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Identifying Market Gaps and Local Manufacturing Potential for Essential Medical Devices in Pakistan

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Abstract

Background: Pakistan's healthcare system faces significant challenges due to its heavy reliance on imported medical devices, creating financial strain and supply chain vulnerabilities that compromise patient care and system resilience.

Objectives: This study aimed to analyze Pakistan's medical device import data to identify and prioritize specific, high-impact products for local development and strategic policy intervention.

Methods: A quantitative analysis of fiscal year 2022-23 import data from the Pakistan Bureau of Statistics was conducted. Data was processed using SPSS, where medical devices were categorized into capital equipment and consumables for comparative statistical analysis.

Results: The findings revealed a stark market bifurcation. A small number of high-value capital equipment items, like CT scanners, accounted for significant import costs, while high-volume, low-cost consumables, such as syringes and cannulae, dominated import quantities.

Implications: This research provides a definitive, evidence-based roadmap for policymakers and investors to target import substitution and foster local industry growth, which is crucial for building a more sustainable and self-sufficient healthcare system in Pakistan.

Keywords: *Medical Devices, Import Dependency, Healthcare Policy, Local Manufacturing, Pakistan, Strategic Sourcing*

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1. INTRODUCTION

The medical device industry stands as a critical pillar of modern healthcare, directly influencing the quality of diagnostics, treatment, and patient outcomes. In emerging economies, a robust domestic medical device sector is not merely an economic asset but a vital component of national health security. However, many of these nations, including Pakistan, face a significant challenge: a heavy reliance on imported medical equipment and consumables. This dependency creates vulnerabilities, from supply chain disruptions that can halt critical procedures to the immense financial strain of importing high-cost technology, ultimately limiting patient access to essential care (Ahmed et al., 2024; Amaral et al., 2024).

Globally, the conversation has shifted towards smarter, more self-reliant healthcare systems. Research highlights the importance of predicting device needs and failures for efficient management (Abd Rahman et al., 2023), while studies in an Asian context underscore the strategic choices nations must make to advance their local medical technology capabilities (Hu et al., 2022). Furthermore, the stability and innovation within this sector are deeply tied to its internal dynamics, including employee satisfaction and regulatory frameworks (Cheah & Lim, 2024; Amaral et al., 2024). Yet, a clear gap exists in translating these global insights into actionable, data-driven strategies for specific emerging markets. Simply recognizing the problem of import dependency is not enough; there is a pressing need to identify exactly which medical devices offer the most strategic and feasible opportunities for local development.

This study addresses this gap by moving from a general awareness of the problem to a precise, evidence-based solution. The objective of this research is to analyze Pakistan's import data for medical devices to identify and prioritize specific, high-impact products for local manufacturing and development. By systematically evaluating devices based on their import volume and financial value, this study aims to provide a clear, actionable roadmap. The ultimate goal is to offer stakeholders, from policymakers to local entrepreneurs, the data-driven insights necessary to foster a resilient, innovative, and self-sustaining medical device industry in Pakistan.

2. METHODOLOGY

This study employed a quantitative, retrospective research design to analyze Pakistan's medical device import landscape. The primary dataset was officially sourced from the Pakistan Bureau of Statistics, covering the complete fiscal year from July 2022 to June 2023. This official record provided a comprehensive overview of the nation's foreign purchases of medical equipment.

The analysis focused on import transactions classified under specific Harmonized System (HS) codes, notably Chapter 90, which meticulously details medical and surgical instruments. For robust data management and statistical examination, the software package SPSS was utilized. The analytical process involved a two-stage approach. First, descriptive statistics were computed to summarize the volume and financial value of imports, identifying the highest-spend and highest-volume items. Subsequently, the imported devices were systematically categorized into two distinct groups: high-value capital equipment and high-volume consumables. This classification enabled a comparative analysis to discern the unique import profiles and strategic opportunities presented by each category, forming the basis for targeted recommendations.

Categorization Framework

The most critical stage involved the systematic categorization of the imported devices into two distinct groups: Capital Equipment and Consumables. To ensure objectivity and reliability, a clear, rule-based framework was

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developed and applied. The classification was determined based on a combination of three key factors:

Unit of Measure and Typical Usage Pattern: Items typically purchased as single, standalone units intended for repeated use over multiple years were flagged for the Capital Equipment category. In contrast, items recorded in bulk quantities and designed for single-use were flagged as Consumables.

Unit Cost Threshold: A review of the unit cost (Total Import Value / Quantity) was used as a final validation step. A clear dichotomy was observed, where items classified as Capital Equipment based on the above rules consistently exhibited a high per-unit cost, while Consumables showed a very low per-unit cost. This served to confirm the initial categorization.

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3. RESULTS

Summary of Imported Medical Devices

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Cumulative Import Quantity	30	6	60,347,344	7,113,847	15,602,221
Cumulative Import Value (PKR)	30	2,938	16,942,919	2,713,204	4,599,676
Cumulative Import Value (USD)	30	13	75,302	9,612	16,311

Table 1 Descriptive Statistics

Note: Value conversion based on an exchange rate of 1 USD = 282 PKR.

The descriptive statistics reveal a market characterized by extreme volatility and a heavy tail distribution. The vast difference between the minimum and maximum values for both quantity and cost, coupled with standard deviations exceeding the mean, indicates that Pakistan's medical device import profile is not uniform. A small number of very high-volume, low-cost consumables (like syringes and needles) and a handful of extremely high-cost, low-volume capital equipment items (like CT scanners) dominate the landscape. This bifurcation suggests that successful domestic manufacturing strategies must adopt two distinct approaches: one targeting mass-produced disposables and another focusing on high-tech, complex apparatus, rather than a one-size-fits-all model.

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Comparison of Capital Equipment vs. Consumables Medical Device Imports

Table 2 Paired Sample T Test

	Category	N	Cumulative Import Quantity		Cumulative Import Value (USD)	
			Mean	Std. Deviation	Mean	Std. Deviation
	Capital Equipment	9	985	1,051	8,524	10,982
	Consumables	21	10,161,369	17,900,000	10,078	18,351
	Total	30	7,113,254	15,600,000	9,612	16,311

Note: Values rounded to nearest whole number for clarity. Import Quantity is measured in number of units.

The comparative analysis reveals a stark dichotomy in Pakistan's medical device imports. Capital equipment, such as CT scanners, is characterized by minimal annual volumes (Mean = 985 units) but carries a substantial mean value of $8,524 per import entry. In direct contrast, consumables like syringes and needles are imported in massive quantities (Mean = 10.16 million units), with a similar mean financial footprint of $10,078 per item. This clear division underscores two distinct market segments: one defined by high-value, specialized technology and the other by high-volume, essential disposables. The data compellingly argues for separate, targeted strategies to develop local manufacturing for each category.

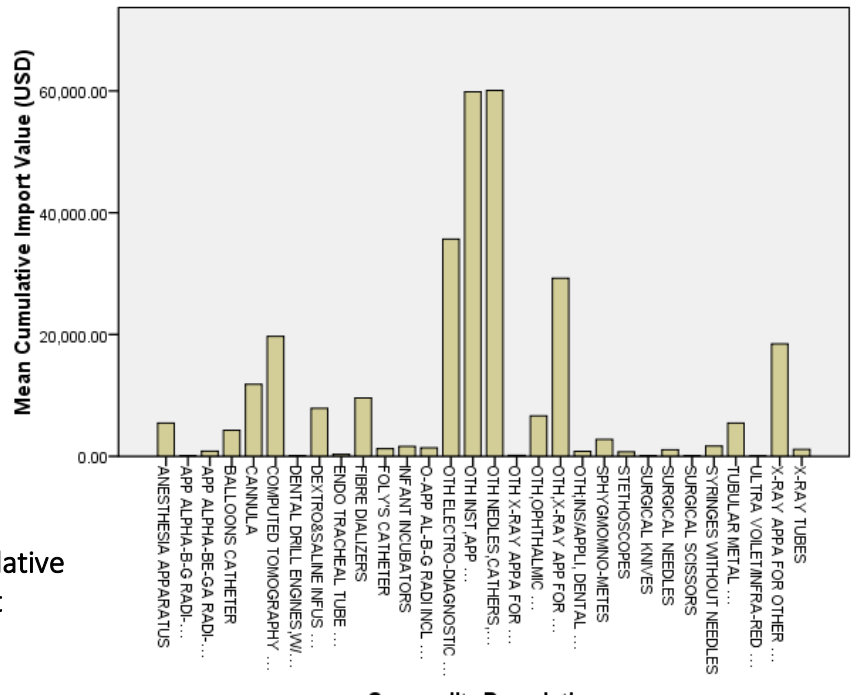

Figure 1

Graph Chart for Cumulative Imports in USD against Commodities

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The chart illustrates the distribution of medical device imports by value and quantity. High-cost, low-volume capital equipment like CT scanners clusters in the high-value quadrant, while low-cost, high-volume consumables like cannulae and syringes dominate the high-quantity axis. This clear visual confirms the fundamental market split between these two distinct product categories.

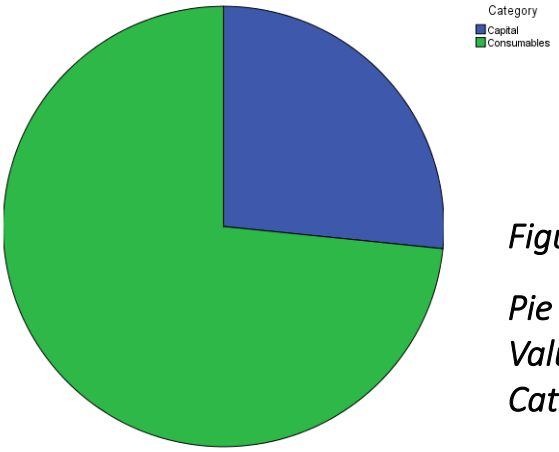

Figure 1

Pie Chart for Cumulative Value Imports in USD Against Category

The chart reveals that while Capital Equipment like CT scanners constitutes a smaller portion of the total number of items imported, it commands a significant and likely dominant share of the total import value in USD. Conversely, Consumables, despite being imported in vastly higher quantities, account for a smaller proportion of the overall financial outlay, highlighting the higher per-unit cost of capital assets.

4. DISCUSSION

This study provides a crucial empirical foundation for a strategic shift in Pakistan's approach to its medical device sector. The findings reveal a market starkly divided between high-volume consumables and high-value capital equipment, a pattern that resonates with global trade models in emerging economies (Yilmaz & Bayrak, 2021). However, this analysis moves beyond merely identifying this bifurcation; it offers a granular, data-driven prioritization framework previously absent in the local context. While previous Pakistani studies have rightly highlighted overarching regulatory and innovation challenges (Liaqat et al., 2022; Sohail, 2025), they often lack the specific, actionable evidence required for targeted industrial policy. This research fills that gap by pinpointing exact product codes, from cannulae to CT scanners, that represent the most significant financial burdens and dependency risks.

The implications for policymakers and industry stakeholders are profound. For high-volume consumables, the path involves strengthening local manufacturing to achieve import substitution, a goal aligned with calls for sustainable development and reduced trade policy uncertainty (Shabbir et al., 2022). For complex capital equipment, the strategy is more nuanced, requiring a focus on technology transfer, local assembly, and specialized maintenance, all of which depend on a robust regulatory environment. This is where a significant challenge lies. The current regulatory landscape, as noted in pharmaceutical and device sectors, can present gaps that hinder local industry growth (Malik et al., 2021; Mubarak et al., 2024). Therefore, the successful execution of the strategies suggested by this data is contingent upon parallel regulatory reforms and institutional

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strengthening, as advocated by global benchmarks (World Health Organization, 2024; Rimpi et al., 2025).

To effectively act on this bifurcation, policy must be equally distinct. For consumables, the focus should be on streamlining approvals and incentivizing bulk production. For capital equipment, strategy must center on fostering technology transfer partnerships and establishing robust technical standards and maintenance ecosystems.

The study successfully demonstrates that Pakistan's import dependency is not a monolithic problem but a structured landscape of specific opportunities. It contributes a new, evidence-based roadmap to the medical literature, shifting the conversation from general concerns to targeted action. The clinical significance is direct: fostering a resilient local medical device industry is fundamental to ensuring stable access to essential healthcare supplies, controlling costs, and ultimately strengthening the entire healthcare system against global supply chain disruptions.

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5. Conclusion

This study successfully demystifies Pakistan's medical device import landscape, transforming the broad challenge of foreign dependency into a clear, actionable strategy. By empirically distinguishing between high-volume consumables and high-value capital equipment, the analysis provides a definitive roadmap for stakeholders, directing targeted manufacturing initiatives and sophisticated technology partnerships. These findings compellingly argue that the path to a self-reliant healthcare sector requires not just industrial will but also a concurrent evolution of the regulatory and innovation ecosystem. Ultimately, implementing this data-driven framework is imperative for building a resilient, cost-effective, and accessible medical device supply chain that can reliably serve Pakistan's population.

AUTHOR'S CONTRIBUTION AND DECLARATIONS

Concept Design, Literature Review and Drafting: Moona Khurshid

Concept Design, Data Collection, and Strategic Recommendations: Muhammad Salman Khan

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Furthermore, this research did not involve the use of animals, plants, or any biological specimens requiring ethical approval. Therefore, ethical clearance from an institutional review board, prior informed consent (PIC) from respondents, or animal/plant welfare approvals are not applicable to this study.

The author(s) affirm full compliance with international ethical standards for research and publication.

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