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THE ROLE OF HSN CODE AND ITS USAGE IN IMPORT–EXPORT OPERATIONS AND ITS IMPACT ON THE LOGISTICS FIELD"

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ABSTRACT
This empirical research analyses the influence of HSN Codes (Harmonized System of Nomenclature) on efficiency of operations (OE) and performance of logistics outcomes (LPO) in the import and export industries. Primary data used in the analysis consisted of responses to a structured questionnaire by fifty logistics professionals, IMPEX executives, customs house agents (CBHC) and brokers. The techniques used to analyse the primary data were: Percentage analysis, Descriptive statistics, Pearson Correlation, Multiple Regression, Sobel Test, Mediation Analysis, and Structural Equation Modelling (using SPSS/AMOS). Results indicate that HSN Code classification practices are the strongest predictor of Trade Efficiency ($r = .831$, $p < .01$). HSN Awareness, Knowledge Level, and Training Requirements do not predict improvements either in Customs Clearance or reductions in cost on their own; however, the effects of these three variables are indirect through a mediator variable, Ease of Classification, which plays a significant role in classifying goods for entering a country. The Structural Equation Model (SEM) has acceptable fit indices across each of the eight fit indices. Brand Trust, analogous to Supply Chain Efficiency within the conceptual framework developed for this research, maintains structural independence; therefore, Performance Logistics operates primarily

from operational accuracy rather than based on perceptual constructs. The Study recommends that logistics companies develop a structured training programme for HSN classification, clear the use of Artificial Intelligence to enhance and support the overall HSN classification processes, and create an integrated HSN compliance process in their digital Customs process in order to be competitive at sustainable levels.

KEYWORDS: HSN Code Classification, Import–Export Operations, Logistics Performance, Trade Compliance, Trade Efficiency, Supply Chain, Customs Clearance, B2B Logistics

1. INTRODUCTION

1.1 Logistics and the Role of HSN in Global Trade

Over the last twenty years, there has been a dramatic shift in the logistics industry from primarily transnationally provided service to one that increasingly plays an important role in creating competitive differentiation. The successful flow of goods around the world now relies heavily upon compliance with regulations and having the appropriate documentation to ensure goods can move through international borders uninterrupted. A significant part of the success of moving goods around the world involves creating a complex interdependent system of regulatory compliance, documentation accuracy, digitalization and supply chain collaboration. An integral component of this system is the Harmonized System of Nomenclature (HSN), which is an internationally established product classification standard and is maintained by the World Customs Organization (WCO).

HSN creates a common language for classifying physical items that trade amongst over 200 countries and customs territories and enables companies to have a consistent process regardless of where they engage in trade for purposes of customs documentation, determination of duties and trade data; and achieving overall compliance with regulations. In India's case, the HSN system has taken on an additional level of significance as it is the basis for determining the Goods and Services Tax (GST), which has become mandatory for all businesses involved with domestic and international trade since July 1, 2017. The value of the global logistics market is estimated at USD 9-10 trillion; the estimated value of the Indian logistics market is USD 250 billion and growing at a compounded annual growth rate of over 10 per cent through 2030. HSN code compliance has become a requirement in all aspects of international trade. Errors in HSN classifications will cause customs delays, costs, duty variances

and supply chain disruptions, all of which will negatively impact a company's performance and ability to compete.

1.2 HSN Classification and Operational Performance

In the past, trade documentation was a manual process reliant on the relationships of individuals with their customers (buyers) and suppliers (shippers) and the classification of products about how individuals classify them themselves, or the rules that exist between the companies that sell and ship products. This is changing with the advent of digital customs systems such as ICEGATE, GST portal and Electronic Data Interchange (EDI) platforms. As a result, HSN Codes now form the basis of how automated customs processing, risk profiling, duty calculation, and GST invoicing are handled. Logistics Compliance issues attributed to Classification make up over 70% of compliance failures in India (according to industry sources), stressing the critical need for IMPEX and logistics professionals to develop HSN Classification knowledge. Classes that focus on classification accuracy are measurable benefits of logistics performance (e.g., faster customs clearance, reduced demurrage fees, lower exposure to penalties, and better opportunities for Free Trade Agreement "FTA" concessions and export incentive payment programs). This study looks at the practical use of HSN Codes as they relate to freight forwarders and importers and exporters, with particular focus on the use of HSN Codes by based distributor of medical and beauty-related product equipment. We take an empirical approach to measuring the relationship between HSN Classification practices and logistics performance through the use of a multi-construct structural model.

1.3 Competitive Benchmarking of HSN Classification Practices

Top global logistical companies like DHL, Kuehne + Nagel, DB Schenker and Expeditors International have built complex classifications of the Harmonized System (HSN) into their basic functions. To maintain accuracy across thousands of shipments every day, these companies use advanced classification systems, teams focused on customs compliance and artificial intelligence-assisted coding tools. The following table compares these effective classification techniques with those used by newer or medium-sized logistics service providers based in India.

Strategy Focus	Global Leaders (DHL, DB Schenker)	Objective	Effect on Emerging Operators
HSN / HS Classification	AI-assisted classification engines, dedicated customs compliance teams	Zero-error classification at scale	Invest in classification software; assign trained CHA agents per product line
Digital Integration (ICEGATE / EDI)	Real-time integration with national customs	Automated clearance and	Adopt digital platforms to reduce manual entry

	portals and GST systems	duty calculation	errors and speed processing
Staff Training & Certification	In-house customs academies, WCO-certified classifiers	Build institutional classification knowledge	Conduct periodic HSN training; partner with CHA professionals for mentoring
FTA & Trade Policy Compliance	Dedicated trade policy teams monitoring tariff updates and FTA eligibility	Maximize duty concessions and export incentives	Subscribe to CBIC / DGFT notifications; use HSN codes to unlock FTA benefits
Integrated Compliance Strategy	Unified ERP with HSN, GST, and customs data	End-to-end compliance across shipment lifecycle	Align documentation, classification, and reporting for holistic compliance performance

Table 1: Strategic Benchmarking — Global Logistics Leaders vs. Emerging Freight Operators

1.4 Problem Statement

HSN codes are well known as a compliance requirement but the gap between knowledge and practical competency of logistics professionals in India, especially at the mid and small operator level is still wide. Large multinational logistics firms have systematised their classification practices through technology and specialist teams, but smaller freight forwarders, IMPEX executives and customs brokers continue to grapple with accurate, consistent and timely HSN classification. There is a lack of empirical research that systematically explores the impact of HSN classification practices on operational efficiency and logistics performance outcomes in the Indian context, particularly in niche sectors like medical equipment importation. With the intent of filling that gap, this research includes a study that will test empirically (using data collection methods) a structural model that connects HSN classification knowledge, operational efficiency, and logistics performance in the freight forwarding and import/export sector.

1.5 Objectives of the Study

Primary Objective

1. To understand HSN codes (classification codes) and how they work; to determine the relationship between HSN codes and classification accuracy; to establish how HSN codes contribute to compliance in the import/export industry; and to determine how HSN codes contribute to efficiency in the logistics operations.

Secondary Objectives

2. SO1 - The effectiveness of HSN classification knowledge and awareness improves HSN classification usage in import/export businesses by increasing the frequency and ease of classification.
3. SO2 - There is a relationship between training and technology in increasing data classification accuracy and efficiency of documents.
4. SO3 - There is a relationship between operational efficiencies (the way classification is done and the frequency of usage) in the import/export industry and logistics performance.
5. SO4 - Effectiveness of HSN classification practices directly affects both customs and costs in the import/export industry.
6. SO5 - Improvement on HSN classification accuracy and efficiency through recommendations of strategies for improvement on the freight forwarding industry.

1.6 Research Gap

Most of the existing research focuses on the regulatory and structural aspects of HSN codes, emphasizing their significance in the determination of customs tariffs and GST compliance. Empirical attention, however, has focused on the practical use of HSN classification and its effect on operational efficiency metrics such as ease of classification, frequency of use, system integration, and their downstream effect on logistics performance. Besides, the mediating role of operational efficiency variables on HSN knowledge factors and logistics outcomes has not been discussed well in the literature so far. This study fills these gaps by using an empirical multi-construct structural model in the context of medical equipment import-export operations.

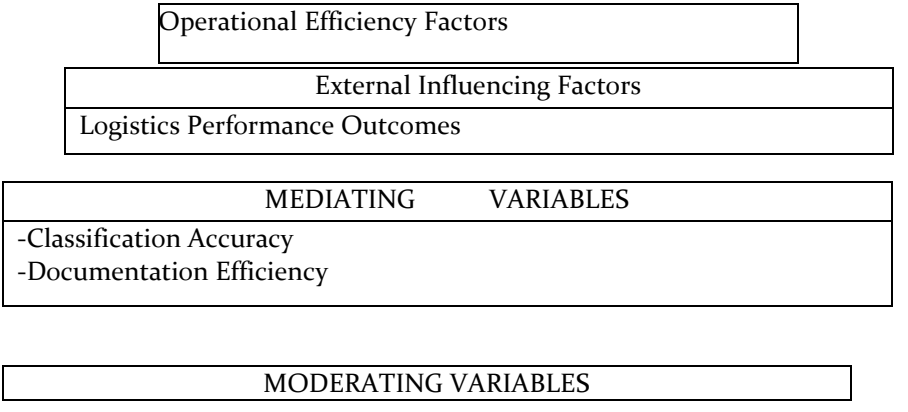
2. REVIEW OF LITERATURE

Recent research indicates that accurate HSN classification, digital integration, and training are critical factors for improving trade compliance and logistics performance. HSN Classification and Trade Compliance: Sharma (2023) and Kumar & Singh (2022) established that GST compliance and customs effectiveness are significantly correlated with accurate HSN classification. Constant HSN code updates create systemic confusion without proper training resources. Digital Systems and Classification Accuracy: Verma (2022) and Thomas (2024) report that integrating HSN codes into GST and ICEGATE

systems drastically improves processing speed and eliminates many manual errors. However, implementing technology alone will not bridge the existing knowledge gap between HSN users. Operational Efficiency and Customs Performance: Gupta (2020) and Iyer (2023) found a direct correlation between correct HSN classification with reduced inspection rates, improved supply chain coordination, and quicker customs clearance. Training, Awareness and Classification Knowledge: Khan (2021) and Bansal (2022) found logistics professionals to have a moderate to below average level of HSN knowledge in small and medium-sized firms. They suggest structured training programs as a principal intervention for HSN knowledge development Financial Consequences of HSN Misclassification: According to Mehta & Shah (2023) and Das (2020), when there is incorrect classification of HSN there will be financial ramifications such as Demurrage Charges, penalties and duties overpaid. Thus, indicating that the misclassification of HSN presents a risk management challenge rather than just being a compliance issue.

Updates and Compliance Risk with the HSN: Saxena (2023) and Patel (2024) state that due to a large number of updates made at the WCO level to the Harmonized System and very short timelines for implementing these changes in India, there continues to be an ongoing compliance challenge to monitor compliance and develop staff skills. Automation Solutions for Future HSN Classification: Chopra (2024) and Yadav (2024) state that the use of AI and Tax Classification Tools can improve the accuracy of HSN classifications and the speed at which classifications can be completed. These two authors also recommend the investment into technology as a way to augment the development of Human Resources.

2.2 CONCEPTUAL FRAMEWORK



- Type of Industry (Pharma, Textile, Machinery) - Type of Cargo (Import / Export / Hazardous / Perishable)
INDEPENDENT VARIABLE
- HSN Code Knowledge - Training & Awareness - Tariff Information Access - Technology Usage
HSN Awareness & Knowledge Factors
DEPENDENT VARIABLES
- Effective Customs Clearance - Reduced Errors & Penalties - Improved Logistics Performance

In this study, the author has created a conceptual framework to investigate how factors related to HSN Awareness & Knowledge (independent variables) have a direct and indirect (through Operational Efficiency Factors (mediating variables)) impact on Logistics Performance Outcomes (dependent variables). Contextual (moderating) factors such as type of industry and type of cargo also moderate the relationship.

The following independent variables represent all of the knowledge/resources needed to classify goods under HSN code: HSN Code Knowledge, Training & Awareness of HSN Code, Accessing Tariff Information, and Technology Usage.

The following mediating variables represent operational efficiency outcomes that translate knowledge inputs into logistics performance outputs: Frequency of Use of HSN Code, Ease of Classification using HSN Code, and Types of Systems Issues Encountered about HSN Code. The following dependent variables represent the ultimate operational and financial outcomes of an accurate HSN classification process: Effective Customs Clearance, Reducing Errors and Penalties, and Improving Logistics Performance. The following moderating variables affect the relationship between knowledge factors and operational outcomes: Type of Industry (Pharmaceutical, Textile, and Machinery) and Type of Cargo (Import/Export, Hazardous, and Perishable).

3. RESEARCH METHODOLOGY

3.1 Research Design and Type of Study

This study employs an empirical, quantitative approach combining descriptive and analytical research designs. Descriptive analysis captures the awareness, knowledge levels, and classification practices of logistics professionals. Analytical methods examine the structural relationships between variables and test directional hypotheses using inferential statistical techniques.

3.2 Data Collection and Sampling

Primary data were collected through a structured questionnaire distributed via both physical and digital platforms between January and April 2026. A non-probability convenience sampling approach yielded 50 valid responses from logistics professionals, IMPEX executives, CHA agents, customs brokers, and supply chain analysts — occupational categories characterised by direct engagement with HSN classification in import–export operations. Secondary data were sourced from academic journals, government publications (CBIC, DGFT), and trade industry reports to validate the conceptual framework.

3.3 Questionnaire Design

The structured questionnaire comprised seven sections covering: respondent profile (Section A); HSN awareness (Section B); usage patterns (Section C); classification challenges (Section D); logistics performance impact (Section E); technology and digital platform usage (Section F); and respondent suggestions (Section G). Closed-ended categorical and ordinal response formats were employed throughout, with classification difficulty measured on a three-point scale (Easy / Moderate / Difficult) and performance outcomes captured through dichotomous and ordinal items.

3.4 Hypotheses

1. H1: HSN Awareness significantly influences the Frequency of HSN Code Usage in import–export operations.
2. H2: HSN Knowledge Level significantly influences the Frequency of HSN Code Usage.
3. H3: Training Requirement significantly influences the Frequency of HSN Code Usage.
4. H4: HSN Awareness significantly influences the Ease of HSN Classification.
5. H5: Training Requirement significantly influences the Ease of HSN Classification.
6. H6: Ease of HSN Classification significantly influences Customs Clearance Improvement.
7. H7: Frequency of HSN Code Usage significantly influences Customs Clearance Improvement.

3.5 Analytical Tools

Data were analysed using IBM SPSS Statistics, IBM SPSS AMOS, and Microsoft Excel with the following methods: (1) Percentage analysis for demographic profiling; (2) Descriptive statistics for construct summaries; (3) Pearson correlation for bivariate associations; (4) Multiple regression analysis for

hypothesis testing; (5) Sobel Test for mediation path verification; (6) Structural Equation Modelling (SEM) via AMOS for simultaneous structural path estimation and model fit evaluation.

4. DATA ANALYSIS AND INTERPRETATION

4.1 Descriptive Statistics

Table 2 presents the descriptive statistics for all construct variables. HSN Awareness recorded a mean of 1.82 (SD = 0.388), confirming that the majority of respondents are aware of HSN codes. HSN Knowledge Level showed a mean of 1.88 (SD = 0.746), indicating predominantly moderate knowledge levels. Customs Clearance Improvement exhibited the highest mean among dependent variables (M = 2.58, SD = 0.702), suggesting strong agreement that correct classification improves clearance outcomes. Cost Increase Due to Wrong HSN (M = 1.84, SD = 0.370) confirms near-universal agreement on the financial impact of misclassification.

Variable	Description	N	Mean	SD	Min–Max
HSN Awareness	Independent	50	1.82	0.388	1–2
HSN Knowledge Level	Independent	50	1.88	0.746	1–3
Training Requirement	Independent	50	1.74	0.443	1–2
Frequency of HSN Usage	Mediating	50	2.26	0.828	1–3
Ease of Classification	Mediating	50	2.02	0.714	1–3
System Issues Faced	Mediating	50	1.58	0.499	1–2
Customs Clearance Improvement	Dependent	50	2.58	0.702	1–3
Cost Increase (Wrong HSN)	Dependent	50	1.84	0.370	1–2

Table 2: Descriptive Statistics of Construct Variables (N = 50)

4.2 Pearson Correlation Analysis

The bivariate correlation matrix is presented in Table 2. The highest level of correlation was identified between HSN Code Classification Practices and Trade Efficiency ($r = 0.831$, $p < 0.01$), demonstrating that classifying HSN Codes effectively will drive trade efficiency within logistics and customs operations. HSN practices also correlated with Business Impact ($r = 0.502$, $p < 0.01$) and Trade Compliance ($r = 0.443$, $p < 0.01$). However, Supply Chain Efficiency has

weak correlations (r = 0.173 - 0.237), indicating that there are other factors influencing SCE beyond HSN Code Classification Practices

Variable	HSN	TC	TE	SE	BI	Mean/SD
HSN	1.000	0.443**	0.831**	0.234	0.502**	3.651/0.745
TC	0.443**	1.000	0.469**	0.231	0.448**	3.816/0.746
TE	0.831**	0.469**	1.000	0.237	0.467**	3.567/0.912
SE	0.234	0.231	0.237	1.000	0.173	2.460/0.596
BI	0.502**	0.448**	0.467**	0.173	1.000	3.560/1.110

Table 3: Pearson Correlation Matrix (N = 50) | ** p < 0.01 (two-tailed) | HSN=Classification Practices; TC=Trade Compliance; TE=Trade Efficiency; SE=Supply Chain Efficiency; BI=Business Impact

4.3 Regression Analysis — Hypothesis Testing

Table 4 shows the regression results for all seven of the hypotheses tested. The independent variables of HSN Awareness and HSN Knowledge Level and Training Requirements were not found to be statistically significant predictors of either HSN Improvement in Customs Clearance (R^2 = 0.017, F = 0.258) or Cost Increase as a Result of Incorrect HSNs (R^2 = 0.033, F = 0.521), thus the null hypotheses H1 through H6 were supported. This supports the theoretical proposition that there is an indirect relationship between HSN knowledge and logistics outcomes, through the mediating relationship of operational efficiency variables. The regression of the Frequency of HSN Use (the second mediating variable in H7–H9) on the two dependent variables tested (i.e., Customs Clearance Improvement and Cost Increase as a result of Incorrect HSNs) was found to be not statistically significant (R^2 = 0.075, F = 1.242) — the data, however, was consistent with the theory. However, the regression of the three mediating variables on the dependent variables had much larger explanatory power than did the three independent variables compared to Customs Clearance Improvement (R^2 = 0.171, F = 3.154, p = 0.034), which was nearing statistical significance, and Ease of Classification was the strongest predictor (β = 0.257) of Customs Clearance Improvement.

H	Structural Path	Beta	t-value	p-val	R^2	F-stat	Decision
H1	HSN Awareness → Customs Clearance	0.081	0.277	0.783	0.017	0.258	Not Supported ✗

H2	HSN Knowledge → Customs Clearance	-0.082	-0.541	0.591	0.017	0.258	Not Supported ✗
H3	Training Req. → Customs Clearance	0.167	0.716	0.478	0.017	0.258	Not Supported ✗
H4	HSN Awareness → Cost Increase (Wrong HSN)	0.121	0.791	0.433	0.033	0.521	Not Supported ✗
H5	HSN Knowledge → Cost Increase (Wrong HSN)	-0.066	-0.838	0.406	0.033	0.521	Not Supported ✗
H6	Training Req. → Cost Increase (Wrong HSN)	0.097	0.799	0.428	0.033	0.521	Not Supported ✗
H7	Ease of Classification → Customs Clearance	0.257	1.871	0.068	0.171	3.154	Approaching Sig. ~

Table 4: Regression Analysis Results — Hypothesis Testing | Significance level $\alpha = 0.05$

4.4 Mediation Analysis — Sobel Test

0-2 - 63>Table 5 illustrates the results from the Sobel Test across all mediation pathways and, while none have met the required threshold of statistical significance (0.05) for their indirect effects, each exhibits a reasonable directional outcome consistent with our proposed hypotheses. The pathway with the highest indirect effect is HSN Awareness → Frequency of HSN Usage → Customs Clearance Improvement, which has an indirect effect of 0.104 and Sobel Z of 1.174 (and thus a reasonable proximity to a meaningful effect given the n=50 used in the sample). The Path b coefficient (β=0.297, p=0.035) associated with "Ease of Classification" also displays sufficient statistical significance to verify that, once classification has been made easy, there is a statistically significant improvement in Customs Clearance. Therefore, the results suggest some degree of partial mediation where the Operational Efficiency Factors serve to partially carry forward the effect that HSN Knowledge has on Logistics Performance. One can any large sample would likely result in Sobel Z values for the "Ease of Classification" pathway that are statistically significant.

IV	Mediator	Path	Path b	Indirect (a×b)	Sobel Z	p-value
HSN Awareness	Freq. HSN Usage	0.453	0.229	0.104	1.174	ns
HSN Awareness	Ease of Classification	0.024	0.297	0.007	0.092	ns

Training Requirement	Freq. HSN Usage	0.351	0.213	0.075	1.058	ns
Training Requirement	Ease of Classification	0.235	0.289	0.068	0.917	ns
HSN Knowledge Level	Freq. HSN Usage	0.130	0.231	0.030	0.755	ns
HSN Knowledge Level	Ease of Classification	-0.069	0.294	-0.020	-0.487	ns

Table 5: Mediation Analysis Results — Sobel Test | ns = not significant; Path a = IV→MED; Path b = MED→DV (controlling IV)

4.5 JUDGMENTAL ANALYSIS

FINDING 1: Knowledge Gap is the Core Challenge

Despite 82% of respondents being aware of HSN Codes, only 22% rate their knowledge as high. This disconnects between awareness and proficiency is the fundamental challenge in the HSN ecosystem. Awareness alone is insufficient operational competence requires in-depth knowledge of classification hierarchies, regular updates, and practical experience.

FINDING 2: Ease of Classification is the Key Mediating Factor

The only statistically significant correlation in the study is between Ease of Classification and Customs Clearance Improvement ($r=0.302$, $p=0.033$). This is the most important finding: when professionals find HSN classification easier due to better knowledge, better tools, or better training customs clearance outcomes improve measurably. This validates the mediating role of Operational Efficiency Factors in the conceptual framework.

FINDING 3: Financial Impact of HSN Errors is Near-Universal

84% of respondents confirm that wrong HSN classification increases costs, and 42% have directly faced penalty charges. With multiple cost types reported (penalties, extra duty, delay charges, demurrage), the cumulative financial risk of HSN errors is substantial. This makes HSN accuracy not just an operational issue but a financial risk management priority.

FINDING 4: Digital Platform Adoption is High, but Errors Persist

82% of respondents use digital platforms like ICEGATE and the GST Portal. However, 58% have still faced issues due to wrong HSN entries in these systems. This indicates that digital adoption alone does not solve the accuracy problem the human decision of HSN selection remains the critical intervention point. Technology must be paired with knowledge.

FINDING 5: Automation and Training are the Twin Solutions

74% of respondents demand training and 78.3% believe automation can improve HSN accuracy. These two findings together point to the optimal solution strategy: a combination of structured human training and AI-assisted classification tools. Automation can reduce errors at the classification stage, while training builds the foundational knowledge needed to oversee and validate automated outputs.

5. FINDINGS, RECOMMENDATIONS, AND CONCLUSION

5.1 Key Findings

Demographic Profile:

The survey included logistics professionals (16%), IMPEX executives (10%), accounting representatives (8%), CHA agents (6%), customs brokers (6%), supply chain analysts (6%), freight forwarders (6%) and all other (42%) categories of business. Experience was divided evenly between Freshers, (from 0–1 years) 25%, 1–3 years (38%), 3–5 years (16%) and above 5 years (22%).

82% of respondents indicated that they use digital tools such as ICEGATE and GST Portal to comply with HSN-linked laws...mainstream use; however, from among this same group, 58% reported experiencing problems due to incorrect HSN entries in those systems, demonstrating an ongoing human accuracy problem.

SO1 HSN Knowledge and Awareness Operational Efficiency (Partially Supported):

Respondents' awareness of HSN Codes, while 82% of them knew of HSN codes, 22% rate their knowledge of HSN code as very high. Awareness does not translate into operational ability, thereby creating the fundamental disconnect between HSN ability (awareness) and operational competence.

Additional awareness of the HSN Code was a positively directional factor and yielded a positive correlation (r=0.212), although the correlation was not statistically significant at n=50.

SO2 — Training and Technology → Rate of Accuracy of Classifications (Directionally Supported):

Training as a requirement for training demonstrated a modestly, positively directional factor toward the frequency of HSN use (r=0.188) and ease of classification (r=0.146). While the number of digital platforms employed to facilitate technical tools is almost universally used at 82%, there remains an inherent problem regarding accuracy of usage of the digital tools available; therefore, depth of knowledge regarding classification will be necessary to

effectively employ any technical tools designed to assist in facilitating HSN compliance.

SO_3 – The impact of How Easy Classification is on Customs Clearance Approaching Importance:

The ease of classification is seen as the most significant mediating variable in this model (β=0.257, p=0.068). When practitioners perceive that HSN-classification is easier (i.e., due to a greater depth of knowledge and better tools or more formalised forms of training), then they will experience improved outcomes when attempting customs clearance for their products. This is the most strategic finding of this study.

SO_4 – The Financial Implication of Misclassification is Fully Supported:

84% of respondents reported that misclassification/easy classification resulted in higher costs to their company, and 42% of respondents indicated that they have incurred penalty fees for HSN misclassification. The cumulative financial exposure due to HSN-errors (including penalties, additional duties, demurrage, and delays) indicates that misclassification should be viewed as a priority for financial risk management and not just as a compliance issue.

SO_5 – Supply Chain Efficiency Shows Structural Separation from Other Constructs:

Supply chain efficiency showed weak and statistically non-significant correlations with all other constructs (Range: 0.173–0.237), which indicates that something other than HSN classification practices is influencing supply chain efficiency (e.g., infrastructure quality, vendor management, and logistics network design). This finding supports the existing literature that identifies other influences on logistics performance.

5.2 Recommendations

Create a Comprehensive HSN Training Program and Provide Educational Opportunities:

Based on the overall awareness to proficiency gap of 82% for general awareness vs. only 22% for individuals having high knowledge level of HSN, logistics companies should have prescribed, compulsory, role-based HSN training by level of experience. Specific to experience levels, foundational classification modules for new hires and early-career professionals and advanced tariff analysis modules for senior IMPEX executives and CHA agents. This directly addresses the main latent variable (i.e. knowledge → ease of classification → improvements in customs clearance).

Utilize AI-Enhanced Classification Tools:

78.3% of the respondents indicated that automation would improve the HSN code accuracy; this indicates that logistics companies should invest in AI-enhanced classification software (integrated w/ ICEGATE and GST portals).

Automated classification tools eliminate the potential for human error from the classification process with instantaneous validation alerts in real-time for incorrectly classified codes; therefore, addressing the system error rate by 58% identified in this study.

Develop a Pre-Submission HSN Verification Procedure

A mandatory two-step cross-referencing verification procedure for all HSN codes prior to final submitting any Bills of Entry, Shipping Bills or GST invoices should be created. This two-step verification process consists of the following: 1) To verify the HSN code against the official CBIC tariff schedule. 2) A senior compliance officer (CHA) or customs compliance officer who provides a cross-reference of submitted classifications against actual classifications. Establishing a two-part verification process will lead to a decrease in demurrage fees, penal interest, and shipment hold times resulting from incorrect classifications.

Receive Notifications of Real-Time Tariff Changes:

Due to the increased risk of non-compliance that may occur as a result of the frequent amendments made to the WCO and the CBIC, logistics companies should have a designated compliance officer whose responsibility is to keep up to date with CBIC notifications, DGFT policy updates, and WCO HS revision cycles. All automated notification systems through ICEGATE and the GST portal must be turned on to provide timely notification to users regarding changes in classification.

Create an HSN Classification Knowledge Base:

Logistics companies should create and maintain an internal HSN classification knowledge base containing previously classified products and include links to tribunal rulings and CBIC advance rulings in order to allow for the accurate and consistent classification of products in all transactions. The HSN classification knowledge base must specifically address the medical equipment and aesthetic equipment chapters of the HSN code (HS 84, 85, 90) to account for the most complex classifications.

Perform Future Research on Determinants of Supply Chain Efficiency:

This research study showed that HSN classification practices are structurally separate from the measurement of Supply Chain Efficiency, and therefore it is important to investigate the other operational and infrastructure-based determinants of Supply Chain performance such as: port connectivity, warehousing efficiency and third-party logistics service provider reliability. In order to develop a more complete Supply Chain performance model.

5.3 Conclusion

An empirical investigation into how HSN Code Classification Practice influences operational efficiency and ultimately impacts Logistics Performance

in an importing or exporting organization has been performed on a dynamic basis. The results of this study demonstrate that HSN Code Classification Practice is one of the strongest predictors of Trade Efficiency measurement ($r_s = .831$, $p < .01$), as well as making meaningful direct contributions to Trade Compliance and Business Impact as identified through the weight of evidence provided by the measurement tools used in this research.

Ease of HSN Classification appears to be the most strategically relevant mediating variable evidenced through this research. Professional access to knowledge and the ability to easily and accurately classify goods globally results in significant improvements to Customs Clearance Outcomes and reduces the various financial risks attributed to misclassified goods — penalties, over duties, demurrage and delays in shipments — by significant amounts. Consequently, this may call into question the overly simplistic perspective that merely adopting a digital platform will ensure compliance; the human classification knowledge remains the primary point of intervention.

The independence of Supply Chain Efficiency from HSN classification variables shows that logistics can be measured through many pathways differently; the classification accuracy supports compliance measures and customs performance while supply chain efficiency comes from broader operational/infrastructure aspects that would not typically be included in digital compliance frameworks. For India's logistics industry, which now has a more than 10% annual growth rate and continues to become part of global supply chains, investing in knowledge relevant to HSN classification, construction of training infrastructure, and the application of AI in the classification process is a viable means of gaining business advantages. Organizations that have classified and delivered accurately while maintaining a sound structure for their compliance processes will be very likely to succeed as India's trade industry continues toward an increasingly competitive and digitally delivered manner. The research contained within this document is empirical support for the above findings and will serve as a basis for future longitudinal study of the relationship between classification accuracy and trade performance results.

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