CHAPTER - III

RESEARCH METHODOLOGY

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3.1. INTRODUCTION

The research methodology adopted for this study is presented in this chapter. In this chapter, study population, sampling, questionnaire design, pre-test, pilot study, data collection method, reliability of data, questionnaire measurement scale, and data analysis methods are discussed.

According to the literature, prior study used simulation and mathematical models to tackle the operations management research challenge. The researchers are urged to adopt the empirical research methodology to explore management-oriented and practical aspects of operations management challenges, so it will contribute differently depending on the study's nature. (Rungtusanatham et al., 2003). Further, Swaamidass (1991) stated that "all operations management studies are suitable for empirical research, but errors in empirical research might arise throughout the study methodology, sample design, and statistical analysis". (Flynn et al., 1990), presented a framework (Figure: 3.1) that explains the empirical research methodology that can be used to record the research and processes used in operations management that provide a clear and structured methodology for the studies. Empirical literature and information are key to theoretical development. To conduct this study, empirical research methods were used.

The review of literature, as outlined in Chapter 2, shows a link between retail supply chain challenges and firm performance. It assists the sports retails in developing and implementing an appropriate supply chain practice. Based on the

nature of empirical research, it may be perceived as risky when compared to mathematical models. According to Swamidass (1991), errors in empirical research might occur in the research process, sample design, and statistical handling of data. Flynn et al. (1990) presented a strategy (Figure 3.1) to reduce possible risk, which has followed for this research.

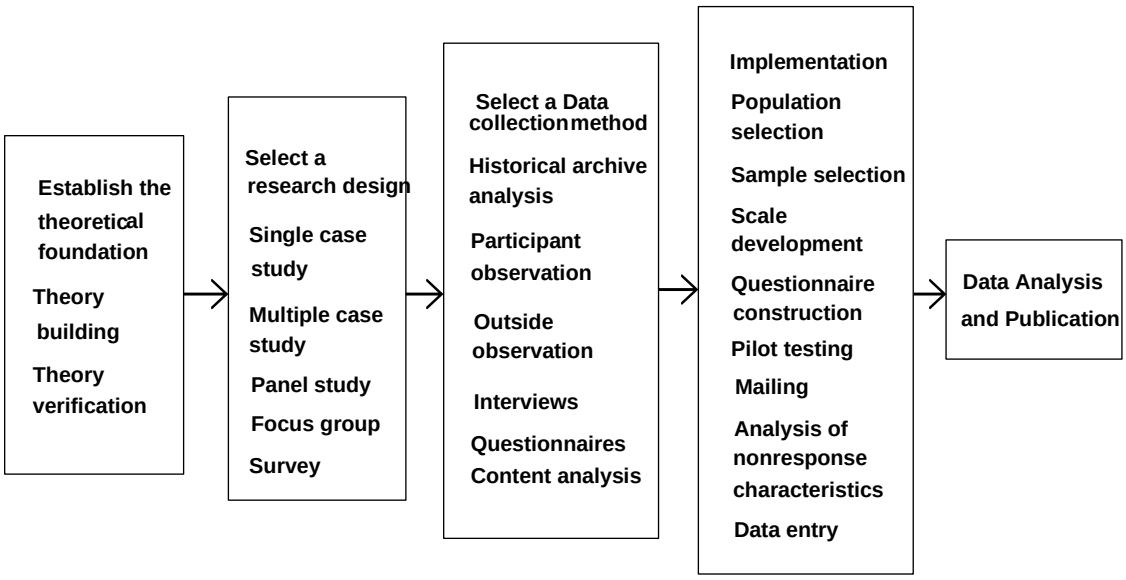


Figure: 3.1 An Approach for Empirical Research

Source: (Flynn, et al.,1990)

Constructing a conceptual framework for the supply chain management begins with clearly understanding its meaning (Ho, et al., 2002). The first step in enhancing theory development is to precisely define and specify the content domain of all constructs. This ensures that there is no confusion, ambiguity, or uncertainty about the conceptual structure of sports retail SC. All constructs are explained in chapter one to ensure clarity about the conceptual aspect of the sports retail SC. It also explored the theoretical connection between external constructions and their interaction with explained variance.

Operations management researchers have been increasingly using survey methodology to collect data for relational studies (Rungtusanatham et al. 2003). A relational study consists of an empirical examination of connections between two or more constructs or variables using either exploratory or confirmatory approaches. This study empirically investigated the challenges in the SC for sports retailers in northeast India and how these challenges impacted on their firm's performance. The study also explored how sports retailers can develop and implement effective SC strategies to improve their SCP. For this empirical research the data was gathered from both primary and secondary sources. The research, however, mainly depends on primary data. Through questionnaires and scheduled interviews with the same set of questions, the primary data was collected from the northeast India sports good's retailers for the analysis.

3.2. RESEARCH DESIGN

Kerlinger (1978), stated that "a research design is a plan, structure, and strategy created to acquire answers to research questions and control variance". This framework guides the entire research process, serving as the blueprint for collecting data, measuring, and analysis. Thyer (1993) defines "a research design as a comprehensive plan for conducting a research study, including the operationalization of variables, selection of a representative sample, data collection, and analysis". Ultimately, "the research design specifies every step of the research process, from developing the hypothesis and its operational implications to analyzing the resulting data" (Kothari, 2004). This study has

adopted the empirical research study since there is no tangible evidence based on experience or observation in the sports retailers SC challenges.

3.2.1. Study Population

Forza (2002) defined “a population as the entire group of people, firms, or plants that the researcher intends to examine”. Despite the presence of over 10,000 stores in northeast India, the number of professionals solely focused on retailing sports products is relatively small. This small group of sporting goods retailers constitutes the population under analysis in this study. This study investigates a wide range of challenges concerning the sports retail SC and retail firms’ performance to capture executives' perceptions. Individuals from northeast India sports retailers were the study's target respondents.

Even the sports retailers practice various SCM activities but still it faces diverse challenges during the operation of their business processes. Considering the challenges factors, the northeast sports retail SC is unique and different, and it also requires a separate, clear approach to dealing with the challenges and uncertainties in its supply chain. Some studies have used the databases of professional groups as their population for retail supply chain management studies; other studies haven't taken the industrial sector into account (Aslam et al., 2018; Cirtita and Glaser-Seguira, 2012). Despite the overall population of sports retailers in north-east India is small, efforts are being made to collect information from all the sports retailers in this region.

3.2.2. Sampling

Sampling is an important process where a small group of units is selected for the study from a larger population to draw conclusions about the population as a whole (Zikmund, 1997). The population consists of sports retailers located in Northeast India. As there is a lack of an appropriate sampling framework, the use of probability sampling is not feasible. So, the non-probability sampling method was adopted for this study. The convenience sampling, a widely used non-probability sampling technique, is adopted for selecting the sample in this research. The convenience sampling method is commonly employed in applied social research, even for conducting structural equation model analysis (Ruvio and Shoham, 2007; Beuckelaer and Wagner, 2012). Nonetheless, there are certain concerns associated with this method, such as the potential for a poor representation of the population and difficulties in calculating sampling error. To address these issues, increasing the sample size is necessary to ensure the research findings.

The fit of a structural equation model “the reliability of parameter estimates, and the statistical power of the analysis are all influenced by the sample size” (Peng and Lai 2012). In this study, a Partial Least Squares Structural Equation Model (PLS-SEM) was adopted to examine the proposed conceptual framework. Data characteristics, including factors like “sample size, non-normal data distribution, and the measurement scale, are frequently considered when choosing between the partial least squares structural equation model and the ordinary least squares structural equation model” (Hair et al., 2014). As per Hair et al. (2017) “a

general rule of thumb for the minimum required sample size is ten times the maximum number of arrowheads pointing at any latent variable in the path model". When determining the sample size, researchers consider the model's background and data characteristics, also may use a statistical power analysis based on the model's component with the largest predictors (Hair, Ringle, and Sarstedt, 2011).

Goodhu, Lewis, and Thomson (2012) conducted a Monte Carlo simulation to assess the accuracy and statistical power of Partial Least Squares (PLS) under various conditions of sample size, indicator reliability, and model complexity. They recommended utilizing Cohen's approach to determine the required sample size based on statistical power. Meanwhile, Hair et al. (2014) advised checking the acceptable level of quality in terms of outer loading (commonly above the threshold of 0.7), as suggested by Cohen (1992). Another approach to determining the sample size is based on the requirements to predict the R^2 values of any endogenous constructs within the structural model, considering the significance level and statistical power. "Minimum sample size requirements were calculated as recommended by Hair et al., (2017) to detect R^2 values of 0.10, 0.25, 0.50, and 0.75 in the model, considering significance levels of 1%, 5%, and 10%, assuming a commonly used level of statistical power (80%), and a specified level of complexity of the PLS path model" show in the table 3.1.

Table 3.1

Sample Size Recommendation in PLS-SEM for a Statistical Power of 80

Maximum Number of Arrows Pointing at a Construct	Significance Level											
	1%				5%				10%			
	Minimum R^2				Minimum R^2				Minimum R^2			
	0.10	0.25	0.50	0.75	0.10	0.25	0.50	0.75	0.10	0.25	0.50	0.75
2	158	75	47	38	110	52	33	26	88	41	26	21
3	176	84	53	42	124	59	38	30	100	48	30	25
4	191	91	58	46	137	65	42	33	111	53	34	27
5	205	98	62	50	147	70	45	36	120	58	37	30
6	217	103	66	53	157	75	48	39	128	62	40	32
7	228	109	69	56	166	80	51	41	136	66	42	35
8	238	114	73	59	174	84	54	44	143	69	45	37
9	247	119	76	62	181	88	57	46	150	73	47	39
10	256	123	79	64	189	91	59	48	156	76	49	41

Source: Cohen (1992); Hair, et al., (2017)

To determine the sample size for the Partial Least Squares Structural Equation Model (PLS-SEM) model with an R^2 value of 0.1 in any endogenous construct, a significant level of 1%, a commonly used statistical power of 80%, and a maximum of 10 arrows pointing at constructs in the PLS-SEM path model. This study's conceptual model comprises five independent variables (retail supply chain challenges), one mediation variable (supply chain performance), and four dependent variables (firm performance). In the PLS path diagram, there are six determinant variables (six arrows) that connect to the dependent variable.

In a general rule of thumb “to determine the minimum sample size is to have at least 10 times the maximum number of arrowheads directed towards any latent variable in the PLS path model” (Hair et al., 2014). For the purpose of statistical power analysis, the minimum sample size is determined to ensure an 80% probability of detecting an effect while accommodating variability. Accordingly, the

minimum of 256 samples are required to validate the PLS-SEM path model (table 3.1). The researcher collected a total of 670 data samples from northeast sports retailers. However, for the analysis, the researcher used only 513 usable data samples.

3.2.3. Questionnaire Design

This paragraph discussed the details development process of a questionnaire. The basic indicators related to sports retail SCM challenges were used. The objective of this questionnaire is to gather specific information from respondents. The researcher reviewed the literature from several authors and was developed the relevant questions for this study to measure the sports retail SC challenges, supply chain performance, and the firm's performance indicators.

The researcher developed the rating scale for each construct, and it was adopted to use the Likert five-point scale, which is commonly used by management researchers. According to Hair et al. (2010), this scale was designed by psychologist Rensis Likert. To measure each item of sports retail SC challenges and SCP, five-point Likert scales were used, ranging from strongly disagree to strongly agree. while, to measure each item of firms' performance indicators, five-point Likert scales were used ranging from extremely worse to extremely better. The researcher then used the statistical methods, such as content validity, reliability tests using Cronbach's Alpha, to validate the constructs questionnaire.

3.2.4. Pre-Testing

The survey questionnaire was pre-test using the sample respondents from academic subject experts in the SCM and sports retailers' executives. Fifteen experts, including five academicians and twenty sports retailer managers/senior managers, assessed the survey items.

The test was to obtain feedback on various aspects of the survey instrument used, such as its length, wording of the questionnaire, design, layout, problems in filling the questionnaire, comments on the survey instrument. The provided feedback was used and modify certain scale items to enhance clarity and improve the survey's understanding towards sports retailers SC challenges, SCP and firm's performance. The suggestions were implemented to refine the questionnaire for future use.

3.2.5. Pilot Study

A pilot study is essential to conduct a research program, validate the survey instrument, to determine the importance, feasibility, and relevance of the present study (Qrunfleh and Tarafdar, 2013). One hundred and forty sports goods' retailers were selected for the study an assess the significance and validity to carried out the present research work. Reliability was checked using Cronbach's Alpha with the aid of SPSS 26.0 software to ensure that the collected data could be used for analysis. The "Reliability coefficients range from 0.00 to 1.00, when it has the higher values, it indicates greater reliability and accuracy in further research" (Hair et al., 2010). A "Cronbach's Alpha value greater than 0.70 can be considered

reliable and suitable for future study, indicating that the constructs are internally consistent factors" (Nunnally, 1978). Scale reliability test Cronbach's alpha indicates greater than (>0.7) suggests that all the measuring scale has good reliability.

3.3. DATA COLLECTIONS

3.3.1. Type of Data Collected

The researcher gathers both of primary and secondary data sources for the analysis. The secondary data was gathered from various sources, like research articles, books, websites and journal etc., to developed a strong conceptual background including the literature review. The primary data were collected from various Northeast India sports good's retailers.

3.3.2. Methods of Data Collection

In a survey method a structure questionnaire type of data collection is adopted to gather the necessary data for testing all the research hypotheses. Kerlinger and Lee (2000) stated that "the Survey method is an appropriate cost-effective method to collect a large number of samples and allow the researchers to quantify the responses and conduct statistical analysis to validate the results". This approach allowed us to understand the impact of retail SC challenges that sports retailers are facing in their SCP and firms' performance.

To collect the data from the respondents, the printed survey questionnaires were distributed directly to the executives or managers of sports goods retailers from the eight different states of Northeast India. Since there are difficulties in obtaining data, the researcher used convenience sampling approach for this study (Zhu, Sarkis, and Lai, 2008) and the researcher collected a total of 670 data from northeast sports retailers. However, for the analysis, the researcher used only 513 usable data.

3.4. RELIABILITY OF QUESTIONNAIRE DATA

The scale reliability is shown in the table.3.2 indicating the co-efficient of correlation, internal consistency and reliability of the measurements for the five constructs of sports retail SC challenge, SCP as mediator and four firms' performance indicators.

Table. 3.2

Reliability (Cronbach's Alpha) of all Measurement Scales

Scale	Dimension	Cronbach's Alpha
Retail Supply Chain Challenge	Demand Management Challenges (DeMC) Distribution Management Challenges (DiMC) Environment Uncertainty Challenges (EUC) Information Management Challenges (IMC) Sourcing challenges (SC)	(α= 0.924*) (α= 0.892*) (α= 0.916*) (α= 0.914*) (α= 0.869*)
Performance	Supply chain performance (SCP)	(α= 0.846*)
Firm Performance Indicators	Delivery performance (DP) Financial performance (FP) Inventory performance (INP) Customers service and satisfaction (CSS)	(α= 0.908*) (α= 0.896*) (α= 0.852*) (α= 0.820*)

3.5. MEASUREMENT SCALES AND INSTRUMENT

The conceptual framework was developed from the existing literature. In literature, the relationship between independent and dependent variables was discussed. This section provides a detailed view of how the measurement items for the construct variables were chosen. A total of ten dimensions were used in constructing the conceptual framework, five of which related to sports retail supply chain challenges, one as a mediator and four as firms' performance indicators. For the purposes of the study, a structured questionnaire is constructed with six measured items in each dimension of sports retail SC challenges, five measure items for the SCP and five measured items in each firms' performance indicator.

3.5.1. Measurement Scale of Demand Management Challenges

Demand management refers to a firm's ability to comprehend its customers' demands as well as their needs and manage them against the supply chain's capabilities (Lambert and Cooper, 2000). To handle demand and supply efficiently, a sports goods retailers must understand the potential demand of its customers as clearly as possible. Thomas, R. W., et al. (2010) state that "retailers must build highly sensitive supply chains in order to meet rapidly evolving consumer demands". Crandall and Markland, R. E. (1996) examine the challenge of demand management in service industries, highlighting capacity management and the classification of DeM strategies. Taylor (2009) study the complexity and challenges involved in demand management and its coordination with SCM and emphasize the need for research to address these challenges effectively.

The items in the table 3.3 were developed from Lambert and Cooper, 2000), Crandall and Markland, R. E. (1996), Thomas, R. W., et al. (2010), Taylor and Fearne (2009); Croxton et al., 2002; Daniel Rexhausena et al. (2012) to measure the DeMC of northeast sports retailers.

Table 3.3

Measurement Scale of Demand Management Challenges

Indicators	Items	Cronbach's Alpha
DeMC1	A clear demand forecasting process is implemented in our retail SC operations.	(α= .916)
DeMC2	The retail firm monitors forecast accuracy to respond to inaccuracies.	(α= .894)
DeMC3	The retail products are segmented according to the specific SC requirements.	(α= .858)
DeMC4	When demand changes, the retail SC responding quickly to customer demand.	(α= .908)
DeMC5	Retail SC achieved the desired demand management performance.	(α= .921)
DeMC6	The performance of sales and operations planning meet the objectives of the firm.	(α= .902)

3.5.2. Measurement Scale of Distribution Management Challenges

The systems and operational needs of distribution networks have changed since modern technological and business advancements, leading to it being challenging to redesign their networks and distribution chains (Ashayeri et al., 2005). Mangan, J., et al. (2008) provides "a comprehensive overview of challenges faced in distribution management in global logistics and SCM. Brintrup, A., et al. (2017) address the challenges of order picking and delivery routing in retail distribution operations and discusses distributed optimization techniques to

improve operational efficiency and customer service in the context of distribution management. Baker, P. (2008) looked at nine case studies to construct different business units and operate distribution Centre's to respond quickly to their markets. The study also looked at the time and service-level consequences of dealing demand and supply fluctuations. Fernie (1989) has noted that distribution has become an integral aspect of marketing strategies for retailers', resulting in numerous companies rethinking their distribution strategies and implementing significant changes.

A six-item was established from Daniel Rexhausena et al. (2012), Ashayeri, J., (2005), and Mangan, J., et al. (2008), Brintrup, A., et al. (2017), and Larson et al. (2007), to measure the DiMC of northeast sports retailers, as given in the table 3.4.

Table 3.4

Measurement Scale of Distribution Management Challenges

Indicators	Items	Cronbach's Alpha
DiMC1	The retail firm clearly defined the distribution management processes.	(α= .914)
DiMC2	The retail firm follows and executes the distribution management method.	(α= .864)
DiMC3	The firm's distribution management maintains an efficient flow of goods and consistency in delivering the quantity of product to our customers.	(α= .902)
DiMC4	The firm's supply chain uses multiple modes of transportation to meet delivery schedules.	(α= .868)
DiMC5	The retail firm maintains a sufficient supply of products in regional distribution centres to quickly respond to customer demand at the right time.	(α= .906)
DiMC6	Distribution management meets the operational needs of our retail firm.	(α= .890)

3.5.3. Measurement Scale of Environment Uncertainty

Vickery et al., (1999) used “five items namely marketing practices, product obsolescence rating, unpredictability of major competitors' firms, and change in production or service mode, to measure environmental uncertainty”. Paulraj, A., & Chen, I. (2007) employed resource dependency theory to explain the direct effect of supply chain uncertainty on strategic supply management. Fynes, B., et al. (2004) developed “a model of environmental uncertainty, SC relationship quality, and SC performance”. Kreiser, P (2002) “categorized and discussed the development of environmental uncertainty to provide future researchers with greater precision and consistency in the construct's use”. Davis (1993) stated that “environmental uncertainty encompasses demand variability, supply disruptions, and changes in market conditions”. Liu, B., & Wang, Y. (2020) explore different dimensions of environmental uncertainty, including market, technological, regulatory, and natural uncertainty and examines how these uncertainties influence supply chain risk, such as disruptions, volatility, and complexity.

The six-item scale was developed for measuring the environmental uncertainty of northeast sports retail from Rogers, D. S., et al. (1998); Wong, C. Y., et al. (2011); Fynes, B., et al. (2004), Paulraj, A., & Chen, I. (2007), Davis (1993) and Kreiser, P., & Marino, L. (2002), given in Table 3.5.

Table 3.5

Measurement Scale of Environment Uncertainty

Indicators	Items	Cronbach's Alpha
EUC1	The firm's demand fluctuates drastically from week to week.	(α=.861)
EUC2	The firm's suppliers regularly supply the required product to meet our requirements.	(α=.902)
EUC3	Retail firm have unreliable or unpredictable partners to supply the product demand.	(α=.917)
EUC4	Depending on product demand, our firm's suppliers deliver consistently quality products.	(α=.894)
EUC5	Retailers maintain weeks' worth of essential materials in stock to respond to future demands.	(α=.906)
EUC6	Even when there is uncertainty in the business environment, the product volume or demand for goods is scheduled and delivered.	(α=.885)

3.5.4. Measurement Scale of Information Management Challenges

Zhou et. al., (2007) stated that sharing effective information improves SC movement that impact their practices. Xie, Y. (2013) analyses information technologies by identifying their functions and features, also considering the strategic and operational advantages and problems in retail SC. Information technology and information-focused capabilities have increasingly been viewed as key predictors of a firm's performance. Lee and Whang (2000) explain that "the evolution of SCM has been greatly influenced by advancements in information system technology". These technological advancements have enabled supply chain partners to collaborate and optimize chain-wide performance, sharing the

resulting profits. Information exchange, facilitated by improvements in information technology, played a vital role in enabling tight coordination.

The measurement scale for information management challenges of northeast sports goods retailers was developed from Lee et al. (2000); Chow et al., 2008; Tan, K. C. (2002); Taylor, C. R., et al., (2020) Mentzer and Ponomarov (2012), Prajogo, D., and Sohal, A. (2013), as given in the table 3.6.

Table 3.6

Measurement Scale of Information Management Challenges

Indicators	Items	Cronbach's Alpha
IMC1	The retail firm effectively shares operational information externally with our key suppliers.	(α=.921)
IMC2	Retail firms update and provide accurate product information in a timely manner to our customers.	(α=.906)
IMC3	The firm gets prior information on new product introductions.	(α=.913)
IMC4	The firm supplier provides accurate product price information when the product's pricing policy changes.	(α=.842)
IMC5	When product demand changes, the retail firm exchanges information with suppliers regarding product specifications.	(α=.896)
IMC6	The retail firm shares the relevant operational information between departments to operate its supply chain effectively.	(α=892)

3.5.5. Measurement Scale of Sourcing Challenges

Supplier selection is a fundamental challenge in retail sourcing. The complexity of choosing the right suppliers is highlighted by Handfield, et al., (2002) “emphasizing the importance of evaluating suppliers not only based on cost but also on their ability to meet quality standards, delivery timelines, and sustainability practices”. Kang (2001) “investigated the various benefits and challenges of retail SC in global sourcing” and Lowson (2001) examined the “current issues of low-cost goods sourced from low-wage global suppliers”. H. Liu and P. McGoldrick (1996) look “at the current trends in international retail sourcing and differentiate between international sourcing by manufacturers and international sourcing by retailers”. Towers et. al., (2010) evaluated sourcing challenges included delivery, flexibility, affordability, quality, reliability, and cultural challenges. The study identified unexpected delivery risks, language barriers, and inflexible negotiations as major sourcing challenges.

The six items presented in the table 3.7, was developed from Shruti et al. (2015); Wagner, S. M., & Bode, C. (2008); Kang (2001), and H. Liu and P. McGoldrick (1996), Towers (2010) for measuring the sourcing management challenges of northeast sports retailers.

Table 3.7

Measurement Scale of Sourcing Challenges

Indicators	Items	Cronbach's Alpha
SC1	The firm implements an effective sourcing process to procure adequate products to meet consumer demand.	(α= .914)
SC2	The firm's supply chain has logistics support when product is sourcing.	(α= .896)
SC3	The retail firm identifying qualified sources for product procurement.	(α= .906)
SC4	The retailers don't face the risk of fluctuating currency exchange rates when we source the products.	(α= .847)
SC5	Regulations such as customs duties or the region have no effect on our firm's sourcing processes.	(α= .869)
SC6	The retail firm clearly defines the quality and quantity of demand and chooses suppliers that meet the requirements.	(α= .908)

3.5.6. Measurement Scale of Supply Chain Performance

SCP in sports goods retailers plays a significant role in modern businesses, determining their competitiveness, profitability, and customer satisfaction. It measures the efficiency, effectiveness, and adaptability of the firm's relationship with its suppliers, manufacturers, distributors, and logistics partners. It balances cost containment, timely delivery, product quality, flexibility, and environmental activities. Supply chain performance evaluations provide details regarding risk reduction, disruption navigation, and innovation utilization.

Understanding how to effectively evaluate supply chain performance can assist sports retail organizations in identifying areas for development and creating resilient supply chains. “Performance measurement in SCM is important for evaluating overall performance” Sharma, S. K. (2016). Bragg (2002) opines, “if you cannot measure supply chain performance, you cannot control or improve performance”. “Performance measures that accurately reflect supply chain operations are required to support continuous improvement within a supply chain” (Guiffrida, A. L and Nagi, 2006). Beamon (1999) explores “the concept of evaluating and measuring the SC performance, emphasizes the importance of effective performance measurement in managing and improving SC operations and also discusses the various performance measures and metrics commonly used in assessing supply chain performance, including cost, quality, flexibility, and delivery time”. Sundram et al. (2011) conducted a study “to explore the relationship between various SCM practices and SCP, including supplier strategic partnerships, customer relationships, information sharing, information quality, postponement, agreed vision and goals, as well as risk and reward sharing”. According to Hausman (2000) “SCP is characterized by fulfilling end customers' requirements, which include product availability, on-time delivery, and maintaining the necessary inventory and capacity within the supply chain to ensure a responsive delivery of such performance”.

To measure the scale of SCP of northeast India sports goods retailers was established from Sharma, S. K. 2016; Sundram et al. 2011; Hausman. 2000; Bhagwat and Sharma, 2007; Ying, S., et al. 2021, as given in the table 3.8.

Table 3.8

Measurement Scale of Supply Chain Performance

Indicators	Items	Cronbach's Alpha
SCP1	The firm's forecasting and material planning are accurate most of the time.	(α= .861)
SCP2	The retail firm has consistently supply of product at right cost	(α= .921)
SCP3	The firm has fast response times to customers demand	(α= .904)
SCP4	The firm maintaining the sufficient supply of quality product	(α= .896)
SCP5	Retail firm maintain the stock out	(α= .840)

3.5.7. Measurement Scale of Delivery Performance

Firm delivery performance" refers to the ability of a retail company to efficiently and effectively deliver products or services to its customers. This aspect of performance is crucial for maintaining customer satisfaction, meeting demand, and ensuring smooth operations within the retail supply chain. Johnson, M., et al. (2019) examine the various last-mile delivery strategies adopted by delivery firms and their influence on performance metrics such as delivery speed, cost efficiency, and customer satisfaction. Ahmad, S., and Schroeder, R. G. (2001) establish a conceptual framework, outlining the key components of delivery performance, which include delivery speed, accuracy, reliability, and responsiveness. They stated that these elements are crucial in determining how well a company can meet its customers' delivery expectations and demands.

In Stewart, G. (1995) research, several metrics are identified to measures of delivery performance, his research shows a general pattern of lead time reduction as an operational approach to enhance delivery performance. Rao, M. C., et al. (2011) introduce delivery performance measurement in the context of integrated SCM explore the practical implementation of delivery performance measurement strategies and also provided an overview of SCM practices. The results provided insight into the firm's delivery reliability, lead times, and order fulfilment accuracy.

The measurement scale of delivery performance for sports retailers was developed from Johnson, M., et al. (2019), Ahmad, S., and Schroeder, R. G. (2001), Stewart, G. (1995), Rao, M. C., et al. (2011).

Table 3.9

Measurement Scale of Delivery Performance

Indicators	Items	Cronbach's Alpha
DP1	On time deliveries	(α= .894)
DP2	Delivery accuracy	(α= .891)
DP3	Delivery flexibility	(α= .869)
DP4	Order fulfillment time	(α= .906)
DP5	Delivery reliability	(α= .918)

3.5.8. Measurement Scale of Financial Performance

Firm financial performance" pertains to the financial health and profitability of a retail company. It involves analyzing various financial indicators and metrics to assess the company's overall financial well-being and efficiency in generating profits. Financial performance is a key component of business success, reflecting

the achievement of a firm's economic goals (Chen and Paulraj, 2004). Profit margin, for instance, indicates the net income generated per unit of sales, representing a key survival goal for every company (Lusch and Brown). Shawnee K. Vickerya et al., (2003) looked into how an integrated supply chain strategy affected performance, specifically how well customer service performed and how it affected financial success.

To measure financial performance, the study employed a set of traditional performance measures. The five items presented in the table 3.10, were obtained and developed from Chen and Paulraj (2004), Siguaw et al., (1998), Shawnee K. Vickerya et al., (2003), Byrd and Davidson (2003), Lusch and Brown, 1996 to measure the financial performance of sports goods retailers in northeast India.

Table 3.10

Measurement Scale of Financial Performance

Indicators	Items	Cronbach's Alpha
FP1	Gross Profit Margin	(α= .906)
FP2	Net Profit Margin	(α= .892)
FP3	Return on Assets	(α= .904)
FP4	Return on Equity	(α= .896)
FP5	Operating Cash Flow	(α= .846)

3.5.9. Measurement Scale of Inventory Performance

Inventory performance is the measurement and assessment of a firm ability to respond to customer demand while minimizing the costs and optimizing efficiency through inventory management. (Billesbach, T. J., & Hayen, R. 1994). Effective inventory management is an important aspect of any successful business

operation. A company's inventory performance plays a pivotal role in determining its profitability, customer satisfaction, and overall operational efficiency. In order to fulfil consumer demand, minimize holding costs, and lower the risk of stockouts or surplus inventory, firms must carefully control inventory levels. According to (Fyke and Cohen, 1994) estimates, inventory products account for about half of the cost of current assets. Traditionally, businesses maintain inventory to address uncertainties; however, sometimes it can result increased lead times (Slack et al. 1995).

The total cost of inventory in a supply chain (Lee and Billington, 1992; Rao, C. M., & Rao, K. P. (2009); Stewart, 1995; Billesbach, T. J., & Hayen, R. 1994; Kim, G. W. (2023) includes opportunity costs, service costs, held-up costs, risk costs, scrap and rework costs, and shortage costs. These costs include warehousing, capital, stockout rate, incoming stock levels, work in progress, inventory costs, finished goods in transit, risk costs, scrap and rework costs, and lost sales or lost production costs.

The five items presented in the table 3.11, were obtained and developed from Fyke and Cohen, (1994), Slack et al. (1995), Rao, C. M., & Rao, K. P. (2009), Billesbach, T. J., & Hayen, R. (1994), Kim, G. W. (2023), Gil, Whan, Kim. (2023) to measure the Inventory performance of sports goods retailers in northeast India.

Table 3.11

Measurement Scale of Inventory Performance

Indicators	Items	Cronbach's Alpha
IP1	Inventory turnover	(α= .896)
IP2	Days sales of Inventory	(α= .869)
IP3	Return on investment in Inventory	(α= .906)
IP4	Inventory holding cost	(α= .891)
IP5	Inventory stockout Rate	(α= .912)

3.5.10 Measurement Scale of Customers Service and Satisfaction

Customer service and customer satisfaction are crucial aspects of any business or organization. Customer service and satisfaction are important factors that affect business success and are measured based on customer expectations and service quality (Ok, S., et al., 2018). It plays a key role in building strong customer relationships, fostering loyalty, and ultimately driving business growth. "Retailers are increasingly recognizing customer service as a key factor that sets apart from competitors" (Ellram et al., 1999).

To enhance supply chain performance and foster efficiency and growth, Sabath (1995) suggests implementing service measurements at each stage of the supply chain. This approach allows retailers to gauge their ability to serve customers effectively (Hausman, 2000).

Tan et al. (1999) further emphasize that maintaining high service quality positively impacts growth and return on assets. "Customer service is essentially a process that aims to maximize the total value for a customer by offering significant value-added benefit to the supply chain in a cost- effective manner" Coyle (2010).

The five items presented in the table 3.12, were obtained and developed from Ok, S., et al., (2018), Sabath (1995), Hausman, (2000), Waller et al., (1999), Oh, H. (1999), Chopra and Meindl (2001), Tan et al. (2003), Ellram et al., (1999) to measure the Customers Service and Satisfaction of sports goods retailers in northeast India.

Table 3.12

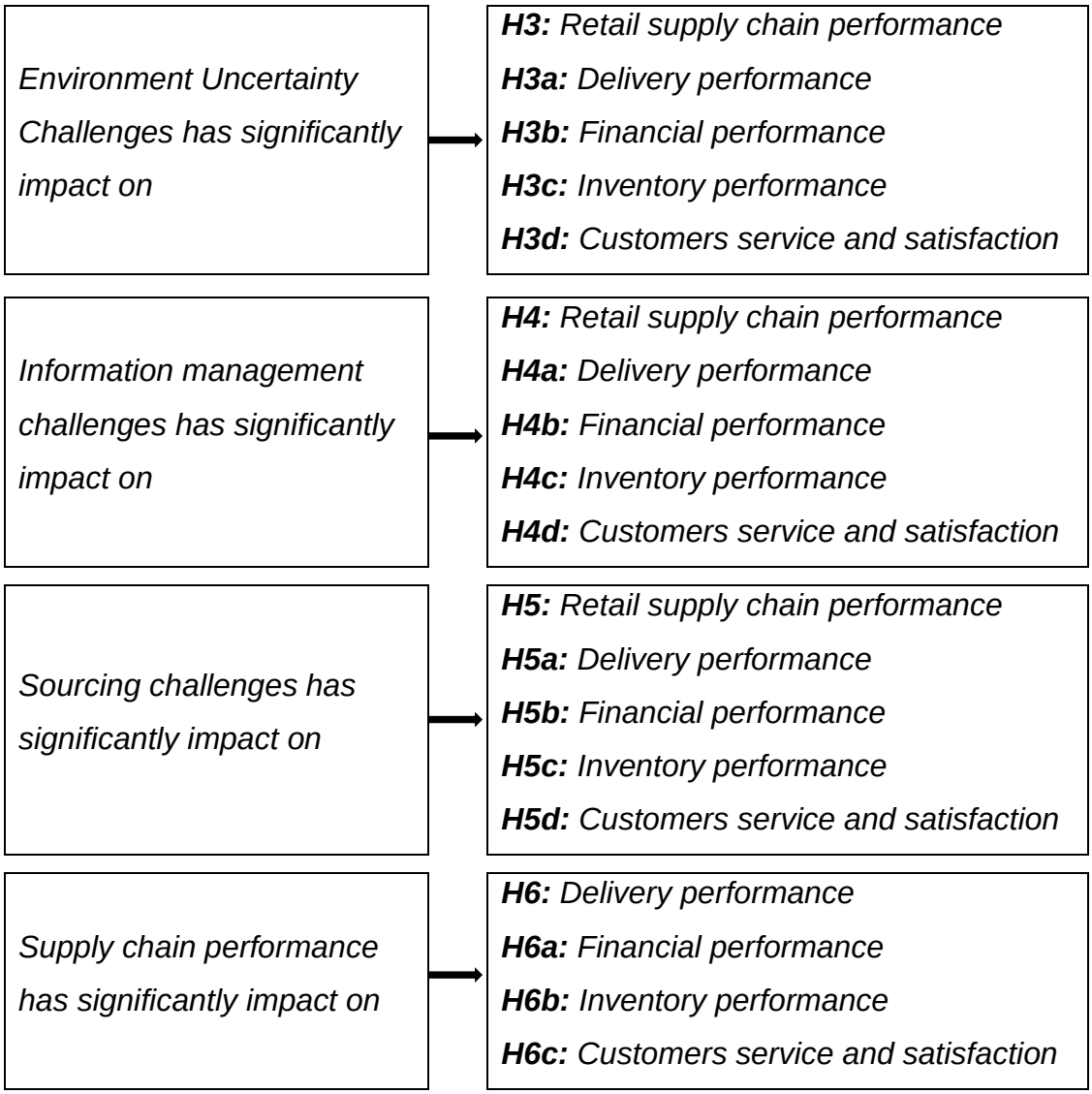
Measurement Scale of Customers Service and Satisfaction

Indicators	Items	Cronbach's Alpha
CSS1	Product quality	(α= .908)
CSS2	Order fulfilment	(α= .894)
CSS3	On time delivery	(α= .916)
CSS4	Customers retention	(α= .892)
CSS5	Service quality	(α= .861)

3.6. RESEARCH HYPOTHESES

The research hypotheses given in the following are frame based on the objective of the study:

Demand management challenges has significantly impact on →	***H1:*** *Retail supply chain performance* ***H1a:*** *Delivery performance* ***H1b:*** *Financial performance* ***H1c:*** *Inventory performance* ***H1d:*** *Customers service and satisfaction*
Distribution management challenges has significantly impact on →	***H2:*** *Retail supply chain performance* ***H2a:*** *Delivery performance* ***H2b:*** *Financial performance* ***H2c:*** *Inventory performance* ***H2d:*** *Customers service and satisfaction*



3.7. DATA ANALYSIS METHODS

The data analysis method consisted of seven stages using descriptive analysis and Partial Least Squares-Structural Equation Model (PLS-SEM). The data was coded, and a master data sheet was created in MS Excel as a CSV file, and imported into IBM SPSS 26.0 for conducting descriptive analysis. Additionally, the same data was imported into Smart-PLS 4.0 for the PLS-SEM analysis.

Sreedevi and Saranga, (2017) stated that “PLS-SEM is a widely adopted method for investigating the direct and indirect effects of multiple variables simultaneously”. The “PLS-SEM is a non-parametric method that does not require multivariate normality of the data. The primary goal of PLS-SEM is to maximize the variance explained by the endogenous latent constructs while minimizing the unexplained variances” (Hair et al., 2017). Peng and Lai, (2012) stated that “One of the advantages of the PLS-SEM is that it does not impose restrictions on sample size, unlike covariance-based SEM, and often yields higher statistical power”. PLS-SEM is particularly suitable for research objectives focused on theory development and explaining variance (Gefen and Straub, 2005). As the research field of the study is less mature and exploratory in nature, PLS-SEM is the preferred technique.

To ensure the accurate application of PLS-SEM in operations management research, the study adhered to the guidelines recommended by Peng and Lai (2012) for using PLS-SEM. This analysis followed the procedures outlined by Gefen et al. (2011), Gefen and Straub (2005), Ringle et al. (2012), Hair et al. (2014), and Hair et al. (2017) to maintain the validity of the analysis and to present comprehensive and relevant information in the report, avoiding any kind of errors, redundancies, or inadequacies.

Stage 1: Demographic Details of Respondents and Descriptive Analysis

The descriptive statistical analysis was conducted using IBM SPSS 26, and the detail results were given. Demographic details of the respondents encompass, such as sports retailing products, years of experience in sports goods retail, annual

sales of the retailers, sourcing products, place of product orders, number of brands dealt, organized or unorganized firms, and retail locations. The frequency, graph, mean, range, and standard deviation values for each observed construct of the respondents were analyzed. These findings were presented in Chapter 4.

Stage 2: Validity and Reliability

The validity and reliability of the measuring scales for each of the 10 constructs was tested using the collected data. Convergent and discriminant validity were used to examine construct validity. At the indicator level, item loading and corresponding t-statistics were examined to ensure convergent validity. It also calculated the average variance extracted (AVE) at the construct level to further assess convergent validity. To test the measurement scale's reliability, we computed Composite Reliability (CR) and Cronbach's alpha.

The discriminant validity of all constructs was calculated using the Fornell-Larcker criterion. Specifically, we compared the square root of AVE with the related inter-construct correlations in the construct correlation matrix. The results indicated sufficient discriminant validity for all the study constructs. The reliability test was conducted for all the measurement scale used in this research. The scales assessed were as follows: Demand Management Challenges (DeMC) Scale, Distribution Management Challenges (DiMC) Scale, Environmental Uncertainty (EU) Scale, Information Management Challenges (IMC) Scale, Sourcing Challenges (SC) Scale, Supply Chain Efficiency (SCE) Scale, Delivery Performance (DP) Scale, Financial Performance (FP) Scale, Inventory Performance (IP) Scale, Customer Service and Satisfaction (CSS) Scale.

Stage 3: Model Estimation

To analyze the structural equation model, the researcher adopted partial least squares (PLS) approach. The PLS tests were performed using Smart PLS 4. 0 software. The "Covariance-Based Structural Equation Model (CB-SEM) is a confirmatory technique that focuses on the theoretically established relationships of the model and aims to minimize the differences between the sample matrix of covariance and the model-indicated covariance matrix," Hair, Ringle, and Sarstedt (2011).

Using the Smart-PLS software, a route model was built with five constructs addressing the retail supply chain challenges, four on firm performance, and one mediator. The PLS algorithm was selected to estimate the PLS path model. SmartPLS 4.0 no longer offers the option to change the settings for the PLS-SEM algorithm. “The permanent setting is 3,000 iterations, which represents the maximum number of iterations used for calculating PLS results” (Hair et al., 2022; Ringle, C. et al. 2024). This number should be large enough to avoid stopping the algorithm due to the stop criterion. The Stop Criterion option is no longer available, and the permanent setting is 10E-7. For each measurement model connection, SmartPLS sets the PLS-SEM algorithm's starting value to 1.0 (Hair et al., 2017). The R^2 values of the latent endogenous variables, the path coefficient for the structural model, and the outer loadings for the measurement models were all calculated using PLS-SEM.

Stage 4: Evaluation of the Reflective Measurement Model

Hair et al., (2014) stated that “reflective measurement models is a measurement model specification in which it is assume that indicators are caused by the underlying construct”. In this study, all ten-construct discussed in the conceptual model are latent variables that need to be measures indirectly. These constructs pertain to the sports retailers SCM challenges and their firms' performance indicators. By their nature, they reflect their indicators, making them reflective constructs. Reflective research is use for addressing complex and strategic managerial issues (Fabbe-Costes & Jahre, 2008). Hair et al., (2011) stated that “reflective indicators are the function of the latent construct, and the latent constructs are reflected in the indicator variables”. In PLS-SEM, outer loading refers to the coefficient value of the relationships between the indicator and the latent construct. Ringle et al., (2012) stated that “researchers often use confirmatory factor analysis (CFA) before model evaluation, it is preferable to evaluate measures using PLS-SEM statistics, considering that the parameter estimates depend on the specific model set-up, it is more appropriate to evaluate these measures via PLS-SEM statistics”. Gefen, et al., 2011 recommended “to report factorial validity, the equivalent of confirmatory factor analysis”. The researchers checked the confirmatory factor analysis using cross loading of the items. “The cross loading on the associated construct should be greater than all of its loading on the other constructs” (Hair, et al., 2014).

Stage 5: Evaluating Structural Relationships between the constructs

Ringle, C. et al., (2024) stated that “bootstrapping is a statistical method used to create subsamples from the original data, which subsample is being used to measure the PLS path model”. This process is repeated until the random subsamples are created, typically around 10,000. The parameter measure obtained from these subsamples are used to derive 95% confidence intervals for significance testing”. The “Bootstrapping also provides standard errors for the estimates, allowing t-values to be calculated to measure the significance of each estimate. The number of subsamples should be large to ensure stability of results. For the initial assessment, a smaller number of bootstrap subsamples (1000) may be used, as it requires less time. The final results preparation, a large number of bootstrap subsamples (10,000)” is recommended (Hair et al. 2022; Becker et al. 2023; Ringle, C. et al., 2024).

Using 513 cases and 10,000 samples, a bootstrapping analysis was performed using SmartPLS 4.0 to obtain t-statistics to determine the significant relationships within the latent variables of the research construct. The number of observed samples and the number of cases were equal. Using MS Excel's T-distribution (TDIST), P-values were determined. The path coefficients' significance was examined using T-statistics. All the variable of the research construct has direct relationship in the path Diagram.

Stage 6: Evaluating the Structure Model of the Study

Evaluating the model begins after testing its convergent and discriminant validity. The first stage is to measure the collinearity in the structural model.

IBM SPSS was used to compute the Variance Inflation Factor (VIF) for testing collinearity. Literature provides different perspectives on how to check the significance of structural models by examining the R^2 value, f^2 effect size values, q^2 effect sizes, and Q^2 predictive relevance. “Endogenous latent variables with R^2 values of 0.75, 0.50, or 0.25 are considered substantial, moderate, and weak, respectively” (Peng & Lai, 2012; Hair et al., 2014).

The change in R^2 was computed by removing a specific exogenous variable from the model. At the same time, effect sizes f^2 were calculated by using the R^2 included value and the R^2 excluded value, respectively. The formula for calculating effect size f^2 is:

$$f^2 = \frac{R^2 \text{ Included} - R^2 \text{ Excluded}}{1 - R^2 \text{ Excluded}}$$

To determine effect size (f^2), Cohen's (1988) guidelines “suggest the values 0.02 as small effect, 0.15 as medium effect, and 0.35 as large effect of the exogenous latent variable”. The “Predictive relevance is evaluated using the blindfolding procedure in SmartPLS 4.0 and the Stone-Geisser Q^2 criterion” (Chin, 2010; Hair et al., 2011). The Q^2 value was calculated for the latent variable with an omission distance of five. The Q^2 value greater than zero shows that the structural model has predictive relevance for the specific construct. This value was measured using a cross-validated redundancy approach. The Partial Least Squares SmartPLS approach is particularly suitable for assessing the structural equation model and its overall fitness, as it emphasizes the model’s predictive capabilities. The model's predictive capability is tested using the blindfolding test.

Stage 7: Evaluating the Mediating Role of Supply Chain Performance (SCP)

According to the literature, many researchers have conducted mediation tests using various methods, including the Sobel test and Preacher and Hayes's approach for calculating variance accounted for (VAF).

The "Sobel test was not considered as it primarily examines the relationships between the independent and dependent variables rather than the relationships involving the mediator. Hair et al., (2014) stated that "the Sobel test is not suitable for testing mediation effects in the PLS-SEM model". The Preacher and Hayes method is more suited for the PLS-SEM method as it has more statistical power than the Sobel test (Hair et al., 2017).

To check" the direct relationships' significance level, Hair et al. (2014) suggested "that the significance of each direct relationship was tested before conducting the mediation test. After testing direct relationships, the significance of the indirect effect was checked by incorporating the mediating variable with the independent and dependent variables". Bootstrapping analysis was then conducted to determine the significance of these relationships. After identifying the significance of the indirect effect, the VAF was calculated. VAF measures the proportion of the indirect effect relative to the total effect, using the formula VAF = (P12 * P23) / (P12 * P23 + P13). Figure 3.2 depicts the mediation model.

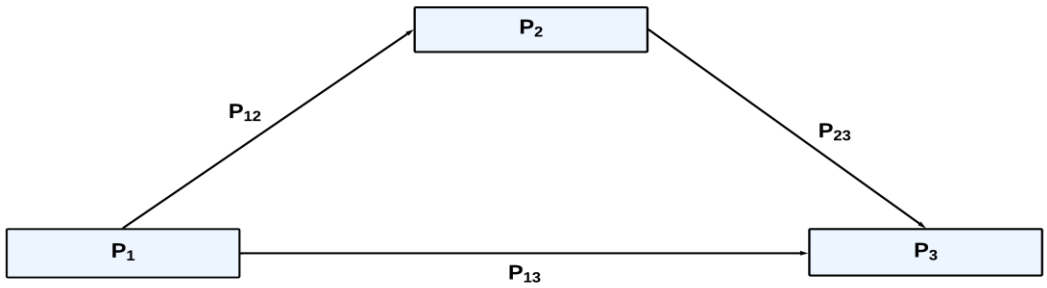


Figure 3.2 Mediator Model

3.7 Chapter Summary

The research design was discussed in this chapter. The literature highlights the importance of empirical research for retail SCM to adopt and refining the best supply chain practices. This empirical research focuses on the Northeast India sports goods retail industry. A systematic approach and adequate sample size selection is required to test the conceptual framework without α or β errors. Following recommendations from researchers, the statistical power was used to determine the sample size. Since the population size is unknown, it is not feasible to use probability sampling methods. Therefore, convenience sampling, a nonprobability method, was used. A path model with ten reflective measurement constructs was developed, with measurement models adapted from existing literature. The measurement scale was distributed to respondents, resulting in the collection of 513 samples through convenience sampling. The constructs were validated, and the model was analyzed using the SmartPLS tool. The mediation effect of supply chain performance (SCP) was tested by calculating the Variance Accounted For (VAF).