Risk Sharing in Defence R&D Projects for Public Private Partnership (Make & Strategic Partnership)

A dissertation submitted to the Indian Institute of Public Administration (IIPA), New Delhi for the degree of Master's Diploma in Public Administration (MDPA) in partial fulfillment of the requirement for the 44th Advanced Professional Programme in Public Administration (APPPA)

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CERTIFICATE

I have the pleasure to certify that Brigadier Rajiv Kumar, VSM has pursued his research work and prepared the present dissertation titled "**Risk Sharing in Defence R&D Projects for Public Private Partnership (Make & Strategic Partnership)**" under my guidance and supervision. The dissertation is the result of his own research and to the best of my knowledge, no part of it has earlier comprised any other monograph, dissertation or book. This is being submitted to the Panjab University for the degree of Master of Philosophy in Social Sciences in partial fulfillment of the requirement for the Advanced Professional Programme in Public Administration of Indian Institute of Public Administration (IIPA), New Delhi.

I recommend that the dissertation of Brigadier Rajiv Kumar, VSM is worthy for the consideration for the award of M. Phil degree by Panjab University, Chandigarh.

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Brigadier Rajiv Kumar, VSM

Executive Summary

Introduction

1. From the ancient times nations have been striving hard to preserve their geographical domains by optimal use of force – either as deterrence or as means to conquer the belligerent forces. World over, the experience and learnings of both the great wars have corroborated the need of a superior technology and self-reliance to maintain the power balance. However, easier said than done, such a vision has mandated the nations to dedicate enormous resources - in terms of funds and time, and appetite to digest the failures.

2. India too was quick and Pt Jawahar Lal Nehru, the first Prime Minister, realising the need of improved technology established the Defence Research and Development Organisation (DRDO) in 1958. The DRDO was formed from the amalgamation of the then already functioning Technical Development Establishment (TDEs) of the Indian Army and the Directorate of Technical Development & Production (DTDP) with the Defence Science Organisation (DSO). The DRDO was entrusted with research and Development (R&D) for defence forces for the advanced technologies and the the defence manufacturing was the sole preserve of Defence Public Sector Units (DPSUs) under the Ministry of Defence, Govt of India.

3. DRDO started its first major project in Surface-to-Air Missiles (SAM) known as Project Indigo in 1960s. Indigo was discontinued in later years without achieving full success. Project Indigo led to Project Devil, along with Project Valiant, to develop short-range SAM and ICBM in the 1970s. Project Devil itself led to the later development of the Prithvi missile under the Integrated Guided Missile Development Programme (IGMDP) in the 1980s. IGMDP was an Indian Ministry of Defence programme between the early 1980s and 2007 for the development of a comprehensive range of missiles, including the Agni missile, Prithvi ballistic missile, Akash missile, Trishul missile and Nag Missile. DRDO also achieved successes in developing other

major systems and critical technologies such as aircraft avionics, UAVs, small arms, artillery systems, EW Systems, tanks and armored vehicles, sonar systems, command and control systems and missile systems. However, even after more than 34 years, the DRDO has not been comprehensively successful at all fronts. According to the CAG reports 70% of the products produced by DRDO have been rejected by the armed forces and some have been delayed for decades viz. Arjun-Main Battle Tank, LCA-Tejas, Nag-Anti tank missile, Kaveri engine, Trishul-Anti aircraft missile (abandoned) (Manekshaws, 2014).

4. While India is at 3rd position in GDP (PPP) and 7th in GDP (nominal) ranking, it a continues to remain the world's largest arms importer, accounting for 14% of the global imports in the 2012-2016 timeframe (Pandit, 2016), in yet another indicator of the country's enduring failure to build a strong domestic defence-industrial base (DIB). Each time a weapon system is imported, the costs are astronomical and we get trapped into expensive service contracts, ammunition purchase, potential possible arms embargos etc. The modern geopolitical scenario, economic situation and the requirement of armed forces demand a relook at the functional aspects of developing the defence related technology in house to be self-reliant, especially should there be a situation like Pokharan Tests (1998) and embargoes imposed.

Justification

5. The 90s witnessed liberalisation of the Indian market, ushering modern technology, best management practices in the corporate world and relatively easy access to high end Automated Industrial technology. Notwithstanding, this corporate success, the defence R&D made little progress due to lack of focus on part of DRDO and inadequate participation by the private players mainly due to unfriendly policies of the government. The policies appeared to provide more advantage to the foreign OEMs and hence the Indian Industry could not participate wholesomely. In spite of the revision of DPP-2013 and formulation of supposedly more industry friendly DPP-2016, it is observed that the corporate sector has been maintaining a wait and watch policy or at times very cautiously indulging themselves in joint exercises of PPP and rarely in R&D. It is this

indifference towards Defence R&D which must invite attention and a detailed study must be performed to obliterate the impediments. A developed R&D base would be mandatory to provide a strong foundation in direction of self-reliance and modernisation.

Aim

6. To study the Risks associated with indigenous R&D activity in PPP model and ascertain ways of Risk Management.

Scope

7. The study will encompass reviewing of the basic tenets of PPP model, existing government provisions of defence collaboration between the government and the industry. While analysing the impact of various government driven initiatives to solicit proactive industrial participation, the study will attempt to analyse the premise of apprehensions of the corporate partners and ascertain the right approach required by the Govt towards risk-sharing inherent to R&D and streamline the processes

Hypothesis

9. **Null Hypothesis (Ho).** A robust Risk Sharing mechanism in defence Research and Development Projects will not substantially enhance Public-Private Partnership in this sector.

10. **Alternate Hypotheses (H1).** A robust Risk Sharing mechanism in defence Research and Development projects will substantially enhance Public-Private Partnership in this sector.

5.1 11. **Constructs**. The Hypothesis was aimed to be validated w.r.t following constructs:-

(a) Funding (R&D requires large funds)

(b) License permissions.

(c) Testing and Trials Facilities – type testing issues.

(d) Intellectual Property Rights

(e) Technology Obsolescence due to long lead times.

(g) Technology for dual use.

(h) Order quantity – confirmed Minimum order quantity and limited repeat orders

(j) Exit Policy

Recommendations

12. A few of the critical recommendations are enumerated below:-

(a) **Dedicated Acquisition Organization**. Similar to various PPP models discussed in Chapter 3, there is a need to have a dedicated **Acquisition Organisation at MoD, but independent of MoD (Ref Program Management Structure for Defence Acquisitions)** with integral experts / specialists onboard, reporting directly to the Defence Minister. A wing of this organisation would take the requirements from the MoD and in consultation with the users (service headquarters) work in close coordination with the industry and supervise the R&D activities. The Acquisition organisation must also serve ***as the easy to access, single point contact*** for addressing all issues like Industrial license, tax-incentives, import/export clearances, offsets, sales etc.

(b) A fifteen year perspective financial model with pragmatic financial allocation for threat based capability development including R&D, thereby assuring industry of the project wise cash flows (putting money where the mouth is).

(c) A clear guidelines for selection of SP (a robust mechanism for selection without fear or favours) and allowing SP to take ownership of the vertical for short, mid and long term.

(b) A clear policy and procedure for sharing of R&D infrastructure facilities / labs under DRDO administration.

(c) Formulation of JVs / PPP agreements between PSUs and academia/start-ups/ potential technical bodies for research and co-development

(d) Ensure ease of access by the private sectors to the Directorate of Defence Production and other concerned officials to facilitate interaction and coordination.

(e) Provide greater visibility to and understanding of DPP, TPCR, DPM etc by means of regular public seminars / interactions with the industry.

(f) Streamline processes and procedures for easy and quick funding, access to working capital, provision for loans for R&D activities and reimbursements of investments. Establishment /activation of Defence Innovation Fund (DIF) and Technology Development Fund (TDF) for providing grants to the relevant agencies for creating facilities may be a step in this direction.

(g) Extend Income Tax incentives which are available to other core industries to industries working on defence R&D projects.

(h) Continued thrust to make projects and thus provide the much needed push to the indigenous designs and equipment.

(j) Provide level playing field to both domestic and foreign bidders – streamlining the DCF method for multi-currency bids, allowing multi-currency bids, provision for price variation clause etc.

(k) Government must make provisions to incentivize the R&D activities right at the school/university levels and harness the resident talents, nurture them and provide appropriate opportunities in the mainstream R&D.

(l) Government as owner of the R&D projects must be ready to accept failures of researches and all long haul projects not completed in a time bound manner should be shelved (like DARPA) instead of continued investment.

(m) The ratio of advance being provided by the government needs to be reviewed. It is proposed that 20-25% on selection of proof of concept and may be another 20% on commencement of the work as advance may be granted to the firm.

(n) The government needs to have a clear policy on the IPR issues and to start with can

have the strategic / security implications of the product as the guiding principle followed by the proportion of funding. Following is suggested:-

(i) In case of a strategic project, the IPR, must be resident with the Government *as 'walk-in rights*', with may be a pre-agreed ratio of the royalty being paid to the firm for any subsequent production order.

(ii) For a fully funded project, the IPR must be purely with the government.

(iii) For lesser critical / strategic projects (e.g. dual use technology), the IPR could be held jointly by the firm and the government with a binding that the product would not be shared with other nations without prior government consent. In such a case the process of approval (how and by whom) along with laid down time period for approval, must also be formalized.

(o) Establishment of a dedicated ***Wing*** at ***Indian National Defence University (INDU)*** (on lines with France) which would train all personnel prior to being transferred to / working at the acquisition of MoD periodically and specialise them vertically with contemporary processes and globally successful techniques.

Conclusion

12. The review of the results indicates that the hypothesis has been rejected and it is proved that a robust Risk Sharing between the Government and Private agencies in defence Research and Development Projects will lead to enhanced Public-Private Partnership in this sector.

13. **Areas of Future Research**. As part of restructuring, future research could be undertaken on following issues:-

(a) To study and formulate restructuring of DRDO on lines of DARPA or DGA, France.

(b) Formulating the government policy towards addressing of IPR issues in joint ventures with the private sector.

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LIST OF ABBREVIATIONS

CAG	Comptroller and Auditor General
DARPA	Defence Advanced Research Projects Agency
DCF	Discounted Cash Flow
DGA	Director Générale de l'Armement , France
DIB	Defence Industrial Base
DoD	Department of Defence
DPM	Defence Procurement Manual
DPP	Defence Procurement Procedure
DPSU	Defence Public Sector Unit
DRDO	Defence Research and Development Organisation
EW	Electronic Warfare
GDP	Gross Domestic Product
ICBM	Inter-Continental Ballistic Missile
IIT/IISc	Indian Institute of Technology / Science
LCA	Light Combat Aircraft
MoD	Ministry of Defence
MSME	Micro, Small and Medium Enterprises
OEM	Original Equipment Manufacturer
RoI	Rate of Interest
S&T	Science and Technology
SIPRI	Stockholm International Peace Research Institute
SQR	Service Qualitative Requirements
TPCR	Technology Perspective Capability Roadmap
UAV	Unmanned Aerial Vehicle

CHAPTER – 1

Introduction

"The threats may be known, but the enemy may be invisible. Full scale wars may become rare, but force will remain an instrument of deterrence and influencing behaviour while the duration of conflicts will be shorter,"

Shri Narendra Modi, Prime minister of India

Address to the combined commanders conference Oct 2014

Introduction

1.1 India is probably the only large country in the world which is overwhelmingly dependent on external sources for its defence requirements. According to *Stockholm International Peace Research Institute (*SIPRI), India is the world's largest arms importer, accounting for 14% of global arms import during 2009-13. According to SIPRI, India's arms imports remain three times greater than those of its rivals China and Pakistan. Its biggest suppliers are Russia, the US, Israel and France. India increased its share of global arms imports from 9.7% in 2007–11 to 12.8% in 2012–16 (Blanchfield, 2017). Noting that India's arms imports has jumped by 30% between 2007-2011 and 2012-2016, SIPRI reiterated the well-acknowledged fact that "a major reason for the high-level of imports is that the Indian arms industry has so far largely failed to produce competitive indigenously-designed weapons" (Pandit, 2016). This dependency on arms import is a stark reminder of how far India is from the objective of substantive self-reliance in defence production that it has aspired to since the early days of independence.

Objectives

1.2 The objectives of the research are as follows:-

(a) To study and understand the architecture of PPP.

(b) To study models being followed by developed nations such as DARPA by USA, Japan, Israel models etc. and examine the factors contributing to their success.

(c) To explore feasibility of incorporation of PPP model in Indian Defence R&D.

(d) To identify the reasons for gap between policies and implementation.

(e) To study and identify the risks associated with indigenous R&D activities.

(f) To determine the way ahead for addressing the shortfalls.

Formulation of Research Problem

1.3 The 90s witnessed liberalisation of the Indian market, ushering modern technology, best management practices in the corporate world and relatively easy access to high end Automated Industrial technology. Compared to this corporate sector success, the progress made in defence R&D by the DRDO was on a lesser scale and the participation by the private sector industries was minimal mainly due to less favourable state policies. The policies appeared to provide more advantage to the foreign OEMs and hence the Indian Industry could not participate wholesomely.

Identification of a Broad Area

1.4. However, in last decade, the government has realised that to be self-reliant in meeting the Defence requirements, involvement of Indian industry is inescapable. With latest thrust of the present Government on Make-in-India, it was imperative that cognisable measures are instituted to bring in the private industry and harness their advantages in the DIB. A most suitable way of achieving the aim recognised by the Government was a concept of Public-Private Partnership (PPP) model.

1.5. The model was already in execution and a successful in the realm of infrastructure systems. Recognising the feasibility and utility of such joint ventures, the PPP model has been extended by the government to the defence industry too. Further, the government has also issued directives and has revamped the existing modus-operandi of defence related procurements and manufacturing (MoD, Defence Procurement Procedure, 2016), to provide a level playing field to both Indian and foreign industries.

Dissecting the Broad Area into Sub Areas

1.6. The concept of **PPP** in defence sector means development of a strong Defence Industrial Base (DIB) which comprises of various fields such as *defence manufacturing, Indigenisation of equipment, Collaborations with foreign OEMs for import of various equipment, Offset management, Transfer of Technology, Maintenance and R&D of weapon technology from drawing boards to prototype*, etc. Each of these sub-areas /fields merit a detailed study and focussed approach towards comprehensive build-up of the DIB in country.

Select Sub-Area of Interest

1.7. While the long term comprehensive success of the defence manufacturing by PPP would be decided in future, it is opined that a major takeaway of such a model would be to provide **impetus to R&D**, which has been hitherto lacked the requisite attention. A developed R&D base would be mandatory to provide a strong foundation in direction of self-reliance and modernisation.

Research Questions

1.8. As brought out earlier, given the threats to India's national security and avoidable burden due to imports of defence equipment, today the DIB is a necessity for India. In spite of the revision of DPP-2013 it was observed that the corporate sector has been maintaining a wait and watch policy or at times very cautiously indulged themselves in these joint exercises of PPP and rarely in R&D. It is this indifference towards Defence R&D which must invite attention and a

detailed study must be performed to obliterate the impediments. Prima-facie the obvious causes seem to be government policy, may be inappropriate comprehension of the provisions by the private industry, methodology of risk sharing, IPRs etc. These factors if looked at individually translate into following questions:-

(a) Will there be a level playing field for both Indian and Foreign OEMs?

(b) Who will own the Intellectual Property Rights – government or the firm?

(c) Who will fund the R&D? What would be the share of government funding?

(d) What would be the model of risk sharing – technical and funds?

(e) Who will bear the risk of failure? Will the firm get its investment back?

(f) What would be the nature of R&D firm's involvement during production?

(g) Will the agency entrusted with manufacturing retain the same design or would it be modified?

(h) What would be the nature of contract design and who would execute and supervise – the services directly, the DRDO, the Department of Defence Production or the MoD?

(j) What would be feasibility for assured future orders? What are the exit provisions for a firm to quit the project enroute?

(k) If multiple firms are undertaking R&D, what happens to the second best and subsequent designs? Are the firms allowed to market it in open market? Will they be allowed to export these designs?

(l) What would be the provisions to involve foreign research bodies or OEMs for R&D?

(m) Where, when and how will the talent for R&D be recruited?

1.9. A quick review of the above questions indicate that the R&D by means of PPP itself would mandate Technical, Administrative, Financial, Legal, Human Resources and Project Management reforms.

Statement (Purpose) of Problem

1.10. *Study the basic tenets of PPP model to provide fillip to the R&D in India's vision of self-reliance of DIBs, analyse the premise of apprehensions of the private sectors and ascertain the right approach required by the Government towards risk-sharing inherent to R&D to incentivise the private sector participation.*

Hypotheses Statement

1.11. A robust Risk Sharing mechanism in defence Research and Development Projects will not substantially enhance Public-Private Partnership in this sector.

Null Hypothesis (Ho)

1.12. A robust Risk Sharing mechanism in defence Research and Development Projects will not substantially enhance Public-Private Partnership in this sector.

Alternate Hypotheses (H1)

1.13. A robust Risk Sharing mechanism in defence Research and Development Projects will substantially enhance Public-Private Partnership in this sector.

Constructs

1.14. The Hypothesis is aimed to be validated wrt following constructs:-

(a) Funding (R&D requires large funds).

(b) Industrial License permissions.

(c) Testing and Trials Facilities – type testing issues.

(d) Intellectual Property Rights

(e) Technological Knowledge.

(h) Exit Policy

Research Design

1.15. **Sample**. The research would be a quantitative research based model and would aim at reaching the environment to know their views, understanding and experience and gather as much as the insight into the problem. The following relevant sample would be approached for gathering

the information:-

(a) Representatives from industry mainly dealing with R&D.

(b) DRDO units – local and outstation

(c) Govt functionaries – SHQ & DDP.

1.16. **Approach to Data Collection.** The data collection aimed at addressing the Why, Who, What, How, aspects of the problem study. The two forms of the data types and methodology for collecting these data are as follows:-

(a) **Primary Data**. The requisite primary data was gathered from :-

(i) Interviews with visiting speakers / subject matter experts.

(ii) Telephonic conversations with involved agencies.

(iii) Questionnaire to the identified sample.

(b) **Secondary Data**. The secondary data was collected from the available literature, publications, reports, and articles by the relevant heads of organisations – both Government of India (GoI) and Private agencies.

Chapterisation

1.17. The research is chapterised as follows:-

(a) Chapter 1 : Introduction

(b) Chapter 2 : Literature survey

(c) Chapter 3 : Principles and Models of PPP worldwide

(d) Chapter 4 : Growth of Indian Defence Private Sector and Govt Initiatives to Promote its Contribution

(e) Chapter 5 : Methodology and Analysis of data

(f) Chapter 6 : Proposed Program Management Structure

(g) Chapter 7 : Proposed Financial Model

(h) Chapter 8 : Conclusion and Recommendations

CHAPTER – 2
Literature Survey

2.1 The '*Literature Review'* was undertaken in order to study if any earlier research work on similar topic or selected hypothesis was carried out. The survey involved reviewing the relevant/related dissertation by past participants, literary work by the scholars in open domain, articles by renowned institutions and any other articles / reports published in journals/magazines etc, so as to capture the worldview on the subject matter.

2.2 An extract of the views of various authors on the private participation in defence field is appended in succeeding sections. The estimate by the United States Department for Agriculture Economic Research Service (USDA) assumes the Indian economy will expand annually at an average 7.4% to $6.84 trillion by 2030. This will make it bigger than that of the economies of Japan ($6.37 trillion) and Germany ($4.38 trillion) (Ray, 2019). However, India's global R&D ranking in terms of expenditure is sixth (Wikipedia , 2019) going down further when calculated in terms of R&D intensity (i.e., total R&D expenditure as a percentage of GDP) while china has doubled its R&D commitment. Moreover, in case of India, the R&D spending is financed by the government as unlike the advanced countries viz. US, Japan, China etc., where majority (60-75%) of R&D spending comes from the private sector. In spite of this funding, the technology depths of Indian firms is shallow. The Ministry of Commerce attributes this to several factors ranging from poor collaboration between the R&D agency and industry, lack of accountability, bureaucratic red-tapism, and the poor human resource base (Behera, 2014). Due to this industrial sector has been spending very little towards the defence R&D.

2.3 Describing the defence R&D setup (Ghosh, 2016), states that the Defence R&D activities in India have progressed without a clear vision, focus, planning and coordination as also not followed the global trends and success stories. The defence R&D is primarily steered by DRDO which commands 52 scientific laboratories and establishments and maintains a strong partnership

with 40 premier academic institutions, 15 national S&T agencies, 50 PSU's including the nine DPSU's, 39 OFs and 1000 plus private-sector industries. The DRDO's budget for 2018-19 was just a mere 2.90% (Union Budget, 2018) of DoD's budget for Financial Year. Taking note of the Self-Reliance Review Committee's plan (70% by 2005), then the Standing Committee on Defence, in a report presented to the Parliament in 1995 had suggested that the allocation to DRDO be progressively increased to 10% of the defence budget by 2000. However, the DRDO's budget was never raised to the 10% mark during the recommended period, peaking to a much lower level of 6.74 per cent, and that too much later, i.e. in 2008-09. Since then, there has been a gradual decline, indicating the low priority accorded to the DRDO and to defence R&D, in the annual defence spending but the results provided by DRDO in the field of cutting edge research has been abysmally bad and hence the cuts justified.

2.5 With the Make in India programme, indigenisation has seen an increased focus. The defence sector is sure to provide immense opportunities – to attract investments, setting up manufacturing facilities, obtaining technologies and capabilities and generating high skilled employment. As stated above while the macro-policy structure to enable private industry participation were generally in place, at the micro level the interpretation and implementation issues (e.g. offsets, regulatory matters, no level playing field etc.) deterred the industry – both domestic and foreign. Pointing out these issues, (Mathur, 2014) has highlighted that to truly leverage the combined potential of one of the largest defence acquisition programmes of the world, a liberal offset policy and India's advantage in low-cost manufacturing and skilled manpower, it is essential that government policies create synergies rather than contradictions.

2.6 Though the government has progressively addressed quite a few of the issues there are a few still pending to be addressed such as Taxation, extension of Income Tax benefits to defence which are presently applicable for other sectors, price variations, DCF method for calculating Net Present Value at government lending RoI etc. In his article (Samaddar, 2016) has gone ahead to elaborate these issues in greater depths by proposing or setting up of separate fund – separate for

each manufacturing, development and Entrepreneurship. He has also proposed to have a Joint Innovation Council with luminaries from industry, IITs/IISc, MoD and defence services.

2.7 The above excerpts are a clear indication that the Indian defence readiness in terms of in-house expertise is still a distant dream and while some steps have been taken towards self-reliance, still cognizable measures need to be instituted, especially to get the private industry onboard the band wagon. The necessity is more acute when the defence R&D is considered. As highlighted above the Indian progress on in-house R&D in defence is insignificant compared to the growth in the Pharma and Transports. One of the instruments propounded to get the government and private sector working together would be the joint ventures like Public-Private Partnerships (PPP). Globally, such models exist and have been successful.

Gap in Research.

2.8 The Literature Review brings out that significant study work has been done to study the reasons for poor performance by the government R&D agency and a lackadaisical response on part of private sector towards indigenous defence industrial base. However, the focus on involvement of private sector in defence R&D to produce quality products and state of the art technology needs closer look to identify the reasons for such a menial performance and discuss remedial measures towards a joint mechanism of public-private venture.

Defence Procurement Procedure**.**

2.9 As part of the implementation of the report of the Group of Ministers on reforming the National Security System, new Defence Procurement Management Structures and Systems were set up in the Ministry of Defence in 2001. The Defence Procurement Procedure - 2002 (DPP-2002) came into effect from 30 December 2002. The Defence Procurement Procedure has since been revised in 2005, 2006, 2008, 2009, 2011, and 2013, enhancing the scope to include 'Make,' 'Buy and Make (Indian)' categories, concept of 'Offsets' and ship building procedure (MoD, Defence Procurement Procedure, 2016). While articulating the new features, DPP-2016 draws heavily from the report of the Committee of Experts set up by the Government under the

chairmanship of Shri Dhirendra Singh (Committee of experts for Amendment to DPP-2013 including formulation of polcy framework, 2015), to suggest a policy framework for facilitating Make in India in defence and further streamlining the procurement process.

2.10 The salient features of DPP-2016 are as follows:-

(a) Preamble as guiding principle of DPP

(b) New Category – **Buy (Indian-IDDM).** IDDM stands for Indigenously Designed Developed and Manufactured.

(i) To promote indigenous design, development & manufacturing

(ii) Minimum of 40% Indigenous Content with IDDM or

(iii) 60% Indigenous Content of total contract value if not indigenous design & development

(iv) Most preferred category

(c) **Buy (Indian)** - Minimum Indigenous Content 40% (against 30%).

(d) **Buy & Make (Indian)** - Indigenous Content of 50% only in Make portion of the scheme.

(e) **Make** projects into two categories :-

(i) **Make-I (government funded).** (up to Rs. 10 crores) The 90% of development cost will be funded by government, with a further provision that 20% of the developmental cost would be paid in advance. Also mandatory issuance of request for proposal (RFP) within two years of successful development, failing which the balance 10% funded by the industry would be reimbursed to it. For the MSMEs, the new procedure provides the first right to undertake prototype development.

(ii) **Make - II (Industry Funded).** (upto Rs. 3 crore for MSMEs) The industry will bear the full cost of development. Also mandatory issuance of request for proposal (RFP) within two years of successful development, failing which the full

cost of development will be refunded to the industry.

(f) AoN validity reduced to six months.

(g) Enhanced Performance Parameters in SQR.

(h) Sharing of government test facilities with private industry.

(j) Offsets applicable for cases above 2000 Crores.

(k) Introduction of L1-T1 Methodology for Award of Contracts.

CHAPTER - 3
Public- Private Partnership

PPP is an agreement between government and private industry to perform work or utilize facilities and equipment. The PPP is directed toward improving the output and performance of of DoD through increased participation by the private sector via industrial partnering

- US DoD

What is PPP?

3.1 In simple terms, a Public-Private Partnership ("PPP") is a term used to describe a government- sponsored initiative or scheme which involves the use of private finance to facilitate the provision of services to the public and/or the delivery of social infrastructure assets. PPP arrangements are useful for large projects that require highly-skilled workers and a significant cash outlay to get started. PPPs have been used to deliver infrastructure assets in the education, transport, defence and health sectors. The public partner is represented by the government at a local, state and/or national level. The private partner can be a privately-owned business, public corporation or consortium of businesses with a specific area of expertise.

The Need for PPP

3.2 There are usually two fundamental drivers for PPPs. Firstly, PPPs enable the public sector to harness the expertise and efficiencies that the private sector can bring to the delivery of certain facilities and services traditionally procured and delivered by the public sector. Secondly, a PPP is structured so that the public sector body seeking to make a capital investment does not incur any borrowing. Rather, the PPP borrowing is incurred by the private sector vehicle implementing the project and therefore, from the public sector's perspective, a PPP is an "off-balance sheet" method of financing the delivery of new or refurbished public sector assets (Tan, 2012).

Functioning of PPP

3.3 The functioning of a typical PPP is enumerated in the succeeding paragraphs.

3.4 **Bidding Process.** A public sector entity (usually a central government body/local authority) will identify the need to deliver a particular project. The public entity will advertise the need for such a project and then run a competitive process under which private sector entities will "bid" in order to win the right to deliver the project. The winning private sector bidder is then awarded a "**Concession**" to implement its solution.

3.5 **Project Company.** A private sector entity will contract with the public entity and raise funds from investors and lenders in order to deliver the project (the "**Project Company**"). Usually, a new, separate, private company will be set up to be the Project Company in order to insulate the private sector sponsors of the project from the risk of insolvency if the project fails. This new company is known as a "Special Purpose Vehicle" (an "**SPV**").

3.6 **Sponsor.** The activities of the Project Company will be managed by one or more private sector companies (the "**Sponsor**"). Typically, the Project Company is set up as a direct/indirect subsidiary of the Sponsor.

3.7 **Documentation.** The Project Company will enter into a contract with the public sector (the "**Concession Agreement**"). This is the key document detailing the terms and conditions of the project.

3.8 **Contractors.** The Project Company will enter into contracts to enable it to implement the project as it will typically have no employees. There will usually be one entity who is made responsible for the delivery of the facilities management services detailed in the Concession Agreement (Tan, 2012).

3.9 Different partnership models may be agreed upon in a PPP including models such as “Design-Build-Finance-Operate” (DBFO) (Kaur, 2016).The payoffs of a well structured PPP include faster delivery, enhanced performance, reduced costs, resource optimization, economy of scales and sustainability.

Types of PPP Contracts

3.10 Generally a long term relationship, between a public and private entity, the partnership may take various forms such as buyer-seller relationship, recipient-donar relationship or a binding agreement in the form of a 'Contract'. The contract type could be either a 'Service', or an 'Operations and Maintenance Management' or a 'Capital project with operations and management'.

3.11 Sometimes PPP is also categorized as under:-

(a) Build-Operate-Transfer (BOT). This can be further classified into the following:-

(i) Design-Build- Finance-Operate or DBFO

(ii) Build-Own-Operate- Transfer or BOOT

(iii) Build-Own-Lease-Transfer or BOLT

(b) Operate-Maintain- Transfer or (OMT)

3.12 In India, a large number of civil but a very few defence related PPP projects have been undertaken in recent years. Public Private Partnerships (PPPs) have been undertaken in energy, infrastructure, transportation, public buildings and waste management.

Funding of PPP

3.13 Different models of PPP funding are characterized by which partner is responsible for owning and maintaining assets at different stages of the project. Examples of PPP models include -The origin of partnerships between the public and private sectors in the delivery of public goods and services can be traced as far back as the first Persian Achaemenid Empire in (559–328 BC). The recent growth in worldwide popularity of a PPP model—first introduced by government of the United Kingdom (UK) in the early 1990s—takes the evolution of PPPs to new heights. Currently, PPPs take many different forms and definitions (Kuan, 2009).

3.14 The Project Company obtains private funding in order to finance the PPP. Usually, funds are made up of a mix of investments by Sponsors (usually a small proportion of the overall debt) and loans from outside lenders

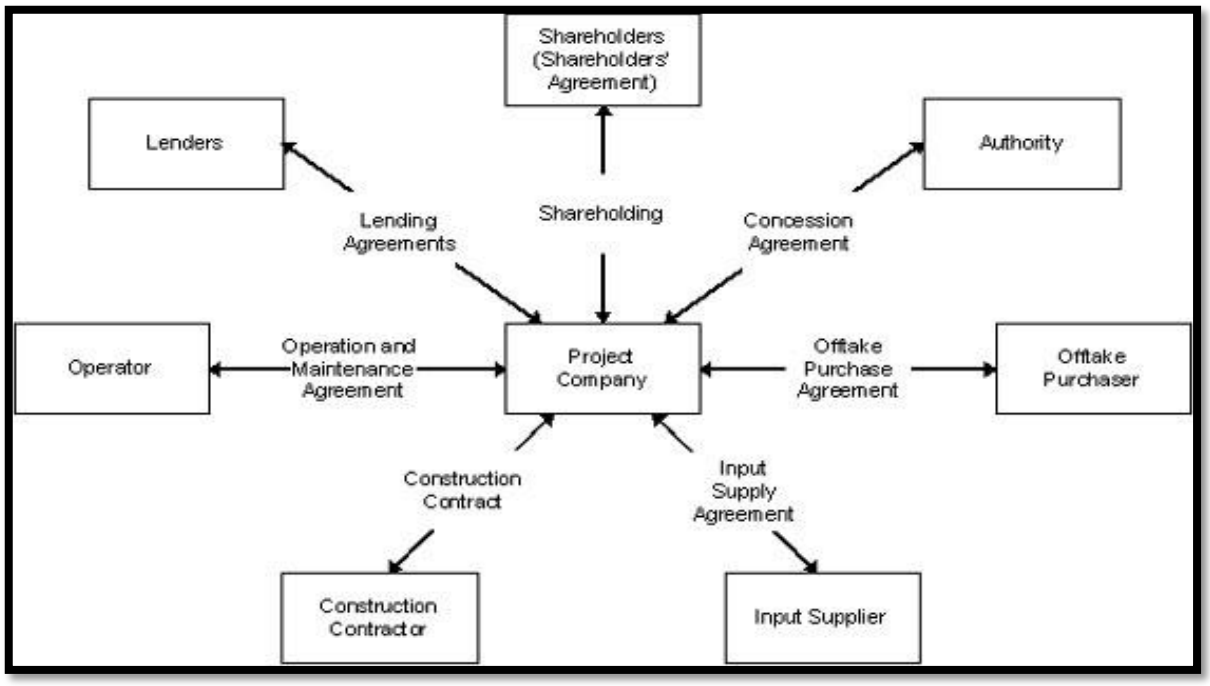

Figure 1 : Schematic of Interaction of Stakeholders in PPP

Advantages and Disadvantages of PPP

3.15 **Advantages**. The advantages of any PPP are as follows:-

(a) Investment decisions under PPP contracts tend to be based on a long-term view rather than short-term concerns.

(b) Risk and work are transferred to the party which is best able to manage it at the least cost, achieving best value.

(c) Projects go through a competitive pricing process, meaning that the cost of public services is benchmarked against market standards.

(d) The timings and costings tend to be more certain and therefore deliver better value for money. Where PPPs are not completed to budget, the private sector usually bears the costs.

(e) The cross-transfer of public and private sector skills, knowledge and expertise can create innovation and efficiency.

(f) The private sector often brings with it greater construction capacity, labour capacity and resources than would be available to the public sector.

(g) Payments to the private sector in PPP projects are usually linked to how they perform, creating incentives and efficiency.

(h) PPP projects are not subject to political interference and deferred payments for the government.

3.12 **Disadvantages**. The disadvantages of any PPP are as follows:-

(a) The number of parties involved and the long-term nature of their relationships often result in complicated contracts and complex negotiations, and therefore high transaction and legal costs. PPP projects can take years to complete.

(b) There is a risk that the private sector party will become insolvent or make large profits during the course of the project – this can cause political problems for the public entity.

(c) The long-term nature of a PPP project means that debt is incurred long before the benefits appear.

(d) Sometimes a public sector entity could borrow more cheaply alone than it could via the private sector. This has to be balanced against the fact that capital expenditure incurred by a public sector body counts as government expenditure which at certain stages of the economic cycle will score against the various statistical measures of government borrowing.

Risk Analysis

3.13 While PPPs seem to be a lucrative option for many infra-developmental projects, they are fraught with a range of different risks**.** These can be usefully divided into following five, categories (IMF, 2004).

(a) *Construction Risk*, which is related to design problems, building cost overruns, and project delays.

(b) *Financial Risk*, which is related to variability in interest rates, exchange rates, and other factors affecting financing costs.

(c) *Performance Risk*, which is related to the availability of an asset, and the continuity and quality of service provision.

(d) *Demand Risk,* which is related to the ongoing need for services.

(e) *Residual Value Risk*, which is related to the future market price of an asset.

3.14 The above risks are present in public, private, and PPP projects. The PPPs seek to transfer risk from the government to the private sector. While an inflow of private capital and a change in management responsibility alone can be beneficial, significant risk transfer is necessary to derive the full benefit from such changes. Adequate risk transfer from the government to the private sector is a key requirement if PPPs are to deliver high-quality and cost-effective services to consumers and the government. However, such a function would entail assessment of the impact of risk transfer on financing costs, and the pricing of risk to ensure efficient risk transfer.

3.15 **Risk Allocation**. The guiding principle of risk allocation is that risk should be allocated to the party best able to manage it. There may be cases where the price charged by a Contractor for taking on a risk exceeds the value to the Contracting Authority of transferring the risk. Cost effective allocation of risk between a Contracting Authority and the Contractor will result in lower costs of construction and operation for projects, and will provide enhanced value for money when compared to traditional procurement. However, if risks are transferred inappropriately to the appointed Contractor, value for money will decline as the premium demanded by the Contractor for managing the risk will outweigh the benefit to the Contracting Authority (Crauser, March 2003).

3.16 **PPP Models in Defence Sector Worldwide**. The PPP mechanism for bolstering defence capability has found success in many advanced nations. A few of these models are discussed below:-

(a) **USA- Defence Advanced Research Projects Agency (DARPA).** Defence

Advanced Research Projects Agency (DARPA) was established in 1958, maintains a small, flat and agile organisation and is responsible for the development of new technologies for use by the military. As the DoD's primary innovation engine, DARPA undertakes projects that are finite in duration but that create lasting revolutionary change (Singh, 2014). Its primary mission is to foster advanced technologies and systems that create fundamental "revolutionary" advantages for the US military. The agency does not perform research directly but rather conceives and finances projects, serving as an active broker among technology, military and, occasionally, policy communities. Consistent with its mission, DARPA pursues a portfolio of Research and Development (R&D) projects. It is independent from other more conventional military/Service R&D organisations and reports directly to the senior (DoD) management. It has a dedicated workforce of approximately 240 professionals directly managing a $2.8 billion budget. The primary recipients of DARPA funds are researchers and research organisations in industry and universities, with smaller amounts going to US government and federally funded laboratories. DARPA's culture encourages taking risks and tolerates failure. It organises several national level technology competitions and seminars for promoting innovations and ideas. It has its feeds on all the major technology related websites.

(b) **Israel- OCS**. The **Office of the Chief Scientist (OCS)** of Israel's Ministry of Economy is the support arm of the Israeli government, charged with fostering the development of industrial R&D within the State of Israel. The mission of the OCS has been defined through the country's "Law for the Encouragement of Industrial Research and Development—1984" (The R&D Law) and its operations are facilitated through Israel's R&D Fund, as well as a variety of international programs, agreements and collaborations. Its mission is to assist the advancement of Israel's knowledge-based science and technology industries in order to encourage innovation and entrepreneurship

while stimulating economic growth (wikipedia, 2018). The main OCS' program (the **R&D Fund**) supports R&D projects of Israeli companies by offering conditional grants of up to 50% of the approved R&D expenditure. If the project is commercially successful, the company will be under an obligation to repay the grant by royalty payments.

(c) **Japan**. It follows the *Kokusanka- Hoshin* ((guideline for indigenous development / production) of 1970 replaced recently by National Defence Programme Guideline (NDPG). The MOD acts as the nodal center. It publishes a formulated R&D vision, shares medium-to-long term R&D plan with defense industry, raises the predictability for companies, promotes stable and efficient facility investment and personnel distribution and tries to realize more effective and efficient R&D based on the R&D vision. The MOD by Advancement of Research and Development System Reform Act also supervises the civil R&D programs including those that cover dual-use technology, Strengthens cooperation with universities and research institutes, Funds advanced research with promising output for defense (MoD, Strategy on Defense Production and Technological Bases, June 2014).

(d) **UK MoD PFI / PPP Model.** The UK MoD's competitive procurement policy was introduced in 1983 (later updated from Private Financing Initiatives **(**PFI) to PPP model in 1997) as part of improving efficiency and achieving value for money. The support services where such services could be done more economically in the private sector (offering benefits to taxpayers) without damaging operational capability, were contracted out. Initially**,** six areas were identified for PFI, namely, training; property and accommodation; information technology; equipment; support services; and utilities. Subsequently, the same has moved on to other activities also such as acquisition of a military satellite communication system (Skynet 5), Army's heavy equipment transport (HET) service contract with the Fasttrax consortium , RAF's future strategic tanker aircraft (FSTA) and the Long-term support contracts for Royal Navy submarines and warships. The MoD

benefitted in terms of Achieving better value for money, risk transfer and innovation etc while the Industry benefited from PFI/PPP through the provision of further market opportunities for maintaining the national defence industrial base. There are opportunities to use spare capacity, to share overheads, to transfer knowledge from civilian markets and to undertake long-term investment against the security of income from a long-term contract (Hartley, 2015). Simultaneously, the Government in consultation with various agencies like Science, Engineering and Manufacturing Technologies Alliance (SEMTA), a sector skills council and **Technology Strategy Board** (TSB) supports a business environment that makes the UK an attractive place for the defence industry by acting as an investor, Customer, Promoter, Regulator and supporter (Defence Industrial Strategy, December 2005).

(e) **France**. Since 1961 Ownership of defence procurement is with *Director Générale de l'Armement* (DGA) (Behera, August 29, 2016)**.** The DGA chief reports directly to the defence minister. The DGA has three primary missions: (i) equipping the armed forces; (ii) preparing the industry to meet future requirements, and (iii) promoting arms exports. With regard to *equipping the armed forces*, the DGA is responsible for design, acquisition and evaluation of the systems while working on a principle of the "entire life of the programmes". For *preparing the industry to meet future requirements*, the DGA is responsible for assessing future threats and risks and setting the technological and industrial goals to meet those contingencies. In these efforts, the DGA identifies the key technologies and provides R&D funding to the industry/university/science and technology centres for development. Its R&D assistance to the industry for futuristic technology development amounted to €787 million in 2017. It's a highly professional organization with 51% of staff as professionals who have undergone training at the dedicated Latresne Training Centre for concerned personnel (Project Management & Technology training).

3.17 Financial constraints, management of life-cycle cost and transfer of part of responsibility from persons in uniform are some of the reasons for PPP in defence sector. World over some of the PPP projects in defence sector include equipment installation and maintenance, Supply-Chain integration and operations, military training, real estate management including housing and infrastructure development.

Successful Defence PPP Projects

3.18 As brought out above, PPP Projects in defence sector have been successfully implemented in countries such as UK, USA, France, Germany and Australia to provide a range of solutions. Some of these are explicitly covered to explore feasibility of similar projects in Indian defence sector.

3.19 **PPP Projects in UK.** The UK defence sector witnessed PPP projects first in 1997. PPP or Public Finance Initiative (PFI) undertaken in UK which merit a mention are as under:-

(a) **Future Strategic Tanker Aircraft (FSTA) Program (Kaushal Vinay, 2013)**. An open competition based selection of the concessionaire was adopted in a PFI project to replace air transport and air to air refueling capability. RAF signed a 10.5 Bn £ PFI with Airtanker Consortium in 2008 wherein 14 Voyagers Airbus 330 aircrafts including a comprehensive support package were contracted. Complete support operations, including training and maintenance are the responsibility of Airtanker while RAF undertakes the flying. A contract period of 27 year has been earmarked during which the aircraft when not in use by the military may also be leased for commercial flying. The aircraft fleet would be managed under three categories which are purely military use, weekdays military but weekend commercial use and purely commercial use but also utilized by military during crisis.

(b) **Allenby / Connaught Housing Project**. A PFI project covering duration of 35 years was signed by UK defence forces in 2006 to provide high quality, modern, fully serviced, living and working accommodation and caters for requirements of approx 19 thousand soldiers. The project besides construction of new buildings and refurbishment /demolition of old ones, caters for a range of services such as estate management, cleaning, transport, stores, waste disposal and document handling. The type of buildings include basic living, dining halls, cafeterias, sporting facilities and on site shops. PFI portfolio has over 50 projects and has maintained a high standard of service delivery while meeting project timelines.

3.20 **PPP Projects in France**. PPP projects undertaken by French Defence Forces are as under:-

(a) **Training of Helicopter Pilots**. A PPP project for training of pilots as well as provisioning of training helicopters by a private agency was signed by French defence in 2008. The PPP project set for a duration of 22 years is designed to cater for 16000 to 22000 flying hours per year meeting the training requirement of approximately 150 helicopter pilots of French defence forces at French Army Aviation School, EALAAT. The private entity was also contracted to supply 36 new Eurocopter EC120 helicopters for the said training as a replacement to 55 SA342 Gazzele helicopters.

(b) **Building Complex**. A PPP project on housing for 9330 civilian and militray staff at a project cost of 3.5 bn Euros was signed in 2014. The site is on lease for a period of 27 years with the private entity receiving an annual rent of 130 mn Euros for building and managing the site.

3.21 **PPP Project in Australian Defence Forces**. A construction project at Joint Operations Command Headquarters (HQJOC) as a high security set up for planning and conduct

of allied operations was contracted in 2006 in the form of a PPP. A 30 year PPP project at an estimated cost of 340 mn $ met its delivery timelines of two years of construction of the facility within the allocated budget.

3.22 **Miscellaneous Defence PPP Projects in the World**. A few other PPP projects in defence sector around the globe are as under:-

(a) German Ministry of Defence signed a PPP Project as a maintenance joint venture with HIL GmbH for maintenance of 10000 combat systems covering the entire value chain. The private entity as part of an eight year contract is bound to ensure 70 percent availability of all combat systems at all times.

(b) United States of America also has ventured in PPP projects handling military housing and closure of bases. 'Hawai Family Housing Project' involving construction of 7894 houses for military families at seven installations was signed by the Army as a JV with Actus Land Lease.

PPP for Operations of Four Ord Factories

3.23 As a bold initiative and show of commitment to increase private participation, MoD has proposed four arms manufacturing Ord factories to be brought under the PPP model (A-First-Defence-Ministry-Moots-Public-Private-Partnerships-For-4-Arms-Units, 2017).

3.24 The four public sector units identified for privatization through the PPP model are Ordnance Factory Tiruchirappalli (OFT), Small Arms Factory (SAF) Kanpur, Ordnance Factory Korwa in UP and Rifle Factory Ishapore (RFI) in Bengal. No private player has, however, been identified as yet. The four factories manufacture 9 mm carbines, light machine guns (5.56 mm), 7.62 mm rifles, rifles (5.56 mm), artillery guns and other infantry weapons alongside miscellaneous other items.

3.25 Some stakeholders are believed to be skeptical of the move. "They are already declaring

many items produced by ordnance factories as non-core and allowing our customers (armed forces) to directly procure it from private players. With this (PPP model), even weapons will be in private hands," said a source. The NDA government has so far declared 143 items "non-core" and asked ordnance factories to focus on core items. The PPP proposal has already resulted in massive protest meetings organised by workers' unions at the four arms factories.

3.26 Consortium Approach Brahmos Super Sonic Cruise Missile, a joint venture between Indian Government and Russian Federation has been a massive success. We need to adopt consortium approach on the lines of Brahmos Aerospace. We need to capitalize maximum on the ability of numerous companies, bring them under one umbrella and push ahead for successful culmination of our Design and Development projects. The Brahmos missiles are already inducted by the Navy & the army.

3.27 Pinaka MBRL is another example where public and private companies came together to develop a formidable weapon system. The Armament Research & Development Establishment (ARDE), Tata, L&T and OFB have worked in close cooperation to make the project a success' (Chander, 2017).

JVs/ Tie Ups of Indian Private Sector Firms with Foreign OEM/ Public Sector

3.28 The recent policy changes and clear focus of the government to enhance private sector participation in defence has led to major industrial houses venturing into defence sector through various modes of partnership with foreign OEMs. The public sector entities are facing stiff competition from the emerging private sector and have also entered into tie ups with reputed foreign as well as Indian OEMs. The model of partnerships range from PPP, Joint Venture, Joint Development, Collaborative Research and scientists exchange. The "Make in India" initiative in defence sector is slowly but steadily gaining ground. The major corporate houses in India such as Tata Group, Bharat Forge Ltd, Reliance Industries, Larsen & Toubro Ltd, Mahindra Group and Godrej Group have signed multiple tie ups/MOUs/ JVs for development, production, procurement

and in certain cases even for transfer of technology. Besides these big players there are middle level players entering defence sector such as Ashok Leyland Defence Systems, Dynamatic Technologies, Premier Explosives Ltd, Tebma Shipyards Ltd, Titagarh Wagons Ltd, Taneja Aerospace and Aviation Ltd, Bharati Shipyard Ltd, Punj Lloyd Aviation Ltd and AMW Motors Ltd. There are host of new small level entrants in the defence sector effectively contributing to the defence sector directly as well as through bigger public and private sector entities.

3.29 The JVs / MOUs/ partnerships are being signed by a range of Indian Private Sector firms with foreign OEMs as well as Indian Public Sector Enterprises. Details of some of the important partnerships along with the areas of tie up/ collaboration are given at **Appendix A**.

CHAPTER-4

Growth of Indian Defence Private Sector and Govt Initiatives to Promote its Contribution

"The government could play the role of a catalyst. We have broken away from the restrictive policies of the past and want to unleash both public and private entrepreneurship and innovation".

"We have continuously battled both insurgency and war. These are all important battles to be fought. But we cannot depend on armaments and equipment from others to fight these battles"-

-Mr Arun Jaitley Union Defence Minister at DIAT 29th May 2017

Indian Private Sector in Defence: A Brief Background

4.1 Participation of private sector in Indian defence industry post independence started against a political belief that development of this critical and strategic industry is best suited for Public Sector. In early 50s and 60s, the entire focus of the Indian government was tilted towards creating structures and institutions in line with a policy to deliberately keep the private sector away from a slowly yet steadily growing defence industrial base. The private sector in Indian defence industry, therefore, could only play a secondary role in the form of supply of raw material, components/parts or semi-finished products as required by the public sector.

4.2 It was in 2001 that Indian Defence Industry was first opened to the Private Sector. More than 300 industrial licenses have been issued by the government to approximately 200 private sector firms. However, more than sixteen years down the line, there has been less than optimal participation of the private sector in defence manufacturing. The Private sector continues to complain of the absence of a level playing field vis-a-vis DPSUs and OFs, which they believe receive preferential treatment by the MoD, particularly when it comes to procurement of major weapon systems such as armoured fighting vehicles, aircrafts, submarines and helicopters (Bharat Anand, 2017).

4.3 It is unfortunate that despite regular amendments to defence acquisition policy, a large network of government institutions coupled with a large public sector based defence industry, India continues to meet 70% of its defence procurement requirements through imports, leaving a huge scope for import substitution.

Reasons for Poor Private Sector Participation and Performance

4.4 There are a number of issues/ problem areas that have converged over a period of time to thwart private sector growth in Indian defence industry. Though, some of these issues have been addressed by successive policy amendments, the private sector performance in defence procurement is way behind the desired level. Some of the reasons are discussed in succeeding paragraphs.

Undue Favourtism to Defence Public Sector by MoD.

4.5 MoD has a poor record of alleged favourtism to DPSUs/OFs vis-à-vis private sector firms in placement of procurement orders. Procedural difficulties are one of the biggest stumbling block for private sector participation, which inherently works on faster speed of execution coupled with associated business interest linked to stricter timelines. It is worthwhile to note that a late entry of private sector in 2001 has already resulted in their poor technological base and skill levels in a highly technology intensive defence manufacturing industry. Major changes to the procurement procedure for greater private sector participation came up with DPP- 2006, wherein “Make” and “Buy and Make” categories were introduced. However, despite several in- principle approvals accorded by MoD, no major success was witnessed in procurements under these categories.

4.6 The process of granting industrial licenses (ILs) to private sector firms has been very tardy and entangled in red tapeism. Besides this, MoD procedure ensure that the payment terms, duty payable and tax structure favour DPSUs/OFs, making the competition even tougher and financially unviable for the private sector.

4.7 Exchange Rate Variation (ERV) has been another area wherein th e private sector has faced similar discrimination. Public sector and government units are insulated against ERV whereas, the Private Sector faces extreme risks due to ERV, particularly in procurements having import content with long delivery periods.

4.8 **Lack of Financial Incentives**. Being a strategic sector, many countries provide a range of fiscal as well as other incentives to their Private sector to help develop a sound defence industrial base. Countries like South Korea and Israel have provisions such as raising funds for indigenous defence potential through defence tax and price preference to local industry competing against global players. On the contrary, in India prevailing tax/ duty structure makes it difficult for private sector firms to compete against defence public sector. Private sector in India is demanding for provisions such as deemed export status, concessional cost of finance and incentives for development of defence production infrastructure.

4.9 **Deemed Export Status**. A benefit in the form of deemed export status is being asked by the domestic suppliers/manufacturers, wherein in selected cases they would get a level playing field by way of an advance authorization for duty free import of input material and excise duty refund already paid on final goods. The deemed export status is presently not being granted to them.

4.10 **Lack of R&D Through Private Sector**. In many advanced countries such as US, Japan, Germany and China having a sound defence industrial base, a sizeable R&D effort comes from the defence industry, unlike India where the R&D on defence is largely restricted to government and public sector units. The idea of introducing "Make" category in 2006 though aimed towards promoting R&D through the Private sector did not take off as intended and there are hardly any significant projects of design and development coming through this route. Creation of a defence fund for R&D has also remained non operational. As regards tax incentive, section 35 of IT Act allows 200 percent weighted tax relief on a private enterprise's contribution to in-house Research & Development or to universities/ national research labs. The scope of this tax

relief is, however, limited to only four areas of expenditure namely, consumables and materials, plant & machinery, human resource and services/utilities. The benefit precludes the balance of the value chain of R&D which covers entire set of activities such as design and development, pilot production, test beds and field trials. The private sector, though, is getting additional relief in the % R&D funding in the revised DPP-2016, with special relief to MSMEs.

4.11 **Lack of Technical Skill**. It is a simple fact that the private sector being away from mainstream defence industry for many years, lacks requisite skilled workforce essential for high end defence manufacturing. It is estimated that in next 10 years defence and other strategic sector such as homeland security and shipbuilding would require skilled workforce of approximately 1.8 million. National Skill Development Corporation (NSDC) has been approached by CII to meet this challenge. NSDC is setting up a Strategic Management Skill Council (SMSC) designed to train approximately 1.5 million trained workforce for different job roles. There is also a plan to develop a potent group of engineers/ academic institutions specializing in defence technology on similar lines as DAE (Department of Atomic Energy) and Indian Space Research Organisation (ISRO).

4.12 **Delay in Acqu isition Process**. MoD has a very tardy acquisition process, wherein even after in principle approval of a procurement proposal, is accorded by Defence Acquisition Counsel, there is a delay of two to three years, before a firm order is placed. There is hardly a stage of procurement that sticks to the stipulated timeline. The private sector, which works on a network of backend collaborations, finds it extremely difficult to operate, particularly in big ticket projects. Retendering and cancellation of proposals also hurts private sector the most.

4.13 **Poor FDI Flow**. Post raising the maximum permissible FDI to 49%, a number of schemes in the "Buy and Make (Indian)" category have been approved. The actual flow of FDI, however has still remained low. Maximum foreign investment has come in the form of FII/FPI, which precludes bringing in new technology. Foreign OEMs have not shown any significant change in their preference to join new Indian JVs. Lack of assurance from government of India on

viability of the JV and some certainty of flow of orders, makes the investments financially unviable.

4.14 **Lack of Private Sector Representation in MoD**. The Private sector has this perception that the MoD is biased and unduly favours the public sector units, for matters related to defence capital procurement. MoD against its own commitment of doing away with nominations and ensuring level playing field between public and private sector enterprises, awarded the big ticket Fleet Support Vessel contract to Hindustan Shipyard Ltd and a 32600 crore MCMV (Mine Counter Measure Vessel) project to Goa Shipyard Ltd through a ToT.

4.15 **Disparity in Payment Terms**. Foreign companies are paid by MoD through an irrevocable LC (Letter of Credit), which makes the payment easier without a human interface. On the contrary, the private sector receives its payment through DAD (MoD's Defence Accounts Department), wherein bureaucratic delays result into late payments ranging between six to nine months. Indian Defence Industry which receives capital with a double digit interest rate, finds it very difficult to compete with public sector as well as foreign firms while participating in 'Buy Global' category.

4.16 **Indigenization Content in "Buy and Make" Category**. Indigenous Content (IC) of 50 percent is mandatory in "Buy and Make (Indian)" category. Private sector finds it difficult to meet this requirement across all major platforms. Private sector advocates a flexible system of minimum percentage of indigenous content in "Buy and Make (Indian)" category, depending upon the type of weapon system and existing indigenous capability with regard to availability of technology.

Steps Taken by Government to Enhance Private Sector Participation

4.17 The present government as part of its "Make in India" campaign, has taken a host of actions to address the anomalies of the present defence procurement system and given requisite thrust to private sector in defence production. During high level visits to various countries,

encouragement to foreign OEMs' participation in defence production as part of "Make in India" has been high on agenda.

4.18 The adverse situation of lack of self reliance in defence coincided with the announcement of "Make in India" initiative of the present government. Ever since, the announcement, government has emphasized that defence manufacturing would form a key component of the "Make in India" initiative. It was almost the same time that the Defence Procurement Procedure - 2013 was under review. Dhirendra Singh Committee and VK Aatre Task Force, both established in 2015, provided a host of recommendations to enhance private sector participation towards greater self reliance. Some of the key recommendations of these committees were accepted as policy changes. MoD promulgated the amended procedure DPP-2016 on 29 Jul 2016, which incorporated some of the key recommendations of both committees.

4.19 Chapter VII of amended DPP (DPP-2016, released on 29th Jul 2016) was conspicuous by its absence in the document. This chapter on "Strategic Partners" (SP) was held back by the government for further deliberations and was planned to be promulgated subsequently.

Government Approval to Strategic Partnership Model (Defence Procurement Procedure (DPP -2016) Chapter VII)

4.20 After ten months of long wait and speculation both by Indian Private Sector and foreign OEMs, Cabinet Committee on Security (CCS) approved the "Strategic Partnership Model" (SPM) on 23 May 2017 (Chopra, 2017). Following this, the much awaited Chapter VII of DPP-2016 on Strategic Partners (SP) was promulgated by MoD on 29 May 2017.

4.21 Kelkar Committee over a decade ago had recommended to the then government that certain private firms must be identified based on their financial, technical and managerial strength as defence industry 'Champions' or 'Raksha Udyog Ratna'. RUR concept faced objections by DPSU trade unions and industry experts who questioned the selection mechanism adopted by a Committee headed by Sh Probir Sengupta, which identified 13 firms to be granted the status of RUR. Strategic Partnership Model seems to be a concept somewhat similar to the erstwhile RUR.

4.22 Increased efficiency, faster technology absorption, enhanced synergy through partnership structure are some of the payoffs of the SP construct. SP model, if implemented well, would also result in a tiered defence industrial ecosystem ready to participate in global value chains, including exports (Bharat Anand, 2017).

Salient Features of Strategic Partnership Model(SPM)

4.23 Currently, there is a heavy dependence on foreign OEMs to provide critical technologies under "Buy and Make" category of DPP. The SPM is aimed to develop indigenous capability on a long term and reduce dependency on foreign OEMs, in line with "Make in India" drive.

4.24 As per the revised policy, Indian Private companies having requisite turnover and net worth would be selected as Strategic Partners (SPs) by the government. As of now four strategic frontline segments namely single engine fighter aircraft,, light helicopters, submarines and armoured fighting vehicles have been identified.

4.25 **Selection Parameters for SPs**. Sound technical ability of a private firm to develop a system integration capability, stable and growing financial base and a host of other conditions would be utilized to shortlist Strategic Partner for each identified segment. Only one Strategic partner (SP) per segment would be shortlisted. It is also a precondition that the SP applying must be an Indian company controlled and owned by Indian resident citizens. It essentially implies that the leadership as well as management of such a firm should be represented predominantly by Indians. Any ownership changes in the pattern of share holding or structure in the SP would require prior approval of the Ministry of Defence. The techno-commercial offer to the MoD would be submitted jointly by the Indian SP and the foreign OEM. The criteria of selection of Indian SP is as under:-

(a) **Technical Criteria**. The Private firm should be able to demonstrate "System of Systems" integration capability involving various weapon system technologies employed in major weapon systems such as ships, aircrafts, tanks and armaments, as outlined in the Expression of Interest (EOI).

(b) **Financial Criteria**.

(i) The company capital assets should be Approx 2000 crore at gross book value.

(ii) In three out of the previous five financial years, the revenue growth of the company should be at least 5 % per annum.

(iii) The firm should have CRISIL/ ICRA "A" or equivalent credit rating.

(c) Other Conditions. Some other conditions include:-

(i) No willful default by the directors and promoters of the firm (as specified by the RBI).

(ii) Strategic Partner (SP) applicant would be evaluated for non performing assets and debt restructuring.

(iii) Audit Report of the SP applicant must reflect sound and robust practices of governance.

4.26 **Shortlisting the OEMs**. MoD criteria for selection of foreign OEMs would be governed by the quantum/scope/range/depth of the technology transfer. Other important guiding factors would include existing percentage indigenous content, support to future R&D, assistance to Indian SP in system integration and support to training/ indigenous skill development. Indian companies selected as SPs can engage with any of the shortlisted foreign OEMs. As per procedure, the Indian SP can submit only one bid in collaborating with any one of the OEMs. Exception to this ruling would be feasible only in diverse platform procurement cases wherein a better technology solution is likely by collaboration of SP with more than one foreign OEM. Key foreign manufacturers like Boeing, Lockheed Martin, Airbus, BAE Systems and Saab are likely contenders. As per certain estimates, India is likely to invest approximately Rs 250 Bn USD in

acquisition of defence hardware in the next decade. OEM may be permitted to manufacture a minimum number of equipment (Numbers less than 10-15 percent) in OEM premises in his parent country.

4.27 **Potential Indian SP Tie ups with Foreign OEMs and FDI Capping**. The Indian Strategic Partner (SP) may establish a tie up with the OEMs in the form of equity partnership or JVs or technology sharing as also miscellaneous aspects such as royalty or operating arrangements. The estimation of foreign investment for an applicant SP would include equity share capital held by the foreign OEM including its subsidiaries and equity capital of other investors. As regards FDI, maximum permissible limit for any applicant SP is 49 % which includes indirect foreign investment.

4.28 **Issues Yet to Unfold in SPM**. The coming together of the Indian SP and foreign OEM have certain issues which are yet to unfold and it is still unclear whether the government will play the matchmaker or they would have a complete say in choosing their partners. The prime vendor being the Indian SP, it should not be reduced merely to a production agency of a foreign OEM. Some of the issues which merit attention are elaborated in succeeding paras.

4.29 The restriction imposed on the OEM over ownership to a max of 49% equity may reduce their appetite for the SPM. The management control of the SP should not disturb the comfort level of the OEM in terms of operational.

4.30 OEM's collaboration with the Indian counterpart would be either through a JV with main firm or a project specific Special Purpose Vehicle (SPV). However, the extent of transfer of technology that would be available to the Indian SP/ SPV, still remains a question mark.

4.31 How would the DPSUs be utilized post implementation of SPM, since there would be an additional capacity available over and above the existing capacity of DPSUs/OFs? Will government utilize DPSUs' capacity and nominate these as and when deemed necessary preferring them over Indian Strategic Partner?

4.32 In case there aren't sufficient orders coming from Indian armed forces, which apparently cannot be ab-initio guaranteed, would a favourable export policy mitigate the adverse impact to ensure viability of a sound business model?

CHAPTER – 5

Data Analysis and Hypothesis Testing

Introduction

5.2 Any quantitative analysis of a research is premised on research design structure, data collection and analysis of the numerical data using various statistical tools. Hence, the correctness and veracity of a statistical analysis is a strong dependent of a diligent execution of all the intermediary steps in the process. In the extant study, the hypothesis testing is being carried out by collecting the data from the respondents in the relevant environment and analysed subsequently.

5.3 **Hypothesis**. The Null (H0) and the Alternate hypothesis (H1) identified were as follows:-

(a) **Null Hypothesis (Ho)**. Robust risk sharing between the Government and Private agencies in defence Research and Development Projects will not lead to enhanced Public-Private Partnership in this sector.

(b) **Alternate Hypotheses (H1)**. Robust risk Sharing between the Government and Private agencies in defence Research and Development Projects will lead to enhanced Public-Private Partnership in this sector.

5.4 **Constructs**. The Hypothesis was aimed to be validated w.r.t following constructs:-

(a) Funding (R&D requires large funds)

(b) License permissions.

(c) Testing and Trials Facilities – type testing issues.

(d) Intellectual Property Rights

(e) Technology Obsolescence due to long lead times.

(i) Technology for dual use.

(j) Order quantity – confirmed Minimum order quantity and limited repeat orders

(k) Exit Policy

Pilot Questionnaire.

5.5 As advised in most research methodology references, a Pilot Questionnaire was prepared

and sent to a sample population comprising serving officers, retired officers, DRDO officers, Indigenisation Directorate and the Industry reps, who have reasonable experience of handling indigenisation or basic R&D activities. Based upon their responses, some questions were reviewed and relegated.

5.6 **Questionnaire**. A questionnaire comprising of 33 questions based on Likert scale and three generic / views seeking questions was finalised. The questions were allocated construct wise identification numbers and subsequently mixed up to avoid providing a pattern to the respondents. The questionnaire is attached at **Appendix 'B'**.

5.7 **Respondents**. The population of the respondents comprised of mostly technical background officers who have experience of / have been associated with maintenance, procurement, indigenisation, R&D, quality assurance, project overseeing in service. In addition response was also sought from the Industry reps, start-up firms and DRDO reps. Further, response was also collected from officers who have no technical background but have been associated with operations and exploitation of technology or contract management, in order to get an impartial or out of box views.

5.8 **Data Collection**. Data from respondents was collected primarily over google forms in excel sheet as well as in some cases questionnaires were sent in physical form and information was collected.

5.9 **SPSS**. The data has been compiled and analysed using the SPSS.

Data Analysis

5.10 **Demographic Data**. The collected data was first checked for completeness using SPSS descriptive statistics. The review of data revealed completeness of demographic data w.r.t rank and service.

Pilot Survey Analysis

5.11 The Pilot Survey analysis is described below.

(a) **Reliability Test**. The Cronbach's Alpha for the Pilot Survey is as follows:-

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.661	.663	33

Table 1: Reliability Statistics for Pilot Survey

Since the Cronbach's Alpha was observed to be below the acceptable levels of 0.7, hence it was **Questionable** and the questionnaire needed to be **reviewed**.

5.12 The Reliability for the constructs (only three shown here) is as follows.

(a) **Construct 1- Funding**

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.548	.577	7

Table 2 : Reliability Statistics for Construct 1

Since the Cronbach's Alpha was observed to be below the acceptable levels of 0.7, hence it was **Questionable** and the questionnaire needed to be **reviewed**.

(b) **Construct 2- Industrial License**

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.472	.465	3

Table 3 : Reliability Statistics for Construct 2

Since the Cronbach's Alpha was observed to be below the acceptable levels of 0.7, hence it was **Questionable** and the questionnaire needed to be **reviewed**.

(c) **Construct 3- Technical Knowledge**

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.364	.426	8

Table 4 : Reliability Statistics for Construct 3

Since the Cronbach's Alpha was observed to be below the acceptable levels of 0.7, hence it was **Questionable**.

5.13 Similarly it was done for other constructs also and it was observed that in most constructs review of the questionnaire was required.

5.14 **Factor Analysis.** The Factor Analysis for the pilot survey is as under.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.713
Bartlett's Test of Sphericity	Approx. Chi-Square	993.397
	df	528
	Sig.	.000

Table 5 : KMO and Bartlett's Test for Pilot Survey

The overall KMO measure of sampling adequacy is 0.713 and hence the sample size is considered to be adequate to carryout factor analysis

5.15 The factor Analysis for the constructs (only for three constructs shown here) is as follows.

(a) **Construct 1- Funding**

(i) KMO and Bartlett's Test

KMO and Bartlett's Test[a]

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.625
Bartlett's Test of Sphericity	Approx. Chi-Square	55.862
	df	21
	Sig.	.000

a. Based on correlations

Table 6 : KMO and Bartlett's Test for Construct 1

The KMO Measure of sampling adequacy is 0.625. This is >0.6 and hence the sample size is adequate to carry out factor analysis.

(ii) **Total Variation**.

Total Variance Explained

	Component	Initial Eigen values[a]			Rotation Sums of Squared Loadings		
		Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
Raw	1	2.685	39.116	39.116	2.561	37.316	37.316
	2	1.609	23.450	62.565	1.733	25.249	62.565
	3	.868	12.648	75.213			
	4	.645	9.396	84.609			
	5	.519	7.563	92.172			
	6	.328	4.780	96.952			
	7	.209	3.048	100.000			
Rescaled	1	2.685	39.116	39.116	2.662	38.030	38.030
	2	1.609	23.450	62.565	1.566	22.365	60.395
	3	.868	12.648	75.213			
	4	.645	9.396	84.609			
	5	.519	7.563	92.172			
	6	.328	4.780	96.952			
	7	.209	3.048	100.000			

Extraction Method: Principal Component Analysis.

Table 7 : Total Variance for Construct 1

The 1st component has 39.116% cumulative value. The value needs to increase to over 40% for it to be acceptable.

(iii) **Scree Plot**

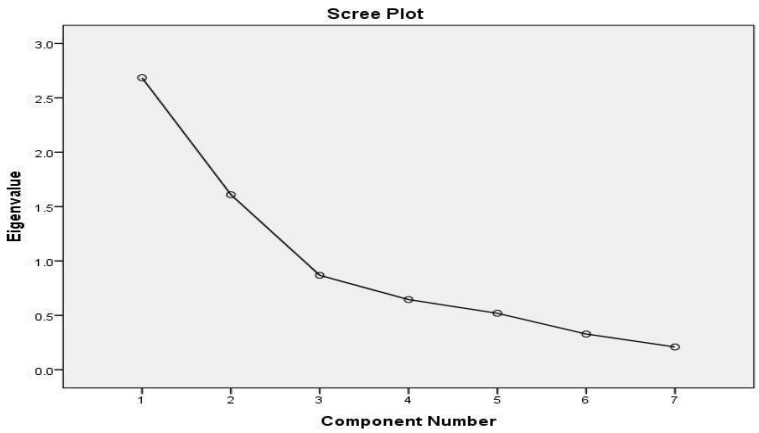

Figure 2 : Figure 2 Scree Plot for Construct 1

There are Eigen values on the Y axis that need to be adjusted as more than 02 are present at value greater than 1.

(b) **Construct 2- Industrial License**

(i) KMO and Bartlett's Test

KMO and Bartlett's Test[a]

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.657
Bartlett's Test of Sphericity	Approx. Chi-Square	17.512
	df	3
	Sig.	.001

a. Based on correlations

Table 8 : KMO and Bartlett's Test for Construct 2

The KMO Measure of sampling adequacy is 0.657. This is >0.6 and hence the sample size is adequate to carry out factor analysis.

(ii) **Total Variation**

Total Variance Explained

	Component	Initial Eigenvalues[a]		
		Total	% of Variance	Cumulative %
Raw	1	.852	60.692	60.692
	2	.407	29.013	89.704
	3	.144	10.296	100.000
Rescaled	1	.852	60.692	60.692
	2	.407	29.013	89.704
	3	.144	10.296	100.000

Extraction Method: Principal Component Analysis.

Table 9 : Total Variance for Construct 2

The 1st component has 60.692% cumulative value and is considered to be acceptable.

(iii) **Scree Plot**

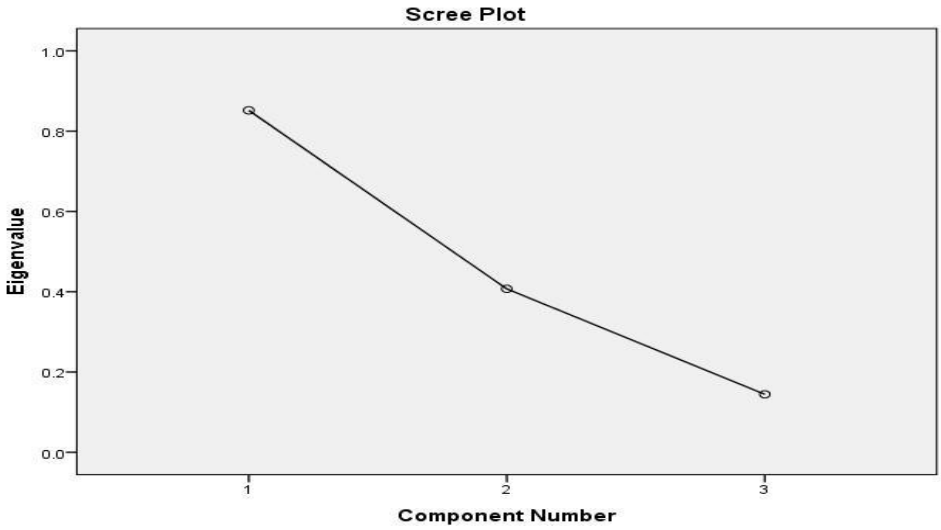

Figure 3 : Figure 3 Scree Plot for Construct 2

The Eigen Values on the Y-axis are as required

(c) **Construct 3- Technological Knowledge**

(i) KMO and Bartlett's Test

KMO and Bartlett's Test[a]

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.576
Bartlett's Test of Sphericity	Approx. Chi-Square	96.974
	Df	28
	Sig.	.000

a. Based on correlations

Table 10 : KMO and Bartlett's Test for Construct 3

The KMO Measure of sampling adequacy is 0.576. This is <0.6 and but since KMO for other constructs >0.6, the sample size is considered adequate to carry out factor analysis.

(ii) **Total Variation**

Total Variance Explained

	Component	Initial Eigenvalues[a]			Rotation Sums of Squared Loadings		
		Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
Raw	1	2.948	36.770	36.770	2.368	29.543	29.543
	2	2.092	26.096	62.866	1.746	21.779	51.322
	3	1.164	14.518	77.385	2.089	26.063	77.385
	4	.843	10.516	87.901			
	5	.403	5.022	92.923			
	6	.356	4.441	97.364			
	7	.159	1.980	99.343			
	8	.053	.657	100.000			
Rescaled	1	2.948	36.770	36.770	2.189	27.365	27.365
	2	2.092	26.096	62.866	1.749	21.865	49.230
	3	1.164	14.518	77.385	1.560	19.506	68.736
	4	.843	10.516	87.901			
	5	.403	5.022	92.923			
	6	.356	4.441	97.364			
	7	.159	1.980	99.343			
	8	.053	.657	100.000			

Extraction Method: Principal Component Analysis.

Table 11 : Total Variance for Construct 3

The 1st component has 36.770% cumulative value. The value needs to increase to over 40% for it to be acceptable.

(iii) **Scree Plot**

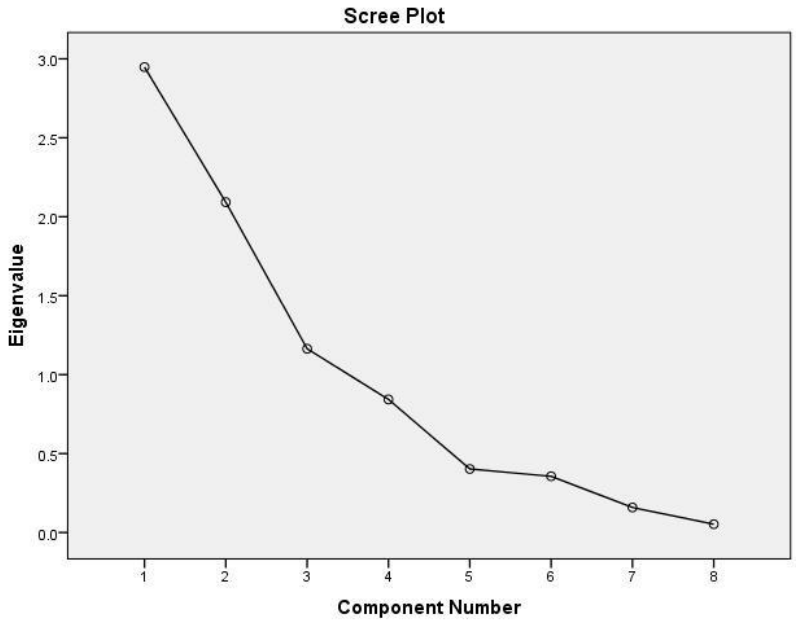

Figure 4 : Figure 4 Scree Plot for Construct 3

There are Eigen values on the Y axis that need to be adjusted as more than 02 are present at value greater than 1.

(d) **Construct 5- IPR Ownership**

(i) KMO and Bartlett's Test

KMO and Bartlett's Test[a]

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.620
Bartlett's Test of Sphericity	Approx. Chi-Square	26.005
	Df	6
	Sig.	.000

Table 12 : KMO and Bartlett's Test Construct 5

The KMO Measure of sampling adequacy is 0.620. This is >0.6 and hence the sample size is adequate to carry out factor analysis.

(ii) **Total Variation**

Total Variance Explained

	Component	Initial Eigenvalues[a]			Rotation Sums of Squared Loadings		
		Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
Raw	1	1.413	50.764	50.764	1.376	49.412	49.412
	2	.811	29.115	79.880	.848	30.468	79.880
	3	.347	12.477	92.357			
	4	.213	7.643	100.000			
Rescaled	1	1.413	50.764	50.764	2.029	50.735	50.735
	2	.811	29.115	79.880	1.113	27.826	78.561
	3	.347	12.477	92.357			
	4	.213	7.643	100.000			

Table 13 : Variation for Construct 5

The 1st component has 50.764% cumulative value and is considered to be acceptable.

(iii) **Scree Plot**

Figure 5 : Scree Plot for Construct 5

The Eigen Values on the Y-axis are as required

5.16 **Revision of the Pilot Survey Questionnaire.** Based on the statistical analysis of the pilot survey, the questionnaire was reviewed and the questions not loading towards the construct were removed. The instrument with a total of 22 questions was again circulated and inputs were sought from the environment. The revised questionnaire is placed at **Appendix 'C'**. A total of 201 responses were received making the sample size as 201.

Descriptive Analysis

5.17 As part of the next step post receipt of the responses, the critical questions (one from each construct) were analysed to ascertain the inputs from the respondents. The same are enumerated in succeeding paragraphs.

(a) **Construct 1- Funding.** The issue of availability of funding from the government was captured by the question "***The funds required for defence R&D projects are easily available from the sponsoring government organisations***". The analysis of responses is as follows-

N	Valid	201
	Missing	0
Mean		2.62
Median		2.00
Std. Deviation		1.071
Variance		1.146
Range		4
Minimum		1
Maximum		5

Table 14 : Descriptive Analysis - Construct 1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	21	10.4	10.4	10.4
	Disagree	101	50.2	50.2	60.7
	Neutral	15	7.5	7.5	68.2
	Agree	61	30.3	30.3	98.5

	Strongly Agree	3	1.5	1.5	100.0
	Total	201	100.0	100.0	

Table 15 : Frequency Distribution Construct 1

(i) As seen from the percentage distribution of the responses, around 61% respondents Disagreed / Strongly Disagreed while only 30% Agreed that the funds are easily available from the government. The same is depicted with the help of the Histogram below.

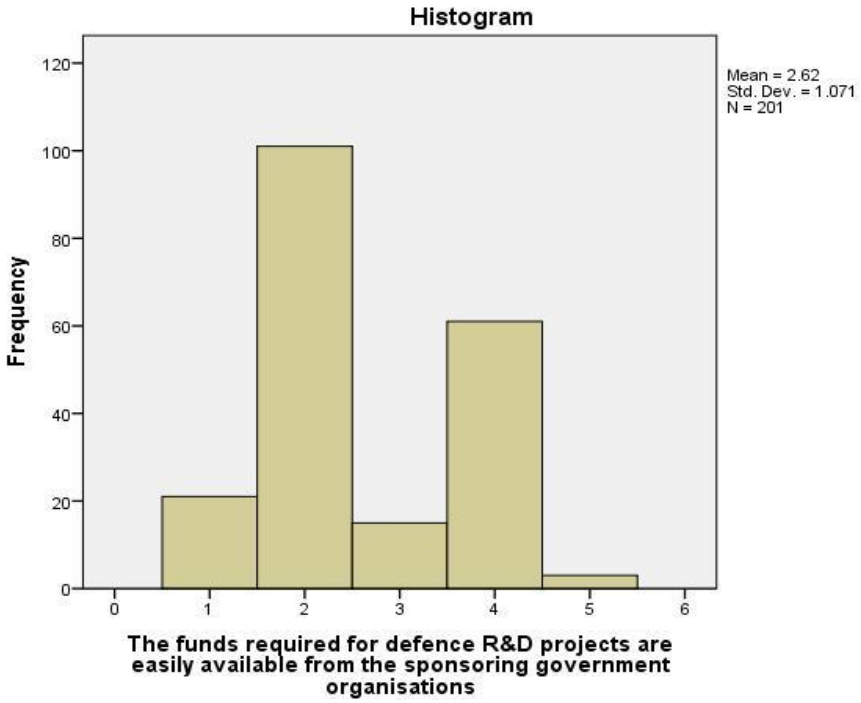

Figure 6 : Frequency Histogram Construct 1

(ii) Inference. The funds are not available from the government/ sponsoring agencies.

(b) **Construct 2 – Industrial License.** The issue of obtaining Industrial License from Govt was captured by the question "***The present procedure of getting the requisite license permission for setting up a R&D facility for defence is simple***". The analysis of responses is as follows-

N	Valid	201
	Missing	0

Mean	2.30
Median	2.00
Std. Deviation	.714
Variance	.510
Range	3
Minimum	1
Maximum	4

Table 16 : Descriptive Analysis - Construct 2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	20	10.0	10.0	10.0
	Disagree	111	55.2	55.2	65.2
	Neutral	60	29.9	29.9	95.0
	Agree	10	5.0	5.0	100.0
	Total	201	100.0	100.0	

Table 17 : Frequency Analysis - Construct 2

(i) As seen from the above percentage distribution of the responses, around 65% respondents Disagreed / Strongly Disagreed while only 5% agreed that the process of getting industrial licenses for defence manufacturing or R&D is easy. The same is depicted with the help of the Histogram below.

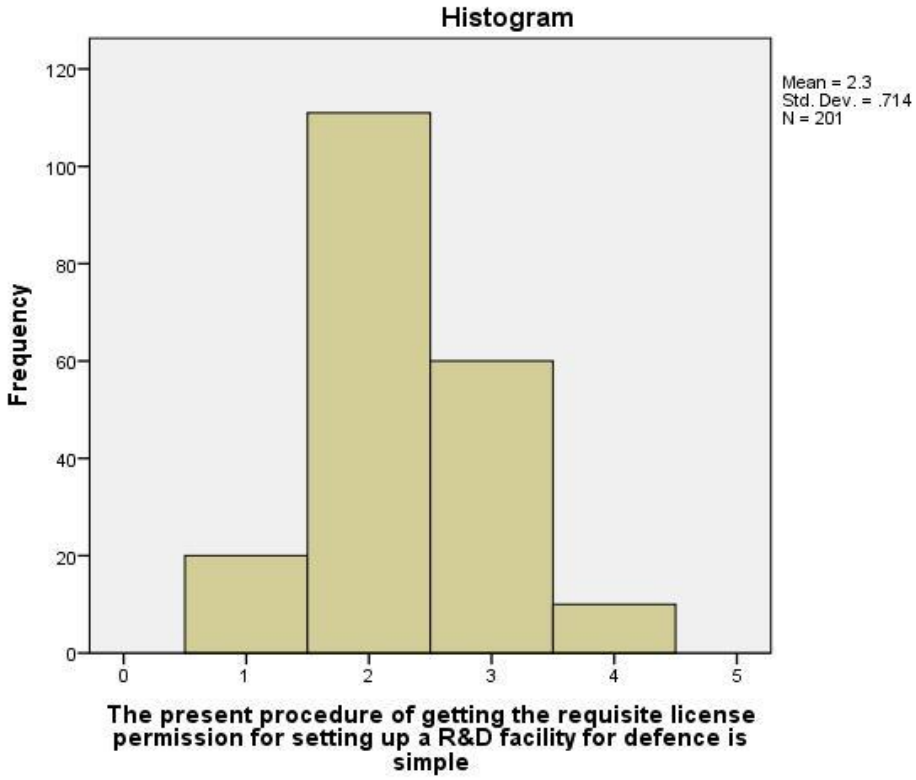

Figure 7 : Frequency Histogram Construct 2

(ii) **Inference. It is not easy to get the industrial licenses for defence manufacturing or R&D for a private industry.**

(c) **Construct 3- Technical Knowledge.** The issue of availability of technology roadmap was captured by the question *"**Information on future technological requirement of the defence forces is readily available to the private R&D agencies***". The analysis of responses is as follows-

N	Valid	201
	Missing	0
Mean		2.42
Median		2.00
Std. Deviation		1.017
Variance		1.034
Range		4
Minimum		1
Maximum		5

Table 18 : Descriptive Analysis - Construct 3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	23	11.4	11.4	11.4
	Disagree	122	60.7	60.7	72.1
	Neutral	10	5.0	5.0	77.1
	Agree	41	20.4	20.4	97.5
	Strongly Agree	5	2.5	2.5	100.0
	Total	201	100.0	100.0	

Table 19 : Frequency Analysis - Construct 3

(i) As seen from the percentage distribution of the responses, around 72% respondents Disagreed / Strongly Disagreed while only 22% Agreed that the information details of the future technological requirement by the defence forces is easily available to the private industries. The same is depicted with the help of the Histogram below.

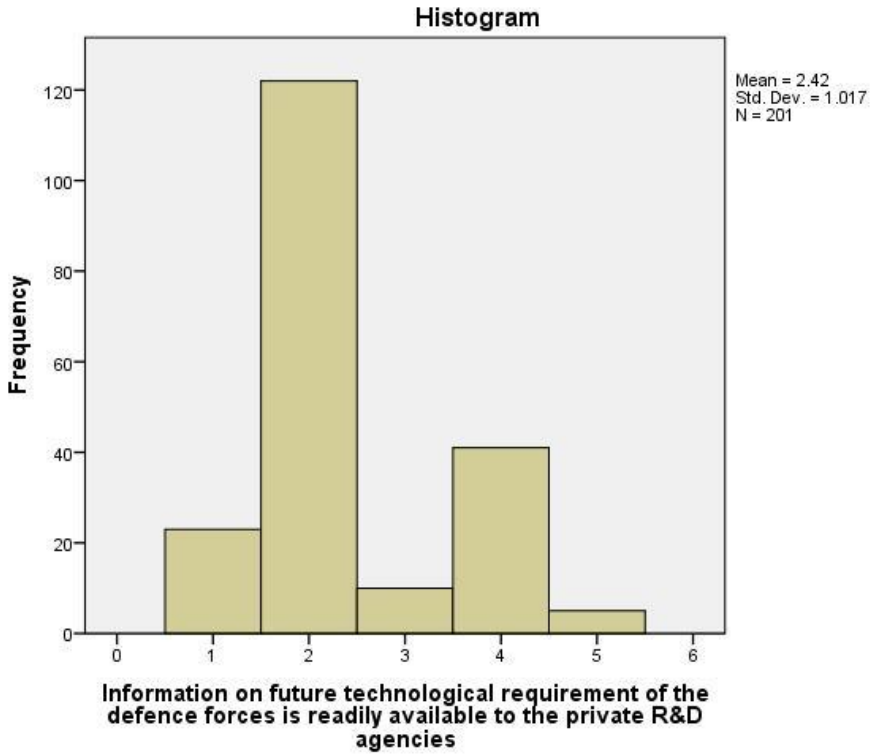

Figure 8 : Frequency Histogram Construct 3

(ii) **Inference. The information details of the future technological requirement by the defence forces is not available to the private industries.**

(d) **Construct 4- Ownership of Intellectual Property Rights.** The issue of IPR was captured by the question "The ownership of IPR by the govt post development is acceptable by the developing agency or research agency". The analysis of responses is as follows-

N	Valid	201
	Missing	0
Mean		3.04
Median		3.00
Std. Deviation		.899
Variance		.808
Range		4
Minimum		1
Maximum		5

Table 20 : Descriptive Analysis - Construct 4

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	5	2.5	2.5	2.5
	Disagree	59	29.4	29.4	31.8
	Neutral	63	31.3	31.3	63.2
	Agree	71	35.3	35.3	98.5
	Strongly Agree	3	1.5	1.5	100.0
	Total	201	100.0	100.0	

Table 21 : Frequency Analysis - Construct 4

(i) As seen from the above percentage distribution of the responses, around 32 % respondents Disagreed / Strongly Disagreed while an equal no of 36% Agreed that the ownership of IPR by the govt post development is acceptable by the developing agency or research agency. Surprisingly an equal no.of respondents have been neutral on the issue. The same is depicted with the help of the Histogram below.

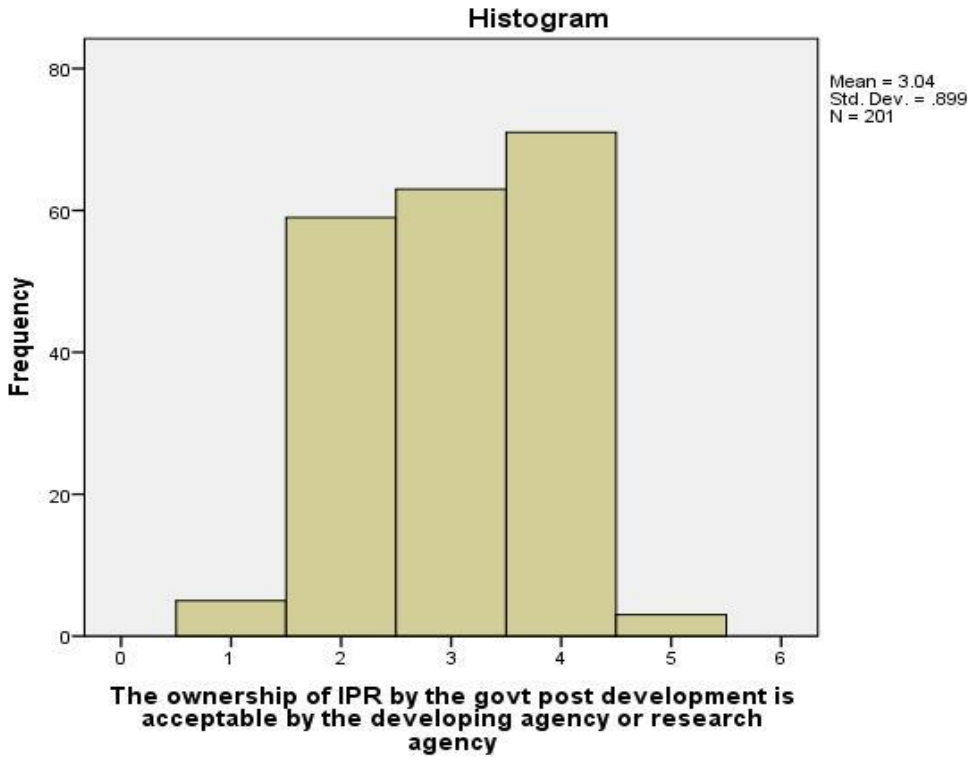

Figure 9 :Frequency Histogram Construct 4

(ii) **Inference. IPR ownership being a delicate issue the views are almost equally divided and hence any decision on such a matter would require in-depth thought process.**

(e) **Construct 5- Testing and Trials.** The issue of availability of Testing and Trial facilities was captured by the question "***Access to testing & trials facilities of DRDO labs will incentivize private sectors participation in defence R&D***".

The analysis of responses is as follows-

N	Valid	201
	Missing	0
Mean		4.14
Median		4.00
Std. Deviation		.717
Variance		.514

Range	3
Minimum	2
Maximum	5

Table 22 : Descriptive Analysis - Construct 5

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	10	5.0	5.0	5.0
	Neutral	9	4.5	4.5	9.5
	Agree	124	61.7	61.7	71.1
	Strongly Agree	58	28.9	28.9	100.0
	Total	201	100.0	100.0	

Table 23 : Frequency Analysis - Construct 5

(i) As seen from the above percentage distribution of the responses, only 5% respondents Disagreed / Strongly Disagreed while an overwhelming 91% Agreed that the access to testing & trials facilities of DRDO labs will incentivize private sectors participation in defence R&D. The same is depicted with the help of the Histogram below.

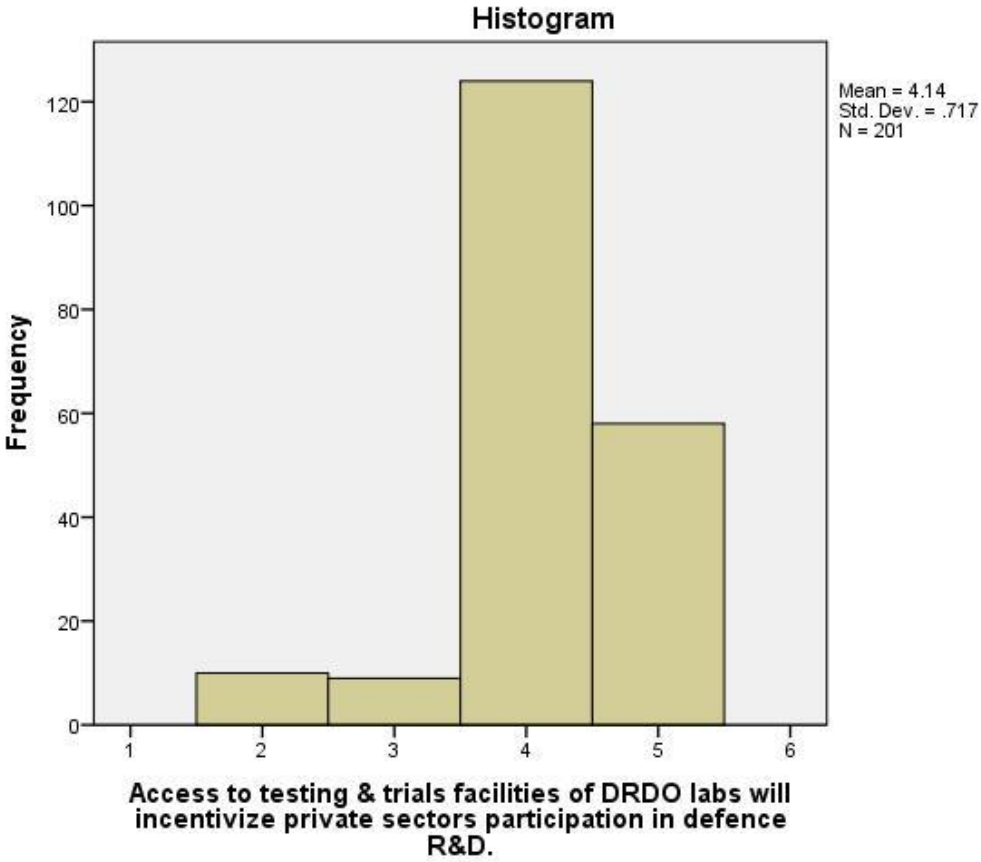

Figure 10 : Frequency Histogram Construct 5

(ii) **Inference. Access to testing & trials facilities of DRDO labs will incentivize private sectors participation in defence R&D.**

(f) **Construct 6- Exit Policy.** The issue of Exit Policy was captured by the question "***The reimbursement of R&D cost incurred by the private organization in partially successful (specifications of product meeting at least /more than 60-70% requirements) will encourage the private industries to take up defence R&D related project.***" The analysis of responses is as follows-

N	Valid	201
	Missing	0
Mean		3.80
Median		4.00
Std. Deviation		.856
Variance		.733
Range		4
Minimum		1
Maximum		5

Table 24 : Descriptive Analysis - Construct 6

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	3	1.5	1.5	1.5
	Disagree	18	9.0	9.0	10.4
	Neutral	26	12.9	12.9	23.4
	Agree	124	61.7	61.7	85.1
	Strongly Agree	30	14.9	14.9	100.0
	Total	201	100.0	100.0	

Table 25 : Frequency Analysis - Construct 6

(i) As seen from the above percentage distribution of the responses, only 11% respondents Disagreed / Strongly Disagreed while 77% Agreed that the ***The reimbursement of R&D cost incurred by the private organization in partially successful (specifications of product meeting atleast /more than 60-70% requirements) will encourage the private industries to take up defence R&D related projects***. The same is depicted with the help of the Histogram below.

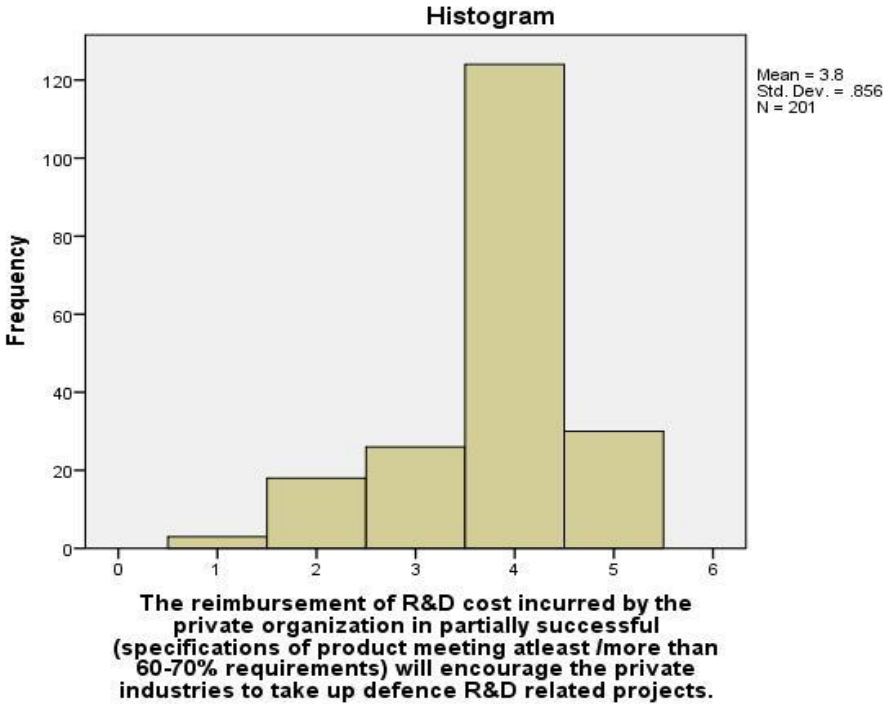

Figure 11 : Frequency Histogram Construct 6

(ii) **Inference**. The reimbursement of R&D cost incurred by the private organization in partially successful (specifications of product meeting atleast /more than 60-70% requirements) will encourage the private industries to take up defence R&D related projects.

Test for Normality

5.18 Subsequently the test for Normality were conducted for the constructs and the results are enumerated in succeeding paragraphs.

(a) **Construct 1- Funding**

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
C1_mean	.090	201	.000	.980	201	.005

a. Lilliefors Significance Correction

Table 26 : Test of Normality

Descriptives

			Statistic	Std. Error
C1_mean	Mean		3.2698	.03194
	95% Confidence Interval for Mean	Lower Bound	3.2068	
		Upper Bound	3.3327	
	5% Trimmed Mean		3.2645	
	Median		3.2222	
	Variance		.205	
	Std. Deviation		.45278	
	Minimum		1.89	
	Maximum		4.56	
	Range		2.67	
	Interquartile Range		.56	
	Skewness		.136	.172
	Kurtosis		.811	.341

Table 27 : Test of Normality - Construct 1

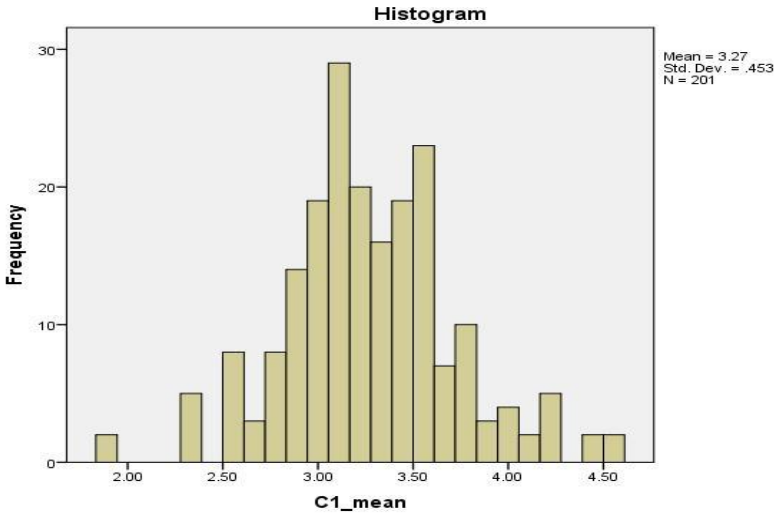

Figure 12 : Frequency Histogram Construct 1

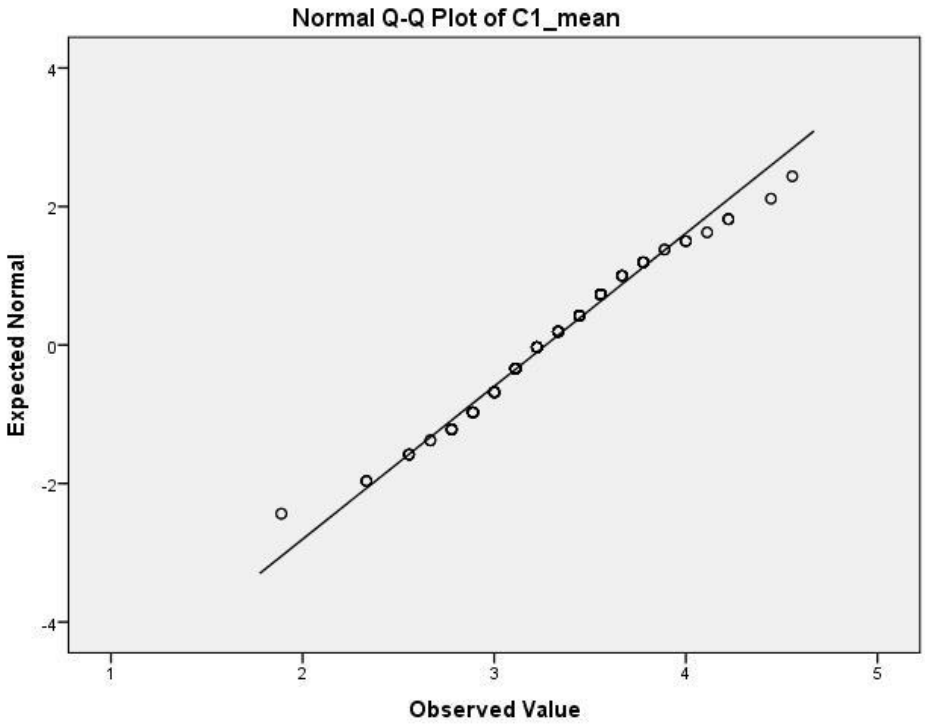

Figure 13 : QQ Plot Construct 1

(b) **Construct 2- Industrial Licensing**

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
C2_mean	.195	201	.000	.932	201	.000

a. Lilliefors Significance Correction

Table 28: Test for Normality - Construct 2

Descriptives

			Statistic	Std. Error
C2_mean	Mean		2.9664	.02441
	95% Confidence Interval for Mean	Lower Bound	2.9183	

		Upper Bound	3.0146	
	5% Trimmed Mean		2.9793	
	Median		3.0000	
	Variance		.120	
	Std. Deviation		.34613	
	Minimum		2.00	
	Maximum		3.50	
	Range		1.50	
	Interquartile Range		.50	
	Skewness		-.362	.172
	Kurtosis		-.332	.341

Table 29 : Test of Normality - Construct 2

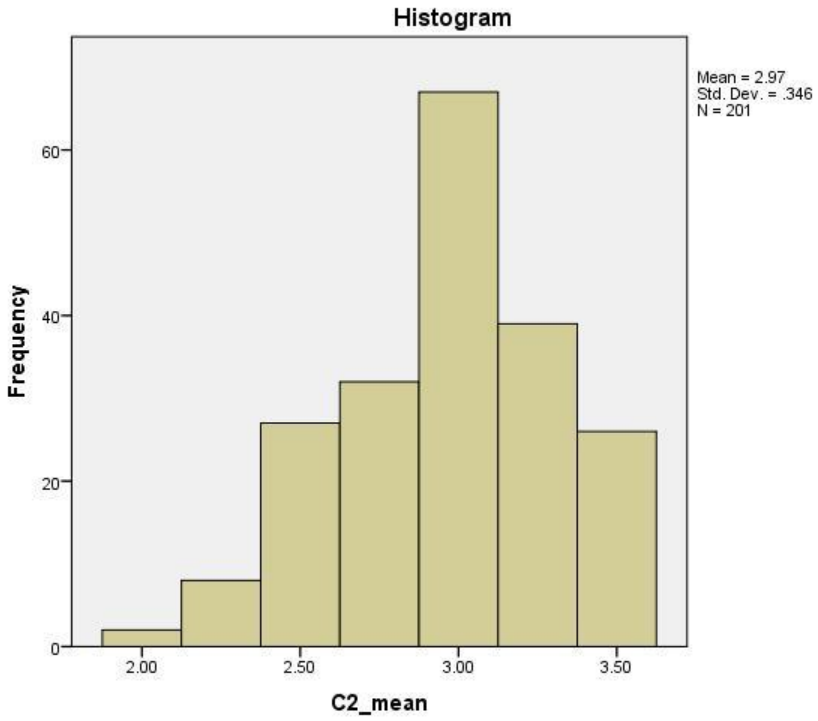

Figure 14 : Frequency Histogram Construct 2

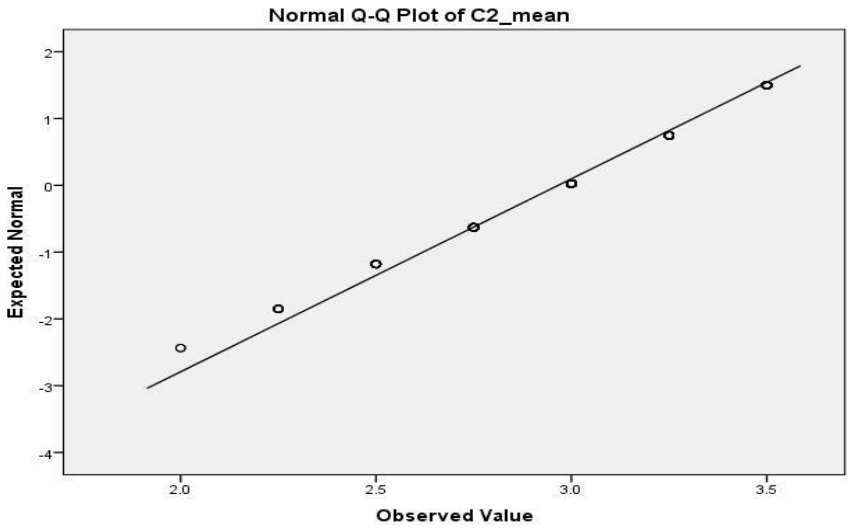

Figure 15 : QQ Plot Construct 2

(c) **Construct 3- Technological Knowledge**

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
C3_mean	.130	201	.000	.971	201	.000

a. Lilliefors Significance Correction

Table 30 : Test for Normality Construct 3

			Statistic	Std. Error
C3_mean	Mean		3.5614	.02895
	95% Confidence Interval for Mean	Lower Bound	3.5043	
		Upper Bound	3.6184	
	5% Trimmed Mean		3.5682	
	Median		3.5000	
	Variance		.168	

	Std. Deviation	.41041	
	Minimum	2.33	
	Maximum	4.50	
	Range	2.17	
	Interquartile Range	.50	
	Skewness	-.273	.172
	Kurtosis	.529	.341

Table 31 : Test for Normality Construct 3

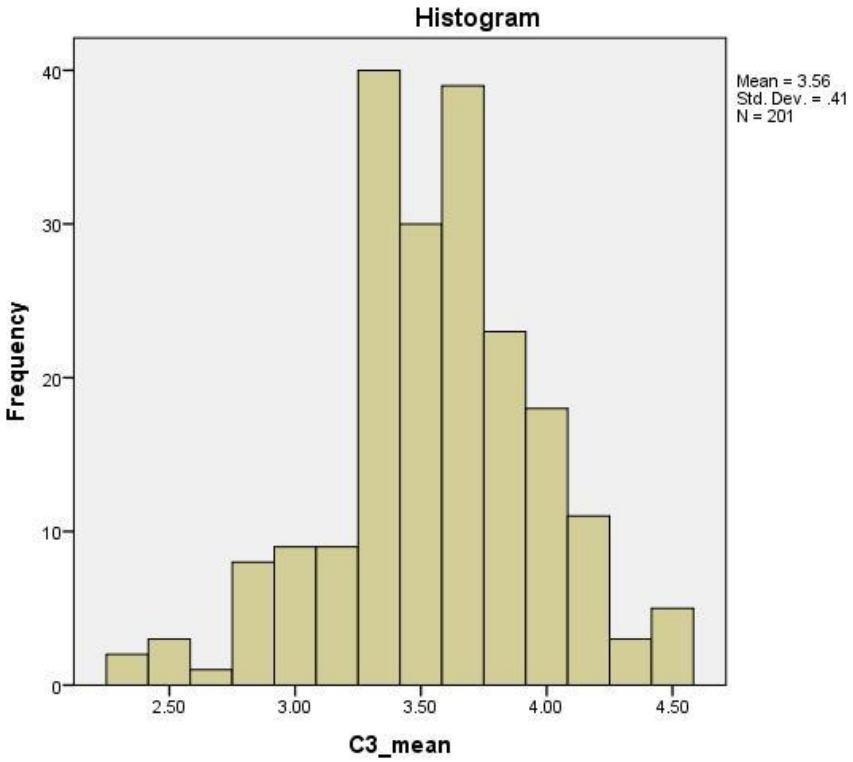

Figure 16 : Frequency Histogram Construct 3

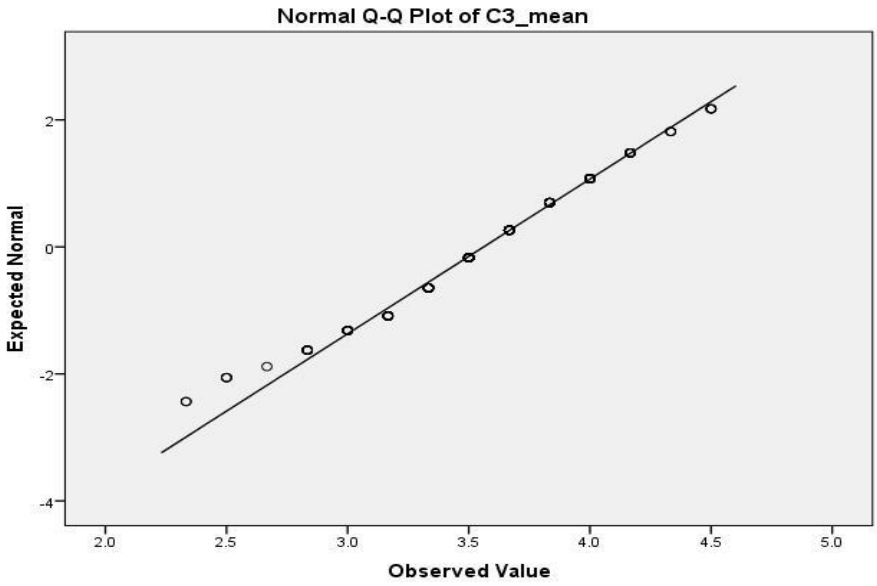

Figure 17 : QQ Plot Construct 3

(d) Construct 4,5,6 - IPR, Testing & Trials and Exit Policy

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
C456_mean	.081	201	.003	.975	201	.001

a. Lilliefors Significance Correction

Table 32 : Test for Normality Construct 4,5,6

Descriptives

			Statistic	Std. Error
C456_mean	Mean		3.5478	.02323
	95% Confidence Interval for Mean	Lower Bound	3.5019	

	Upper Bound		3.
	5% Trimmed Mean		3.
	Median		3.
	Variance		
	Std. Deviation		.3
	Minimum		
	Maximum		
	Range		
	Interquartile Range		
	Skewness		
	Kurtosis		

Table 33 : Test for Normality Construct 4,5,6

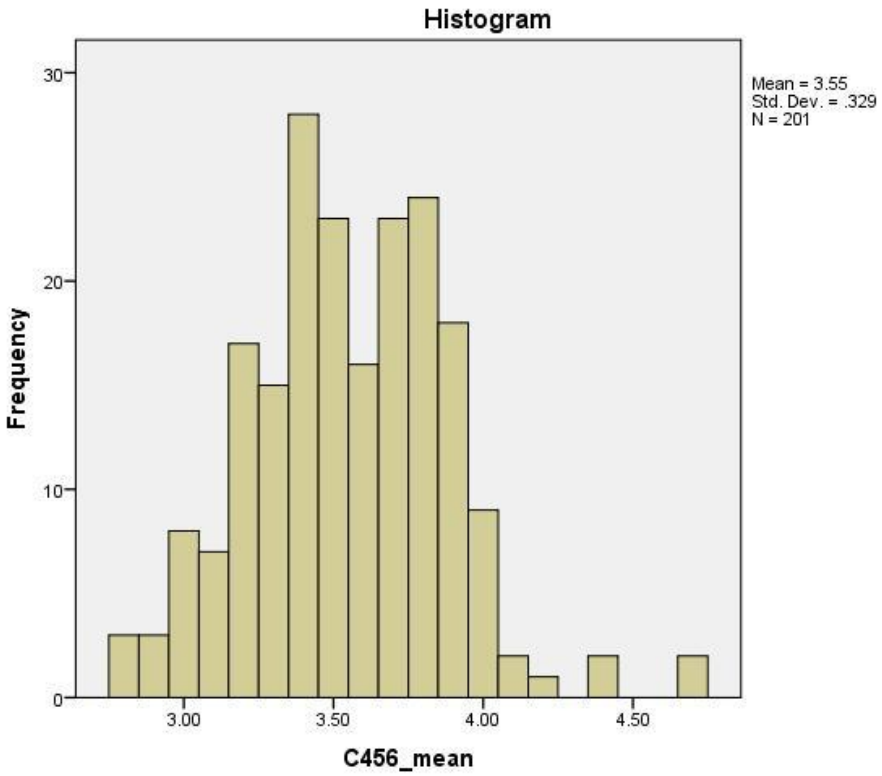

Figure 18 : Frequency Histogram Construct 4,5,6

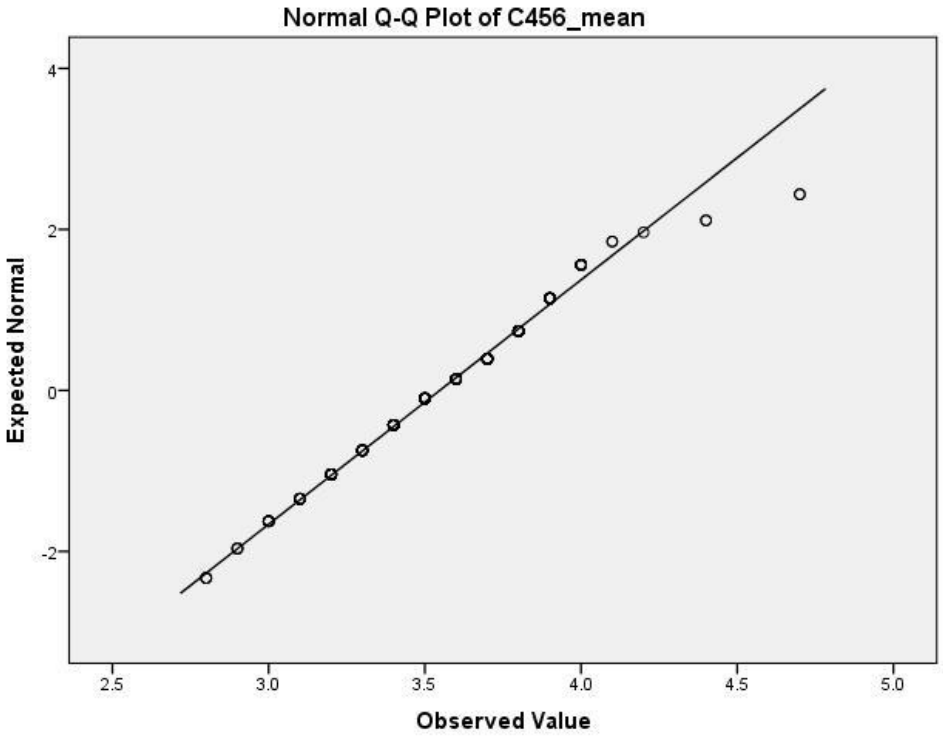

Figure 19 : QQ Plot Construct 4,5,6

5.19 **Inference**. Though the P value above is less than .05 for most of the constructs, signifying that the data may not be Normal. Given the sample size constraints for the research, the data can be considered as Normal.

Non-Parametric Test

5.20 The Non-Parametric Test has also been carried out on the construct score for all the constructs. The output or the same is shown below. As the LoS is LESS than 0.05 in all cases, the Null Hypothesis can be **Rejected**.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The categories of The funds required for defence R&D projects are easily available from the sponsoring government organisations occur with equal probabilities.	One-Sample Chi-Square Test	.000	Reject the null hypothesis.
2	The categories of The government is ready to fund defence R&D projects. occur with equal probabilities.	One-Sample Chi-Square Test	.002	Reject the null hypothesis.
3	The categories of The govt rules permit forming consortium of firms to bid for defence R&D projects occur with equal probabilities.	One-Sample Chi-Square Test	.043	Reject the null hypothesis.
4	The categories of Loans for defence R&D are easily available from the financial institutions. occur with equal probabilities.	One-Sample Chi-Square Test	.000	Reject the null hypothesis.
5	The categories of The present procedure of getting the requisite license permission for setting up a R&D facility for defence is simple occur with equal probabilities.	One-Sample Chi-Square Test	.000	Reject the null hypothesis.
6	The categories of Most of the firms involved in R&D projects should be co-Located so that the technology and expertise available with one could be shared by the other. occur with equal probabilities.	One-Sample Chi-Square Test	.000	Reject the null hypothesis.
7	The categories of Information on future technological requirement of the defence forces is readily available to the private R&D agencies occur with equal probabilities.	One-Sample Chi-Square Test	.000	Reject the null hypothesis.
8	The categories of The delay encountered in testing and trials of the product does not lead to obsolescence of the technology occur with equal probabilities.	One-Sample Chi-Square Test	.006	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
9	The categories of The Defence Research and Development Organisation (DRDO) interacts with private industries whilst conceiving the futuristic requirements of the defence technology. occur with equal probabilities.	One-Sample Chi-Square Test	.008	Reject the null hypothesis.
10	The categories of The firm bidding for R&D projects must have core expertise in the field of research. occur with equal probabilities.	One-Sample Chi-Square Test	.000	Reject the null hypothesis.
11	The categories of In case of any defence exhibitions overseas, it should be mandatory for all Tier 1 companies to exhibit products developed by Indian SMEs/MSMEs to give greater visibility and encourage future contribution by these smaller companies. occur with equal probabilities.	One-Sample Chi-Square Test	.002	Reject the null hypothesis.
12	The categories of The ownership of IPR by the govt post development is acceptable by the developing agency or research agency occur with equal probabilities.	One-Sample Chi-Square Test	.001	Reject the null hypothesis.
13	The categories of The govt must allow the technology to be exported or civil use of the same occur with equal probabilities.	One-Sample Chi-Square Test	.000	Reject the null hypothesis.
14	The categories of IPR ownership must be with the firm and not with govt. occur with equal probabilities	One-Sample Chi-Square Test	.002	Reject the null hypothesis.
15	The categories of IPR if owned by the government must yield royalty for the design agency during the further production occur with equal probabilities.	One-Sample Chi-Square Test	.000	Reject the null hypothesis.
16	The categories of Most of the private firms have fully developed own Testing &Trials facilities occur with equal probabilities.	One-Sample Chi-Square Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
17	The categories of Access to testing & trials facilities of DRDO labs will not incentivize private sectors participation in defence R&D. occur with equal probabilities.	One-Sample Chi-Square Test	.002	Reject the null hypothesis.
18	The categories of A regular repeat order for year after year production of the accepted product allow the private industry to invest in R&D for further improvisations of technology. occur with equal probabilities.	One-Sample Chi-Square Test	.000	Reject the null hypothesis.
19	The categories of The present government policies allow a firm to exit a developmental project without any penalties occur with equal probabilities.	One-Sample Chi-Square Test	.000	Reject the null hypothesis.
20	The categories of The reimbursement of R&D cost incurred by the private organization in partially successful (specifications of product meeting atleast /more than 60-70% requirements) will encourage the private industries to take up defence R&D related projects. occur with equal probabilities.	One-Sample Chi-Square Test	.043	Reject the null hypothesis.
21	The categories of If the firm carrying out development / design projects becomes bankrupt, additional aid from the govt in salvation or facilitating takeover by another interested firm would encourage the firm to take risk of indulging in the defence R&D projects. occur with equal probabilities.	One-Sample Chi-Square Test	.013	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Figure 20 : Results of Non-Parametric Test for all Constructs

5.21 **Inference**. ***THE NULL HYPOTHESIS CAN BE REJECTED***

INPUTS AND IMPRESSIONS FROM THE FUNCTIONERIES

5.22 Besides survey intervention above, efforts were made to gather inputs from functionaries from executive side and industry with the view to obtain more subjective grasp over the issue and also be able to provide some cogent recommendations. The views expressed across constructs above have been appended in succeeding paras.

5.23 To ensure that larger number of companies participates in the process of defence manufacturing in the private sector, and the SP maintains focus on a core area of expertise, only one SP generally be selected per segment. Across four verticals of Fighter Aircraft, Helicopters, Submarines and AFVs; one or at best two SPs be selected with adequate tech and financial background to work towards not only towards current requirement but right upto replacement of the current inventory. **This will encourage the select industry to bring in requisite capital, organisation, enterprise, technology from the long term perspective thus managing risk of a 'going concern'.**

5.24 The SPs, in the present scheme of things, are not substitutes for the inefficient DPSUs and OFs; rather, they are visualised as poor cousins of state-owned entities. This is amply clear from the policy document, which gives liberty to the MoD to buy items from the DPSUs/OFB subject to their capacity constraints. In other words, only when the DPSUs/OFB are not able to deliver within a stipulated timeframe (because of their overflowing orders), SPs would be considered for contract execution. This is a highly inefficient way of protecting state-owned entities whose inefficiency and poor functioning have so far been the main reason for India's poor record in attaining self reliance. How does private industry manage or mitigate this huge risk?

5.25 Any preferential treatment to DPSUs/ OFs takes away steam from the very thought of SP concept. Scorpion Submarine program was awarded to MDL in 2005 for delivery of six submarines between 2012-15. While first submarine is inducted in 2017, the program is delayed by more than five years with cost over run of Rs 6000 Cr. **MDL order book, as per statement of CMD, MDL on 08 Feb 16 was Rs 83000 Cr with reported annual turnover of Rs 4121 Cr only in 2015-16. Simple calculation shows that the time lag itself with this huge order book is close to whopping 20 years.** Quoting from the policy document-'Strategic Partnerships seek to enhance indigenous defence manufacturing capabilities through the private sector over and above the existing production base. Keeping this broad objective in view, MOD may consider the role of DPSUs/OFB at the appropriate stage(s) keeping in view the order book position, capacity and price competitiveness.' However, MDL has now approached MoD for including it as SP for P-75(I) program which it would execute with Naval Group of India. MDL must prove maturity of its organizational structures and processes before it qualifies for SP at the cost of more enthusiastic

private conglomerate. **There is no way the private industry can manage or mitigate this risk of preferential treatment.**

5.26 Incidentally, the number of SPs recommended for selection is the same as the number of companies identified under the Raksha Udyog Ratna (RUR) scheme, which was first suggested by the Kelkar Committee report of 2005 but never implemented due to political inertia. In what could possibly become a more radical measure from the point of view of defence acquisition. **There is a definite requirement of creation of an independent regulator and a specialised wing in the MoD to deal exclusively with the chosen SPs. These two measures, if found acceptable by the government, will end a major risk of trust gap that has hitherto existed between the MoD and the private sector.**

5.27 The policy document has limited the participation of SPs to 'Buy and Make' contracts involving transfer of technology. In other words, SPs are not supposed to get preferential treatment for executing the crucial 'Buy and Make (India)' and 'Make' contracts. **Given that capability creation and its nurture under the latter two categories are more critical from the self-reliance point of view, it would have been prudent for the principle of Strategic Partnership to be extended to these as well thereby obviating the risk of short on orders in the selected vertical.**

5.28 The lack of institutional capacity and ability to guide the new process to its logical conclusion is a serious concern. In the past, several promising measures, especially those connected with the 'Make' and 'Buy and Make (Indian)' procedures, have failed to yield the desired results because of these shortcomings. Although the new Chapter VII of DPP talks of "an appropriate institutional and administrative mechanism" besides "adequate expertise in relevant fields like procurement, contract law and ToT [Transfer of Technology] arrangements", much would depend on how they unfold. **Needless to say, it is the lack of reforms in the structures and decision-making processes which is the major risk factor for SP.**

5.29 Policy document directs selection of SP and OEM both thereby reducing the whole exercise to 'Match Making' rather than leveraging enterprise of private industry. In the proposed way, all SPs will be approaching more than one or all OEMs therby not creating a maze but also giving huge options to foreign OEMs defeating the very aim of empowering own industry. **In the current format, whole exercise resembles 'Buy & Make (Global) in ways more than one.**

5.30 Bureaucratic delays are endemic to all three (high tech) 'Make' projects offered to private players over a decade ago. Incidentally, 'Make' projects go a step beyond even the government's Make in India flagship mission because here the MoD funds research and creates proprietary defence systems. The Rs 70,000 crore Battlefield Management System (BMS)-meant to seamlessly link all of the army's formations; armour, artillery and infantryhas been shelved

because of **lack of funds**. The Rs 18,000 crore Tactical Communication Systems (TCS)-which will provide communication links for offensive formations when they are in enemy territory-has been pending a decision at the last stage, the Cabinet Committee on Security, since last year. And the FICV is yet to get to even the project development phase with private industry having spent huge sums of money towards development of prototypes which have been displayed in multiple Defence Expos. Its more than a decade that we have been working at this project. The government's initiative for the defence industry participation has not taken off for a variety of reasons-the biggest of which is the inability to launch high-profile indigenous projects like the FICV, BMS and TCS. Industry is definitely averse to such risks of fund infusion, time delays and uncertainities.

5.31 Highlighting the lack of defence ministry commitment to the "Make" procedure that was first proposed by the Kelkar Committee in 2005-06, is the lack of funding for "Make" category projects since then. Not a penny was spent on "Make" projects in two years (2012-13 and 2015-16). And the highest allocation this category ever received was in 2016-17: ~184 crore, a laughable 0.25 per cent of the capital budget. There has to be a long term financial commitment along with TPCR thereby enhancing the surety and risk appetite of private industry.

Budgetary allocations for "Make" procedure

(Rs crore)

	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Allocated	Nil	118.32	89.22	1.00	35.71	144.21	Nil	44.63
Spent	81.95	29.10	Nil	28.86	0.50	Nil	183.79	???

(Source: Finance Ministry budget documents)

5.32 The projects included in the latest list are a far cry from big projects like the Futuristic Infantry Combat Vehicle (FICV), Tactical Communication System (TCS) and Battlefield Management System (BMS), which were conceived under this category in the years following its adoption in 2006 and much before notification of the 2016 list. The inability to conclude a single prototype development contract in the last list has chastened MoD as the new list, as indeed the earlier list of 23 projects, comprises projects that are apparently less ambitious and, therefore, have a better chance of showing some tangible results. Lowering the benchmark itself may not lead us to intended goal of 'Self Reliance'.

5.33 The Avro-replacement programme of the Indian Air Force (IAF) started with the suggestion that it be placed in the 'Buy (Global)' category. During a presentation by the Air Headquarters to the then Secretary (Defence Finance), it was suggested that the programme had

the potential of being placed in the 'Buy and Make (Indian)' category by roping in the private sector. The suggestion was received well by the IAF team, led by the then Deputy Chief of Air Staff. The suggestion to categorize the proposal as 'Buy and Make (Indian)', however, ran into difficulty as there are no ***guidelines*** that could be followed to nominate the Indian companies from the private sector to whom the Request for Proposal (RFP) could be issued. After further rounds of discussions, it was decided that the proposal could be placed under the 'Buy and Make' category. That gave rise to another problem. In 'Buy and Make' category, there is a requirement of nominating an Indian Production Partner (IPP) but there are no ***guidelines*** that could be invoked to nominate an Indian company from the private sector. It was then mooted to let the foreign Original Equipment Manufacturer (OEM) select the IPP. Two specially constituted committees, the first headed by the Scientific Advisor to the Defence Minister and the other by the Additional Secretary in the Department of Defence Production, went into this issue before a modus vivendi could be worked out. **We have refused to learn lessons; even today the guidelines for selection of SP have not yet been finalised except Naval component.**

5.34 The Department of Defence Production under the Ministry of Defence has cleared 31 projects and has given them in-principle approval under the Make-II scheme. Make-II is an industry-funded scheme. This seems to be offloading your losses to industry without any commitment. **This may work out initially but if system fails to follow up with supply orders, industry may not like to proceed with such risks always.**

5.35 MoF notification on Custom duty dated 30/04/2015 and MoF notification on Excise duty dated 30/04/2015 have had major ramifications for the industry. Some germane aspects include:-

(a) DPSUs/OFBs will continue to enjoy the benefit of BCD exemption (ranging from 7.5% to 15%) on their imports for supply to MoD, which will give them a price advantage of 7.5% to 15% over private players.

(b) Foreign OEMs will continue to enjoy the complete exemption from payment of Import Duty [Basic Customs Duty (BCD) + Countervailing Duty (CVD) + Special Additional Duty (SAD)], which gives them the price advantage of around 28% over domestic suppliers including DPSUs/OFBs.

(c) The Foreign OEMs will also take advantage of import duty exemption and import equipment / machinery, which would be required by them for manufacture of the defence items to be supplied to GoI, whereas the Indian company has to import such equipment with payment of import duty requiring more investment. This will again adversely affect the economic efficiency of this sector.

(d) The Demands for Grants are approved on the Gross Expenditure, and not Net Expenditure. This implies that Taxes paid by MoD as part of the purchase cost would be

budgeted within the allotted Gross Expenditure and tax refunds (should it be notified) would go to the Consolidated Fund of India. This pre supposes that the MoD has the ability to prepare and follow up with the tax authorities for refunds which itself are unlikely to be credited within the same financial year. Thus, MoD would procure lesser quantity of items as domestic procurement since these taxes and duties have to be absorbed within the allotted gross expenditure, thus overall less kitty for private industry to eye for.

(e) **Risk mitigation on taxes is sought for the growth of the Indian defence industry on two aspects**:-

(i) First, provide a level playing field between the Public, Private and Foreign OEMs by rationalization of indirect taxes such as Central Excise, Customs Duty and Service Tax and exemption from duty on purchase / import of inputs/ raw materials / capital goods etc. for all domestic manufacturers so that the tax levies on manufacturing is same for all players.

(ii) Second, promote creation of additional industrial units to boost manufacturing. Benefits under the IT Act on the same lines as has been made available to other core sectors are yet to be extended to the Defence Sector. Also of note is that in the proposed Goods and Service Tax defence products and services supplied to the MoD need to be classified under Zero Rate.

(f) Deemed Exports The present taxation regime and the Foreign Trade Policy does not aid in promoting "Make in India" since the inverted tax and duty structure makes direct imports cheaper than manufacturing in India. Considering the indigenous content by way of local production and value addition to be about 30% of the product base cost and the balance 70% being import content, the table below summarizes the final cost to the MoD under different scenarios and highlights the disadvantageous tax regime for indigenous manufacturing:-

Acquisition Model	Base Cost	Taxes & Duties	Delivered Cost	Remarks
Current Options				
Buy Global	100.00	0.00	100.00	No taxes and duties applicable
Buy and Make in India in Domestic Tariff Area	100.00	38.09	138.09	All taxes and duties applicable
Buy and Make in India from SEZ location	100.00	29.50	129.50	Only Customs duty applicable for sale to MOD being in DTA
Proposed Option				
Buy and Make in India from Domestic Tariff Area with Deemed Exports Benefit under FTP	100.00	14.88	114.88	Avail Benefits under Deemed Exports
Buy and Make in India from Domestic Tariff Area with Deemed Exports Benefit under FTP and Section 5 of Central Sales Tax Act	100.00	0.00	100.00	No taxes and duties applicable

5.36 As discussed above there are major risks associated with funding, organizational structures and guidelines aspects. In the chapters to follow, one has endeavored to work out a financial model for long term capability development including R&D (also inspired by the lecture of Mr Kohli, FADS (Retd)), a program management structure and a capability maturity model.

CHAPTER- 6

A Program Management Structure for Defence Acquisitions

6.1 In accordance with the provisions of DPP 2016, the acquisition of weapon systems and equipment for the Armed Forces flows from the LTIPP over 15 years duration. The LTIPP is translated into specific assets to be acquired, in the form of Services Capital Acquisition Plan (SCAP), covering a five year period. A list of equipment and weapon systems required to be procured immediately is listed in the form of the Annual Acquisition Plan (AAP). The AAP covers a period of two years and rolls over to the next financial year derived from the SCAP. The AAP is prepared and prioritised in consonance with the budget allocation for capital acquisitions. Presently the AAP 2018-20 is in vogue and consists of schemes from the approved Army SCAP 2017-22. Presently, no project management is carried out in the acquisition in the services except in the case of a 'Make' procedure where a loosely constituted IPMT has been prescribed in the DPP. However till date not a single substantial 'Make' case has fructified since its inception.

6.2 Bernard Gray reforms (Gray, October 2009) to the acquisition system of United Kingdom(UK) affected in 2009 covered in great detail the entire spectrum from capability building to acquisition of equipment. The Bernard Gray report specifically recommends that the delivery arm of the UK MoD i.e. the Defence Equipment and Support (DE&S) among others needs greater levels of skills in programme and project management. The report brings out that the DE&S management structure lacks focus on the core area of project management for equipment procurement and support and that the organisation is not structured in the most suitable way to deliver a programme of 1.2 Billion pounds per annum on equipment procurement and support. The report says that the head of the project organisation for acquisition should have extensive experience in running project based organisations of similar size and complexity. Enforcing such a requirement renders unlikely that such an individual could be recruited from within the Armed Forces. A similar review for the ADF was carried out in 2008 which

specifically pointed at inadequate project management resources in Capability Development Group (CDG) as one of its major concerns. Project management the world over has been established and accepted as the only credible way for efficient capital acquisition which unfortunately finds no presence in the Indian system. Little wonder then, that the Indian system has failed to meet the aspirations of the users. In fact all stages of the existing DPP are most amenable and can easily be aligned to a typical project as is also being followed in advanced Armies. Establishment of a defence capability can be broken into four phases *viz.* the *concept* phase, the *planning* phase, *execution* phase and the *transfer* phase which correspond to various phases of a typical project.

6.3 The apex of the current procurement structure implied by the DPP is the DAC headed by the RM and in which the RRM, Service Chiefs, all secretaries of the MoD and the Deputy Chief of Integrated Defence Staff (DCIDS) are members. The body akin to a company board of directors holds significant strategic and financial authority vested in it. The three main functional verticals involved in establishment of capability for the Armed Forces are the Defence Production Board controlling all DPSUs and OFBs, the Research & Development (R&D) Board controlling DRDO and the Defence Procurement Board which encapsulates all specialist functions of the three services and IDS required for carrying out procurements. The defence production board owns the production function for indigenous and license builds, the R&D board owns the National Defence Technology road map and the procurement specialist functions viz contracts, commercial and technical or operational are owned by the Defence Procurement Board. This structure is a functional organisational structure with limited formal cross-functional interactions except when specifically called for by the DPP in the case of categorisation of proposals viz. SCAPCHC and the SCAPCC. All project decisions are centralised with at the organisational apex and the bandwidth available at that level would therefore be limited. A failure by one of the sister boards, i.e. Production board or the R&D board to deliver a capability on time is only resolved at

the organisational apex with no cross communication or collaborative problem solving at the functional level. The key point to note is that, the organisational apex is ultimately responsible for any failure in schedule or cost of establishment of a capability. *There is a pressing need to formalise organisational structures that would own programme, portfolio and project management functions. Re-organisation of specialist functions within each functional vertical for each of the specialities i.e land, sea and air systems would greatly help in developing groups of excellence for joint capability development structures as well as providing effective functional support to a projectised organisation through a project management vertical.* The project management vertical is not an entirely new concept in the DPP which mandates Integrated Project Management Teams (IPMT) in the ship building guidelines and 'Make' procedure of the DPP. IPMTs are cross-functional teams that are formed for management of individual or small groups of homogenous projects. These teams typically function under the direct control of the programme management groups of each service and are required to create project plans authorising detailed milestones to be met in a given timeframe.

6.4 **Programme Management in Corporate Sector.** Corporate sector in India is driving highly complex projects worth millions of dollars annually using state of art technology and project management best practices. A typical multinational vertical with a single domain specialisation would be handling approximately 200 projects annually with an outlay of USD $15 billion which roughly equals the Rafael deal. Any new project undertaken by a corporate entity in India today is first examined by an apex committee akin to a Project Initiation Forum (PIF). The PIF consists of subject matter experts (SMEs) from different verticals such as telecom, banking, finance, and media. The PIF accords the **first pass** to a project post initial risk analysis. DPP 2016 is also silent on risk management in all categories of acquisition except for a fleeting mention in the case of '*Make Procedure'.* In capital acquisitions, there are a variety of external and internal risk factors that need to be assessed. A precondition to overall risk management is risk

assessment. Risk assessment involves analysing the probability, the impact, and the effect of every known risk on the achievement of established objectives, as well as the corrective action to take should that risk occur. The risk assessment is therefore a prerequisite for determining how the risks should be managed and mitigated. Mitigation seeks to put measures in place to lessen the severity of a risk event, should that event occur. To realise the maximum benefit of risk management, the management and communication of risks needs to be an integral part of existing procurement and organisational functions. Thereafter the project is allotted to a programme manager rather than the domain specialist hence making the programme manager responsible for execution of a particular project from the very beginning. The programme manager in turn has a number of project managers under him and assigns this particular project to one of them. The project manager so detailed interacts with the all the verticals required in the project called the Delivery Project Executives (DPEs) and ask them to assign resources namely Line function executives to fulfill the project requirements. Line function executives are assigned by DPEs who also work out detailed time and cost estimates, detailed risk analysis and detailed requirements of resources. The **second pass** approval is accorded somewhere at this stage. These line function executives will report to the project manager in addition to their vertical head thus ensuring a **projectised organisation** in place. In case there is a risk of time and cost over runs, the project manager will exactly know the problem and will resolve it. If the resolution is beyond the project manager the programme manager will be informed who will interact with the senior delivery manager of the concerned vertical for resolution and the escalation loop continues till the risk is mitigated. Mid - course corrections are carried out by the project team as the project progresses and milestones are charted through a in house software . These project management models are common place in India and seldom suffer time and cost over runs and is the only way to enhance the effectiveness of the defence capital acquisitions in India.

6.5 **Capability Programme Management in the Australian Defence Forces (ADF).** Capability development program of the ADF is an apt case study identical to Indian conditions as the ADF also sources a sizeable content of its high tech weapon systems ex import. Australia has one of the most evolved capability and acquisition management organisations in the form of the CDG and the DMO. Capability planning in the ADF has a life cycle that begins with the shortfall between what the government wants the ADF to achieve and the capacity of the ADF. This is then progressively translated into a new capability system or an upgrade of the existing system. The ADF on an annual basis presents a submission developed by the CDG to the government laying down the capability gap. The most concrete expression of the government priorities for development of ADF is the DCP, which unlike the Indian LTIPP is a duly costed ten year roll on plan of the yet unapproved capital acquisition projects. Before a project is included in the DCP, it is clearly defined as to what the project will deliver at what cost, and in what schedule as also the initial risk inherent with the project. CDG is responsible for informing the government of the capability, cost and schedule and the risk inherent in each project so that the government can take an informed decision. Prior to seeking entry into the DCP, formal agreement is documented on the cost schedule and capability requirements of the project as well as the *acquisition strategy*. This agreement is signed by the chief of the CDG and the capability manager which is usually a service chief and CEO of the DMO. The ADF devotes 10 to 15 percent of its project funds for complex projects before the first pass for detailed analysis and project definition. Risk analysis in the beginning would benefit from the initial investment in terms of technical risks, integration and commercial risks. Thereafter the capability is transformed into costed and defined requirements. The approval for acquisition of a capability is accorded by the government through a tailored *two pass* process which accords a greater rigour to high cost and technologically complex projects while simple projects are cleared in a lesser time frame. In the first pass, funding for approved options are fully analysed through detailed studies, analyses and industry studies and at this stage no commitment is given by the government to acquire the capability. Care is taken that most of

the capital acquisition are carried out off the shelf as in their experience setting requirements beyond that of “off the shelf” generates disproportionately large increases to cost, schedule and risk to projects. To facilitate accountability between stakeholders at this stage namely the CDG and DMO, IPMTs are formed and a draft Material Acquisition Agreement (MAA) is developed which reflects the expected capability required by the capability managers and the business acquisition strategy developed by the DMO. The MAA ensures that all stakeholders understand their respective responsibilities throughout the acquisition. This results in the DMO achieving most of its project before time. An unclassified version of the DCP is published every two years to inform the industry of the specific nature and size of each project. The DCP provides description and background, likely acquisition strategy, through life support considerations, planned year of government decision and entry into service, anticipated cost range and opportunities for Industry.

6.6 Capability building in tune with defence requirements is a vital activity for any nation. Capability building is typically carried out through inductions of equipment and training of personnel of the Armed forces. In order to ensure capability building is carried out in step with the national security strategy the introduction of the Defence Procurement Procedure (DPP) for capital procurements in 2006 was an important step. The aim of the procedure was to ensure that no capability (and therefore strategic) gaps was created between the nation and its threats by ad-hoc procurement practices which were followed up-to that time.

6.7 **Capabilty Development Executive in the Indian scenario.** Most modern defence forces have developed various models for planning and developing defence capability. These capability-based models work on a 'top-down basis' starting from strategic priorities, environment and doctrine, finally arriving at capability plans, which at the very outset, factor budgetary constraints at the highest level. The recent Ravindra Gupta Committee Report on "Defence Modernisation and Self Reliance" emphatically recommends the setting up of a Capability

Development Executive (CDE). The present 15 years Long Term Integrated Perspective Plan (LTIPP) is more 'an aggregation' of the Army, Navy and Air Force Plans, with no inter-service prioritization or jointmanship. In fact, it is more likely that it is the Finance Department which prioritizes schemes based more on funds availability, committed liabilities and likely cash outflows. LTIPP's linkage to National Security objectives is nebulous and MoD role more for 'approval' rather than as participant. The global experience has been that 'turf wars' prevent the Services from adopting jointmanship, voluntarily. Invariably, it has to be imposed on the Armed Forces, as was done in the USA in 1986, with the Goldwater Nichols Act. A suggested CDG for the IA is discussed in succeeding paragraphs.

6.8 The Capability Development Executive (CDE) should be headed by a three star Armed Forces Officer of the status of Army Commander (or equivalent from the three services; equivalent to a Secretary to the Govt of India) called Commander-in-Chief Capability Development Executive (CINCCDE). He would report directly to the RM. At the apex level of the organisation, to assist the CINCCDE, should be another Lt Gen (or equivalent)/Additional Secretary level appointment dealing with integration, strategic prioritization, budgeting and technology analysis called Chief of Strategic Priorities (CoSP). The appointment should be on a rotational basis amongst the three services as well as civil services. At the execution level, Capability Development Groups (CDG) will be formed under Lt Gens/Major Generals or equivalent from the three services who will be called Capability Development Managers (CDM). To ensure a joint development of capabilities, these will be formed on the basis of likely strategic environments for operations separately for China, Pakistan, Maritime Ops, UN PKO, Air Ops including Air Defence, OOAC ops, Counter Insurgency/Counter Terrorism (CI/CT) ops, NCW ops and capability integration ops. The CDGs will be staffed by a mix of Armed Forces and Civil Service officers including the three services, Civil Services, Finance, Costing, DRDO and DGQA. The service officers should have domain knowledge of respective fronts/operations being

handled by the CDGs. The detailed composition of each CDG can be worked out subsequently once the broad outlines of such an organisation are approved, in principle. The organisation will also have an SQR Development Group (SQRDG) with an industry interface which will generate SQRs based on approved capability plans. This will address the lacuna in the system and aid in improving the process of development of SQR. The tenure of appointments in the CDE should be adequately long to ensure continuity and building up of institutional knowledge.

6.9 The process of capability development will be a 'top-down' flow based on the strategic guidance provided by the Raksha Mantri's Operational Directive (RMOD). It would take into account budgetary constraints, except for some requirements which cannot be compromised whatever the cost (which must be spelt out in CDP). Also this may be the first step towards T1-L1 concept as acquisitions must be based on mix of Best Capability (Technical-T1) and Economy (L1 or lowest cost). This would entail initially arriving at a statement of desired capability vis a vis assessment of current capability. Thereafter the capability gaps would be identified and feasibility studies would be required to be carried out for defining capability development needs. The capability development plan will be finalized by each CDG with financial, technological and industrial vetting by experts. Thereafter the capability will be integrated and prioritized under the CoSP and thereafter it will be approved by CINCCDE who will further process it for approval by the RM. Once the capability plans and SQRs are developed, the material aspects are processed for acquisition as prevalent now as per the DPP through the 15 years Capability road map, DCAP and AAP. The non material aspects of capability development such as organisational issues, training, personnel management, infrastructure development and logistics etc will be undertaken by the respective Service HQ and IDS.

6.10 Defence capital acquisition is a system and not simply a process. Modernisation of defence forces is dependent on ability of a nation to build its capability and is a direct result of

Capital acquisition practices . Studies of organisational best practices to improve effectiveness suggest three focus areas viz structure, process and people. So far most attempts have been undertaken by addressing only the DPP. Aim is to look at:-

(a) **Process**. What ails the system as far as the acqn practices are concerned because of which the stated intent of DPP is not been achieved.

(b) **Structure**. Is the existing procurement organisational structure to ensure public accountability, transparency in operations, impartiality and self- reliance?

(c) **People**. The people dimension has been addressed to the extent of change management Implications due to a change in organisational structure.

6.11 **Planning *vs* Budgeting**. The Armed forces carry out their planning and obtain AoNs(Acceptance of Necessity) for as many schemes as desired with an indicative budget. There is no indication from the budgeting POV that each AoN will result in enhancement of combat capability on ground. No prioritization is accorded to the AoN by the Armed forces either based on budgetary resources / changed strategic priorities. To take an example, AoNs worth INR 1,17,830 Cr stood approved for 2015-16 however, the entire modernisation budget for 2015-16 was INR 75,148 incl 85-96 percent of committed liabilities. Hence there is a mismatch between planning , budgeting and acquisition and this results in a continuous gap between desired capabilities and budgetary commitments eventually making planning process irrelevant. This can be reversed if strategy drives planning, planning drives programs, programs drive budget and finally a streamlined program management ensures that the capability is delivered on time within the available budget. This system is being followed the world over especially in advanced Armies. The process of PPBE is briefly explained in succeeding paragraphs.

6.12 The defence planning and budgeting process are currently independent of each other. The armed forces are free to plan and obtain AoNs for as many schemes as desired. There is however no assurance from a budgeting points of view that each AoN will result in a contract, program

and a capability on ground. Similarly the armed forces are under no obligation to re-evaluate their proposal to examine the art of the possible and evaluate potential strategic gaps based on the budgetary commitment. Indeed the armed forces to do not even have to priorities their proposals and all pending AoNs could potentially be considered as priority “one” thereby confusing budget allocation. Budget allocation all pending scheme will almost certainly blows a strategic monetary hole in the nation’s finances that should ideally be a cause of concern for the military planners. This situation results in a continuously growing gap between desired capabilities and budgetary commitments eventually making the planning process irrelevant. This situation can be reversed if strategy drivers planning, planning drivers program, programs drive budgets and finally stringent program management ensures that capabilities are delivered on time and within budget every time. This is management parlance is called the Planning, Program, Budgeting and Executing (PPBE) process.

6.13 **PPBE Process**. Providing program traceability to the overall military strategy for each program is typically achieved by adopting the Planning, programming, Budgeting and Execution (PPBE) system. PPBE will serve to integrate strategy, program, financial planning and execution. A brief description of the PPBE process is enumerated below:-

(a) **Planning.** The planning phase of PPBE begins with the articulation of resource-informed national defence policies and military strategy by the strategic leadership. This articulation is referred to here as the Strategic Defence Planning Guidance (SDPG). This could be an elaborated document based on an evaluation of the threat perception thought a formal net assessment, which is continually monitored and refined through a strategic management process. This articulation is an essential part of the defence acquisition process and is the root document for the acquisition process.

(b) **Programming.** Typically an organisation such as the COSC links the planning and programming phases of the PPBE process. The programming phase begins

with each armed force, defence manufacturing unit and defence research agency writing a document usually named the Program Objective Memorandum (POM) for each proposed program that meets the strategic objective. The POM when complete will provide in detail the proposed budget (manpower and funding) die a typical period of five year. This document must also describe what is not fully funded, and the risk associated with the budget shortfall for review by the strategic leadership. Metrics for program success to enable effective monitoring and control of the program are als o developed during this phase. Marginal budget adjustment and potential strategic alternatives can then be chosen by the leadership (COSC) to integrate POMs from various agencies into an overall coherent Defence program. Un-resolved issues can be raised upto the level of the Defence secretary for closure allowing the finalisation of what is usually referred to as a Program Decision Memorandum (PDM) which has the same horizon of the SCAP. This document will provide the overall plan of action for a five-year period detailing all aspects of manpower, functioning, funding for this period.

(c) **Budgeting.** Budgeting phase is concurrent with the programming phase. Each service, manufacturing unit and defence research agency submits its budget estimate with its Program Objective Memorandum (POM). The integrated defence staff then converts their program budgets into a demand for grant along with justification. Typically the budget forecasts only the next two years, but with more detail than the POM. These suggestions are reviewed by analysis typically from Finance ministry, CAG etc to ensure that program funding matches current policy, that they are priced right and justified well to parliament. Typically, the analysis would write-up their questions during formal budget review hearings. After the hearings, each analyst prepares a Program Budget Decision (PBD) for each program that proposes financial adjustment to address Any issue or problems identified during the hearing. The program budget decision is then approved by

a competent authority such as the Raksha Mantri and the updated capital budget request to parliament is then finalized.

(d) **Execution**. This phase must start with the request for proposal and end with the successful completion of the entry into service phase of the capability. The primary objective of this phase is to ensure that the desired capability is delivered to the approved program cost and timelines. The phase is punctuated by constant reviews wherein the metrics developed through the programming phase help measure actual output versus expected performance. If the program misses its metrics, then the execution review may lead to recommendations to adjust the budget or programs so that it meets the desired outcomes. For this reason, the execution review of all ongoing programs are carried out concurrently with the program and budget review for new and proposed programs.

6.14 **Monitoring Metrics and Technology**. An important adage in project management is "if it cannot be measured, it cannot be managed". Therefore, measurement of activities needs to be mandated in any process. Effectiveness implies that the outcome of the process was successful at a strategic/macro level. Efficiency implies that the output of the process was efficiently achieved in terms of resources and time at a tactical level. Therefore both strategic and tactical metrics will be necessary.

6.15 **Strategic Metrics**. Strategic metrics are historical in nature and are vital to steer ongoing acquisition projects. An acquisition of a weapon system for instance might have occurred within cost and on schedule but may end up being completely ineffective in achieving the original strategic goals. It is very important that such the causes that resulted in such a situation are fixed and not repeated. It needs no emphasis that such qualitative metrics are not white washed for the fear of personal careers. This aspect is covered in the people section subsequently.

6.16 **Tactical Metrics & Technology**. Tactical metrics are those that are monitored during the execution of the project. These are the kind of metrics that project, program and portfolio managers report to a project management vertical within an organisation. These metrics are integrated into the work and cash flow of a project and are available on a networked metrics and the technology is beyond the scope of this report. Some tactical metrics are summarized in the tale below:-

Ser No	**Tactical Metric**	**Question Answered**	**Measured**
1.	Time	How are we doing against the schedule?	Schedule Performance Index (SPI) = Earned Value + Planned Value
2.	Cost	How are we doing against the budget?	Cost Performance Index (CPI) = Earned Value + Actual Cost
3.	Resources	Are we within anticipated limits of resources spent?	Actual resource utilization vis-a`-vis planned
4.	Scope	Have the scope changes been more than expected/	Number of Change Requests
5.	Quality	Are the quality problems being fixed?	Number of defects fixed per user acceptance test
6.	Action	Are we keeping up with our action Item list?	Number of action items behind schedule for resolution

Table 34 : Tactical Metrics Used to Monitor Project Execution

6.17 Currently the DPP is the sole process document that steers defence procurement. Analysts have flagged six main issues from time to time which are considered as problem areas with the acquisition system. ***Firstly***, there is a growing trend of large value capital acquisitions that completely bypass the main procedure of the DPP through the Intergovernmental agreement

(Clause 71-72) and the Foreign Military Sales routes that have been pointed out as a sign of ineffectiveness of the DPP to achieve the necessary capability build up in the desired time frames. ***Secondly***, there are currently eleven phases of evaluation that are carried out by no less than seven committees and 13 departmental organs between the SQR and post contract management stages. Seven of these phases have no time limits. ***Thirdly***, there is a class division among industries created through categorisation such as foreign, Indian Majors, State Owned Industries, Indian owned private industry SMEs, etc. There has been a call for a level playing field. ***Fourthly***, the offset policy has been a non-starter when looked at from the point of view of its original intention, which is building indigenous capacity. Now the expanded scope is expected to have its own inter-ministerial issues when implemented on ground without an agreed road map. We have had very little ToT for critical systems as a consequence of the existing provisions of the DPP. The last and the most important issue, which has the potential to resolve all others, is the lack of alignment of intentions of the DPP with the structure of execution and the lack of accountability to capability development. It is felt that there is a strong need to focus on this aspect more in order to bring in accountability into the DPP.

6.18 The aspect of mismatch of alignment between intent of DPP and the execution structure are given as under:-

(a) Statement of Intention.

(b) Improvement in accountability.

(c) Refinement in Structure.

<u>Statement of Intention</u>

6.19 **Intention of the DPP**: The Strategic Defence Planning Guidelines (SDPG) is a document derived from the National Military Strategy. This document provides the necessary guidance for creation of the LTIPP (Long Term Integrated Procurement Plan, the 5 year SCAP (Services Capital Acquisition Plan) and the 2 year roll on Annual Acquisition Plan. It is imperative that

these plans achieve their procurement targets so that the overall capability outcome desired by the SDPG is achieved. It needs no emphasis that Defence capability is a composite of industrial, operational and technological capabilities of the nation.

6.20 **Defence Technology Capability Road Map**: There is no substitute to self-reliance in key military technologies which enable the un-hindered growth of indigenous defence technology capability. The intention of offsets is to eventually gain self-reliance through reverse investments from foreign vendors. Foreign vendors are unlikely to part with key technologies without sustained negotiations from own side. The requirement of a road map to provide the necessary guidance to achieve technology capabilities is therefore implied in the DPP though not explicitly stated.

6.21 **Industrial Self Reliance Road Map**: Another aim of the offsets provision is to build the industrial capacity for self-reliance in defence production. The requirement therefore to achieve defence manufacturing self reliance through planned capacity build up is also implicit in the DPP.

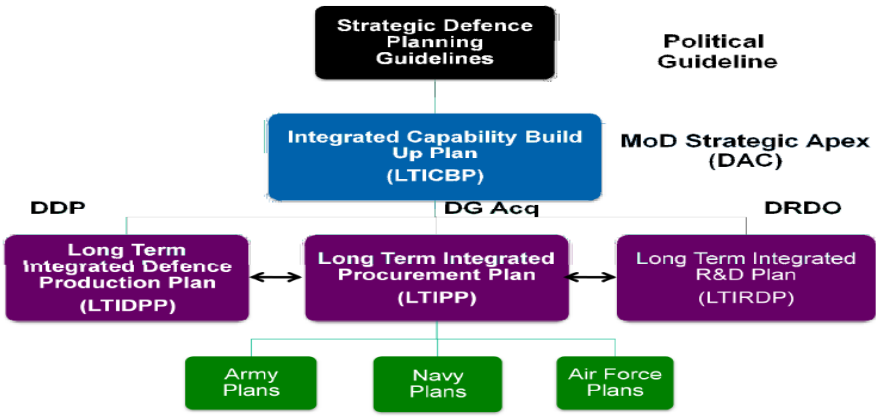

Figure 21 : Integrated perspective plan

6.22 Perspective Plans for the industry and the DRDO need to be in synchronization with the LTIPP in order to achieve the time lines specified in the LTIPP for almost all categories of procurement. The plans of the industry, armed forces and the DRDO need to satisfy an outcome that is desired by the strategic apex of the ministry of defence, which could be the DAC. This outcome

would need to be in synchronism with the strategic defence planning guidelines issued by a political body such as the CCS in order to be in sync with the developments in other state security apparatus outside the ministry of defence. Therefore, if the DPP is to achieve the aims that it has set for itself, it needs to transform itself into a procedure that will ensure that the integrated defence capability build up plan for the nation is achieved for the desired capabilities within the desired time frames. The plans need to be top driven to be effective and that the LTIPP has to become the core - operating document that would ensure that all plans are moving in synchronism. This top down process is crucial for effectiveness of the DPP and needs to be enshrined in the DPP with clear responsibilities of who will do what. The DPP is currently not explicit about the agencies responsible to determine capabilities or specifying time frames for achieving those capabilities on ground although these have been largely undertaken by the Service Headquarters. Hence the DPP should include text to require the military capability road map (LTIPP), the defence technology capability road map/equivalent document and the industrial self reliance road map/equivalent document to be in alignment to the Strategic Defence Planning Guidelines (SDPG) or equivalent document. Secondly, the DPP must include text that requires the various departments of defence to create execution plan/processes/structures to ensure that the timelines and milestones required by the approved road maps for capability build up for defence, technology and industry are achieved. Causes for delays must be escalated to the higher levels till resolution is achieved.

Improvement In Accountability.

6.23 **Capability Establishment Phases (C,D,E,F)**. Establishment of a defence capability can be broken into four phases:-

(a) **Concept Phase(C).** Operational and maintenance specialists, based on their experience conceive a potential weapon system based on possibilities and sustainability. The operational component envisages the various possibilities of employment to satisfy itself that the originally desired capability is actually achieved. The maintenance specialty

would make an initial feasibility evaluation of the sustenance and availability aspects of potential weapon systems. This stage typically completes with the acceptance of necessity of the system to establish the new capability and commencement of the process which will lead up to the award of the contract.

(b) **Planning Phase(D).** In this phase the creation of the systems requirements specifications, the contractual framework for deliveries and the commercial process for enabling the activity are developed. Short listing of potential vendors/equipment, trial evaluations, evaluation of design proposals, evaluation of manufacturing plans, evaluation/negotiation of commercial proposals and the award of contract to the most appropriate vendor is carried out at this stage.

(c) **Execution Phase(E).** This is the stage in which all parties to the contract fulfill their obligations and the deliverables accrue to the recipient service.

(d) **Transfer Phase(F).** The transfer phase is the phase in which the delivered system is stabilized and the required systems of sustenance of the system to establish the desired capability is fully established.

6.24 **Project Management.** The four-stage endeavor described above, that aims to deliver a capability to the Armed forces, can be stated to be a project and a portfolio of such projects can be stated as a program. Project management is the discipline of planning, organising, securing, managing, leading, and controlling resources to achieve the specific goal of the endeavor. This management/leadership activity is interwoven into the four-stage process and the process is deeply dependent on the project management leadership to succeed.

6.25 A combined graphic showing the project phases, the effort required, the contractual stages and the main specialist functions in each phase that eventually lead up to the establishment of a desired capability, is placed below:

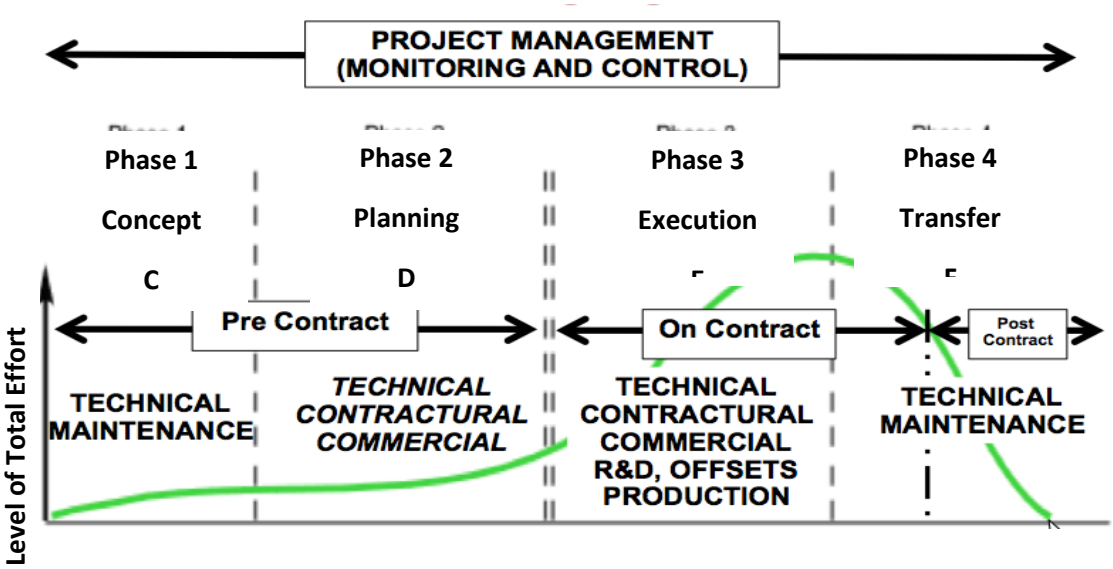

Figure 22 : Capability Establishment Phases

6.26 **Project Phases/Functions and Roles defined in the DPP**. The project phases (including monitoring and control which is a contiguous phase) have different functions which predominate in their contribution for successful completion of the phase.

6.27 **Concept Phase.** The technical function and the maintenance (sustenance) function form a key role in the concept phase. Key DPP milestones that are achieved in this phase are finalisation of SQRs, accordance of the Acceptance Of Necessity (AoN) and the floating of the Request for Information (RFI)/Request for Proposals (RFP). These specialist functions are typically performed by the Service HQs spearheaded by the Deputy Chiefs through teams of service officers interfaced with the MoD through the Defence Acquisition Wing (AM, FM, TM). To a limited extent the production function in the form of PSUs (Public Sector Units)/OFBs(Ordnance Factory Boards), the DRDO (Defence Research and Development Organisation), and DOMW (Defence Offsets Management Wing) do participate in the creation of a Technical Project Report (TPR) under the chairmanship of the Defence Acquisition Wing. This project report, however, is usually aimed at coordinating the finer details of technical specifications in order to ensure producability by the production function and alignment of offset proposals to the technology road map, if any. It therefore emerges from an assessment of the concept phase provisions of the DPP that the approvals for various specialist decisions are at the apex level i.e the DAC, CCS with no

traditional program managerial functions other than the limited coordination currently performed by the Integrated Defence Staff Head Quarters (IDS) and currently, there is limited or no contribution of Quality Assurance, technology management and production management specialists at this stage of a proposal.

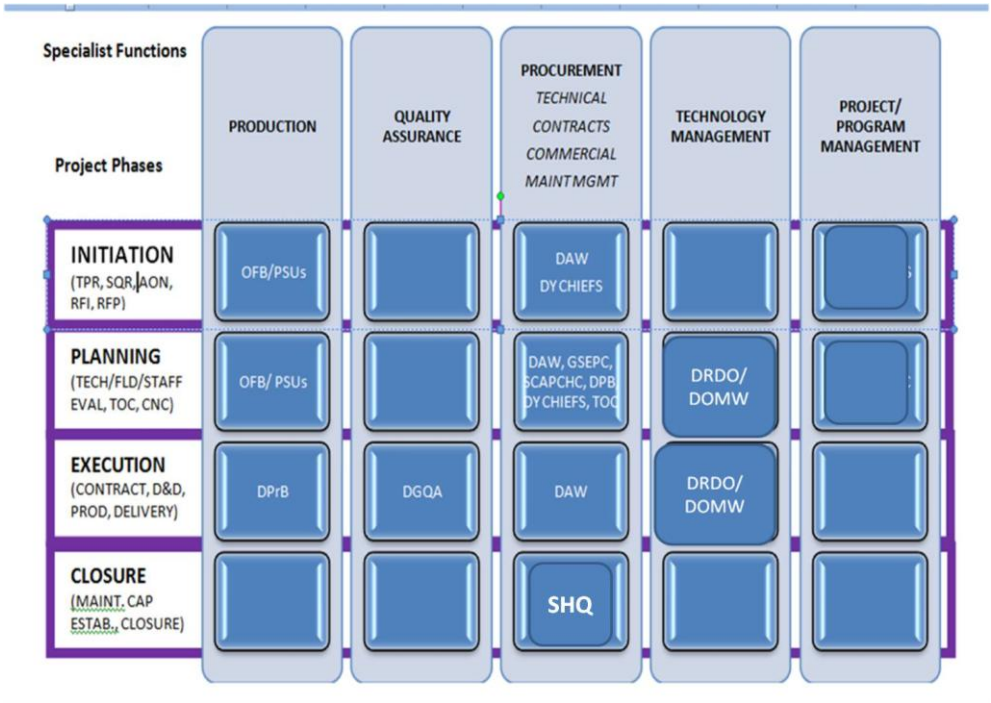

Figure 23 : phases, specialist functions and roles in DPP

6.28 **Planning and Design Stage.** This is the stage the leads up to the contract award. The key project milestones achieved during this phase are the technical evaluation, field evaluation and staff evaluations of the various proposals received from the vendor at the end of the previous stage i.e initiation/conception stage. Depending on the size of the project, various guidelines for award of categorisation of the project, evaluations and commercial negotiations are provided by the DPP. The various specialist functions under the DAW (Acquisition manager (Contracts function), Technical Manager (Operational Function), Financial Manager (Commercial Function)) are closely assisted by the concerned specialists in the Service Headquarters' typically spearheaded by the Deputy Chiefs of the three services.

6.29 Joint cross-functional committees such as the SCAPCHC (Services Capital Acquisition Plan Categorisation Higher Committee), the SCAPCC (Services Capital Acquisition Plan

Categorisation Committee) are catered for in the DPP for categorisation and acquisition process definition for equipment. In-service structures, typically under the Deputy Chiefs, to finalise Joint Staff and General/Air/Flag Staff Quality Requirements are left to the SHQs. IHQ Army committees such as the GSEPC (General Staff Equipment Policy Committee) and the JSEPC (Joint Staffs Equipment Policy Committee), are examples of internal cross functional structures that aid in the formulation of the SQRs. It emerges from the assessment of the planning and design phase provisions of the DPP that, as in the previous phase the approvals for various specialist decisions are at the apex level i.e the DAC, CCS with no traditional program managerial functions other than the limited coordination currently performed by the Integrated Defence Staff Head Quarters (IDS). Secondly, there is limited or no contribution of Quality Assurance specialists at this stage of a proposal and thirdly, maintenance management function is conspicuous by its absence at this stage. This function is crucial to ensuring in-service sustainability planning for the inducted capability. This centralized function would typically manage the establishment of maintenance capability both with service and industry based options for the echelons of maintenance above the operational level. This function will also need to consolidate the stocking policy and infrastructure to ensure smooth induction and establishment of the fleet.

6.30 **The execution phase.** This phase commences with the award of contract and finishes with the receipt of all contractual deliverables. While shown as a discrete phase, this phase usually telescopes into the closure phase as deliverables to the recipient service may be spaced in time and closure may be simultaneously happening in respect of certain deliverables while others may still be under production/delivery according to a mutually agreed programme. Any design and development of systems/production tools, their productionisation, production and delivery takes place during this phase. If produced indigenously, the PSUs/OFBs play a major role and quality assurance is monitored by DGQA and its equivalents for airborne and maritime systems. In pursuant of an offset agreement, DOMW would facilitate delivery of any production

technology to indigenous industry while DRDO would manage technology induction into its fold if provided for in that manner in the offset agreement. It emerges from an assessment of the execution phase provisions of the DPP that the DPP as in the previous phases does not recognise the need for a suitably empowered formal program management structure to ensure that the deliverables reach the recipient service/other organisations involved, in accordance to contract and secondly, the arrangement assumes that the contractual obligations would be completely satisfied by both internal and external contractors and protective clauses in the standard contractual document would be adequate to ensure that the capability is established in time.

6.31 **Closure Phase.** The closure phase is an important phase in which all actions necessary (both contractual and non-contractual) to ensure the operational and maintenance capability establishment for sustenance of the weapon system is done. On ground it is being done by MGOs branch. A project team typically spearheads this with each specialist function confirming that the contractor has achieved contractual deliverables and contractual payments have been completed. It emerges that the DPP currently does not explicitly address this aspect. The DPP could be further refined to include a formal empowered project management structure to ensure that all stages of the capability establishment project are successfully achieved within designated timelines and within budget.

6.32 **Project Hierarchy.** The hierarchy of projects in an integrated defence capability build up program is enumerated below.

(a) **Project level (Lowest)**: A large number of land, maritime and aerospace projects managed by individual project managers.

(b) **Program Level** : A group of such projects that may achieve a lower level capability outcome can be considered as a single program and a number of such programs of projects would be managed by program managers.

(c) **Portfolio Level**: All programs that roll out a composite land, air or maritime capability be considered as portfolios and managed by portfolio managers.

(d) **Sponsor Level (Highest Level)**: The amalgamated outcome of these programs would be the defence capability at any given time and would be typically managed by the program sponsor such as the DAC.

6.33 At all levels the focus is on just three things "Schedule", "Quality" and "Cost".

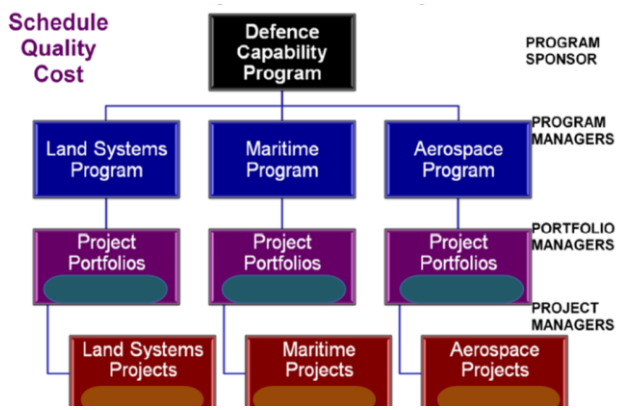

Figure 24 : Project hierarchies

6.34. **Refinement In Structure.** The existing apex of the current procurement structure is illustrated below:-

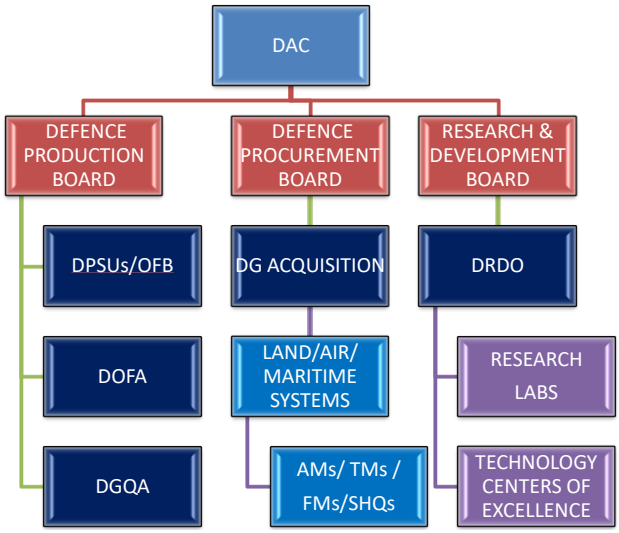

Figure 25 : Existing acquisition organisational structure

6.35 **Project Interface.** As we had seen earlier every project has four phases viz. Initiation, planning, execution and closure. A project needs different specialist functions to be performed at different stages as enumerated below:-

(a) The Procurement function is an important specialist function, which is, currently spear-headed by the DG acquisitions vertical in the MoD. Contractual (Acquisition Managers), commercial (Financial Managers), technical (Technical Managers) and sustenance (Maintenance Managers) aspects of an acquisition are addressed by sub-specialist verticals within the procurement vertical.

(b) The manufacturing function currently spear-headed by the Defence Production vertical in the MoD would be responsible for all aspects requiring manufacturing support in the establishment of the desired defence capability. Quality control is an important sub specialisation of this vertical that ensures that the desired quality requirements are met.

(c) The Research and Development function, which is led by the Defence Research vertical of the MoD, would be responsible for all aspects that require development of new systems and equipment through defence research. Among the many sub-vertical specialisations within this vertical an important vertical is the productionising speciality, which transfers any newly developed system to the manufacturing function.

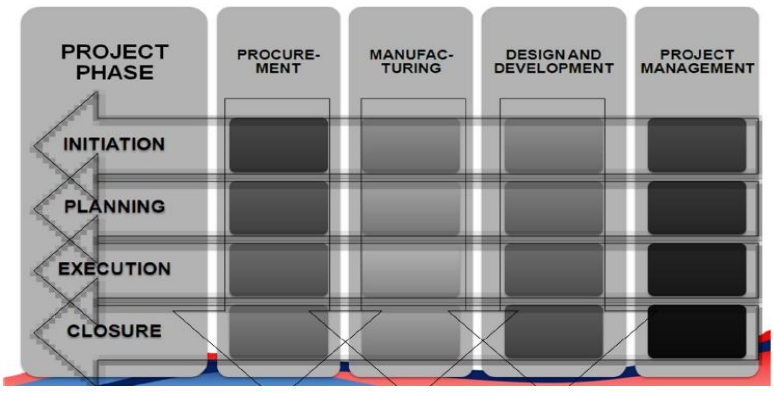

Figure 26 : Project management roles

6.37 The flow of specialist functional authority is top down in all the specialist verticals. The flow of specialist authority ensures that best practices in that specialist vertical are mandated through orders and guidelines to achieve the end result desired as part of a specialist contribution to a project. Costing, and estimating functions are typically embedded into specialist functions of a large scale.

6.38 **Project Vertical and Specialist Interface.** It can be argued that project management is also a speciality. Best practices to ensure achievement of outcomes are embedded into the project management vertical through orders and guidelines in a manner very similar to that of the other verticals. However a key difference in this vertical is its interface with specialist verticals. A project management vertical knits the specialists into a functional team thereby achieving the desired outcome of the project. The interface of this vertical with the specialist vertical is lateral and project authority flows laterally across the specialist verticals. The project management vertical takes complete responsibility for the project outcome while the functional verticals take responsibility for the project outputs. This type of organisation is called a *matrix organisation* or a two dimensional organisation and is widely used both within the military and civilian applications. Clearly this feature does not exist in the currently specified procurement organisation and therefore accountability for project outcomes is not specified. This is considered as a major lacuna in the structure of the procurement organisation specified in the DPP which lays responsibility for outputs but not for outcomes.

6.40 **Projectised Organisations.** Projectised organisations popularly also called Matrix organisations have a two dimensional structure. Examples of such organisations in operation are the Defence Procurement Material Organisation (Australia), the US Homeland Security (after reorganisation post 9/11), Civil commercial aviation systems and the South African Armed forces. The CDS/Theatre command structure being considered for the Indian Armed Forces would also eventually be a good example of a matrix organisation. The first dimension of the two

dimensional matrix organisationis the traditional functional organisations where each speciality is organized in accordance with their functional specifications similar to the existing organisational structure for procurement dictated by the DPP. The second dimension is the project dimension, which takes responsibility for delivering a single cross functional project within a specified schedule and cost. This dimension is assigned specialists from the functional verticals who act as resources for the project manager. The division of project and specialist responsibilities are shown in the concept diagrams below: -

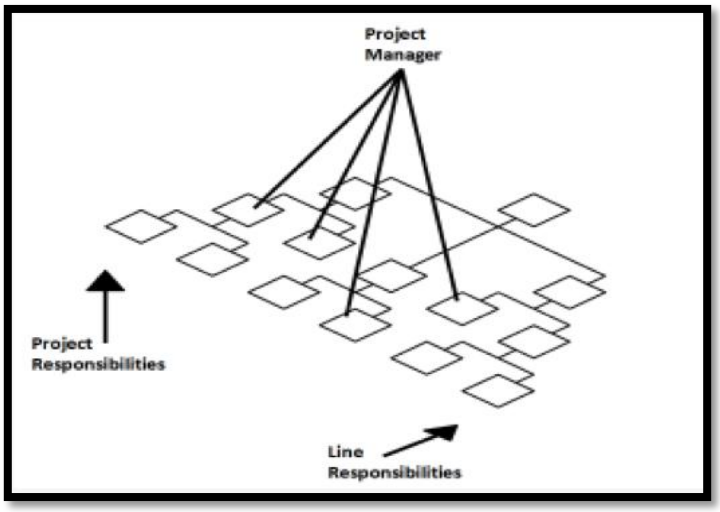

Figure 27 : Matrix organisation – division of responsibility

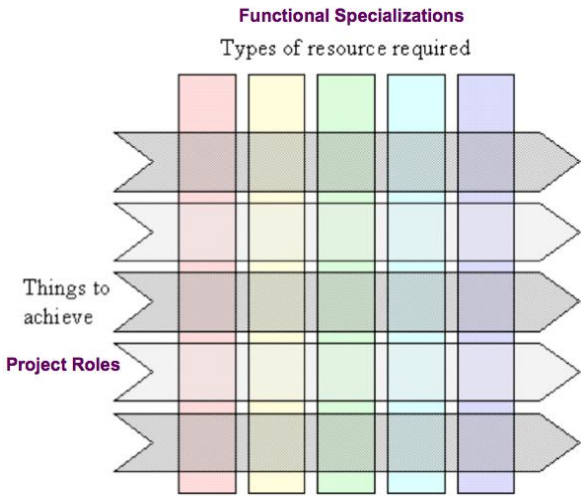

Figure 28 : Matrix organisation – project roles

6.41 **Integrated Project Management Teams.** IPMT (Integrated Project Management Teams) are already in use in the ship building guidelines of the DPP as well as the "Make" procedure. IPMTs are cross-functional teams that are formed for management of individual or small groups of projects, which are of similar nature. These teams typically function under the direct control of the program management groups of each service. These teams are required to create project plans, which have detailed milestones to be met. The IPMT will steer the individual projects to completion in respect of the process requirements laid out in this procedure. The IPMT should have the powers to release payments in accordance with agreed payment terms in relation to achievement of milestones. Payment terms involving Earned Value are typically used by these teams to comprehensively monitor milestones and in some countries it is mandatory to release payments according to achieved milestones called Earned Value Management (EVM). EVM also provides a good insight into the costing processes of the project and should be mandatorily used in respect of Indian Vendors and PSUs.

6.42 Previous analysis brings out two main areas of improvement possible to the procurement organisation implied by the Defence Procurement Procedure. These are firstly, introduction of Program/Project management functionality in the existing acquisition structure and leveraging available expertise in the form of groups of excellence for land, maritime and airborne capability. Secondly, use of a project management software to monitor the various activities and stages in the acquisition process to prevent time and cost over runs.

CHAPTER-7

Economic Forecasting and Determining Pragmatic Parameters for Long Term Financial Allocation for Capital Budgeting Including R&D Boosting PPP

Introduction

7.1 A detailed ***economic scan*** and analysis of own country as well as our competing nations, is essential to arrive at availability of financial resources that the competing nations may invest in the future for developing military capabilities. Once likely financial investments for developing military capabilities by the competing nations are forecasted, it would provide the planners the '***Strategic Military Financial Gap***'. Based upon this the apex authority can take a decision to arrive at an acceptable financial gap and accordingly commit financial resources to generate capabilities. ***This long term commitment of funds will ensure that the Private Industry proactivates towards bringing in own resources for Defence Research and Development, the inertia which sharing of TPCR alone may not able to overcome.*** Inability or impracticability of either '***Closing the Financial Gap***" or "***Achieving Desired Financial Gap***" vis-à-vis any particular competing nation, would enable us to ascertain the "***Long Term Military Financial Risks***" which, would need to be managed through other instruments of National Power (Economic, Diplomatic etc). ***However, it is felt that at least for one LTIPP term, we may need to reassure the industry about project wise committed funding towards promoting the concept of PPP in Defence in right earnest.***

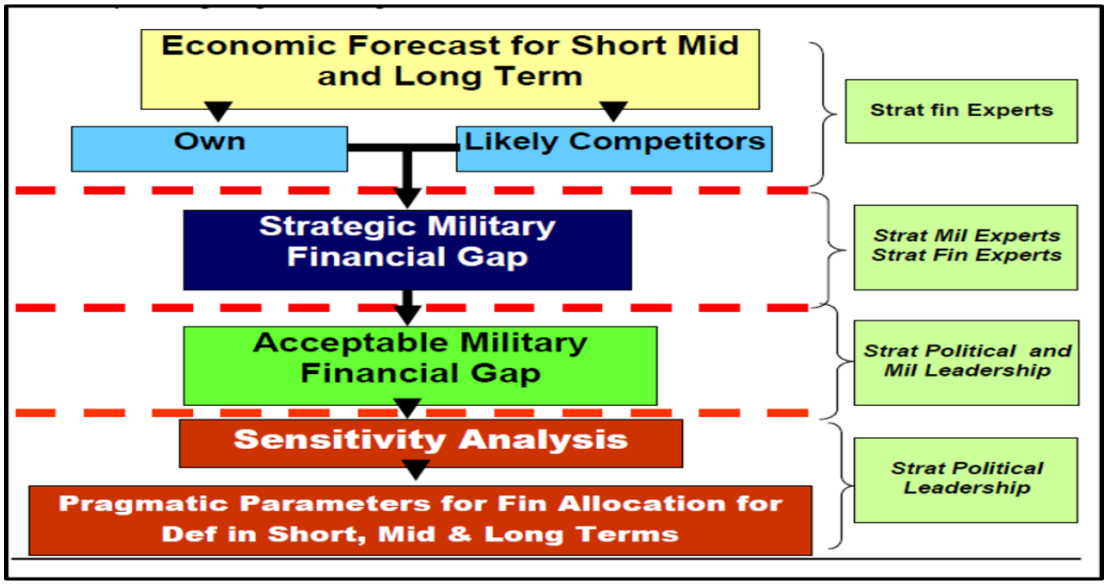

Figure 29 : Suggested Flow Diagram of Various Activities for Financial Planning

FORECAST OF GDPs AND LIKELY FUTURE DEFENCE BUDGETS

7.2 **Details & Assumptions**. The following assumption have been made :-

(a) GDP data is based on 59-year data from 1960 upto 2018 based on the source : http://data.worldbank.org/indicator/NY.GDP.MKTP.CD (Data.Worldbank.Org/indicator, 2019).

(b) Data analysis is based on Time Series & Trend Analysis as well as Regression Analysis.

(c) The forecast for the period from 2019 to 2030 has been worked out for India taking into account inflation (based on average CPI index) (tradingeconomics.com/india/inflation-cpi, 2019).

(d) The forecast for the period from 2019 to 2030 has been worked out for China, Pakistan and USA has been worked out taking into account inflation trend from the Internet.

Forecast of GDPs and Likely Future Defence Budgets.

(a) **India**

(i) **Forecast of GDP as per Time Series Trend Analysis**. This is calculated based on the Time Series and Trend Analysis (Polynomial series of order 4) of the GDP data of past 59 years as per Narrative.

Year	Forecast GDP Data (MUSD)
2015-16	2,102,543
2016-17	2,274,698
2017-18	2,600,818
2018-19	2,948,764
2019-20	3,142,818
2020-21	3,406,917
2021-22	3,688,710
2022-23	3,988,984
2023-24	4,308,539
2024-25	4,648,195
2025-26	5,008,786
2026-27	5,391,167
2027-28	5,796,205
2028-29	6,224,787
2029-30	6,677,816

Table 35 : Forecast of GDP as per Time Series Trend Analysis

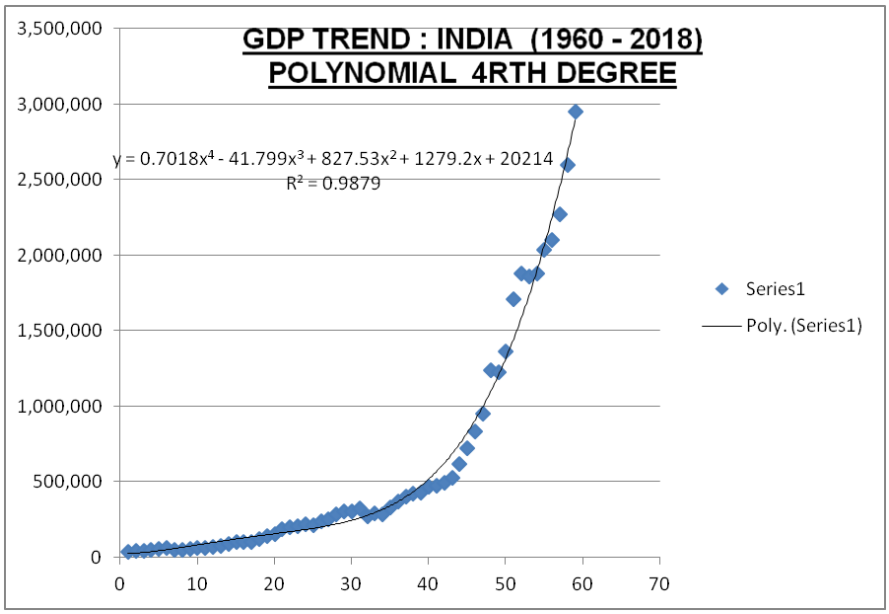

Figure 30 : Forecast of GDP as per Time Series Trend Analysis Plot

(ii) **Forecast of GDP as per Experts' Average Forecasted Rates**. The calculations are based on the 'Forecast of Average Growth Rates given by experts as given in the Narrative (Y1 to Y5 at 7%, Y6 to Y 10 at 7.25% & Y 11 to Y 15 at 7.5%). Additionally average inflation of 5.5 % annually has been added based on macroeconomic indicator.

Year	Forecast GDP Data (MUSD)
2015-16	2,284,260
2016-17	2,558,371
2017-18	2,865,376
2018-19	3,209,221
2019-20	3,594,328
2020-21	4,034,633
2021-22	4,528,875
2022-23	5,083,662
2023-24	5,706,411

2024-25	6,405,446
2025-26	7,206,127
2026-27	8,106,893
2027-28	9,120,255
2028-29	10,260,287
2029-30	11,542,822

Table 36 : Forecast of GDP as per Experts' Average Forecasted Rates

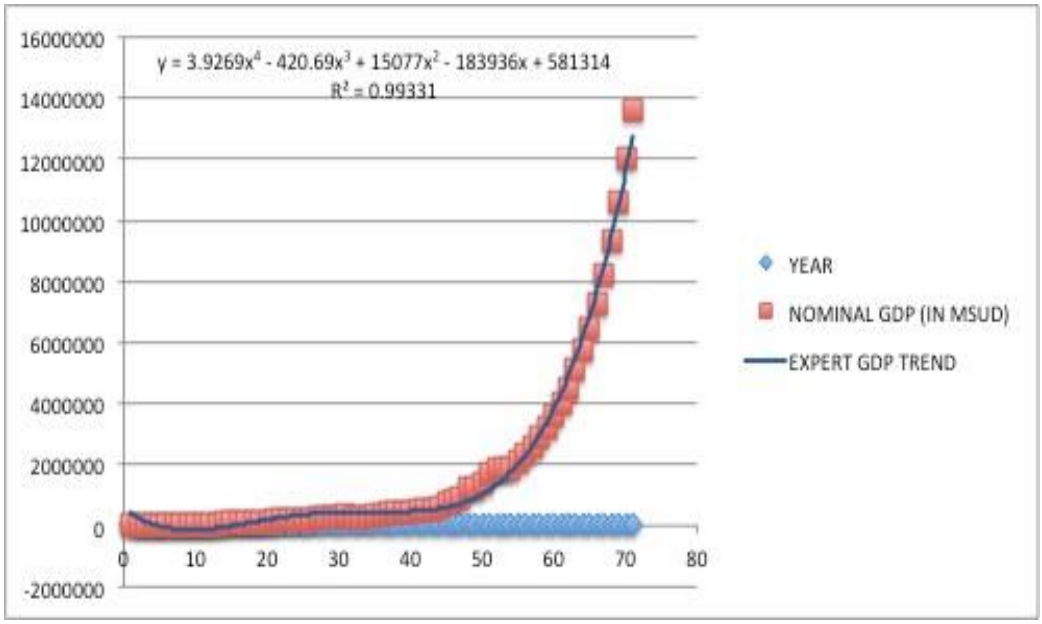

Figure 31 : Forecast of GDP as per Experts' Forecasted Rates Plot

(iii) **Realistic Future GDP Amounts.** For each year, the Average of the amounts arrived at from (i) and (ii) above.

Year	Realistic Forecast GDP Data (MUSD)
2015-16	2,180,369
2016-17	2,399,712
2017-18	2,726,091

2018-19	3,082,074
2019-20	3,364,315
2020-21	3,713,222
2021-22	4,097,274
2022-23	4,520,104
2023-24	4,985,757
2024-25	5,498,752
2025-26	6,070,909
2026-27	6,702,855
2027-28	7,401,247
2028-29	8,173,555
2029-30	9,028,171

Table 37 : Realistic Future GDP Amounts

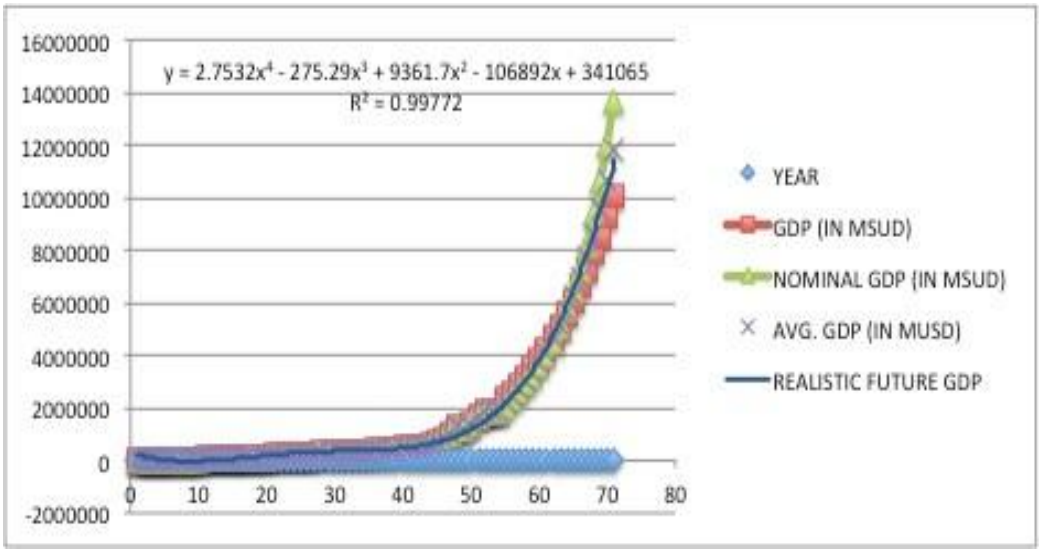

Figure 32 : Realistic Future GDP Amounts Plot

(iv) **Forecast of CGE as per Linear Regression Analysis.** This is calculated by Linear Regression Analysis of GDP (Independent variable) & CGE (dependent variable) data of past 59 years.

Year	Forecast CGE Data (MUSD)
2015-16	250,250
2016-17	275,518
2017-18	313,117
2018-19	354,127
2019-20	386,641
2020-21	426,835
2021-22	471,078
2022-23	519,788
2023-24	573,431
2024-25	632,528
2025-26	698,440
2026-27	771,241
2027-28	851,695
2028-29	940,665
2029-30	1,039,117

Table 38 : Forecast of CGE as per Linear Regression Analysis

Note: - The intercept formula is as below based on regression

CGE (IN MUSD) = - 928.3727 + 0.1152 * AVG. GDP (IN MUSD)

(v) **Forecast of MIL EXP. as per Linear Regression Analysis.** This is calculated by Linear Regression Analysis of GDP & CGE (independent variables) and Military Expenditure (dependent variable) data of past 25 years.

Year	Forecast Avg. MIL EXP. (MUSD)
2015-16	55,718
2016-17	60,858
2017-18	69,097
2018-19	78,018
2019-20	84,400
2020-21	92,494
2021-22	101,328
2022-23	110,969
2023-24	121,493
2024-25	132,983
2025-26	145,643
2026-27	159,492
2027-28	174,650
2028-29	191,248
2029-30	209,435

Table 39 : Forecast of MIL EXP. as per Linear Regression Analysis

Note: - The intercept formula is as below based on regression

MIL EXP. (IN MUSD) = 1455.3180 + 0.0084 * AVG. GDP (IN MUSD) + 0.1459 * CGE (IN MUSD)

(vi) **Forecast of Minimum & Maximum MIL EXP.** This is computed by finding out the Error Estimate as follows with data of Sy,x and n obtained from regression analysis at (v) above as follows:-

Year	Forecast Min. MIL EXP. (MUSD)	Forecast Avg. MIL EXP. (MUSD)	Forecast Max. MIL EXP. (MUSD)
2015-16	53,093	55,718	58,344
2016-17	58,233	60,858	63,484
2017-18	66,472	69,097	71,723
2018-19	75,392	78,018	80,644
2019-20	81,774	84,400	87,026
2020-21	89,868	92,494	95,119
2021-22	98,702	101,328	103,953
2022-23	108,344	110,969	113,595
2023-24	118,868	121,493	124,119
2024-25	130,357	132,983	135,608
2025-26	143,018	145,643	148,269
2026-27	156,867	159,492	162,118
2027-28	172,024	174,650	177,275
2028-29	188,622	191,248	193,873
2029-30	206,810	209,435	212,061

Table 40 : Forecast of Minimum & Maximum MIL EXP

S y,x (S value of regression analysis)	**1,274.8307**
n (no. of observations)	26
df = n-2	24
LOS	0.05
Std. Error (SE) = T.INV.2T(LOS,df)	2.063898562
Error of Estimate (EE) = SE * S y,x **MIN. MIL. EXP. = AVG. MIL. EXP. – EE** **MAX. MIL. EXP. = AVG. MIL. EXP. + EE**	**2631.121258**

(vii) **Forecast Defence Expenditure**. It is computed as 65% of total Military Expenditure computed at (vi) above.

Year	Forecast Min. DEF. EXP. (MUSD)	Forecast Most likely DEF. EXP. (MUSD)	Forecast Max. DEF. EXP. (MUSD)
2015-16	34,510	36,217	37,923
2016-17	37,851	39,558	41,264
2017-18	43,207	44,913	46,620
2018-19	49,005	50,712	52,418
2019-20	53,153	54,860	56,567
2020-21	58,414	60,121	61,828

2021-22	64,156	65,863	67,570
2022-23	70,423	72,130	73,837
2023-24	77,264	78,971	80,677
2024-25	84,732	86,439	88,145
2025-26	92,961	94,668	96,375
2026-27	101,963	103,670	105,377
2027-28	111,816	113,522	115,229
2028-29	122,604	124,311	126,018
2029-30	134,426	136,133	137,840

Table 41 : Forecast Defence Expenditure

(b) **China**

(i) **Forecast of GDP as per Time Series Trend Analysis**. This is calculated based on the Time Series and Trend Analysis (Polynomial series of order 4) of the GDP data of past 59 years.

Year	Forecast GDP Data (MUSD)
2015-16	11,783,496
2016-17	13,312,679
2017-18	14,985,259
2018-19	16,809,620
2019-20	18,794,378
2020-21	20,948,378
2021-22	23,280,692
2022-23	25,800,623

2023-24	28,517,704
2024-25	31,441,694
2025-26	34,582,583
2026-27	37,950,591
2027-28	41,556,166
Year	**Forecast GDP Data (MUSD)**
2028-29	45,409,984
2029-30	49,522,953

Table 42 : China Forecast of GDP as per Time Series Trend Analysis

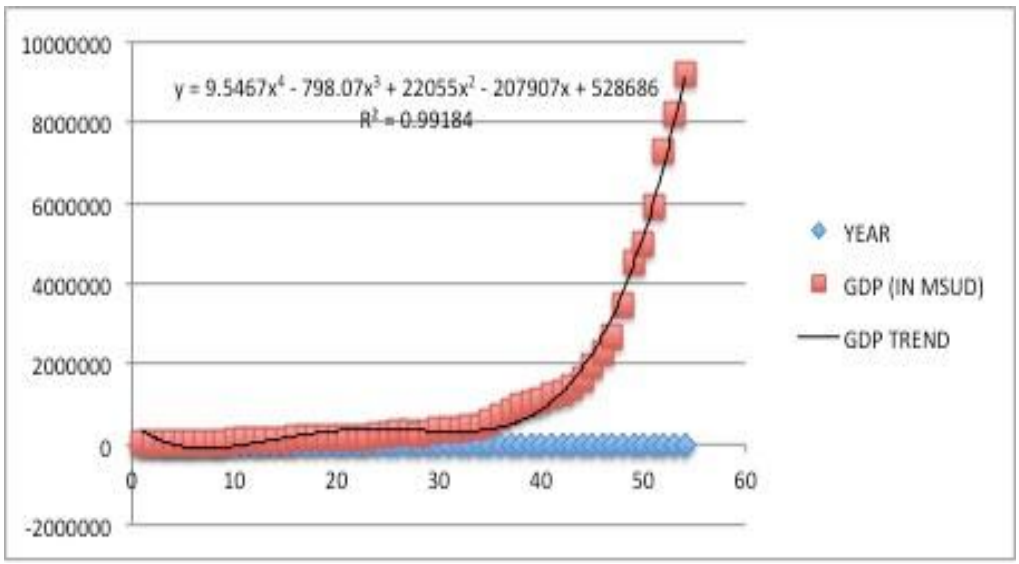

Figure 33 : Forecast of GDP as per Time Series Trend Analysis Plot

(ii) **Forecast of GDP as per Experts' Average Forecasted Rates**. The calculations are based on the 'Forecast of Average Growth Rates given by experts as given in the Narrative (Y1 to Y5 at 7.5%, Y6 to Y 10 at 7.25% & Y 11 to Y 15 at 7%). Additionally average inflation of 3 % annually has been added based on macroeconomic indicator.

Year	Forecast GDP Data (MUSD)
2015-16	11,129,963
2016-17	12,215,134
2017-18	13,406,110
2018-19	14,713,206
2019-20	16,147,743
2020-21	17,722,148
2021-22	19,405,752
2022-23	21,249,299
2023-24	23,267,982
2024-25	25,478,440
2025-26	27,898,892
2026-27	30,409,793
2027-28	33,146,674
2028-29	36,129,875
2029-30	39,381,563

Table 43 : China Forecast of GDP as per Experts' Average Forecasted Rates

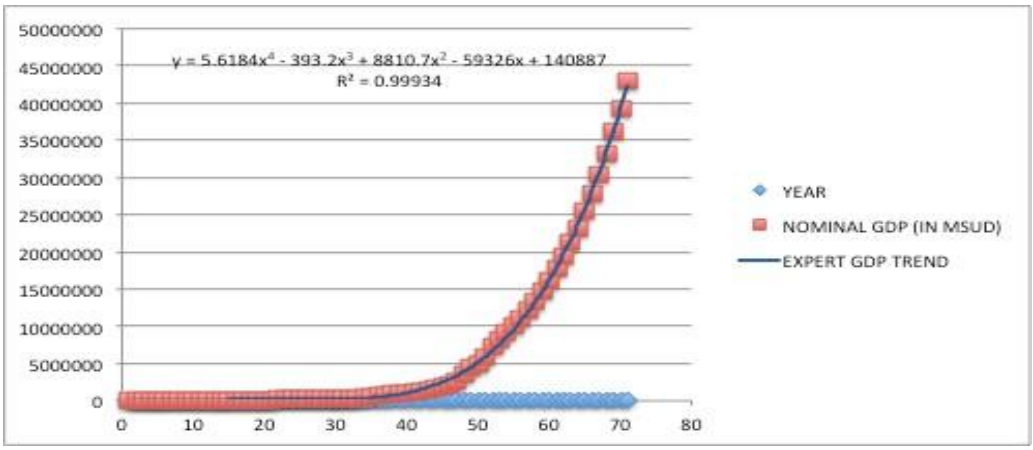

Figure 34 : Forecast of GDP Experts' Forecasted Rates Plot

(iii) **Realistic Future GDP Amounts.** For each year, the Average of the amounts arrived at from (i) and (ii) above.

Year	Realistic Forecast GDP Data (MUSD)
2015-16	11,456,729
2016-17	12,763,907
2017-18	14,195,684
2018-19	15,761,413
2019-20	17,471,061
2020-21	19,335,263
2021-22	21,343,222
2022-23	23,524,961
2023-24	25,892,843
2024-25	28,460,067
2025-26	31,240,738
2026-27	34,180,192
2027-28	37,351,420
2028-29	40,769,929
2029-30	44,452,258

Table 44 : China Realistic Future GDP Amounts

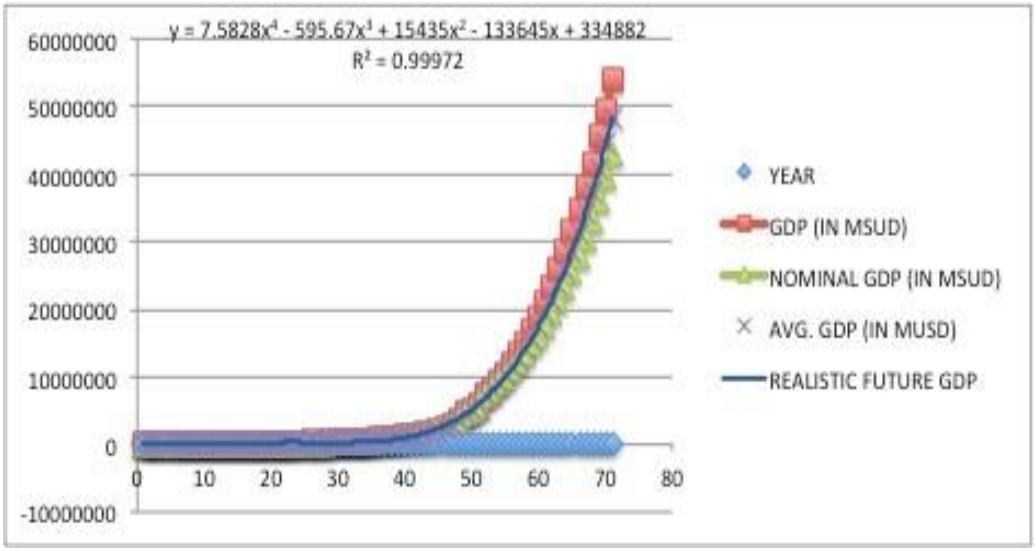

Figure 35 : Realistic Future GDP Amounts Plot

(iv) **Forecast of CGE as per Linear Regression Analysis**. This is calculated by Linear Regression Analysis of GDP (Independent variable) & CGE (dependent variable) data of past 59 years.

Year	Forecast CGE Data (MUSD)
2015-16	1,568,106
2016-17	1,746,667
2017-18	1,942,247
2018-19	2,156,126
2019-20	2,389,664
2020-21	2,644,314
2021-22	2,918,601
2022-23	3,216,627
2023-24	3,540,079
2024-25	3,890,762
2025-26	4,270,602
2026-27	4,672,131
2027-28	5,105,321
2028-29	5,572,289
2029-30	6,075,295

Table 45 : China Forecast of CGE as per Linear Regression Analysis

Note: - The intercept formula is as below based on regression

CGE (IN MUSD) = 3116.891 + 0.1366 * AVG. GDP (IN MUSD)

(v) **Forecast of MIL EXP. as per Linear Regression Analysis**. This is calculated by Linear Regression Analysis of GDP & CGE (independent variables) and Military Expenditure (dependent variable) data of past 25 years.

Year	Forecast Avg. MIL EXP. (MUSD)
2015-16	233,992
2016-17	260,550
2017-18	289,640
2018-19	321,451
2019-20	356,186
2020-21	394,061
2021-22	434,857
2022-23	479,183
2023-24	527,292
2024-25	579,450
2025-26	635,945
2026-27	695,666
2027-28	760,096
2028-29	829,550
2029-30	904,364

Table 46 : China Forecast of MIL EXP. as per Linear Regression Analysis

Note: - The intercept formula is as below based on regression

MIL EXP. (IN MUSD) = 1366.2893 + 0.0265 * AVG. GDP (IN MUSD) - 0.0451 * CGE (IN MUSD)

Forecast of Minimum & Maximum MIL EXP. This is computed by finding out the Error Estimate as follows with data of S y,x and n obtained from regression analysis at (v) above as follows:-

S y,x	**3,094.84635**
n	26
df = n-2	24
LOS	0.05
Std. Error (SE) = T.INV.2T(LOS,df)	2.063898562
Error of Estimate (EE) = SE * S y,x	**6387.448922**

Year	Forecast Avg. MIL EXP. (MUSD)	Forecast Min. MIL EXP. (MUSD)	Forecast Max. MIL EXP. (MUSD)
2015-16	227,605	233,992	240,380
2016-17	254,163	260,550	266,938
2017-18	283,252	289,640	296,027
2018-19	315,063	321,451	327,838
2019-20	349,798	356,186	362,573
2020-21	387,674	394,061	400,448
2021-22	428,469	434,857	441,244
2022-23	472,796	479,183	485,571
2023-24	520,904	527,292	533,679

2024-25	573,063	579,450	585,837
2025-26	629,558	635,945	642,332
2026-27	689,279	695,666	702,053
2027-28	753,709	760,096	766,483
2028-29	823,163	829,550	835,937
2029-30	897,977	904,364	910,751

(vi) **Forecast Defence Expenditure**. It is computed as 65% of total Military Expenditure computed at (vi) above.

Year	Forecast Min. DEF. EXP. (MUSD)	Forecast Most likely DEF. EXP. (MUSD)	Forecast Max. DEF. EXP. (MUSD)
2015-16	147,943	152,095	156,247
2016-17	165,206	169,358	173,510
2017-18	184,114	188,266	192,418
2018-19	204,791	208,943	213,095
2019-20	227,369	231,521	235,673
2020-21	251,988	256,140	260,291
2021-22	278,505	282,657	286,809
2022-23	307,317	311,469	315,621
2023-24	338,588	342,740	346,891
2024-25	372,491	376,642	380,794
2025-26	409,212	413,364	417,516
2026-27	448,031	452,183	456,335

2027-28	489,911	494,062	498,214
2028-29	535,056	539,207	543,359
2029-30	583,685	587,837	591,988

Table 47 : China Forecast Defence Expenditure

(c) **Pakistan**

(i) **Forecast of GDP as per Time Series Trend Analysis**. This is calculated based on the Time Series and Trend Analysis of the GDP data of past 59 years.

Year	Forecast GDP Data (MUSD)
2015-16	297,529
2016-17	326,304
2017-18	357,510
2018-19	391,285
2019-20	427,771
2020-21	467,115
2021-22	509,466
2022-23	554,978
2023-24	603,809
2024-25	656,119
2025-26	712,075
2026-27	771,845
2027-28	835,601
2028-29	903,521
2029-30	975,783

Table 48 : Pak Forecast of GDP as per Time Series Trend Analysis

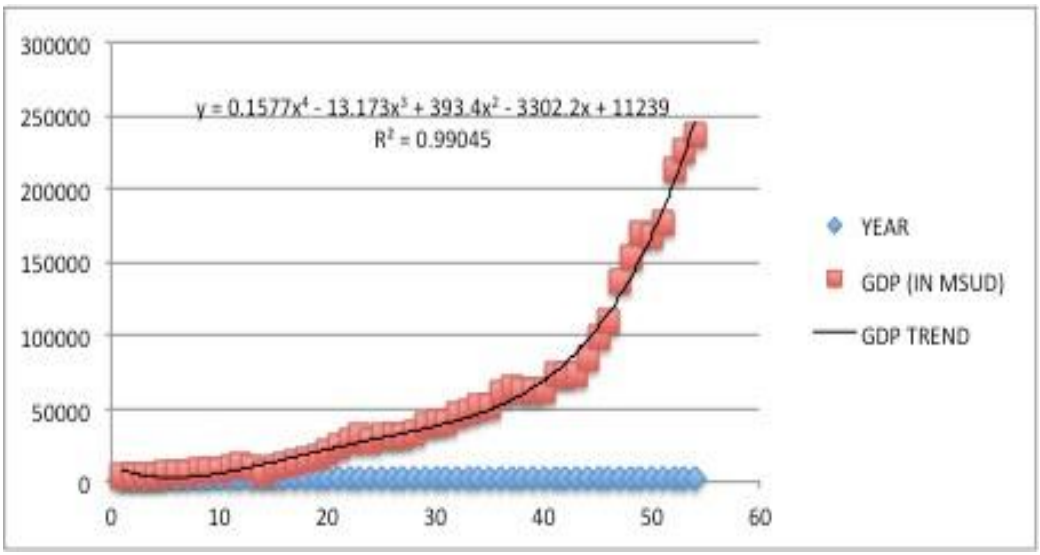

Figure 36 : Forecast of GDP as per Time Series Trend Analysis Plot

(ii) **Forecast of GDP as per Experts' Average Forecasted Rates**. The calculations are based on the 'Forecast of Average Growth Rates given by experts as given in the Narrative (Y1 to Y5 at 4.1%, Y6 to Y 10 at 4.5% & Y 11 to Y 15 at 5%). Additionally average inflation of 8.5 % annually has been added based on macroeconomic indicator.

Year	Forecast GDP Data (MUSD)
2015-16	300,011
2016-17	337,813
2017-18	380,377
2018-19	428,304
2019-20	482,271
2020-21	543,037
2021-22	613,632
2022-23	693,404

2023-24	783,546
2024-25	885,407
2025-26	1,000,510
2026-27	1,135,579
2027-28	1,288,882
2028-29	1,462,882
2029-30	1,660,371

Table 49 : Pak Forecast of GDP as per Experts' Average Forecasted Rates

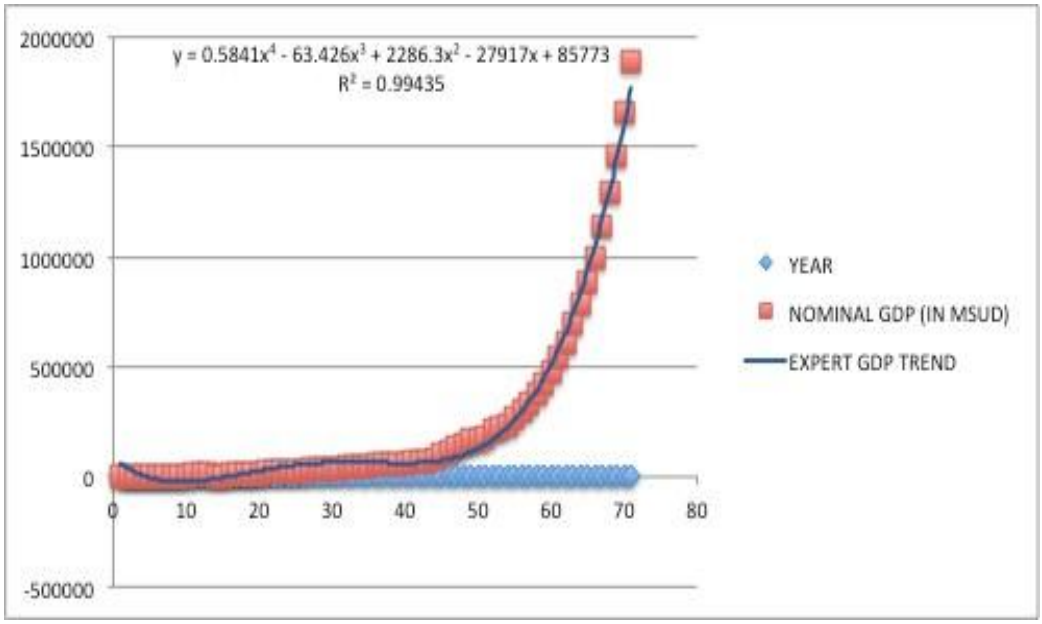

Figure 37 : Forecast of GDP as per Experts' Avg. Forecasted Rates Plot

(iii) **Realistic Future GDP Amounts.** For each year, the Average of the amounts arrived at from (i) and (ii) above.

Year	Realistic Forecast GDP Data (MUSD)
2015-16	298,770
2016-17	332,058
2017-18	368,943

2018-19	409,795
2019-20	455,021
2020-21	505,076
2021-22	561,549
2022-23	624,191
2023-24	693,677
2024-25	770,763
2025-26	856,293
2026-27	953,712
2027-28	1,062,242
2028-29	1,183,201
2029-30	1,318,077

Table 50 : Pak Realistic Future GDP Amounts

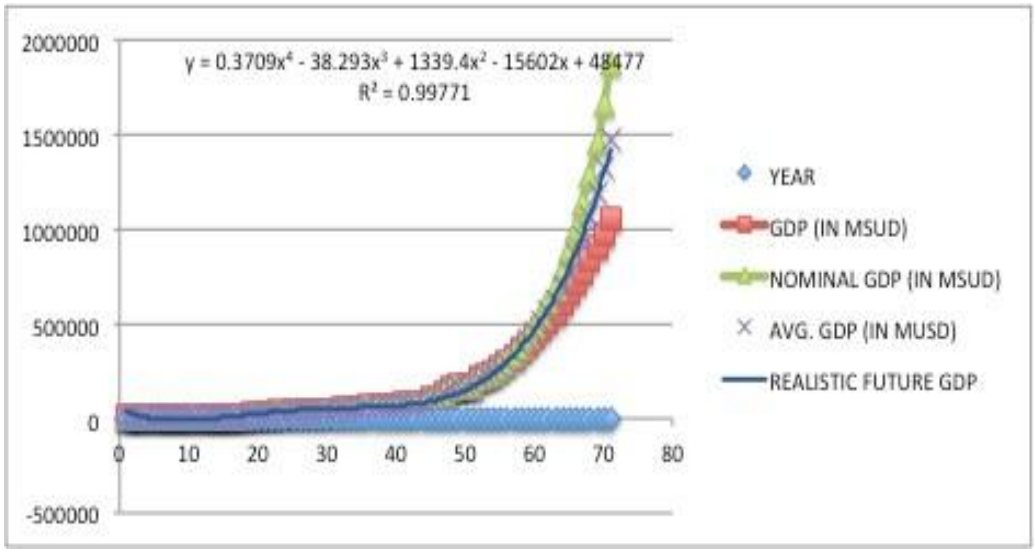

Figure 38 : Realistic Future GDP Amounts Plot

(iv) **Forecast of CGE as per Linear Regression Analysis**. This is calculated by Linear Regression Analysis of GDP (Independent variable) & CGE (dependent variable) data of past 59 years.

Year	Forecast CGE Data (MUSD)
2015-16	30,215
2016-17	33,544
2017-18	37,233
2018-19	41,318
2019-20	45,841
2020-21	50,846
2021-22	56,493
2022-23	62,758
2023-24	69,706
2024-25	77,415
2025-26	85,968
2026-27	95,710
2027-28	106,563
2028-29	118,659
2029-30	132,146

Table 51 : Pak Forecast of CGE as per Linear Regression Analysis

Note: - The intercept formula is as below based on regression

CGE (IN MUSD) = 338.4766 + 0.1 * AVG. GDP (IN MUSD)

(v) **Forecast of MIL EXP. as per Linear Regression Analysis**. This is calculated by Linear Regression Analysis of GDP & CGE (independent variables) and Military Expenditure (dependent variable) data of past 25 years.

Year	Forecast Avg. MIL EXP. (MUSD)
2015-16	8,875
2016-17	9,668
2017-18	10,547
2018-19	11,520
2019-20	12,598
2020-21	13,790
2021-22	15,136
2022-23	16,628
2023-24	18,284
2024-25	20,121
2025-26	22,159
2026-27	24,480
2027-28	27,066
2028-29	29,948
2029-30	33,162

Table 52 : Pak Forecast of MIL EXP as per Linear Regression Analysis

Note: - The intercept formula is as below based on regression

MIL EXP. (IN MUSD) = 1722.6640+ 0.0140 * AVG. GDP (IN MUSD) - 0.0982 * CGE (IN MUSD)

Forecast of Minimum & Maximum MIL EXP. This is computed by finding out the Error Estimate as follows with data of S y,x and n obtained from regression analysis at (v) above:-

S y,x	**293.48758**
n	26
df = n-2	24
LOS	0.05
Std. Error (SE) = T.INV.2T(LOS,df)	2.063898562
Error of Estimate (EE) = SE * S y,x	**605.7285923**

Year	Forecast Min. MIL EXP. (MUSD)	Forecast Avg. MIL EXP. (MUSD)	Forecast Max. MIL EXP. (MUSD)
2015-16	8,269	8,875	9,480
2016-17	9,062	9,668	10,274
2017-18	9,941	10,547	11,152
2018-19	10,914	11,520	12,126
2019-20	11,992	12,598	13,203
2020-21	13,185	13,790	14,396
2021-22	14,530	15,136	15,742
2022-23	16,023	16,628	17,234

2023-24	17,678	18,284	18,890
2024-25	19,515	20,121	20,727
2025-26	21,553	22,159	22,764
2026-27	23,874	24,480	25,086
2027-28	26,460	27,066	27,672
2028-29	29,342	29,948	30,554
2029-30	32,556	33,162	33,767

(vi) **Forecast Defence Expenditure**. It is computed as 65% of total Military Expenditure computed at (vi) above.

Year	Forecast Min. DEF. EXP. (MUSD)	Forecast Most likely DEF. EXP. (MUSD)	Forecast Max. DEF. EXP. (MUSD)
2015-16	5,375	5,769	6,162
2016-17	5,890	6,284	6,678
2017-18	6,462	6,855	7,249
2018-19	7,094	7,488	7,882
2019-20	7,795	8,188	8,582
2020-21	8,570	8,964	9,357
2021-22	9,445	9,838	10,232
2022-23	10,415	10,809	11,202
2023-24	11,491	11,885	12,278
2024-25	12,685	13,079	13,472
2025-26	14,009	14,403	14,797

2026-27	15,518	15,912	16,306
2027-28	17,199	17,593	17,987
2028-29	19,072	19,466	19,860
2029-30	21,161	21,555	21,949

Table 53 : Pak Forecast Defence Expenditure

(d) **USA**

(i) **Forecast of GDP as per Time Series Trend Analysis**. This is calculated based on the Time Series and Trend Analysis (Polynomial series of order 4) of the GDP data of past 59 years.

Year	Forecast GDP Data (MUSD)
2015-16	17,777,165
2016-17	18,245,829
2017-18	18,702,153
2018-19	19,144,490
2019-20	19,571,146
2020-21	19,980,378
2021-22	20,370,394
2022-23	20,739,354
2023-24	21,085,367
2024-25	21,406,497
2025-26	21,700,755
2026-27	21,966,108
2027-28	22,200,469

2028-29	22,401,706
2029-30	22,567,638

Table 54 : USA Forecast of GDP as per Time Series Trend Analysis

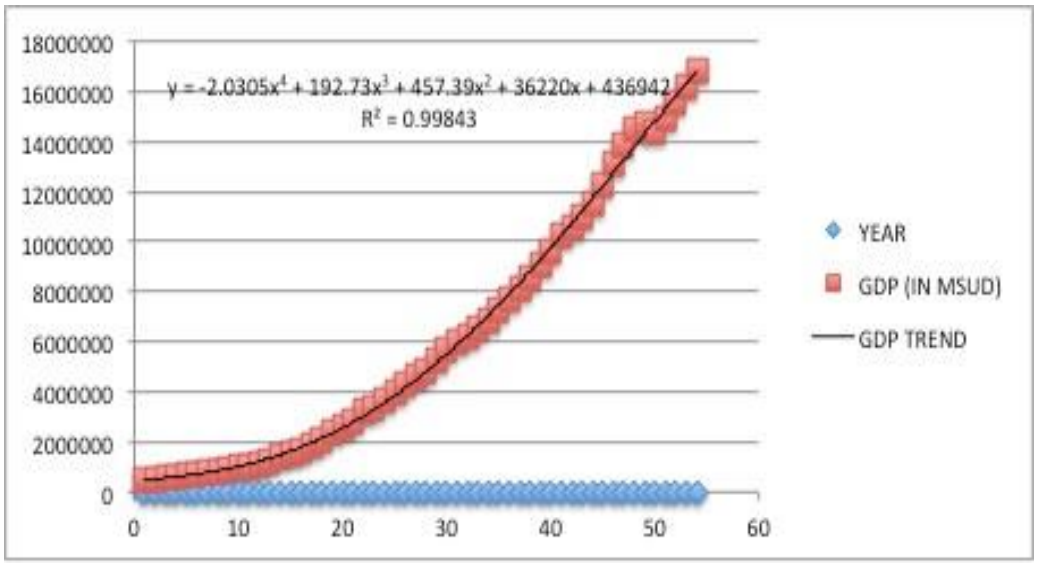

Figure 39 : Forecast of GDP as per Time Series Trend Analysis

(ii) **Forecast of GDP as per Experts' Average Forecasted Rates**. The calculations are based on the 'Forecast of Average Growth Rates given by experts (Y1 to Y5 at 4 %, Y6 to Y 10 at 4.5% & Y 11 to Y 15 at 5%). Additionally average inflation of 1.7 % annually has been added based on macroeconomic indicator.

Year	Forecast GDP Data (MUSD)
2015-16	18,769,783
2016-17	19,839,661
2017-18	20,970,522
2018-19	22,165,841
2019-20	23,429,294
2020-21	24,764,764

2021-22	26,300,179
2022-23	27,930,790
2023-24	29,662,499
2024-25	31,501,574
2025-26	33,454,672
2026-27	35,696,135
2027-28	38,087,776
2028-29	40,639,657
2029-30	43,362,514

Table 55 : USA Forecast of GDP as per Experts' Average Forecasted Rates

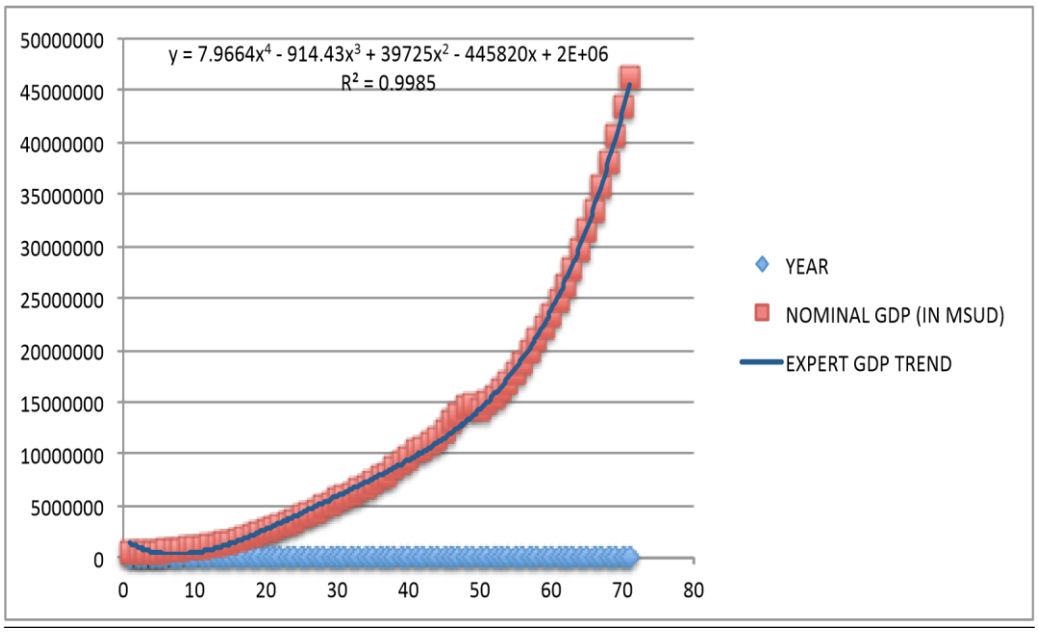

Figure 40 : Forecast of GDP as per Experts' Avg

(iii) **Realistic Future GDP Amounts.** For each year, the Average of the amounts arrived at from (i) and (ii) above.

Year	Realistic Forecast GDP Data (MUSD)
2015-16	18,273,474
2016-17	19,042,745
2017-18	19,836,337
2018-19	20,655,165
2019-20	21,500,220
2020-21	22,372,571
2021-22	23,335,287
2022-23	24,335,072
2023-24	25,373,933
2024-25	26,454,036
2025-26	27,577,714
2026-27	28,831,121
2027-28	30,144,122
2028-29	31,520,682
2029-30	32,965,076

Table 56 : USA Realistic Future GDP Amount

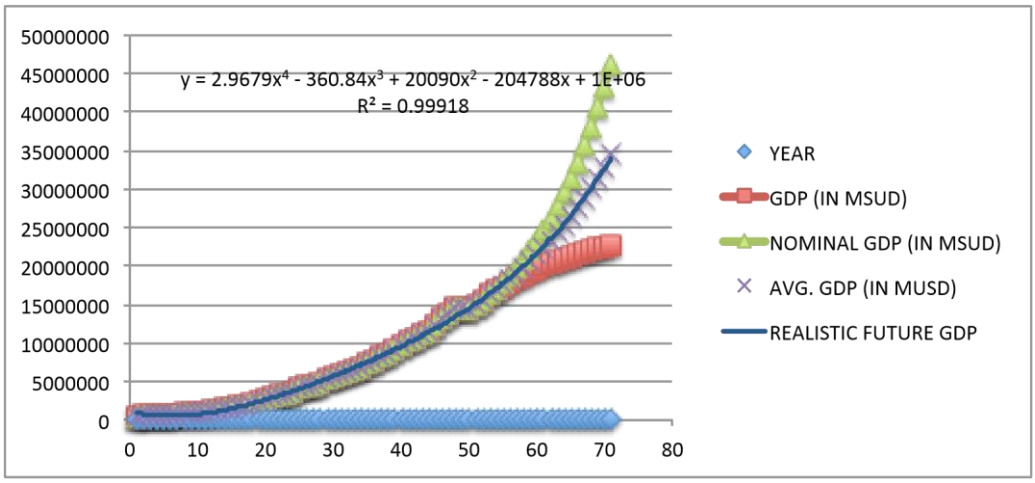

Figure 41 : Realistic Future GDP Amounts Plot

(iv) **Forecast of CGE as per Linear Regression Analysis**. This is calculated by Linear Regression Analysis of GDP (Independent variable) & CGE (dependent variable) data of past 59 years.

Year	Forecast CGE Data (MUSD)
2015-16	2,825,897
2016-17	2,944,519
2017-18	3,066,891
2018-19	3,193,154
2019-20	3,323,462
2020-21	3,457,978
2021-22	3,606,429
2022-23	3,760,596
2023-24	3,920,788
2024-25	4,087,340
2025-26	4,260,611
2026-27	4,453,887
2027-28	4,656,351
2028-29	4,868,617
2029-30	5,091,343

Table 57 : USA Forecast of CGE as per Linear Regression Analysis

Note: - The intercept formula is as below based on regression

CGE (IN MUSD) = 8127.8219 + 0.1542 * AVG. GDP (IN MUSD)

Forecast of Capital Defence Budget including Research and Development

7.4 **Forecast of Capital Defence Budget including R&D**.

(a) **India**. Average distribution of 40% of the Defence Budget of India as Capital Defence Budget has been the base for this calculation.

(i) Every Year (Y1 to Y15). The results are tabulated below for ***India***.

Year	DSE (MUSD)	CAPITAL BUDGET (MUSD)
2015-16	36,217	14,487
2016-17	39,558	15,823
2017-18	44,913	17,965
2018-19	50,712	20,285
2019-20	54,860	21,944
2020-21	60,121	24,048
2021-22	65,863	26,345
2022-23	72,130	28,852
2023-24	78,971	31,588
2024-25	86,439	34,576
2025-26	94,668	37,867
2026-27	103,670	41,468
2027-28	113,522	45,409
2028-29	124,311	49,724
2029-30	136,133	54,453

Table 58 : India Forecast of Capital Defence Budget including R&D

Capital Budget Requirement Summary

(ii) In Short Term (sum of amounts for Y1 to Y5): 115,704 ***MUSD***

(iii) In Medium Term (sum of amounts of Y1 to Y 10): 339,294 **MUSD** (iv)

(iv) In Long Term (sum of amounts Y1 to Y15): 719,164 ***MUSD***

(b) **China**. Average distribution of 40% of the Defence Budget of China as Capital Defence Budget has been the base for this calculation.

(i) Every Year (Y1 to Y15). The results are tabulated below for ***China***.

Year	DSE (MUSD)	CAPITAL BUDGET (IN MUSD
2015-16	152,095	62,359
2016-17	169,358	69,437
2017-18	188,266	77,189
2018-19	208,943	85,667
2019-20	231,521	94,924
2020-21	256,140	105,017
2021-22	282,657	115,889
2022-23	311,469	127,702
2023-24	342,740	140,523
2024-25	376,642	154,423
2025-26	413,364	169,479
2026-27	452,183	185,395
2027-28	494,062	202,566
2028-29	539,207	221,075
2029-30	587,837	241,013

Table 59 : China Forecast of Capital Defence Budget including R&D

Capital Budget Summary

(i) In Short Term (sum of amounts for Y1 to Y5): ***494,592 MUSD***

(ii) In Medium Term (sum of amounts of Y1 to Y 10): **1,202,610 MUSD**

(iii) In Long Term (sum of amounts Y1 to Y15): ***2,315,133 MUSD***

(c) **Pakistan**. Average distribution of 40% of the Defence Budget of Pakistan as Capital Defence Budget has been the base for this calculation.

(i) Every Year (Y1 to Y15). The results are tabulated below for ***Pakistan***.

Year	DSE (MUSD)	CAPITAL BUDGET (IN MUSD
2015-16	5,769	2,307
2016-17	6,284	2,514
Year	**DSE (MUSD)**	**CAPITAL BUDGET (IN MUSD**
2017-18	6,855	2,742
2018-19	7,488	2,995
2019-20	8,188	3,275
2020-21	8,964	3,585
2021-22	9,838	3,935
2022-23	10,809	4,323
2023-24	11,885	4,754
2024-25	13,079	5,231
2025-26	14,403	5,761
2026-27	15,912	6,365

2027-28	17,593	7,037
2028-29	19,466	7,786
2029-30	21,555	8,622

Table 60 : Pak Forecast of Capital Defence Budget including R&D

Capital Budget Summary

(ii) In Short Term (sum of amounts for Y1 to Y5): ***17,419 MUSD***

(iii) In Medium Term (sum of amounts of Y1 to Y 10): **41,425 MUSD**

(iv) In Long Term (sum of amounts Y1 to Y15): ***80,789 MUSD***

Military Security Concerns and Analysis

India

7.5 **Security Concerns**. Major security concerns of India are as follows:-

(a) Pakistan's single minded India centric approach, including unsolved territorial disputes.

(b) Pakistan's support to non-state actors.

(c) Internal security issues with external support both from Pakistan, China and other neighbouring countries.

(d) Assertive China and unsolved boundary issues.

(e) Growing bonhomie between China and our neighbours.

(f) Porous borders with eastern neighbours.

(g) Extension of China's footprints in IOR.

(h) Energy security and security of energy.

(j) Cyber threat.

(k) OOAC.

7.6 **Weightage**. Summarized weightage of security concern of India vis-à-vis various competitors/facets is as under:-

CONCERN	WEIGHTAGE
Pakistan	0.2
China	0.4
Eastern Neighbours	0.05
IOR	0.2
Strat. Reserve including OOAC	0.05
Internal Security	0.1
Total	1

Table 61: India Military Security Concerns Weightage

China

7.7 **Security Concerns**. Major security concerns of China are as follows:-

(a) Asia pivot of USA.

(b) Energy security and security of energy.

(c) South China Sea including Taiwan.

(d) Long-standing territorial disputes with Japan and South Korea.

(e) Revival of Russia.

(f) Containment of emerging India.

(g) Extending influence in IOR.

(j) Internal Security in areas of TAR and Xinjiang province.

(k) OOAC.

7.8 **Weightage**. Summarized weightage of security concern of China vis-à-vis various competitors/facets is as under:-

CONCERN	WEIGHTAGE
USA	0.25
South China Sea incl. Taiwan	0.18
India	0.15
IOR	0.2
Japan & South Korea	0.085
Russia & CAR	0.05
OOAC	0.06
Tibet & Internal Security	0.025
Total	1

Table 62 : China Military Security Concerns Weightage

Pakistan

7.9 **Security Concerns**. Major security concerns of Pakistan are as follows: -

(a) Military imbalance with India.

(b) Unsolved border disputes, including Kashmir issue.

(c) Growing influence of India in Afghanistan including withdrawal of ISAF.

(d) Internal Security threat.

(e) Water & Energy Security.

(f) Capability development to influence North Arabian Sea.

(g) India's Strategic Relationship with USA.

7.10 **Weightage**. Summarized weightage of security concern of Pakistan vis-à-vis various competitors/facets is as under:-

CONCERN	WEIGHTAGE
India	0.45
Internal Security	0.25
North Arabian Sea	0.05
Afghanistan	0.2
Safeguarding Energy Security	0.05
Total	1

Table 63 : Pak Military Security Concerns Weightage

Assessment of Strategic Military Financial Gaps

7.11 The following considerations have been kept in mind while carrying out the assessment: -

(a) Entire Capital Defence Budget cannot be utilized for developing military capability to be used against one competitor nor will utilization of entire Capital Defence Budget lead to developing desired military capability to be used against all competitors.

(b) Each country would utilize the following:-

(i) Specified proportion of Capital Defence Budgets to develop military capabilities for each security concerns, as per its own priority/ weightage.

(ii) Specified proportion of Capital Defence Budget to develop "Strategic Reserve Military Capability" which can be utilized to address any or all military security concerns and contingencies.

(c) Thus, military security concerns of China and Pakistan have been identified along with assigning prudent weightages on account of India vis-a- vis others.

(d) The percentage of Capital Defence Budget that China and Pakistan would utilize to address Military concerns against India as well as percentage that they may utilize to develop "Strategic Reserve Military Capability" have been identified.

(e) Similarly, for India, percentage of Capital Defence Budgets that would be adequate for developing military capabilities to address Pakistan and China as well as for "Strategic Reserve Military Capability" in relation to other military security concerns/aspirations viz, IOR and other potential competitors in the region have also been worked out.

(f) Utilizable Capital Amounts for Developing Military Capability (for Short, Medium and Long terms i.e. Y1 –Y5, Y1 Y1-Y10, Y1-Y15).

Financial Gap as a Result of Above Analysis

7.12 **For India**. Given as per expert opinion 100 BUSD, 150 BUSD, 200 BUSD over short, mid and long term with an escalation of 5%.

Period□□	Short Term (Y1-Y5)	Mid Term (Y1-Y10)	Long Term (Y1-Y15)
Amount to achieve desired capability in (MUSD)	129,554	318,554	637,034
Amount for modernisation	100,000	250,000	450,000
Amount to achieve desired capability based on	116,038	330,170	679,725

Future Value in MUSD (a)			
Minimum Allotment as per Forecast (b)	125,450	310,820	626,089
Most Likely Allotment as per Forecast (c)	129,554	318,345	637,034
Max allotment as per Forecast (d)	133,659	325,870	647,980
Period	**Short Term (Y1-Y5)**	**Mid Term (Y1-Y10)**	**Long Term (Y1-Y15)**
Financial Gap Worst Case (b) - (a)	9,412	-19,350	-53,636
Financial Gap Level 1 (c) - (a)	13,516	-11,825	-42,691
Financial Gap Best Case (d) - (a)	17,621	-4,300	-31,745

Table 64 : India Financial Gap

7.13 **Theatre Specific Perspective**.

(a) **China against India**.

Period	Capital(MUSD)	India	US	South China Sea & Taiwan	Russia & CAR	Japan & South Korea	IOR	OOAC	Tibet & Int. Sec	Total
Weightage		0.15	0.25	0.18	0.05	0.085	0.2	0.06	0.025	1
2015-16	69,437	10,416	17,359	12,499	3,472	5,902	13,887	4,166	1,736	69437
2016-17	77,189	11,578	19,297	13,894	3,859	6,561	15,438	4,631	1,930	77189

2017-18	85,667	12,850	21,417	15,420	4,283	7,282	17,133	5,140	2,142	85667
2018-19	94,924	14,239	23,731	17,086	4,746	8,069	18,985	5,695	2,373	94924
2019-20	105,017	15,753	26,254	18,903	5,251	8,926	21,003	6,301	2,625	105017
		64,835					**86,447**		**10,806**	
2020-21	115,889	17,383	28,972	20,860	5,794	9,851	23,178	6,953	2,897	115889
2021-22	127,702	19,155	31,926	22,986	6,385	10,855	25,540	7,662	3,193	127702
2022-23	140,523	21,078	35,131	25,294	7,026	11,944	28,105	8,431	3,513	140523
2023-24	154,423	23,163	38,606	27,796	7,721	13,126	30,885	9,265	3,861	154423
2024-25	169,479	25,422	42,370	30,506	8,474	14,406	33,896	10,169	4,237	169479
		106,202					**141,603**		**17,700**	
2025-26	185,395	27,809	46,349	33,371	9,270	15,759	37,079	11,124	4,635	185395
2026-27	202,566	30,385	50,642	36,462	10,128	17,218	40,513	12,154	5,064	202566
2027-28	221,075	33,161	55,269	39,794	11,054	18,791	44,215	13,265	5,527	221075

2028-29	241,013	36,152	60,253	43,382	12,051	20,486	48,203	14,461	6,025	241013
2029-30	262,475	39,371	65,619	47,246	13,124	22,310	52,495	15,749	6,562	262475
		166,879					**222,505**		**27,813**	

		Cumulative
Short Term (Y1-Y5)*	**162,088**	**162,088**
Mid Term (Y5-Y10)*	**265,506**	**427,594**
Long Term (Y10-Y15)*	**417,197**	**844,790**

Table 65 : Theatre Specific Perspective

***Note - Figure is sum total of Capital Budget allocation for capability development against India, IOR & Tibet (incl. IS)**

(b) **Pakistan against India**.

Period	**Capital(MUSD)**	**India**	**China**	**Arabian Sea**	**Afghanistan**	**Safeguarding Energy Security**	**Internal Security**	**Total**
Weightage		**0.45**	**0**	**0.05**	**0.2**	**0.05**	**0.25**	1
2015-16	2,307	1,038	0	115	461	115	577	2307
2016-17	2,514	1,131	0	126	503	126	629	2514

2017-18	2,742	1,234	0	137	548	137	686	2742
2018-19	2,995	1,348	0	150	599	150	749	2995
2019-20	3,275	1,474	0	164	655	164	819	3275
		6,225		**692**				
2020-21	3,585	1,613	0	179	717	179	896	3585
2021-22	3,935	1,771	0	197	787	197	984	3935
2022-23	4,323	1,945	0	216	865	216	1,081	4323
2023-24	4,754	2,139	0	238	951	238	1,189	4754
2024-25	5,231	2,354	0	262	1,046	262	1,308	5231
		9,823		**1,091**				
2025-26	5,761	2,592	0	288	1,152	288	1,440	5761
2026-27	6,365	2,864	0	318	1,273	318	1,591	6365
2027-28	7,037	3,167	0	352	1,407	352	1,759	7037

2028-29	7,786	3,504	0	389	1,557	389	1,947	7786
2029-30	8,622	3,880	0	431	1,724	431	2,156	8622
TOTAL		**16,007**		**1,779**				

		Cumulative
Short Term (Y1-Y5)*	**6,917**	**6,917**
Mid Term (Y1-Y10)*	**10,914**	**17,831**
Long Term (Y1-Y15)*	**17,786**	**35,616**

Table 66 : Theatre Specific Perspective

***Note - Figure is sum total of Capital Budget allocation for capability development against India and Arabian Sea.**

(c) **India against Pakistan & China**

Period	**Capital(MUSD)**	**China**	**Pakistan**	**Myanmar, Bhutan, Nepal, Bangladesh**	**IOR**	**OOAC**	**Internal Security**	**Total**
Weightage		0.4	0.2	0.05	0.2	0.05	0.1	1
2015-16	16,471	6,588	3,294	824	3,294	824	1,647	16471
2016-17	18,261	7,304	3,652	913	3,652	913	1,826	18261
2017-	20,232	8,093	4,046	1,012	4,046	1,012	2,023	20232

18								
2018-19	22,401	8,960	4,480	1,120	4,480	1,120	2,240	22401
2019-20	24,785	9,914	4,957	1,239	4,957	1,239	2,479	24785
		40,860	**20,430**		**20,430**		**10,215**	
2020-21	27,403	10,961	5,481	1,370	5,481	1,370	2,740	27403
2021-22	30,409	12,164	6,082	1,520	6,082	1,520	3,041	30409
2022-23	33,725	13,490	6,745	1,686	6,745	1,686	3,373	33725
2023-24	37,382	14,953	7,476	1,869	7,476	1,869	3,738	37382
2024-25	41,414	16,566	8,283	2,071	8,283	2,071	4,141	41414
		68,133	**34,067**		**34,067**		**17,033**	
2025-26	45,860	18,344	9,172	2,293	9,172	2,293	4,586	45860
2026-27	50,999	20,400	10,200	2,550	10,200	2,550	5,100	50999
2027-28	56,703	22,681	11,341	2,835	11,341	2,835	5,670	56703
2028-	63,035	25,214	12,607	3,152	12,607	3,152	6,304	63035

29								
2029-30	70,068	28,027	14,014	3,503	14,014	3,503	7,007	70068
TOTAL		**114,666**	**57,333**		**57,333**		**28,667**	

	Against China		Against Pak	
		Cumulative		Cumulative
Short Term (Y1Y5)*	**71,505**	**71,505**	**30,645**	**30,645**
Mid Term (Y1-10)*	**119,233**	**190,738**	**51,100**	**81,745**
Long Term (Y1Y15)*	**200,666**	**391,404**	**86,000**	**167,744**

Table 67 : Theatre Specific Perspective

*Note - Figure is sum total of Capital Budget allocation for capability development against:-

(i) China including IOR & internal security (ii) Pakistan including internal security.

7.14 **Financial Capacity Differential**.

Period	**STRATEGIC MIL FIN GAP**			
	China-India	**% shortfall for India wrt China**	**Pakistan – India**	**% Excess for India wrt Pakistan**
Short Term	90583	127%	23728	77%
Mid Term	146273	123%	40186	79%
Long Term	216531	108%	68214	79%

Table 68 : Financial Capacity Differential

Risk Analysis

7.15 As per the current trends, the strategic military financial gap with respect to Pakistan is in favour of India (77 – 79 % excess) and hence no problems are envisaged on this front. This however indicates that we are more Pakistan Centric at the moment and we could address the gap with respect to China by a gradual and regular shift of allocations/ resources towards our Chinese concerns to enable us to catch up faster with China in the medium to long term (shortfall of 108 to 123 %). Alternately, shifting it from our allocations to Pakistan centric concerns to ensure that more reserves are available to address our concerns against China could increase the allocations to Strategic Reserves and OOAC. The aspirations should match the affordability. If there exists a mismatch i.e. aspirations are more than affordability, there is an inherent Risk involved. The additional fund allocation would entail the following towards China:-

(a) China is building road, rail and air connectivity as part of its major expanse for infrastructure development. This needs to be mitigated by developing adequate infrastructure development on the Indian territory as well by India.

(b) Since China is asserting its presence in the IOR, India needs to build more ships and hence increase its presence in the region.

(c) There is a need to develop strategic lift capability.

(d) There is a need for enhancing the role and operation of the already formed Mountain Strike Core.

(e) Rapid reaction force is required to be deployed in case of escalation of situations.

(f) There is a need for develop forward logistics nodes.

(g) The intelligence, surveillance and reconnaissance capability is required to be enhanced as cyber space is being adequately exploited by China.

(h) Space based assets for conduct of military operations are essential.

(i) There is a need to develop long range vectors.

Recommendations

7.16 As per current trends, the financial gap in favour of China during the short, medium and long term is the cause of worry and needs to be addressed on top priority. The above gap can be addressed by taking the following measures:-

(a) The government needs to initiate steps to increase GDP growth rate while keeping the inflation under check.

(b) Increase in percentage allocation for Defence from GDP.

(c) Decrease in Defence revenue expenditure gradually.

(d) Continue CBMs along the borders.

(e) Political and economic initiatives to engage China in bilateral trade and investment in energy sector.

(f) Building strategic deterrence.

7.17 **India - Pakistan**. As per the current trends, the strategic military financial gap wrt Pakistan is in favour of India. No problems are envisaged on this front. This however indicates that we are more Pakistan Centric at the moment and we could address the gap wrt China by a gradual and regular shift of allocations/ resources towards our Chinese concerns to enable us to

catch up faster with China in the medium to long term. Alternately, shifting it from our allocations to Pakistan centric concerns to ensure that more reserves are available to address our concerns against China could increase the allocations to Strategic Reserves and OOAC. It is therefore strongly recommended that Defence allocations need to be appropriated in order to bridge capability against China.

Conclusion

7.18 Forecasting can at best be an approximation and provide a means to plan for the future. There is a need to exercise caution while dealing with these forecasts, they may be fraught with dangers of uncertainty and complexity. There is a need to continuously monitor the environment to look for the signs or change so that these can be incorporated and comparatively accurate assessment can be made at that point of time.

7.19 In order to meet our aspirations to be the regional power, India needs to match its capabilities with the responsibilities that are expected from the regional player. These responsibilities include the ability to carry out the desired military and non-military tasks as relevant. This necessitates the developing of compatible and credible military might in the IOR. China will continue to be our immediate competitor in the region. We need to bridge the present and future strategic military financial gap with respect to China.

CHAPTER – 8

Recommendations and Areas of Future Research

8.1 As enunciated in the TPCR, the Indian Armed Forces are poised for major modernisation in the next fifteen years. This process would involve upgrades of hardware and systems as well as purchase of new state of art equipment to enable them meet the security challenges in the coming decades; the volumes are high and the financial outlays large. There is substantial scope in the process for Indian industry to harness this market to develop indigenous capability; especially in high technology areas. Given such a forecast it would be only prudent to have the in-house expertise built-up and the private industries catching up with the requirements of defence forces.

Recommendations

8.2 With the new DPP-2016 where in the thrust is on giving priority to the Indian MSMEs and Indian Industry under the new IDDM category, it is upto the industry to take the step forward. However, as part of risk sharing or mitigation, the government needs to make the environment in which the private sector would operate, conducive for business, else the participation of the private sector would remain more or less on paper as hitherto. The recommendations that mandate actions on part of the government for early resolution are described in the succeeding paragraphs.

(a) **Dedicated Acquisition Organization**. Similar to various PPP models discussed in Chapter 3, there is a need to have a dedicated **Acquisition Organisation at MoD, but independent of MoD (Ref Program Management Structure for Defence Acquisitions)** with integral experts / specialists onboard, reporting directly to the Defence Minister. A wing of this organisation would take the requirements from the MoD and in consultation with the users (service headquarters) work in close coordination with the industry and supervise the R&D activities. The Acquisition organisation must also serve ***as the easy to***

access, single point contact for addressing all issues like Industrial license, tax-incentives, import/export clearances, offsets, sales etc.

(b) A fifteen year perspective financial model with pragmatic financial allocation for threat based capability development including R&D, thereby assuring industry of the project wise cash flows (putting money where the mouth is).

(c) A clear guidelines for selection of SP (a robust mechanism for selection without fear or favours) and allowing SP to take ownership of the vertical for short, mid and long term.

(d) A clear policy and procedure for sharing of R&D infrastructure facilities / labs under DRDO administration.

(e) Formulation of JVs / PPP agreements between PSUs and academia/start-ups/ potential technical bodies for research and co-development

(f) Ensure ease of access by the private sectors to the Directorate of Defence Production and other concerned officials to facilitate interaction and coordination.

(g) Provide greater visibility to and understanding of DPP, TPCR, DPM etc by means of regular public seminars / interactions with the industry.

(h) Streamline processes and procedures for easy and quick funding, access to working capital, provision for loans for R&D activities and reimbursements of investments. Establishment /activation of Defence Innovation Fund (DIF) and Technology Development Fund (TDF) for providing grants to the relevant agencies for creating facilities may be a step in this direction.

(i) Extend Income Tax incentives which are available to other core industries to industries working on defence R&D projects.

(j) Continued thrust to make projects and thus provide the much needed push to the indigenous designs and equipment.

(k) Provide level playing field to both domestic and foreign bidders – streamlining the

DCF method for multi-currency bids, allowing multi-currency bids, provision for price variation clause etc.

(l) Government must make provisions to incentivize the R&D activities right at the school/university levels and harness the resident talents, nurture them and provide appropriate opportunities in the mainstream R&D.

(m) Government as owner of the R&D projects must be ready to accept failures of researches and all long haul projects not completed in a time bound manner should be shelved (like DARPA) instead of continued investment.

(n) The ratio of advance being provided by the government needs to be reviewed. It is proposed that 20-25% on selection of proof of concept and may be another 20% on commencement of the work as advance may be granted to the firm.

(o) The government needs to have a clear policy on the IPR issues and to start with can have the strategic / security implications of the product as the guiding principle followed by the proportion of funding. Following is suggested:-

(i) In case of a strategic project, the IPR, must be resident with the Government *as 'walk-in rights*', with may be a pre-agreed ratio of the royalty being paid to the firm for any subsequent production order.

(ii) For a fully funded project, the IPR must be purely with the government.

(iii) For lesser critical / strategic projects (e.g. dual use technology), the IPR could be held jointly by the firm and the government with a binding that the product would not be shared with other nations without prior government consent. In such a case the process of approval (how and by whom) along with laid down time period for approval, must also be formalized.

(p) Establishment of a dedicated ***Wing*** at ***Indian National Defence University (INDU)*** (on lines with France) which would train all personnel prior to being transferred to / working at the acquisition of MoD periodically and specialise them vertically with

contemporary processes and globally successful techniques.

8.3 **Areas of Future Research**. As part of restructuring, future research could be undertaken on following issues:-

(a) To study and formulate restructuring of DRDO on lines of DARPA or DGA, France.

(b) Formulating the government policy towards addressing of IPR issues in joint ventures with the private sector.

(ARTICLE)

MIC INDIA INC (MILITARY INDUSTRY COMPLEX INCORPORATION) … TIME TO MATURE!

CAPABILITY MATURITY MODEL IMPLEMENTATION

Indian Defence Conglomerates have displayed some extraordinary maturity and capability in the complete product life cycle for advanced systems such as missile launchers, rocket launchers, sensors such as radars and sonars, avionics, secure communication and aircraft sub-systems. With world-class skills in IT and ITeS, the private sector has augmented India's indigenous defence production capability. However self-reliance in the field of defence acquisitions seems to be an extremely distant reality and associated policies are only retarding the process further. I talk of ***Capability Maturity Model*** *that can not only bring in level play field for private and public defence industry alike but can actually weave a comprehensive eco system towards realising '****Make in India****'.Readon…*

"…unless the void that exists between the scientists, the engineers and war fighter is recognised- a hiatus will exist between the inventor who knows what they could invent if only they knew what was wanted, and the soldiers who know or ought to know what they want and would ask for if they only knew how much science could do for them…"

…Winston Churchill

Ground Zero.

1. A nation with most innovative MARS mission under its belt continue to flounder over its all three fighter aircrafts induction projects. Rightly so, the Air Chief expresses serious concerns over the delays in MMRCA, Tejas and FGFA which could translate into serious voids in IAF operational capabilities on single front only leave alone ambitious yet pragmatic two front scenario[1]. Down to just 34 fighter squadrons which include 14 aging and virtually obsolete MiG-21s and MiG-27s, the Force is obviously worried about its fast depleting air combat power. While Tejas and FGFA are stuck with limitations of captive R&D agencies, MMRCA delays are well known and have been in public domain for long for all possible reasons with deliveries still far

[1] Economic Times, defence, 14 Jul 2018

away. In 2013, while Brazilian Embraer competed with Canadian rival Bombardier for the title of the third largest airplane maker after Airbus and Boeing[2], the giants in Lockheed Martin and Sikorsky Aerospace Services could bet on the youngest kid on the block AMMROC (Advanced Military Maintenance, Repair and Overhaul Centre-UAE) for world class MRO (Maintenance, Repair and Overhaul) delivery[3]. It needs some serious introspection that why capability maturity of own defence industry comes under suspicion every time. Is it about quantifying, providing right opportunities and establishing accountability of own niche competence in the field or lack of the same altogether? The article establishes that it has got to do more with the former and putting bricks and mortars in place for the same.

2. The Avro-replacement programme of the Indian Air Force (IAF) started with the suggestion that it be placed in the 'Buy (Global)' category[4]. During a presentation by the Air Headquarters to the then Secretary (Defence Finance), it was suggested that the programme had the potential of being placed in the 'Buy and Make (Indian)' category by roping in the private sector. The suggestion was received well by the IAF team, led by the then Deputy Chief of Air Staff. The suggestion to categorize the proposal as 'Buy and Make (Indian)', however, ran into difficulty as there are no ***guidelines*** that could be followed to nominate the Indian companies from the private sector to whom the Request for Proposal (RFP) could be issued. After further rounds of discussions, it was decided that the proposal could be placed under the 'Buy and Make' category. That gave rise to another problem. In 'Buy and Make' category, there is a requirement of nominating an Indian Production Partner (IPP) but there are no ***guidelines*** that could be invoked to nominate an Indian company from the private sector. It was then mooted to let the foreign Original Equipment Manufacturer (OEM) select the IPP. Two specially constituted committees, the first headed by the Scientific Advisor to the Defence Minister and the other by the Additional Secretary in the Department of Defence Production, went into this issue before a modus vivendi could be worked out.

3. **A Good Question**? In the case above, answers shall follow but the good question is "**Do we know what, when and whom to ask, what to assess and review, how to quantify, document, accept and certify and finally how to move beyond transactions alone into an era of strategic partnerships**?" so that time and again we don't attempt applying lengthy case specific solutions tying ourselves further into knots. Won't it be desirable that the entire MIC India Inc individually and collectively could state upfront and validate its capabilities, product and processes strengths? **Let's look at how Software Industry leveraged on this inclusive tool,**

[2] http://en.wikipedia.org/wiki/Embraer, accessed on 05 Oct 18
[3] Briefing during Author's visit to AMMROC facility, UAE, 17 Sep 14
[4] Economic moorings of the defence budget, 27 Feb 2013, IDSA comment, Amit Chowshish

Capability Maturity Model (CMM), and today the same world over is being replicated by niche value chains.

Capability Maturity Model Integration (CMMI)

4. Capability Maturity Model Integration (CMMI) is a process improvement approach that provides organizations with the essential elements of effective processes, which will improve their performance. CMMI-based process improvement[5] includes identifying an organization's process strengths and weaknesses and making process changes to turn weaknesses into strengths. The CMMI model provides organizations a rating on a numerical scale (1 – 5, with 5 being the highest) and is managed by the Software Engineering Institute (SEI). CMMI applies to teams, work groups, projects, divisions, and entire organizations. It's a collections of best practices that help organizations to dramatically improve effectiveness, efficiency, and quality. CMMI offers solutions that help improve an organization's performance and its ability to meet its business objectives.

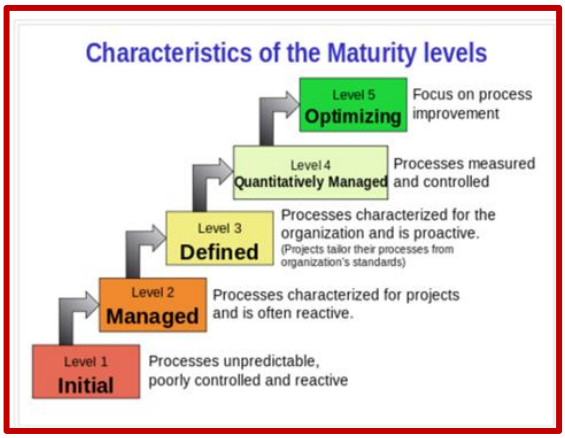

FIGURE 1: A PROGRESSIVE CMMI

5. The purpose of CMMI is to provide guidance for improving an organization's processes and its ability to manage the research, development, acquisition and maintenance of products and services. CMMI places proven practices into a structure that helps an organization assess its organizational maturity and process area capability, establish priorities for improvement, and guide the implementation of these improvements.

6. Setting a trend in governance efficiency and robustness, Technopark, Trivandrum[6], an autonomous society promoted by the Government of Kerala, became India's first technology park to obtain CMMI level 4. The acceptance for CMMI level 4 provides Technopark capability to provide world class, robust and failsafe **physical, power and data infrastructure**, offering a no compromise yet low cost enabling environment.

The Captive State Machinery: Hesitant to Quantify.

7. With an employee base of 1.8 lac people across 10 DPSUs and 40 OFs, which is at par with UK or France, own product line up of defence equipment is no match to these countries. Benchmarking output with own manufacturing industries alone, per capita output of DPSUs and

[5] http://www.selectbs.com/process-maturity, assessed on 20 Dec 2018
[6] http://www.technopark.org, assessed on 20 Dec 2018

Ordnance Factories stand at Rs 15 lac when compared to former's approx 20-40 lac per capita[7] production. Most DPSUs and OFs are working as insipid assembly lines sourcing components from private producers. While ToT absorption and its full exploitation with DPSUs continue to be a criticality, accountability and competition are being consistently ignored by denying JVs to private sector - an aspect that merits attention. A small country like Israel, which gained independence at almost the same time as India and with a population less than 1% of India's, today accounts for 10% of total global defence exports. China which until 2006 was the largest importer of defence goods, is today the fifth largest defence equipment exporter and State Owned Enterprises (SOEs) have got major stakes towards the same (of course they have been in news for both corruption and inefficiency issues too). Paradoxically, India, with its huge pool of technically qualified, globally competitive manpower, in dire need for employment for its population, has emerged as the largest importer.

8. From 2000 to 2015, while our capital expenditure has quintupled (from approx $ 3 Bn to $ 15 Bn), our inventory has declined on various counts viz Artillery pieces, Fighter Aircrafts, Attack Helicopters etc. I guess, intergovernmental purchases, overvalued technology, expensive sustainment programs have been the major contributors towards this increasing hollowness in authorised inventory of major weapon systems. A permanent bias towards Defence Public Sector Units (DPSUs) for licensed production of T-90 to SU 30 MKI is yet another cause for reduced bang for the buck.

9. While very recently procedures (read Defence procurement Procedures DPP) has managed to pull off a giant deal for MMRCA purely on competitive essence, it may still be early to assume that these procedures alone could guide Indian Defence Forces' capability build up plan without compromising on pricing and promoting own much needed self-reliant agenda. Hence with more than $ 100 bn of Defence Capital spending over next five years (which is only expected to double in medium term) on account of Naval Platforms to include submarines and support vessels, combat aircrafts from basic trainers to Mirage upgrade and ground equipment ranging from FICV to Javeline ATGMs to Future Infantry Soldier as System (F-INSAS), it is time we seriously invested in promoting and putting in place our own MIC. There is perhaps nothing new in what I have been asserting here but what is it that is consistently keeping us away from our intent (if I presume that to be genuine!). It is imperative and must that State owned DPSUs, OFs and DRDO Labs must go through an audit based on CMMI discussed above and must they achieve the time bound targets else pay the penalty in terms of losing out to Industry.

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[7] Boston Consultancy Report 2012

Indian Defence Industry: Quantify to be Counted.

10. Until 2001, when the defence industry was liberalised, the private sector's contribution to defence production was mainly restricted to supplying raw materials and parts and components. With the liberalisation of the industry, many private companies have however come forward, with some showing deep interest. According to the MoD, around 75 private companies[8] have till date received 135 industrial licenses for production of a variety of defence systems and sub-systems. More significantly, these LoIs pertain to some high technology items, including Armoured & Combat Vehicles, Radars, Electronic Warfare Equipment, Warships, Submarine, Avionics, Military aircraft, Safety & Ballistic products, Armaments and Ammunition among others.

11. Private sector participation in India's defence sector has made some invaluable contributions. While TATA Power SED demonstrated rich insight and technical depth in building 'Samyukta' — India's first major electronic warfare system, author is witness to TATA's innovation and enterprise acumen exhibited through technological demonstration of Mounted Gun System at its Bangalore Facility. FICV is yet another example wherein L&T and TATA Motors have shown immense prowess as developer and integrator. Similarly, L&T's in-house development of hull construction technologies for submarines was aptly employed towards INS Arihant — India's first nuclear submarine. Indian Defence Conglomerates in Bharat Forge, TATA, L&T, Ashok Leyland, M&M and others have displayed capability in the complete product life cycle for advanced systems such as missile launchers, rocket launchers, sensors such as radars and sonars, avionics, secure communication, and aircraft sub-systems. With world-class skills in IT, ITeS and manufacturing, the private sector has augmented India's indigenous defence production capability. However, incidents like shelving of FICV project, inordinate delays of TCS and industrialist Baba Kalyani's outburst for lack of facilities extension by GoI towards testing of weapons developed shows system owner's apathy to the entire process of capability development and promoting much needed self-reliance. Time is now ripe to change tack so as to capture maximum wind in local Defence Industries' sails. During one of the National Seminar conducted by CDM, when extra visible bonhomie amongst industry captains present was questioned by one of the delegates, prompt came the reply from industry lobby that 'Even 100 percent of zero is zero and hence any amount of competition for that zero (referring to zero opportunity to entire private defence industry over captive PSUs) or bad blood amongst them was actually worth nothing and hence that bonhomie'. I would say such sentiments reflect both maturity and desperation on part of

[8] www.indiandefencereview.com, assessed on 05 Oct 18

Industry that is capable of delivering but missing on opportunities due faulty policy formulation. It is time that relationship with private defence industry got upgraded to 'Partner' from 'Seller'.[9]

12. Since private sector is relatively new to defence production, it has taken routes of partnership and acquisition to get into the higher league. There have been several partnerships between Indian private companies and their foreign counterparts. Of particular significance is the joint venture (JV) between the India's Mahindra with UK's largest defence company BAE Systems. The JV, with an initial strength of 50-60 people, plans to produce a range of armoured vehicles. As regards acquisition of foreign companies, the same Mahindra Group acquired in December 2009, majority stakes in two Australian defence companies, Aerostaff Australia and Gippsland Aeronautics, signaling its entry into the defence and aerospace business. The global Defence and domestic majors have shown tremendous faith in the potential and processes of home grown players. TATA-Boeing for manufacturing of aerospace components, TATA – Sikorsky for production of helicopter cabins, Merc's Bangalore based design team are some very fine examples of maturity of Indian players and stamp and seal of the World's finest over their respective strengths, capacities and processes ripeness. Perhaps its time that it got recorded for internal consumption too.

13. Global defence companies are keen on actively engaging local defence industry enterprise due shrinking defence budgets all over and Indian industries demonstrated potential in engineering services and component manufacturing leveraging low manufacturing costs and skill pool. If we are able to carve out suitable policies Indian Defence Industry can not only cater for its own defence needs but also gain substantial export share (must formulate own export facilitation agency on the lines of Russia's Rosonboro and SA's ARMSCOR) thus leading to positive trade flows and significant job creation.

14. To take the process further and quantify research and development depth, industry interfaces (FICCI, CII, ASSOCHAM) may consider it prudent to evolve customised CMMI model and document maturity of own processes in the fields and domains specific thus providing a ready 'Bill of Fare' to the decision makers with adequate competition and parallel avoiding legal battles which have led to retraction and prolonging of many a modernisation initiatives in recent past.

[9] ORF Seminar series, http://orfonline.org/cms/sites/orfonline, assessed on 05 Oct 18

15. Ancillaries Just to put the whole idea in perspective, we may divide our defence requirements in select verticals viz Air Defence and Missiles, Aviation and Aerospace, Combat Vehicles, Armament and C4I2SR. Now a central agency, Defence Technology Commission (DTC) may work out the **Trinity** to include Core Capability Drivers, Processes and associated eco system which is most essential to be counted in each or all of the verticals cited above. An Expression of Interest, EoI, may not be able to obtain 20-30 such conglomerates, my guess, who may be keen to get quantified on the trinity and get suitable accreditation in terms of CMMI 1 to 5. Going by absolute merit each of the vertical may have two-three CMMI 5 qualifiers and they must become the leverage points in our Buy/ Make (Indian) motivation. Going by free market principles, capable SMEs/ MSMEs would automatically gravitate towards these giants and get fully absorbed in their mission ensuring win-win for both, fig-2 refers.

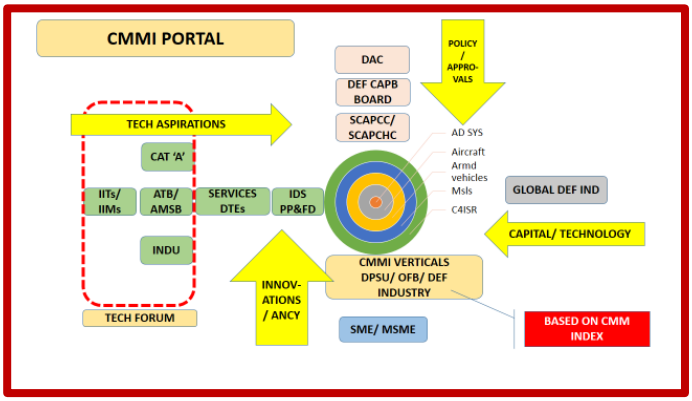

FIGURE *2* : OWN CMMI LANDSCAPE FOR DEFENCE INDUSTRY

UAE Defence Industry Capability Maturity Initiatives: A Robust Beginning

16. Tawazun (an Arabic word for balance) was created in 2007 to develop ventures through industrial partnerships and strategic investments that could add value to the UAE's industrial manufacturing primarily in the areas of defence (automotive, munitions, metals) and aerospace. Within this short time period, Tawazun has been able to put in place an advanced manufacturing park where local conglomerates have been provided with the mandate and opportunities to tie up with Global Defence Industry leaders. Strategic alliances have been formed with clear definition of the revenue generation within and markets tie up beyond. During interactions on site by the author, it stood out that Tawazun Precision Industries (tie up with Boeing), NIMR (manufacturing APCs), Caracal International (manufacturing entire range of small arms from pistol to CQB and sniper rifles), Tawazun Dynamics (honing strap on bomb guidance systems- MK 81, MK 82 and MK 83 bombs) and others were committed to absorb technologies

FIGURE *3* : UAE MIC TOWARDS IN-STEP CMMI

and build processes not only limiting to self-reliance but become an important link in the global arms supply chain. The strength of the initiatives lies in identifying right players, work out mutually assuaging and reassuring long term strategic tie ups, lay down stringent milestones and SLAs and establish accountability all across.

Execution Gap

17. It was in 2005 that the Vijay Kelkar committee emphasised self-reliance, active private sector participation, a long-term product strategy and identification of system integrators in the form of Raksha Udyog Ratnas (RURs) or Champions of Industry from private sector, which would be on par with DPSUs. However, the MoD has jettisoned the concept of RURs. The nomination of defence PSUs remains the preferred route. The Nuclear Power Corporation of India (NPCIL) and the Indian Space Research Organisation (ISRO) recognised the strengths of private industry and involved them during the initial stage, not as vendors but as risk-sharing partners. As a result, India sustained its capabilities even under the sanctions. Industry's partnership with ISRO and NPCIL is a shining example of PPP, which also needs to be emulated by the defence and aerospace sectors. Against the backdrop of India emerging as the world's largest importer of arms, an industry lobby and a global consultancy recommended setting up of a National Defence Manufacturing Commission (NDMC) under the Prime Minister's Office (PMO) to focus on building a domestic industrial base to make the nation self-reliant in the sector. Besides setting up National Defence Manufacturing Commission, CII-BCG report 2012 has recommended revival of formation of Defence Industry Champions, Raksha Udyog Ratnas, for Indian Defence Industry through identification based on their managerial and technical capabilities and that the accreditation could be a rolling process that should be open for changes (additions and deletions) on a regular basis. RURs will also ensure the growth of the Indian SMEs which will be integral part of their supply chain. While the private sector has to bring more to the table, DPSUs and OFs should be given all that is essential to make them shift gear to become globally competitive and highly efficient models of excellence.

Conclusion

18. Today with the military leadership acknowledging the inadequacies and voids and ready to take extra bit of responsibility towards addressing the same, today with the National leadership committed to provide the business environment as second to none, today with the international community and rating agencies reaffirming faith in India's growth story all over again through

pledging funds and enterprise, today with Indian business community looking set in the drivers' seat and displaying that appetite to chart growth and not complain about the associated risks, it is time our policy makers set course for a paradigm shift in involving industry in the process of Defence Capability building. We have learned our lessons through likes of FICV and TCS 2000 projects where transactional processes alone have failed to deliver. It is time we talked business with domestic defence industry and take the SRM to next levels through long term, mutually beneficial, meaningful commitments. It is time we evolved matrices for identifying right partners through CMMI across verticals and then build behind an all-inclusive eco system to include special zones, dedicated sovereign funds, technology incubator, collaborative academia and finding right place in the global supply chains. Its time to strike…

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Appendix "A"

(Refers to Para 3.29 of Chapter 3)

Indian Companies and Foreign OEMs Partnerships/ JVs/ Tie up/ MOUs

Ser No	Indian JV/ Tie Up Partner	Foreign OEM as JV/Tie Up Partner	Type of Systems
1	Bharat Forge Ltd	Rafael Advanced Def System	Missile Technology, Remote Weapon Systems and Advanced Armour Solutions including ICV BMP-II Upgrade and Tactical Control System
		Elbiet System,	Most Advanced Artillery and Mortars Systems Solutions.
		Rolls-Royce Corp	Supply of Aero engine parts
2	Tata Group Tata Advanced Systems	Boeing Co ,USA	Jointly developing products and platforms in aerospace and defence manufacturing
		Lockheed Martin Corp, USA	Manufacturing aero structure of Chinook CH 47 and AH 61 s in India; Manufacturing including export of new generation fighter aircraft F-16
		Bell Helicopters Ltd	Naval Utility Helicopters
		Sikorsky Aircraft Corp	Indigenous manufacturing of helicopters including for the Navy
3	Reliance Group Reliance Defence/ Reliance Aerostructures	Thales French company,	Underwater Systems
		Ukraine-based Antonov	Transport aircrafts
		Israel's Rafael	Air-to-Air Missiles
		Yugoimport Serbia's state-run defence major	To manufacture ammunition in India.
		Dassault Aviation (France)	Manufacturing unit in India for Dassault Aviation's supply and offset contract partner (IOP) for 1 22000 crore fighter jet deal signed with France
		LIG Nex1(South Korea)	Air defence, surveillance radar, sensors and missiles.

		Kalashnikov Israel Company	Manufacture Kalashnikov class of weapons for Indian armed forces
		DCNS France	Landing Platform Docks
4	Mahindra Defence Systems	Airbus Helicopters of Europe	To make military helicopters
		UK's Ultra Electronics	To build equipment for underwater warfare Technologically Advanced Radios for Indian Army
		Airbus Helicopters	To produce military helicopters in India
5	Larsen & Toubro	Navantia, Spain	Landing Platform Docks
		MBDA Missile Systems Ltd, France	To develop and supply missiles and missile systems to Indian armed forces
		Hanwha Techwin, Korea	To supply self-propelled guns to the army
		Nexter Systems, France	Mounted gun systems (MGS) Artillery programme of the Indian army
		EADS Defence and Security of Europe	Development, design, manufacturing and related services in the fields of electronic warfare, radars, military avionics and mobile systems
6	Hindustan Aeronautics Ltd (HAL)	Samtel Avionics Pvt Ltd	SU-30 Mk I Multi Function Display (MFD) to HAL
		M/S Alphatocol Pvt Ltd	To supply major structural assemblies of SU-30 fighter aircraft such as Flaperon, Rear Door, Front Door, Airbrake, Cartridge Box, Wing Tip to HAL
7	Bharat Electronics Ltd (BEL)	HAL	Cockpit Modules, Flight Control and Weapon Control Systems for LCA Mk I and Mk II.
		Thales France	Multi Target Tracking Radar
		Thales and Dassault	AESA radar and EW Suite will be manufactured by BEL under co-production agreement
		General Electric Pvt	Medical equipment manufactured

		Ltd	by the joint venture GE-BE Pvt Ltd
		M/S Rolta Pvt Ltd	A Special Purpose Vehicle to develop BMS (Battlefield Management System)
8	Ashok Leyland Defence Systems Ltd (ALDS)	Krauss-Maffei Wegmann (KMW) GmbH and Co. KG, Germany	To cooperate in developing advanced defence systems such as artillery, armoured wheel vehicles and bridge laying systems for Indian defence establishments
		Paramount Group, South Africa	For the development and manufacture of Mine Protected Vehicles in India
		Lockheed Martin	combat vehicles for the Indian Army. The base platforms of Lockheed combat vehicles will be used to develop light specialist and light armoured multi-purpose vehicles for the Indian Army.
9	Dynamatic Technology Ltd	IAI Israel	Jointly handle production/ assembly of UAVs support to mini UAV.
10	Kalyani Strategic Systems Ltd	IAI Israel	JV would build and market Air defence systems and ground to ground / ground to sea munitions.
11	Defsys (Defence Solution Pvt Ltd)	Controp Precision Technologies Ltd (Controp Israel)	Production of Electro-optical (E/O) systems utilized for day-night surveillance in mini UAVs, electro-optical payloads on naval platforms and E/O pods for helicopters and light aircrafts.
12	Rossel Techsys	Boeing Co	A build-to-print manufacturing and supply of wire harness of all types of commercial and defence aviation platforms
13	National Skill Development Centre and Ministry of Industry, IT and Commerce Telangana	Airbus, Aerocampus France	A "Centre of Excellence" aimed towards enhancing the skill and employability of local youth. Also collaborate with global aerospace majors in support of "Make in India" initiative

Appendix "B"

(Refers to Para 5.5 of Chapter 5)

QUESTIONNAIRE

PUBLIC PRIVATE PARTNERSHIP IN DEFENCE RESEARCH & DEVELOPMENT

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
SD	D	N	A	SA

	Q No	Question	SD	D	N	A	SA
		Funding					
C1Q1	1	The funds required for defence R&D projects are easily available from the sponsoring government organisations					
C1Q2	2	The government is ready to fund defence R&D projects.					
C1Q3	3	The funds provided by the government are generally sufficient for undertaking R&D					
C1Q4	4	The govt rules permit forming consortium of firms to bid for defence R&D projects					
C1Q5	5	Loans for defence R&D are easily available from the financial Institutions.					
C1Q6	6	Waiving of Bank Guarantees for SME/MSMEs would encourage their participation in defence R&D projects.					
C1Q7	7	The provision for reimbursement of suitable project design but not selected for production due to cost factor, will mitigate the financial concerns of the firm and ensure participation in future projects					
		Industrial License Procurement					
C2Q1	11	The present procedure of getting the requisite license permission for setting up a R&D facility for defence is Simple					
C2Q2	12	There exists a single window for getting all the permissions and licenses for initiating R&D activity					
C2Q3	13	*The procedure to obtain license for setting up defence R&D project facility involves multiple offices leading to delays and problems*					

C2Q4	14	Most of the firms involved in R&D projects should be co-located so that the technology and expertise available with one could be shared by the other.					
		Technology Knowledge					
C3Q1	15	Information on future technological requirement of the defence forces is readily available to the private R&D Agencies					
C3Q2	16	The time span available for development of a technology is sufficient					
C3Q3	17	*The delay encountered in testing and trials of the product does not lead to obsolescence of the Technology*					
C3Q4	18	There is serious shortage of qualified manpower in India to undertake R&D activities.					
C3Q5	19	The Defence Research and Development Organisation (DRDO) interacts with private industries whilst conceiving the futuristic requirements of the defence technology.					
C3Q6	20	R&D of technologies which can serve dual purpose-military and civil; must be permitted by the Government					
C3Q7	21	The firm bidding for R&D projects must have core expertise in the field of research.					
C3Q8	22	In case of any defence exhibitions overseas, it should be mandatory for all Tier 1 companies to exhibit products developed by Indian SMEs/MSMEs to give greater visibility and encourage future contribution by these smaller companies.					
		Ownership of Intellectual Property Rights					
C4Q1	23	The ownership of IPR by the govt post development is acceptable by the developing agency or research Agency					
C4Q2	24	The govt must allow the technology to be exported or civil use of the same					
C4Q3	25	*IPR ownership must be with the firm and not with govt.*					

C4Q4	26	IPR if owned by the government must yield royalty for the design agency during the further production					
		Do you propose any other model for IPR ownership					
		Test and Trials (T&T)					
C5Q1	27	Most of the private firms have fully developed own Testing &Trials facilities					
C5Q2	28	Access to testing & trials facilities of DRDO labs will not incentivize private sectors participation in defence R&D.					
C5Q3	29	A lot of time is wasted in Testing and Trials of a newly developed prototype					
C5Q4	30	A regular repeat order for year after year production of the accepted product allow the private industry to invest in R&D for further improvisations o technology.					
		Exit Policy					
C6Q1	31	The present government policies allow a firm to exit a developmental project without any penalties					
C6Q2	32	The reimbursement of R&D cost incurred by the private organization in **partially successful** (specifications of product meeting atleast /more than 60-70% requirements) will encourage the private industries to take up defence R&D related projects.					
C6Q3	33	If the firm carrying out development / design projects becomes bankrupt, additional aid from the govt in salvation or facilitating takeover by another interested firm would encourage the firm to take risk of indulging in the defence R&D projects.					
C6Q4	34	*If a firm exits midway of the project due to financial reasons, refunds/ reimbursements should be provided to compensate the losses*					

Appendix "C"

(Refers to Para 5.15 of Chapter 5)

REVISED QUESTIONNAIRE

	Q No	Question	SD	D	N	A	SA
		Funding					
C1Q1	1	The funds required for defence R&D projects are easily available from the sponsoring government Organizations					
C1Q2	2	The government is ready to fund defence R&D projects.					
C1Q3	3	The funds provided by the government are generally sufficient for undertaking R&D					
C1Q4	4	The govt rules permit forming consortium of firms to bid for defence R&D projects					
C1Q5	5	Loans for defence R&D are easily available from the financial Institutions.					
		Industrial License Procurement					
C2Q1	6	The present procedure of getting the requisite license permission for setting up a R&D facility for defence is simple					
C2Q4	7	Most of the firms involved in R&D projects should be co-located so that the technology and expertise available with one could be shared by the other.					
		Technology Knowledge					
C3Q1	8	Information on future technological requirement of the defence forces is readily available to the private R&D agencies					
C3Q3	9	*The delay encountered in testing and trials of the product does not lead to obsolescence of the Technology*					
C3Q5	10	The Defence Research and Development Organisation (DRDO) interacts with private industries whilst conceiving the futuristic requirements of the defence technology.					

C3Q7	11	The firm bidding for R&D projects must have core expertise in the field of research.					
C3Q8	12	In case of any defence exhibitions overseas, it should be mandatory for all Tier 1 companies to exhibit products developed by Indian SMEs/MSMEs to give greater visibility and encourage future contribution by these smaller companies.					
		Ownership of Intellectual Property Rights					
C4Q1	13	The ownership of IPR by the govt post development is acceptable by the developing agency or research agency					
C4Q2	14	The govt must allow the technology to be exported or civil use of the same					
C4Q3	15	*IPR ownership must be with the firm and not with govt.*					
C4Q4	16	IPR if owned by the government must yield royalty for the design agency during the further production					
		Test and Trials (T&T)					
C5Q1	17	Most of the private firms have fully developed own Testing &Trials facilities					
C5Q2	18	Access to testing & trials facilities of DRDO labs will not incentivize private sectors participation in defence R&D.					
C5Q4	19	A regular repeat order for year after year production of the accepted product allow the private industry to invest in R&D for further improvisations o technology.					
		Exit Policy					
C6Q1	20	The present government policies allow a firm to exit a developmental project without any penalties					
C6Q2	21	The reimbursement of R&D cost incurred by the private organization in **partially successful**					

		(specifications of product meeting atleast /more than 60-70% requirements) will encourage the private industries to take up defence R&D related projects.					

C6Q3	22	If the firm carrying out development / design projects becomes bankrupt, additional aid from the govt in salvation or facilitating takeover by another interested firm would encourage the firm to take risk of indulging in the defence R&D projects.					