCs need to

608 adapt strategies appropriately. RSCs need to adapt to this restricted living phase and prepare

609 themselves for the 'new normal'. COVID-19 is compelling organisations to develop resilient

610 RSCs that includes e-commerce that will be able to survive in any future emergency or

611 uncertain situation.

612

613 Those SCs focusing on order fulfilment, digitisation, inventory, demand and financial

614 stability are more effective during a pandemic as these strategies help organisations to

615 enhance their operational efficiency.

616

617 **5 Conclusion**

618 COVID-19 is a warning to retail organisations to re-plan and enhance readiness for an

619 uncertain future. The changing social, economic, environmental and political landscapes have

620 stressed the need for retailers to transform their existing business models. Order fulfilment

621 and demand forecasting are the key challenges exacerbated by COVID-19. Retailers who do

622 not plan for both these factors to meet customer expectation have placed themselves at high

623 risk of failure in the long term. This study has made an attempt to understand and analyse the

624 determinants of RSCs that may enhance business performance during and post COVID-19.

625 FOCUM has been used to establish the prominent determinants. A BWM is employed to

626 assess the business strategies of RSCs and to identify the most appropriate, given the

627 conditions caused by the pandemic. The dominant determinants highlighted are collaboration

628 efficiency, digital technologies adoption, partnership structure and communication quality.

629 These findings show that RSCs need full integration and collaboration to survive during and

630 post pandemic. Currently, the focus should be on order fulfilment, inventory control, demand

631 and financial stability.

632 Social distancing and the risks of being in public places are the new features that drive the

633 shift of consumers and organisations towards the adoption of e-commerce. This study has

634 opened a window of opportunity for retailers and suppliers to recognise changing consumer

635 behaviour; they can strategize the optimal human and machine ratio and then choose the most

25

636 appropriate operating models accordingly. RSCs have to gain control of the on-going crisis
637 and should invest in building more resilient supply chains with advanced digital technologies.
638 There is a new normal that needs to be addressed.
639 This study has some limitations. Firstly, the study has applied methods for assessing RSCs
640 that are based on experts' opinions; hence the experts' bias may act as a limitation. The study
641 may be further empirically validated in future. The expert group has not included customers
642 and other stakeholders; the study can therefore be extended to include customers to enhance
643 the credibility of the expert group. Secondly, the impact of COVID-19 is global and hence
644 the study can be extended to other nations. The research framework has been developed in
645 the context of a single country; it may be tested further for different countries where
646 conditions are similar. Thirdly, the current study has consulted with experts from the retail
647 and supply chain industry of India and thus any outcome is region specific. More experts
648 from further afield can be added to validate the results of this research.
649

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Appendices

Appendix I

981 Details of determinants

Criteria	Implied meaning	Business outcomes
Collaboration efficiency (C_1) (Collaborative Planning, Forecasting and replenishment, Resource sharing, Network resources, Co-creation)	The collaboration among RSC partners for predicting demand and supply management	Enhances resilience of RSCs that may help survival in post pandemic situation. External sources provide strategic opportunities to RSCs to take strategic actions. Collaborative innovation brings value added products that may fulfil the needs of customers during difficult times
Partnership structure (C_2) (Including Flexibility, Visibility, governance structures)	The structure of partnerships among retailers and suppliers to enhance the business performance	It improves information sharing, integration, transparency and flexibility among partners in RSCs. It helps a retail organisation to quickly respond to the uncertain environment
Adoption of Digital Technologies (C_3)	Big Data Analytics (BDA), Artificial intelligence, Internet of things etc. adoption in retail organisations to enhance the efficiency of business operations.	Online order and delivery management accelerates order fulfilment processes and enhances efficiency. BDA provides insights for decision making to deal with uncertain conditions. Saves cost and time
Humanitarian relief operations (C_4)	The emergency operations performed by retail organisations during uncertainty.	Reducing product complexity and delivering product flexibility results in reducing the cost.

		More options to make delivery helps retailers to avoid flow disruptions
Operational and dynamic capabilities (C$_5$)	Capabilities to develop competitive advantages for retail organisations	Re-designing may support in risk reduction and developing competitive advantage for resilient supply chains during and post COVID-19
Information and Communication quality (C$_6$)	Flow of information and communication between all partners among RSCs	Internal communication develops capabilities between retailers, suppliers and customers

- Steps to fill the Table I A

1. Arrange the criteria according to their preference.

2. Provide values to each determinant on a scale 1 to 9

Table I-A: Preference rating of determinants

Criteria	C$_1$	C$_2$	C$_3$	C$_4$	C$_5$	C$_6$

Details of Business Strategies

Alternatives	Performance outcomes
Digitisation strategy (BS$_1$)	Digital technology adoption to provide customer services online and handle multiple requests at one time
Omni-channel strategy (BS$_2$)	Omni-channel supply chains provide one-touch integration across all channels to provide unified experience.
Diversification and offshoring strategy (BS$_3$)	Extension of the portfolio of services including core and non-core services
Order fulfilment and optimisation strategy (BS$_4$)	Exhausting local partners to jointly work for pickup and delivery items
Inventory control strategy (BS$_5$)	The ability to predict and manage demand. Demand forecasting and inventory control need to be considered to prevent stock-out situations.
Distribution network strategy (BS$_6$)	Retailers are extending their distribution networks to meet demands of customers and enhance their survivability
Revenue management strategy (BS$_7$)	Financial stability under a variety of different scenarios. Retailers are closely looking at liquidity and working capital
Customer Relationship Management (CRM) strategy (BS$_8$)	Building and maintaining trust among consumers.
Dynamic pricing strategy (BS$_9$)	Competitive pricing as demand increases in uncertain conditions. Sentiment analysis can help in effective pricing.

- Identify the best and worst criteria on the basis of criteria and rate in Table I-B on the basis

of prominent determinants ranked in I-A (Rate1 for best and 9 for worst)

37

999 **Table I-B:** Preference rating of business strategies

Alternative=9	BS$_1$	BS$_2$	BS$_3$	BS$_4$	BS$_5$	BS$_6$	BS$_7$	BS$_8$	BS$_9$

1000
1001
1002 • Select the best alternative
1003 • Select the worst alternative
1004
1005
1006 - Compare each alternative relative to best and worst alternatives and rate in Table I-C and I-
1007 D
1008
1009
1010
1011 **Table I-C:** Comparison of alternatives (Best to other)

Best to other	BS$_1$	BS$_2$	BS$_3$	BS$_4$	BS$_5$	BS$_6$	BS$_7$	BS$_8$	BS$_9$
Best Criteria (ranking 1-9)									

1012
1013
1014 **Table I-D**: Comparison of alternatives (Others to the Worst)

Others to the Worst	Rank
BS$_1$	
BS$_2$	
BS$_3$	
BS$_4$	
BS$_5$	
BS$_6$	
BS$_7$	
BS$_8$	
BS$_9$	

1015

1016 **Appendix II**

1017
1018 **Table II-A:** Expert responses for determinants (criteria)

Experts	C$_1$	C$_3$	C$_4$	C$_5$	C$_2$	C$_6$
E1	1.00	2.50	3.50	4.00	5.00	6.00
E2	1.00	2.00	3.50	4.50	6.00	7.00
E3	1.00	2.60	5.00	3.00	6.50	8.00
E4	1.00	3.50	2.40	4.00	4.50	7.00
E5	1.00	2.00	3.00	5.00	7.00	9.00
E6	1.00	3.00	2.00	3.00	7.00	9.00
E7	1.00	2.50	2.00	5.00	5.00	7.00
E8	1.00	2.00	4.00	5.00	7.00	8.00
E9	1.00	2.50	3.00	4.00	6.00	6.00
E10	1.00	3.00	4.00	3.00	7.00	8.00

E11	1.00	4.00	3.00	5.00	5.50	7.00
E12	1.00	2.00	4.00	4.00	7.00	8.00
E13	1.00	3.00	3.00	5.00	6.00	8.00
E14	1.00	3.50	5.00	5.00	4.00	7.50
E15	1.00	2.50	2.00	3.00	4.50	7.00
E16	1.00	3.00	4.00	3.00	7.00	6.00
E17	1.00	2.00	2.00	5.00	6.00	8.00
E18	1.00	3.00	4.00	4.00	7.00	6.00
E19	1.00	3.00	3.50	3.00	5.00	7.00
E20	1.00	3.50	3.00	5.00	7.00	8.00
E21	1.00	2.50	4.00	6.00	6.00	7.00
E22	1.00	3.00	4.00	4.00	6.50	8.00

1019

1020 **Table II- B:** Comparison of Business Strategy Alternatives using BWM solver

Experts	BS_1	BS_2	BS_3	BS_4	BS_5	BS_6	BS_7	BS_8	BS_9
E1	0.2516	0.1380	0.1055	0.0974	0.0974	0.0731	0.1461	0.0584	0.0325
E2	0.2456	0.1347	0.0951	0.0951	0.0951	0.1030	0.1426	0.0571	0.0317
E3	0.2635	0.1419	0.0932	0.0770	0.1027	0.1027	0.0770	0.1176	0.0243
E4	0.2641	0.1094	0.1086	0.1642	0.1094	0.1094	0.0657	0.0469	0.0222
E5	0.0237	0.2818	0.1159	0.1751	0.1167	0.1167	0.0700	0.0500	0.0500
E6	0.1163	0.2952	0.0398	0.1163	0.1431	0.1193	0.0716	0.0716	0.0268
E7	0.1267	0.0171	0.2291	0.1097	0.1267	0.1015	0.1267	0.0609	0.1015
E8	0.1297	0.0243	0.2676	0.1054	0.1297	0.0649	0.1081	0.0649	0.1054
E9	0.1305	0.0384	0.0864	0.2994	0.1305	0.0691	0.1152	0.0282	0.1024
E10	0.1143	0.0381	0.1167	0.2882	0.1143	0.1143	0.0686	0.0310	0.1143
E11	0.1180	0.0363	0.1180	0.2813	0.1543	0.0817	0.0653	0.0363	0.1089
E12	0.1489	0.0350	0.1138	0.2715	0.1489	0.0788	0.0350	0.0630	0.1051
E13	0.1414	0.0749	0.1082	0.1498	0.2579	0.0749	0.0333	0.0599	0.0998
E14	0.0948	0.0711	0.1280	0.1422	0.2417	0.0995	0.0284	0.0995	0.0948
E15	0.0813	0.1084	0.1129	0.1626	0.2755	0.0650	0.0316	0.0813	0.0813
E16	0.0811	0.1081	0.1622	0.1622	0.0270	0.1892	0.1081	0.0811	0.0811
E17	0.1393	0.0984	0.0984	0.0738	0.0328	0.2541	0.0984	0.1066	0.0984
E18	0.1282	0.1026	0.1026	0.0769	0.0256	0.1026	0.2564	0.1026	0.1026
E19	0.1250	0.1000	0.1000	0.0750	0.1250	0.0250	0.2500	0.1000	0.1000
E20	0.1229	0.0975	0.0975	0.0805	0.1229	0.0254	0.0805	0.2754	0.0975
E21	0.0997	0.0748	0.0748	0.0997	0.1365	0.0262	0.0840	0.2677	0.1365
E22	0.1045	0.0784	0.0255	0.1045	0.1439	0.0348	0.0929	0.2716	0.1439

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