Quantifying the Mediation of Firm's Internal Integration on Supply Chain Uncertainty and Customer Satisfaction: Study from Oil and Lubricant Industry

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Abstract: This study evaluates the facets of Supply Chain Uncertainty, Strategy Innovation, Firm's Internal Integration, and Customer Satisfaction within the Oil and Lubricant Industry of Pakistan. In this explanatory research, a model is developed to validate the premise of drafting a value-creating Firm's internal Integration to assist and implement in Oil and Lubricant Industry. The study exploits the primary data source from 150 professionals working in Industry; Structural Equation Modelling analyzes data from the respondents. The antecedent of Supplier uncertainty negatively affects firm's internal integration and Customer satisfaction. In contrast, Technology Uncertainties positively affect Customer satisfaction. However, the moderating effect of Strategy Innovation amplifies the relationship between Firm' Internal Integration and Customer Services. To increase Firm's Internal Integration, managers need to comprehend the dynamics of Supply Chain uncertainty and adopt strategies for innovation to satisfy end customers. The study exclusively focuses on Oil and Lubricant Industry of Pakistan and the first of its kind. In contrast, previous research about Supply Chain Uncertainty and Integration has been conducted outside Pakistan. Future examinations can include more elements and can increase the demographic horizon by involving other industries as well. It is recommended to take Supply Chain Resilience as a mediating variable in studies to evaluate firms' integration effect. The study results make a theoretical contribution to existing literature due to analyzing the mediating effect of a Firm's internal Integration among Uncertainty and Customer satisfaction yet moderating through Strategy Innovation within the context of Oil and Lubricant Industry of Pakistan.

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1.   Introduction

Many supply chains become unsuccessful in delivering products and services to the customers during the coronavirus pandemic(Salih & Salih, 2025). At the start of COVID-19, it was initially observed as a Chinese local matter. But it adversely affected the global supply chains; reportedly, 95% of Fortune 1000 firms that had the Integration with China experienced disruptions and issues in the flow of operations. Supply Chain Integration (SCI), along with its antecedents, Supplier, Customer, and Internal Integration, have been studied extensively in the literature, and its impacts on global SCM networks' smooth functioning. Yet, these pandemic disruptions brought new talks to the forefront. Apart from the recent pandemic of 2019, numerous incidents have threatened the Supply Chains of companies worldwide associated with terrorism, political, and economic crises.

The convergence of all inventory flow processes is essential for a successful and reliable supply chain. Every organization competes successfully to support its partnerships with suppliers and customers(Li et al., 2025). Demand in the supply chain will increase the supply chain surplus's overall value in producing products. Considering the globalization in view, the growth Oil and Lubricant supply chains in Pakistan is not in line with the swift growth of world-wide markets. Pakistan, having a struggling economy need to apply more for a structured industrial supply chains and keeping in view the market uncertainties, supply chain integration becomes an essential problem for the management of supply chains.

On the other hand, minimal research has been conducted to analyze suppliers and customer integration. The Oil and Lubricant (O&L) industry comprises many companies in the Pakistani economy. Moreover, it is known that these businesses are immune to a different form of economic recession shocks, especially in the form of volatility in oil prices or pandemics. Supply chains of O&L companies also needs to be the integrated among its network players. Integration serves better to handle the relationship between manufacturers, suppliers, and customers. Market oriented companies need ultimate supply chain integrations in order to improve their performances. Market integration has a significant relationship with overall business performance(Setyadi et al., 2025).

The Oil and Lubricant (O&L) Industry is a complex trade with corresponding complex processes across its supply chain. O&L has been a significant impact on the global and local economy. Despite being a high-risk industry, many of the supply chain strategies are copies of

other sectors. This is because few players are compared to other sectors in O&L; these players include clients and contractors (Caliskan et al., 2025).

For a struggling economy like Pakistan, the outbreak of Covid-19 could not have come at a worse time since Pakistan's overall economic outlook was already at a low ebb. For the oil and lubricant industry, in particular, Covid-19, along with a persistent lockdown of business activity, is turning out to be a continuous disaster for supply chains with no end in sight. The country's oil sector has to also grapple with poor decision-making being done by OGRA, which severely lacks clear-cut, result-oriented policies to drive the industry out of the crisis. The oil sector currently demands some drastic measures to be taken immediately in supply chain integration focusing on the Firm's internal Integration.

1.1   Problem Statement

In the tempestuous and uncertain business environment, every firm in the supply chain is susceptible to disruptive incidents. In recent times, numerous researchers have conducted studies to understand integrations patterns in supply chain, from investing in supply chain capabilities of internal Integration and making the system agile and robust. The control of the investment is necessary for increasing the company profit and sustaining the competitive position. The current business scenario has been critically important to gauge supply chain integration and its capability to perform in the long-run if it would be controlled timely and accordingly. Therefore, supply chain integration challenges, including internal and external Integration, require an immediate and proactive approach from organizations. However, such dependency may also come with specific parameters that, utmost importantly, include supply chain performance. Usually, companies rely on and become dependent on their capabilities, including their information systems, supply chain orientation, and risk management strategies. On such factual grounds, it becomes essential to understand organizations' internal supply chain integration and its capabilities to coup up with any unfavorable situation in a larger perspective.

1.2   Objectives and Scope of the study

The study will attempt to measure the effect of mediation of firm's internal integration among, supply chain uncertainty and customer satisfaction while moderating through strategy innovation.

Through this study, the gaps have been identified in the Internal supply chain integration of organizations, which can give insights to improve the processes carried out in given organizations, which can enhance the organization's capabilities of Integration, decrease supply chain uncertainty and enhance customer satisfaction besides provide ways to improve

supply chain performance by investing in internal integration capabilities and making supply chain resilient and thereby increasing the efficiency and strengthening of strategies to attain the respective goals and to satisfy the end customer.

1.3. Significance of the Study

This research will help companies make tactics and strategies that can help achieve strategic goals through mutual benefit between internal and external players. This study will also help Oil and Lubricant industry personnel understand the significance of Supply chain capabilities and internal Integration and its dynamic nature that could foster any company's success by acquiring the resources that are not in their control.

1.4 Research Questions

RQ1: How could a Firm's Internal Integration affect the relationship between Supply chain uncertainty and Customer Satisfaction?

RQ2: How can a firm's strategic innovation affect the Firm's Internal Integration and Customer Satisfaction relationship?

2. Literature Review

Supply Chain Integration (SCI) is the intensity of engagement with business's vendors and customers(Salous & Dwaikat, 2025). SCI has become a vital factor for organizations to succeed. Many studies have been carried out in the subject area over the last decade, where SCI's importance has been highlighted. A study conducted by (Alahmad, 2024)signifies SCI's importance for organizational success in the long run. Firms playing their role in the chain urges the need for engagement with their immediate supplier and supplier's supplier and similarly for the downstream customer and customer's customer. This extensive cooperation is required to reflect sustainable business success has done considerable work in the same area stating that SCI is a form of the strategic partnership between the producer of goods and their respective supply chain partners. SCI comprises integrations between supplier, internal, and customer, and all the stated integrations are equally crucial for sustainable supply chain management.

A supply chain is seen as a node and link network. A node is an organization that can be a supplier, producer, or consumer of goods/services who act as an agent capable of determining and optimizing its benefit within the constraints of its supply chain operations. The connections are transactions concerning the flow of goods, information, and financing between nodes(Alahmad, 2024; Langer & Acciaro, 2025). An organization must be integrated internally as well as externally as a partner in the supply chain. This Integration requires

information convergence systems, improved cooperation, and knowledge exchange among its suppliers and customers.

Several empirical types of research had revealed that there is an important and positive relationship between the level of supply chain integration and organizational performance as well as customer satisfaction (Langer & Acciaro, 2025; Olunwa & Joshua, n.d.; Shish, 2025) but inadequate and evolving concepts made by these researchers have led to varying conclusions of the relationship.

consumer integration requires understanding the relationship between the supplier and the company information system. To help the customer and strengthen its business position, the company's time and money are required. As such, the incorporation of consumers requires consumers' involvement in decisions related to the retailer's goods. (Shish, 2025)also highlighted that customer integration comprises of the understanding of relationships among suppliers and firm's policies and procedures. The time and resources allocated by the provider for these activities were expected to support the client, i.e., improve his market role. As such, customers' participation requires customers' involvement in the decisions about the retailer's offer of products.

The importance of Integration across many industries.(Eusufzai, 2023) urges the cooperation and working together of supply chain allies to upsurge the effectiveness and efficiency of end-to-end chain to meet the customer demand, which in turn achieve supply chain surplus for the partners. Likewise, found out the factor influencing competitive advantages and their effect on companies' performance. SCI also has a constructive impact on Customer Satisfaction (CS) as well as financial performance (FP) of the organizations. Similar nature of work has been carried out by(Aydogan et al., 2025) in India, where Integration positively impacts CS and FP. However, both the studies were carried out with the smallest sample size. SCI is considered as a construct of multiple dimensions and since there are two forms of SCI external and internal. Externally, there are another two types, i.e., supplier and customer. Initiatives and services that facilitate linkages between trade partners could theoretically be included in the partnerships. Customer integration involves information, service, and material information flows that flow from end customer to the supplier, and the services and materials that flow forward(Fajar et al., 2022a; Tao et al., 2025).

Researchers have analyzed Integration in Supply Chain in combination with other component variables such as (Fajar et al., 2022b)reported a case study conducted on East African manufacturing firms and concluded that firms with strategic intra-company capital were less dedicated to external Integration and that SCI was hampered by reliance across

multiple levels but improved by interdependence. do related work in the retailing field of France and China, where the variables of supplier and consumer relationships are analyzed with cost and flexibility. The study concluded that the Integration of consumers and vendors is a significant component in a cost-oriented configuration. The Integration of supply chain systems is a substantial component in flexibility-oriented configuration. Higher-level supply chain alignment in the retailing industry will contribute to improved market results.

In various areas, including company theory, marketing, and strategy, complexity has become an important construct. (Chan et al., 2025) indicates that the supply chains are split up by three distinct causes of uncertainty: supplier uncertainty, manufacturing uncertainty, and market or demand uncertainty. The literature also suggests that technology uncertainty also exists, and it becomes the driving force for the companies to get a competitive advantage(Hossain, 2025). As a theoretical framework through supply chain uncertainty can be studied is based on manufacturing strategy theory, which recognizes that manufacturing strategy is affected by environment uncertainty and is a major factor of business performance

Studies conducted by (Hossain, 2025; Song et al., 2025; Tao et al., 2025) signify SCI's importance on the Firm's performance and particularly on Customer satisfaction. Similarly, a recent study by (Song et al., 2025)also suggested that Customer satisfaction is eventually the final product of all variables studied under Supply chain integration. It's a source of increasing profitability for the company and overall achievement in the business. However, this study was only conducted on Indian SME enterprises and cannot be generalized for other companies.

Based on the above literature discussions, the conceptual framework for the study is devised where the Supply chain uncertainties, including demand, supply, and technology, are considered independent variables. Its impact is checked on customer satisfaction through the mediating role of the Firm's internal Integration. Strategy innovation is considered as a moderator to gauge its effect on the relationship between the Firm's internal Integration and customer satisfaction(Zhang et al., 2025). A study conducted by (Aydogan et al., 2025) concluded that satisfaction of the customer has a significant positive relationship with the financial performance of the company and it also has a positive mediating effect between the relationship of customer integration and company performance. Similarly, demonstrated types of integrations used by 3PLs companies in which internal integration has the most significant effect on supply chain practices. The following variables used for this study are taken from various sources of literature as mentioned below table;

Table 1*: Variables used for the study and their sources*

| Variables	Sources
Firm's Internal Integration	Flynn, B. B., Huo, B., & Zhao, X. (2010). The impact of supply chain integration on performance: A contingency and configuration approach. *Journal of operations management*, *28*(1), 58-71.
Supply Chain Uncertainty	Chen, I. J., & Paulraj, A. (2004). Towards a theory of supply chain management: the constructs and measurements. *Journal of operations management*, *22*(2), 119-150.
Strategy Innovation	Terziovski, M. (2010). Innovation practice and its performance implications in small and medium enterprises (SMEs) in the manufacturing sector: a resource-based view. *Strategic Management Journal*, *31*(8), 892-902.
Customer Satisfaction	Al-Hawary, S. I. S., Mohammad, A. S., Mohammad, A. A. S., & Alsarahni, A. H. H. (2017). Supply chain flexibility aspects and their impact on customers satisfaction of pharmaceutical industry in Jordan. *International Journal of Business Performance and Supply Chain Modelling*, *9*(4), 326-343.

Source*: Author's construction*

2.1 Hypotheses

Following hypotheses are extracted from the literature to carry out this research study.

No.	Hypothesis Statements
H1	Supplier Uncertainty (SU) has a negative effect on Customer Satisfaction (CS) in the Oil and Lubricant industry of Pakistan.
H2	Supplier Uncertainty (SU) has a negative effect on the Firm's Internal Integration (IN) in the Oil and Lubricant industry of Pakistan.
H3	Technology Uncertainty (TU) has a negative impact on Customer Satisfaction (CS) in the Oil and Lubricant industry of Pakistan.
H4	Technology Uncertainty (TU) has a negative impact on the Firm's Internal Integration (IN) in the Oil and Lubricant industry of Pakistan.
H5	Firm's Internal Integration (IN) has a positive impact on Customer Satisfaction (CS) in the Oil and Lubricant Industry of Pakistan.
H6	Firm's Strategy Innovation (SI) positively affects Customer Satisfaction (CS) in the Oil and Lubricant Industry of Pakistan.
H7	Firm's Strategy Innovation (SI) positively affects the relationship between the Firm's Internal Integration (IN) and Customer Satisfaction (CS) in the Oil and Lubricant Industry of Pakistan.

Figure 1: *Theoretical and Conceptual Model*
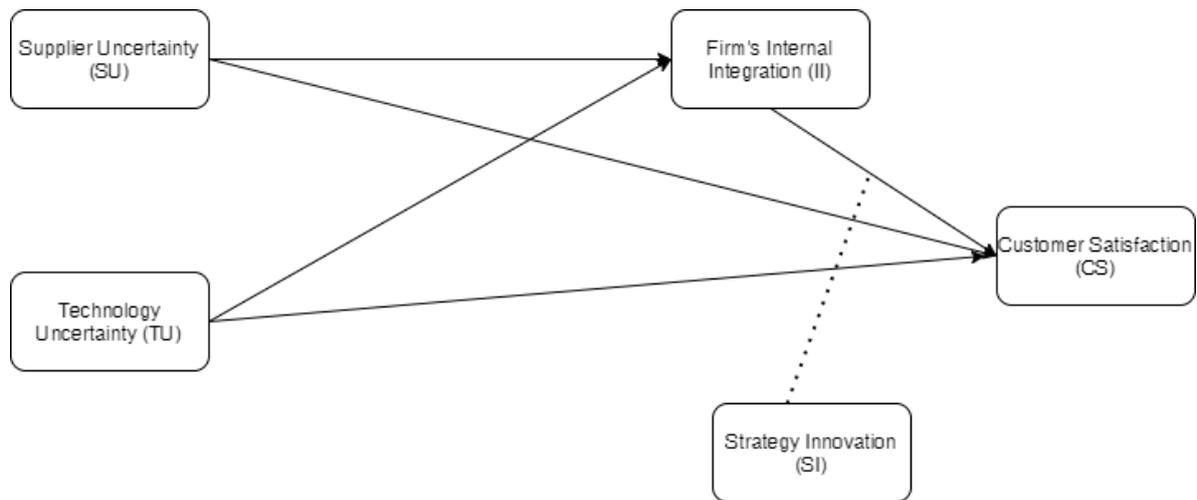
3.   Research Methodology

An empirical, methodological approach is followed for this study based on a resource-based perspective given by(Haque, 2025). Data is collected through a questionnaire, which is considered the most favored instrument in supply chain surveys. It is used by almost 42% of the supply chain researches (Kamal & Irani, 2014). An online survey through Google forms was created because the online web approach has advantages over paper-based surveys, including cost-effectiveness, accessibility, efficiency, and data analysis(Aditya et al., n.d.).The target group was professionals working in Oil and Lubricant Industry of Pakistan, and data were collected for four months starting Sep 2020 to Dec 2020. Since the respondents are already available in Pakistan's different cities, a non-probability sampling design is used through the purposive sampling technique.

The collected data is further analyzed through Structural Equation Modeling (SEM) using SMART-PLS. Cause and effect relationships are considered an important research area, and such interactions focus on various market concerns. Past complex approaches have been developed in economic and social science, such as causal analysis or structural equation analysis for multivariate analyses(Raygoza-Limón et al., 2025). In the past two decades, the structural equation approaches have grown firmly in supply chain management for multivariate computational data analysis.In addition to this area, the dynamic causal relations study using Structural Equation Modelling (SEM) is still commonly used in economics, psychology, and sociology.

The clear distinction between the measurement theory (model of measurement) and material theory is characteristic of SEM models (structural model). The calculation model explains how the theoretical structures (latent variables) are related to their measures (observable variables), modeled on a factor structure.

To conduct this study, a sample of 150 respondents is taken from the personnel to know the relationship as calculated by G Power (Song et al., 2025)Purposive sampling has been used in this study because we need to quantify and analyze the responses from experts working in Pakistan's Oil and Lubricant industry. The subject sampling technique is when the people are sorted out from a pre-specified group and then sampled (Gerrish & Lacey, 2010).

3.1 Questionnaire Design and Measures

As discussed in Table 1 (above), following questions have been taken for the given constructs to test the relationships.

Table 1: *Questions to test the relationships*

Construct	Code	Items	Source
Firm's Internal Integration	IN1	There is an efficient data integration system among the internal functions of our company.	Flynn and Zhao (2010)
	IN2	We have an Enterprise application integration among internal functions	
	IN3	We have Integrative inventory management in place.	
	IN4	We have cross-functional teams for process improvements in our company.	
Supplier Uncertainty	*SU1*	*Our suppliers consistently meet our requirements – Omitted*	
	SU2	Our suppliers provide consistent quality of product.	
	SU3	We have a comprehensive inspection of incoming critical product from suppliers	
	SU4	We have a high rejection rate of incoming product from suppliers	Chen and Paulraj (2004)
Technology Uncertainty	TU1	Our industry is characterized by rapidly changing technology	
	TU2	The rate of process obsolescence is high in our industry	
	TU3	If we don't keep up with changes in technology, it will be difficult for us to remain competitive	
Strategy Innovation	SIn1	Our company's Vision or mission includes a reference to innovation	Terziovski (2010)
	SIn2	Our innovation strategy helps the Firm to achieve its strategic goals	
	SIn3	Internal cooperation in the Firm is seen as an essential part of innovation strategy implementation in the Firm	
	SIn4	Customer satisfaction in the Firm is seen as an essential part of the firm innovation strategy	
Customer Satisfaction	CS1	Our companies provide good quality of Products	Al-Hawary et al. (2017)
	CS2	Our companies provide products with low, competitive prices	

CS3	We provide fast delivery to our customers.	
CS4	Our company responds to our customers' requirements and their complaints in an active manner - *Omitted*	

4.   Results and Discussion

4.1   Descriptive Statistics

A total of 150 responses have been collected from Oil and Lubricant Industry of Pakistan. These respondents are the companies engaged in the business of Petroleum Marketing as well as Lubricant manufacturing and distribution business. Demographic characteristics are given in Table no. 2.

Table 2*: Demographic Characteristics of the Sample*

Description Sample Size = 150		Frequency	Percent
Designation	Manager	71	47.3
	Asst. Manager	49	32.7
	Executive	15	10.0
	Head of Department	15	10.0
Education	Masters & Above	92	61.3
	Graduate	53	35.5
	Intermediate	5	3.3
Department	Procurement	52	34.7
	Supply Chain	36	24.0
	Operations	24	16.0
	Sales & Marketing	17	11.3
	Finance	15	10.0
	Other	6	4.0
Company Age (in years)	7-9	76	50.7
	4-6	54	36.0
	10-12	12	8.0
	1-3	7	4.7
	13 & Above	1	0.7
Company Size (No. of employees)	Uptil 50	45	30.0
	101 to 200	44	29.3
	51 to 100	43	28.7
	201 to 400	14	9.3
	401 & Above	4	2.7
Gender	Male	133	88.7
	Female	17	11.3

Note: The source of this table is author's estimation

Table 2 shows the demographic nature of the data that is collected from 150 respondents. This study was industry-focused, so the sample from Oil and Lubricant industry has been taken to evaluate the mediating effect of the Firm's Internal Integration (II) between Supply Chain Uncertainty (SCU) and Customer Satisfaction (CS).

4.2   Testing Data for Normality

Before estimating the model and testing hypotheses, the collected data is reviewed through reliability and validity testing and checking for normal distribution. Information is checked for normality through Mardia's Test of Normality, which states that if p-values are less than 0.05, the data is not normal; therefore, we can run non-parametric testing through SMART PLS. Figure 2 shows that the p-values are 0, which means that the respondents' data is useful for non-parametric testing.

Figure 2 : *Output of Skewness and Kurtosis*

```
Sample size:  150
Number of variables:  5

Univariate skewness and kurtosis
              Skewness   SE_skew   Kurtosis    SE_kurt
Cust_Satis  -1.4154255 0.1980384 1.7914957 0.3935831
Inter_Integ -0.8425887 0.1980384 0.5084698 0.3935831
Strag_Inn   -1.6705360 0.1980384 1.5634636 0.3935831
Supp_Uncer  -0.9472580 0.1980384 0.7942560 0.3935831
Tech_Uncer   1.5834543 0.1980384 1.6143214 0.3935831

Mardia's multivariate skewness and kurtosis
                 b           z p-value
Skewness 27.61314 690.32842        0
Kurtosis 59.17503  17.69431        0
```

4.3   Mahalanobis Distance test for outliers

Mahalanobis Distance test for outliers is carried out on the data received from the respondents on SPSS Software. It is a renowned criteria for detection of outliers in multi-variate data (Penny, 1996). Example of results output is given as under: -

Table 3: *Example of Mahalanobis Distance Test for Outliers*

Case ID	Mahalanobis Distance	P-value	Outlier Coding	Rank
105	18.39390	0.00	1	1

Mahalanobis Distance is calculated with Customer satisfaction as a dependent variable in the given table while taking Supplier, and Technology Uncertainty as an Independent Variable. It is found that case # 105 (Rank # 1) as an outlier after the arrangement of P values of the Mahalanobis Distance in ascending order.

4.4 Construct Reliability and Validity

Evaluation of the measurement model adopts a confirmatory assessment of the convergent and discriminant validity (Campbell & Fiske, 1959). Convergent validity (CV) is adequate in the given study because the Average Variance Extracted (AVE) is over 0.500. Composite Reliability is also established since each construct's values are above 0.70 (See Figure 3). The results for Reliability and validity and outer loadings for the items are given in Table 4. Discriminant validity is evaluated through the forell-larcker criterion (Table 5). The table shows that the Average Variance Extracted (AVE) square root for the construct is greater than the inter-construct correlation. Discriminant validity is also assessed by the Heterotrait-Monotrait (HT-MT) ratio of correlations (Henseler et al., 2015) having values below 0.90. Hence, discriminant validity for the model is also established (See Table 6)

Figure 1: *Measurement Model with Composite Reliability (Construct Validity)*
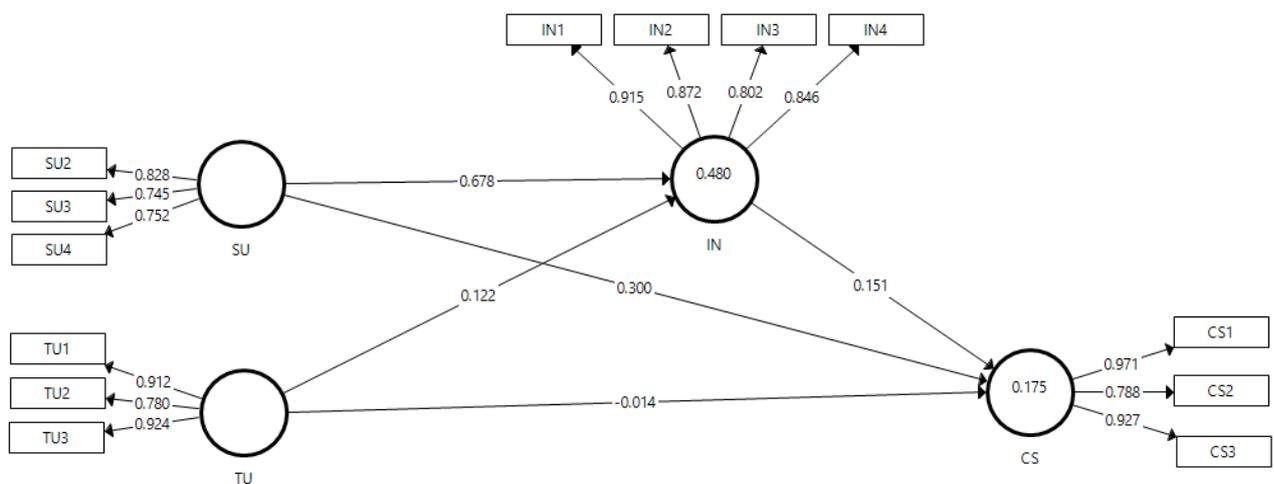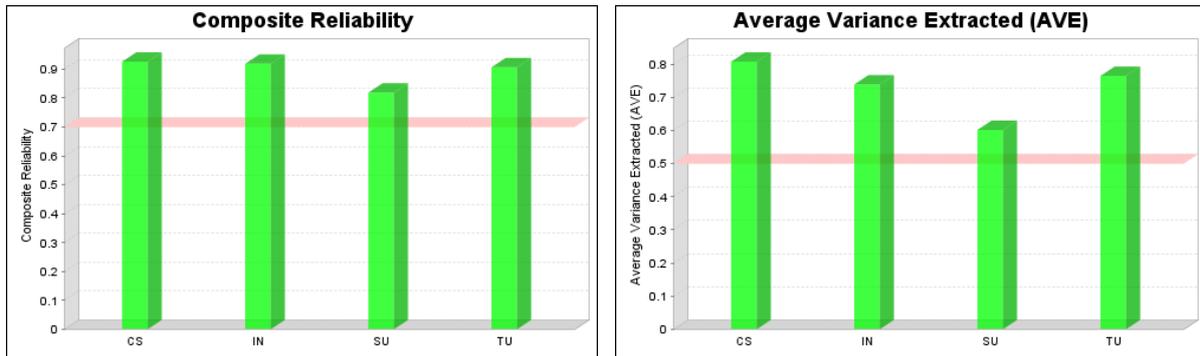
Figure 4*: SMART PLS Output for CR and AVE*

Table 4: *First Order Reflective Measurement Model Results*

First Order Reflective Constructs	Items	Loadings	CR	AVE
Customer Satisfaction	CS1	0.962	0.926	0.808
	CS2	0.827		
	CS3	0.902		
	CS4	‡		
Internal Integration	IN1	0.915	0.919	0.739
	IN2	0.871		
	IN3	0.803		
	IN4	0.847		
Strategy Innovation	SI1	0.891	0.929	0.766
	SI2	0.843		
	SI3	0.834		
	SI4	0.929		
Supplier Uncertainty	SU1	‡	0.819	0.602
	SU2	0.827		
	SU3	0.747		
	SU4	0.751		
Technology Uncertainty	TU1	0.909	0.907	0.765
	TU2	0.780		
	TU3	0.927		

‡ *Item dropped*

Note: The above table indicates Outer Loadings, Composite Reliability (CR), and Convergent Validity (AVE) with threshold values of 0.708, 0.700, and 0.500, respectively.

Table 5*: Value for Fornell-Larcker Criterion*

	CS	IN	SI	SU	TU
CS	*0.899*				
IN	0.358	*0.860*			
SI	0.742	0.540	*0.875*		
SU	0.393	0.682	0.427	*0.776*	
TU	0.008	0.147	-0.045	*0.038*	*0.875*

Notes: Values in Italic represents Square Root of AVE.

Table 6*: Values for Heterotrait-Monotrait Ratio (HTMT)*

	CS	IN	SI	SU
CS				
IN	0.398			
SI	0.815	0.615		
SU	0.507	0.872	0.540	
TU	0.090	0.164	0.135	0.099

4.5 Predictive Capability of the Model

After confirming the Reliability and validity of the construct measures, structural model results are evaluated, i.e., examining the model's predictive capabilities. The structural model reflects the paths hypothesized in the research framework. It is assessed based on R^2 and the significance of paths. The goodness of the model is resolute by the strength of each structural path determined by R^2 value for the dependent variable (Briones Penalver et al., 2018); the given value of R^2 should be equal to or over 0.10. Hence, the predictive capability is established for the model.

Through bootstrapping in SMART-PLS, 5000, resamples also make 95% confidence intervals, as given in Table 7. A confidence interval different from zero designates a significant relationship among variables. Hypotheses testing results for the same are tabulated in Table 7, where the relationships of Supply Chain Uncertainty (SCU) with Customer Satisfaction (CS) moderating through Firm's Internal Integration (IN) is calculated.

PLS-SEM aims to maximize the R^2 values of the endogenous variables in the path model. As given in Table 7, of determination of CS is 0.158, which indicates that 15.8 per cent of the variance in CS is explained by SCU while mediating through IN and moderating via SI.

4.6 Hypotheses Testing

Hypotheses testing is done in two phases. First examined the dimensions of Supply Chain Uncertainty on Customer Satisfaction for Hypotheses 1 to 5, while mediating through Firm's Internal Integration. Results of these hypotheses are given in the below table:

Table 7: *Values for Hypotheses Testing*

Relationships	β	STDEV	T Stats	P Values	5.00%	95.00%
IN → CS	0.151	0.137	1.105	0.135	-0.073	0.372
SU → CS	0.300	0.093	3.217	0.001	0.154	0.460
SU → IN	0.678	0.047	14.383	0.000	0.600	0.754
TU → CS	-0.014	0.088	0.163	0.435	-0.169	0.114
TU → IN	0.122	0.07	1.734	0.042	-0.007	0.226

|	R²
CS	0.158
IN	0.473

4.6.1 Moderation Analysis

To test the hypothesis *H6,* i.e., to check the effect of moderator Strategy Innovation (SI) on the relationship between Internal Integration (IN) and Customer Satisfaction (CS), following results are received.

Table 8: *Values of Hypotheses Testing (Moderation Analysis)*

Relationships	β	STDEV	T Stats	P Values	5.00%	95.00%
IN → CS	-0.060	0.075	0.800	0.212	-0.178	0.068
SI → CS	0.966	0.038	25.762	0.000	0.901	1.020
SI*IN → CS	0.294	0.076	3.872	0.000	0.150	0.400
SU → CS	0.132	0.069	1.902	0.029	0.015	0.242
SU → IN	0.677	0.047	14.301	0.000	0.597	0.753
TU → CS	0.078	0.047	1.647	0.050	-0.003	0.152
TU → IN	0.121	0.069	1.754	0.040	-0.002	0.229

	R²
CS	0.719
IN	0.473

Figure 4: *Measurement Model with Moderation Effect*
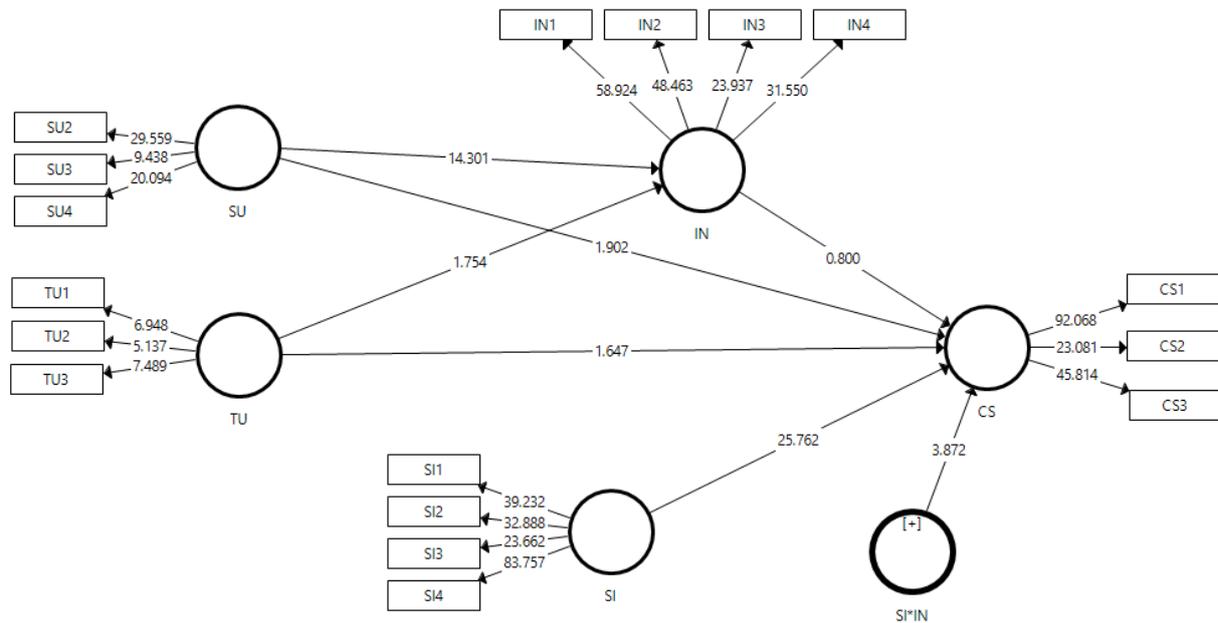
4.6.2 Hypotheses Testing Results

As given in Table 9, Hypotheses results revealed that at a significance level (p>0.05), our premise in five cases i.e., SU effecting CS & IN, TU effecting IN, SI effecting CS & SI*IN impacting CS (H1: t=1.771, p=0.038), (H2: t = 14.301, p = 0.000), (H4: t = 1.754, p = 0.000), (H6: t = 25.762, p = 0.000) and (H7: t = 3.8720, p = 0.000). However, for the remaining two cases, the hypotheses are not supported.

Table 9: *Hypotheses Testing Results*

Hypotheses	Relationships	T Stats	P Values	Results
H1	SU → CS	1.771	0.038	**Supported**
H2	SU → IN	14.301	0.000	**Supported**
H3	TU → CS	1.548	0.061	Not Supported
H4	TU → IN	1.754	0.040	**Supported**
H5	IN → CS	0.800	0.212	Not Supported
H6	SI → CS	25.762	0.000	**Supported**
H7	SI*IN → CS	3.872	0.000	**Supported**

Note: P < 0.05;

4.7 Importance-Performance Map Analysis (IPMA)

IPMA Analysis Ranks Strategy Innovation (SI) as the highest variable having both importance and performance in the model. However, Technology Uncertainty (TU) is on the lower side of the map.

Figure 5: *SMART PLS Output for IPMA*
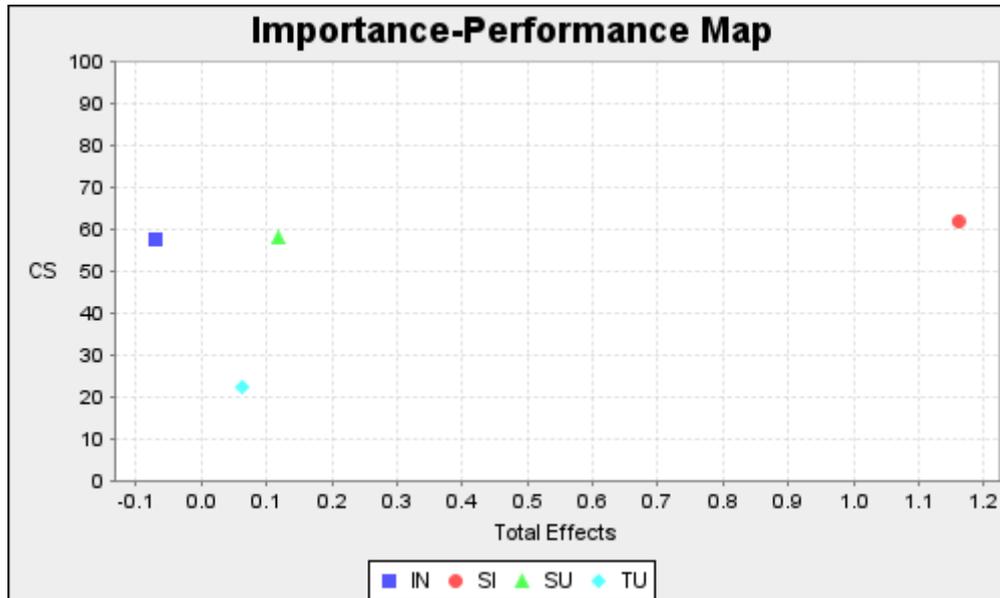
4.5 Discussion

The study results give surprising results about Supply chain practices in Oil and Lubricant Industry of Pakistan. It is evident from the study that Technology Uncertainty (TU) doesn't negatively influence Customer Satisfaction (CS) of the consumers of Oil and Lubricant products. This may because the Oil & Gas Regulatory Authority (OGRA) of Pakistan regulates the industry and sets the prices and therefore, any change in demand and supply of the products doesn't directly affect the prices. On the other hand, the study also proves that the Supplier Uncertainty (SU) is having a negative effect on Customer Satisfaction (CS) as well as Internal Integration of the firm because the industry mostly relies on the imports of oil either in the form of raw crude Oil or in finished form therefore any change in supply will affect directly to the customer need of the industry.

The study results confirm the negative effect of Supplier Uncertainty on Firm's Internal Integration and Customer Satisfaction which corroborates B. B. Flynn et al., (2010) and Chang et al., (2016) who concluded similar results while studying relationships of supply chain integration.

5. Conclusion, Limitations and Recommendations

5.1 Conclusion

The given study set out to understand how Supply Chain Uncertainty Impacts Customer Satisfaction of Oil and Lubricant Industry and how internal Integration mediates the relationship between them Further, the study also checks the moderation of Strategy Innovation among these relationships in Pakistan's context. The study supports the manufacturing strategy theory which recognizes that manufacturing strategy is affected by environmental uncertainty and is a major factor of business performance (Swamidass & Newell, 1987). It is found that within the context of Pakistani market, technology uncertainty doesn't harm Firm's internal Integration and customer satisfaction; however, Supplier Uncertainty has a negative effect on Firm's internal Integration and customer satisfaction. Furthermore, it is also observed that Strategy innovation play a vital role and greatly influence the relationship between the Firm's Internal Integration and customer satisfaction.

The given study improves knowledge and understanding of Firm's Internal Integration for Oil and Lubricant Industry's subtle phenomenon, thus providing a new viewpoint to the literature, which usually not focused on such relationships. In this sense, the study contributes while testing Strategy Innovation as a moderator, which provides a broader viewpoint of Internal Integration in Supply Chain for Oil and Lubricant Industry. The study also contributes to help the managers understand the disruptions caused by the uncertainties in the oil and lubricant supply chain and accordingly prepare plan for Firm's internal Integration and adopt strategies for innovation to satisfy the end customers. A suitable planning mechanism is required for the import of given products from foreign entities. A delay in acquiring the products will end up the Firm in stock out position and, therefore, affect customer satisfaction.

5.2 Limitations and Recommendations

Although the study is one of few quantitative works undertaken on Structural Equation Modelling which has taken into account various magnitudes of Supply Chain Uncertainty and Firm's Internal Integration, the study is exclusively focused on Oil and Lubricant Industry of Pakistan. Previous researches about Supply Chain Uncertainty have been conducted outside Pakistan. Future examinations can include more elements and can increase the demographic horizon by involving other industries as well. Supply Chain Resilience can be taken as a mediating variable in studies to evaluate the integration effect of firms.

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