

A Systematic Review of Stakeholder's Role in New Product Development for Defence Sector

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The study delves into the uncharted territory of the Defence sector, aiming to unravel the roles of Customers and Supply Chain Partners in the realm of New Product Development. A meticulous research endeavour was undertaken, systematically scouring interdisciplinary databases like Google Scholar, Web of Science, and Microsoft Research, employing terms like 'New Product Development' and 'Customer role in Product Development.' The findings were meticulously tabulated, considering factors such as timing, domains, and thematic nuances, unveiling a conspicuous gap in the existing body of knowledge. While the literature review illuminated a wealth of published work elucidating the roles of customers and supply chain partners in New Product Development across diverse industries, a notable observation emerged - the dearth of extensive research within the Defence industry. This void underscores a critical need for dedicated exploration and scholarly inquiry in this specific arena, accentuating a significant research gap and signaling a prime opportunity for organizations and institutions involved in Defence-related endeavours. The study stands as a pioneering effort, marking the first systematic attempt to review literature within the Defence industry's unique context. The identification of variables and gaps from prior literature enriches the discourse, providing a foundation for future exploration. The implications of this study reverberate across theoretical, conceptual, and managerial dimensions, offering a roadmap for future research endeavours.

Keywords: Customer, New product development, Supply chain partner, Systematic literature review

Introduction

The scholarly exploration encompasses a wide range of subjects, and one area of particular importance is the dynamics of New Product Development (NPD) within the defence sector. This research endeavor prompts a deep dive into the known and unknown aspects of NPD, with a focus on the implications that highlight the significance of this study. Specifically, this study aims to unravel unexplored territories within the complex interplay between customers, supply chain partners, and the Defence Research and Development Organization (DRDO) in the context of NPD.

To embark on this intellectual journey, it is crucial to critically examine the existing knowledge and identify what has already been established and what remains undiscovered.¹ While NPD is a well-explored topic in various industries, its dynamics within the defence sector present unique challenges due to the sector's high technological sophistication and strategic importance. This raises the fundamental question:

What do we currently know about NPD in the defence sector, and what crucial aspects are still elusive?

The primary focus of this research is to explore NPD within the defence sector, a topic that holds intrinsic interest and paramount importance in both theoretical and practical dimensions. Given the defence sector's significant budgetary allocation, which serves as a cornerstone of national security and technological advancement, the investigation into NPD takes center stage in academic discourse.

A thorough examination of existing literature uncovers a wide range of theoretical perspectives and empirical findings that have influenced our understanding of NPD.² Scholars from different industries have explored the impact of customers and supply chain partners on innovation strategies.^{3,4} However, the defence sector has been noticeably overlooked in this body of knowledge. This research aims to merge existing insights with a specialized focus on the defence industry, offering a more comprehensive understanding of NPD dynamics.

Amidst the vast realm of scholarly investigation, this research addresses a significant and unaddressed

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puzzle.² What specific dynamics define NPD within the defence sector, and why is it deserving of our scholarly attention? The defence industry presents a unique set of challenges, including classified technologies, strict regulatory frameworks, and a complex network of stakeholders.⁴⁻⁶ Solving this puzzle not only promises academic enlightenment but also practical insights with profound implications for national defence and technological advancement.

In order to delve deeper into the relationship between customers, supply chain partners, and the development of new products, as well as to bridge the gaps identified in previous research papers, this study takes a comprehensive approach. The significance of customers in the defence sector underscores the need for extensive research in defence industries to facilitate the development of new products.⁷

The expected insights derived from this study go beyond what is currently known. By examining the intricacies of NPD within the defence sector, the research aims to uncover unique aspects that define innovation in this particular context.^{3,4,8} The identification of gaps in existing knowledge and the exploration of uncharted territories within this critical field are poised to make a significant contribution to academic discourse.

At its core, this study not only seeks to make incremental contributions but also to fundamentally transform, challenge, and enhance scholars' comprehension of NPD. By focusing on an industry characterized by its intricate complexities, the research strives to provide fresh perspectives that surpass the limitations of current knowledge.⁵ The defence sector, often analyzed from a strategic studies perspective, gains a new dimension as this study sheds light on the interconnected relationships among customers, supply chain partners, and the DRDO within the specialized context of NPD.

Research Questions

At its essence, this study grapples with a series of crucial research inquiries that act as guiding lights, shedding light on the path of investigation:

- a) What are the primary roles played by customers, supply chain partners (including DRDO), and the complex relationships⁹ among them in the development of new products within the defence sector, and what are the implications and consequences of these roles throughout the NPD process?
- b) How are customers defined in the existing literature, and how does this definition differ when applied to the defence sector?
- c) What observable models govern the relationships between customers, supply chain partners, and the resulting new products tailored to meet the customers' needs?¹⁰
- d) In what capacity do supply chain partners contribute to the entirety of this model, and how does their role influence NPD outcomes?
- e) How does the fulfilment of demand for customers in the defence sector differ from other supply chains, such as those in the hotel, food, hospital, or entertainment industries?

These research inquiries are not only shaping the extent of our investigation but also emphasizing the importance of comprehending the intricate interplay of stakeholders within the defence sector's NPD landscape. By addressing these questions, it is aimed by this study to not only contribute to academic discourse but also provide practical insights that can inform strategic decision-making within this strategically vital industry. As these inquiries are delved into, the goal is to uncover unexplored dimensions, challenge existing paradigms, and offer a comprehensive understanding of NPD within the defence sector.

Methodology

Phase 1 Planning

For this systematic literature review, meticulous planning was undertaken to ensure a comprehensive and thorough exploration of the identified study area. The primary databases selected for the search were Google Scholar and Web of Sciences. An exhaustive approach was adopted, employing various combinations of search terms to incorporate maximum studies. A detailed search was done conducted with various search combinations to identify various studies covering the stakeholders role in NPD in defence sector. The search resulted in 'NIL' results. Thereafter, an attempt was made to explore the main domains and branches of knowledge, though yielding negligible results.

Review Protocol

The study employed a unique review protocol labelled as "6Ws2Hs," aligning with the research questions.⁹ This protocol, structured around the questions of "WWWWWWHH," facilitated a

comprehensive understanding of prior research and guided the present study.

Keywords & Search Strategy

The literature search employed a comprehensive strategy utilizing two major academic databases: Google Scholar and Web of Science. To capture relevant studies from diverse domains and branches of knowledge, different sets of keywords were used. The search terms included combinations of the following keywords:

("customer role"¹¹ OR "customer involvement"¹² OR "customer participation"¹³) AND ("supply chain"¹⁴ OR "supply chain partners" OR "suppliers") AND ("new product development" OR "NPD" OR "product innovation") AND ("defence sector"¹⁵ OR "defence industry" OR "military")

Additional keyword variations were used to broaden the search, such as "customer integration,"¹⁶ "customer experience,"¹⁷ "customer requirements,"¹⁸ "customer expectation,"¹⁹ "customer empowerment,"²⁰ "supplier integration,"²¹ "supplier innovation,"²² "co-creation,"²³ "Interactions,"²⁴ "collaborative product development,"²⁵ "defence procurement," and "defence acquisition,"²⁶ "R&D integration,"²⁷ "stakeholder engagements,"²⁸ "NPD models,"²⁹

The search process involved a detailed strategy, considering factors like publication years (focusing on literature from the past two decades), citation counts, countries of origin, publishers, and interdisciplinary searches. This approach aimed to encompass research from various fields, including management, commerce, financial studies, social sciences, humanities, medicine, and nursing.

Selection Criteria: The selection of papers for inclusion in the study followed a set of predetermined criteria:

1. **Relevance:** Studies that explored the roles of customers, supply chain partners, and new product development in the defence sector or related industries were prioritized.
2. **Quality:** Peer-reviewed journal articles, conference proceedings, and books from reputable publishers were favoured to ensure the quality and reliability of the included literature.
3. **Perspective:** Both theoretical and empirical studies were considered to provide a comprehensive understanding of the topic from multiple perspectives.
4. **Accessibility:** Only studies with full-text availability were included in the final analysis.

5. **Language:** The search was limited to publications in English to ensure consistency and minimize potential misinterpretations due to language barriers.

The initial search yielded a large number of results, which were further screened for duplicates and relevance based on the titles and abstracts. The remaining studies were subjected to a full-text review, and those meeting the selection criteria were included in the final analysis.

To supplement the findings from the defence sector, the study also compared and contrasted insights from related industries, such as food, hotel and hospitality, entertainment, and fast-moving consumer goods (FMCG). This cross-industry comparison aimed to identify potential best practices and transferable knowledge that could inform the understanding of customer and supply chain partner roles in new product development within the defence sector.³⁰⁻³²

Missing Gaps

The combination of searches revealed varying results, often confined to specific industries or stakeholders. Notably, no study captured the role of both customers and the industry in the NPD process especially in the defence sector.

Inclusion Criteria

Establishing clear inclusion criteria was vital for the systematic literature review. The criteria aimed to include studies from diverse domains and branches, focusing on variables, nature of the study, theoretical and conceptual models, frameworks, and structural models. The criteria outlined were:

- a. Literature focusing on customers involved in the overall development of new products in the defence sectors of India.
- b. Significant literature exploring multiple domains rather than focusing solely on one.
- c. Selection based on variables, theoretical models, conceptual models, frameworks, and structural models published in prior studies.

Exclusion Criteria

Exclusion criteria was crucial for refining the literature search and excluding irrelevant studies. The exclusion criteria comprised studies inclusive of author names in duplicate searches, studies on global defence sectors other than India, and topics unrelated to the current research. Additionally, duplicates of abstracts and secondary publications were excluded.

Quality Assessment

A robust quality assessment was designed exclusively, aligning with the research questions. The assessment stages focused on the research questions, the aim, significance, and context of the study. The "6Ws2Hs" protocol guided this assessment, ensuring alignment with the research objectives (see Fig. 1 and Table 1).

Systematic Literature Review

Number of Publications

During the google search a number of publications under different topics were displayed, providing an overview of the search outcomes.

Phase 2 Conducting

Search Strategy: The search strategy was meticulously executed, as presented in Table 2. Different topics, such as the role of customers, supply chain partners and defence management were explored emphasizing a thorough investigation.

Selection Process: The focus shifted to the selection process, identifying variables and addressing gaps. This step was crucial in completing the systematic literature review.

Review Protocol Validation: The review protocol validation (Table 3) was conducted to ensure adherence to the selected protocols for the study.

A flow diagram (Fig. 2) depicted the systematic literature review process. This process identified 2678 records and employed rigorous screening criteria to select eligible studies. Following this initial screening, 100 full-text articles were assessed for relevance. Due to exclusion criteria, an additional 55 articles were excluded, resulting in a final selection of 45 research papers for this study.

The flow diagram could be likened to a treasure map, guiding us through the twists and turns of the literature landscape. The identification of records,

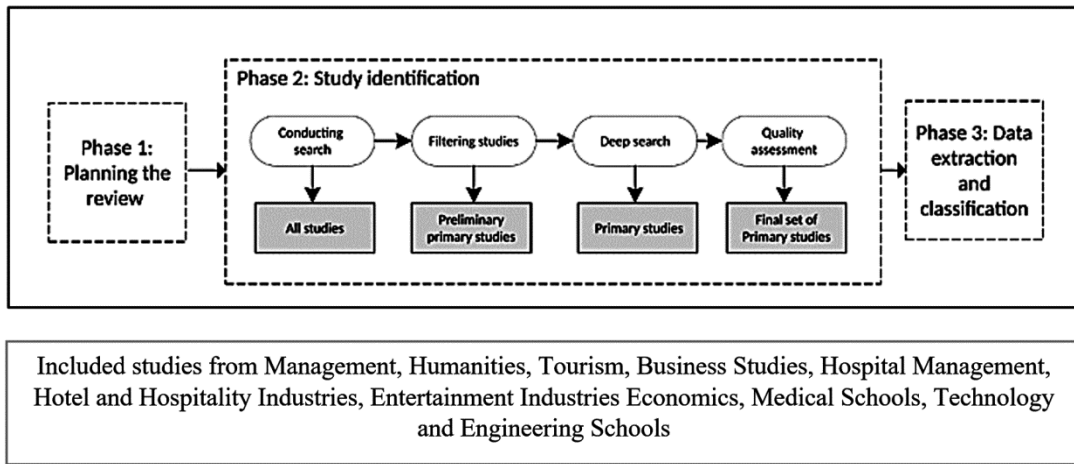


Fig. 1 — Phase 2 of the study

Table 1 — Quality assessment

Stage	Quality criteria	Description
Stage 1	Focus on research questions	At this stage, it was decided that the focus will be exclusively on the research questions that were designed and planned for the study.
Stage 2	Aim and significance of the study	It was absolutely essential and necessary to focus on the role of the customers, supply chain partners and the NPD. The search must be confined towards it only. This will certainly help to know the importance of role of the Customers, partners of the supply chain in NPD in Indian defence sector. This will essentially contribute in understanding the research questions raised out for the research.
Stage 3	Context of the study	One has observed that there is a role played by the customers and their contributions towards development of the new product. Thus, it becomes necessary to understand the importance of the study through prior literature and to know more about the research also. Since Indian defence sector is known for various innovations of the new products, the study highlights the cross-disciplinary approach to comprehend about the role of the customers and supply chain partners and how the new products are developed and designed through DRDO. Moreover, it has played a major role to take care of the customers or supply chain partners like DRDO or to attract the innovations in the designing and development of the new products.

Table 2 — Role of supply chain in NPD

S. No.	Supply chain research topics	Research done or not done wrt defence services	Scope & significance
1	Role of supply chain management in NPD	Not done	Yes
2	The role of procurement in NPD	Not done	Yes
3	Early supplier involvement in NPD	Not done	Yes
4	Supply chain strategy for NPD	Not done	Yes
5	What is not an important consideration for the supply chain of a NPD	Not done	Yes
6	Marketing in supply chain management	Not done	Yes
7	Product development and procurement	Not done	Yes
8	Product characteristics in supply chain	Not done	Yes
9	NPD in supply chain	Not done	Yes
10	Strategy towards NPD in innovativeness	Not done	Yes

Table 3 — Review protocol validation

Research question	Data item for extraction	Description
What is the primary role played by customers and supply chain partners, including DRDO, in the development of new products within the defence sector	Customers, role of the customers, defence service customers, customers from the defence sector, designations of the customers, demands of the customers, different areas of the defence services, attitudes, beliefs, defence backgrounds, experiences, interaction between defence officers	These were really useful to know more about the research question and the manner in which the research was conducted in the prior literature. These helped in identifying the gaps and the missing links.
Why is this role significant, and what are its broader implications?	Importance of the customers, role of the supply chain partners, kind of supply chain, value of the supply chain partner, usefulness, nature of the customers and the partners of the supply chain, association between customers and supply chain partners, their relationship, how their association helped towards the development of the new product.	The research helped to proceed further with the identification of the models from the multi-disciplinary studies and recognize the missing links and gaps from the theoretical, conceptual, frameworks and structural aspects of the studies.
How do the complex relationships among customers, supply chain partners, and DRDO unfold within the immediate community, and what valuable insights can be derived from these dynamics?	Relationship, association, officers, high designations, initiatives, role towards the consumption of the products, development of the products, need, transformations, future generations	The model was developed to understand the role of the customers, partners involved in the entire supply chain and the development of the new product
What are the consequences of these roles, and how do they resonate throughout the NPD process?	Various customers from defence sectors, innovations in the defence products, need for the new products, teams of the supply chain partner DRDO	Resulted into new products in the defence sector, role of the technology, sustainability, partnerships at local and global levels
How are customers defined in the existing literature, and how does this definition differ when applied to the Defence sector?	Definition of the customers from other industries like food, hospital, entertainment, hotel, gaming, automobile, technological industries etc.	Various definitions of the customers, needs, demands, development of the new product, various stages of the development, strategies, digital marketing, designing and planning of the new product development were observed in the prior studies.
What observable models govern the relationships between customers, supply chain partners, and the resulting new products tailored to meet the customers' needs?	Model of the innovation of the product, relationship between the customers, supply chain partner, effects of the supply chain partner, role of the customers, stages, processes and development phases of the new product	What kind of the customers are present in the defence sectors? What are their demands and needs? How are these demands and needs fulfilled by the supply chain partner and DRDO? How are new products designed and developed? What are the strategies for it? What kind of planning is needed? Who does it? Is there a role of technology also?
In what capacity do supply chain partners contribute to the entirety of this model, and how does their role influence NPD outcomes?	Selection and identification of the supply chain partner, within quarters of DRDO, external to DRDO, internal to DRDO, role of customers and DRDO, technology, customers and DRDO, development of the new product and DRDO.	Internal and external supply chain partners from DRDO, local officers, local customers, local supply chain partners, external officers or customers for DRDO are closely observed and studied to arrive at the final model.
How does the fulfillment of demand for customers in the defence sector differ from other supply chains, such as those in the hotel, food, hospital, or entertainment industries?	Comparative studies from other industries, observations on the demands and needs presented by the defence customers, how supply chain partners involve for the development of the new product.	Different models for the demands and needs are observed and compared with the defence sectors

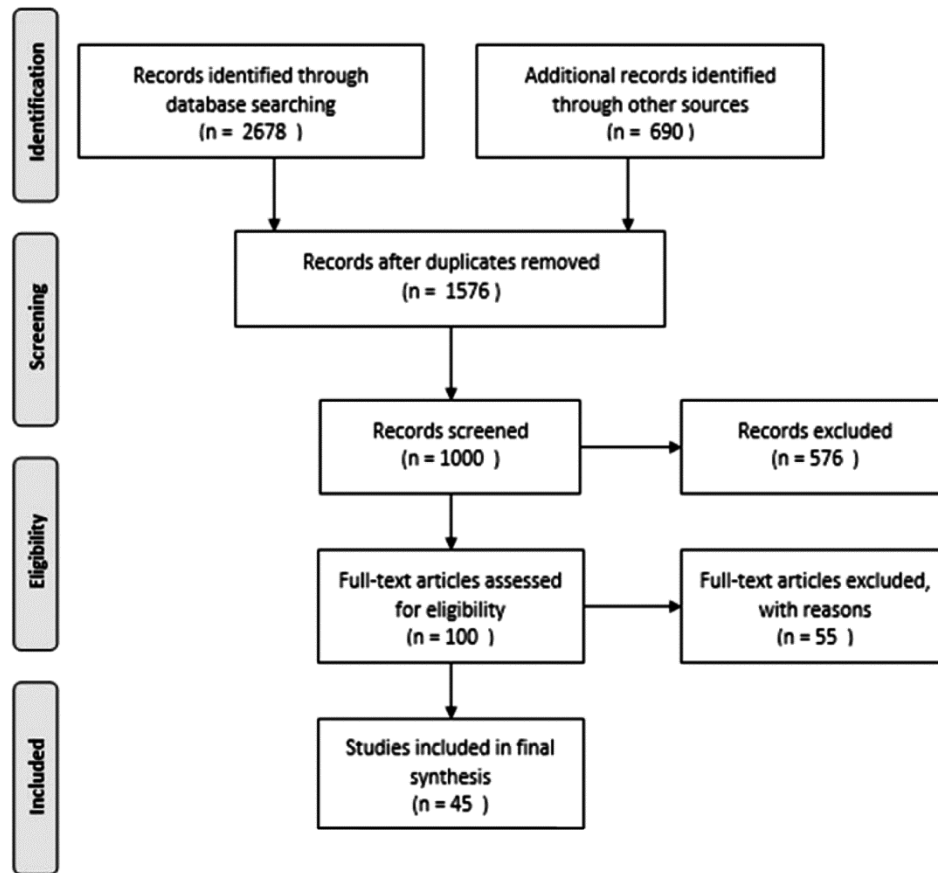


Fig. 2 — The flow diagram (Source: Moher D, 2009)

additional sources, and the meticulous screening process represented the steps taken in uncovering the jewels of information relevant to our research.

Findings

The exploration of the role of customers, supply chain partners, and new product development in defence sectors is a journey through the intricate tapestry of the defence industry. In this comprehensive discussion, we delve into the nuanced findings obtained through the review protocol validation, search keywords, flow diagram, reviews typology, service industry comparison, and identification of missing gaps. This detailed examination provides a panoramic view of the existing knowledge, reveals gaps, and sets the stage for our research endeavours.

Main role of customers, supply chain partners and DRDO in NPD in defence sector

Our journey begins with an in-depth exploration of the multifaceted roles played by customers, supply chain partners, and the DRDO in the development of

new products within the defence sector. The literature review acted as a gateway, unravelling a plethora of insights into designations, demands, attitudes, beliefs, and experiences of these key players.

Beyond mere identification, the review served a dual purpose – it laid bare the intricacies of relationships among these entities. The interactions between defence officers, the demands of customers, and the transformative initiatives undertaken by DRDO emerged as critical components. The review protocol not only allowed for a comprehensive understanding of these elements but also acted as a compass, guiding us to identify gaps and missing links in the existing literature.

Relevance and importance

Understanding the relevance and importance of customers, supply chain partners, and their collaboration in the defence sector was paramount. The literature review illuminated the landscape, emphasizing the significance of customer engagement and the dynamic nature of their association with supply chain partners. This understanding extended

beyond the immediate context, revealing models from multi-disciplinary studies.

The research's trajectory was influenced by the identification of these models. It propelled us towards recognizing gaps in theoretical and conceptual frameworks, offering a profound insight into the structural aspects of prior studies. This meticulous validation of the research protocol not only laid the foundation for our study but also demonstrated the necessity of a holistic approach in exploring defence sector dynamics.

Relationship among DRDO, Customers and Supply Chain Partners

In constructing a model to capture the intricate relationship dynamics among DRDO, customers, and supply chain partners, the research ventured into uncharted territory. The model aimed to be a comprehensive map, delineating the collaborative efforts required for the seamless development of new defence products.

This segment of the review protocol validation served as the architect's blueprint for our study. It encapsulated officers' roles, high designations, transformative initiatives, and the overarching influence of DRDO in the development and consumption of defence products. The model, akin to a compass rose, pointed in the direction of an integrated understanding of the defence sector ecosystem.

Repercussions

The study unfolded the repercussions of involving various defence sector customers. It was not just about meeting demands but sparking innovations in defence products. The study underscored the integral role of technology, ensuring sustainability, and fostering partnerships at both local and global levels.

The findings in this section can be likened to a ripple effect, where the initial engagement with customers creates waves of innovation and collaboration. The research protocol validation, through this lens, highlighted the broader implications of our study on the defence industry.

Definitions of Customers in Defence Sectors

Moving beyond the immediate stakeholders, the review protocol navigated through the landscape of customer definitions. It drew analogies from various industries such as food, hospitality, entertainment, and technology to understand the multifaceted nature of customers in the defence sector. The exploration

resembled a comparative analysis, akin to examining different chapters in a book. Each industry presented a unique definition, shedding light on the diverse facets of customer needs, demands, and the intricate stages of product development. This segment underscored the importance of contextualizing customer definitions within the defence sector milieu.

In the context of the defence sector, the literature defines customers as the end-users or organizations responsible for the operational deployment and utilization of defence products and systems. Specifically, the customers in the defence sector are typically the armed forces or military branches of a nation. This definition of customers in the defence sector differs from other sectors in several ways:

Unique requirements: Defence customers have highly specialized and mission-critical requirements that prioritize factors such as national security, operational effectiveness, and technological superiority over commercial considerations.

Complex procurement processes: The procurement of defence products and systems involves rigorous evaluation, testing, and approval processes governed by specific regulations and policies like Defence Acquisition Procedure (DAP 2020)³³, which can significantly impact customer involvement¹² and decision-making.

Long product lifecycles: Defence products and systems often have extended lifecycles spanning decades, necessitating ongoing maintenance, upgrades, and support from suppliers, which shapes the nature of customer-supplier relationships.

Confidentiality and security concerns: Due to the sensitive nature of defence operations, customer interactions and product development processes may be subject to strict confidentiality and security protocols, potentially limiting the extent of customer involvement.¹²

By recognizing these unique characteristics of customers in the defence sector, researchers and practitioners can better understand the nuances involved in customer engagement, co-creation, and the development of tailored solutions that meet the specific demands of this critical domain.

Model between customers, supply chain partners and NPD

One of the cruxes of the research protocol validation was the exploration of the model governing the relationships between customers, supply chain partners, and the development of new defence products. The study aimed to unravel the intricacies of

customer demands, needs fulfilment, and the strategic involvement of supply chain partner DRDO.

This part of the review protocol could be visualized as decoding a complex puzzle. The questions posed – What kind of customers exist in the defence sector? How are their needs fulfilled? How are new products designed and developed? What strategies and planning are involved? Is technology a pivotal player in this process? These questions set the stage for a profound exploration into the heart of defence sector dynamics.

Role of Supply Chain Partners

The focus shifted to the crucial role played by supply chain partners in the defence sector model. The selection and identification of these partners, both internal and external to DRDO, were scrutinized. The role of technology, the collaborative efforts of customers, and DRDO in product development took centre stage.

This aspect of the review protocol validation was akin to peeling layers off an onion. It delved into the complexities of internal and external supply chain partnerships, closely observing local officers, customers, and external entities connected with DRDO. The aim was to arrive at a comprehensive understanding of the interplay between these elements.

Fulfilment of customer demand in comparison to other industries

The fulfilment of customer demand in the defence sector is a complex and multifaceted endeavour, characterized by distinct challenges and processes that set it apart from other supply chains, such as those in the hotel, food, hospital, or entertainment industries. This disparity arises from the unique nature of the defence sector, which is intrinsically tied to national security, strategic interests, and the protection of sovereign territories. A comprehensive review of the literature reveals several key factors that differentiate demand fulfilment in the defence sector from other industries. Firstly, the customer base in the defence sector is highly specialized and restricted, with the primary customers being government agencies, military organizations, and allied nations.³⁴ This contrasts sharply with the broader and more diverse customer base in industries like hospitality, food services, or entertainment, where the target market encompasses a wide range of consumer segments.

Furthermore, the nature of the products and services demanded in the defence sector is inherently

unique. Unlike consumer goods or recreational services, the defence sector deals with highly specialized equipment, weapons systems, and technological advancements that are often classified or subject to stringent regulations.³⁵ This heightened level of sensitivity and secrecy introduces additional layers of complexity in demand fulfilment, requiring robust security protocols, supply chain visibility, and strict adherence to compliance measures. Another distinguishing factor is the extended and intricate supply chain networks that underpin the defence sector. These networks often involve multiple tiers of suppliers, subcontractors, and international collaborations, each contributing specialized components or expertise.³⁶ Coordinating and managing such complex supply chains, while ensuring timely delivery and quality assurance, presents significant challenges that are not as prevalent in industries with more localized or streamlined supply networks.

Moreover, the demand patterns in the defence sector are heavily influenced by geopolitical factors, strategic priorities, and evolving security threats.³⁷ These dynamic forces can lead to fluctuations in demand, necessitating agility and responsiveness in the supply chain to adapt to changing requirements. In contrast, industries like hospitality or entertainment typically experience more predictable and cyclical demand patterns driven by consumer trends and seasonal variations. Another critical aspect that differentiates demand fulfilment in the defence sector is the stringent quality and performance standards imposed on products and services.^{35,37} The consequence of failure in the defence domain can be catastrophic, with lives and national security at stake. As a result, rigorous testing, validation, and quality assurance processes are integral to the demand fulfilment cycle, adding complexity and potential delays compared to industries with less stringent performance requirements.

Furthermore, the defence sector often operates under unique contractual and procurement frameworks, involving intricate regulations, oversight mechanisms, and compliance requirements.³⁴ These frameworks aim to ensure transparency, accountability, and responsible use of public funds, but they can also introduce bureaucratic hurdles and extended lead times, impacting the efficiency of demand fulfilment. Additionally, the literature highlights the critical role of collaboration and

information sharing among stakeholders in the defence sector supply chain.³⁵ Effective communication and coordination between government agencies, prime contractors, subcontractors, and allied nations are essential for ensuring timely delivery, identifying potential bottlenecks, and addressing emerging threats or technological advancements. This level of collaboration and information sharing is often more tightly regulated and controlled compared to other industries due to security considerations.

While the defence sector faces unique challenges in demand fulfilment, it is essential to acknowledge that other industries, such as healthcare or critical infrastructure, may share some similarities in terms of stringent quality and safety standards, regulatory oversight, and the need for robust supply chain management practices. However, the convergence of factors such as national security concerns, geopolitical influences, and the specialized nature of defence products and services creates a distinct landscape for demand fulfilment in the defence sector.

Overall, the fulfilment of customer demand in the defence sector is a intricate and multidimensional process that diverges significantly from supply chains in industries like hospitality, food services, or entertainment. The specialized customer base, unique product and service requirements, complex supply chain networks, geopolitical influences, stringent quality standards, and regulatory frameworks contribute to the distinct challenges faced by the defence sector. By understanding these nuances and drawing insights from the literature, researchers and practitioners can develop tailored strategies and frameworks to optimize demand fulfilment in the defence sector, ensuring timely delivery, quality assurance, and effective collaboration among stakeholders while addressing the overarching goal of national security and strategic interests.

This first typology classifies literature reviews based on their focus or approach, such as theoretical, thematic, domain-specific, structural, framework-based, definitional, model-based, conceptual, or bibliometric (Table 4). These review types cover various aspects of customer roles, supply chain partner roles, and new product development (NPD), but they do not specifically focus on the interrelationships between these three elements and the defence sectors.

The second typology categorizes literature reviews based on their methodological approach or purpose, such as systematic reviews, scoping reviews, integrated reviews, narrative reviews, umbrella reviews, historical reviews, argumentative reviews, literature reviews, critical reviews, rapid reviews, and mapping reviews (Table 5). These review types specifically focus on the interrelationships between customer roles, supply chain partner roles, and new product development (NPD) in different service sectors, but they do not cover the defence sector.

The classification of reviews into these two typologies highlights the diversity of research approaches employed in the existing literature. The first typology encompasses various review types that cover customer roles,¹¹ supply chain partner roles, and new product development, but they do not explicitly focus on the interrelationships between these three elements. In contrast, the second typology includes review types that specifically examine the relationships between customers, supply chain partners, and NPD in different service sectors.

However, a notable observation is that none of the review types from either typology cover the defence sector. This gap in the literature suggests a need for more research and reviews specifically focused on the roles of customers, supply chain partners, and new product development in the defence sector.

Table 4 — Assessing the applicability of literature review approaches in defence research

S. No	First kind of typology of reviews	Publications					Covered or not covered for defence sector	Research relevance
		Role of customers	Supply chain partners	NPD	Role of customers and supply chain partners	Customers, supply chain partners and NPD		
1	Theoretical reviews	Yes	Yes	Yes	Yes	Yes	Not covered	Yes
2	Thematic reviews	Yes	Yes	Yes	Yes	Yes	Not covered	Yes
3	Domain reviews	Yes	Yes	Yes	Yes	Yes	Not covered	Yes
4	Structural reviews	Yes	Yes	Yes	Yes	Yes	Not covered	Yes
5	Framework reviews	Yes	Yes	Yes	Yes	Yes	Not covered	Yes
6	Definitional reviews	Yes	Yes	Yes	Yes	Yes	Not covered	Yes
7	Model reviews	Yes	Yes	Yes	Yes	Yes	Not covered	Yes
8	Conceptual reviews	Yes	Yes	Yes	Yes	Yes	Not covered	Yes
9	Bibliometric reviews	Yes	Yes	Yes	Yes	Yes	Not covered	Yes

Table 5 — Methodological review approaches

S. No.	Second kind of typology of reviews	Topics covered	Covered or not covered for defence sectors	Research relevance
1	Systematic reviews	Role of customers, supply chain partner and NPD in different service sectors	No	Yes
2	Scopic reviews	Role of customers, supply chain partner and NPD in different service sectors	No	Yes
3	Integrated reviews	Role of customers, supply chain partner and NPD in different service sectors	No	Yes
4	Narrative reviews	Role of customers, supply chain partner and NPD in different service sectors	No	Yes
5	Umbrella reviews	Role of customers, supply chain partner and NPD in different service sectors	No	Yes
6	Historical reviews	Role of customers, supply chain partner and NPD in different service sectors	No	Yes
7	Argumentative reviews	Role of customers, supply chain partner and NPD in different service sectors	No	Yes
8	Literature reviews	Role of customers, supply chain partner and NPD in different service sectors	No	Yes
9	Critical reviews	Role of customers, supply chain partner and NPD in different service sectors	No	Yes
10	Rapid reviews	Role of customers, supply chain partner and NPD in different service sectors	No	Yes
11	Mapping reviews	Role of customers, supply chain partner and NPD in different service sectors	No	Yes

Table 6 — Service industry and main variables

S. No	Service industry	Role of customers	Supply chain partners	NPD	Role of customers and supply chain partners	Customers, supply chain partners and NPD
1	FMCG	Yes	Yes	Yes	Yes	Yes
2	Hospitality industry	Yes	Yes	Yes	Yes	Yes
3	Telecom industry	Yes	Yes	Yes	Yes	Yes
4	Travel industry	Yes	Yes	Yes	Yes	Yes
5	Entertainment industry	Yes	Yes	Yes	Yes	Yes
6	Hospital industry	Yes	Yes	Yes	Yes	Yes
7	Technological industry	Yes	Yes	Yes	Yes	Yes
8	Engineering industry	Yes	Yes	Yes	Yes	Yes
9	Tourism industry	Yes	Yes	Yes	Yes	Yes
10	Hotel industry	Yes	Yes	Yes	Yes	Yes
11	Defence industry	Partially	Partially	Partially	Partially	Partially

By presenting these two typologies, the authors aim to provide a comprehensive overview of the existing literature review approaches and identify areas that require further exploration, particularly in the context of the defence sector.

This table serves as a comprehensive overview of the research coverage across various service industries, specifically examining the role of customers, supply chain partners, and new product development (NPD), as well as the interrelationships between these variables (Table 6). The table's primary purpose is to present a structured and systematic analysis of the extent to which these critical variables were explored within the context of different service industries. By providing a concise yet informative summary, Table 6 enables researchers, practitioners, and industry stakeholders to quickly grasp the depth and breadth of the research undertaken, identify potential gaps, and determine areas that may require further investigation.

The table is organized into six columns, each representing a distinct aspect of the research. The first column lists the service industries under consideration, ranging from well-established sectors

such as Fast-Moving Consumer Goods (FMCG), hospitality, and telecommunications, to emerging and specialized domains like the defence sector. The subsequent columns address the individual variables of interest: the role of customers, the role of supply chain partners, and the role of NPD. These columns indicate whether the research thoroughly examined the respective variable for each industry, denoted by a "Yes," or if the coverage was limited or incomplete, represented by "Partially." The fifth column, "Role of Customers and Supply Chain Partners," highlights the research's exploration of the interplay between these two critical stakeholders within each service industry. Similarly, the final column, "Customers, Supply Chain Partners, and NPD," indicates whether the research delved into the intricate relationships and dynamics among all three variables within the respective industry contexts.

By systematically presenting this information, Table 6 serves as a comprehensive roadmap, guiding researchers and industry practitioners in identifying areas that have been thoroughly investigated, as well as those that may warrant further attention. For instance, industries such as FMCG, hospitality,

telecommunications, travel, entertainment, hospitals, technology, engineering, tourism, and hotels consistently display a "Yes" across all columns. This pattern suggests that the research has extensively covered the roles of customers, supply chain partners, and NPD, as well as their interrelationships, within these industries. Such comprehensive coverage provides a solid foundation for further building upon existing knowledge and exploring more nuanced or specialized aspects of these sectors. On the other hand, the defence sector stands out as an area where the coverage is marked as "Partially" across all columns. This observation highlights a potential gap in the current body of research, indicating that the roles of customers, supply chain partners, and NPD, as well as their interconnections, have not been fully explored within the defence industry context. The identification of such gaps is crucial, as it not only underscores the need for further investigation but also presents opportunities for researchers to make significant contributions to the field. By delving into the intricacies of the defence sector, researchers can uncover valuable insights, address unique challenges, and potentially develop innovative strategies tailored to the specific dynamics of this industry. Moreover, the presence of "Partially" in certain columns for other industries may also indicate areas that require additional research attention. For example, while the research may have extensively covered the role of customers in a particular industry, there might be gaps in understanding the role of supply chain partners or the interplay between these variables and NPD.

The content of Table 6 serves as a powerful tool for research prioritization and resource allocation. By identifying industries or variables with limited or partial coverage, researchers and industry stakeholders can strategically allocate resources to address these gaps, ensuring a more comprehensive understanding of the service industry landscape. Furthermore, the table can facilitate cross-industry comparisons and knowledge transfer. Industries with extensive coverage can serve as benchmarks or provide valuable lessons that can be adapted and applied to sectors with identified gaps. This cross-pollination of knowledge and best practices can accelerate research efforts and drive innovation across various service industries.

In addition to guiding future research directions, Table 6 can also inform industry practices and decision-making processes. By understanding the roles and interrelationships of customers, supply chain

partners, and NPD within their respective industries, businesses can develop more effective strategies, optimize their operations, and enhance customer experiences. For example, industries with comprehensive coverage of these variables may have already implemented best practices or developed innovative approaches to leveraging customer insights, managing supply chain partnerships, and driving successful new product launches. Other industries can learn from these experiences and adapt successful strategies to their specific contexts. Moreover, the table can serve as a valuable resource for educational purposes, providing a comprehensive overview of the service industry landscape and highlighting areas of interest for academic curricula or professional development programs.

Therefore, Table 6 serves as a powerful synthesis of the research coverage across various service industries, focusing on the critical variables of customers, supply chain partners, and new product development. By presenting a structured and systematic overview, the table enables researchers, practitioners, and industry stakeholders to quickly identify areas of comprehensive coverage, as well as potential gaps that warrant further exploration. The identification of these gaps is not merely an acknowledgment of limitations but rather a catalyst for future research opportunities. Each gap represents an unexplored territory, a frontier ripe for investigation, where new insights and innovative solutions can be uncovered.

By leveraging the information provided in Table 6, researchers can strategically prioritize their efforts, allocate resources effectively, and contribute to the advancement of knowledge within specific service industries or across the broader service sector landscape. Additionally, industry practitioners can utilize the table's insights to inform their decision-making processes, optimize operations, and enhance customer experiences. Ultimately, Table 6 serves as a valuable roadmap, guiding researchers and industry stakeholders toward a deeper understanding of the intricate dynamics within service industries, fostering innovation, and driving the continuous evolution of best practices in an increasingly competitive and dynamic service-oriented economy.

Implications

Managerial Implications

The study bears substantive managerial implications, furnishing actionable insights conducive

to informed decision-making within the ambit of defence sector management:

Hierarchical Structuring: Implementation of a discernible hierarchy among supply chain partners, new product developers, and defence management is advocated.³⁸ A dedicated project management team, attuned to the intricacies of customer features, is paramount.

Project Oversight: Significance is ascribed to the designation of a focal point for the actual delivery of NPD demands, ensuring seamless communication and adherence to customer needs.

Enhancing Customer Experiences: The study propounds a concentrated effort directed at enhancing customer experiences throughout the NPD project lifecycle, thereby necessitating a nuanced understanding of perceptions and experiences.

Control Mechanisms: A crucial managerial implication underscores the imperative of maintaining control over supply chain partners, situated strategically between customers and new product developers.³⁹ Effective governance is posited as essential for alignment with customer expectations and strategic objectives.

Theoretical Implications

The study contributes significantly to theoretical advancements, fostering cross-disciplinary research and enriching our understanding of the multifaceted dynamics operative in this domain:

Extended Domain Studies: The theoretical frameworks developed in this study lay the groundwork for the extension of studies into other domains. A theoretical foundation that comprehensively explores the relevance of customers, supply chain partners, and developers across various service sectors is advocated.

Role of Key Players: Theoretical frameworks are encouraged to place emphasis on discerning the distinct roles of customers, supply chain partners, and developers.³¹ An enriched understanding of the individual and collective impacts of these pivotal entities on the NPD process is deemed essential.

Different Experiences: The study urges theoretical perspectives to delve into the various kinds of experiences, necessitating regular attention to actual experiences of customers,⁴⁰ defence management,⁴¹ and developers for a comprehensive grasp of NPD intricacies.⁴²

Conceptual Implications

Conceptually, the study introduces novel frameworks that reshape our understanding of the defence sector, introducing concepts that offer a nuanced lens to interpret the complex dynamics at play:

Emphasis on Experiences: A central conceptual implication is the introduction of the concept of experiences, differentiating between actual experiences, perceptions, expectations, and the totality of experiences. This conceptual framework adds layers of depth to the understanding of customer involvement in NPD.

Importance of Demands: A pivotal conceptual implication underscores the importance of comprehending customer demands. This encompasses the delivery of demands, communication channels, and the role of developers in meeting and exceeding customer expectations.^{8,43}

Methodological Implications

Methodologically, the study not only illuminates the theoretical landscape but also underscores considerations for future research endeavours, offering insights into the methodological facets that merit attention:

Qualitative and Quantitative Studies: The study posits the need for a balanced methodological approach. While qualitative studies offer depth, quantitative studies provide a complementary perspective, fostering a holistic understanding of the identified research areas.⁴⁴

In-depth Exploration: Future research should undertake in-depth qualitative studies to explore intricacies such as communication among key players, understanding customer experiences, and gauging the impact of NPD on defence sector dynamics.

Expanded Research Questions and Variables: The study advocates the expansion of research questions and variables to facilitate a comprehensive exploration. Variables such as timeliness completion of the project, direct and indirect effects, moderating effects, mediating effects, and correlations are identified as integral to an exhaustive research agenda.

The implications drawn from this study extend beyond immediate application, resonating with the spheres of managerial, theoretical, conceptual, and methodological considerations. In navigating the complex landscape of defence sector dynamics, these implications serve as a compass, guiding both practitioners and researchers toward a nuanced

understanding of the intricate interplay between customers, supply chain partners, and new product development.

As the defence sector continues its trajectory of evolution, these implications carve a path forward, where theoretical insights converge with practical considerations, steering the industry toward a future characterized by informed decision-making and strategic collaboration. The study thus serves as a catalyst for the continued advancement of knowledge and practice in the dynamic realm of defence sector dynamics.

Model Implications

The comprehensive review of literature and analysis of existing dynamics in the defence sector pave the way for a conceptual model that encapsulates the roles and interrelationships among the critical stakeholders: Customers, supply chain partners in NPD. The proposed model, illustrated in Fig. 3, offers a holistic perspective on the intricate ecosystem underlying product development in the defence sector.

The above model indicates the various stakeholders of Ministry of Defence (MoD).⁴⁵ Within this model, the Indian Armed Forces assume the pivotal role of customers, are responsible for providing specifications and requirements for the desired systems. Additionally, they actively engage in the product development process by conducting trials and evaluations of the developed products. DRDO acts as the developer, undertaking the crucial task of translating customer requirements into tangible product solutions.

The model highlights the multifaceted support provided by DRDO to the industry, which encompasses two distinct pathways. Firstly, DRDO involves the industry as Development-cum-Production Partner (DcPP) from the initial stages of product development, fostering collaboration and knowledge sharing. Secondly, in cases where the

Industry was not involved in the development phase, DRDO facilitates the transfer of technology (ToT) to equip the industry with the necessary know-how for product manufacturing.

Furthermore, the model illustrates the reciprocal relationship between the Indian Armed Forces and the industry. The Armed Forces issue production orders and contracts to the industry, which in turn delivers the desired products, along with critical support services such as Annual Maintenance Contracts (AMC), Life cycle support, and the provision of providing spare parts.

This conceptual model not only captures the current state of product development dynamics but also serves as a framework for identifying potential areas for improvement, exploring new avenues of collaboration, and optimizing the overall efficiency and effectiveness of the defence sector's product development ecosystem.

Future Scope

Based on the systematic literature review, there are several promising areas for future research in the study of the role of customers, supply chain partners, and new product development (NPD) in the defence sector. Here are some potential areas for future research:

In-depth Exploration of Customer Experiences: The study highlights the need for a comprehensive understanding of customer experiences throughout the NPD project lifecycle. Future research could delve into the nuances of customer experiences, including their perceptions, expectations, and overall satisfaction with the developed products. Qualitative studies, such as ethnographic observations, interviews, and focus group discussions, can provide valuable insights into the lived experiences of customers in the defence sector. Additionally, quantitative studies could measure the impact of customer experiences on various aspects of NPD, such as project success, efficiency, and customer retention.

Communication Channels and Strategies: Effective communication between customers, supply chain partners, and the DRDO is crucial for successful NPD. Future research could explore the communication channels and strategies employed in the defence sector, evaluating their effectiveness and identifying areas for improvement. This line of inquiry could investigate the role of digital communication technologies, information-sharing platforms, and collaborative tools in streamlining communication and enhancing project outcomes.

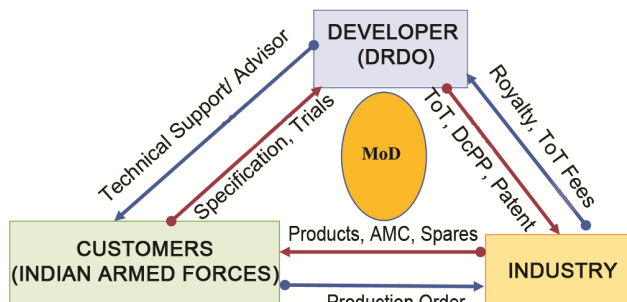


Fig. 3 — Final model

Sustainable Innovation and Environmental Considerations: As environmental concerns gain prominence; the defence sector faces mounting pressure to adopt sustainable practices in NPD. Future research could explore the integration of environmental considerations into the NPD process, examining the challenges and opportunities associated with developing eco-friendly defence products. Investigations could focus on the development of sustainable materials, energy-efficient technologies, and waste management strategies, as well as the potential for leveraging circular economy principles in the defence industry.

Entrepreneurial Opportunities and Spin-offs: The defence sector's technological advancements often have far-reaching implications and potential applications in civilian sectors. Future research could explore the entrepreneurial opportunities and spin-offs arising from defence-related NPD. Identifying avenues for technology transfer, commercialization, and the creation of new ventures could foster innovation and economic growth, while also promoting the dual-use of defence technologies for civilian purposes.

Cross-functional Collaboration and Integration: Successful NPD in the defence sector requires effective collaboration and integration among various stakeholders, including researchers, engineers, designers, and production teams. Future research could investigate the dynamics of cross-functional collaboration, examining the barriers and enablers to successful integration. Additionally, studies could explore the potential for adopting agile methodologies, such as Scrum or Lean, in the context of defence NPD, evaluating their impact on project outcomes and team dynamics.

Intellectual Property Management and Knowledge Transfer: The defence sector is characterized by highly sensitive and classified technologies, necessitating robust intellectual property (IP) management strategies. Future research could explore IP management practices in the context of NPD, investigating strategies for protecting sensitive information while facilitating knowledge transfer and collaboration among stakeholders. Additionally, studies could examine the role of non-disclosure agreements, patents, and licensing arrangements in fostering innovation while safeguarding national security interests.

Supply Chain Resilience and Risk Management: The defence sector's supply chains are often complex and

subject to various risks, ranging from geopolitical tensions to supply disruptions. Future research could focus on enhancing supply chain resilience and developing robust risk management strategies tailored to the defence industry. Studies could investigate the impact of supply chain disruptions on NPD projects, and explore strategies for mitigating risks through diversification, contingency planning, and the adoption of advanced technologies such as blockchain and artificial intelligence.

Comparative Studies across Defence Sectors: Given the global nature of the defence industry, comparative studies across different countries and regions could provide valuable insights into the diverse approaches to NPD. Future research could compare and contrast the roles of customers, supply chain partners, and government agencies across various defence sectors, identifying best practices and areas for cross-border collaboration. Additionally, studies could explore the impact of cultural, regulatory, and geopolitical factors on NPD practices in the defence sector.

Adoption of Emerging Technologies: The defence sector is at the forefront of technological innovation, leveraging cutting-edge technologies such as artificial intelligence, robotics, and additive manufacturing. Future research could investigate the adoption and integration of these emerging technologies into the NPD process, assessing their impact on product design, development, and manufacturing. Additionally, studies could explore the ethical and societal implications of incorporating advanced technologies into defence systems, fostering responsible innovation practices.

Talent management and human capital development: The defence sector relies heavily on highly skilled and specialized personnel, including engineers, scientists, and technical experts. Future research could focus on talent management strategies and human capital development in the context of NPD. Studies could investigate the recruitment, training, and retention of skilled professionals, as well as the role of educational institutions and industry-academia collaborations in building a robust talent pipeline for the defence sector.

These areas for future research offer a wide range of opportunities to deepen our understanding of the complex interplay between customers, supply chain partners, and NPD in the defence sector. By addressing these research avenues, scholars and practitioners can contribute to the advancement of

knowledge, foster innovation, and enhance the strategic capabilities of the defence industry. Interdisciplinary collaborations and partnerships between academia, industry, and government agencies will be crucial in pursuing these research endeavours, ensuring that the findings translate into practical applications and informed decision-making within the defence sector.

Limitations of the Study

In the pursuit of academic inquiry, this study, like its counterparts, is not immune to certain inherent limitations. These limitations, intricately woven into the fabric of the research process, provide valuable insights into the challenges faced during the course of the study.

Data Availability Challenges

One of the primary limitations encountered in this study revolves around the intricate tapestry of data availability. Both primary and secondary data sources faced challenges, resulting in partial gaps in the research landscape. Despite rigorous efforts in the data acquisition process, the study contended with non-availability, leading to a nuanced understanding of the subject matter. This limitation prompts a reflective exploration of the impact on the study's comprehensiveness, underscoring the importance of acknowledging the constraints imposed by data availability.

Defence Sector: Classified Realities and Information Restrictions

A distinctive challenge stems from the focal point of the research—the defence sector. The inherent nature of this industry, characterized by classified information and stringent confidentiality protocols, introduces a layer of complexity. The closed and niche nature of the defence sector restricted the flow of information, posing challenges in accessing comprehensive datasets. This limitation underscores the unique intricacies associated with studying an industry where information is tightly controlled, and confidentiality is paramount.

Implications for Analytical Depth: Navigating Constraints

These limitations, particularly the challenges in data availability and the restricted nature of information in the defence sector, ripple through the study's analytical scope. The inability to access certain datasets may have implications for the depth of analysis, potentially leaving certain facets of the

research question unexplored. Recognizing these constraints is essential for contextualizing the study's findings and understanding the boundaries within which the research operates.

Future Scope:

Illuminating Pathways for Subsequent Exploration

In acknowledging the limitations, it is imperative to recognize the positive outlook for future studies. The research lays a foundation for subsequent exploration, unveiling areas ripe for further investigation beyond the current scope. Evidently, the identified topic harbours untapped potential, as discerned from the insights gleaned through Tables 2, 4 and 5.

Identified Areas of Exploration: A Roadmap for Future Inquiry

The research elucidates specific areas warranting attention in future studies. These areas, outlined in Tables 2, 4 and 5 serve as a roadmap for researchers, pointing towards avenues that demand further exploration. The positive scope for future studies is substantiated by the gaps identified in the current research, inviting scholars to delve deeper into nuanced aspects and expand the horizons of knowledge.

Potential for Enriched Understanding: Tables as Catalysts for Inquiry

Catalysing further inquiry, Tables 2, 4 and 5 acting as catalysts for inquiry, showcase the expansive terrain awaiting exploration. Each table delineates facets that, while acknowledged in the current study, beckon for in-depth investigation. Future scholars are poised to build upon these foundations, leveraging the identified gaps and nuances to enrich our understanding of the interplay between customers, supply chain partners, and new product development in the defence sector.

Conclusions

This systematic review delves into the roles of customers, supply chain partners, and new product development (NPD) within the defence sector. It tackles core research questions, revealing intricate relationships, strategic needs, and unique challenges. While limited data access due to defence secrecy exists, the study emphasizes the importance of a holistic view for defence innovation. Gaps in existing research are identified as opportunities for future exploration. Examining real customer experiences, sustainable practices through communication channels, and entrepreneurial potential in defence are

suggested as future pathways. These areas guide further research, urging scholars to build upon this foundation and contribute to an evolving knowledge base that adapts to the defence landscape. This review consolidates existing knowledge and calls for future scholars to delve deeper, question assumptions, and unravel the complexities of customer, supply chain partner, and NPD interplay in defence. By acknowledging limitations and embracing future possibilities, the study fosters a dynamic dialogue in the pursuit of knowledge.

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