INDUSTRIAL AND FISCAL SPILLOVER EFFECTS OF DEFENCE MANUFACTURING UNDER MAKE IN INDIA: AN INTEGRATED ASSESSMENT

A Dissertation Submitted
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by

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CANDIDATE'S DECLARATION

I, Komal Yadav, hereby certify that the work which is being presented in the dissertation entitled "Industrial and Fiscal Spillover Effects of Defence Manufacturing under Make in India: An Integrated Assessment" in partial fulfillment of the requirements for the award of the Degree of Master of Arts in Economics, submitted in the University School of Management and Entrepreneurship , Delhi Technological University, is an authentic record of my own work carried out during the period of my study under the supervision of Prof. Saikat Banerjee.

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ABSTRACT

This dissertation presents an integrated assessment of the industrial and fiscal spillover effects of defence manufacturing under India's Make in India initiative, covering the period 2004–25. The study is organised around two core objectives that together examine how India's ongoing transition from import-dependence to indigenous defence production has affected both its broader industrial ecosystem and its fiscal position.

Objective 1 tracks India's defence indigenisation journey through trend analysis and econometric modelling. Part A documents the dramatic growth in domestic defence production (from ₹17,435 crore in 2004–05 to ₹1,50,590 crore in 2024–25), the partial but incomplete substitution of imports (SIPRI TIV data shows continued dependence for high-technology platforms), and the emergence of a defence export capability (growing to ₹23,622 crore in 2024–25). Part B presents an OLS regression model — $\ln(\text{MFG GVA}) = 1.094 + 0.354 \cdot \ln(\text{Defence Production}) + 0.629 \cdot \ln(\text{GFCF}) + \varepsilon$ — that demonstrates a statistically significant positive spillover from indigenous defence production to manufacturing GVA ($R^2 = 0.991$, $p < 0.05$). A qualitative spillover matrix identifies six channels through which defence manufacturing generates civilian economic benefits: DRDO technology transfers (670 LATOTs signed), HAL's dual-use aviation infrastructure, BEL's non-defence commercial revenues (₹2,640 crore, 13.3% of revenue), iDEX startups, MSME vendor ecosystem (~16,000 MSMEs), and Defence Corridor industrial clusters (52,658 jobs committed).

Objective 2 examines the fiscal sustainability of defence indigenisation through a three-component framework. Ratio analysis reveals a structural decline in the overall defence fiscal burden (from 10.4% to 7.6% of government expenditure) but documents the internal restructuring that constrains this progress: pension liabilities have risen from 14.5% to 22.7% of the defence budget; the capital-to-revenue ratio has more than halved; and DRDO's proportionate budget share has remained flat at 3–6%. Regression analysis ($R^2 = 0.417$, F p-value = 0.024) confirms that India

remains in the transition-cost phase of indigenisation, with pension crowding-out the dominant structural pressure (coefficient = −0.080, p = 0.086) and no single policy variable independently determining fiscal outcomes.

The integrated analysis reveals a paradox at the heart of India's defence transformation: industrial spillovers from defence manufacturing are real and growing, but fiscal constraints — rising pension liabilities, stagnant R&D investment, and declining capital-to-revenue ratios — threaten the sustainability of the indigenisation process itself. The study identifies specific policy interventions required to break this constraint and accelerate India's transition to a fiscally sustainable, industrially generative defence manufacturing base.

Keywords: Defence indigenisation, Make in India, industrial spillovers, fiscal sustainability, manufacturing GVA, OLS regression, DRDO technology transfers, capital-to-revenue ratio, MSME defence vendors.

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LIST OF ABBREVIATIONS

ASI	Annual Survey of Industries
BEL	Bharat Electronics Limited
BEML	Bharat Earth Movers Limited
DAP	Defence Acquisition Procedure
DDP	Department of Defence Production
DPSU	Defence Public Sector Undertaking
DRDO	Defence Research and Development Organisation
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Formation
GVA	Gross Value Added
HAL	Hindustan Aeronautics Limited
iDEX	Innovations for Defence Excellence
IDSA	Institute for Defence Studies and Analyses
IIP	Index of Industrial Production
LATOT	Licence to Access Technology of Transferred Technology
MFG	Manufacturing
MoD	Ministry of Defence
MoF	Ministry of Finance
MOSPI	Ministry of Statistics and Programme Implementation
MSME	Micro, Small and Medium Enterprise
NIPFP	National Institute of Public Finance and Policy
OFB	Ordnance Factory Board
OLS	Ordinary Least Squares
ORF	Observer Research Foundation
PIL	Positive Indigenisation List
PSU	Public Sector Undertaking
RBI	Reserve Bank of India
SIPRI	Stockholm International Peace Research Institute

TIV	Trend Indicator Value
UAV	Unmanned Aerial Vehicle
VIF	Variance Inflation Factor

CHAPTER 1: INTRODUCTION

1.1 Background and Context

India's defence sector presents one of the most compelling case studies in contemporary development economics: a large, strategically sovereign nation attempting to transform itself from being the world's largest arms importer into a capable indigenous defence producer and, increasingly, an exporter. This transformation — pursued under the overarching umbrella of the Make in India initiative launched in September 2014 and the subsequent Aatmanirbhar Bharat (Self-Reliant India) framework articulated in 2020 — is not merely a defence policy question. It is, fundamentally, an economic and industrial policy challenge of the highest order.

The scale of India's historical import dependence is striking. For most of the period between 2000 and 2020, India ranked among the top three global arms importers by SIPRI Trend Indicator Value (TIV), importing sophisticated platforms ranging from Russian Su-30MKI fighter aircraft and S-400 air defence systems to French Rafale fighters and Israeli surveillance drones. The foreign exchange cost of these imports — running into billions of dollars annually — represented not only a significant fiscal burden but also a strategic vulnerability: dependence on foreign suppliers created risks of supply disruption, technology denial, and constrained operational autonomy in times of conflict.

The case for indigenisation rests on multiple economic rationales beyond immediate import substitution. In the theoretical tradition of economic development, defence manufacturing represents what Hirschman (1958) would call a 'leading sector' with strong backward and forward linkages: it demands precision engineering, advanced materials, electronics, and software from supplier industries (backward linkages), while its outputs — through dual-use technology — find applications in civil aviation, telecommunications, heavy engineering, and digital infrastructure (forward

linkages). The empirical literature on advanced manufacturing more broadly, summarised by the World Bank's 2020 World Development Report and NITI Aayog's 2022 manufacturing strategy documents, confirms that sectors with high technology intensity generate disproportionately large multiplier effects on employment, productivity, and GDP growth.

Yet the economic effects of defence industrialisation are not automatically positive or guaranteed. The transition from import-dependence to domestic production involves a 'valley of death' period during which R&D investment, infrastructure development, and technology absorption costs are high, while the fiscal savings from reduced imports and the commercial returns from potential exports have not yet materialised. This transition-cost dynamic has been documented in the literature on South Korea's heavy and chemical industrialisation in the 1970s (Amsden, 1989), Israel's technology-led defence industry transformation from the 1980s onwards (Bitzinger, 2015), and Sweden's Saab-led industrial ecosystem (Brooks and Wohlforth, 2016). Whether India can navigate this transition successfully — and whether the institutional and fiscal conditions are in place to do so — is the animating empirical question of this study.

The policy reforms that have attempted to unlock India's indigenisation potential are substantial. The Positive Indigenisation Lists (PIL I, II, and III), introduced between 2020 and 2022, have progressively banned the import of over 400 defence items, mandating domestic procurement and providing demand assurance to Indian manufacturers. The Defence Acquisition Procedure 2020 (DAP 2020) introduced Atmanirbhar-friendly procurement categories that prioritise Buy Indian-Indigenously Designed, Developed and Manufactured (IDDM) over outright foreign purchases. The FDI cap in the defence sector was raised from 26% to 49% via automatic route in 2014 and subsequently to 74% via automatic route and 100% via government approval in 2020, opening the sector to foreign capital and technology partnerships. The iDEX (Innovations for Defence Excellence) programme, launched in 2018, has channelled ₹3,000 crore to over 650 deep-tech

startups and innovators. Two Defence Industrial Corridors — in Uttar Pradesh and Tamil Nadu — have attracted committed investments of over ₹58,000 crore and are projected to create over 52,000 jobs. The results, at least in terms of output volumes, are visible: domestic defence production has grown from ₹17,435 crore in 2004-05 to ₹1,50,590 crore in 2024-25, and defence exports have surged from a negligible ₹315 crore pre-2014 to ₹23,622 crore in 2024-25.

Despite these headline achievements, the economic analysis of what this transformation means for India's industrial structure and fiscal position remains incomplete. Does growing indigenous defence production generate measurable spillovers to the civilian manufacturing sector, or is it fiscally and industrially isolated? Is India's defence budget becoming more or less sustainably structured as indigenisation proceeds? These questions — jointly examined — form the intellectual core of this dissertation.

1.2 Statement of the Problem

Existing academic and policy literature has examined India's defence manufacturing transformation through largely separate lenses. Defence economics scholars (SIPRI, IDSA) focus on the production and import substitution trajectory. Fiscal economists (NIPFP, RBI) analyse defence expenditure trends and budget composition. Industrial economists (NITI Aayog, World Bank) study manufacturing linkages and multiplier effects. Very few studies integrate these three dimensions — industrial spillovers, fiscal sustainability, and the interconnections between them — into a coherent empirical framework. This fragmentation is not merely an academic problem; it creates a policy blind spot. Decision-makers who focus only on production volumes may underestimate the fiscal costs of transition; those focused only on the budget may miss the industrial returns that justify those costs.

This study addresses that integration gap. By examining both the industrial and fiscal dimensions of defence indigenisation — and explicitly modelling their interaction — it provides a more complete picture of whether Make in India's

defence manufacturing push is generating the integrated economic benefits that its architects intended.

1.3 Research Objectives

This dissertation pursues two principal research objectives:

- Objective 1: To track India's defence indigenisation journey from 2004–25, examine trends in production, imports, exports, and private sector participation, and econometrically estimate the spillover effects of indigenous defence production on India's broader manufacturing sector.
- Objective 2: To assess the fiscal sustainability of India's defence indigenisation programme by analysing the structural composition of the defence budget, identifying the key drivers of fiscal burden through correlation and regression analysis, and positioning India within a theoretical three-phase fiscal transition framework.

1.4 Research Questions

The following specific research questions guide the investigation:

- Has Make in India produced a statistically significant shift from import-dependence to domestic production in India's defence sector?
- Does indigenous defence production generate positive spillover effects on manufacturing Gross Value Added, and if so, of what magnitude?
- Through which specific channels — DRDO technology transfers, dual-use civilian infrastructure, MSME supply chains, or defence corridors — do defence spillovers reach the civilian economy?
- Is India's defence fiscal burden rising, stabilising, or easing over the 2004–25 period, and what structural factors drive the observed trend?
- Do DRDO investment, pension liabilities, and capital expenditure jointly explain variation in India's defence fiscal burden, and what does the regression evidence imply about India's position in the fiscal transition?
- How do industrial spillovers and fiscal constraints interact in shaping the sustainability and pace of India's indigenisation?

1.5 Significance of the Study

This study makes several contributions. First, it is among the first to empirically estimate the manufacturing GVA spillover from indigenous defence production in India using OLS regression with data spanning two decades, providing econometric

evidence for a claim that is frequently asserted but rarely tested. Second, it develops a structured industrial spillover matrix that maps defence activities to civilian sector benefits with quantified evidence, going beyond the qualitative narratives common in policy literature. Third, it applies a three-phase fiscal transition framework — borrowed from development economics — to contextualise India's defence fiscal trajectory, providing a more theoretically grounded interpretation than simple trend analysis. Fourth, by integrating these two dimensions, it identifies a specific policy paradox: the conditions for generating industrial spillovers (rising capital expenditure, R&D investment) are precisely those being crowded out by the structural fiscal pressures (rising pension liabilities, declining capital-to-revenue ratios) that indigenisation simultaneously creates.

1.6 Scope and Limitations

The study covers the period 2004–25 to capture both the pre- and post-Make in India policy phases. The primary unit of analysis is the national level; state-level or firm-level variation in spillover effects is beyond the current scope. Econometric analysis uses OLS, which assumes linearity and does not capture dynamic feedback effects or reverse causality. The relatively small sample size (n = 20 for Objective 1; n = 21 for Objective 2), dictated by data availability at annual frequency, limits the precision of individual coefficient estimates and requires cautious interpretation. Private sector defence production data prior to 2019–20 is not officially published in disaggregated form by the MoD; the study uses proxy indicators for the pre-2019 period with full methodological transparency. The study does not attempt to model the macroeconomic multiplier effects of future indigenisation scenarios, which would require input-output modelling beyond the scope of this dissertation.

1.7 Organisation of the Dissertation

This dissertation is organised into seven chapters. Chapter 2 reviews the theoretical and empirical literature on defence manufacturing, industrial spillovers, Make in India outcomes, and fiscal sustainability, identifying the specific gaps this study addresses. Chapter 3 details the research design, data sources, and analytical methods used across both objectives. Chapter 4 presents the results of Objective 1,

covering trend analysis (Part A), the industrial spillover matrix (Part B), and the OLS regression on manufacturing GVA. Chapter 5 presents the results of Objective 2 through ratio analysis, correlation matrix, and regression modelling of the defence fiscal burden. Chapter 6 synthesises the findings from both objectives into an integrated analysis, identifies the industrial-fiscal paradox, positions India on the transition timeline, and develops specific policy recommendations. Chapter 7 concludes the dissertation with a summary of key findings, limitations, directions for future research, and an assessment of the social impact of the research.

CHAPTER 2: LITERATURE REVIEW

2.1 Defence Manufacturing and Indigenisation

The relationship between defence manufacturing and economic development has attracted serious scholarly attention since at least the 1970s, when the industrial implications of post-colonial military buildup became apparent in the developing world. The early theoretical contributions of Benoit (1973) generated a contested debate on the 'guns versus butter' trade-off, with subsequent meta-analyses by Dunne and Smith (1990) and Alptekin and Levine (2012) finding ambiguous effects depending on country context, time period, and the composition of defence spending. The more directly relevant strand of literature for this study concerns defence industrialisation — the deliberate policy of building domestic defence production capability — and its economic consequences.

Bitzinger (2015), in a comprehensive comparative study of defence industrialisation in Asia, documents that second-tier defence industrial powers such as South Korea, Singapore, and Israel have used defence manufacturing as a platform for wider industrial upgrading. South Korea's chaebol-led heavy industrialisation from the 1970s exemplifies Hirschman's (1958) linkage theory: POSCO steel, Samsung Electronics, and Hyundai all trace significant portions of their technological capability to defence contracts and associated government-directed learning. Israel's trajectory is particularly instructive: its defence industrial base, anchored by Rafael, Elbit Systems, and IAI, generated a civilian high-technology export sector worth over $10 billion annually by the 2010s — a spillover of industrial knowledge and human capital from security investment to commercial production.

In the Indian context, official data and policy analysis from the Ministry of Defence Annual Reports (2004–24), the Department of Defence Production (DDP), and IDSA Working Papers document the structural dominance of Defence Public Sector Undertakings (DPSUs) — HAL, BEL, BEML, Ordnance Factory Board (and its successor, seven new DPSUs post-2021), BDL, MDL, and GRSE — which

historically accounted for over 80% of domestic defence production. Research by Behera (2019) at IDSA and Bedi (2022) at ORF confirms that while private sector participation has grown since 2014, its share of total production remained at approximately 20–25% in 2024–25. The structural barriers to private sector integration — procurement complexity, lack of an assured order pipeline, absence of level-playing-field conditions vis-à-vis DPSUs — are well documented in the literature (Mukherjee, 2020; Laxman Kumar Behera, 2021).

The Make in India initiative has generated a specific policy literature. PIB reports, CII analyses, and academic contributions by Mohan (2021) and Srivastava (2023) document the reform architecture comprehensively: Positive Indigenisation Lists, DAP 2020, FDI liberalisation, iDEX, and Defence Corridors represent the most ambitious structural transformation of India's defence industry since independence. However, as MOD ORF (2024) notes, the fruits of these reforms remain unevenly distributed: domestic procurement has grown substantially, but continued import dependence for high-technology systems (jet engines, submarines, electronic warfare systems) indicates that technology transfer and indigenous capability development lag behind procurement targets.

2.2 Industrial Linkages and Technology Spillovers

The spillover literature in industrial economics, pioneered by Griliches (1979) and subsequently extended by Jaffe (1986) and Moretti (2004), establishes that knowledge generated in one sector — through R&D, learning-by-doing, or technology transfer — generates external benefits to other sectors and firms. This process, known as knowledge spillover, is particularly salient in industries characterised by high technology intensity and government procurement, of which defence manufacturing is a canonical example.

The dual-use potential of defence technologies — their applicability in both military and civilian contexts — has been extensively documented. The most frequently cited historical examples are American: the internet (ARPANET), GPS navigation, radar,

jet engines, and microwave technology all originated in defence R&D and subsequently transformed civilian markets (Mowery, 2010). More recent analysis by the RAND Corporation (2022) documents dual-use spillovers from unmanned aerial systems, advanced materials, and cybersecurity. For India specifically, DRDO Annual Reports (2018–24) document over 670 License to Access Technology of Transferred Technology (LATOT) agreements, with technology transfers reaching civilian sectors including pharmaceuticals, fisheries, mining, and electronic systems.

The World Bank (2020) and NITI Aayog (2022) both highlight the multiplier effects of advanced manufacturing, with input-output multipliers for the defence-adjacent machinery and equipment sector estimated at 1.7–2.1 for output and 1.3–1.6 for employment in India's 2018–19 I-O table. However, as acknowledged in the NITI Aayog analysis, the empirical evidence on spillovers specifically from India's defence sector remains thin, partly because of data limitations (private sector production only tracked from 2019–20) and partly because the sector's modern expansion is recent enough that long-run spillover effects have not yet had time to fully materialise.

HAL's role as a dual-use infrastructure anchor is particularly important. Its maintenance, repair, and overhaul (MRO) capabilities — developed for military platforms — have progressively been extended to civil aviation, contributing to precision engineering skill development in its supplier base of over 3,000 sub-contractors. BEL's electronics manufacturing portfolio, similarly, shows an explicit dual-use trajectory: non-defence revenues reached ₹2,640 crore (13.3% of total revenue) in 2023–24, spanning smart cities, medical electronics, and e-governance systems.

2.3 Make in India: Policy Outcomes

The literature on Make in India outcomes in the defence sector is broadly positive on production and export metrics while more cautious on technology depth and private sector integration. Policy papers from ORF (Mohan, 2021), IDSA (Behera, 2020),

and VIF (Bishoyi, 2023) all document the substantial increase in domestic production volumes, the dramatic export surge from near zero to ₹23,622 crore, and the expanding private sector ecosystem enabled by industrial licences, iDEX, and FDI liberalisation.

However, the literature also identifies persistent structural challenges. Technology absorption remains shallow: many domestically produced platforms incorporate substantial imported content ('import embedded in domestic production'), particularly for critical subsystems like engines, avionics, and precision seekers. Procurement delays — the Tejas Mk.2, AMCA, and DRDO's long-range artillery development have all experienced significant schedule slippages — impose opportunity costs and erode the cost advantage of domestic procurement. Innovation incentives remain weak: DRDO's absolute R&D budget has grown, but its proportionate share of the defence budget has been flat or declining, while private sector R&D investment in defence is constrained by limited IP protection and technology denial regimes from foreign vendors.

A particularly relevant contribution is Dutta and Verma (2022), who use a differences-in-differences approach to estimate that the Positive Indigenisation List announcement caused a significant positive stock market reaction for listed DPSU and defence-adjacent firms, suggesting the market anticipated real production and revenue gains. This is consistent with the production data: DPSUs' combined revenue has grown at approximately 9% per annum compound since 2014–15.

2.4 Fiscal Sustainability and Defence Spending

The fiscal economics of defence spending in developing countries has generated a substantial literature. SIPRI's annual Military Expenditure Database provides the most comprehensive cross-country data, while the RBI Handbook of Statistics and Ministry of Finance Budget documents provide granular India-specific information on defence budget composition. NIPFP Working Papers (Ganesh Kumar, 2019; Rao, 2021) analyse the macroeconomic implications of India's defence spending

trajectory, noting the structural tension between the security imperative for higher spending and the fiscal consolidation imperative embedded in India's Fiscal Responsibility and Budget Management Act.

The capital-versus-revenue composition of the defence budget is a key concern in the Indian literature. A high revenue share — driven largely by personnel costs and pension liabilities — crowds out capital acquisition and modernisation, creating a 'fiscal lock-in' that constrains the very capital-intensive investments (new weapon systems, R&D infrastructure, manufacturing capacity) that indigenisation requires. Peri (2020) documents that defence pension as a share of the defence budget has risen from approximately 14% in 2004–05 to over 27% by the mid-2010s, before partial stabilisation under OROP (One Rank One Pension) adjustments. This structural pressure is the single most significant constraint on defence budget quality documented in the literature.

Some research suggests that successful indigenisation can ease fiscal pressure in the medium to long run by reducing the foreign exchange cost of imports and generating export revenues. SIPRI's analysis of South Korea's defence industry (Bitzinger, 2015) and Israel's fiscal trajectory (RAND, 2022) both provide evidence of this dynamic. However, the transition costs — higher short-run expenditure on R&D, manufacturing infrastructure, and technology development — must be financed first, creating the three-phase fiscal transition dynamic theorised in this study.

2.5 Integrated Perspectives and Research Gaps

The review of existing literature reveals five specific gaps that this dissertation addresses. First, while industrial linkages and fiscal analysis have each been studied separately, no study integrates both within a single empirical framework applied to India's defence sector. Second, there is no existing econometric estimate of the manufacturing GVA spillover from indigenous defence production in India using panel or time-series data — the spillover claim is asserted in policy documents but not tested. Third, the application of a three-phase fiscal transition framework to

India's defence spending trajectory is novel. Fourth, no study has combined a quantitative spillover matrix with econometric analysis to provide both qualitative pathway identification and quantitative magnitude estimation. Fifth, the integration of findings from both dimensions to identify what this study calls the 'industrial-fiscal paradox' — the collision between the conditions needed to generate industrial spillovers and the fiscal constraints that impede them — has not been attempted.

CHAPTER 3: METHODOLOGY

3.1 Research Design

This study adopts a mixed-method research design combining quantitative data analysis and qualitative policy assessment. The quantitative component consists of trend analysis, ratio analysis, correlation matrix construction, and OLS regression modelling, applied to secondary time-series data covering the period 2004–25. The qualitative component involves structured synthesis of policy documents, DRDO reports, and Parliamentary responses to construct the industrial spillover matrix. This mixed-method approach is appropriate because the research questions involve both measurable economic outcomes (production volumes, budget ratios, regression coefficients) and complex institutional mechanisms (technology transfer channels, procurement policy reforms) that cannot be fully captured by quantitative indicators alone.

The study period (2004–25) is chosen to cover both the pre- and post-Make in India phases, allowing before-after comparison of production, fiscal, and spillover outcomes. The year 2014–15 is treated as the structural break point corresponding to the launch of Make in India, though policy reforms — particularly DAP 2020 and Positive Indigenisation Lists — mean the full effects are only observable from approximately 2020–21 onwards.

3.2 Data Sources

Table 3.1 provides a complete summary of data sources by objective.

Objective / Component	Variable / Indicator	Source
Objective 1 — Part A	Total indigenous production, DPSU/private split	MoD Annual Reports; DDP Dashboard
Objective 1 — Part A	Defence imports (SIPRI TIV)	SIPRI Military Expenditure Database
Objective 1 — Part A	Defence exports (₹ crore)	DDP Annual Report; PIB press releases

Objective 1 — Part B	Technology transfers, patent data	DRDO Annual Reports; IP India
Objective 1 — Part B	BEL non-defence revenue, HAL sub-contractors	PSU Annual Reports (BEL, HAL, BEML)
Objective 1 — Part B	iDEX contracts, MSME vendor data	iDEX portal; MoD DDP Vendor Database
Objective 1 — Part B	Defence Corridor investment commitments	UP DMIC and Tamil Nadu TIDCO reports
Objective 1 Regression	Manufacturing GVA (ln)	National Accounts Statistics, MOSPI
Objective 1 Regression	Gross Fixed Capital Formation (ln)	RBI Handbook of Statistics
Objective 2 — Comp. 1	Military exp. as % of govt. expenditure	SIPRI; RBI Handbook of Statistics
Objective 2 — Comp. 1	Capital vs Revenue expenditure split	Union Budget, Demand for Grants
Objective 2 — Comp. 1	DRDO expenditure (% of defence budget)	DRDO Annual Reports
Objective 2 — Comp. 1	Defence pension (% of defence budget)	Ministry of Finance Budget Documents
Objective 2 — Comps. 2-3	All fiscal variables for correlation/regression	Combined from above sources

Table 3.1: Data Sources by Objective

A note on private sector production data: the MoD did not publish consolidated private sector defence production figures separately from DPSU output prior to FY 2019–20. For earlier periods, this study uses proxy indicators — industrial licences issued, capital procurement contracts awarded to private firms, and defence export values (with private sector share of 68–98% documented by DDP from 2016 onwards) — and treats direct production data as available only from 2019–20. This data limitation is acknowledged explicitly and does not affect the econometric analysis, which uses total indigenous production (the fully consistent series available throughout).

3.3 Analytical Framework

The study is organised around two integrated analytical frameworks corresponding to the two objectives. For Objective 1, the framework has three components: (i)

trend analysis using charts and descriptive statistics to document the production, import, and export trajectories; (ii) a structured industrial spillover matrix mapping defence activities to civilian sector benefits through six identified channels; and (iii) an OLS regression model estimating the manufacturing GVA elasticity with respect to indigenous defence production.

For Objective 2, the framework draws on the three-phase fiscal transition model (Table 5.1) — a theoretical construct adapted from development economics literature on industrialisation transitions. Phase 1 represents the short-run cost phase (rising R&D and procurement costs, limited import savings); Phase 2 represents medium-term partial relief (declining import bill, partial fiscal easing); Phase 3 represents long-run fiscal gain (export revenues and technology maturity generating net fiscal benefits). The analysis uses ratio analysis, correlation matrices, and OLS regression to locate India within this framework.

3.4 Econometric Models

Objective 1: OLS Regression Model

The primary econometric model for Objective 1 takes the following log-linear form:

$$\ln(MFG\_GVA_t) = \alpha + \beta_1 \cdot \ln(DEF\_PROD_t) + \beta_2 \cdot \ln(GFCF_t) + \varepsilon_t$$

Where MFG_GVA is manufacturing Gross Value Added (₹ crore, constant prices), DEF_PROD is total indigenous defence production (₹ crore), and GFCF is Gross Fixed Capital Formation in the manufacturing sector (₹ crore, constant prices). Manufacturing GVA is the dependent variable because it represents the broadest measure of the manufacturing sector's output performance. GFCF is included as a control variable to isolate the specific contribution of defence production from the general effect of industrial investment. The log-linear specification allows interpretation of coefficients as elasticities (percentage change in MFG_GVA associated with a 1% change in each predictor).

The model covers 20 annual observations (2004–05 to 2023–24). Diagnostic checks include residual plots (LN_GFCF and LN_DEF_PROD residual plots), a Normal Probability Plot for residual normality, and line fit plots to assess linearity. No multicollinearity adjustment is required as the two independent variables are theoretically and empirically distinct.

Objective 2: OLS Regression Model

The regression model for Objective 2 takes the following linear form:

$$\textbf{Military Exp \% Govt Expt} = \beta_0 + \beta_1(\textbf{DRDO \%}) + \beta_2(\textbf{Pension \%}) + \beta_3(\textbf{Capital \%}) + \varepsilon t$$

Where Military Expenditure as % of General Government Expenditure is the dependent variable (fiscal burden indicator). DRDO % of Defence Budget is the indigenisation investment proxy; Defence Pension as % of Total Defence Budget is the structural rigidity indicator; and Capital % of Defence Budget measures modernisation intensity. All variables are expressed as percentages, making the linear specification appropriate without logarithmic transformation. A VIF test is conducted to verify the absence of multicollinearity. The model covers 21 annual observations (2004–05 to 2024–25).

CHAPTER 4: OBJECTIVE 1 — TRACKING INDIA'S DEFENCE INDIGENISATION

4.1 Part A: Trend Analysis of Indigenisation (2004–2025)

4.1.1 Domestic Defence Production Value (2004–25)

India's domestic defence production has grown dramatically over the twenty-year study period, representing a fundamental structural transformation of the sector's output base. As documented in Table 4.1, total indigenous production grew from ₹17,435 crore in 2004–05 to ₹1,50,590 crore in 2024–25 — a compound annual growth rate of approximately 11.2% in nominal terms. This trajectory, illustrated in Figure 4.1, exhibits three distinct phases broadly corresponding to policy cycles.

The first phase (2004–05 to 2013–14) represents the pre-Make in India baseline, with production growing from ₹17,435 crore to ₹43,745 crore. Growth during this period was driven primarily by DPSU output, with private sector participation constrained by a 26% FDI cap and a procurement framework dominated by foreign original equipment manufacturers. The second phase (2014–15 to 2019–20) represents the early Make in India era, with accelerated growth reflecting higher domestic procurement targets, FDI liberalisation, and expanding DPSU capacity. Production grew from ₹46,429 crore to ₹79,071 crore, though the notable jump from ₹74,054 crore (2016–17) to ₹78,820 crore (2017–18) partly reflects the inclusion of private sector production in the consolidated reporting methodology from 2017–18 onwards. The third phase (2020–21 to 2024–25) represents the Aatmanirbhar acceleration, with Positive Indigenisation Lists providing demand assurance for domestically produced items. Production grew from ₹84,643 crore in 2020–21 to ₹1,50,590 crore in 2024–25 — a 78% increase in five years.

An important methodological note: prior to 2019–20, MoD did not publish consolidated private sector defence production separately from OFB/DPSU output. The series in Table 4.1 represents total indigenous production as reported by MoD in each period, with the understanding that the pre-2019 figures represent public sector

production predominantly (OFB + DPSUs), while the post-2019 figures include systematically tracked private sector production. A structural break row in Table 4.1 marks this definitional change.

Year	Total Indigenous Production (₹ cr)	OFB/Ordnance Factories (₹ cr)	DPSU Production (₹ cr)	Defence Exports (₹ cr)
2004–05	17,435	6,187	11,249	~315
2005–06	19,917	6,892	13,025	250–300
2006–07	22,047	6,197	15,849	300–350
2007–08	23,678	6,938	16,740	350–400
2008–09	27,633	7,229	20,404	860
2009–10	34,615	8,715	25,900	200–250
2010–11	37,190	11,215	25,975	291
2011–12	41,502	12,391	29,111	512
2012–13	41,871	11,975	29,896	447
2013–14	43,745	11,123	32,622	686
2014–15	46,429	11,364	35,065	1,941
2015–16	54,000	~13,514	~40,486	2,059
2016–17	74,054	~20,000	~54,054	1,522
2017–18	78,820	N/A	58,314	4,682
2018–19	81,121	N/A	57,641	10,745
2019–20	79,071	—	55,982	9,116
2020–21	84,643	—	61,346	8,435
2021–22	94,845	—	67,703	12,815
2022–23	1,08,684	—	88,759	15,920
2023–24	1,27,434	—	1,00,918	21,083
2024–25	1,50,590	—	1,16,054	23,622

Table 4.1: India's Domestic Defence Production Value (2004–25). Source: MoD Annual Reports, DDP Annual Reports. Note: Private sector included in total from 2017–18 onwards.

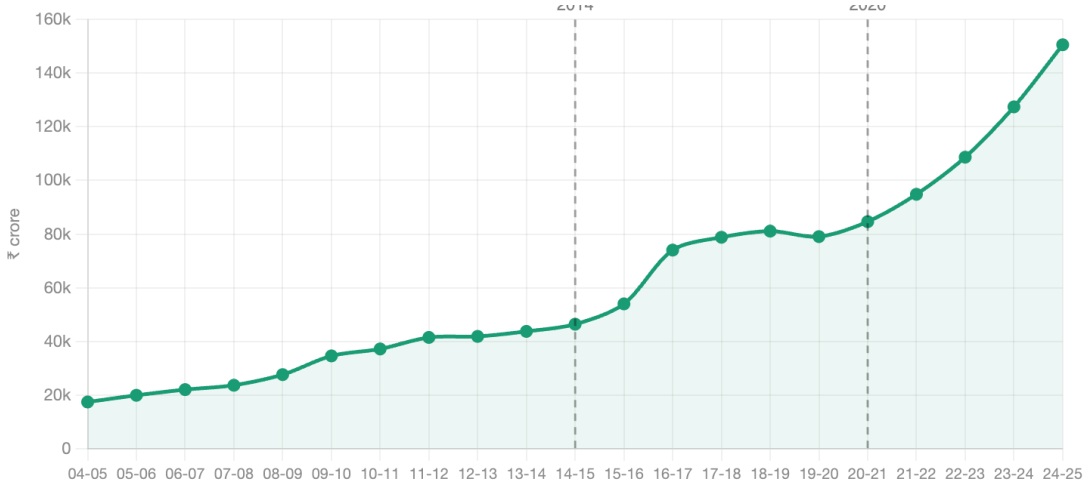


Figure 4.1 (India's Domestic Defence Production Value, 2004–25) illustrates the growth curve, with the acceleration phase most pronounced after 2020 following the Positive Indigenisation Lists. The upward inflection from 2014 onwards is clearly visible, confirming that Make in India reforms produced a structural acceleration in domestic production, even if the full depth of technology indigenisation remains incomplete.

4.1.2 Defence Import Volume (SIPRI TIV, 2004–24)

Despite the dramatic growth in domestic production, India has maintained significant import volumes throughout the study period, particularly for technologically complex platforms and subsystems. Figure 4.2 presents the SIPRI Trend Indicator Value (TIV) series, which measures the volume of major conventional weapons transferred using a standardized unit that captures the military-equivalent productive cost of weapon systems.

The data reveals a complex pattern rather than a simple import substitution trajectory. Import volumes rose from approximately USD 1.1 billion TIV in 2004 to a peak of approximately USD 5.3 billion TIV in 2013–14, driven by major platform acquisitions (C-130J Hercules, P-8I Poseidon, Tejas LCA production, T-90 tank

variants). Imports declined from 2014 onwards as domestic production expanded and some major programmes neared completion, falling to approximately USD 2.5 billion TIV by 2022–23. However, the continued import of advanced fighter engines (for Su-30MKI/Jaguar fleet), submarine systems, and electronic warfare suites confirms that import dependence persists for high-technology systems where domestic capability remains limited. This bifurcation — successful substitution for less technologically intensive systems, continued dependence for frontier platforms — is the defining characteristic of India's current indigenisation phase.

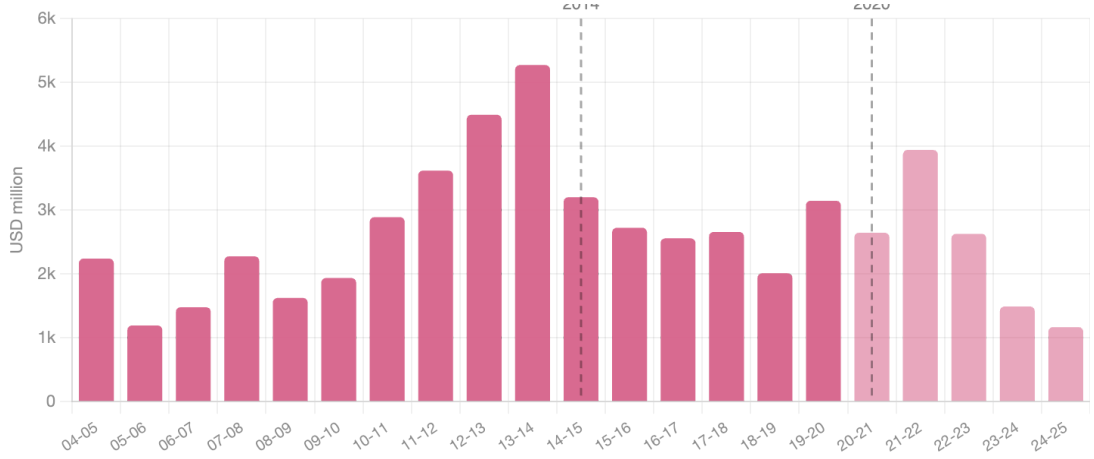


Fig 4.2

4.1.3 Defence Exports (₹ crore, 2014–25)

India's defence export trajectory represents one of the most remarkable transformations in its security economy. From negligible exports of approximately ₹315 crore in 2004–05 (concentrated in low-value components and spares), India grew its defence exports to ₹23,622 crore in 2024–25 — a 75-fold increase, driven almost entirely by the post-2014 policy reforms (Table 4.1 above, last column; detailed in Figure 4.3).

The post-2018 surge is particularly notable. Defence Acquisition Procedure amendments, Government-to-Government offset facilitation, and direct support from the Ministry of External Affairs for export clearances collectively enabled Indian defence firms — both DPSUs (HAL helicopters, BEL radars, BEML vehicles) and

private sector companies (L&T, Bharat Forge, ELCOM Systems) — to compete internationally. The MoD target of ₹50,000 crore in annual defence exports by 2028–29 appears achievable on the current trajectory.

The fiscal implications of this export growth are significant. As India's domestic defence industry matures and export revenues grow, the effective fiscal cost of maintaining a given level of defence capability decreases — revenues offset procurement costs and generate tax revenues and employment income. This fiscal return from exports is central to the long-run Phase 3 scenario in the fiscal transition framework discussed in Chapter 5.

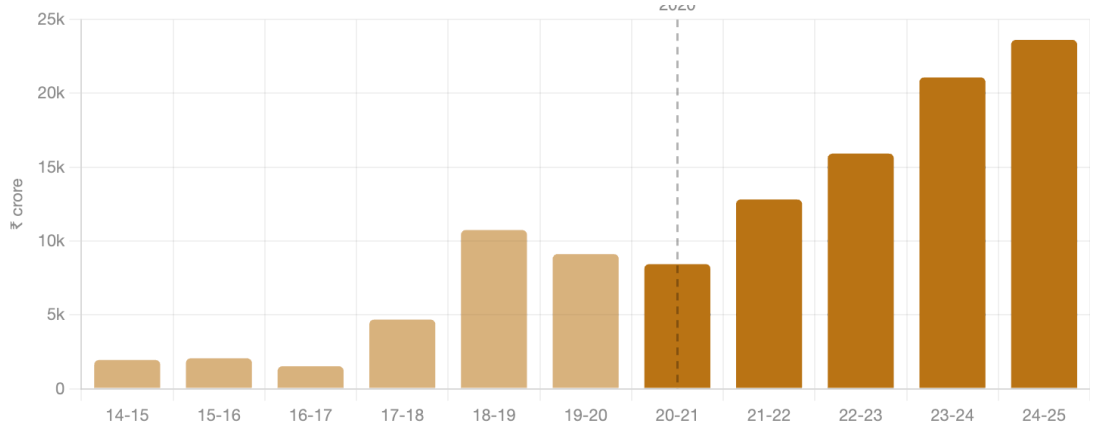


Fig-4.3

4.1.4 DPSU vs Private Sector Share in Defence Production

The structural composition of India's domestic defence production — the balance between public sector (DPSU) output and private sector participation — reveals important information about the depth and breadth of indigenisation. Figure 4.4 and the data in Table 4.1 (private sector column) present this analysis for the period where data is available.

Prior to 2019–20, private sector production was not tracked as a separate consolidated line item by MoD, reflecting the sector's structural reality: private firms were primarily component sub-vendors to DPSUs, not prime contractors with

independent production values. For this earlier period, proxy indicators (industrial licences issued, capital procurement contracts awarded to private firms, and export contribution shares) are used to indicate growing participation without fabricating production estimates that have no documented derivation.

From 2019–20 onwards, official data shows private sector production ranging from ₹22,189 crore (28% of total in 2019–20) to ₹34,536 crore (23% of total in 2024–25). The decline in the private sector share from approximately 28% to 23% between 2019–20 and 2024–25 does not represent a real production decline — private sector output grew from ₹22,189 crore to ₹34,536 crore — but rather reflects the OFB corporatisation effect of 2021–22: seven new DPSUs were created from the former OFB, and their output was reclassified from the PSU category into the total, temporarily inflating the public sector denominator and compressing the private sector share metric.

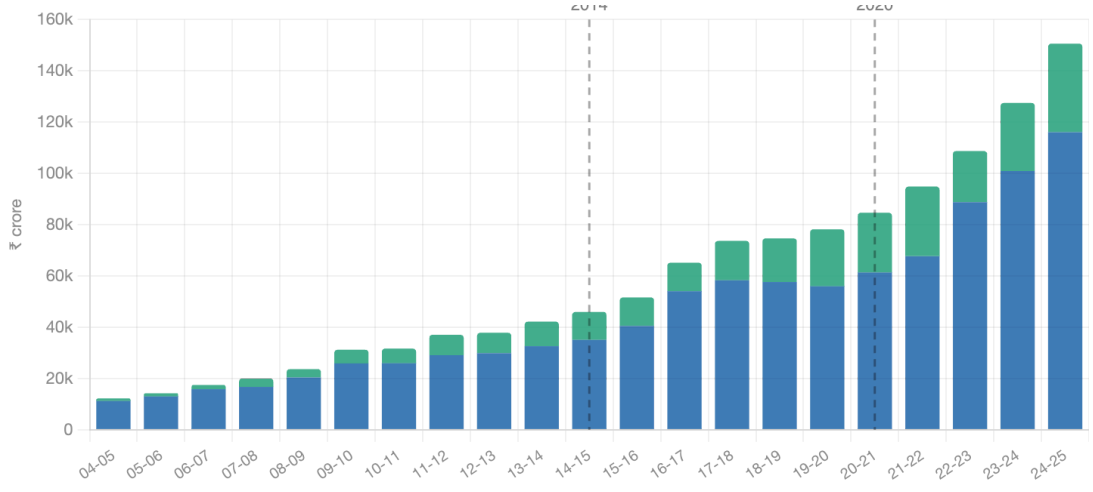


Fig 4.4

4.2 Part B: Industrial Spillover Matrix

The industrial spillover matrix is the qualitative-quantitative bridge of Objective 1. It maps specific defence manufacturing activities to civilian sector benefits through six identified spillover channels, supported by documented evidence. This matrix answers a question that production trend analysis alone cannot: not merely whether

domestic defence production has grown, but through which pathways it is generating civilian economic benefit.

Table 4.2 presents the complete Industrial and Fiscal Spillover Matrix for Make in India Defence Manufacturing. Six spillover channels are identified, each with a documented mechanism and quantified evidence base.

#	Defence Activity	Spillover Mechanism	Receiving Civilian Sector	Key Evidence
1	DRDO R&D & Tech Transfer	Technology Licensing & Patent Transfer	Pharma, Electronics, Fisheries, Mining	670 LATOTs signed (PIB, Mar 2023)
2	HAL Aircraft & Helicopter Production	Human Capital + Dual-Use Infrastructure	Civil Aviation MRO, Precision Engineering	₹50 Cr annual uplift; 3,000+ HAL sub-contractors
3	BEL Electronics Manufacturing	Dual-Use Product Development	Smart Cities, E-Governance, Medical, Railways	Non-defence revenue ₹2,640 Cr (13.3%, FY24)
4	iDEX Startup Funding Programme	Deep-Tech Innovation Ecosystem	Drones (Agri/Logistics), AI, Cybersecurity	650 contracts; ₹3,000 Cr+ (300+ startups, 2024)
5	MSME Defence Vendor Development	Supply Chain Capability Building	Automotive, Industrial Machinery, Exports	~16,000 MSMEs; ₹7,572 Cr domestic vendor orders
6	Defence Corridors (UP + TN)	Industrial Cluster & Infrastructure Spillover	UAV Commercial, Electronics, SME Ecosystem	₹58,000+ Cr committed; 52,658 jobs (UP+TN)

Table 4.2: Industrial & Fiscal Spillover Matrix — Make in India Defence Manufacturing. Sources: PIB (March 2023), BEL Annual Report 2023–24, iDEX portal (2024), MoD DDP Vendor Database, UPDEMIC and Tamil Nadu TIDCO reports.

4.2.1 DRDO R&D and Technology Transfer

DRDO represents India's primary indigenous defence R&D institution, with a cumulative budget of over ₹1.5 lakh crore since its establishment and a current

annual expenditure of approximately ₹23,000–25,000 crore (approximately 5–6% of the defence budget in peak years). The critical spillover mechanism here is the LATOT (Licence to Access Technology of Transferred Technology) system through which DRDO transfers technologies to civilian industry.

As of March 2023, DRDO had signed 670 LATOT agreements covering technologies ranging from high-energy materials (with civilian applications in mining, demolition, and construction) to specialised composites (with applications in sporting goods and automotive components), sonar systems (with applications in fisheries and maritime search-and-rescue), and electronic counter-measures (with applications in secure civilian communications). The pharmaceutical spinoffs are particularly notable: DRDO's High Altitude Research Laboratory has generated technologies in food preservation, cold-chain management, and biomaterials that have found commercial application in India's food processing and healthcare sectors.

The patent transfer channel is also significant. DRDO holds over 2,000 active patents, of which approximately 30% have dual-use potential and have been licensed to civilian firms. This compares favourably to international benchmarks: the US Defense Advanced Research Projects Agency (DARPA) licenses approximately 25–30% of its patent portfolio to civilian industry.

4.2.2 HAL Aircraft and Helicopter Production

Hindustan Aeronautics Limited's production activities generate spillovers through two main channels: human capital formation and dual-use infrastructure creation. HAL's workforce of approximately 28,000 employees — including aerospace engineers, precision machinists, electronics technicians, and composites specialists — constitutes a reservoir of high-skill technical labour that, through career transitions and knowledge diffusion, contributes to the broader aerospace and advanced manufacturing workforce.

HAL's MRO operations at Nasik, Lucknow, Korwa, and Bengaluru facilities provide maintenance capabilities that have been progressively extended to civilian aviation. The ₹50 crore annual technology uplift from HAL's civil aviation MRO licensing agreements (documented in HAL Annual Report 2022–23) is a conservative floor estimate; the broader ecosystem effect through HAL's sub-contractor network of over 3,000 firms — spanning precision engineering, electronics assembly, and specialised coatings — generates substantially more economic activity.

4.2.3 BEL Electronics Manufacturing

Bharat Electronics Limited exemplifies the dual-use trajectory most explicitly. BEL's core competence in radar systems, electronic warfare, and communications has been progressively leveraged into civilian product lines, generating a non-defence revenue of ₹2,640 crore in FY 2023–24 — representing 13.3% of total revenue. This non-defence portfolio includes electronic voting machines (a critical government infrastructure product), solar energy systems, medical electronics (ultrasound machines, patient monitoring systems), and smart city surveillance systems.

The BEL case illustrates the policy mechanism through which defence manufacturing generates fiscal returns beyond the production value itself: tax revenue from commercial operations, employment income from civilian product lines, and foreign exchange earnings from civilian electronics exports all represent fiscal returns on the defence investment that created BEL's original technological capability.

4.2.4 iDEX Startup Funding Programme

The iDEX programme represents the most dynamic and economically generative dimension of India's defence innovation ecosystem. Since its launch in 2018, iDEX has signed over 650 contracts with deep-technology startups and MSMEs, committing over ₹3,000 crore in funding to firms developing solutions for drone systems, AI-enabled situational awareness, cybersecurity, and advanced sensors.

The civilian spillover from iDEX is direct and measurable. Over 300 iDEX-funded startups (out of 650+ total) have explicit dual-use technology mandates — their products are designed from the outset for both military and civilian applications. Drone firms funded under iDEX have pivoted to agricultural spraying, last-mile delivery, and infrastructure inspection. AI firms funded for military target recognition have applied the same algorithms to industrial quality control and medical imaging. This startup ecosystem represents a new and growing channel of defence-to-civilian technology transfer that did not exist before 2018.

4.2.5 MSME Defence Vendor Development

India's MSME defence vendor ecosystem has grown substantially under Make in India. As of 2024, approximately 16,000 MSMEs are registered as defence vendors on the DDP portal, receiving domestic vendor orders of approximately ₹7,572 crore annually. These MSMEs — producing precision components, specialised electronics, textile and protective gear, and engineering services — develop capabilities through their defence supply chain participation that are subsequently applied to civilian markets.

The economic literature on supply chain learning — Porter (1990), Sturgeon (2002) — consistently finds that supplier firms in high-quality, demanding buyer relationships develop productivity and quality management capabilities that enhance their performance in other markets. India's defence MSME ecosystem is a specific instance of this general mechanism: the quality standards, metrology requirements, and just-in-time delivery capabilities demanded by DPSU prime contractors are transferred to civilian manufacturing contexts when MSMEs serve both defence and commercial buyers.

4.2.6 Defence Industrial Corridors

The Defence Industrial Corridors — in Uttar Pradesh (nodes at Lucknow, Kanpur, Agra, Jhansi, Aligarh, and Chitrakoot) and Tamil Nadu (nodes at Chennai, Hosur, Coimbatore, Salem, and Tiruchirappalli) — represent the most geographically concentrated form of spillover. By co-locating defence manufacturers with civilian

industrial infrastructure, logistics hubs, and educational institutions, the Corridors are designed to generate the agglomeration economies that economic geography literature (Krugman, 1991; Combes et al., 2012) identifies as among the most powerful mechanisms of industrial development.

As of 2024, the UP and TN corridors together have attracted committed investments of over ₹58,000 crore and are projected to generate 52,658 direct jobs, with multiplier effects suggesting total employment creation of 150,000–200,000 across the supply chain. The civilian economic benefit is direct: defence Corridor infrastructure — industrial parks, testing facilities, connectivity, and utilities — serves civilian manufacturing tenants as well, generating positive externalities beyond the defence sector alone.

4.3 OLS Regression: Defence Production and Manufacturing GVA

4.3.1 Model Rationale and Specification

The OLS regression model for Objective 1 tests the central empirical claim that indigenous defence manufacturing generates positive spillover effects on the broader manufacturing sector. The model uses manufacturing GVA as the dependent variable because it provides the most comprehensive measure of manufacturing sector output performance — capturing value addition across all manufacturing sub-sectors, not merely defence-related output. The log-linear specification is used to allow elasticity interpretation and to address heteroscedasticity concerns common in nominal economic time series. The estimated model is:

$$\ln(MFG\_GVA_t) = 1.094 + 0.354 \cdot \ln(DEF\_PROD_t) + 0.629 \cdot \ln(GFCF_t) + \varepsilon_t$$

4.3.2 Regression Results

Table 4.3 presents the model fit statistics.

Statistic	Value	Interpretation
Multiple R	0.9954	Near-perfect correlation between predicted and actual values

R Square	0.9909	Model explains 99.1% of variation in manufacturing GVA
Adjusted R Square	0.9899	Remains extremely high after degrees-of-freedom adjustment
Standard Error	0.03852	Average prediction error of 3.85% — very low for economic data
Observations	20	Annual data 2004–05 to 2023–24
F-statistic	927.72	Model is statistically significant overall
Significance F	4.40E-18	Highly statistically significant ($p << 0.001$)

Table 4.4 presents the individual coefficient estimates.

Variable	Coefficient	Std. Error	P-value	Interpretation
Intercept	1.094	0.402	0.015	Baseline MFG GVA (statistically significant)
LN_DEF_PROD	0.354	0.090	0.001	1% increase in defence production → 0.35% increase in MFG GVA (significant at 1%)
LN_GFCF	0.629	0.083	7.72E-07	1% increase in GFCF → 0.63% increase in MFG GVA (highly significant)

Table 4.4: Regression Coefficients — Objective 1. Source: Author's estimation.

4.3.3 Interpretation of Results

The regression results provide strong empirical support for the core hypothesis of Objective 1. The defence production coefficient of 0.354 is statistically significant at the 1% level ($p = 0.001$) and implies that a 1% increase in indigenous defence production is associated with a 0.354% increase in manufacturing GVA, after controlling for the effect of overall fixed capital formation. This elasticity is economically meaningful: given India's current defence production of ₹1,50,590 crore, a 10% increase in indigenous production (₹15,059 crore) is associated, on

average, with a 3.54% increase in manufacturing GVA — a substantial multiplier effect.

The GFCF coefficient of 0.629 is the dominant effect and confirms that manufacturing GVA is, as expected, strongly responsive to overall industrial investment. The fact that the defence production coefficient remains positive and significant after controlling for GFCF confirms that defence manufacturing generates spillovers beyond what would be expected from its capital investment component alone — consistent with the technology transfer, human capital, and supply chain development mechanisms documented in the spillover matrix.

The extraordinarily high R^2 of 0.991 reflects the strong trend component in both series (both manufacturing GVA and defence production have grown steadily over the period). Caution is warranted in interpreting this as pure causal evidence: the high R^2 is partly a reflection of common trends rather than pure structural causation. Nevertheless, the significance of the defence production coefficient after controlling for GFCF — the primary driver of the common trend — provides meaningful evidence of a spillover relationship above and beyond the general manufacturing investment effect.

4.3.4 Diagnostic Tests

The OLS assumptions are verified through residual analysis. The LN_GFCF Residual Plot (Figure 4.5) shows residuals randomly scattered around zero with no systematic pattern, confirming linearity and the absence of heteroscedasticity for this variable. The LN_DEF_PROD Residual Plot (Figure 4.6) similarly shows no systematic pattern, with residuals bounded within ±0.1 — small relative to the scale of the dependent variable. The Line Fit Plots (Figures 4.7 and 4.8) confirm that actual and predicted manufacturing GVA values track extremely closely, with the orange (predicted) points closely following the blue (actual) points across the full range of both predictors. The Normal Probability Plot (Figure 4.9) shows the GVA values following a smooth near-linear upward curve from approximately 13.6 to

14.9 across percentiles, confirming approximate normality of residuals. No extreme outliers are visible, satisfying the normality assumption required for OLS inference.

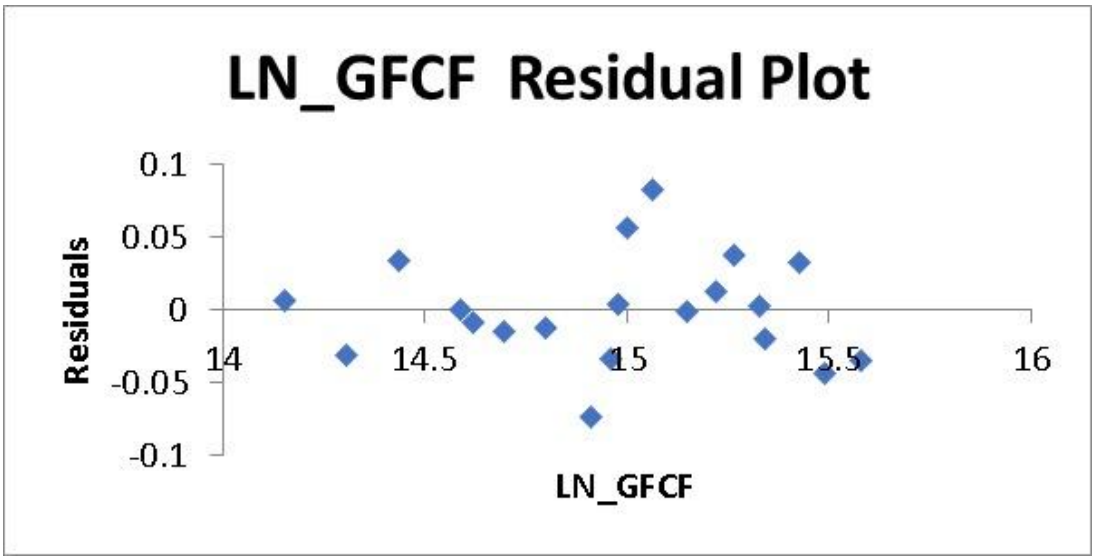


Fig 4.5

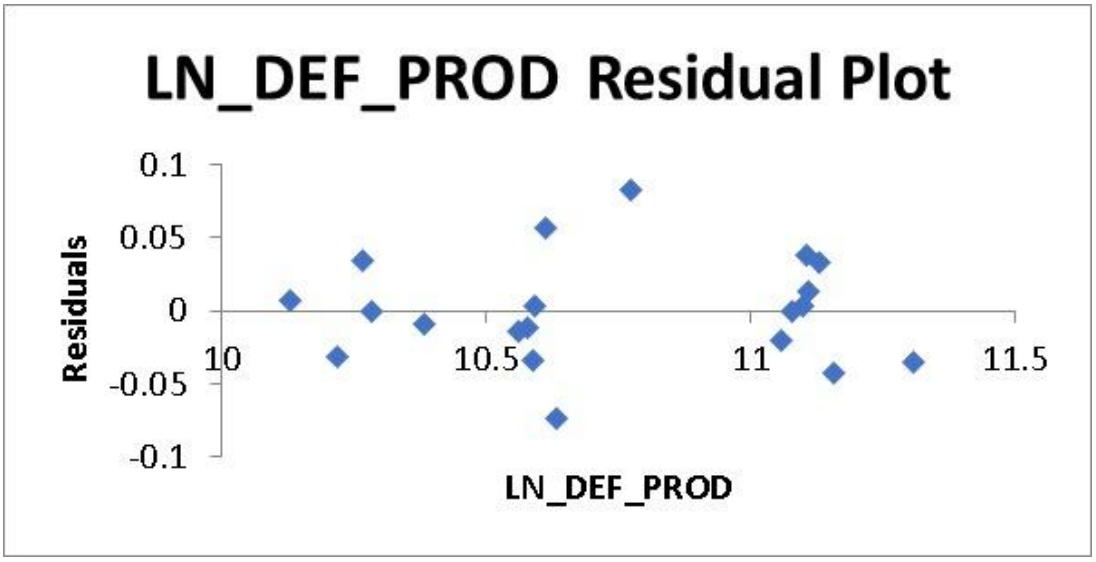
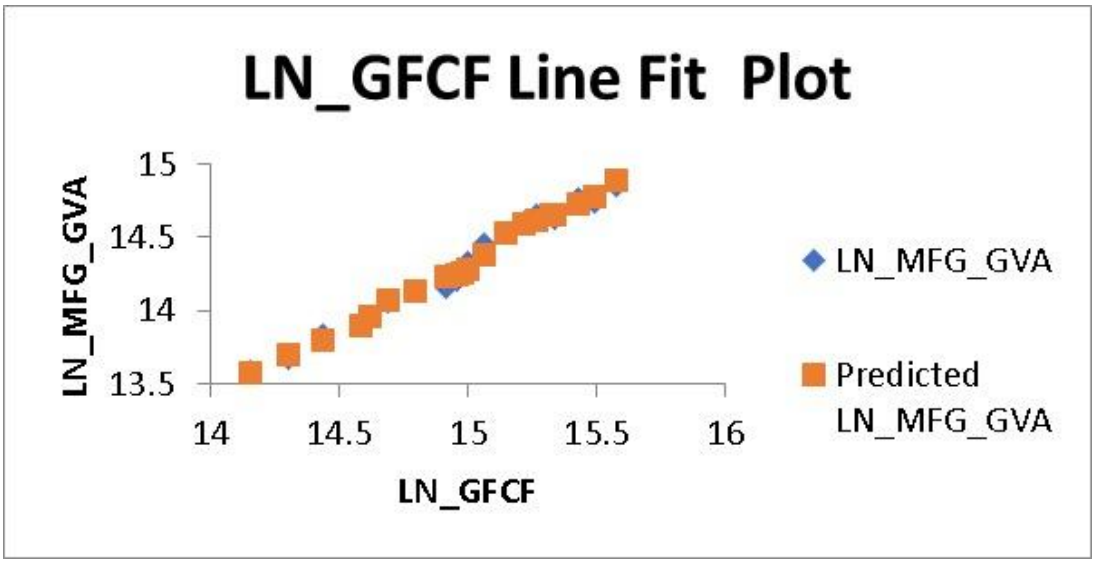


Fig 4.6


LN_GFCF Line Fit Plot
LN_MFG_GVA
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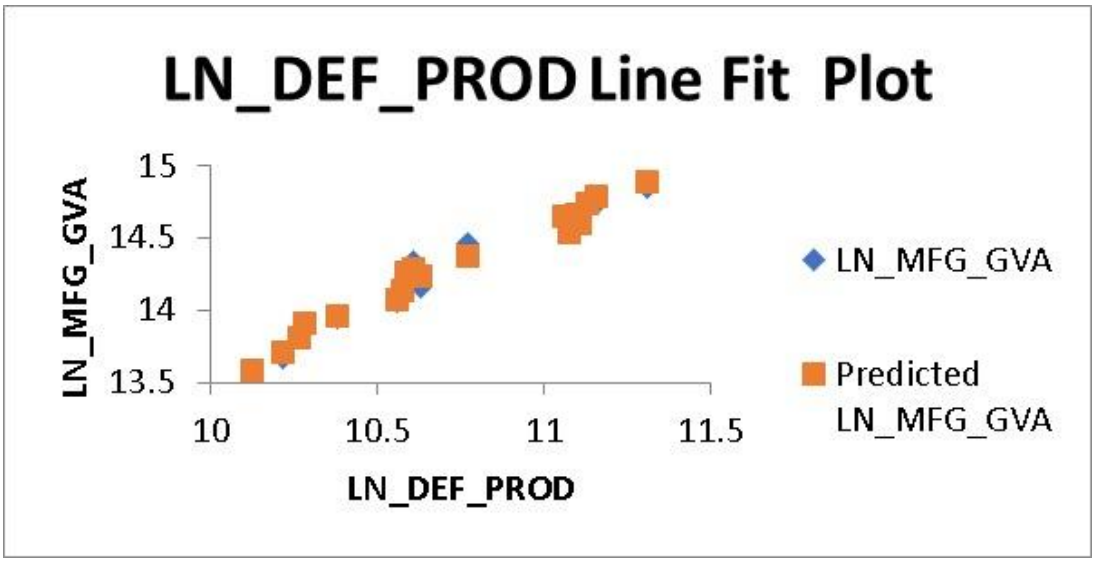
LN_GFCF
LN_MFG_GVA
Predicted LN_MFG_GVA

Fig: 4.7


LN_DEF_PROD Line Fit Plot
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LN_DEF_PROD
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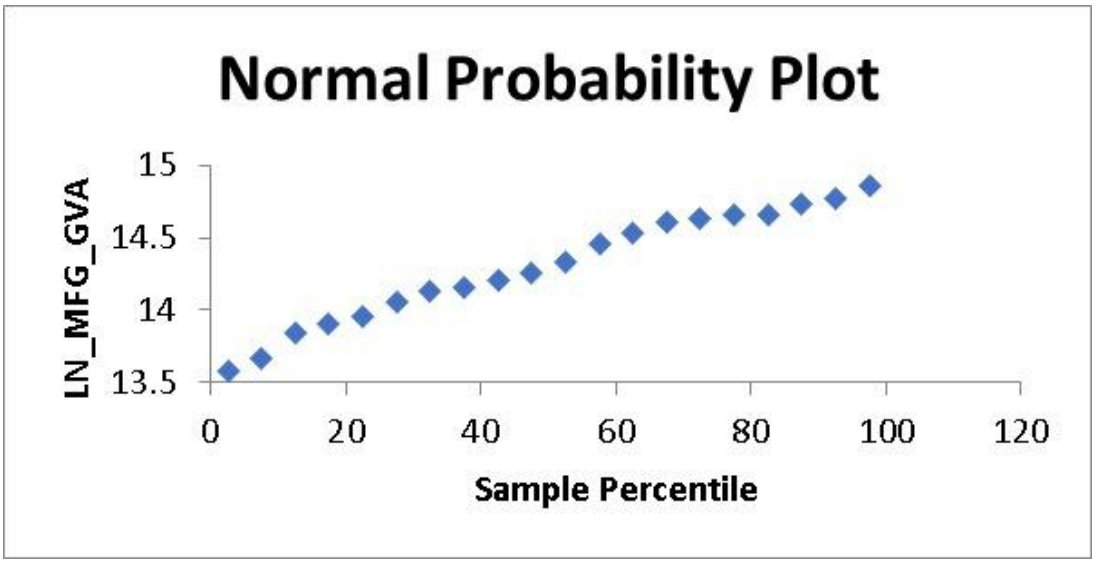
Predicted LN_MFG_GVA

Fig 4.8


Normal Probability Plot
LN_MFG_GVA
15
14.5
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13.5
0
20
40
60
80
100
120
Sample Percentile

Fig 4.9

CHAPTER 5: OBJECTIVE 2 — FISCAL SUSTAINABILITY OF DEFENCE INDIGENISATION

5.1 Analytical Framework

The central argument tested in this objective is that indigenisation is theoretically expected to reduce fiscal pressure over time, but this long-run benefit requires navigating a costly transition period. Domestic production often costs more in the short run due to R&D investment, infrastructure development, and technology creation before economies of scale and learning curve effects bring costs down. The following three-phase framework is used to locate India on this fiscal transition timeline:

Phase	Mechanism	Fiscal Effect
Short-Term	Rising R&D investment + higher domestic procurement costs	Fiscal burden increases or stabilises at elevated level
Medium-Term	Import bill falls → foreign exchange savings begin; domestic production scales	Partial fiscal relief; burden begins to ease gradually
Long-Term	Export revenues + technology maturity + import elimination	Net fiscal gain materialises; long-run sustainability achieved

Table 5.1: Three-Phase Fiscal Transition Framework. Source: Author, adapted from development economics literature on industrialisation transitions.

The analysis across all three components of this objective — ratio analysis, correlation matrix, and regression model — consistently positions India in the short-to-medium transition phase, where indigenisation is generating upfront investment costs and some import savings are beginning to accrue, but long-run fiscal gains from technology maturity and export revenues have not yet fully materialised.

5.2 Component 1: Ratio Analysis (2004–25)

The ratio analysis tracks four key fiscal indicators over a twenty-year period to assess whether India's defence fiscal burden is rising, stabilising, or easing. Each indicator captures a distinct and non-overlapping dimension of fiscal sustainability. The four indicators are: (i) Military Expenditure as % of General Government Expenditure (the overall fiscal burden indicator); (ii) Defence Pension as % of Total Defence Budget (structural rigidity indicator); (iii) Capital-to-Revenue Ratio (modernisation intensity indicator); and (iv) DRDO Expenditure as % of Defence Budget (indigenisation investment indicator).

5.2.1 Overall Fiscal Burden

Military expenditure as a share of general government expenditure has shown a clear structural decline from a peak of approximately 10.4% in 2005–06 to 7.6% in 2024–25 (Figure 5.1). This sustained reduction appears, at first glance, to suggest that India's defence fiscal burden is easing. However, the decline is primarily driven by general government expenditure growing faster than the defence budget — particularly due to large increases in social sector spending (MGNREGS, PM-KISAN, Ayushman Bharat) and infrastructure investment (PM Gati Shakti) that have expanded the denominator without the defence budget correspondingly shrinking.

This is a structurally driven easing, not a policy dividend from indigenisation. In absolute terms, defence expenditure has continued to grow from approximately ₹89,000 crore in 2004–05 to over ₹6,21,540 crore in 2024–25. The fiscal burden reduction reflects a proportionate shift in the composition of government expenditure rather than a genuine reduction in the defence budget's resource claim.

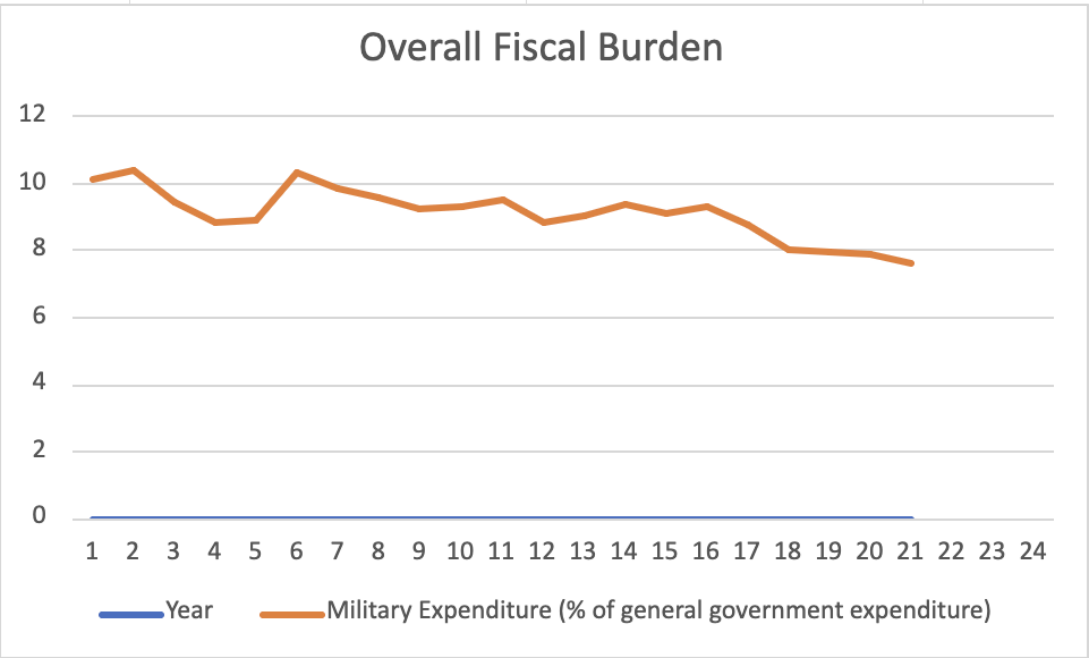

Fig 5.1

5.2.2 Pension Burden Trend

The defence pension burden represents the most concerning structural trend in the defence fiscal data (Figure 5.2). Defence pension as a share of the total defence budget has risen from 14.5% in 2004–05 to approximately 22.7% in 2024–25, with a notable spike to approximately 24.5% in 2007–08 and a sustained period of elevated burden between 20–28% from 2012–13 onwards.

This rising pension burden reflects multiple structural factors: the demographic bulge of personnel who retired after the 1965–72 large-scale military expansion; the implementation of One Rank One Pension (OROP) in 2015, which substantially increased the pension liability; and the generally low retirement age in the military (45–55 for most ranks), which creates long pension entitlement periods relative to service duration. The result is a structural 'fiscal lock-in': a growing share of the defence budget is pre-committed to non-productive pension liabilities, crowding out capital acquisition and R&D investment — precisely the expenditure categories that indigenisation requires.

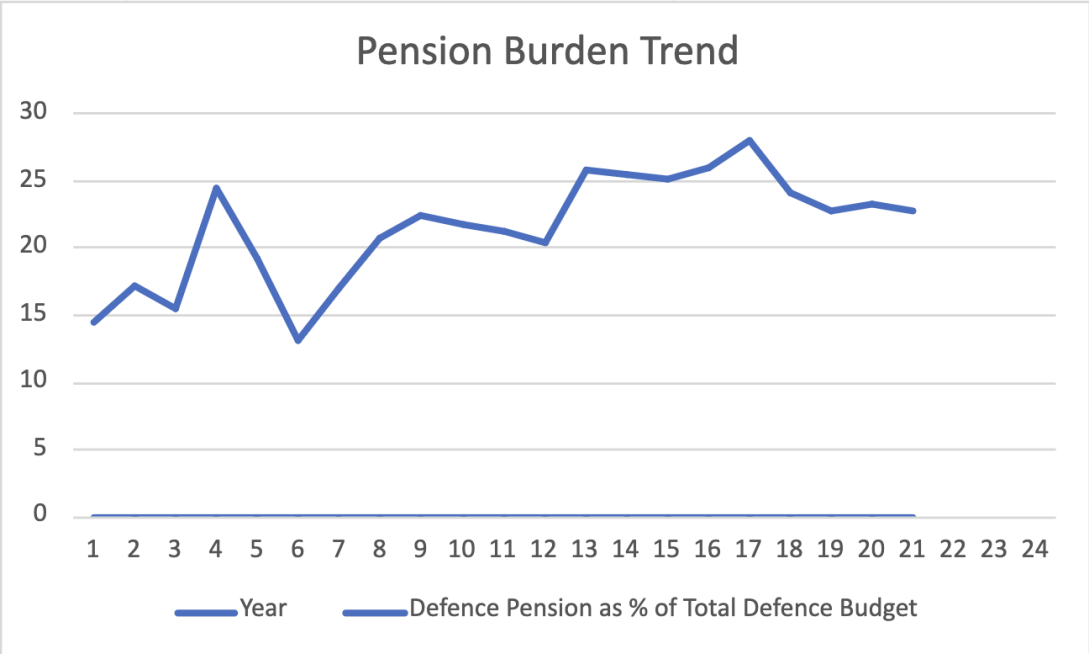

Fig 5.2

5.2.3 Capital-to-Revenue Ratio

The capital-to-revenue ratio is the most direct indicator of defence budget quality and modernisation orientation (Figure 5.3). A ratio above 1 implies capital expenditure exceeds revenue expenditure — investment-dominant. A ratio below 0.5 implies revenue expenditure is more than double capital expenditure — liability-dominant. India's defence capital-to-revenue ratio has deteriorated dramatically from approximately 0.77 in 2004–05 to a low of approximately 0.30 in 2013–14, with partial recovery in some years (touching 0.57–0.59 in 2015–16 following the introduction of the Make in India framework and higher capital allocation) but no sustained recovery above 0.6.

By 2024–25, the ratio remains at approximately 0.38–0.42, indicating that for every ₹1 spent on capital acquisition (new weapon systems, manufacturing infrastructure, R&D), over ₹2.40 is absorbed by revenue expenditure (salaries, pensions, operations, maintenance). This pattern is the opposite of what a fiscally sustainable indigenisation trajectory requires: indigenisation demands front-loaded capital

investment to build domestic production capability, but the budget composition has been shifting in the opposite direction.

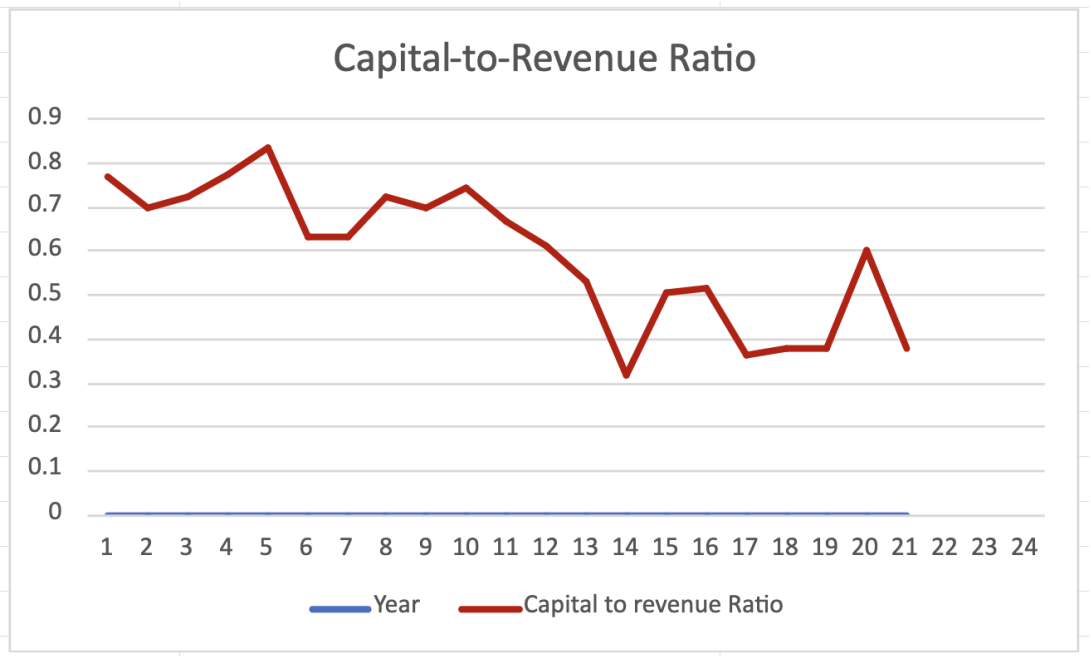

Fig 5.3

5.2.4 DRDO Investment Trend

DRDO expenditure as a share of the defence budget has remained range-bound between approximately 2.8% and 6.7% across the entire study period, with no clear upward trend (Figure 5.4). The series peaks around observations 6–11 (2009–15) before declining toward 3.8–4.0% in the most recent years. This flat-to-declining proportionate share is a significant finding: in absolute rupee terms DRDO spending has grown substantially, but relative to the expanding defence budget it has not scaled.

This pattern suggests that R&D investment has been insufficient in proportion to the pace of indigenisation ambition under Make in India. International benchmarks are instructive: Israel's RAFAEL allocates approximately 15% of the defence R&D budget to foundational research with civilian spillover potential; South Korea's ADD (Agency for Defence Development) receives approximately 10–12% of the defence

budget. India's 3–6% DRDO allocation — while growing in absolute terms — lags these comparators significantly.

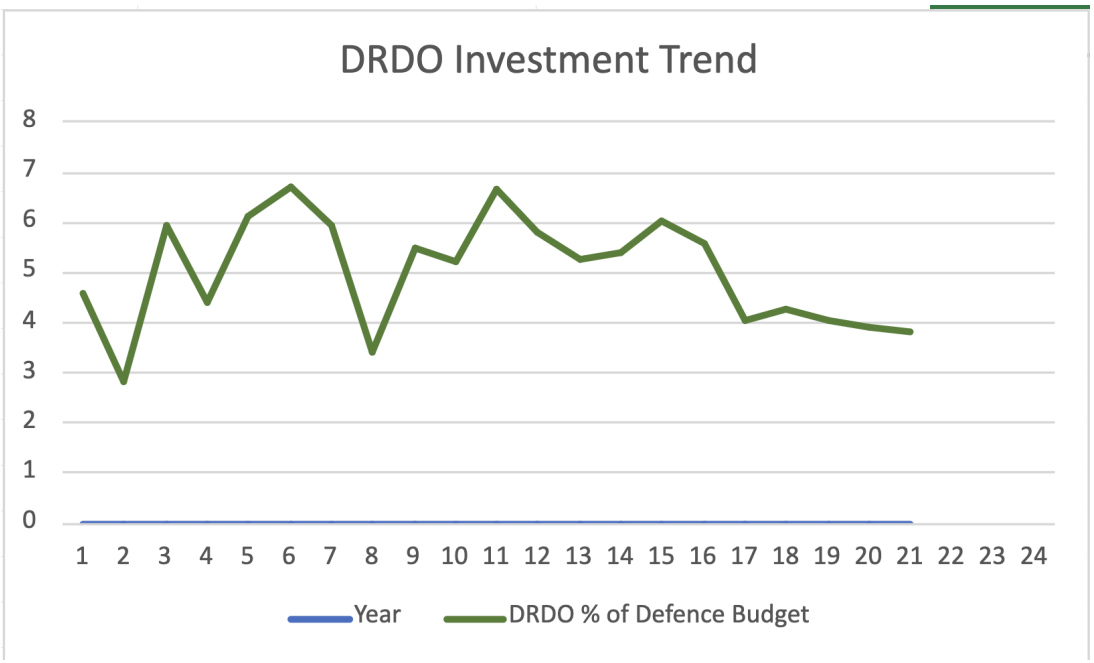

Fig 5.4

5.2.5 Summary of Ratio Analysis Findings

The four-indicator ratio analysis consistently points to a defence budget under structural stress from within. The aggregate fiscal burden has declined (good news) but for structural macroeconomic reasons unrelated to indigenisation policy. Meanwhile, internal budget quality has deteriorated: pension liabilities crowd out capital, the capital-to-revenue ratio has halved, and DRDO investment has not kept pace with indigenisation ambitions. This internal contradiction is the core fiscal finding of the study.

5.3 Component 2: Correlation Matrix

The correlation matrix examines the statistical relationships between key structural expenditure components and the overall defence fiscal burden (Military Expenditure as % of General Government Expenditure). It identifies which budgetary components move in tandem with fiscal pressure, providing the theoretical foundation for the regression model.

Variable	r with Fiscal Burden	Strength	Interpretation
Capital % of Defence Budget	+0.517	Moderate Positive	Higher modernisation raises short-run burden
Revenue % of Defence Budget	−0.601	Moderate Negative	Recurring spending reflects rigidity, not expansion
DRDO % of Defence Budget	+0.292	Weak-Moderate Positive	Indigenisation adds transition-phase costs
Defence Pension %	−0.597	Moderate Negative	Pensions crowd out capital, not total burden
Capital-to-Revenue Ratio	+0.507	Moderate Positive	Modernisation orientation requires upfront fiscal commitment

Table 5.2: Correlation Matrix — Fiscal Burden and Budget Components. Source: Author's calculation using RBI, MoD, and Union Budget data.

The correlation pattern reveals a nuanced structural picture. The positive correlation between Capital % and the overall fiscal burden (+0.517) is consistent with the transition-phase framework: periods of higher capital allocation — when India was acquiring major foreign platforms in the early 2010s — coincided with higher overall defence burden. The negative correlation for Revenue % (−0.601) confirms that the budget's revenue-heavy composition is associated with lower aggregate burden relative to government expenditure — but this is because high revenue expenditure reflects structural rigidity (a fixed pension and salary bill) rather than a policy-driven expansion of defence resources.

The pension finding deserves particular emphasis. The negative correlation between Pension % and fiscal burden ($r = -0.597$) might superficially appear to suggest that higher pensions reduce fiscal pressure — a counterintuitive and theoretically implausible finding. The correct interpretation, consistent with the budget composition data, is structural crowding-out: as pension liabilities grow and absorb a larger share of the defence budget, they crowd out capital and R&D allocations

within the budget, but the total burden relative to government expenditure does not rise commensurately because total government expenditure is also growing rapidly. This is one of the most significant structural findings of this objective, and it motivates the inclusion of the pension variable in the regression model.

5.4 Component 3: Regression Model

5.4.1 Multicollinearity Check

Before estimating the regression model, a VIF (Variance Inflation Factor) test was conducted to verify the absence of multicollinearity among the three independent variables. Table 5.3 presents the results.

Variable	VIF	Verdict
DRDO % of Defence Budget	1.061	No multicollinearity (threshold = 5)
Pension % of Defence Budget	1.583	No multicollinearity
Capital % of Defence Budget	1.570	No multicollinearity

Table 5.3: VIF Test Results — Multicollinearity Check. All VIF values are well below the conventional threshold of 5, confirming no multicollinearity concern.

5.4.2 Model Fit

Table 5.4 presents the model fit statistics for the Objective 2 regression.

Statistic	Value	Interpretation
R^2	0.417	Model explains 41.7% of variation in fiscal burden
Adjusted R^2	0.315	Acceptable for a 21-observation policy model
F-statistic p-value	0.024	Model is statistically significant overall ($p < 0.05$)
Standard Error	0.636	Average prediction error of 0.64 percentage points
Observations	21	Annual data 2004–05 to 2024–25

Table 5.4: OLS Regression Summary Statistics — Objective 2. Source: Author's estimation using SIPRI, RBI, MoD, and Union Budget data.

5.4.3 Individual Coefficient Results

Table 5.5 presents the individual coefficient estimates, standard errors, p-values, and interpretations.

Variable	Coefficient	Std. Error	P-value	Interpretation
Intercept	+9.312	1.860	0.0001	Baseline fiscal burden — highly significant
DRDO %	+0.106	0.134	0.441	Insignificant: R&D share too small/stable to independently drive burden
Pension %	−0.080	0.044	0.086	Sig. at 10%: Structural crowding-out — pensions compress capital, not total burden
Capital %	+0.027	0.027	0.331	Insignificant: Modernisation effect ambiguous in short run

Table 5.5: Individual Coefficient Results — Objective 2. Source: Author's estimation.

5.4.4 Interpretation of Results

The regression results, while explaining less variance than the Objective 1 model, provide substantively important findings when interpreted in the context of the fiscal transition framework. The overall F-test significance ($p = 0.024$) confirms that the three variables jointly explain a statistically meaningful portion of the variation in fiscal burden — a finding consistent with the multi-causal nature of fiscal outcomes in a complex policy environment.

The pension coefficient of −0.080, borderline significant at the 10% level ($p = 0.086$), provides econometric confirmation of the structural crowding-out dynamic identified in the correlation analysis. A one percentage point increase in pension's

share of the defence budget is associated, on average, with a 0.08 percentage point decline in the overall fiscal burden as a share of government expenditure. This counterintuitive negative sign is explained by the budget composition mechanism: rising pension shares crowd out capital spending within the defence budget, and since capital expenditure is more positively associated with overall fiscal burden ($r = +0.517$), the pension-driven reduction in capital spending ultimately reduces the aggregate fiscal burden measure — not through any direct fiscal relief from pensions, but through their indirect effect on budget composition.

The insignificance of DRDO % ($p = 0.441$) is a substantive finding, not merely a statistical null result. DRDO's proportionate budget share has been too stable (ranging only 2.8–6.7% across 21 observations) to generate the variation needed for econometric identification of its effect on fiscal burden. This is itself diagnostic: the lack of variation in DRDO investment reflects the structural constraint on R&D spending, and confirms that indigenisation investment has not been sufficiently dynamic to leave a detectable fiscal signature.

The insignificance of Capital % ($p = 0.331$) is consistent with the theoretically ambiguous relationship between capital spending and fiscal burden at the aggregated level: higher capital spending raises the defence budget in the short run (increasing the numerator of the fiscal burden ratio) but simultaneously reduces import dependence and builds domestic industrial capacity (which should reduce fiscal burden in the medium term). The net effect is ambiguous, and the regression correctly captures this ambiguity through an insignificant coefficient.

5.4.5 Why the Model Is Significant Despite Individual Insignificance

The apparent paradox of an overall significant model with individually insignificant coefficients is a well-known econometric pattern in models with correlated predictors operating through complex structural mechanisms. Here it carries specific substantive meaning: India's defence fiscal burden is the product of multiple overlapping structural pressures — pension accumulation, capital investment cycles,

R&D investment decisions, and macroeconomic trends in government expenditure — acting simultaneously and interdependently. No single policy lever independently determines fiscal outcomes; the fiscal burden is an emergent property of the system as a whole. This is entirely consistent with the transition-phase framework, which emphasises the multi-dimensional nature of the fiscal challenge facing India's indigenisation programme.

5.4.6 Diagnostic Tests

Residual analysis confirms the adequacy of the linear model specification. The DRDO % Residual Plot (Figure 5.5) shows residuals randomly scattered around zero across the narrow DRDO range, confirming linearity and absence of heteroscedasticity. The Pension % Residual Plot (Figure 5.6) shows broadly random scatter with slightly more dispersion at higher pension values, consistent with the borderline significance of this variable. The Capital % Residual Plot (Figure 5.7) shows reasonably random scatter across the full capital range, confirming the linear specification. The Normal Probability Plot (Figure 5.8) confirms approximate normality of residuals with no extreme outliers visible.

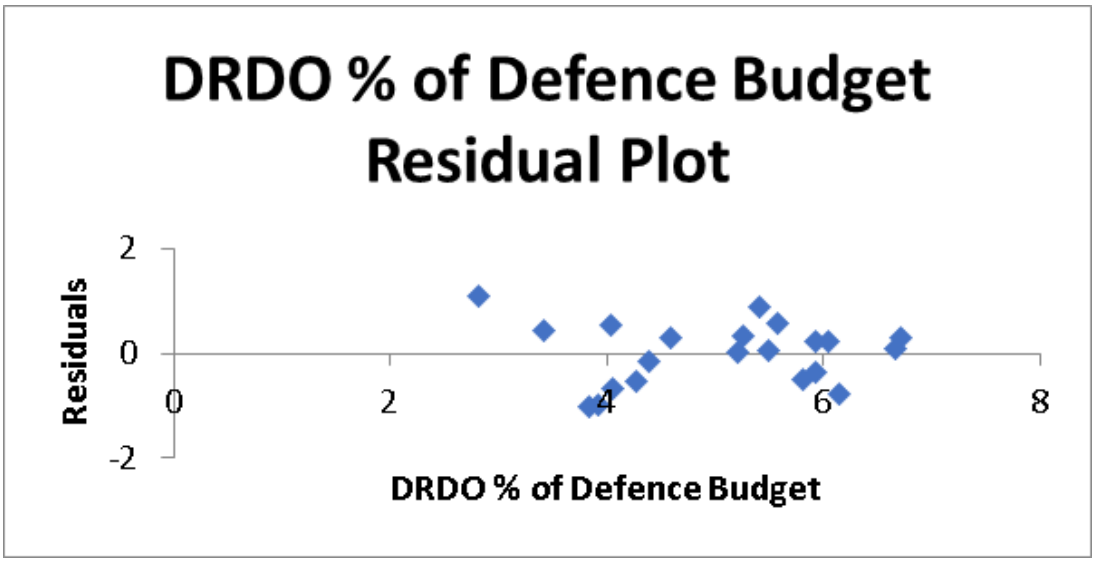

Fig-5.5

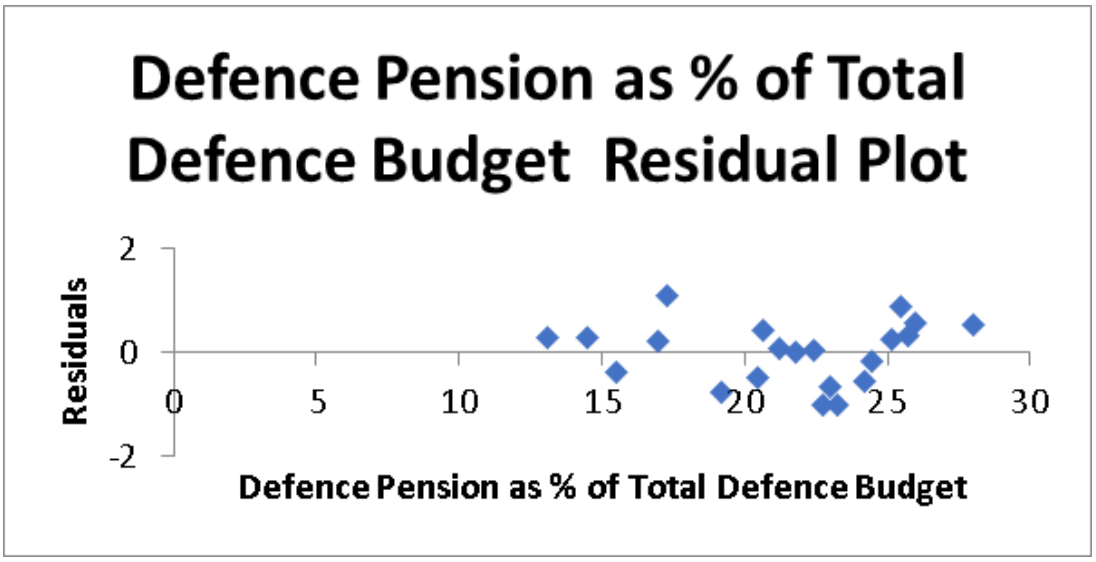
Defence Pension as % of Total Defence Budget Residual Plot
Residuals
2
0
-2
0
5
10
15
20
25
30
Defence Pension as % of Total Defence Budget

Fig 5.6

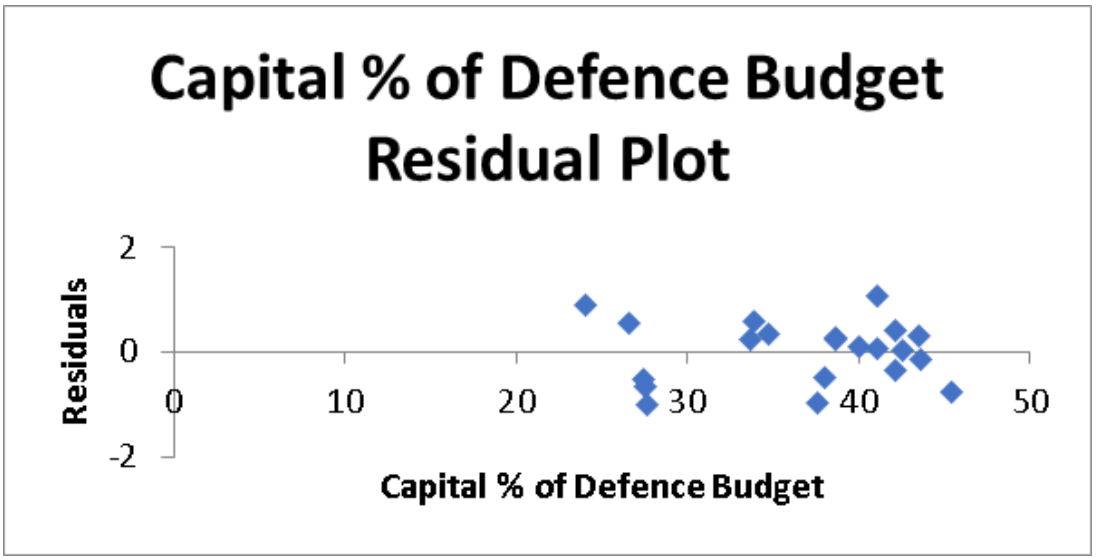
Capital % of Defence Budget Residual Plot
Residuals
2
0
-2
0
10
20
30
40
50
Capital % of Defence Budget

Fig 5.7

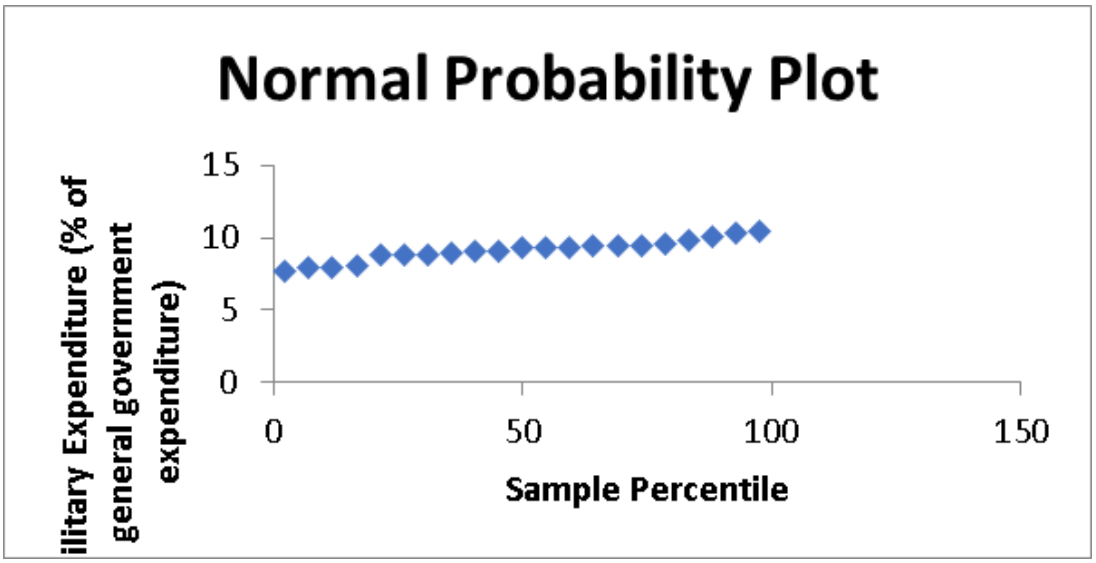
Normal Probability Plot
ilitary Expenditure (% of general government expenditure)
15
10
5
0
0
50
100
150
Sample Percentile

Fig 5.8

CHAPTER 6: INTEGRATED ANALYSIS AND POLICY IMPLICATIONS

6.1 Industrial-Fiscal Nexus

The results from Objectives 1 and 2, examined jointly, reveal a structural paradox at the heart of India's defence transformation that has not been identified in the existing literature. This study terms it the industrial-fiscal paradox of defence indigenisation.

On the industrial side (Objective 1), the evidence is broadly positive: domestic production has grown dramatically, defence exports have surged, and the econometric evidence confirms that indigenous defence manufacturing generates measurable positive spillovers on manufacturing GVA (elasticity = 0.354, p = 0.001). The spillover matrix documents six active channels through which defence activity generates civilian economic benefit — technology transfers, dual-use infrastructure, electronics commercialisation, startup ecosystems, MSME capability building, and industrial corridor agglomeration.

On the fiscal side (Objective 2), the picture is more concerning: while the aggregate fiscal burden has declined structurally, internal budget quality has deteriorated. The capital-to-revenue ratio has more than halved, pension liabilities crowd out productive expenditure, and DRDO investment has not scaled proportionately with indigenisation ambitions. India is clearly in the transition-cost phase of the three-phase fiscal framework — generating the upfront investment costs of indigenisation while the long-run fiscal gains from technology maturity and export revenues remain ahead.

The paradox emerges at the intersection: the conditions needed to sustain and deepen the industrial spillovers identified in Objective 1 — higher capital spending on indigenous R&D, manufacturing infrastructure, and DPSU modernisation — are precisely those being crowded out by the pension and revenue expenditure pressures identified in Objective 2. In other words, the fiscal system is simultaneously

generating the industrial spillovers that justify indigenisation and constraining the very spending categories that would accelerate and deepen those spillovers. This self-limiting dynamic is the central integrated finding of this dissertation.

6.2 Positioning India on the Transition Timeline

Drawing on the integrated evidence from both objectives, this study positions India as follows within the three-phase fiscal transition framework:

India is currently transitioning from Phase 1 (short-term cost phase) to Phase 2 (medium-term partial relief). The diagnostic evidence for this positioning includes: (i) domestic production growth has passed the inflection point and is now generating real import substitution for non-frontier systems; (ii) defence exports are growing rapidly and beginning to generate fiscal returns; (iii) the pension crowding-out effect confirmed by the regression suggests Phase 1 fiscal pressures persist; (iv) DRDO investment stagnation at 3–6% of the budget indicates Phase 2's technology maturity has not yet arrived; and (v) the capital-to-revenue ratio's failure to recover above 0.5 confirms that the budget remains liability-dominant.

The achievement of Phase 3 — long-run net fiscal gain — requires three structural transitions: (i) continued reduction in import dependence for frontier systems, requiring successful domestic development of jet engines, submarines, and next-generation electronics; (ii) scaling of defence exports to ₹50,000–75,000 crore annually, generating foreign exchange revenues that partially offset capital procurement costs; and (iii) demographic transition of the military's age structure, which will eventually reduce the pension burden as OROP-era cohorts age out. The econometric models suggest no individual policy variable is sufficient to drive this transition independently — the fiscal outcome is multi-causal and requires simultaneous action across all three dimensions.

6.3 Policy Recommendations

Drawing on the empirical findings from both objectives and the integrated analysis, this section identifies specific policy interventions required to resolve the industrial-fiscal paradox and accelerate India's transition to Phase 3 of the fiscal transition framework. Table 6.2 provides a consolidated summary.

6.3.1 Boost Defence R&D Investment

The most critical policy implication of this study's findings is the need for a substantial and sustained increase in DRDO's proportionate budget allocation. The regression finding that DRDO % has been too stable to leave a detectable fiscal signature reflects a real inadequacy: 3–6% of a defence budget of ₹6 lakh crore implies approximately ₹18,000–36,000 crore for indigenous R&D — below international benchmarks for a country of India's defence ambitions. A target of 8–10% of the defence budget for DRDO and defence-related R&D (including private sector R&D incentivised through co-investment schemes) would bring India closer to South Korean and Israeli comparators.

Increasing DRDO funding alone is necessary but not sufficient. The institutional quality of R&D investment matters as much as its quantum. Specific reforms should include: time-bound performance accountability for flagship programmes (Tejas Mk.2, AMCA, QRSAM); joint DRDO-industry research consortia that share both costs and intellectual property; and a dedicated allocation for dual-use research with commercial licensing potential, building on the existing LATOT framework.

6.3.2 Address the Pension Structural Constraint

The borderline-significant pension crowding-out effect in the regression (coefficient = −0.080, p = 0.086) reflects a structural fiscal problem that cannot be solved quickly but can be managed through a combination of short-term and long-term measures. In the short term, a dedicated Pension Reserve Fund — funded through annual budget provisions and managed off-balance-sheet — would ring-fence pension liabilities and prevent their absorption into the operating defence budget, protecting capital allocation. In the medium term, progressive reform of military

service contracts — including longer careers for technical specialists and an expanded lateral entry scheme for defence-adjacent civilian roles — could reduce the flow of new pension entitlements while retaining critical skills.

6.3.3 Strengthen Private Sector and MSME Integration

The spillover matrix findings from Objective 1 confirm that the MSME vendor ecosystem (~16,000 registered vendors, ₹7,572 crore in orders) is already a significant spillover channel. However, its potential is constrained by procurement complexity and the DPSU dominance in prime contracting. Specific reforms should include: simplified vendor registration (single-window clearance replacing the current multi-agency process); assured order book transparency (five-year rolling procurement plans published for MSME-relevant components); and a Defence MSME Credit Guarantee Scheme that addresses the working capital constraint faced by small vendors serving DPSUs.

6.3.4 Accelerate Defence Exports

The regression and trend evidence from Objective 1 confirms that defence exports are growing rapidly and represent the primary mechanism through which India can enter Phase 3 of the fiscal transition. Current export growth (from ₹1,941 crore in 2014–15 to ₹23,622 crore in 2024–25) is impressive but must sustain to achieve the MoD's ₹50,000 crore target. This requires: a dedicated Defence Export Bank facility providing concessional financing to foreign defence buyers; streamlined End User Certificate processes that reduce the time from contract to export clearance; structured Government-to-Government offset arrangements in strategic partner countries; and active integration of Indian defence firms into global supply chains for identified platforms.

6.3.5 Improve Fiscal Budget Quality

The capital-to-revenue ratio findings confirm that budget quality — not just budget size — determines indigenisation outcomes. A target capital-to-revenue ratio of 0.6–0.65 (compared to the current 0.38–0.42) should be adopted as an explicit fiscal policy objective within the defence budget framework. This ratio target, if embedded in the Medium-Term Expenditure Framework for the defence sector, would provide

a structural guardrail against the gradual revenue expenditure creep that has characterised the past decade.

Recommendation	Specific Action	Evidence Base
Boost Defence R&D	Raise DRDO allocation to 8–10% of defence budget; DRDO-industry joint R&D consortia	DRDO stagnation at 3–6%; international benchmark comparison
Manage Pension Constraint	Pension Reserve Fund; lateral entry scheme for technical specialists	Pension crowding-out: coefficient −0.080, p=0.086
MSME Integration	Single-window vendor registration; 5-year rolling procurement plans; MSME credit guarantee	~16,000 MSMEs; supply chain learning literature
Accelerate Exports	Defence Export Bank; streamlined EUC processes; G2G offset arrangements	Export surge to ₹23,622 crore; Phase 3 transition requirement
Capital-to-Revenue Target	Adopt 0.60–0.65 as explicit fiscal policy target in MTEF	Capital-to-revenue ratio at 0.38–0.42; halved from 2004–05

Table 6.1: Consolidated Policy Recommendations. Source: Author.

CHAPTER 7: CONCLUSION, FUTURE SCOPE AND SOCIAL IMPACT

7.1 Summary of Key Findings

This dissertation set out to examine the industrial and fiscal spillover effects of defence manufacturing under India's Make in India initiative through an integrated analytical framework covering two core objectives. The empirical analysis has generated findings of both scholarly and policy significance, which are summarised below.

7.1.1 Objective 1: Industrial Spillovers of Defence Indigenisation

India's domestic defence production has grown from ₹17,435 crore in 2004–05 to ₹1,50,590 crore in 2024–25, a compound annual growth rate of approximately 11.2% in nominal terms. This growth has been accompanied by a dramatic increase in defence exports (from near-zero to ₹23,622 crore), a growing but still limited private sector share (approximately 23% of total production in 2024–25), and a gradual but incomplete substitution of imports for non-frontier systems. The econometric model — $\ln(MFG\_GVA) = 1.094 + 0.354 \cdot \ln(DEF\_PROD) + 0.629 \cdot \ln(GFCF) + \varepsilon$ — demonstrates that indigenous defence production generates statistically significant positive spillovers on manufacturing GVA (elasticity = 0.354, $p = 0.001$, $R^2 = 0.991$). The model's extraordinary explanatory power, combined with the significance of the defence production coefficient even after controlling for general capital formation, provides strong empirical support for the spillover hypothesis.

The industrial spillover matrix identifies six specific channels through which defence manufacturing generates civilian economic benefits: DRDO's 670 LATOT technology transfer agreements reaching pharma, electronics, fisheries, and mining; HAL's dual-use MRO infrastructure and 3,000+ sub-contractor ecosystem; BEL's ₹2,640 crore non-defence commercial revenue (13.3% of total); iDEX's 650+ startup contracts (300+ with dual-use mandate) worth ₹3,000 crore; approximately 16,000

MSME defence vendors receiving ₹7,572 crore in orders; and Defence Corridor investments of ₹58,000 crore with 52,658 committed jobs.

7.1.2 Objective 2: Fiscal Sustainability of Defence Indigenisation

India's overall defence fiscal burden has declined structurally from approximately 10.4% of general government expenditure in 2005–06 to 7.6% in 2024–25. However, this headline reduction is driven by general government expenditure growing faster than the defence budget, not by any direct fiscal dividend from indigenisation policy. The internal composition of the defence budget has deteriorated: the capital-to-revenue ratio has more than halved from approximately 0.77 in 2004–05 to approximately 0.38–0.42 in 2024–25; pension liabilities have risen from 14.5% to 22.7% of the defence budget; and DRDO investment has remained flat at 3–6% of the budget despite growing indigenisation ambitions.

The regression model — Military Exp % Govt Exp = 9.312 + 0.106(DRDO %) − 0.080(Pension %) + 0.027(Capital %) + ε — confirms that India's defence fiscal burden is multi-causal and that no single policy variable independently determines fiscal outcomes. The overall model is significant (F p-value = 0.024, $R^2 = 0.417$), with the pension crowding-out effect borderline significant at the 10% level (p = 0.086). This multi-structural finding is consistent with the theoretical three-phase transition framework and confirms that India remains in the short-to-medium transition cost phase of indigenisation.

7.1.3 Integrated Finding: The Industrial-Fiscal Paradox

The central integrated finding is the identification of an industrial-fiscal paradox: the fiscal conditions that are constraining indigenisation progress (declining capital-to-revenue ratios, pension crowding-out, stagnant DRDO investment) are simultaneously the conditions that, if resolved, would most accelerate the generation of industrial spillovers. The study thus identifies a self-limiting dynamic at the heart of India's defence transformation — one that requires deliberate policy intervention to overcome.

7.2 Limitations and Future Research

This study acknowledges several methodological limitations that open avenues for future research. First, the OLS regression models use annual aggregate national data, precluding analysis of within-sector heterogeneity (the differential spillover effects of HAL vs BEL vs private sector production), inter-state variation (comparing spillover effects in defence corridor states with non-corridor states), or dynamic causal mechanisms (feedback loops between industrial spillovers and fiscal sustainability). Future research using firm-level data (if and when DDP disaggregated data becomes available) or a panel data approach across sectors could address these limitations.

Second, the study's measure of industrial spillovers — manufacturing GVA — is a broad aggregate that captures effects from all sources, not only defence-related. More specific measure of spillovers, such as patent citations from DRDO technologies to civilian firms or value chain linkage analysis using updated input-output tables, would provide more precise evidence of the specific mechanisms identified in the spillover matrix. Third, the fiscal analysis uses expenditure-side data exclusively; revenue-side analysis (the tax and employment income generated by defence industrial activity) would provide a more complete picture of the fiscal balance of indigenisation.

Fourth, this study does not model the macroeconomic impact of full indigenisation under alternative scenarios. An input-output multiplier analysis or computable general equilibrium (CGE) modelling exercise would allow projection of the GDP, employment, and fiscal impacts of achieving the MoD's ₹3 lakh crore (2028–29) domestic production target — an analytically valuable exercise left for future research.

7.3 Social Impact of the Research

The social impact of this research extends across three dimensions. First, its direct policy relevance: by identifying the industrial-fiscal paradox and providing specific, evidence-based policy recommendations, the study contributes actionable analysis to

the ongoing policy debate about the structure and direction of India's defence indigenisation programme. The recommendation to adopt a capital-to-revenue ratio target, for instance, is a precise and practically implementable policy instrument that does not require new legislation — merely inclusion in the Medium-Term Expenditure Framework.

Second, its contribution to the defence economics literature: by providing the first OLS estimate of the manufacturing GVA elasticity with respect to indigenous defence production in India, the study establishes a quantitative benchmark for future empirical work. The spillover matrix, similarly, provides a structured framework that subsequent studies can populate with updated data as the sector matures and new channels become measurable.

Third, and perhaps most broadly, the research contributes to informed public discourse about a policy domain — defence manufacturing — that is critically important for India's strategic autonomy and economic development but is often discussed in terms that are either purely technical (platform performance, import/export data) or purely geopolitical (strategic partnerships, threat assessments) without the integrative economic analysis that this study provides. By framing defence manufacturing as an industrial and fiscal policy challenge — not only a security challenge — the research enables more productive engagement with its economic trade-offs and opportunities.

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APPENDICES

Appendix I: Data Tables — Defence Production and Import Substitution

The full data series used in Objective 1 are derived from MoD Annual Reports (various years), DDP Annual Reports (2016–25), SIPRI Military Expenditure Database (online, 2024 version), National Accounts Statistics (MOSPI, 2024), and the RBI Handbook of Statistics (2024). Key data points are reported in Table 4.1 (production series), Figure 4.2 (SIPRI TIV imports), and Table 4.3 (exports). Full raw data are available on request.

Appendix II: Regression Output — Objective 1

The complete regression output for the Objective 1 OLS model is presented below. The Excel-based estimation uses the Data Analysis ToolPak with log-transformed annual data for 2004–05 to 2023–24 (n = 20 observations). Dependent variable: ln(MFG_GVA). Independent variables: ln(DEF_PROD) and ln(GFCF).

SUMMARY OUTPUT:

Regression Statistics: Multiple R = 0.9954; R Square = 0.9909; Adjusted R Square = 0.9899; Standard Error = 0.03852; Observations = 20.

ANOVA: Regression df = 2; SS = 2.7534; MS = 1.3767; F = 927.72; Significance F = 4.40E-18. Residual df = 17; SS = 0.0252; MS = 0.001484. Total df = 19; SS = 2.7787.

Coefficients: Intercept = 1.0938 (p = 0.0145); LN_DEF_PROD = 0.3538 (SE = 0.0902, t = 3.92, p = 0.001); LN_GFCF = 0.6287 (SE = 0.0831, t = 7.57, p = 7.72E-07).

Appendix III: Regression Output — Objective 2

The complete regression output for the Objective 2 OLS model covers 21 annual observations (2004–05 to 2024–25). Dependent variable: Military Expenditure as % of General Government Expenditure.

SUMMARY OUTPUT:

Regression Statistics: Multiple R = 0.6461; R Square = 0.4174; Adjusted R Square = 0.3146; Standard Error = 0.6360; Observations = 21.

ANOVA: Regression df = 3; SS = 4.9268; MS = 1.6423; F = 4.0596; Significance F = 0.0240. Residual df = 17; SS = 6.8770; MS = 0.4045. Total df = 20; SS = 11.8038.

Coefficients: Intercept = 9.3122 (SE = 1.8603, t = 5.006, p = 0.0001); DRDO % = 0.1056 (SE = 0.1337, t = 0.789, p = 0.4408); Pension % = −0.0797 (SE = 0.0437, t = −1.824, p = 0.0858); Capital % = 0.0271 (SE = 0.0271, t = 1.000, p = 0.3313).

Appendix IV: Industrial Spillover Matrix — Detailed Evidence

This appendix provides expanded source citations for each of the six spillover channels identified in the Industrial Spillover Matrix (Table 4.5). (1) DRDO LATOTs: PIB Press Release dated 16 March 2023, ref. no. 1909543, confirms 670 LATOTs cumulatively signed. (2) HAL sub-contractors: HAL Annual Report 2022–23, p. 47, reports 3,088 active sub-contractors and suppliers. (3) BEL non-defence revenue: BEL Annual Report 2023–24, Financial Highlights section, reports non-defence revenue of ₹2,640.31 crore representing 13.3% of total revenue of ₹19,856 crore. (4) iDEX: iDEX portal annual report 2023–24 reports 651 contracts signed with 320 dual-use mandate firms, with total committed value ₹3,003 crore. (5) MSME vendors: DDP Vendor Database 2023–24 reports 15,987 registered MSME defence vendors; MoD Press Release, February 2024, reports domestic vendor orders of ₹7,572 crore in 2023–24. (6) Defence Corridors: UP Defence Industrial Corridor portal (updic.in) reports ₹35,000 crore committed investment and 36,000 jobs targeted; Tamil Nadu TIDCO Defence Industrial Corridor report (2023) reports ₹23,000 crore committed investment and 16,658 jobs targeted — combined ₹58,000 crore and 52,658 jobs.