ABSTRACT

1. Introduction

The global rise in disruptions, such as pandemics, geopolitical conflicts, and natural disasters, has highlighted the critical need for resilience in business operations. Table 1 is a summary of significant worldwide disruptions in the recent decade. It encompasses various crises, including health-related disruptions, natural and man-made calamities, and the continuing Ukraine-Russia war. Figure 1 illustrates the nature of the five types of supply chain disruption. Every event presents considerable challenges to supply chains, revealing vulnerabilities and underscoring the necessity for resilience strategies. Furthermore, it highlights significant natural disasters in India, emphasizing the rising incidence of floods, earthquakes, and cyclones, which have resulted in increased risk for businesses over time. This data underscores the significance of strategic planning and effective logistics in alleviating the enduring effects of such interruptions. Disruptions cause significant challenges for organizations, including financial losses, operational delays, and decreased customer satisfaction.

Table 1 Major worldwide disruptions in recent decades

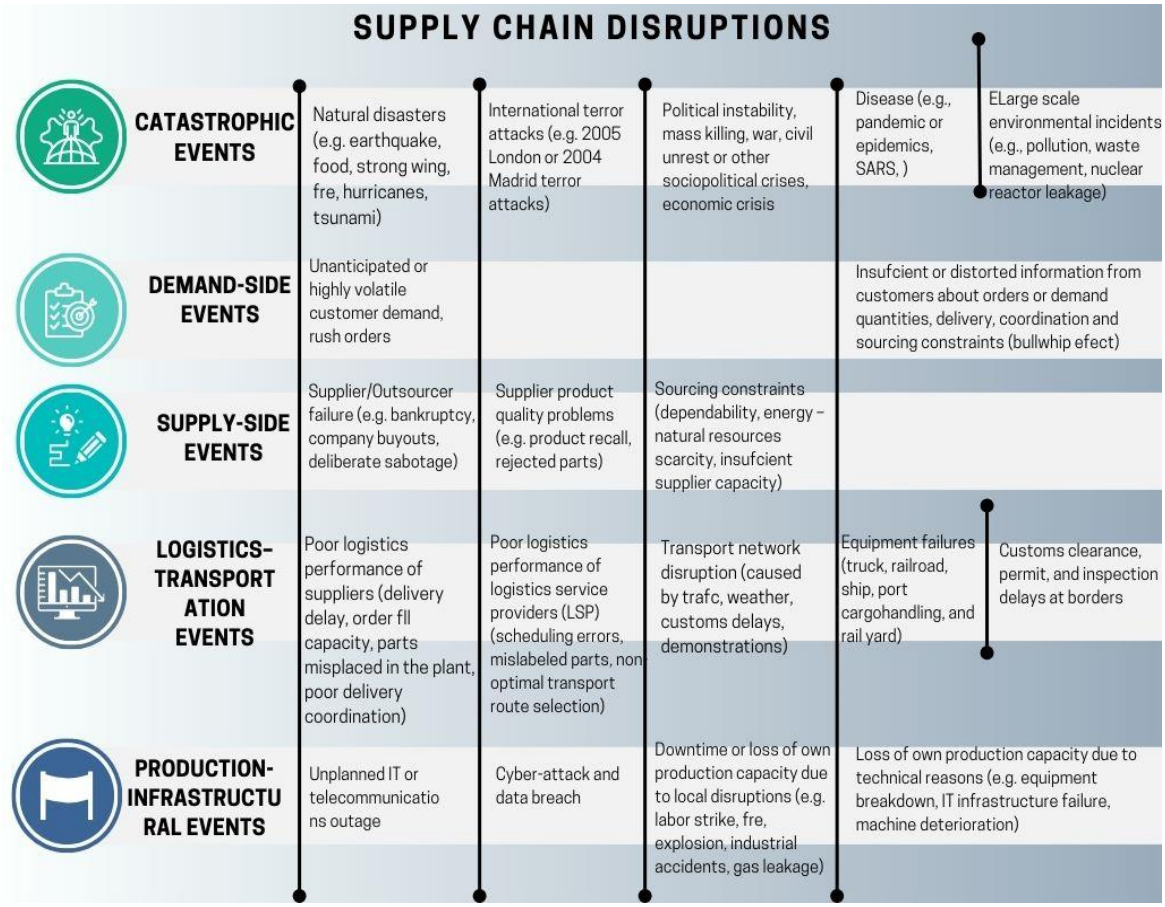
Disruptions	*Year*	*Impact*	*Sources*
SARS	2003	It caused significant disruptions, especially in Asia, where travel restrictions and quarantines profoundly affected essential manufacturing hubs like China and Hong Kong, halting production and transportation	Overby et al., 2004
Financial Crisis	2008	During the global financial crisis, business scales in some industries declined significantly or ceased entirely, whereas the service sector saw very minimal disruption.	Rapaccini et al., 2020
Swine flu (H1N1)	2009	The H1N1 swine flu pandemic exposed gaps in global SC, resulting in disruptions from shortages of workers, transportation delays, and heightened demand for medical supplies. These effects highlighted the necessity for robust supply chain measures to address future health emergencies.	Schnitzler & Schnizler, 2009; Page et al., 2012
Japan's Tsunami	2011	The tsunami that hit Japan also imposed challenges and affected the SC and organizational performance. It caused significant global supply chain disruptions, impeding manufacturing, postponing shipments, and resulting in shortages of critical components, especially in the automobile and electronics industries.	Hendricks and Singhal, 2003; Hirata and Matsuda, 2021
Ebola	2014	The Ebola outbreak resulted in significant mortality and social upheaval in Sierra Leone and Liberia, imposing transportation limitations that impeded the movement of products, diminished agricultural output, and escalated food prices throughout Africa.	Butt, 2022

Disruptions	*Year*	*Impact*	*Sources*
SARS-CoV-2 (COVID-19)	2019	The impacts of the COVID-19 pandemic on supply networks markedly diverge from traditional interruptions in terms of breadth, scale, and nature. This pandemic affected every nation and sector, unlike ordinary interruptions that may be limited or industry-specific. Its ramifications unfolded successively, disseminating from regions to nations and throughout many sectors in a domino effect.	Craighead, et al., 2020
Panama Canal blockage	2021	The incident halted global trade and caused significant delays in shipping. This incident revealed the vulnerability of global supply chains to disruptions at essential infrastructure locations since the canal accounts for approximately 12% of world trade.	Miller and Clayton, 2023; Rose et al., 2023
Ukraine-Russia war	2022 (Started in 2014)	The Ukraine-Russia war began in 2014 with the annexation of Crimea and escalated into a full-scale war in 2022. The vulnerability of logistical networks amid geopolitical crises significantly disrupts the worldwide supply of energy and agricultural commodities like wheat, resulting in shortages and price surges. The conflict also affected essential transport lines in Eastern Europe, compelling corporations to reroute cargo and rapidly modify their logistics plans.	Hamidu et al., 2023; Nugroho et al., 2024
Major recent disasters in India:			
Kerala flood *Bihar flood* *Kashmir earthquake* *Cyclone Hudhud Vishakhapatnam* *Indian Ocean Tsunami* *North Indian dust storms* *Indian cold wave* *Cloudburst (Leh)*	2019 2019 2005 2014 2004 2018 2012 2010	An overview of natural disasters in India since independence and significant calamities that have affected the nation in the last decade. Since gaining independence, there has been a gradual increase in the frequency of disasters, resulting in a corresponding rise in fatalities attributed to such tragedies. The largest number of calamities might be observed in the event of floods. While catastrophic situations cannot be prevented, their aftermath can be mitigated via meticulous preparation and efficient operations in humanitarian logistics.	Negi & Negi, 2021

Recent disruptions, including the COVID-19 pandemic, have raised the importance of resilience, exposing vulnerabilities in supply chains and logistics networks. Organizations must adopt proactive and reactive strategies to manage such disruptions effectively, focusing on operational efficiency, logistics flexibility, technological innovation, and customer-centricity, etc. Organizations must participate in an ongoing learning process to attain resilience (Eryarsoy et al., 2022). Further, these learning processes of crisis management stages take a long time and can be divided into four namely calamity, quick and dry, restart, and adapt (Rapaccini et al, 2020).

In this context, the logistics and courier sectors, which form the backbone of global trade, have become increasingly vital yet vulnerable. The Courier, Express, and Parcel (CEP) industry plays a crucial role in supporting e-commerce growth and economic development. However, it faces challenges like infrastructure gaps, regulatory

limitations, competition between service providers, and the entrance of e-commerce players in the last-mile delivery.



Source: Adapted from Katsaliaki et. al., 2022

Figure 1 Supply chain disruptions

2. Research Gap

The literature review highlights several research gaps in the CEP sector that require attention:

i) Wang (2017) discussed supply chain uncertainty and risk and suggested that external factors such as customers, environmental issues etc. are more crucial than internal factors. Epidemic or pandemic outbreaks are the most unpredictable (special) cases that increase the uncertainty and risk of global supply chains (Inanov, 2020). Due to the SARS outbreak in 2003, Chinese 3PLs faced a decline in domestic transportation activities (Zhou et al., 2008). Thus, the impact of recent pandemic disruption, i.e., the

COVID-19 phenomenon, is yet to be found in relation to the CEP industry at the domestic level in local markets.

ii) There are debates among researchers regarding the competitive advantages that can yield superior performance to a particular sector and factors affecting the growth (Kaleke & Morgan, 2017; Soloducho-Pelc, 2014; Wang, 2014). Thus, a gap exists for conducting further studies focusing on both the competitive advantages of the players and the organizational performance of CEP service providers.

iii) There are many studies from firms' perspective (Chodakowska & Nazarko, 2016; Faroos, 2019; Karcz & Slusarezyk, 2016; Marchet et al., 2017; Zhou et al., 2008) and some based on customers' perception (Harrington et al., 2016; Ho et al., 2012; Noordin et al., 2017; Pisal, 2003) to evaluate the logistics service providers. Only a few research studies have focused on both these aspects together. (Asthana & Dwivedi, 2020; Lasis, 2018; Mahadev, 2015). Thus, a gap exists for conducting a study incorporating both CEP service providers' and users' perspectives in times of disruptions.

iv) Only three international studies explicitly examine supply chain and LSPs (Herold et al., 2021; Hohenstein, 2022; Garola et al., 2023), each with a distinct emphasis. At national level, (Mahadev, 2015; Pal et al., 2010; Potder, 2015; Selvavinanyagam et al., 2018) and state level (Dutta & Borah, 2018), studies were conducted on the role, issues, challenges, efficiency, customer satisfaction, adoption level of technological innovations etc. of the Indian postal system but no such studies have been found on preparedness of CEP service providers in times of disruptions.

v) The researcher could find negligible studies emphasizing empirical investigation on intense competition among CEP service providers. There is a need to respond to academics' requests for empirical investigations that quantify organizational resilience (Koh et al., 2024) in the face of disruptive events and to examine reactions to such crises (Choi, 2021; Ivanov and Dolgui, 2020).

3. Research Questions

The research questions are formulated as:

RQ1: How did CEP service providers respond to disruptive events during the pandemic?

RQ2: What level of customer satisfaction and behavioral intentions regarding CEP service quality were observed during a disruptive environment?

RQ3: How to quantify the resilience of the CEP industry against disruptions?

RQ4: What is the status of competitiveness preparedness among the CEP service providers in India?

4. Objectives of the study

Objective 1: To identify product/service innovations being implemented by courier, express, and parcel service providers in times of disruptions.

Objective 2: To determine the areas of competitive advantage of the courier, express, and parcel service providers in times of disruptions.

Objective 3: To assess the operating efficiency of the courier, express, and parcel service providers in times of disruptions.

Objective 4: To determine the factors influencing customer satisfaction levels from courier, express, and parcel services in times of disruptions.

Objective 5: To develop a framework mechanism for gauging differentiation and competitive preparedness by courier, express, and parcel service providers in times of disruptions.

5. Research hypothesis development and conceptual framework

The hypotheses for this study are developed objectively (Table 2), and a CSQ conceptual framework is also developed for courier service quality (Figure 2).

Table 2 Hypothesis for this study

Objectives	***Hypotheses***
Objective 1	*H1* Introduction of innovation by CEP service providers positively influences business performance during disruptions
Objective 2	*H2* Factors of competitive advantages of CEP service providers positively influence business performance during disruptions

Objective 3	*H3* Operating efficiency of CEP service providers positively influences business performance during disruptions
Objective 4	*H4a.* The quality of CEP services positively impacts customer satisfaction during disruptions *H4b* The quality of CEP services positively impacts customer loyalty during disruptions *H4c* The quality of CEP services negatively impacts customer disloyalty during disruptions *H4d.* Customer satisfaction with CEP services positively impacts customer loyalty during disruptions *H4e.* Customer satisfaction with CEP services negatively impacts customer disloyalty during disruptions *H4f.* Customer loyalty is influenced by CEP service quality through customer satisfaction during disruptions *H4g.* Customer disloyalty is influenced by CEP service quality through customer satisfaction during disruptions *H4h.* Customer satisfaction with CEP services positively impacts willingness to pay during disruptions *H4i.* Customer loyalty to CEP services positively impacts willingness to pay during disruptions *H4j.* Customer disloyalty of CEP services negatively impacts willingness to pay during disruptions
Objective 5	*H5* There is a significant difference among the CEP service providers regarding competitive preparedness during disruptions

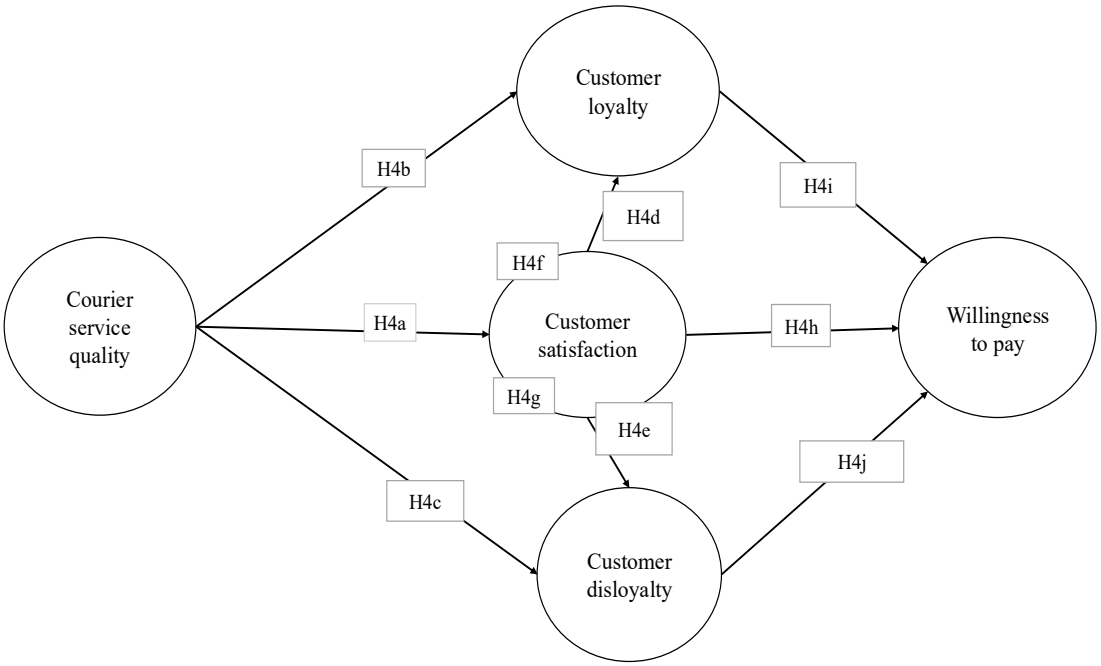


Figure 2 Conceptual framework for courier service quality (CSQ)

6. Research methodology

This empirical study employs both exploratory and descriptive research designs to collect and analyze data. Initially, exploratory research was conducted to investigate logistics resilience management and assess the preparedness of CEP service providers. This phase involved a comprehensive literature review and informal discussions with

CEP managers to gain insights into industry challenges and strategies. The study then adopts a descriptive approach to collect quantitative data. Primary data for the dependent, independent, and mediator variables was collected through a structured questionnaire administered to CEP service providers and customers, while information from websites and industry reports on the courier and express sector was also used. Partial least squares structural equation modelling (PLS-SEM) is used to analyze cause-and-effect relationships among the constructs. Finally, a data-driven composite index formulation is applied to quantify resilience, offering a comprehensive, data-based assessment of the industry's preparedness for disruptions. The research design is presented in Figure 3.

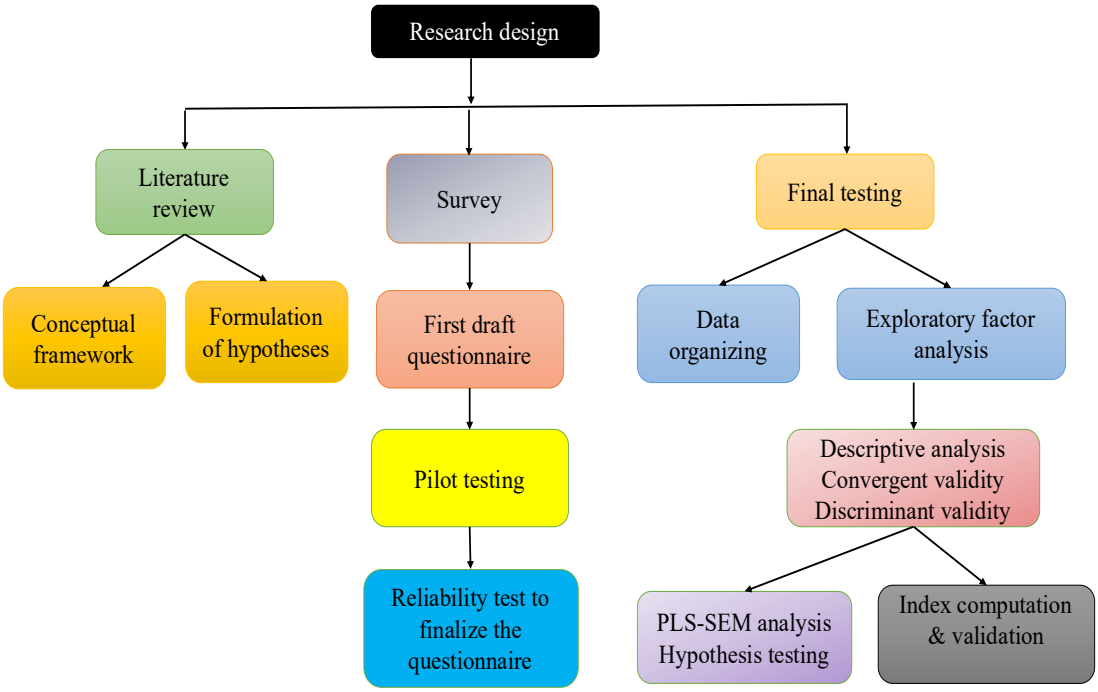


Figure 3 Research design framework

The selection of CEP service providers was based on Express Industry Council of India (EICI), Courier Association of India, own observation during field visits, and the data from the Guwahati Municipal Corporation (GMC). The approach "Average sample in similar studies" is used to determine the number of respondents to measure the satisfaction level of the customers. A total sample size of 800 is proposed for this study. The target population comprises customers who have utilized both postal services and private courier services at least twice during the period from 2020 to 2022. Both individual and organizational customers meeting these criteria were considered for

inclusion. To capture relevant data from the customer groups and service providers, separate sets of questionnaires were designed.

Measurement:

Objective 1, refers to the examination of the product/services innovations that are incorporated by courier, express, and parcel service providers to meet the demands of the dynamic environment.

Objective 2, is about determining the factors of competitive advantages and detailed analysis to figure out the most important resources/capabilities or value additions that helped the service providers to sustain in the market.

Objective 3, refers to the efficiency analysis of the service providers to map out whether the resources are being utilized efficiently and effectively.

Objective 4, deals with the evaluation of the functioning of CEP service providers from the customers' perspective. To achieve this objective, the users were asked questions regarding the service quality, perceived satisfaction, and behavioral intentions.

Objective 5, is to suggest a framework for CEP service providers based on current market analysis on the competitiveness of each player in the industry and the gap between supply-side (service operators) and demand-side (customers). This objective was attempted by computing composite indices to quantify resilience.

Index creation:

A composite index is created by combining standardized indicators, where the weights assigned to each indicator indicate their relative significance. Distinct weighting approaches, such as statistical methodologies or expert judgment, might yield divergent outcomes (Figure 4).

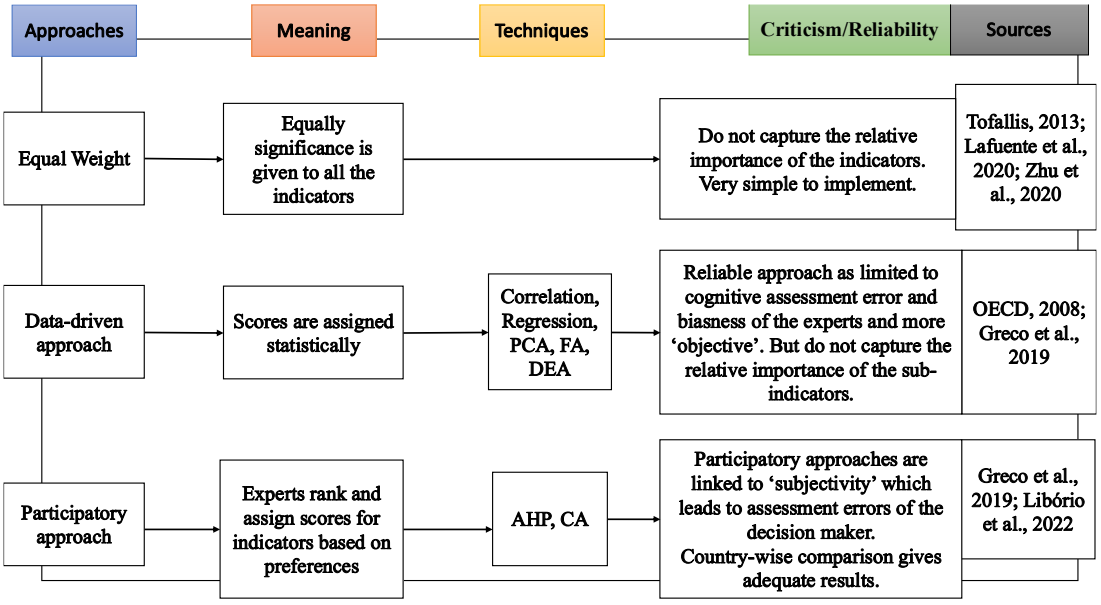


Figure 4 Summary of approaches for weighting sub-indicators

The computation of the composite index (CI) score was drawn on a methodology (Figure 5) using a data-driven weighted average approach. Given the importance of reliable weighting, this study applies loading scores derived from a factor analysis approach, using principal component analysis (PCA) as the extraction method along with varimax rotation to assign weights to each item (Nicoletti et al., 2000; Tresch et al., 2006). Notably, this study implements a factor analysis (FA) approach by using squared factor loadings, enhancing the precision and reliability of the research model.

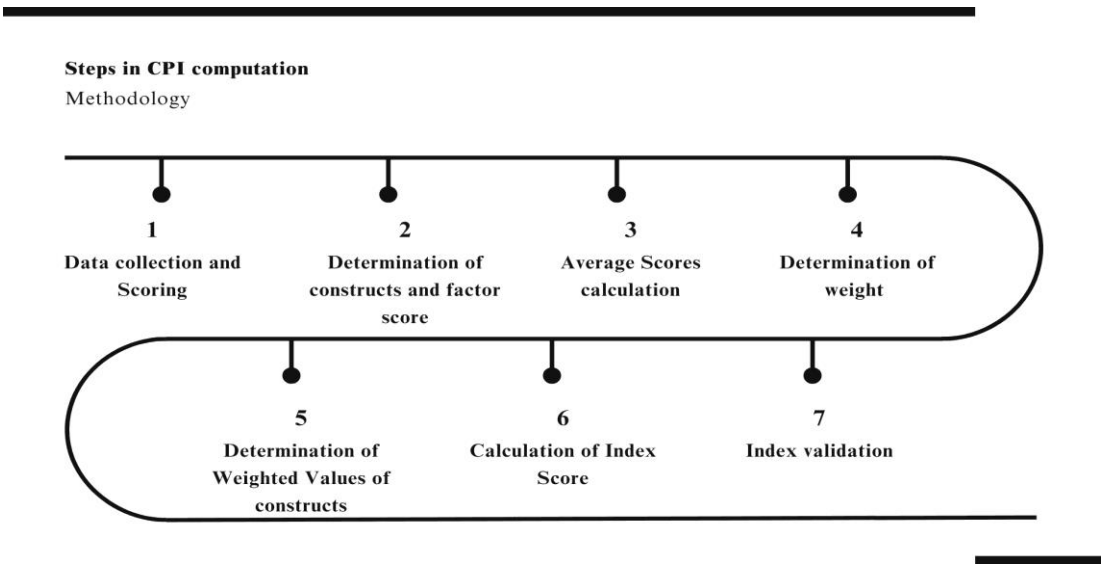


Figure 5 Flowchart summarizing the methodology

7. Findings of the study

The major findings of the study are:

i) Objective 1:

The worldwide pandemic outbreak posed multiple challenges, including mobility limitations, supply chain interruptions, and increased health and safety concerns. CEP service providers were compelled to reevaluate their current processes and adopt innovative techniques, motivated by both necessity and opportunity. These modifications have facilitated the industry's navigation through a phase of significant disruption. These innovations are summarized in five groups, namely *health and safety measures in delivery service*, *contactless delivery*, *technological innovation*, *business expansion,* and *sustainability initiatives*.

ii) Objective 2:

Factor analysis extracts the variables, leading to the discovery of five constructs grouped from 24 sub-indicators that together accounted for 83.65% of the overall variance. The factors of competitive advantages are identified, namely *logistics excellence (LE), operating efficiency (OE), innovation (INV), synergistic adaptation (SA), and disruption preparedness (DP)*.

iii) Objective 3:

The calculated average operating efficiency score is 4.78. Approximately 54% of CEP service providers perform above the average score, while 20% fall below, indicating significant variability in operational efficiency. Efficient CEP providers leverage adaptability, time-sensitive deliveries, and cost management to maintain operational continuity and achieve superior performance during disruptions. By addressing inefficiencies in flexibility, responsiveness, and processing time, low-performing providers can improve their operational benchmarks and competitiveness. *Top-performing* CEP service providers exhibit superior flexibility, quick processing, and proficiency in managing express deliveries, positioning them as reliable service providers during disruptions. *Bottom-performing* CEP service providers face challenges in flexibility, express delivery capabilities, and processing efficiency, leading to vulnerabilities during high-demand periods or crises.

iv) **Objective 4:**

Courier service quality factors are identified, and then the structural equation models (CSQ model) are created using the partial least squares approach for all the customer segments. The hypotheses are tested: (a) courier service quality positively affects customer satisfaction; (b) courier service quality has a positive direct and indirect impact on customer loyalty via customer satisfaction as a mediator; (c) courier service quality has an indirect negative impact on customer disloyalty via customer satisfaction as a mediator; (d) customer satisfaction positively affects customer loyalty and negatively affects customer disloyalty; (e) customer satisfaction and customer loyalty positively affect the willingness to pay of customers. However, there is no evidence that (f) customer disloyalty negatively affects the willingness to pay of customers.

v) **Objective 5:**

Composite indices are measured to quantify resilience.

a) The average CPI score is calculated and found to be 4.73. Among CEP service providers, 48% scored above this average, with the highest score reaching 6.60, while 52% scored below average, with the lowest score being 2.60. The clustering of the CEPs is done in four groups, namely *Stellar Achievers*, *Strong Contenders, Steady Performers, and Developing Players,* based on the arithmetic division of the obtained values. Market leaders can serve as role models for CEPs struggling to reach average performance levels, while average performers can learn from these leaders to exceed their current performance and achieve greater success.

b) The computed CSQI score of 3.43, reflecting that individual customers perceive postal services as moderately satisfactory. For private couriers, the CSQI score stood at 3.50, indicating a similar moderate satisfaction level among individual users during disruptions.

c) The computed CSQI score is 3.92, suggesting moderate satisfaction among organizational customers rated postal services, while private courier services received a higher CSQI score of 4.60, demonstrating a comparable level of moderate satisfaction during disruptions.

8. Academic contribution

This research enhances the literature on logistics resilience, particularly in the CEP sector, and contributes to the literature on uncertainty preparedness by illustrating the responses of CEP service providers to unpredictable disruptions and presenting a methodology for a composite index that quantifies CEP service providers' resilience during such events. The creation of a Competitive Preparedness Index (CPI) and Courier Service Quality Index (CSQI) represents a novel enhancement to the current body of literature. While the SERVQUAL model is commonly used to evaluate service quality, our study aimed to develop a specialized framework tailored specifically to the courier service industry. This study not only understands the antecedents but also the consequences of customer satisfaction.

9. Managerial contribution

The present study's practical implications are wide-ranging. The research has clearly stated the need for a tool to measure CEP service providers' resilience during disruption. The Competitive Preparedness Index (CPI) proposed for this study can be used by CEP service providers of different natures and located in different geographic regions to measure their position in the market. Management of Steady Performers and Developing Players may think of collaboration with the market leaders, such as Stellar Achievers in our study, for better preparedness. The findings can assist governmental entities and organizations in providing support to Steady Performers and Developing Players by offering training and resources for development. Along with that, the newly developed Courier Service Quality (CSQ) Index will offer managers an evaluation base to measure customer satisfaction with CEP services over time.

10. Suggestions

(i) **Managerial focus:** For Strong Contenders and Steady Performers, targeted improvements in operational efficiency and innovation could help bridge the gap with Stellar Achievers. For Developing Players, foundational improvements in all dimensions, particularly logistics and customer-centric adaptability, are essential.

(ii) **Alternative delivery options:** The rising cost of delivery underscores the need for customer involvement through options like self-pickup, parcel lockers, or mobile centers, offering convenience while managing costs. Post offices can act as a secure place for piloting such initiatives, enabling CEP providers to evaluate the relevance and effectiveness of these methods.

(iii) **Competitive-competition**: Adopting competitive strategies can help CEP operators sustain in a disruptive environment, but careful policy planning is crucial. Ineffective policies and government rigidity could undermine their competitiveness in the Indian market.

(iv) **Suggestions for India Post:** The study's context-specific methodology is also intended to help India Post's management, marketers, and government obtain a better grasp of the complex occurrences.

(v) **Academic research and development**: A pertinent area of discussion is the strength of the relationship between academic research and development (R&D) and the courier sector, along with how communication between these areas might be improved.

(vi) **Strategic change proposed for the CEP industry**: The strategic changes proposed to the management of CEP service providers such as strategic orientation, service configuration, value creation, business-specific factors, and linking business processes.

(vii) **Business model for courier, express, and parcel service providers**: The proposed business model for this study provides a framework to enhance the resilience and competitiveness of CEP service providers.

11. Conclusion

This study explores the preparedness of the CEP sector to navigate disruptions, particularly in geographically challenging regions like North-East India. It evaluates CEP service providers' resilience and operating efficiency, identifying strategies to enhance service quality and customer satisfaction. The findings contribute to both academic literature on logistics resilience and managerial practices, offering actionable insights for policymakers and industry leaders. By addressing gaps in existing research, the study lays a foundation for developing robust and adaptable logistics frameworks tailored to dynamic market conditions.

12. Limitations and scope for future studies

- Scholarly literature emphasizes the necessity of testing models and instruments in many situations to foster generalizability and deepen the understanding of theories. Since this is a new conceptual model developed to capture the need of a disruptive environment, this model needs to be tested in different segments of the logistics industry and supply chain as well.
- The public-private partnership (PPP) in the courier industry requires thorough exploration of how to maintain competitive delivery costs while facilitating synergy, enhanced efficiency, modernization, and economies of scale within the Indian postal sector.
- Future studies may concentrate on reconciling definitions of constructs and evaluating methodologies for integrating resilience measures from diverse sources through the composite index technique defined in this study. Moreover, extending and modifying the composite index to evaluate resilience in additional sectors and varying sample sizes may identify the specific nodes that most substantially influence or risk supply chain resilience.
- Cross-country analysis can be done by comparing the resilience management of CEP service providers in India and other countries using the CPI and CSQ.
- Other approaches to compute composite index, such as participatory-based approach, machine learning, etc., can be explored in further studies.