

**Evaluation of Interface Mechanism Between  
Defence Equipment Designers, Producers and Users**

**Dissertation submitted to the Punjab University, Chandigarh  
for the award of degree of PG Diploma in Public Administration**

**by**

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## CERTIFICATE

1. I have the pleasure to certify that Air Cmde Kada Srinivasa Rao has pursued his research work and prepared the present dissertation titled “Evaluation of Interface Mechanism Between Defence Equipment Designers, Producers and Users” 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, Chandigarh, for the purpose of Post Graduate Diploma in Public Administration in Partial fulfilment of the requirement for the Advanced Professional Programme in Public Administration of Indian Institute of Public Administration (IIPA), New Delhi.

2. I recommend that the dissertation of Air Cmde Kada Srinivasa Rao is worthy of consideration for the award of Masters Diploma in Public Administration of Punjab University, Chandigarh.

  
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Place: New Delhi

(Air Commodore Kada Srinivasa Rao)

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## LIST OF ABBREVIATIONS

<b>S No</b>	<b>Abbreviation</b>	<b>Expansion</b>
1	DPSU	Defence Public Sector Undertaking
2	MoD	Ministry of Defence
3	CAD	Computer Aided Designing
4	FDI	Foreign Direct Investment
5	IDSA	Institute for Defence Studies and Analyses
6	OFB	Ordnance Factory Board
7	CII	Confederation of Indian Industries
8	EME	Electrical and Mechanical Engineers
9	DGQA	Director General of Quality Assurance
10	PMG	Project Management Group
11	DRDO	Defence Research & Development Organisation
12	DPP	Defence Procurement Policy
13	BDL	Bharat Dynamics Limited
14	IAF	Indian Air Force
15	L&T	Larson & Toubro
16	MoD	Ministry of Defence
17	DOFA	Defence Offset Facilitation Agency
18	DIPP	Department of Industrial Policy
19	ToT	Transfer of Technology
20	CII	Confederation of Indian Industry
21	RUR	Raksha Udyog Ratna
22	IHQ	Integrated Head Quarters
23	HAL	Hindustan Aeronautics Limited
24	BEL	Bharat Electronics Limited
25	OFs	Ordnance Factories
26	MDL	Mazagaon Docks Limited
27	MDNL	Mishra Dhatu Nigam Limited
28	BEML	Bharat Earth Movers Limited
29	IGMDP	Integrated Guided Missiles Development Programme
30	FTP	Fast Track Procurement
31	HQ ATVP	Advanced Tactical Vessels Programme
32	R&D	Research and Development
33	GRSE	Garden Reach Shipbuilders and Engineers
34	PMT	Project Management Team
35	ASQR	Air Staff Qualitative Requirements
36	LCA	Light Combat Aircraft
37	TTL	Total Technical Life
38	LSP	Limited Series Production
39	TD	Technology Demonstrator
40	IOC	Initial Operational Clearance

<b>S No</b>	<b>Abbreviation</b>	<b>Expansion</b>
41	FOC	Final Operational Clearance
42	PV	Prototype Vehicle
43	ADA	Aeronautics Development Agency
44	PDP	Project Definition Phase
45	NFTC	National Flight Testing Centre
46	SPV	Special Purpose Vehicle
47	SBU	Strategic Business Unit
48	AMCA	Advanced Medium Combat Aircraft
49	SAIL	Steel Authority of India Limited
50	TAL	Torpedo Advanced Light
51	DGNAI	Director General of Naval Armament Inspection
52	AVSC	Ajay Vikram Singh Committee
53	LTIPP	Long Term Integrated Perspective Plan



## ABSTRACT

### EVALUATION OF INTERFACE MECHANISM BETWEEN DEFENCE EQUIPMENT DESIGNERS, PRODUCERS AND USERS

1. Purpose of Research. The purpose of this thesis is to study and analyse the present state of interface between IAF, DRDO and DPSUs by way of deputation of officers as a part of Project Management Teams (PMT) for steering various projects for producing cutting edge technologies for aircraft and other weapon systems as per the laid down ASQRs and delivery schedules.
2. Statement of the Problem. “The various indigenous projects assigned to DRDO and DPSUs to develop cutting edge technologies of aircraft and weapon systems for the IAF are inordinately delayed, resulting in jeopardizing modernization programme and cost overruns with constrained capital budget. Necessary impetus may not have been given for steering various projects by IAF project officers on deputation to these organizations as a part of Project Management Teams, resulting in non-compliance of products as per Air Staff Qualitative Requirement (ASQR) and delivery schedules.”
3. Objectives.
  - (a) To examine effectiveness of current mechanism of interface in the form of deputation of officers to DRDO and DPSUs as a part of Project Management Teams (PMTs) for delivery of weapon systems / products as per the ASQRs in prescribed time frames.

(b) To suggest future mechanisms for effective interface with both Public and Private Sector to improve the defence production ecosystem in India.

4. Research Design and Strategy.

(a) Population. Service officers of the rank of Col equivalent who are assigned as Project Managers in DRDO and DPSUs constitute the entire population

(b) Sampling Design. Convenient Non-Random Sampling

(c) Observational Design

(i) Primary Data: Survey through instrument devised on 5-point Likert Scale was administered to Service officers of the rank of Colonel equivalent who are Project Managers on deputation to DRDO and DPSUs

(ii) Secondary Data : Case Studies, Reports, Journals, Magazines and News Paper Articles

(d) Operational Design. Quantitative Research

(e) Data Collection Methods. Data collected using Questionnaire administered by e-mail.

5. A summary of the statistically valid findings from the analysis carried out are highlighted below: -

(a) The lack of political will in the past and bureaucratic interference on procurement matters has adversely affected defence production.

(b) The present organizational set up where in Department of Defence Production is placed under MoD has demerits in terms of preferential and captive treatment of DPSUs vis-à-vis the private players there by denying level playing field.

(c) The present system of deputation of IAF officers to DPSUs and DRDO is not adequate to meet the nation's military capability by way of enhancing indigenous defence production.

(d) Parochial and vested interests of DPSUs, DRDO and OFB has resulted in Service officers not being accepted on deputation to these organizations. This has adversely affected deputation of IAF officers to DPSUs, OFs and DRDO thereby impacting indigenous defence production.

#### Recommendations.

6. Frequent seminars, workshops, Def Expos be conducted on a regular basis for enhancing interaction between the user (Armed Forces) and the producer (private industry) to bring about awareness amongst each other and for better appreciation of each other's needs and constraints.

7. DRDO scientists should visit field units of the three Services on a regular basis to see the environment armed forces function in, the problems faced by the personnel and how DRDO can be of help. It is recommended that a certain percentage of scientists be recruited by the Armed Forces through the Short Service Commission route and after five to ten years be transferred laterally to the DRDO.

8. There is a need to set up a combined R&D cadre of IAF, Army and Navy to tide over the delays in development of critical technologies and weapon systems.

9. India could emulate the US model by putting the development of critical projects akin to Air Force Research Laboratory (AFRL) in the United States with dedicated senior officers working on multiple programmes.

10. The Services should depute their qualified & experienced domain experts on deputation to DRDO for a period of 5 years to progress important projects. The selected service officers must be empowered with adequate financial and administrative powers in the DRDO to steer the projects to success.

11. Since the DDP is part of the MoD, there is a situation wherein the designer (DRDO), manufacturers (PSUs and OFB) and the captive customer (the three Services) are all bundled into one entity. Hence, the first step would be to review the corporate control of the PSUs and the OFB and place them under a different silo viz Ministry of Commerce and Industry.

12. All the authorized vacancies in DRDO ex cadre posts should be filled by Service HQ even at the cost of short-term shortage in human resource as this would accrue long term results in indigenous defence production.

13. There is a need to explore deputation of superseded officers who are domain experts in various fields. In addition, officers with domain expertise who are prematurely retiring early may be absorbed in DPSUs and DRDO.

**EVALUATION OF INTERFACE MECHANISM BETWEEN**  
**DEFENCE EQUIPMENT DESIGNERS, PRODUCERS AND USERS**

## CHAPTER - I

### INTRODUCTION

1. India inherited a very basic defence production infrastructure from the British at the time of independence<sup>1</sup>. Though the Indian Army was fighting only the wars for the British outside the country, it was made to bear the costs of British imported weapons from India-generated revenue. Therefore, it sustained the defence industry of UK. The indigenous industrial prowess was confined to a very low technology spectrum of defence production mainly to cater for repair and overhaul facilities of the imported weapon systems. Notable pre-independence defence industries included the following:-

(a) Walchand Aircraft Factory in Bangalore which was involved in repair and maintenance of aircraft. Japanese attacks during World War II made British India acquire one-third of Hindustan Aircraft in 1941 and later nationalise it in 1942. Hindustan Aircraft came to build ties with aircraft manufacturers of the US. Hindustan Aircraft handed over their factory to those companies and hence, US aircrafts were made in Bangalore<sup>2</sup>.

(b) Mazagaon Docks in Bombay undertook repair of warships

(c) Garden Reach Shipyard in Calcutta engaged in maintenance, repair and overhauling of Naval ships.

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<sup>1</sup> <https://www.vifindia.org/article/2012/february/06/India-s-Defence-Production-and-Research-Need-for-Transformational-up-gradation>, Ajit Doval, KC - Former Director, VIF, February 6, 2012

<sup>2</sup> <https://www.deccanherald.com/content/634901/unravelling-hals-heritage.html/Mookonda> Kushalappa, SEP 25, 2017

- (d) Gun and Shell Factory at Cossipore, Calcutta was established in 1801.
- (e) Ammunition Factory in Kirkee in Maharashtra was established in 1889.
- (f) Rifle Factory at Ishapore was established in 1901.
- (g) Gun Carriage Factory at Jabalpur was established in 1904. Overall, there were 16 Ordnance Factories, production in 1947-48 stood at \$ 8 million.

2. The first decade after independence were the neglected years in the area of defence production and developing R&D facilities<sup>3</sup>. No ordnance factory was established or R&D capabilities developed. India had no concept of forward-looking strategic plan and expenditure on strengthening national security capabilities was considered as non-productive drain on scarce financial resources. While self-sufficiency was the credo of those times, the fundamental approach was to develop self-sufficiency in core industries, completely neglecting indigenous defence production and importing arms to keep the army in a high state of defence preparedness at all times. It was not realized that defence production was a highly specialised sector requiring heavy capital investments, a strong R&D and production infrastructure from design to production and eventual integration and necessitates a long gestation period. Though Defence Research and Development Organisation (DRDO) was created in 1958<sup>4</sup>, with the looming threat from China, it was a halfhearted exercise and DRDO was starved of resources, qualified technical manpower and lacked high level strategic direction. Reluctance of western countries to part with defence technologies or collaboration, along with bureaucratic controls; bereft both of expertise and security sensitivity, aggravated the problem.

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<sup>3</sup> [www.ukessays.com/essays/history/evolution-of-defence-industry-in-india-history-essay](http://www.ukessays.com/essays/history/evolution-of-defence-industry-in-india-history-essay)

<sup>4</sup> [www.drdo.gov.in](http://www.drdo.gov.in)

3. In the aftermath of 1962 Chinese debacle, the importance and urgency of expanding our defence production sector was realised, albeit at a very heavy cost and sacrifices. New ideas were conceived and in course of time a number of new establishments and expansion of some existing infrastructure were undertaken. These corporations known as Defence Public Sector Unit (DPSU), gave a fillip to India's defence industry. Working under the Ministry of Defence Production, eight DPSUs viz Hindustan Aeronautics Limited (HAL), Bharat Electronics Limited (BEL), Bharat Earth Movers Limited (BEML), Mazagaon Dockyard Limited (MDL), Garden Reach Shipbuilders and Engineers (GRSE), Goa Shipyard Limited (GSL), Bharat Dynamics Limited (BDL), and Mishra Dhatu Nigam Limited (MDNL) became the mainstay of India's indigenisation programme. During 2009-10, Hindustan Shipyard Limited was shifted from the Ministry of Shipping to the Ministry of Defence. Though they substantially contributed, their overall range of capabilities lack in certain areas. These DPSUs have developed some credible research and development capabilities.

4. After the 1962 war, India's doctrine of self-sufficiency in defence equipment, besides indigenous production, required reliable foreign sources for acquisition of weapons systems, access to technologies and uninterrupted supply of spares. India's preference was to develop defence production partnership with European manufacturers, especially UK, France and Sweden. However, most of the Western countries including the United States did not come forward and therefore an impression started gaining ground that the Western powers could not be a trusted and dependable in the long term as partners. This led to the entry of the erstwhile USSR as the major supplier of defence equipment to India and till today their share is approximately over 70%. USSR decided not only to supply MiG-21 aircraft and other weapons but also agreed for licensed production. This ushered India into a league of licensed production. Though this



arrangement served India quite well for two decades; after the breakup of the USSR and the changing dynamics of India's defence requirements, it did not sustain India's needs any longer. Licensed production also tied India to stereotypes, affecting India's indigenous growth and innovativeness to develop cutting edge weapon systems from design to mass production stage.

5. Pokhran explosion also had adverse consequences on India's defence industry and R&D. The technology embargoes imposed on India hit number of Indian defence projects and scientific research<sup>5</sup>.

6. In Nov 1962 the Government of India established a Department of Defence Production for indigenous development for a comprehensive defence production infrastructure. As a result, besides the nine Defence Public Sector Undertakings mentioned above, a large number of ordnance factories were commissioned. The Ordnance Factory Board was established at Kolkata way back in 1775 by the British. It started humbly with a Gun Powder Factory in the year 1787. Their number increased from 18 in 1947 to 39. The combined work force of DPSUs and Ordnance Factories is around 2 lakhs<sup>6</sup>. Considering India's overall defence needs, their contribution is however, modest. OFB earned Rs 238 crore from exports in 2017-18<sup>7</sup>.

7. Ordnance Factories are mainly producing relatively low to medium technology items as follows :-

- (a) Ammunitions and explosives
- (b) Weapons, vehicles and equipment

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<sup>5</sup> <https://The Indian Express.com/article/opinion/columns/test-and-effect-Pokhran -nuclear-tests-517194/lite>, May 11, 2018, George Perkovich

<sup>6</sup> <https://niti.gov.in>docs>wrkgrp12>

<sup>7</sup> <https://timesofindia.indiatimes.com/india/at-200-yr-old-ordnance-factories-anxiety-anticipation-and-some-sulk/> Chethan Kumar | TNN Oct 16, 2019

- (c) Materials and components
- (d) Armoured vehicles
- (e) Clothing

8. A major shift in policy was brought about in May 2001 when the GoI allowed participation of private sector in defence production. Under the guidelines issued by the government 100% investment by private sector is allowed in designated fields and 26% through foreign direct investment. Though the Department of Industrial Policy and Promotion had issued 155 Letters of Intent to various Indian companies, no major breakthrough was achieved in actual production during the next two decades<sup>8</sup>. Bureaucratic delays and complicated procedures are reckoned to be major bottle necks. The FDI cap was later enhanced to 49%. However, in Dec 2020, the Finance Ministry announced a revised cap in FDI to 74%<sup>9</sup>.

9. Another major shift in policy came about in 2006 when the MoD brought about changes in defence procurement procedures. Under the Defence Procurement Policy (DPP), 30% offsets were provided in respect of all contracts above Rs. 300 crores. Specified spares or services to the tune of 30% of the value of such contracts were to be procured from indigenous Indian industry. The offset guidelines were further revised in Sep 2020, wherein preference was given to manufacture of complete defence products over components and various multipliers have been added to give incentivisation in discharge of Offsets.

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<sup>8</sup> <https://www.vifindia.org/article/2012/february/06/India-s-Defence-Production-and-Research-Need-for-Transformational-up-gradation>, Ajit Doval, KC - Former Director, VIF, February 6, 2012

<sup>9</sup> <https://www.investindia.gov.in/foreign-direct-investment>

## Current Setting.

10. Post-Pokhran nuclear testing, technology denial came as a blessing in disguise. India increasingly started focusing on indigenisation programmes as also diversification of sources of import. The modernisation and upgradation phase that started in 1999 led to diversification of product range as also accessing technology from new sources. Induction of the private sector into the defence sector was a turning point. Outsourcing of certain non-core requirements by the Defence PSUs and ordnance factories developed a wide vendor base that includes not only some of the large enterprises/conglomerates but also a large number of medium and small-scale enterprises.

11. The government brought out another edition of Defence Production Policy<sup>10</sup> In 2010, which had many positive features. It emphasized achieving self-reliance in design, development and mass production of weapon systems / platforms and equipment. With the objective of achieving greater synergy in production of high-end products, formation of consortia, joint ventures and public-private partnership was encouraged. Greater integration between technical, scientific research and production silos was achieved. However, while the policy objectives were objective and forward looking, on ground nothing much changed and most of the innovative ideas remained at blueprint stage.

12. Setting up of 12 Development Centres with State-of-the-Art CAD facilities to boost R&D efforts in the ordnance factories was a positive initiative<sup>11</sup>. The DPSUs also embarked on enhancement of their R&D infrastructure and effort; the initiatives taken by HAL, BEL and BDL in this regard are particularly noteworthy.

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<sup>10</sup> <https://www.mod.gov.in/defence-production-policy>

<sup>11</sup> [https://frontline.thehindu.com/other/advertorial/article/Building confidence/A special correspondent, edition: August 26, 2011](https://frontline.thehindu.com/other/advertorial/article/Building%20confidence/A%20special%20correspondent,%20edition:%20August%2026,%202011)

13. Today India enjoys advantages like availability of investible capital, accessibility to denied dual technologies in the past, willingness for cooperation and collaboration by defence production giants, particularly from the West due to the economic downturn there. India today is proud to have a scientific community that is globally competitive and a pool of skilled manpower with long years of experience and knowledge relating to defence industries. The changing geopolitical dynamics and China's aggressive posturing with huge capability development of its armed forces and expansion of its defence production and R&D, leaves India with no option but to bring about both a qualitative and quantitative change in her strategy. However, infirmities in certain areas like shy governance, vested interests of the corrupt, external political compulsions and security insensitivity of the bureaucracy often negate these advantages<sup>12</sup>.

14. **Unless the entire higher strategic policy guidance, integrated system of identifying long term defence needs in consultation of the three Services, initiating focused research resources along with the forces are available in real time, the country may not achieve its full potential. It is also important that right from the initial stage of conceptualization, the end users i.e armed forces are associated in decision making process right from design to production stage.** While highest standards of integrity and probity are needed for bringing about systemic and procedural changes, these should not give rise to indecision, procrastination and bureaucratic red tapism. It is an irony that some of our scientists in DRDO labs in the past did not contribute their best due to a bureaucratic work culture, lack of incentives, poor leadership and coordination at the top, resource crunch etc. Whenever given better infrastructure, opportunities, freedom and incentives they have achieved outstanding results.

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<sup>12</sup> <https://idsa.in/system/files/Monograph6.pdf>

15. There always exists a powerful lobby in the country supported by network of arms manufacturers and their agents who have a vested interest in hindering India's indigenous defence production programme. With India's estimated expenditure of \$130 billion<sup>13</sup> on defense acquisitions during the next seven years, they see a promising commercial opportunity in the offing. Their governments often exert political pressures to support their cause. It is also advisable that India should not completely insulate itself from the international arms market as it will both be bad economics and security planning. India cannot insist on developing technologies that can be accessed internationally at much more competitive prices, without undermining our independence in critical sectors.

16. India needs to transform and strengthen the defence production and research undertaken by 39 Ordnance Factories, eight Defence Public Sector Undertakings (DPSUs), 50 laboratories under the Defence Research and Development Organisation (DRDO) and the private sector players. Some of the bigger private sector outfits like Larsen and Toubro, Mahindra Defence Systems, Pipavav Shipyard, Tata Advanced Systems Limited etc. have displayed willingness to get integrated with this eco-system and contribute their share towards augmenting India's defence capabilities. They are more than willing to upgrade their manufacturing infrastructure and undertake research and development work provided they are assured of sustained orders, R&D costs are shared and international marketing opportunities are permitted to be created.

17. The US Department of Defence came out in Jan 2012, with its Strategic Guidance Document<sup>14</sup>, nineteen years after the last one was brought out in 1993. Spelling out American "Priorities for 21st Century Defence" this document delineates the future arc of competition and

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<sup>13</sup> <https://economictimes.indiatimes.com/news/defence/india-to-spend-a-whopping-usd-130-billion-for-military-modernisation-in-next-5-7-years/> PTI, Sep 10, 2019

<sup>14</sup> <https://www.vifindia.org/article/2012/february/06/India-s-Defence-Production-and-Research-Need-for-Transformational-up-gradation>, Ajit Doval, KC - Former Director, VIF, February 6, 2012

conflict extending from Asia Pacific to West Asia. Geographically, the median point of this strategically important region passes through India. This situation positions India in a setting that accentuates its strategic vulnerability and also provides opportunities for playing a more dominant and pro-active role in the region.

18. It is a sad state that even after 73 years of independence, the world's second fastest growing economy, one of the highest end-user of defence equipment, a country having the world's third largest pool of technical manpower and scientific talent and with a track record of indigenously excelling in high-end technologies of space, nuclear, information technology etc, is still dependent on foreign countries to meet 70% of its defence requirements.

19. There is a need to develop close coordination between the user, designer and supplier of military equipment to achieve better efficiency and effectiveness. This can only be realized if technically qualified personnel of the armed forces are deputed to DRDO labs, PSUs and private industries as a part of Project Management Teams (PMTs) to involve and expedite the critical projects related to modernization.

20. The Indian Air Force is in the midst of a major modernisation programme. This process involves induction of several advanced weapon and combat support systems that are likely to transform the IAF over the next decade into a much more potent force to reckon with. Presently the strength of fighter squadrons has come down to 31 squadrons only as against the sanctioned government strength of 42 squadrons to cater for a collusive threat from both our Western and Northern adversaries. There is a large gap in timely replacement for the phased-out aircraft and related weapon systems due to delay in indigenous projects as well as acquisition.

#### Background of the Problem.

21. The Indian Air Force is in the midst of a major modernisation programme. This process involves induction of several advanced weapon and combat support systems that are likely to transform the IAF over the next decade into a much more potent force to reckon with. Presently the strength of fighter squadrons has come down to 31 squadrons only as against the sanctioned government strength of 42 squadrons to cater for a collusive threat from both our Western and Northern adversaries. There is a large gap in timely replacement for the phased-out aircraft and related weapon systems due to delay in indigenous projects as well as acquisition.

#### Statement of the Problem.

22. “The various indigenous projects assigned to DRDO and DPSUs to develop cutting edge technologies of aircraft and weapon systems for the IAF are inordinately delayed, resulting in jeopardizing modernization programme and cost overruns with constrained capital budget. Necessary impetus may not have been given for steering various projects by IAF project officers on deputation to these organizations as a part of Project Management Teams, resulting in non-compliance of products as per Air Staff Qualitative Requirement (ASQR) and delivery schedules.”

#### Purpose of Research.

23. The purpose of this thesis is to study and analyse the present state of project management by IAF project officers on deputation to DRDO and DPSUs as a part of Project Management Teams (PMT) for steering various projects for producing cutting edge technologies for aircraft and other weapon systems as per the laid down ASQRs and delivery schedules.

24. Objectives.

(a) To examine effectiveness of current mechanism of interface in the form of deputation of officers to DRDO and DPSUs as a part of Project Management Teams (PMTs) for delivery of weapon systems / products as per the ASQRs in prescribed time frames.

(b) To suggest future mechanisms for effective interface with both Public and Private Sector to improve the defence production ecosystem in India.

Nature of the Study.

25. Nature of the study is descriptive in nature. The survey design for this study is based on data collection to determine whether deputation of officers to DRDO and DPSUs as a part of Project Management Teams is effective for achieving timely completion of indigenous projects undertaken by DRDO and DPSUs .

26. Quantitative approach has been chosen for this study for various reasons. Firstly, quantitative research is most suitable to test hypotheses; whereas a qualitative approach neither confirms nor dis-confirms hypotheses. Secondly, qualitative research involves analysis of much information to identify imperceptible themes; this research however, tests hypothesis based on descriptive statistics, for which a quantitative approach is more powerful. This quantitative study was based on a survey to gather participants' data. The sample population consisted of officers of the rank of Col equivalent on deputation as Project Managers at DRDO Labs and DPSUs.



27. Research Design and Strategy.

- (a) Population. Service officers of the rank of Col equivalent who are assigned as Project Managers in DRDO and PSUs constitute the entire population
- (b) Sampling Design. Convenient Non-Random Sampling
- (c) Observational Design.
  - (i) Primary Data: Survey through instrument devised on 5-point Likert Scale was administered to Service officers of the rank of Colonel equivalent who are Project Managers on deputation to DRDO and DPSUs
  - (ii) Secondary Data : Case Studies, Reports, Journals, Magazines and News Paper Articles
- (d) Operational Design. Quantitative Research
- (e) Data Collection Methods. Data collected using Questionnaire administered by e-mail.

28. Rationale for Research. The combat potential of a force like the IAF depends on the contemporary technological innovations, modernization with cutting edge technologies for desired maintainability, reliability and sustenance of aircraft and associated weapon systems, communications, surveillance and air defence systems. This research may bring forth the importance of Project Management Teams to the IAF leadership in steering projects entrusted to DRDO and DPSUs for complying with Air Staff Qualitative Requirements (ASQRs) and prescribed time frames for delivery.

Research Questions.

29. The various research questions of the thesis are as follows: -

(a) Is deputation of serving officers to DRDO and DPSUs as a part of Project Management Teams (PMTs) an effective interface for delivery of weapon systems / products as per the ASQRs in prescribed time frames?

(b) Is deputation of officers as part of PMTs to both Public and Private Sector beneficial for improving defence production and timely completion of defence projects?

30. Limitation. The study will rely on different reports, articles and journals. There is lack of information in the open domain on the subject of deputation of officers as a part of PMTs to various PSUs and DRDO labs as the matter is confidential. Due to COVID-19 situation, responses to the questionnaire may not be adequate.

31. Literature Review. Literature Review includes various Government Reports, Standing Committee Reports, Reports of Department of Defence Production, and Reports/Journals/Publications related to DRDO and DPSUs.

Hypotheses.

32. Null Hypothesis (H0). Deputation of IAF officers to Defence Research and Development Organisation (DRDO), Defence Public Sector Undertakings (DPSUs) and industry will not facilitate achieving timely completion of projects as per the Air Staff Qualitative Requirements (ASQRs) and enhancement of defence production.

33. Alternate Hypothesis (H1). Deputation of IAF officers to Defence Research and Development Organisation Public Sector Undertakings and industry will facilitate achieving timely completion of projects as per the Air Staff Qualitative Requirements (ASQRs) and enhancement of defence production.

34. Survey and Data Collection. There is lack of information on the exact number of IAF officers on deputation to various PSUs and DRDO labs as the matter is confidential and not available in the open domain. Data pertaining to various issues concerning achievement of better defence production has been taken by administering a questionnaire (attached at Appendix 'A') from the officers of the rank of Col Equivalent who are on deputation as Project Managers in DRDO Labs and DPSUs.

Sample Size.

35. Convenient Non-Random Sampling technique was followed for collecting data from 43 officers of the rank of Col equivalent who are on deputation as Project Managers at various DRDO labs and DPSUs. The breakdown of the sample is as follows:-

- (a) Army – 19
- (b) Navy - 03
- (c) Air Force - 21

### **Layout of the Study**

36. The layout of research will be as per the following chapters of the study:-

- (a) Chapter I - **Introduction.** This chapter will outline the introduction to the subject and layout of the dissertation.
- (b) Chapter II - **Literature Review.** Chapter II contains literature review for the research with respect to steering various IAF projects in DRDO and DPSUs as per laid down ASQRs and delivery schedules by Project Management Teams in the past and their effectiveness.
- (c) Chapter III – **Interface between IAF, DRDO, DPSUs and CII through**

**Project Management Teams.** This chapter brings out case studies of interface between defence production agencies and the IAF as well as best practices followed by the Army and Navy

(d) Chapter IV – **Findings and Discussion.** In this chapter the questionnaire data has been analysed to draw out meaningful inferences and interpretations. It explains the descriptive analysis of individual questions of the instrument administered.

(e) Chapter V – **Recommendations.** This part summarises the study by bringing forth the recommendations and conclusion.

## **CHAPTER II**

### **LITERATURE REVIEW**

1. For a country with such a large public sector defence manufacturing setup and industry potential, India is unique in its dependence on imports. Countries such as UK and France, which employ a comparable number in the defence sector, are large exporters of weapons. On the other hand, India in stark contrast, is the world's largest importer, spending 70% of its defence acquisition budget overseas. India uses about 30% of its defence acquisition budget to import directly and spends the remaining to DPSUs. They, in turn, spend approximately half of that money abroad as well, through an opaque process that sometimes involves a single vendor selected at the executives' discretion. Manohar Parikkar Institute for Defence Studies and Analyses (IDSA) puts the collective import dependency of defence PSUs at 35-45%.

#### **Politics of Continuity**

2. The political pressure to perpetuate the existing system is immense. A statist mindset that glorifies DPSUs<sup>15</sup>, and the large and unionised workforce that opposes privatisation, both exert pressure on successive governments, who are sympathetic to such concerns. The workforce at DPSUs are unionised and will not allow any reforms. The All-India Defence Employees Federation and other unions oppose any move by the government to allow the industry any space, saying this will compromise national security and interest.

3. Another problem that fundamentally poses an impediment to private sector participation is the office of Secretary, Defence Production. This office, which reports to the Defence

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<sup>15</sup> <https://economictimes.indiatimes.com/news/company/corporate-trends/why-government-has-failed-to-encourage-private-sector-in-defence-production/By Sruthijith KK/Mar 19, 2013>

Secretary, is responsible for defence production, the performance of DPSUs and the Ordnance Factory Board. The incentive is to send orders to the factories under this office's watch and keep the private sector out. Consequently, the order books of DPSUs such as Hindustan Aeronautics Limited and Bharat Dynamics Limited are multiples of their turnover. The biggest challenge is that as to how to bring the private sector into the government's folds and how to make the government responsible for the growth of private industry." Since the DDP is part of the MoD, we have a situation where the designer (DRDO), manufacturer (DPSUs and OFB) and the captive customers (The three Services) are all bundled into one entity. The bureaucrats posted to the DDP have no knowledge of the Defence Sector. It is an irony that they learn their trade charter from the establishments they control rather than from the armed forces they are meant to serve. Therefore, the first step would be to review the corporate control of the DPSUs and the OFB.

4. Whereas for every step forward, the government also takes a step backwards. In 2005, the Vijay Kelkar committee<sup>16</sup> on defence acquisition recommended that select private sector firms be given the status of 'Raksha Udyog Ratnas' and the government treat them at par with DPSUs when allocating business. In 2007, the ministry examined 40 companies and found 15 eligible for the status. But in the wake of vehement opposition from DPSUs, the proposal was shelved in 2010.

5. The MoD unveiled a defence production policy in 2011, giving a major role to the private industry. It envisaged that all long-term needs should be met indigenously, and the ministry would proactively encourage a larger involvement of the private sector. There has been little progress since, and it remained a non-starter.

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<sup>16</sup> <http://www.idsa.in/system/files/monograph21.pdf>

## **Private Sector Dilemma**<sup>17</sup>

6. The wavering intent on the government's part is putting private companies in a disadvantageous situation wherein their risk-taking and capital investment is not being duly rewarded. For example, L&T and Tata Power SED have worked for a long time with DRDO on various strategic projects. The two companies built the Pinaka multi-barrel rocket launcher. Once again, they rose to the occasion along with Walchandnagar Industries and played a major role in building INS Arihant, India's first nuclear-powered submarine.

## **Public Sector and Present Status**

7. **Role of Ordnance Factories**<sup>18</sup>. These factories are primarily tasked with manufacture of arms, ammunition, equipment, armoured personnel carriers, transport vehicles, clothing and general stores. After meeting the requirement of the armed forces, spare capacities are exploited for supply to non-defence sector and exports.

8. Owing to the monopoly they have enjoyed over a period of time as 'state pampered organisations' they could neither sustain in the race with foreign counterparts in producing sophisticated equipment required by armed forces nor showcase such capabilities. Due to continuous dependency on DRDO, and total neglect of in-house R&D facilities, they failed miserably to deliver the indents in time. The ordnance factories are plagued with slackness due to lack of competition, plethora of human resource issues. A brief description on DRDO is worth mentioning in this context to appreciate the close link between these two mutually nonperforming organisations.

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<sup>17</sup> [http://articles.economic times.india times.com/2013-03-19](http://articles.economic-times.india-times.com/2013-03-19)

<sup>18</sup> <https://ofb.gov.in/pages/ofb-in-brief>

## **DRDO Organisation**

9. **Formation of DRDO Organisation.** The Defence Research and Development Organisation (DRDO) was formed in 1958 and since then, DRDO has risen from a few laboratories to a large organisation with fiftyone well-established laboratories spread throughout the country<sup>19</sup>. The DRDO is engaged in pursuit of State-of-the-Art technologies so as to achieve progressive self-reliance in weapons and equipment. Every year about 200 plus scientists join the DRDO. At the same time many of the scientists leave the organization for greener pasture after certain experience. This results in inconsistency in various ongoing projects. The workforce of the DRDO is over 25,000 personnel with 6750 scientists in its Defence Research Development Service (DRDS) cadre.

10. **Achievements of DRDO.** Integrated Guided Missile Development Programme. The most significant breakthrough was in the field of Integrated Guided Missile Development Programme (IGMDP) that DRDO can boast of. Government of India approved the IGMDP in 1983-84 with the aim of producing a wide range of guided missiles for the three Services. Supersonic anti-ship cruise missile BRAHMOS; a joint venture with Russia is yet another success story. Besides these, achievements in other fields they claim are Main Battle Tank Arjun, Advanced Light Helicopter, Pilot less target aircraft, radar systems like the INDRA I and II, special steels, packed foods, snow clothing, vehicles, bridge layers, naval sonars and EW consoles, to name a few.

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<sup>19</sup> [www.drdo.gov.in](http://www.drdo.gov.in)



11. **Failure of DRDO** Whenever the armed forces wanted a cutting-edge weapon system, the DRDO invariably committed that they can produce it and it has an unassailable record of never delivering/delivering with cost overruns. Ultimately, we imported that equipment at a prohibitive cost. Most of the indigenisation projects of DRDO/OFB are much behind the schedule with success stories limited to few technology demonstrators. The classic examples of our R&D failures<sup>20</sup> are the Arjun Main Battle Tank, INSAS rifles, Saras Transport Aircraft, Kaveri Aeroengine, Akaash Missile, Nag Anti-tank missile, Indra Radar and many more.

12. **Absence of Perspective Plan.** The lackadaisical attitude of Ordnance Factories<sup>21</sup> left indelible blemishes on the public sector technological front despite being the largest employer of manpower and pushed it towards incompetence and organisational failure. In the absence of any road map of their future perspective, they even cannot provide any assurance that they can meet the projected needs of armed forces and thus fail to generate any confidence of the Services. Another noteworthy feature is, while the DPSUs outsource to the extent of 30 percent, this figure is about 80 percent in the case of ordnance factories. Thus, it was evident that the ordnance factories in turn are heavily dependent on private sector and the role of private sector cannot be underestimated though for the time being they are restricted to a secondary role.

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<sup>20</sup> [http://article.economic times.india times.com/2014-08-23](http://article.economic%20times.india%20times.com/2014-08-23)

<sup>21</sup> <https://www.thestatesman.com/opinion/why-ordnance-factories-must-be-cut-to-size>

13. **DPSUs and Present Status.** The country's defence production capacity was concentrated in another agency viz DPSUs besides Ordnance Factories. The DPSUs are placed under the Department of Defence Production within the MoD. With enhanced production of armaments during the 1960-70s the number of DPSUs had grown to nine by the 1980s. This was reduced to eight in 1986 by shifting Praga Machine Tools limited to the Ministry of Industry. The DPSUs are involved in manufacture of modern sophisticated weapon systems, advanced electronics, and production of metal alloys for aerospace projects. The eight DPSUs are M/s Hindustan Aeronautics Limited, M/s Bharat Electronics Limited, M/s Bharat Earth Movers Limited, M/s Mazagon Dock Limited, M/s Goa Shipyard Limited, M/s Garden Reach Shipbuilders and Engineers Limited, M/s Bharat Dynamics Limited and M/s Mishra Dhatu Nigam Limited.

14. **DPSU Summary.** The DPSUs have been developing a wide variety of weapon systems and equipment under licenced production. This large industrial infrastructure should, in fact, provide the means to produce, maintain and repair majority of India's military hardware, providing leverage against dependency on foreign import. However, there has been a little or no effort in this direction. OFs, DPSUs and the private sector should commit themselves in research and developing defence equipment to cater for defence requirements. In this effort, if collaboration leads to innovation or failures, the OFs and DPSUs should be prepared to face both consequences.

15. **Emerging Challenges Offer Opportunities to look at Change.** The defence industry, by virtue of its technological edge and security applications is a crucial strategic industry.

Governments in the West have since long recognised this aspect and continue to formulate policies that both support the industry as well as retain its competitiveness. In contrast, the Indian government, while treating all DPSUs as defence specific, has done little to exploit these enterprises to meet industrial challenges<sup>22</sup>. India therefore, frequently fell prey to the games that developed nations played in the past. Realising the colossal loss to the exchequer, Government woke up and started reforms by promulgating various liberalisations and policies to encourage the private sector thereby to curtail the dependency on foreign countries.

### **A Peek into Light Combat Aircraft (LCA) Project.**

16. 114th Public Accounts Committee Report on design, development, manufacture of LCA dated 14 Dec 2018 brought out that the LCA project was sanctioned in 1983 to provide replacement aircraft for MiG-21 fleet which were to complete their Total Technical Life (TTL) and were to be phased out in 1990s<sup>23</sup>. As specified in ASR (Air Staff Requirement) in 1985, LCA was to be inducted into the Indian Air Force (IAF) by 1994.

17. MoD Report attributes the delays in LCA Project as under: -

- (i) Change in avionics architecture demanded by customer
- (ii) Addition of new systems like Helmet Mounted Display and Sight (HMDS) and Weapon Suite by the client

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<sup>22</sup> [https://economictimes.indiatimes.com/news/defence/government-considering-putting-psus-out-of-defence-ministry-range/range/Manu\\_Pubby/Jun\\_25\\_2019](https://economictimes.indiatimes.com/news/defence/government-considering-putting-psus-out-of-defence-ministry-range/range/Manu_Pubby/Jun_25_2019)

<sup>23</sup> [https://eparlib.nic.in/bitstream/123456789/783969/1/16\\_Public\\_Accounts\\_114.pdf](https://eparlib.nic.in/bitstream/123456789/783969/1/16_Public_Accounts_114.pdf)

- (iii) Delayed decisions by user in finalizing of Gun, Air to Air Refuelling (AAR) & Beyond Visual Range (BVR) missiles
- (iv) LCA programme has taken ab-initio development & Limited Series Production (LSP) as blessing in disguise
- (v) Delay in flight testing due to the grounding of aircraft for Escape System & Pipeline Butting Mods
- (vi) This development and flight testing was planned concurrently on various LSP aircraft to achieve Initial Operational Clearance (IOC) & Final Operational Clearance (FOC) goals quickly
- (vii) During the course of development, changes in the critical systems like communication system, Radar & HMDS have forced Standard Operating Procedure (SOP) change staggered on different LSPs
- (viii) Awaiting maturity of all the systems on Prototype Vehicle (PV) series aircraft and completing IOC task involving around 2500 sorties with three PV series aircraft would have resulted in further delays

18. As per MoU entered into between Hindustan Aeronautics Limited (HAL) and Aeronautics Development Agency (ADA) in Jun 2002, HAL was supposed to supply eight LSP aircraft between 2006 and 2008. Against this, HAL supplied seven LSP aircraft between 2007 and 2013 with a delay ranging from 4 to 51 months, mainly due to design changes by ADA which resulted in equipping each of the LSPs with different configuration. It was also observed that ADA had utilised these LSP aircraft towards flight testing/evaluation by National Flight-

Testing Centre (NFTC) for achieving IOC/FOC, instead of handing over these aircraft to the IAF.

19. In Nov 2009, GoI extended the milestones of LCA project to end of Dec 2012 and an additional amount of Rs 2475.78 crore was sanctioned to cover extended programme cost, expenditure towards Programme Management, maintenance and operational cost of 15 aircraft, foreign flight test consultancy for optimizing the flight testing, spares for LSP aircraft, etc. Major portion of the cost towards maintenance of 15 aircraft (187.78 crore) during this extended period was due to ADA exploiting the LSP aircraft along with TDs/PVs towards flight testing/evaluation. However, these extended timelines also could not be adhered to by ADA as LCA achieved IOC only in Dec 2013. FOC was ultimately achieved on 18 Mar 2020.

**Shortfall in Accomplishment of Air Staff Qualitative Requirement (ASQR).**

20. Air Staff Requirement (1985) prescribes the physical parameters of LCA such as aircraft tare weight, fuel capacity, weapons carrying capacity, missiles, survivability, navigation, etc and features like single point defueling, pilot safety system, all weather operations, fuel system etc to make the aircraft capable of performing its role of multi mission fighter aircraft and have enhanced survivability against battle damage and attrition. The ASR also envisages timeline for induction of LCA, quantity of LCA fighters and trainers required. There were no other revisions to the ASRs by IAF, except in respect of weapon requirements.

21. Audit also observed that LCA which had achieved IOC in Dec 2013 did not meet the ASR in terms of increased weight, reduced internal fuel capacity, non-compliance of all-weather operations, non-achievement of single point defueling, fuel system protection, pilot protection etc., for which, ADA obtained 53 concessions/permanent waivers from Air HQ in Dec 2013. IAF

responded to audit's observation that the concessions/permanent waivers would adversely impact the operational performance of the aircraft.

### **Meeting of Weapon Requirement on LCA as per ASQR**

22. When the audit pointed out in Sep 2014 that delays caused due to changes in the weapons by IAF, Air HQ responded that the extended schedule of design and development of LCA had resulted in several weapons and systems becoming obsolete/out of stock/operationally irrelevant and to retain operational edge, latest weapons had to be integrated. It was also brought out that ADA being the programme manager could have inducted additional resources to facilitate the integration of the changed weapons in time. Consequent to design and development of LCA programme getting extended from time to time, IAF had to opt for newer weapons to retain operational edge of LCA. This consequently had a further impact on the timelines of the LCA programme.

### **Lack of User Involvement.**

23. Audit observed in Sep 2014, that the LCA Project Definition Phase (PDP) Review Committee had strongly recommended early establishment of a Liaison Group between Air HQ and ADA to facilitate closer interaction between the design team and the user for better appreciation of mutual perception, including appropriate trade-offs in performance, weight, time frame, cost, technological complexity and operational considerations of LCA.

24. However, no liaison group was formed. As a result, IAF played limited role as a member in Governing and General Body meetings. The active user participation in the LCA Programme

was started only after the formation of an Empowered Committee, LCA Review Committee consisting of ADA, HAL, IAF and LCA Project Management Team (LCA-PMT) at ADA. The Empowered Committee chaired by the Chief of Air Staff, co-chaired by Secretary Defence Production (DP) and Scientific Advisor (SA) to Raksha Mantri (RM) / Director General (DG) ADA met quarterly to review the programme with the main objective to monitor the flight development activities. The LCA Review Committee headed by Deputy Chief of Air Staff (DCAS) met every month to review all the issues concerning the programme. LCA Project Management Team (LCA-PMT) headed by an Air Vice Marshal (AVM) to function as a single point interface between the IAF and ADA/NFTC/HAL for co-ordination of flight test activities, positioning of weapons stores for LCA etc.

25. Audit sought reasons for not forming a standing Liaison Group between Air HQ and ADA in Sep 2014 to ensure closer interaction between the design team and the user as recommended by the LCA PDP Review Committee. Air HQ intimated in Dec 2014 that expertise of IAF personnel was not in the area of design of aircraft, but in capability to guide the programme in terms of user requirement of operations and maintainability. Hence, formation of standing Liaison Group prior to 2007 may not have been fruitful. It was also added that IAF test pilots and test engineers were involved in the project as part of NFTC, Bangalore since 2001.

26. Thus, non-formation of a standing Liaison Group between Air HQ and ADA in time to ensure closer interaction between the design and user teams for better appreciation of mutual perception, including appropriate trade-offs in performance, weight, time frame, cost, technological complexity and operational considerations of LCA also impacted the LCA development timelines.

27. The Ministry brought out that due to the above reasons, maintenance related issues were not identified in the early stages of the design & development by the test crew as well as test engineers till involvement of IAF-PMT from the year 2007. This has adversely impacted design modes and timeline.

**Alternate Measures by IAF to Maintain the Force Level.**

28. Audit enquired in Jun 2014 regarding steps taken by Air HQ to overcome the depletion of squadron level in view of delay in induction of LCA. In reply, Air HQ stated in Feb 2015 that the following measures had been taken in addition to revising phasing out of MiG-21 squadrons:-

- (a) Up-gradation of 125 MiG BIS aircraft (Nov 1995) at a cost of 626 million USD (equivalent to Rs 2135 crore)
- (b) Up-gradation of 62 MiG-29 aircraft into multi role MiG-29 UPG standard aircraft (Mar 2008) at a cost of 964 million USD (Rs 3841.87 crore). Upgradation was in progress (Feb 2015)
- (c) Up-gradation of 61 Jaguar Aircraft (Dec 2009) at a cost of Rs 3113.02 crore.
- (d) Upgradation of Mirage 2000 aircraft in 2011 through Original Equipment Manufacturer (OEM) and HAL at a total cost of Rs 10947 crore.

29. Due to delay in induction of LCA, IAF had to up-grade other fleet at a cost of Rs 20,037 crore. In addition, phasing out of MiG-21 was also revised in Jan 2013 to utilise the ageing fleet for extended period till the year 2023.



30. Due to inordinate delay in the formation of LCA squadron, MoD apprised the Committee about the steps taken/proposed to fast track the same by furnishing the following:

(a) Phased approach for LCA development was changed to Concurrent Development approach.

(b) Following reviews are held continuously to avoid further delay:

(i) Daily reviews at LCA Assembly hangar

(ii) Weekly Review in ADA

(iii) Special Review Committees have been set up by Honourable

(iv) Raksha Mantri to review the Progress of the programme

(v) Every month by DCAS

(vi) Half yearly review by Governing Body chaired by Secy, Defence R&D

(vii) Quarterly review by Empowered Committee, Chaired by Chief of Air Staff (CAS)

(viii) Annual Review by General Body chaired by Honourable RM

(c) **Formation of PMT with Air Force officers at ADA**

(d) Formation of Quick Reaction Teams (QRT) to resolve design/production issues

(e) The programme is rescheduled to suit the Induction Programme of IAF

(f) Private partners, modular assembly, etc

31. The Committee noted that due to huge delays in development and induction of LCA, IAF had to up-grade MiG-BIS, MiG-29, Mirage-2000 and Jaguar aircraft at a cost of Rs 20,037 crore, phasing out of MiG-21 had to be revised to 2023 and IAF is operating with 35 squadrons as against 42 squadrons sanctioned out of which squadrons for MiG-21 aircraft and MiG-27 aircraft would be phased out in due course. The Committee was disappointed to note that the failure of HAL/ADA and MoD to provide the required number of aircraft has adversely affected the combat potential of the IAF resulting in security threat to the country. The Committee noted with serious concern that due to lack of R&D in the aviation sector, the country had to shell out thousands of crores of rupees for procurement of 56 combat aircraft from foreign countries. In times of hostilities, it would be very difficult for the nation to rely on and procure combat aircraft from other countries. The Committee while noting the measures taken by the IAF to maintain the operational preparedness and to overcome the drawdown of squadron strength, exhorted the Ministry to initiate urgent steps to expedite development of LCA to cater to the operational needs of the IAF so as to restrict import of fighter aircraft of this class and achieve self-reliance in the long run.

### **Turf Issues.**

32. The organisational gap between HAL and ADA, a prime cause of Tejas delays, had to be bridged by the IAF<sup>24</sup>. Ramping up Tejas production was based on a special purpose vehicle (SPV) model or a strategic business unit (SBU) model. The government wanted to bring HAL and ADA together. IAF needed Tejas in large numbers and the only way to achieve this was

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<sup>24</sup> <https://www.theweek.in/news/india/2018/07/11/iaf-control-tejas-project-hal/> Anantha Krishnan M. July 11, 2018

through a fresh look to overcome delays. Accordingly, as per the Government's approval based on the Committee's Report, the IAF deputed an officer of the rank of Air Marshal to head ADA.

33. While the IAF seemed to have won on this account, it was not easy for it to run the show, going by the responses from some HAL insiders. HAL insiders perceived that the Tejas programme was at a crucial juncture, and any disturbance to the production and design process would have been disastrous and that the new incumbent was an outsider and there wouldn't have been all-out support to him.

34. Some others opined that organisational differences will be an impediment with an IAF official at the helm of affairs. The management of IAF personnel, where non-unionised military personnel work, is totally different from a unionised set-up in HAL. Factory Act and the labour laws play a key role towards the management of HAL workforce, which is not the case with the IAF. Success depends upon close coordination between various divisions of HAL. IAF leadership will be an administrative nightmare because of structural incoherence of introducing a functionary laterally at an operational level. A Key Risk Indicator (KRI) of IAF is Repair and Overhaul management. Tejas production may be impacted by this attitude.

35. An IAF PMT has been functioning at ADA from 2004, monitoring the progress of production series Tejas aircraft. The team is currently headed by an Air Marshal. The IAF is of the opinion that organizational behavior of HAL has no role in operational matters. The production and design agencies viz HAL and ADA must expedite all their efforts.

36. While IAF minced no words on delay in Tejas development, it is a fact that it also made many changes on operational needs. The IAF wants a Software-Designed Radio (SDR) on board all FOC platforms, a new addition, which was not envisaged earlier. This is the advantage with a

homegrown project. Ultimately, the IAF pilots will have to fly the LCA. IAF's needs will be dynamic as per technology upgrades with time. IAF is bothered about the safety of the man in the cockpit and the machine and not just implementation of Tejas Programme by some quarters of HAL hierarchy.

### **Future Projects in Pipeline.**

37. HAL is currently working on two indigenous fighter jets for the IAF viz Tejas Mk2 and the fifth-generation Advanced Medium Combat Aircraft (AMCA). HAL is looking at a seven-to-eight-year timeframe for these aircraft to get airborne. These projects require close monitoring.

38. **LCA Mk2.** Contrary to what its name suggests, LCA Mk2 is a significantly modified version of LCA Mk1. It will actually be a medium-weight fighter aircraft. Among other changes, GE F404 engines in LCA Mk1 will be replaced with more powerful F414 turbofan engines and canards will be added behind the cockpit. IAF demanded at least 18 degrees per second sustained rate of turn. While the F414 turbofan engine will provide more thrust with 65-100 kN, canards will significantly improve the aircraft's manoeuvrability.

39. **Medium Weight Fighter (MWF).** Due to modifications being made by the Aeronautical Development Agency, the Mk2 variant will have higher payload capacities, giving it more weapon delivery options and will carry more fuel, which will enhance its range. ADA reports indicate that it is studying at least 2 variations of the design of the fighter. It's still unclear whether the new fighter will be a tail-less delta platform, similar to the IAF's LCA Tejas fighter or feature canards, a small forewing placed ahead of the main wing of the aircraft to aid maneuverability.

40. **Advanced Medium Combat Aircraft.** AMCA, India's fifth-generation stealth fighter has been in development for some years now. HAL and ADA are together in the design of AMCA. HAL is planning to productionise by creating a special vehicle, a joint venture between HAL, DRDO and a private partner<sup>25</sup>.

41. To give a fillip to timely delivery of Projects as per the ASQRs, it is pertinent to develop close coordination and synergy between the user, designer and producer of military equipment to achieve better efficiency and effectiveness. This can only be realized if technically qualified domain experts of the IAF are deputed to DRDO and DPSUs as project managers to involve from the design stage till induction and sustenance thereafter. Simultaneously, there is a need to formulate ways to integrate the user Project Management Teams (PMTs), Department of Defence Production, DRDO and DPSUs right at the design stage itself to facilitate products with compliance of ASQRs and delivery schedules.\_

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<sup>25</sup> <https://idrw.org/mwf-af-and-amca-program-team-feeling-the-heat-from-iaf-chiefs-unofficial-race-between-programs/> November 15, 2019

## **CHAPTER - III**

### **CASE STUDIES OF INTERFACE BETWEEN ALL THREE SERVICES** **WITH DEFENCE RESEARCH AND PRODUCTION AGENCIES**

#### **The Indian Navy Example**

1. A very pioneer and prominent 'green shoot', which had not got its due attention is synergy achieved by the Indian Navy with DRDO, SAIL and private industry resulting in development and production of strategic steel for all indigenous warships<sup>26</sup>.
2. The Indian Naval fleet consists of ships of both eastern and western origin which use different grades of structural steel, leading to import of various grades of steel for maintenance, repair and overhaul. This had led to problems like timely procurement and non-availability with foreign vendors etc. Further, a large component of steel used had to be imported for the ships under construction in various Indian shipyards, The Indian Navy was compelled to resort to indigenous development of Warship Grade Steel and ensure timely induction of warships without depleting its operational fleet strength and capability.
3. The Navy collaborated with Defence Metallurgical Research Laboratory (DMRL), Hyderabad and HQ Advanced Tactical Vessels Programme (ATVP) in development of DMR

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<sup>26</sup> [https://issuu.com/defenceandsecurityalert/docs/dsa\\_february\\_2012/27](https://issuu.com/defenceandsecurityalert/docs/dsa_february_2012/27)

249A steel plates, bulb structural sections etc for ships and submarines. M/s Steel Authority of India Ltd (SAIL) and M/s Essar Steel were successful in rolling out DMR 249A steel plates and M/s Krishna Industries, the bulb bars. The Indian Navy also associated with Naval Materials Research Laboratory (NMRL), Ambernath (Thane) in developing indigenous weld consumables in various weld categories for welding of DMR 249A steel.

4. On successful completion of this project the Indian Navy decided to use DMR 249A grade steel for all its warship building / repairs. Further, this indigenously produced DMR 249A grade steel replaced all other steels in use in the Indian Navy.

5. **'Green Shoots' in Naval Armament.** The Indian Navy has been committed to self-reliance and indigenisation in the field of armament and ammunition. It has been providing support at all stages like design, development, production and induction of armament by laying down achievable SQRs and positioning high caliber officers to DRDO Laboratories and production agencies to assist during development and production. The Indian Navy has put in place a three-pronged strategy to achieve the goal of self-reliance in armaments and ammunition.

(a) **The Ab-initio Approach.** The Indian Navy started positioning its officers at DRDO laboratories for naval projects since the late seventies. This effort resulted in a synergy which has yielded result in development of an indigenous air launched torpedo system "Torpedo Advanced Light" (TAL). It can be appreciated that the torpedo is a highly complex underwater weapon, utilising a synergetic mix of technologies like hydraulics, electronics, acoustics, explosives, mechanics, power systems, computers,

structural engineering etc. It is related to its underwater sensors, fire control systems, launchers and test benches. On completion of the development process of TAL the design has been assigned to public and private industry for production.

(b) **Synergetic Approach.** Spinoffs of this synergetic effort between the Indian Navy, DRDO and associated private industry have resulted in development of several cutting-edge technologies for the first time. Composites, compact high power sea water activated batteries, titanium alloys, contra rotating DC propulsion motors, sensor instrumentation packages, hybrid control and guidance motors were developed and produced indigenously. The TAL torpedo consists of 95% of indigenous components and sub-systems. This synergetic approach of the Indian Navy has also led to design, development and production of torpedo decoys, various types of mines, propulsion batteries, a spectrum of explosive stores such as boosters, sustainers, pyrotechnics and pyro charges as import substitution.

6. Non availability of certain critical technologies was an area of concern for the Indian Navy. To overcome this, the Indian Navy and DRDO entered into joint design development and production with established international manufacturers. The Long-Range Surface to Air missile project is one such example which significantly increased participation by the Indian industry. Brahmos supersonic missile is a unique joint venture between the Indian and Russian governments. The main reason for its success can be attributed to mutual sharing of core competencies, continued support of both governments, special arrangements in the JV for its management and functioning, integration of public-private industries as a consortium and most



importantly, involvement of the Indian Navy from the very first trial launch onwards. The Indian Navy's initiative in expediting the trials by earmarking INS Rajput as a trial platform enabled M/s Brahmos to leapfrog the development/technical/user trial cycle leading to signing of the first contract with Indian Navy just after about 10 trials as against over 20 trials which had been planned initially. Needless to say, 'Green Shoots' in synergy had led to a success story.

7. **Transfer of Technology (ToT) Route with Ordnance Factories and DPSUs.**

The Government's Defence Production Policy has the following objectives: -

- (a) To achieve substantive self-reliance in the design, development and production of equipment/ weapon systems/ platforms required for defence in an early time frame.
- (b) To provide conditions conducive for the private industry participation in this endeavour
- (c) To enhance the potential of SMEs in indigenization
- (d) To broaden the defence R&D base of the country

8. Indian Ordnance Factories Organisation is more than 200 years old, with the first factory at Cossipore having been established in 1801. The organisation has over the years grown from labour intensive manual operations to highly automated computer-based manufacturing systems and the emphasis shifted from production of basic and intermediate products to production of finished equipment and the organization emerged as the system integrator.

9. The Ordnance Factories along with DPSUs have been continuously upgrading their capabilities and widening their product range. They have acquired capabilities in various fields

through transfer of technology and have also developed a large number of major products like *Kavach* for the Navy on their own. Over a period of time, DPSUs and Ordnance Factories have developed a wide production base through outsourcing in the private industry which includes a large number of medium and small-scale enterprises in addition to large scale industries. To capitalise on this, the Navy decided to support ToTs with international OEMs which has resulted in optimum utilisation of created facilities, building of indigenous capabilities and better cost effectiveness.

10. Successful production of AK630 and SRGM guns, heavy and light torpedo tube launchers, ammunition for naval guns of various calibers bears testimony to the correctness of this approach. The in-house R&D efforts of the DPSUs and Ordnance Factories provided value additions and upgrades and required impetus to the indigenous effort.

11. Indian Navy has collaborated with various vendors for its requirement of fast-moving armament components by providing direct design and engineering solutions. Notable achievements are hi-tech silver zinc and sea water activated batteries for torpedoes and missiles through indigenous battery manufactures. They are complex systems which propel torpedoes weighing above 1.5 tons underwater at very high speeds and endurance.

12. In the field of armaments, quality is of vital importance. In view of the peculiar situations which the Indian Navy encounters at sea, it is very particular about the quality parameters of armament it procures and for ensuring this, it has a quality assurance branch named Director General of Naval Armament Inspection (DGNAI) with its integral team of quality professionals.

DGNAI of the Indian Navy is the only QA agency amongst the three services that is responsible to the user for assuring quality of naval armament through its entire life cycle from the design, development, manufacture, in-service usage and finally its disposal. These tasks are performed by DGNAI during the course of development, production in India & abroad, in-service maintenance, repair, exploitation and defect investigation.

13. The Indian Navy has this integral component DGNAI of trained quality professionals in all relevant ordnance factories, DRDO laboratories, assisting the private industry manufacturing naval armament components by giving timely and innovative inputs and resolving technical glitches.

14. The above-mentioned representative examples covering a broad spectrum of technologies have been presented to highlight the efforts of the Indian Navy. The synergy 'Green Shoots' owe their success to the involvement and commitment of the Indian Navy to self-reliance and indigenisation right from the grass roots levels.

### **The Army Example**

15. **The Dhanush Howitzer Model.** The Dhanush performance in sub-zero temperatures in Sikkim implies that it is working in the extreme climatic conditions and performing satisfactorily<sup>27</sup>. Dhanush has 23 major assemblies and 874 sub-assemblies, 80% of which have been indigenized. The system has 3430 manufactured items/sub-systems which have been mostly manufactured in house by OFB and about 4902 bought out items which are under indigenisation.

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<sup>27</sup> [https://ofb.gov.in/uploads/unit/0/Make\\_in\\_India\\_Weapon.pdf](https://ofb.gov.in/uploads/unit/0/Make_in_India_Weapon.pdf)

16. Evolution of Dhanush started from upgrades done in 2008 to another upgrade in 2012 155 mm FH Electronics and 155 mm FH Project Dhanush OFB Prototype -1 in Dec 2012. Finally, in 2013-14, OFB Prototypes 3,4,5 and 6 were developed. Gradual development of Dhanush was undertaken which meant that the major sub-assemblies were manufactured separately in stages. OFB changed the indigenous components, one by one and proof fired them to establish the accuracy of the manufacturing process.

17. **Two Sample Guns from Army to OFB.** The first one was upgraded with the 45-caliber barrel and associated components. The second one was upgraded electronically, and both these guns were proof fired at Balasore successfully. The success of these two gun systems helped OFB in taking the next step forward. At this stage OFB was to decide whether to go in for 45 or 39 caliber gun systems. After the success of the upgraded 45 caliber gun, it was concluded that OFB should further proceed on the same path by developing 45 caliber gun systems only. Both these guns developed had 45 to 65% of indigenised components. Both these guns were test fired at Balasore and proved to be satisfactory. In 2013 OFB had a demonstration firing of these guns at Pokhran. In 2013, OFB undertook several firing trials in different locations in the country. The prototype was manufactured and successfully test fired at Pokhran. The fifth prototype was developed after two months and trial evaluated in Sikkim in Mar 2014.

18. **Associations and Stakeholders.** The project was steered by the active involvement and commitment of all stakeholders. Indian Army as user provided support, monitoring and coordination. DRDO was responsible for design support, DGQA for proof testing and validation,

SAIL supplied micro alloy steel plates, 506 ABW partnered in development and maintenance and BEL supported electrical & electronic modules for the sighting system and electronic suite. Associations and contributions of various departments within OFB as well as few DPSUs and private sector in the development and manufacture of Dhanush gun systems have been noteworthy, especially for laser cutting, fabrication, machining, integration & assembly of Dhanush prototype by various private enterprises.

19. **Charter for Weapon Development and Execution Team (WDET).** WDET acted as a single point referral and coordination agency with user for efficient execution and time bound development including proactive actions by users, designers and manufacturing agencies. Weekly monitoring of development of outsourced components, testing/evaluation also was a part of their charter implementation of user, feedback into redesign/upgrading of components.

20. **Role/Involvement of EME.** 506 Army Base Workshop was permanent member of WDET and part of the initial training to core team on gun assembly, testing of hydraulics and gun systems, maintenance cover during trials and support in indigenisation of sub-assemblies.

21. DGQA provided support for proof testing, proactive participation in development and design validation, while DRDO was involved in design validation, range tables and design.

22. The crucial takeaways from the project are the synergy between user, designer and manufacturer, single window user interface, flexible procurement provisions and access to specialized design validation and testing agencies.

**CHAPTER – IV:**  
**FINDINGS AND DISCUSSION**

**Questionnaire**

1. A questionnaire was prepared and circulated in the environment to obtain the world view of Service officers on deputation as a part of Project management Teams to various DRDO labs, DPSUs and its impact on defence production. A copy of this questionnaire is attached as Appendix 'A'.

2. The questionnaire was circulated through e-mail. Likert scale was employed to achieve meaningful analysis of the data. A majority of respondents responded through email. The responses were thereafter compiled for analysis through SPSS and analysed as given in Appendices 'B' to 'D'.

**Analysis of Data**

3. For analyzing the data obtained, the SPSS software was employed. SPSS is a free software application for analysis of sampled data. The software provides No of tools for analyzing the data. Various tools of the software employed for drawing inferences are delineated in subsequent paragraphs.

4. **Descriptive Statistics.** Data was analysed using Descriptive statistics option in the ‘Analyse’ menu. MCTD aspects to include mean, Standard deviation, Variances, minimum and maximum for all the questions containing Likert scale were carried out. A case summary is placed at Appendix ‘C’ A simple but effective columned output is given at Table 4.1 below. A cursory examination shows that the means of all forwarded coded are greater than 3 which is a positive response and is 1.51 i.e., lesser than 3 for the reverse coded question. Thus, we can conclude that the overall result has been favourable. The standard deviation for all the 43 responses is greater than one. These questions and their respective responses will be scrutinized minutely during our analysis.

Table 4.1 : Descriptive Statistics

<b>Descriptive Statistics</b>			
	Mean	Std. Deviation	Analysis N
LACK OF POLITICAL WILL	3.98	.913	43
INDEPENDENT OF BUREAUCRATIC INTERFERENCE	1.51	.551	43
DPSUS, DRDO AND OFS SUCCESSFUL IN TIMELY DELIVERY	1.53	.909	43
END MONOPOLY AND PROVIDE LEVEL FIELD	4.58	.626	43
REORGANISE DEF PRODN UNDER COMMERCE MINISTRY	3.93	.936	43
SERVING OFFRS CONTRIBUTING TOWARDS IMPLEMENTATION	3.00	1.047	43
INTERFACE BETWEEN IAF AND PRIVATE SECTOR INADEQUATE	3.91	.840	43
DEPUTATION OF OFFRS AS PART OF PMTs WILL BENEFIT	4.19	.546	43
EXISTING DEPUTATION POLICY IS CONTRIBUTING GREATLY	3.21	.965	43
ESTABLISHMENT OF DEFENCE WING UNDER CII	4.19	.664	43

SUITABLE OFFRS FROM F(P) TECH, LGS TO BE IDENTIFIED FOR PROCUREMENT	4.35	.720	43
SERVICES UNABLE TO FILL ONE THIRD DRDO VACANCIES	3.93	.884	43
SERVING OFFRS NOT BEING ACCEPTED IN DRDO ORG	4.16	.898	43
VACANT POSTS TO BE FILLED BY IAF TECH OFFRS WITH DOMAIN KNOWLEDGE	4.30	.708	43
DEPUTATION SHOULD OF GP CAPT AND ABOVE	4.05	.925	43
DEPUTATION OF PPO OFFRS WITH CALBRE WILL ENHANCE INDIG DEF PRODN	3.98	.801	43
PLACEMENT OF RETIRING OFFRS IN PVT SECTOR AS SECOND CAREER	4.05	.815	43
LEVERAGE MAKE IN INDIA CONCEPT TO ENHANCE DEF PRODN	4.42	.545	43
SHARE LTIPP WITH PVT FIRMS FOR THEM TO PLAN AND MAKE INVESTMENTS	4.30	.674	43
PEEL FACTOR OF AVSC II REC NOT IMPLEMENTED DUE TO PAROCHIAL INTERESTS OF OTHER ORG	4.28	.630	43

5. **Chi-Square analysis.** Chi-square analysis of each question with Rank and Service of the respondent as a crosstab was carried out. The following aspects are highlighted: -

- (a) The cross-tabulation data was formatted for data input into SPSS in the manner where the rank and service of the respondent has been given codes. The null and alternate hypothesis with the decision rules based on the significance of the calculated value of the Chi square statistic was checked using this tool. The significance of the Chi squared calculated is the area or probability that one would get that value of Chi squared if the null hypothesis was true i.e., if the observed and expected proportions were similar.



Chi-square analysis of all the questions has been carried out using the SPSS software tool.

(b) The Chi Square test for cross tabulations is invoked from the descriptive statistics – Cross tabs menu options of the SPSS software. This tool was used to carry out the Chi Square test of independence.

(c) The output is placed at Appendix ‘D’. Details are as under: -

(i) The first table provides the summary of valid cases. All cases are valid in this case with no missing values.

(ii) The first entry in the second table provides the chi squared statistic. Here we see that the Pearson chi square statistic for Question 1 is 11.709 with a degree of freedom of 8 (row -3\* col -3) and the significance of this value. The significance is 0.165 which is more than 0.05 which is the chosen LOS. Thus, we can say that we are able to reject the null hypothesis that the response to this question is independent of the rank and service of the respondent.

(iii) Similarly, the chi square values of all the questions, with the rank and service of the respondent as cross tab, has been calculated and analysed. The Pearson chi square static of all questions except question 20 (are above the significance level of 0.05 and hence the responses can be considered to be dependent of the arm of the respondent. Though no specific conclusion can be drawn from this statistic at the moment, this aspect will also be analysed when each construct / question is examined separately.

6. **Homogeneity Test Using One Way ANOVA.**

(a) As a hypothesis test, ANOVA computes the F statistic which is a ratio of the estimate of population variance calculated from the group means (within groups) to the same value calculated using individual values. This ratio should be a small value if all the groups are picked up from the same population or populations of similar characteristics. If this ratio has a high value, then we can conclude that they are not from the same population or from populations with similar characteristics. This ratio is known to carry according to the F distribution which is the sampling distribution of the F statistic. Just like in the case of the Chi Square statistic. Just like in the case of the Chi Square statistic is read as the area under the curve from the right. Thus, if the p value for a given statistic is greater than the LOS, we reject the null hypothesis that the groups are not from the same or similar populations.

(b) The one-way ANOVA analysis was carried out using the software tools available. The ANOVA output shows three tables at Table No 4.2 below. This report is as under: -

(i) The first table is the descriptive table which provides some descriptive statistics for each question. The basic descriptive output provides the mean, standard deviation, standard error, 95% confidence interval for the mean, the maximum and minimum. A scan of the interval estimates for the mean at a 95% CL shows that few questions have means that vary from the unfavourable to the favourable responses i.e., lower limit below 3 and upper limit above 3.

Table No 4.2 : ANOVA

**ANOVA**

		Sum of Squares	df	Mean Square	F	Sig.
LACK OF POLITICAL WILL	Between Groups	3.458	2	1.729	2.194	.125
	Within Groups	31.519	40	.788		
	Total	34.977	42			
INDEPENDENT OF BUREAUCRATIC INTERFERENCE	Between Groups	2.108	2	1.054	3.963	.027
	Within Groups	10.637	40	.266		
	Total	12.744	42			
DPSUS, DRDO AND OFS SUCCESSFUL IN TIMELY DELIVERY	Between Groups	4.342	2	2.171	2.861	.069
	Within Groups	30.356	40	.759		
	Total	34.698	42			
END MONOPOLY AND PROVIDE LEVEL FIELD	Between Groups	.881	2	.441	1.131	.333
	Within Groups	15.584	40	.390		
	Total	16.465	42			
REORGANISE DEF PRODN UNDER COMMERCE MINISTRY	Between Groups	.645	2	.323	.357	.702
	Within Groups	36.145	40	.904		
	Total	36.791	42			
SERVING OFFRS CONTRIBUTING TOWARDS IMPLEMENTATION	Between Groups	3.258	2	1.629	1.525	.230
	Within Groups	42.742	40	1.069		
	Total	46.000	42			
INTERFACE BETWEEN IAF AND PRIVATE SECTOR INADEQUATE	Between Groups	1.483	2	.741	1.053	.358
	Within Groups	28.145	40	.704		
	Total	29.628	42			
DEPUTATION OF OFFRSAS PART OF PMG WILL BENEFIT	Between Groups	.612	2	.306	1.028	.367
	Within Groups	11.900	40	.297		
	Total	12.512	42			
EXISTING DEPUTATION POLICY IS CONTRIBUTING GREATLY	Between Groups	2.029	2	1.014	1.094	.345
	Within Groups	37.088	40	.927		
	Total	39.116	42			

ESTABLISHMENT OF DEFENCE WING UNDER CII	Between Groups	1.208	2	.604	1.397	.259
	Within Groups	17.303	40	.433		
	Total	18.512	42			
SUITABLE OFFRS FROM F(P) TECH, LGS TO BE IDENTIFIED FOR PROCUREMENT	Between Groups	.043	2	.022	.040	.961
	Within Groups	21.724	40	.543		
	Total	21.767	42			
SERVICES UNABLE TO FILL ONE THIRD DRDO VACANCIES	Between Groups	3.132	2	1.566	2.112	.134
	Within Groups	29.659	40	.741		
	Total	32.791	42			
SERVING OFFRS NOT BEING ACCEPTED IN DRDO ORG	Between Groups	3.525	2	1.762	2.324	.111
	Within Groups	30.336	40	.758		
	Total	33.860	42			
VACANT POSTS TO BE FILLED BY IAF TECH OFFRS WITH DOMAIN KNOWLEDGE	Between Groups	.769	2	.385	.758	.475
	Within Groups	20.301	40	.508		
	Total	21.070	42			
DEPUTATION SHOULD OF GP CAPT AND ABOVE	Between Groups	.388	2	.194	.219	.805
	Within Groups	35.519	40	.888		
	Total	35.907	42			
DEPUTATION OF PPO OFFRS WITH CALBRE WILL ENHANCE INDIG DEF PRODN	Between Groups	2.054	2	1.027	1.649	.205
	Within Groups	24.922	40	.623		
	Total	26.977	42			
PLACEMENT OF RETIRING OFFRS IN PVT SECTOR AS SECOND CAREER	Between Groups	.388	2	.194	.282	.756
	Within Groups	27.519	40	.688		
	Total	27.907	42			
LEVERAGE MAKE IN INDIA CONCEPT TO ENHANCE DEF PRODN	Between Groups	.139	2	.070	.226	.799
	Within Groups	12.326	40	.308		
	Total	12.465	42			
SHARE LTIPP WITH PVT FIRMS FOR THEM TO PLAN AND MAKE INVESTMENTS	Between Groups	.298	2	.149	.317	.730
	Within Groups	18.772	40	.469		
	Total	19.070	42			
PEEL FACTOR OF AVSC II REC NOT IMPLEMENTED DUE TO PAROCHIAL INTERESTS OF OTHER ORG	Between Groups	3.438	2	1.719	5.204	.010
	Within Groups	13.213	40	.330		
	Total	16.651	42			

## Analysis of Few Significant Constructs of the Study

### 8. Efficiency of DPSUs and DRDO and the biased attitude of the department of Defence

Production towards DPSUs vis-à-vis private industry. Following are the findings :-

(a) An overwhelming 96% of the respondents disagreed that the DPSUs, DRDO and OFs have been successful in timely delivery of cutting-edge technologies in defence production.

(b) Similarly, 98% of respondents agreed that there is need to put an end to monopoly enjoyed by DPSUs, DRDO and OFs vis-à-vis private industry.

(c) 68% of the respondents agreed that reorganising Department of Defence Production from MoD to Ministry of Commerce and Industry will provide necessary impetus towards level playing field for private industry vis-à-vis DPSUs, DRDO and OFs and enhance Defence production.

### 9. Present State of interface in terms of contribution of officers on deputation to DPSUs and DRDO towards steering the projects as per the ASQRs and prescribed time frames. The

responses were found to have a large variation with chi square statistic of 0.245, a mean of 3 and a standard deviation of 1.047. The responses do not therefore reveal any worthwhile information. However, the present levels of deputation are very low hence the data could be construed as the contribution at present levels is very less.

10. Present interface between IAF and the DPSUs/private industry and its impact on defence production. The findings are as follows:-

(a) 75% of respondents agreed that the present level of interface between the IAF and private industry is grossly inadequate. The chi square sig of data is 0.672 with a mean of 3.91 and standard deviation of 0.84.

(b) 90% of the respondents agreed that deputation of officers as a part of PMTs to public and private sector would improve defence production and timely completion of projects. The chi square significance is 0.698 with a mean of 4.19 and standard deviation of 0.546.

(c) 86% of respondents agreed that there is strong case for strengthening the defence wing under CII to facilitate all projects. The chi square sig is 0.329 with a mean of 4.19 and standard deviation of 0.664.

(d) 88% of the respondents agree that IAF pilots, technical and logistics officers with domain expertise on a weapon system/ procurement process need to be identified and deputed to DPSUs, DRDO labs, OFs and CII to facilitate all IAF projects to be materialized indigenously with cutting edge technologies. The chi square sig is 0.897 with a mean of 4.35 and standard deviation of 0.72.

11. Problems related to authorized vacancies for Service officers in DRDO not being filled by Service HQ. Following are the salient findings :-

(a) 73% agreed that as per the existing policy one third of DRDO vacancies (600 Approx) are to be filled by officers of the three Services in the ranks of Lt Cols to Maj Gen equivalent. The Services have not been able to fill all these vacancies due to shortage

and sparability of officers. The chi square sig is 0.556 with a mean of 3.93 and standard deviation of 0.884.

(b) 88% of the respondents agreed that Parochial and vested interests of DPSUs, DRDO and OFB has resulted in Service officers not being accepted on deputation to these organizations. The homogeneity of response is borne but by the chi square sig of 0.517 with a mean of 4.16 and standard deviation of 0.898.

(c) An overwhelming 93% of respondents agreed that the posts lying vacant DRDO (Services Cadre) could be filled by deputing IAF technical officers with domain expertise and flair for research (5-7 yrs) to further our projects as well as develop new technologies. The chi square sig is 0.541 with a mean of 4.3 and standard deviation of 0.708.

(d) 88% of respondents agreed to the fact that the peel factors recommended by Ajay Vikram Singh Committee - Phase II could not be implemented in true letter and spirit due to parochial interests of other organizations/ departments by not accepting panels forwarded by Service HQ.

13. Leveraging the Government's initiative and campaign for 'Make in India'.

(a) An overwhelmingly 93% of respondents agreed that with the thrust of the present Govt for indigenization (Make in India), there is a strong case for Air HQ to leverage the same by sparing officers to expedite long pending projects. The chi square sig is 0.635 with mean of 4.42 and standard deviation of 0.545.

(b) The data has a mean of 4.3 with standard deviation of 0.674 and implies that there is an impetus required in this direction for achieving synergy with the private industry. The statistical validation also enables this input being utilized for drawing conclusions.

### **Validation of Hypothesis.**

15. **Hypothesis.** The hypothesis as formulated in Chapter I is as under: -

(a) **Null Hypothesis.** Deputation of IAF officers to Defence Research and Development Organisation (DRDO), Defence Public Sector Undertakings (DPSUs) **will not** facilitate achieving timely completion of projects as per the Air Staff Qualitative Requirements (ASQRs) and enhancement of defence production.

(b) **Alternate Hypothesis.** Deputation of IAF officers to Defence Research and Development Organisation (DRDO), Defence Public Sector Undertakings (DPSUs) and industry will facilitate achieving timely completion of projects as per the Air Staff Qualitative Requirements (ASQRs) and enhancement of defence production.

**From the ibid conclusions drawn out of statistical inferences in this chapter, as well as arguments projected in the previous chapters, there is enough evidence to reject the null hypothesis. The alternate hypothesis thus stands validated.**



16. A summary of the statistically valid derivations from the analysis carried out earlier in the chapter are highlighted below: -

(a) The lack of political will in the past and bureaucratic interference on procurement matters has adversely affected defence production.

(b) The present organizational set up where in Department of Defence Production is placed under MoD has demerits in terms of preferential and captive treatment of DPSUs vis-à-vis the private players there by denying level playing field. Therefore, there is a need for the government to place DDP under Ministry of Commerce and Industry.

(c) The present system of deputation of IAF officers to DPSUs and DRDO is not adequate to meet the nation's military capability by way of enhancing indigenous defence production. There is an immediate need to address these issues by filling all authorized vacant posts in DRDO for long term self-reliance goals.

(d) Parochial and vested interests of DPSUs, DRDO and OFB has resulted in Service officers not being accepted on deputation to these organizations. This has adversely affected deputation of IAF officers to DPSUs, OFs and DRDO thereby impacting indigenous defence production.

**CHAPTER V**  
**RECOMMENDATIONS**

1. In the preceding chapters all aspects of impact of deputation of IAF officers to DPSUs have been studied and analysed. The study includes the genesis of defence production in India, its growth, policies, effectiveness in present state and drawbacks. A case study each of all the three Services have been brought out. The present efforts by the new government have been highlighted. A comprehensive questionnaire covering all relevant aspects was administered to the sample population and analysed in Chapter IV. The analysis of the responses to the questionnaire and the study of the subject through literature survey has validated that the interface mechanism between defence equipment designers, producers and users will enhance defence production. The study attempts to bring forth a number of recommendations, which are explained in the succeeding Paras.

2. A strong and objective partnership between the public and private sectors alone will enable India to sustain a credible defence industrial base for the future, setting the country firmly on the path of self-reliance. Efforts to create synergy between private and public industry would be based upon the optimum exploitation of core competence of these enterprises on a level playing field.

3. Frequent seminars, workshops, Def Expos be conducted on a regular basis for enhancing interaction between the user (Armed Forces) and the producer (private industry) to bring about awareness amongst each other and for better appreciation of each other's needs and constraints.

4. DRDO scientists should visit field units of the three Services on a regular basis to see the environment armed forces function in, the problems faced by the personnel and how DRDO can be of help. It is recommended that a certain percentage of scientists be recruited by the Armed Forces through the Short Service Commission route and after five to ten years be transferred laterally to the DRDO for understanding the needs of the users.
5. There is a need to set up a combined R&D cadre of IAF, Army and Navy to tide over the delays in development of critical technologies and weapon systems.
6. India could emulate the US model by putting the development of critical projects akin to Air Force Research Laboratory (AFRL) in the United States with dedicated senior officers working on multiple programmes.
7. The Services should depute their qualified & experienced domain experts on deputation to DRDO and DPSUs for a period of 5 years to progress important projects. The selected service officers must be empowered with adequate financial and administrative powers in the DRDO and DPSUs to steer the projects to success.
8. Since the DDP is part of the MoD, there is a situation wherein the designer (DRDO), manufacturers (PSUs and OFB) and the captive customer (the three Services) are all bundled into one entity. Hence, the first step would be to review the corporate control of the PSUs and the OFB and place them under a different silo viz Ministry of Commerce and Industry.
9. All the authorized vacancies in DRDO ex cadre posts should be filled by Service HQ even at the cost of short-term shortage in human resource as this would accrue long term results

in indigenous defence production. This strategy would further create vacancies in select ranks of Col equivalent and above, thereby improving the promotion prospects in officer cadre.

10. In case of select rank officers, there is a need to explore deputation of superseded officers who are domain experts in various fields. In addition, officers with domain expertise who are prematurely retiring early may be absorbed in DPSUs and DRDO.

11. Recommendations of Ajay Vikram Singh Committee – II with regard to lateral absorption of officers in other ministries could not be implemented due to parochial interests of the organizations. However, MoD can ensure that these recommendations are implemented in DRDO and DPSUs as these come under the purview of MoD.

### **Conclusion.**

12. In view of the various factors brought out in the dissertation with respect to deputing domain experts as interface between DRDO and DPSUs, there is an immediate need to give necessary impetus by the IAF to spare officers for steering various projects as per the laid down ASQRs in an expeditious manner.

(Refer Para 1 of Chapter IV)

**RESEARCH QUESTIONNAIRE**

Researcher: Air Cmde KS Rao

Participant 46<sup>th</sup> APPPA Course

Indian Institute of Public Administration

May be mailed to [srinivasraokada@yahoo.co.in](mailto:srinivasraokada@yahoo.co.in)

Dear Sirs,

1. I Air Cmde KS Rao am undergoing 46<sup>th</sup> APPPA Course at Indian Institute of Public Administration. I am carrying out research on **“Evaluation of Interface Mechanism Between Defence Equipment Designers, Producers and Users”**

2. **Background** The Public - Private Industry interface with Services is very limited at present. In spite of a number of GoMs, Parliamentary Committees submitting their reports with reference to self-reliance, defence indigenization and Public-Private Partnership, not much has been achieved in this direction. Successive Governments have not been able to implement these meaningful recommendations till date.

3. Therefore, there is a need to address the issue by deputing Project Management Teams (PMTs) consisting of serving officers at the level of Col equivalent rank with expertise in the

weapon system, R&D, procurement and acquisition management as an interface to facilitate speedy development and production without administrative delays and cost overruns.

4. I solicit your frank and valuable inputs to the following questions by sparing your valuable time. your considered views and rich experience would add immensely to my research.

**Instructions.** Pl fill in the boxes with responses against each option as listed in the format given below. (Strongly Agree-5, Agree – 4, Neutral – 3, Disagree – 2, Strongly Disagree- 1)

S No	Question	SA 5	A 4	N 3	D 2	SD 1
1.	Our political class lacks the will to effect changes in our defence production					
2.	Our defence production systems are independent of bureaucratic and political interference					
3.	DPSUs, DRDO and OFs have been successful in timely delivery of much needed cutting-edge technologies in defence production					
4.	There is a need to put an end to the monopoly enjoyed by DPSUs, DRDO and OFs and provide a level playing field to Private Sector to participate in defence production					
5.	Reorganising Department of Defence Production from MoD under Ministry of Commerce and Industry will provide necessary impetus towards level playing field for private industry vis-à-vis DPSUs, DRDO and OFs and enhancement of defence production.					

6.	Presently serving officers tenanted Ex- cadre posts at various DRDO labs are contributing a great deal towards implementation of defence projects.					
7.	Present interface between the IAF and Private Industry (CII) is grossly inadequate to exploit the potential to indigenize our needs.					
8.	Deputation / association of officers as part of PMGs to Public and Private Sector would benefit improving defence production and timely completion of defence projects.					
9.	The existing deputation model of officers to DRDO Labs viz CABS, ADA, ADE etc contributed a great deal in achieving our AEW&C and LCA projects.					
10.	There is a strong case for strengthening the Defence Wing under the aegis of CII to facilitate all IAF projects / acquisitions.					
11.	IAF pilots, technical and logistics officers with domain expertise on a weapon system/ procurement process need to be identified and deputed to DPSUs, DRDO labs, OFs and CII to facilitate all IAF projects to be materialized indigenously with cutting edge technologies.					
12.	As per the existing policy one third of DRDO vacancies (600 Approx) are to be filled by officers of the three Services in the ranks of Lt Cols to Maj Gen equivalent. The Services have not been able to fill all these vacancies due to shortage and sparability of officers.					

13.	Parochial and vested interests of DPSUs, DRDO and OFB has resulted in Service officers not being accepted on deputation to these organizations.					
14.	The posts lying vacant DRDO (Services cadre) could be filled by deputing IAF technical officers with domain expertise and flair for research (5-7 yrs) to further our projects as well as develop new technologies.					
15.	Deputation of IAF officers should be at the rank of Gp Capt and above to give necessary impetus to projects and improve the existing abysmal promotion prospects,					
16.	Deputation of high caliber superseded officers with required domain expertise / experience to DPSUs, DRDO and OFs will enhance the prospects of indigenous defence production.					
17.	In case deputation of serving officers to Pvt Sector is not feasible, suitable officers proceeding on retirement/ premature retirement could be given placements in Private Sector as second career to enhance defence production.					
18.	With the thrust of the present Govt for indigenization (Make in India), there is a strong case for Air HQ to leverage the same by sparing officers to expedite long pending projects.					
19	There is a need to share our LTIPP requirements to the private industry to evince keen interest in them for long term production plans and investments in defence					



	production infrastructure of the nation.					
20.	The peel factors recommended by AVSC Phase II could not be implemented in true letter and spirit in the last five years due to parochial interests of other organizations/ departments by not accepting panels forwarded by Service HQ.					

Thanks a lot for sparing your valuable time

Rank \_\_\_\_\_ Name \_\_\_\_\_

Arm/Branch \_\_\_\_\_ Service \_\_\_\_\_ Yrs

(Refer Para 2 Of Chapter IV)

**PERCENTAGE RESPONSES****STRONGLY AGREE/AGREE/NEUTRAL/DISAGREE/STRONGLY DISAGRE**

S No	Question	SA	A	N	D	SD
		5	4	3	2	1
1	Our political class lacks the will to effect changes in our defence production	26	56	14	5	0
2	Our defence production systems are independent of bureaucratic and political interference	0	2	2	49	47
3	DPSUs, DRDO and OFs have been successful in timely delivery of much needed cutting-edge technologies in defence production	5	2	0	35	58
4	There is a need to put an end to the monopoly enjoyed by DPSUs, DRDO and OFs and provide a level playing field to Private Sector to participate in defence production	60	37	0	2	0
5	Reorganising Department of Defence Production from MoD under Ministry of Commerce and Industry will provide necessary impetus towards level playing field for private industry vis-à-vis DPSUs, DRDO and OFs and enhancement of Defence production.	23	44	30	2	0
6	Presently serving officers tenanted Ex- cadre posts at various DRDO labs are contributing a great deal towards implementation of defence projects.	7	23	35	30	5
7	Present interface between the IAF and Private Industry (CII) is grossly inadequate to exploit the potential to indigenize our needs.	28	47	23	2	0
8	Deputation / association of officers as part of PMGs to Public and Private Sector would benefit improving defence production and timely completion of defence	23	67	7	2	0

	projects.					
9	The existing deputation model of officers to DRDO Labs viz CABS, ADA, ADE etc contributed a great deal in achieving our AEW&C and LCA projects.	9	28	40	21	2
10	There is a strong case for strengthening a Defence Wing under the aegis of CII to facilitate all IAF projects / acquisitions.	30	56	14	0	0
11	IAF pilots, technical and logistics officers with domain expertise on a weapon system/ procurement process need to be identified and deputed to DPSUs, DRDO labs, OFs and CII to facilitate all IAF projects to be materialized indigenously with cutting edge technologies.	44	44	12	0	0
12	As per the existing policy one third of DRDO vacancies (600 Approx) are to be filled by officers of the three Services in the ranks of Lt Cols to Maj Gen equivalent. The Services have not been able to fill all these vacancies due to shortage and sparability of officers.	26	47	23	2	2
13	Parochial and vested interests of DPSUs, DRDO and OFB has resulted in Service officers not being accepted on deputation to these organizations.	37	51	5	5	2
14	The posts lying vacant DRDO (Services cadre) could be filled by deputing IAF technical officers with domain expertise and flair for research (5-7 yrs) to further our projects as well as develop new technologies.	40	53	5	2	0
15	Deputation of IAF officers should be at the rank of Gp Capt and above to give necessary impetus to projects and improve the existing abysmal promotion prospects.	28	56	7	7	2
16	Deputation of high caliber passed over (non-empaneled) officers with required domain expertise / experience to DPSUs, DRDO and OFs will enhance the prospects of indigenous defence production.	21	60	14	5	0
17	In case deputation of serving officers to Pvt Sector is not feasible, suitable officers proceeding on retirement/ premature retirement could be given placements in Private Sector as second career to enhance defence production.	21	63	9	5	2
18	With the thrust of the present Govt for indigenization (Make in India), there is a strong case for Air HQ to leverage the same by sparing officers to expedite long	40	53	7	0	0

	pending projects.					
19	There is a need to share our LTIPP requirements to the private industry to evince keen interest in them for long term production plans and investments in defence production infrastructure of the nation.	35	58	5	2	0
20	The peel factors recommended by AVSC Phase II could not be implemented in true letter and spirit in the last five years due to parochial interests of other organizations/ departments by not accepting panels forwarded by Service HQ.	30	58	12	0	0

Appendix 'C'

(Refer Para 4 of Chapter IV)

**Case Summaries**

SERVICE		SERVICE BRACKET	LACK OF POLITICAL WILL	INDEPENDENT OF BUREAUCRATIC INTERFERENCE	DPSUs, DRDO and OFs SUCCESSFUL AND TIMELY COMPLETION	END MONOPOLY AND PROVIDE LEVEL FIELD	REORGANISE DEF PRODN UNDER COMMERCE MINISTRY
ARMY	N	19	19	19	19	19	19
	Mean	1.1053	3.95	1.74	1.53	4.42	3.84
	Std. Deviation	.31530	.970	.562	.964	.769	1.015
	Skewness	2.798	-1.517	-.058	2.826	-1.757	-1.079
NAVY	N	3	3	3	3	3	3
	Mean	1.0000	5.00	1.00	2.67	4.67	4.33
	Std. Deviation	0.00000	0.000	0.000	2.082	.577	1.155
	Skewness				1.293	-1.732	-1.732
AIR FORCE	N	21	21	21	21	21	21
	Mean	1.3810	3.86	1.38	1.38	4.71	3.95
	Std. Deviation	.49761	.854	.498	.498	.463	.865
	Skewness	.529	-.773	.529	.529	-1.023	-.416
Total	N	43	43	43	43	43	43
	Mean	1.2326	3.98	1.51	1.53	4.58	3.93
	Std. Deviation	.42746	.913	.551	.909	.626	.936
	Skewness	1.312	-1.136	.400	2.685	-1.848	-.770

### Case Summaries

SERVICE		SERVICE_ BRACKET	SERVING OFFRS CONTRIBUTING TOWARDS IMPLEMENTATION	INTERFACE BETWEEN IAF AND PRIVATE SECTOR INADEQUATE	DEPUTATION OF OFFRS AS PART OF PMG WILL BENEFIT	EXISTING DEPUTATION POLICY IS CONTRIBUTING GREATLY	STRENGTH ENING OF DEFENCE WING UNDER CII
ARMY	N	19	19	19	19	19	19
	Mean	1.1053	2.89	3.84	4.05	3.37	4.26
	Std. Deviation	.31530	.809	.834	.621	.761	.733
	Skewness	2.798	.907	-.320	-1.580	.075	-.471
NAVY	N	3	3	3	3	3	3
	Mean	1.0000	4.00	3.33	4.33	3.67	4.67
	Std. Deviation	0.00000	1.000	.577	.577	1.155	.577
	Skewness		0.000	1.732	1.732	1.732	-1.732
AIR FORCE	N	21	21	21	21	21	21
	Mean	1.3810	2.95	4.05	4.29	3.00	4.05
	Std. Deviation	.49761	1.203	.865	.463	1.095	.590
	Skewness	.529	.100	-.610	1.023	.252	.001
Total	N	43	43	43	43	43	43
	Mean	1.2326	3.00	3.91	4.19	3.21	4.19
	Std. Deviation	.42746	1.047	.840	.546	.965	.664
	Skewness	1.312	.261	-.324	-.808	.057	-.223

### Case Summaries

SERVICE	SERVICE BRACKET	SUITABLE OFFRS FROM F(P) TECH, LGS TO BE IDENTIFIED FOR PROCUREMENT	SERVICES UNABLE TO FILL ONE THIRD DRDO VACANCIES	SERVING OFFRS NOT BEING ACCEPTED IN DRDO ORG	VACANT POSTS TO BE FILLED BY IAF TECH OFFRS WITH DOMAIN KNOWLEDGE	DEPUTATION SHOULD OF GP CAPT AND ABOVE
ARMY	19	19	19	19	19	19
	1.1053	4.32	3.63	3.84	4.21	3.95
	.31530	.820	1.065	1.015	.787	1.079
	2.798	-1.359	-.693	-1.436	-1.174	-1.370
NAVY	3	3	3	3	3	3
	1.0000	4.33	4.00	4.33	4.00	4.00
	0.00000	.577	1.000	.577	1.000	0.000
		1.732	0.000	1.732	0.000	
AIR FORCE	21	21	21	21	21	21
	1.3810	4.38	4.19	4.43	4.43	4.14
	.49761	.669	.602	.746	.598	.854
	.529	-.626	-.071	-1.725	-.476	-1.360
Total	43	43	43	43	43	43
	1.2326	4.35	3.93	4.16	4.30	4.05
	.42746	.720	.884	.898	.708	.925
	1.312	-1.044	-.946	-1.577	-.935	-1.422

### Case Summaries

SERVICE	SERVICE_BRACKET	DEPUTATION OF PPO OFFRS WITH CALBRE WILL ENHANCE INDIG DEF PRODN	PLACEMENT OF RETIRING OFFRS IN PVT SECTOR AS SECOND CAREER	LEVERAGE MAKE IN INDIA CONCEPT TO ENHANCE DEF PRODN	SHARE LTIPP WITH PVT FIRMS FOR THEM TO PLAN AND MAKE INVESTMENTS	PEEL FACTOR OF AVSC II REC NOT IMPLEMENTED DUE TO PAROCHIAL INTERESTS OF OTHER ORG
ARMY	19	19	19	19	19	19
	1.1053	3.74	3.95	4.37	4.32	4.47
	.31530	.991	.970	.496	.582	.513
	2.798	-.554	-1.925	.593	-.120	.115
NAVY	3	3	3	3	3	3
	1.0000	4.00	4.00	4.33	4.00	3.33
	0.00000	0.000	0.000	.577	1.000	.577
				1.732	0.000	1.732
AIR FORCE	21	21	21	21	21	21
	1.3810	4.19	4.14	4.48	4.33	4.24
	.49761	.602	.727	.602	.730	.625
	.529	-.071	-1.092	-.662	-1.482	-.195
Total	43	43	43	43	43	43
	1.2326	3.98	4.05	4.42	4.30	4.28
	.42746	.801	.815	.545	.674	.630
	1.312	-.830	-1.747	-.125	-.937	-.288



**RANK \* LACK OF POLITICAL WILL**

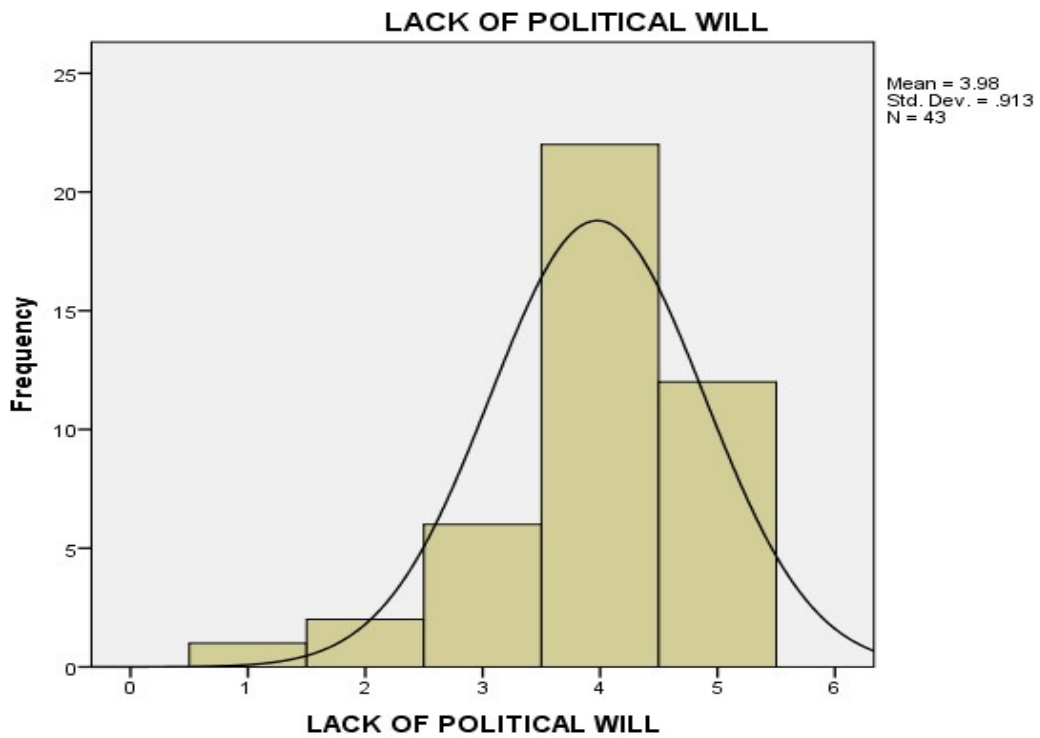
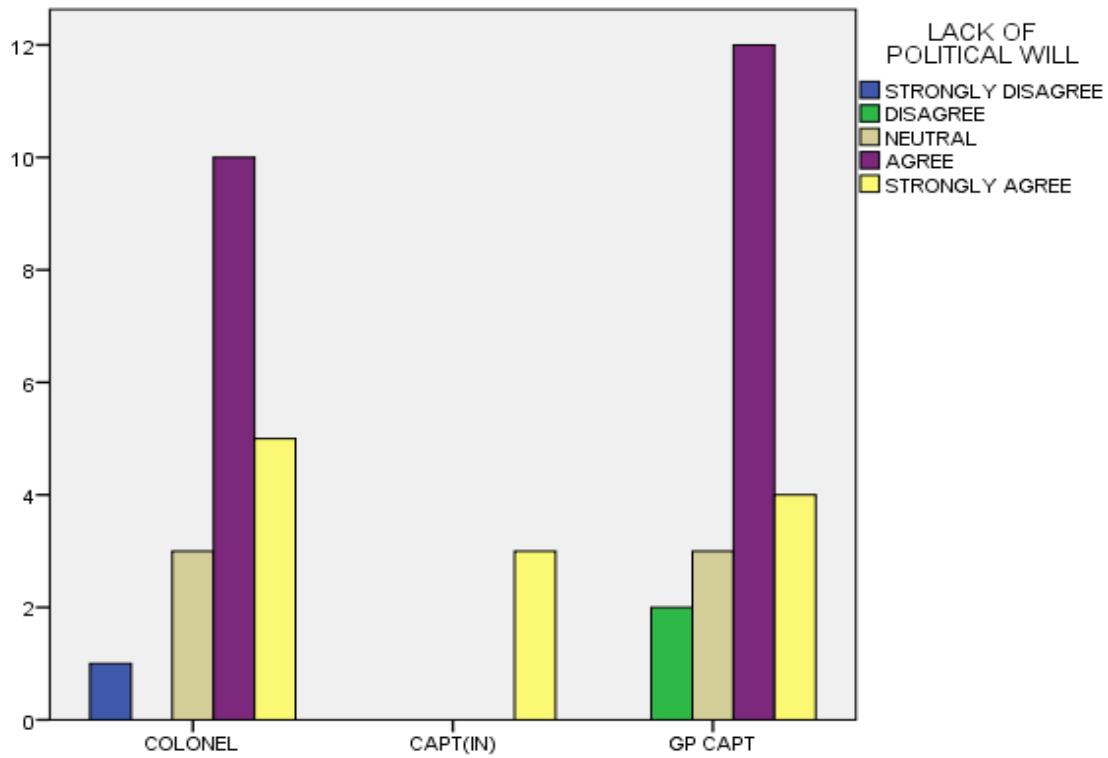
**Crosstab**

			LACK OF POLITICAL WILL					Total
			STRONGLY DISAGREE	DISAGRE E	NEUTRAL	AGRE E	STRONGLY AGREE	
RANK COLONEL	Count	1	0	3	10	5	19	
	Expected Count	.4	.9	2.7	9.7	5.3	19.0	
	% within LACK OF POLITICAL WILL	100.0%	0.0%	50.0%	45.5%	41.7%	44.2%	
CAPT(IN)	Count	0	0	0	0	3	3	
	Expected Count	.1	.1	.4	1.5	.8	3.0	
	% within LACK OF POLITICAL WILL	0.0%	0.0%	0.0%	0.0%	25.0%	7.0%	
GP CAPT	Count	0	2	3	12	4	21	
	Expected Count	.5	1.0	2.9	10.7	5.9	21.0	
	% within LACK OF POLITICAL WILL	0.0%	100.0%	50.0%	54.5%	33.3%	48.8%	
Total	Count	1	2	6	22	12	43	
	Expected Count	1.0	2.0	6.0	22.0	12.0	43.0	
	% within LACK OF POLITICAL WILL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	

**Chi-Square Tests**

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	11.709 <sup>a</sup>	8	.165
Likelihood Ratio	12.617	8	.126
Linear-by-Linear Association	.115	1	.735
N of Valid Cases	43		

a. 11 cells (73.3%) have expected count less than 5. The minimum expected count is .07.



## RANK \* INDEPENDENT OF BUREAUCRATIC INTERFERENCE

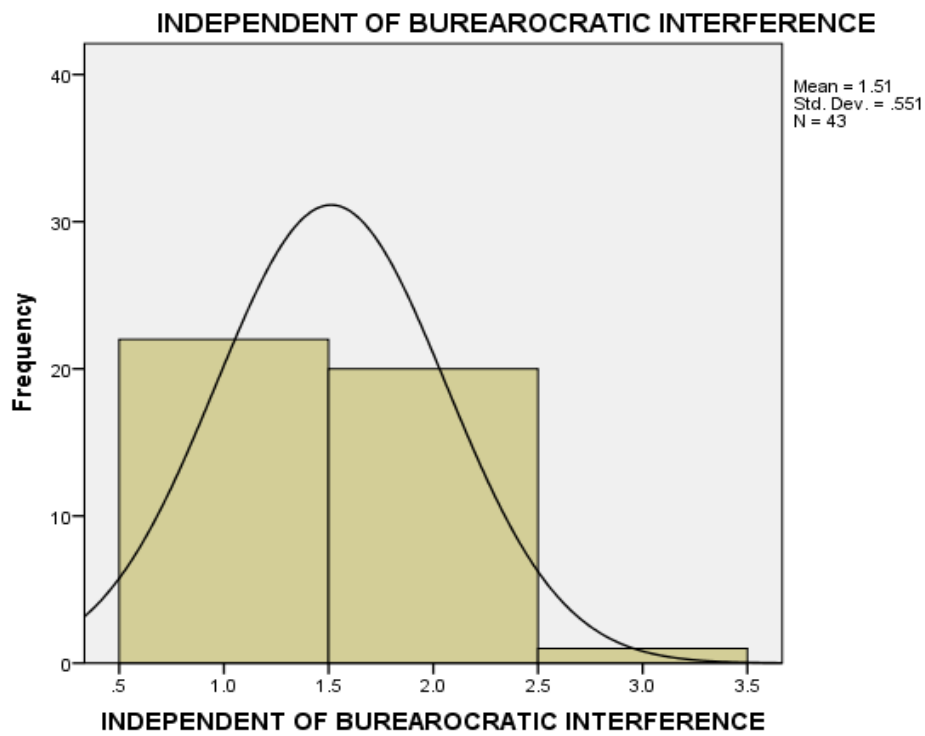
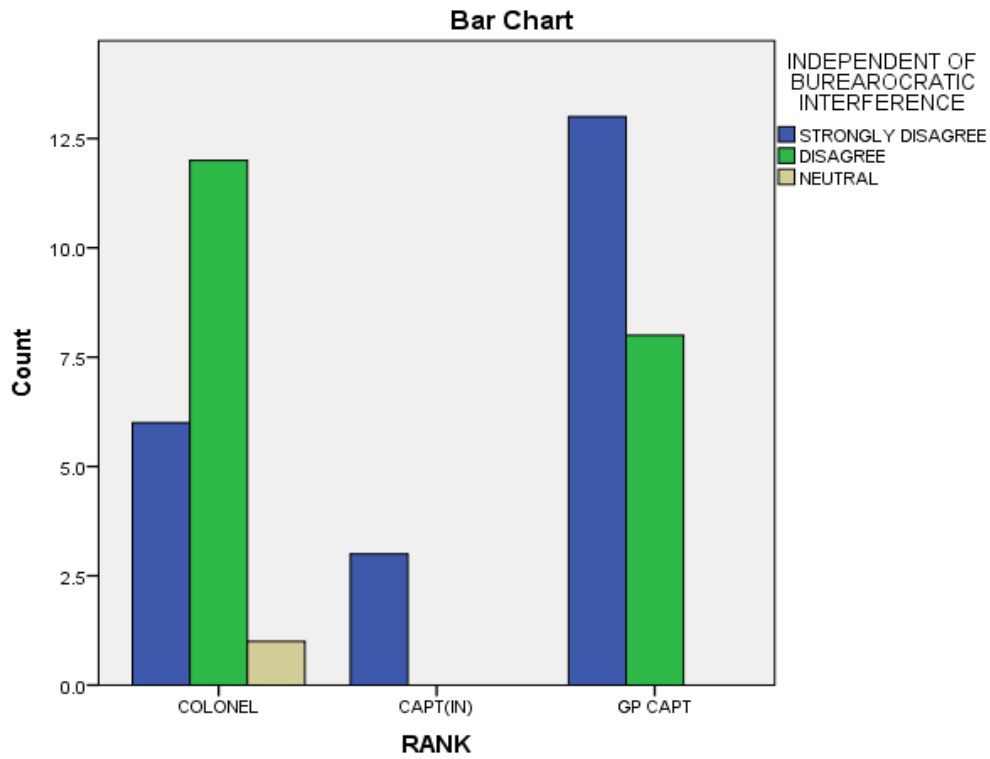
Crosstab

			INDEPENDENT OF BUREAUCRATIC INTERFERENCE			Total
			STRONGLY DISAGREE	DISAGREE	NEUTRAL	
RANK	COLONEL	Count	6	12	1	19
		Expected Count	9.7	8.8	.4	19.0
		% within INDEPENDENT OF BUREAUCRATIC INTERFERENCE	27.3%	60.0%	100.0%	44.2%
	CAPT(IN)	Count	3	0	0	3
		Expected Count	1.5	1.4	.1	3.0
		% within INDEPENDENT OF BUREAUCRATIC INTERFERENCE	13.6%	0.0%	0.0%	7.0%
	GP CAPT	Count	13	8	0	21
		Expected Count	10.7	9.8	.5	21.0
		% within INDEPENDENT OF BUREAUCRATIC INTERFERENCE	59.1%	40.0%	0.0%	48.8%
Total	Count	22	20	1	43	
	Expected Count	22.0	20.0	1.0	43.0	
	% within INDEPENDENT OF BUREAUCRATIC INTERFERENCE	100.0%	100.0%	100.0%	100.0%	

### Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.407 <sup>a</sup>	4	.116
Likelihood Ratio	8.968	4	.062
Linear-by-Linear Association	4.073	1	.044
N of Valid Cases	43		

a. 5 cells (55.6%) have expected count less than 5. The minimum expected count is .07.



## RANK \* DPSUS, DRDO AND OFS SUCCESSFUL IN TIMELY DELIVERY

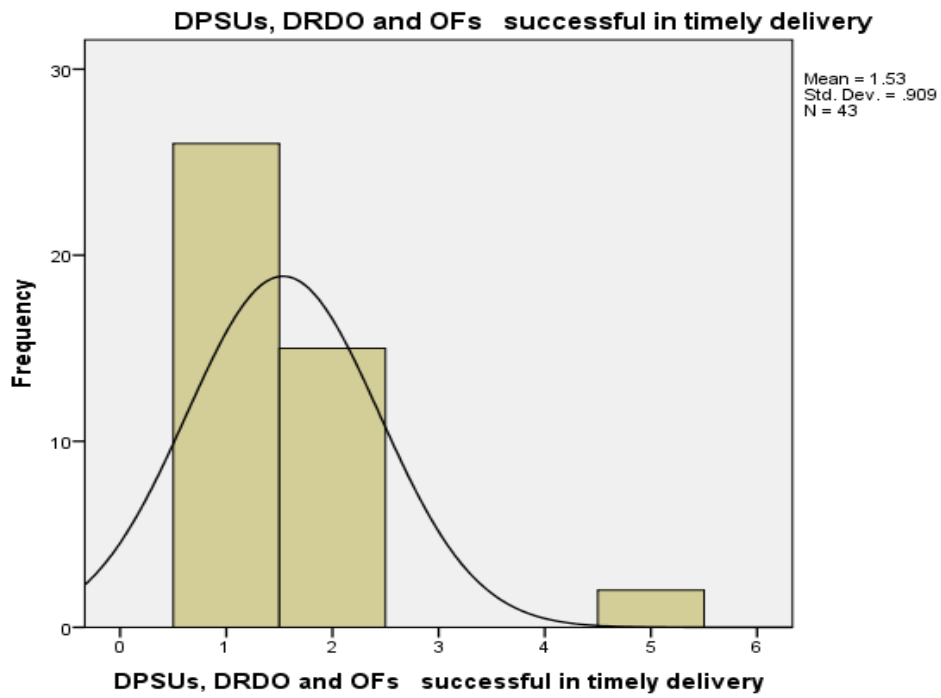
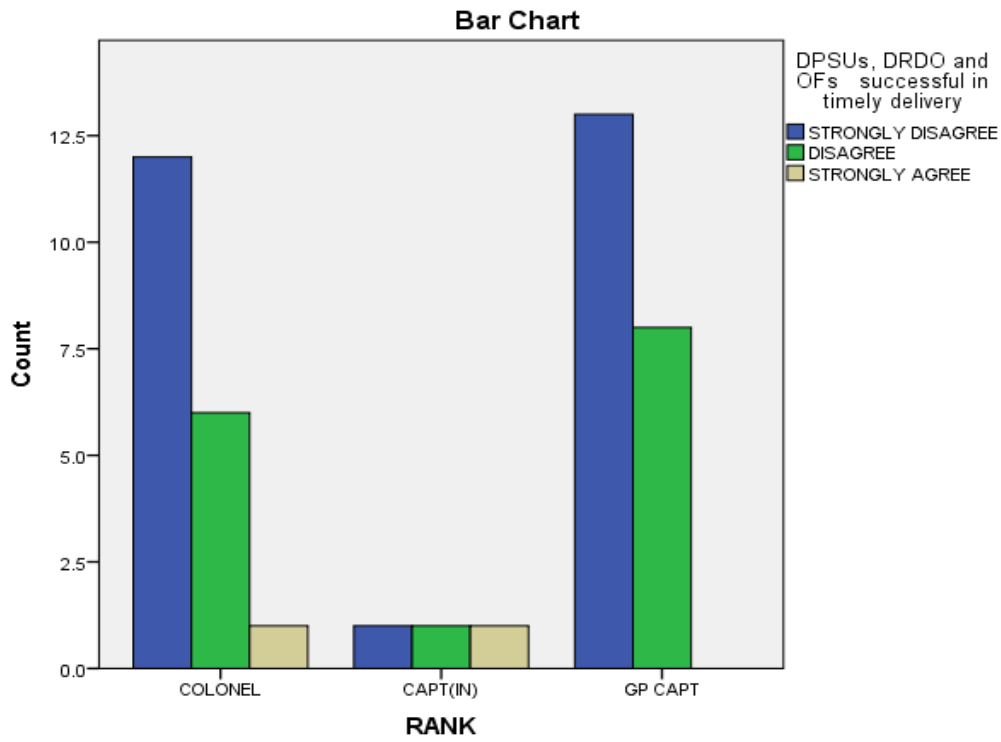
**Crosstab**

			DPSUs, DRDO and OFs successful in timely delivery			Total
			STRONGLY DISAGREE	DISAGREE	STRONGLY AGREE	
RANK	COLONEL	Count	12	6	1	19
		Expected Count	11.5	6.6	.9	19.0
		% within DPSUs, DRDO and OFs successful in timely delivery	46.2%	40.0%	50.0%	44.2%
	CAPT(IN)	Count	1	1	1	3
		Expected Count	1.8	1.0	.1	3.0
		% within DPSUs, DRDO and OFs successful in timely delivery	3.8%	6.7%	50.0%	7.0%
	GP CAPT	Count	13	8	0	21
		Expected Count	12.7	7.3	1.0	21.0
		% within DPSUs, DRDO and OFs successful in timely delivery	50.0%	53.3%	0.0%	48.8%
Total	Count	26	15	2	43	
	Expected Count	26.0	15.0	2.0	43.0	
	% within DPSUs, DRDO and OFs successful in timely delivery	100.0%	100.0%	100.0%	100.0%	

### Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.817 <sup>a</sup>	4	.146
Likelihood Ratio	4.776	4	.311
Linear-by-Linear Association	.286	1	.593
N of Valid Cases	43		

a. 5 cells (55.6%) have expected count less than 5. The minimum expected count is .14.



## RANK \* END MONOPOLY AND PROVIDE LEVEL FIELD

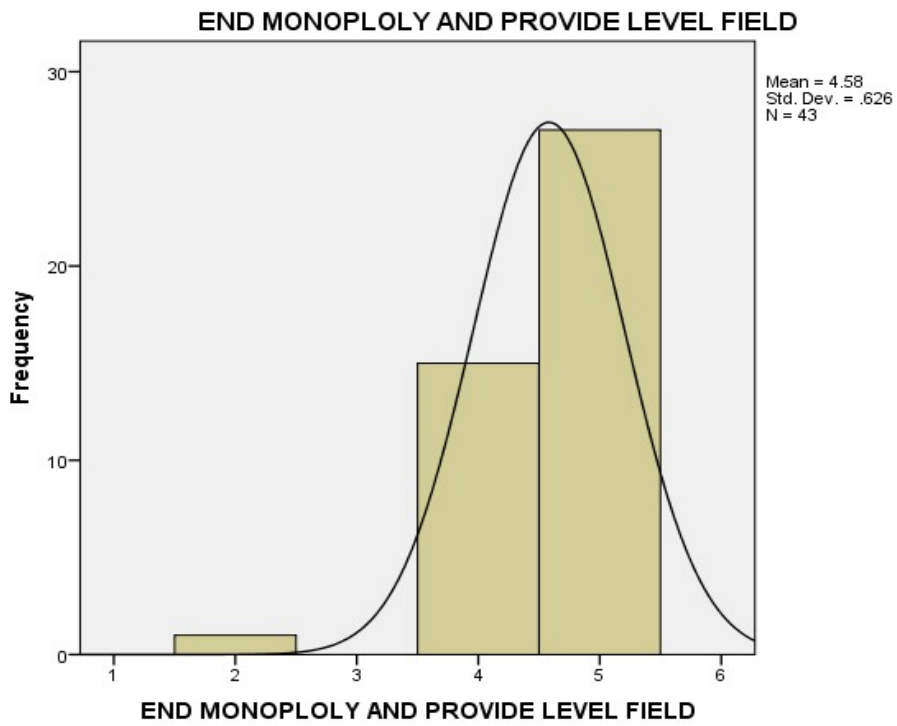
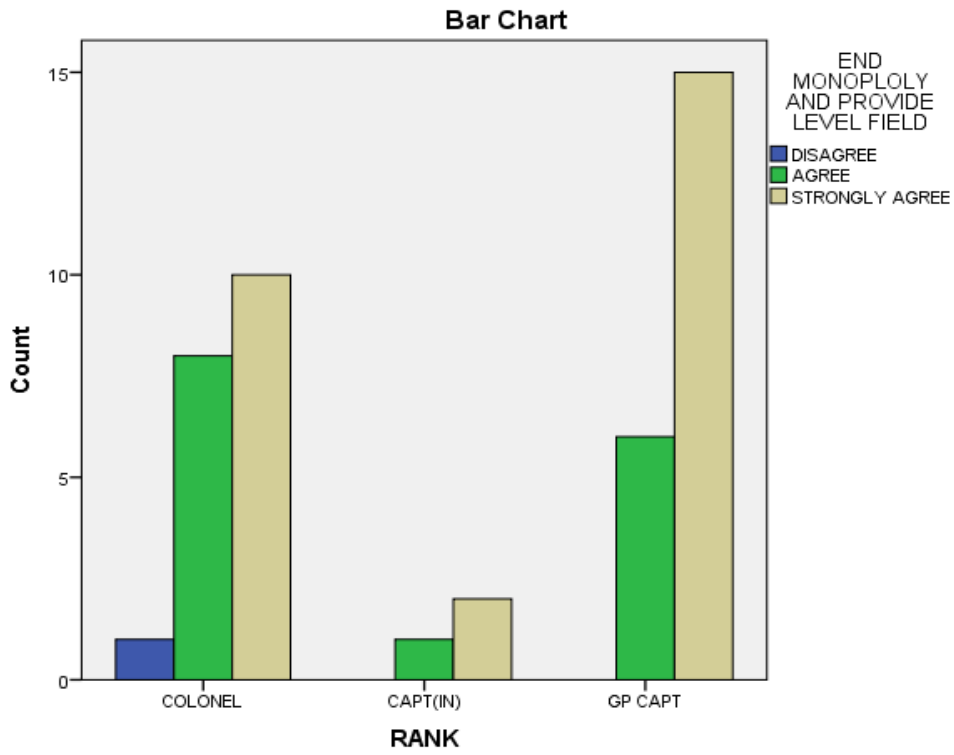
Crosstab

			END MONOPOLY AND PROVIDE LEVEL FIELD			Total
			DISAGREE	AGREE	STRONGLY AGREE	
RANK	COLONEL	Count	1	8	10	19
		Expected Count	.4	6.6	11.9	19.0
		% within END MONOPLOLY AND PROVIDE LEVEL FIELD	100.0%	53.3%	37.0%	44.2%
	CAPT(IN)	Count	0	1	2	3
		Expected Count	.1	1.0	1.9	3.0
		% within END MONOPLOLY AND PROVIDE LEVEL FIELD	0.0%	6.7%	7.4%	7.0%
	GP CAPT	Count	0	6	15	21
		Expected Count	.5	7.3	13.2	21.0
		% within END MONOPLOLY AND PROVIDE LEVEL FIELD	0.0%	40.0%	55.6%	48.8%
Total	Count	1	15	27	43	
	Expected Count	1.0	15.0	27.0	43.0	
	% within END MONOPLOLY AND PROVIDE LEVEL FIELD	100.0%	100.0%	100.0%	100.0%	

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.358 <sup>a</sup>	4	.670
Likelihood Ratio	2.734	4	.603
Linear-by-Linear Association	2.178	1	.140
N of Valid Cases	43		

a. 5 cells (55.6%) have expected count less than 5. The minimum expected count is .07.





## RANK \* REORGANISE DEF PRODN UNDER COMMERCE MINISTRY

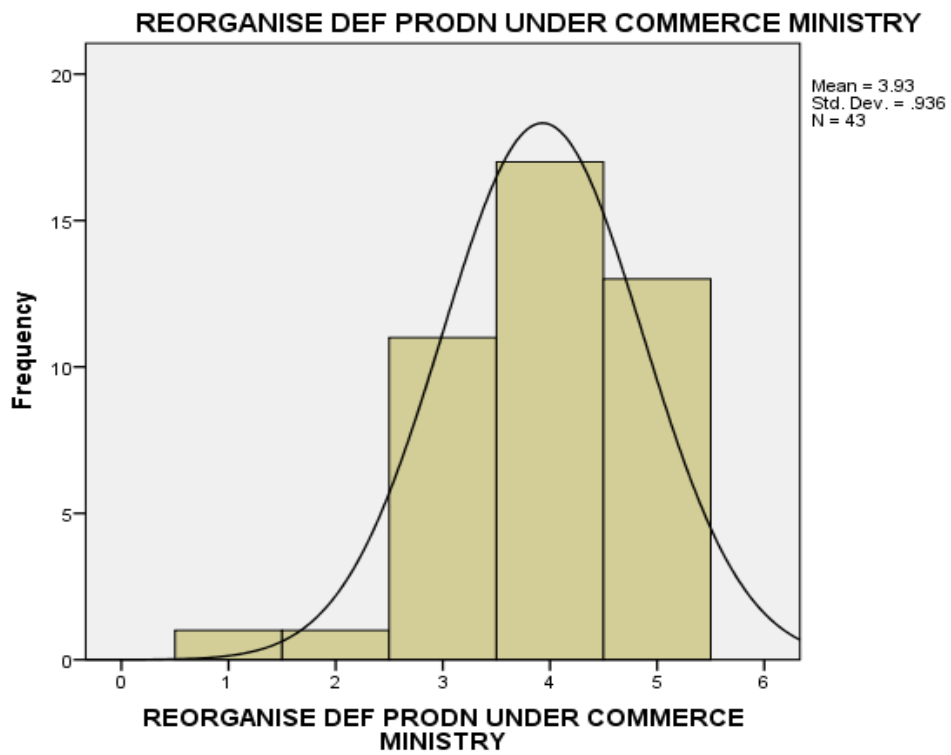
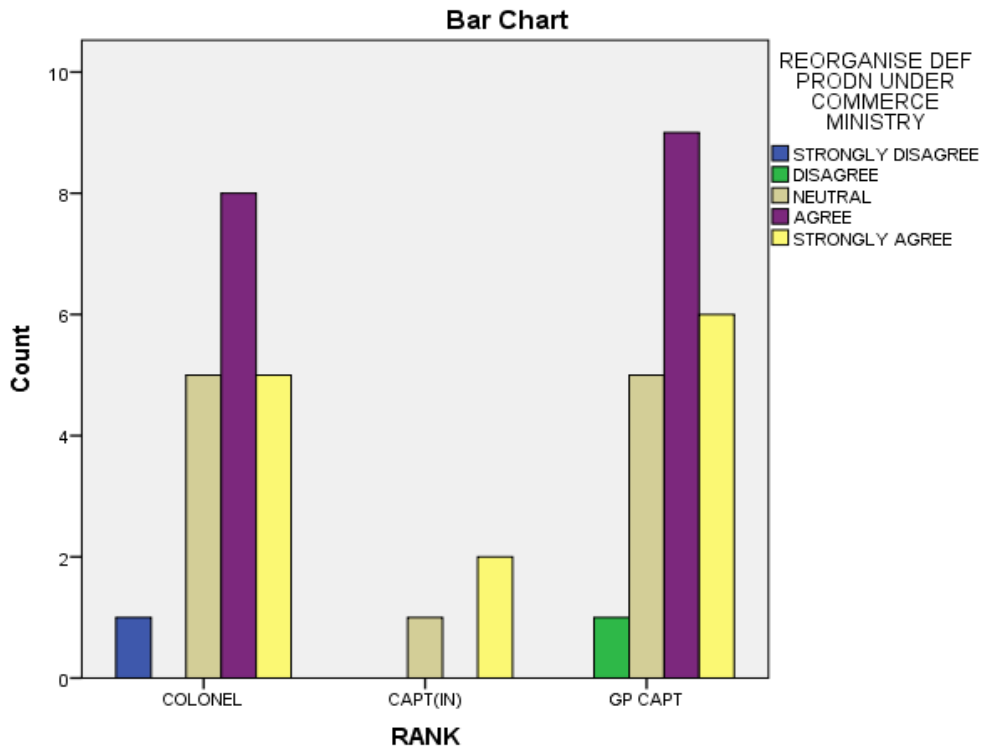
**Crosstab**

			REORGANISE DEF PRODN UNDER COMMERCE MINISTRY					Total
			STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE	
RANK	COLONEL	Count	1	0	5	8	5	19
		Expected Count	.4	.4	4.9	7.5	5.7	19.0
		% within REORGANISE DEF PRODN UNDER COMMERCE MINISTRY	100.0%	0.0%	45.5%	47.1%	38.5%	44.2%
	CAPT(IN)	Count	0	0	1	0	2	3
		Expected Count	.1	.1	.8	1.2	.9	3.0
		% within REORGANISE DEF PRODN UNDER COMMERCE MINISTRY	0.0%	0.0%	9.1%	0.0%	15.4%	7.0%
	GP CAPT	Count	0	1	5	9	6	21
		Expected Count	.5	.5	5.4	8.3	6.3	21.0
		% within REORGANISE DEF PRODN UNDER COMMERCE MINISTRY	0.0%	100.0%	45.5%	52.9%	46.2%	48.8%
Total	Count	1	1	11	17	13	43	
	Expected Count	1.0	1.0	11.0	17.0	13.0	43.0	
	% within REORGANISE DEF PRODN UNDER COMMERCE MINISTRY	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	

### Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.120 <sup>a</sup>	8	.745
Likelihood Ratio	6.719	8	.567
Linear-by-Linear Association	.131	1	.717
N of Valid Cases	43		

a. 10 cells (66.7%) have expected count less than 5. The minimum expected count is .07.



**RANK \* SERVING OFFRS CONTRIBUTING TOWARDS  
IMPLEMENTATION**

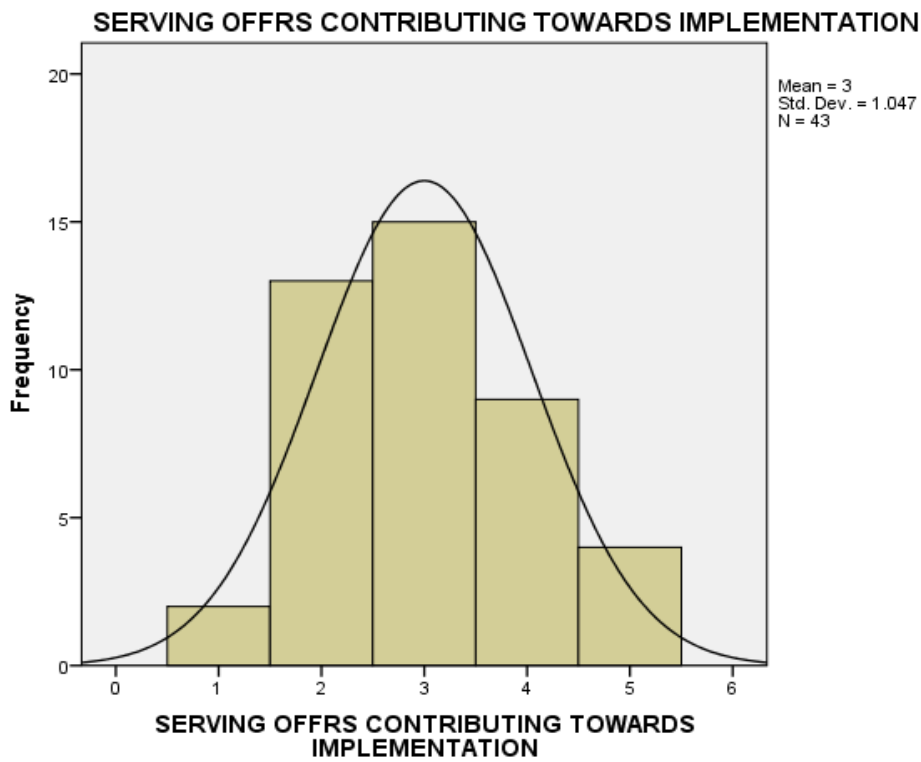
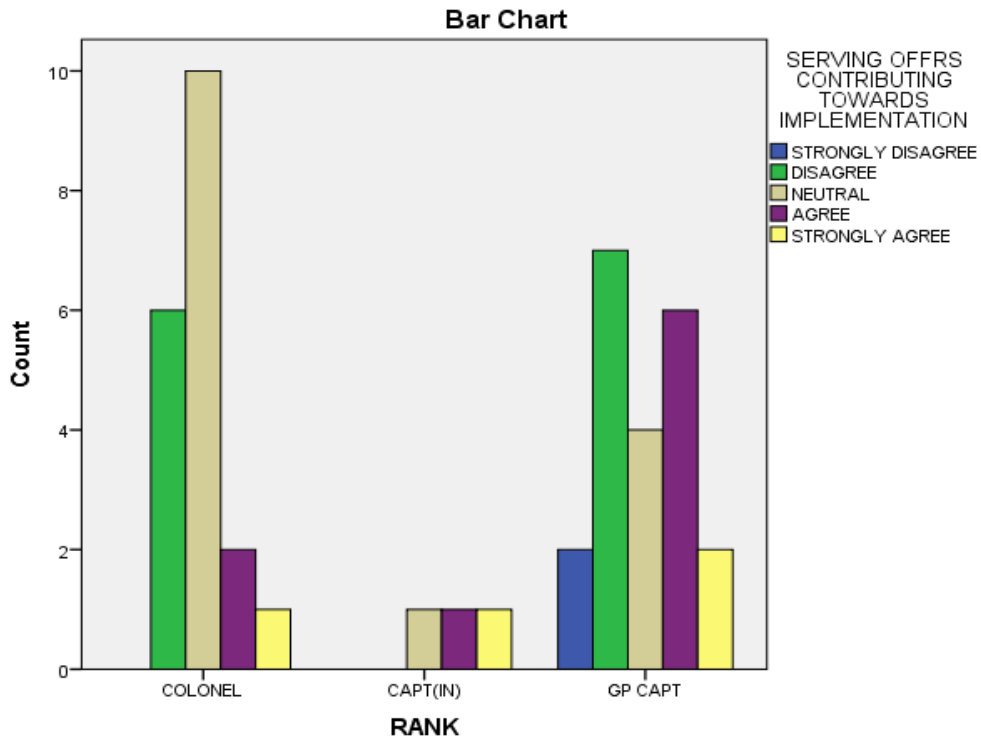
**Crosstab**

			SERVING OFFRS CONTRIBUTING TOWARDS IMPLEMENTATION					Total
			STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE	
RANK COLONEL	Count	0	6	10	2	1	19	
	Expected Count	.9	5.7	6.6	4.0	1.8	19.0	
	% within SERVING OFFRS CONTRIBUTING TOWARDS IMPLEMENTATION	0.0%	46.2%	66.7%	22.2%	25.0%	44.2%	
CAPT(IN)	Count	0	0	1	1	1	3	
	Expected Count	.1	.9	1.0	.6	.3	3.0	
	% within SERVING OFFRS CONTRIBUTING TOWARDS IMPLEMENTATION	0.0%	0.0%	6.7%	11.1%	25.0%	7.0%	
GP CAPT	Count	2	7	4	6	2	21	
	Expected Count	1.0	6.3	7.3	4.4	2.0	21.0	
	% within SERVING OFFRS CONTRIBUTING TOWARDS IMPLEMENTATION	100.0%	53.8%	26.7%	66.7%	50.0%	48.8%	
Total	Count	2	13	15	9	4	43	
	Expected Count	2.0	13.0	15.0	9.0	4.0	43.0	
	% within SERVING OFFRS CONTRIBUTING TOWARDS IMPLEMENTATION	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	

**Chi-Square Tests**

	Value	df	Asymp. Sig. (2- sided)
Pearson Chi-Square	10.293 <sup>a</sup>	8	.245
Likelihood Ratio	11.475	8	.176
Linear-by-Linear Association	.023	1	.880
N of Valid Cases	43		

a. 11 cells (73.3%) have expected count less than 5. The minimum expected count is .14.



**RANK \* INTERFACE BETWEEN IAF AND PRIVATE SECTOR  
INADEQUATE**

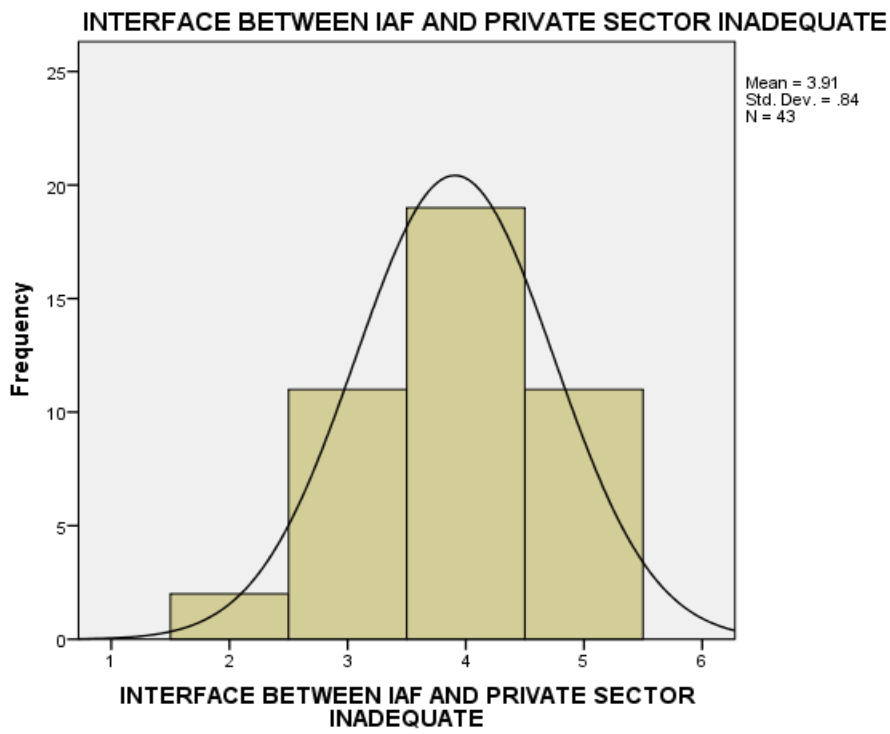
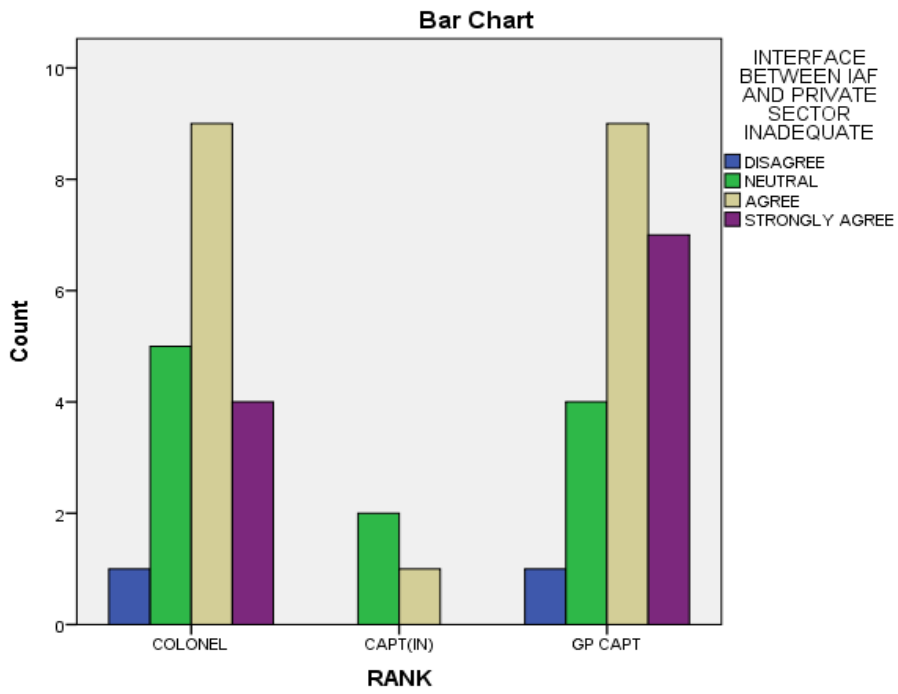
**Crosstab**

			INTERFACE BETWEEN IAF AND PRIVATE SECTOR INADEQUATE				Total
			DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE	
RANK	COLONEL	Count	1	5	9	4	19
		Expected Count	.9	4.9	8.4	4.9	19.0
		% within INTERFACE BETWEEN IAF AND PRIVATE SECTOR INADEQUATE	50.0%	45.5%	47.4%	36.4%	44.2%
	CAPT(IN)	Count	0	2	1	0	3
		Expected Count	.1	.8	1.3	.8	3.0
		% within INTERFACE BETWEEN IAF AND PRIVATE SECTOR INADEQUATE	0.0%	18.2%	5.3%	0.0%	7.0%
	GP CAPT	Count	1	4	9	7	21
		Expected Count	1.0	5.4	9.3	5.4	21.0
		% within INTERFACE BETWEEN IAF AND PRIVATE SECTOR INADEQUATE	50.0%	36.4%	47.4%	63.6%	48.8%
Total	Count	2	11	19	11	43	
	Expected Count	2.0	11.0	19.0	11.0	43.0	
	% within INTERFACE BETWEEN IAF AND PRIVATE SECTOR INADEQUATE	100.0%	100.0%	100.0%	100.0%	100.0%	

**Chi-Square Tests**

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.034 <sup>a</sup>	6	.672
Likelihood Ratio	4.335	6	.631
Linear-by-Linear Association	.622	1	.430
N of Valid Cases	43		

a. 8 cells (66.7%) have expected count less than 5. The minimum expected count is .14.



**RANK \* DEPUTATION OF OFFRS AS PART OF PMT WILL BENEFIT**

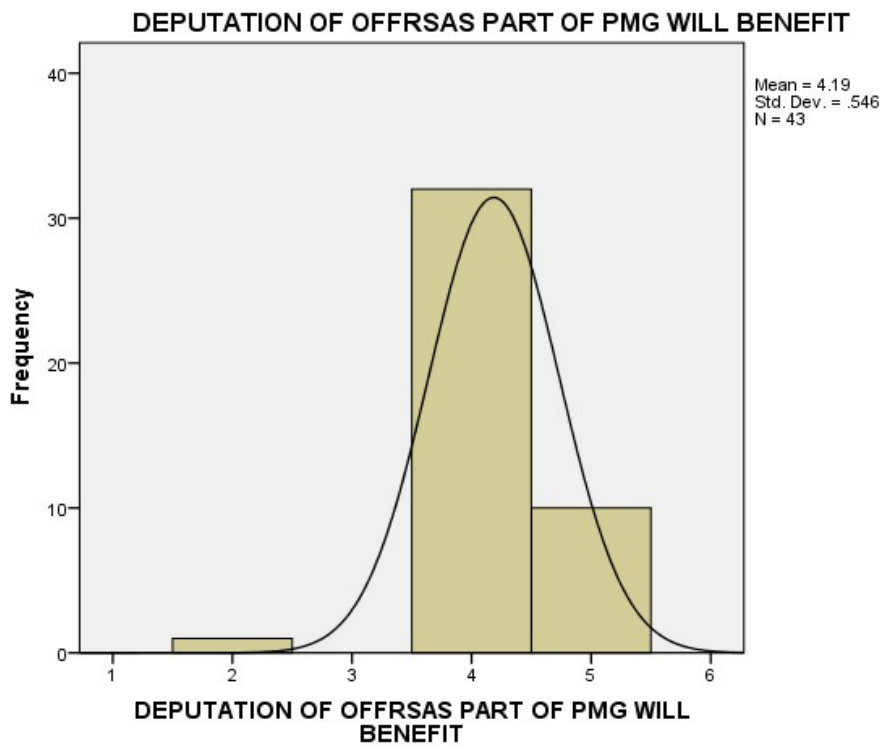
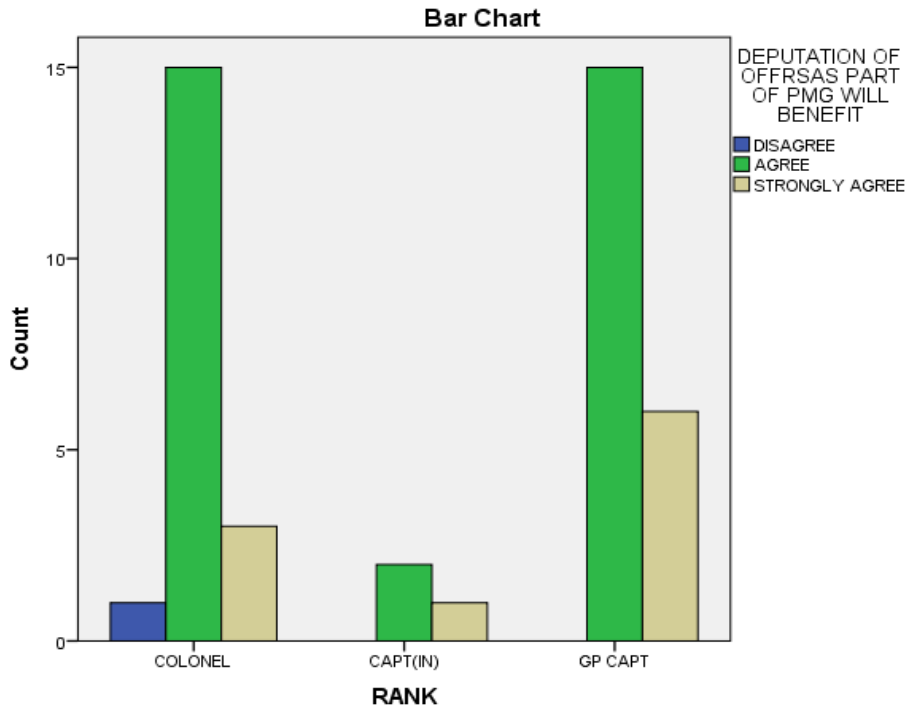
**Crosstab**

			DEPUTATION OF OFFRSAS PART OF PMG WILL BENEFIT			Total
			DISAGREE	AGREE	STRONGLY AGREE	
RANK	COLONEL	Count	1	15	3	19
		Expected Count	.4	14.1	4.4	19.0
		% within DEPUTATION OF OFFRSAS PART OF PMG WILL BENEFIT	100.0%	46.9%	30.0%	44.2%
	CAPT(IN)	Count	0	2	1	3
		Expected Count	.1	2.2	.7	3.0
		% within DEPUTATION OF OFFRSAS PART OF PMG WILL BENEFIT	0.0%	6.3%	10.0%	7.0%
	GP CAPT	Count	0	15	6	21
		Expected Count	.5	15.6	4.9	21.0
		% within DEPUTATION OF OFFRSAS PART OF PMG WILL BENEFIT	0.0%	46.9%	60.0%	48.8%
Total	Count	1	32	10	43	
	Expected Count	1.0	32.0	10.0	43.0	
	% within DEPUTATION OF OFFRSAS PART OF PMG WILL BENEFIT	100.0%	100.0%	100.0%	100.0%	

**Chi-Square Tests**

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.207 <sup>a</sup>	4	.698
Likelihood Ratio	2.603	4	.626
Linear-by-Linear Association	1.802	1	.180
N of Valid Cases	43		

a. 7 cells (77.8%) have expected count less than 5. The minimum expected count is .07.





**RANK \* EXISTING DEPUTATION POLICY IS CONTRIBUTING GREATLY**

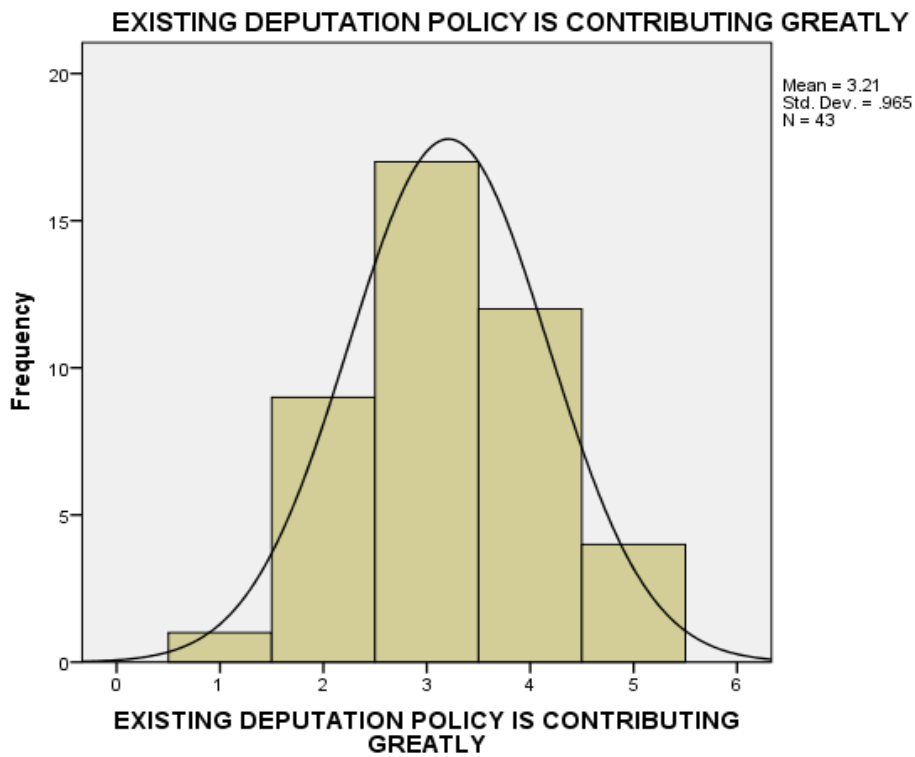
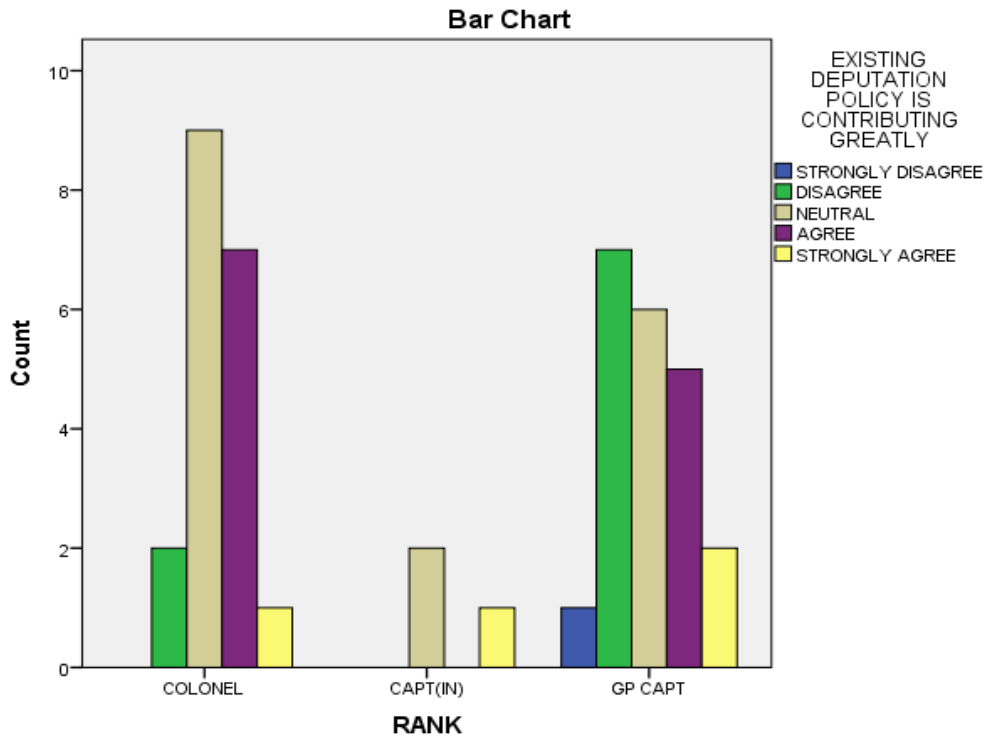
**Crosstab**

			EXISTING DEPUTATION POLICY IS CONTRIBUTING GREATLY					Total
			STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE	
RANK	COLONEL	Count	0	2	9	7	1	19
		Expected Count	.4	4.0	7.5	5.3	1.8	19.0
		% within EXISTING DEPUTATION POLICY IS CONTRIBUTING GREATLY	0.0%	22.2%	52.9%	58.3%	25.0%	44.2%
	CAPT(IN)	Count	0	0	2	0	1	3
		Expected Count	.1	.6	1.2	.8	.3	3.0
		% within EXISTING DEPUTATION POLICY IS CONTRIBUTING GREATLY	0.0%	0.0%	11.8%	0.0%	25.0%	7.0%
	GP CAPT	Count	1	7	6	5	2	21
		Expected Count	.5	4.4	8.3	5.9	2.0	21.0
		% within EXISTING DEPUTATION POLICY IS CONTRIBUTING GREATLY	100.0%	77.8%	35.3%	41.7%	50.0%	48.8%
Total	Count	1	9	17	12	4	43	
	Expected Count	1.0	9.0	17.0	12.0	4.0	43.0	
	% within EXISTING DEPUTATION POLICY IS CONTRIBUTING GREATLY	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	

**Chi-Square Tests**

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9.397 <sup>a</sup>	8	.310
Likelihood Ratio	10.454	8	.235
Linear-by-Linear Association	1.481	1	.224
N of Valid Cases	43		

a. 11 cells (73.3%) have expected count less than 5. The minimum expected count is .07.



## RANK \* STRENGTHENING OF DEFENCE WING UNDER CII

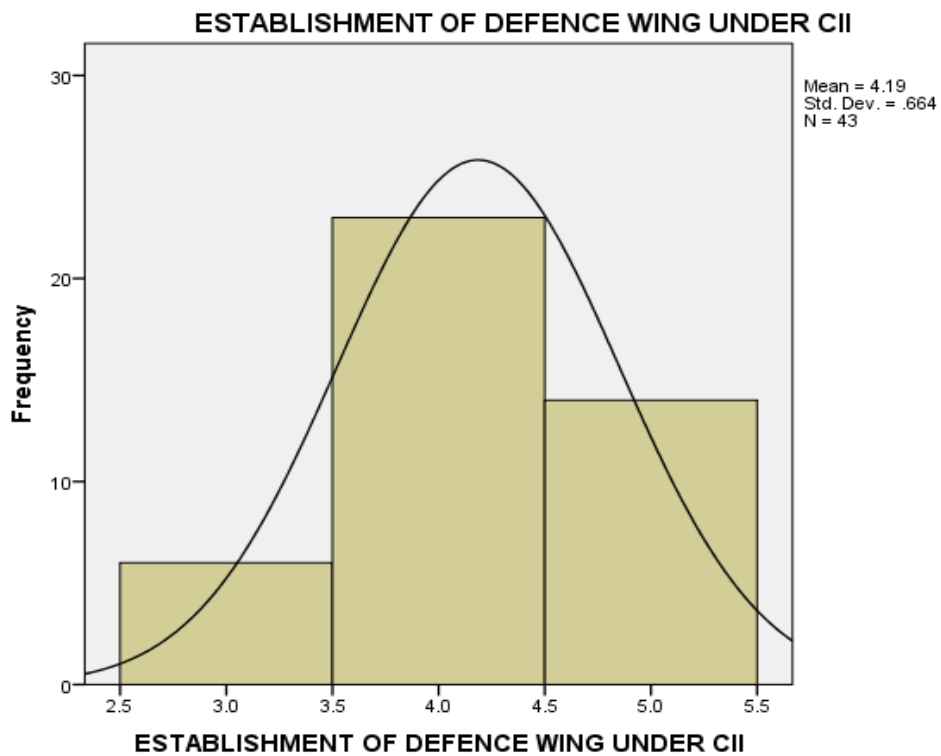
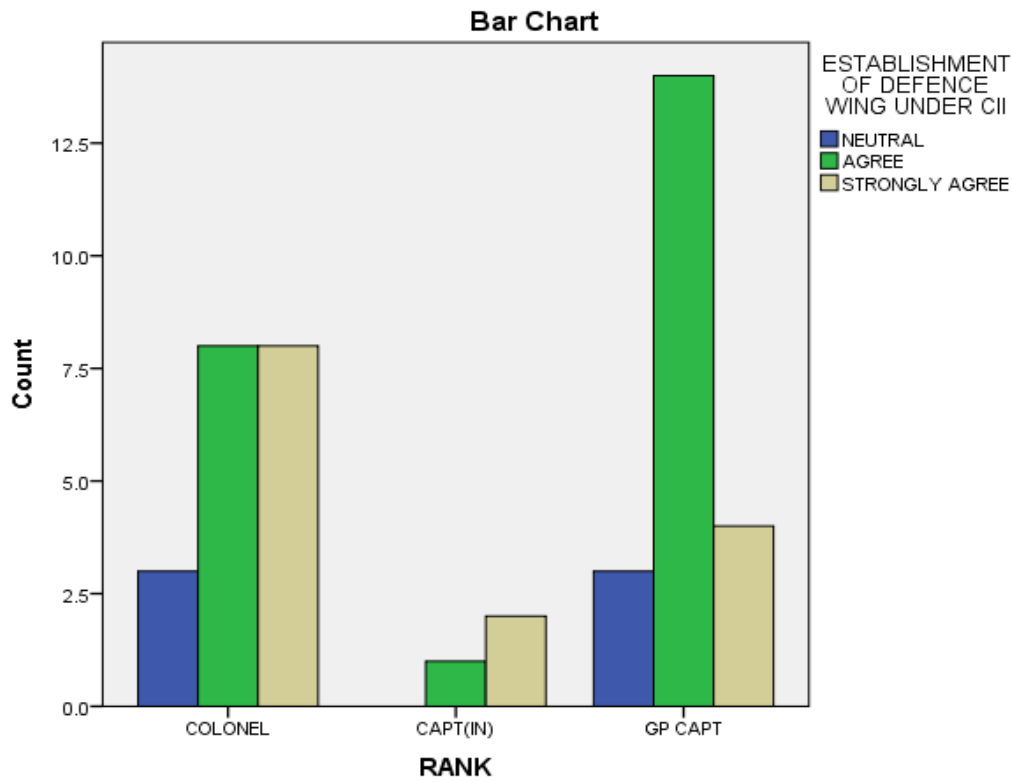
**Crosstab**

			ESTABLISHMENT OF DEFENCE WING UNDER CII			Total
			NEUTRAL	AGREE	STRONGLY AGREE	
RANK	COLONEL	Count	3	8	8	19
		Expected Count	2.7	10.2	6.2	19.0
		% within STRENGTHENING OF DEFENCE WING UNDER CII	50.0%	34.8%	57.1%	44.2%
	CAPT(IN)	Count	0	1	2	3
		Expected Count	.4	1.6	1.0	3.0
		% within STRENGTHENING OF DEFENCE WING UNDER CII	0.0%	4.3%	14.3%	7.0%
	GP CAPT	Count	3	14	4	21
		Expected Count	2.9	11.2	6.8	21.0
		% within STRENGTHENING OF DEFENCE WING UNDER CII	50.0%	60.9%	28.6%	48.8%
Total	Count	6	23	14	43	
	Expected Count	6.0	23.0	14.0	43.0	
	% within STRENGTHENING OF DEFENCE WING UNDER CII	100.0%	100.0%	100.0%	100.0%	

**Chi-Square Tests**

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.617 <sup>a</sup>	4	.329
Likelihood Ratio	4.967	4	.291
Linear-by-Linear Association	1.087	1	.297
N of Valid Cases	43		

a. 5 cells (55.6%) have expected count less than 5. The minimum expected count is .42.



**RANK \* SUITABLE OFFRS FROM F(P) ,TECH AND LGS BRANCHES BE IDENTIFIED FOR DEPUTATION**

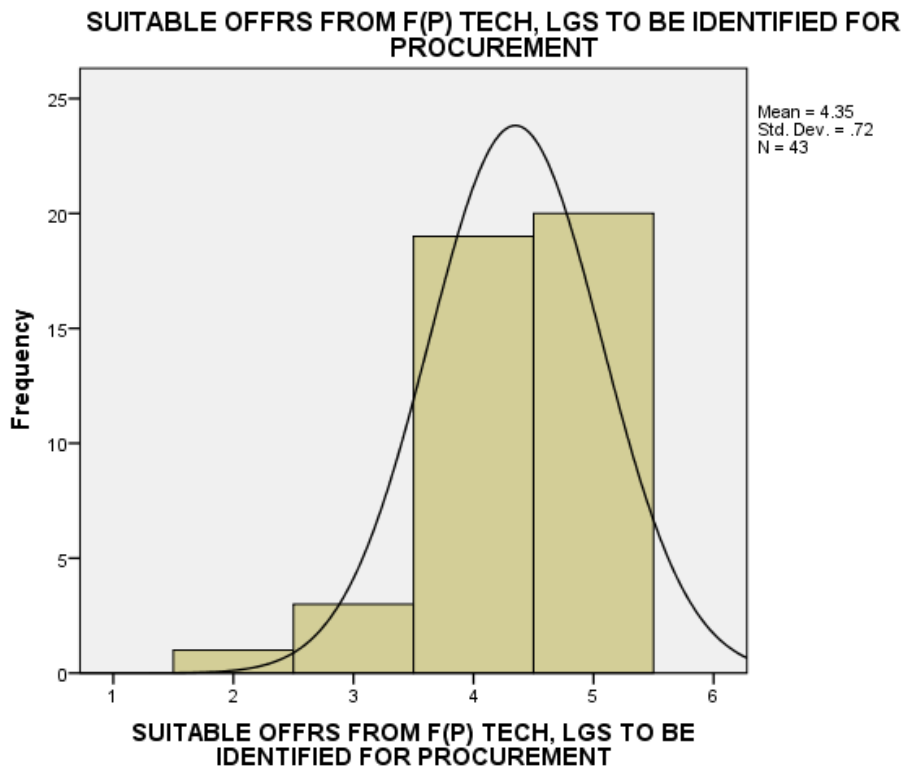
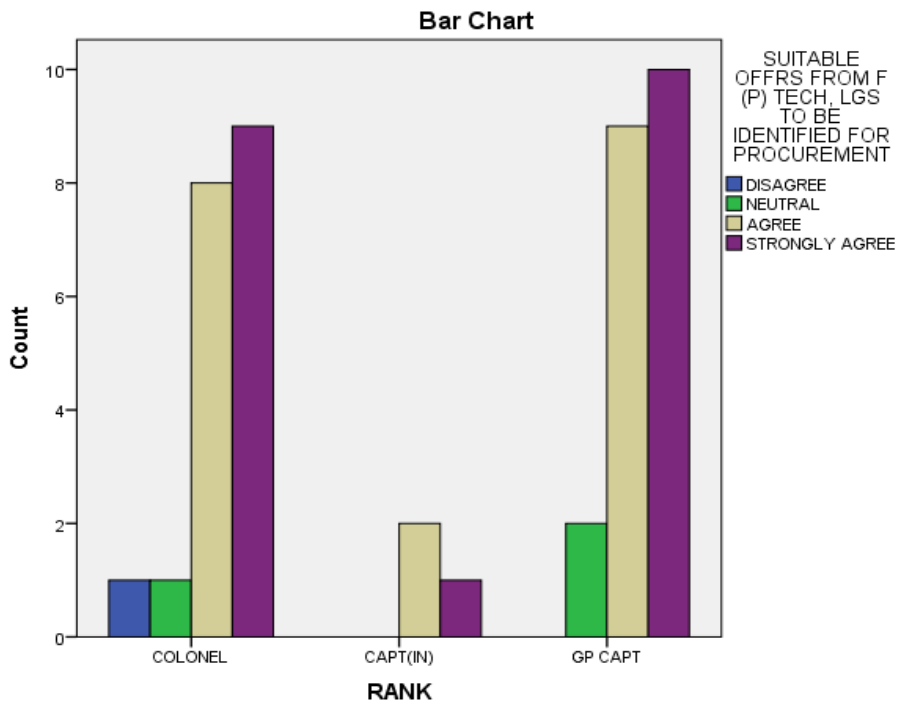
**Crosstab**

			SUITABLE OFFRS FROM F(P) TECH, LGS TO BE IDENTIFIED FOR DEPUTATION				Total
			DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE	
RANK	COLONEL	Count	1	1	8	9	19
		Expected Count	.4	1.3	8.4	8.8	19.0
		% within SUITABLE OFFRS FROM F(P) TECH, LGS TO BE IDENTIFIED FOR PROCUREMENT	100.0%	33.3%	42.1%	45.0%	44.2%
	CAPT(IN)	Count	0	0	2	1	3
		Expected Count	.1	.2	1.3	1.4	3.0
		% within SUITABLE OFFRS FROM F(P) TECH, LGS TO BE IDENTIFIED FOR PROCUREMENT	0.0%	0.0%	10.5%	5.0%	7.0%
	GP CAPT	Count	0	2	9	10	21
		Expected Count	.5	1.5	9.3	9.8	21.0
		% within SUITABLE OFFRS FROM F(P) TECH, LGS TO BE IDENTIFIED FOR PROCUREMENT	0.0%	66.7%	47.4%	50.0%	48.8%
Total	Count	1	3	19	20	43	
	Expected Count	1.0	3.0	19.0	20.0	43.0	
	% within SUITABLE OFFRS FROM F(P) TECH, LGS TO BE IDENTIFIED FOR PROCUREMENT	100.0%	100.0%	100.0%	100.0%	100.0%	

**Chi-Square Tests**

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.238 <sup>a</sup>	6	.897
Likelihood Ratio	2.771	6	.837
Linear-by-Linear Association	.082	1	.775
N of Valid Cases	43		

a. 8 cells (66.7%) have expected count less than 5. The minimum expected count is .07.



## **RANK \* SERVICES UNABLE TO FILL ONE THIRD DRDO VACANCIES**

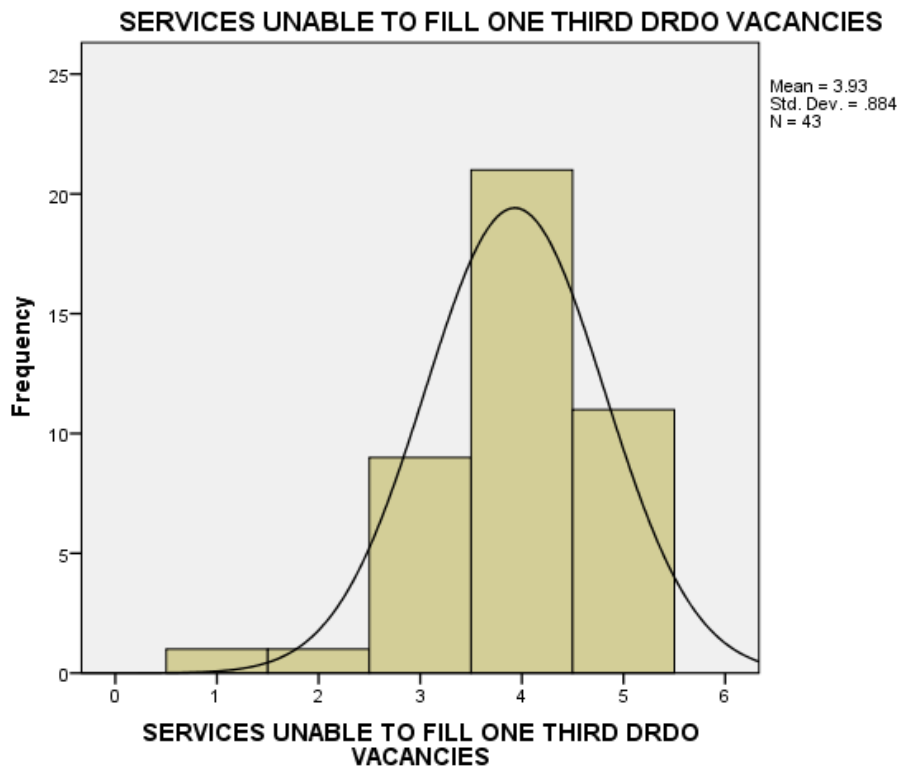
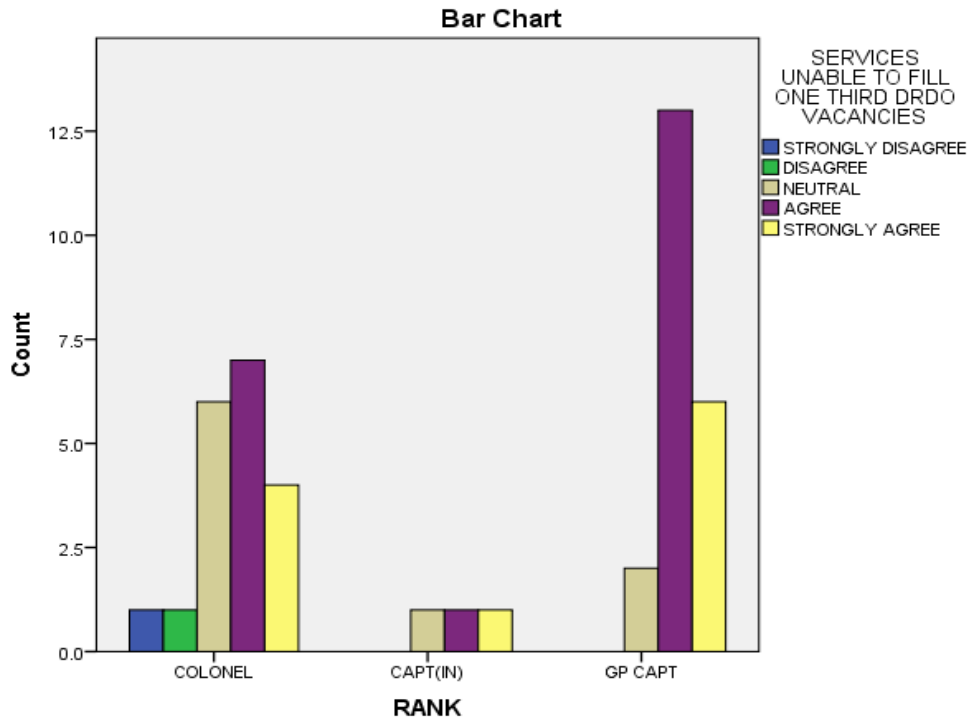
Crosstab

			SERVICES UNABLE TO FILL ONE THIRD DRDO VACANCIES					Total
			STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE	
RANK COLONEL	Count	1	1	6	7	4	19	
	Expected Count	.4	.4	4.0	9.3	4.9	19.0	
	% within SERVICES UNABLE TO FILL ONE THIRD DRDO VACANCIES	100.0%	100.0%	66.7%	33.3%	36.4%	44.2%	
CAPT(IN)	Count	0	0	1	1	1	3	
	Expected Count	.1	.1	.6	1.5	.8	3.0	
	% within SERVICES UNABLE TO FILL ONE THIRD DRDO VACANCIES	0.0%	0.0%	11.1%	4.8%	9.1%	7.0%	
GP CAPT	Count	0	0	2	13	6	21	
	Expected Count	.5	.5	4.4	10.3	5.4	21.0	
	% within SERVICES UNABLE TO FILL ONE THIRD DRDO VACANCIES	0.0%	0.0%	22.2%	61.9%	54.5%	48.8%	
Total	Count	1	1	9	21	11	43	
	Expected Count	1.0	1.0	9.0	21.0	11.0	43.0	
	% within SERVICES UNABLE TO FILL ONE THIRD DRDO VACANCIES	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	

### Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.819 <sup>a</sup>	8	.556
Likelihood Ratio	7.736	8	.460
Linear-by-Linear Association	3.983	1	.046
N of Valid Cases	43		

a. 12 cells (80.0%) have expected count less than 5. The minimum expected count is .07.





**RANK \* SERVING OFFRS NOT BEING ACCEPTED IN DRDO ORG**

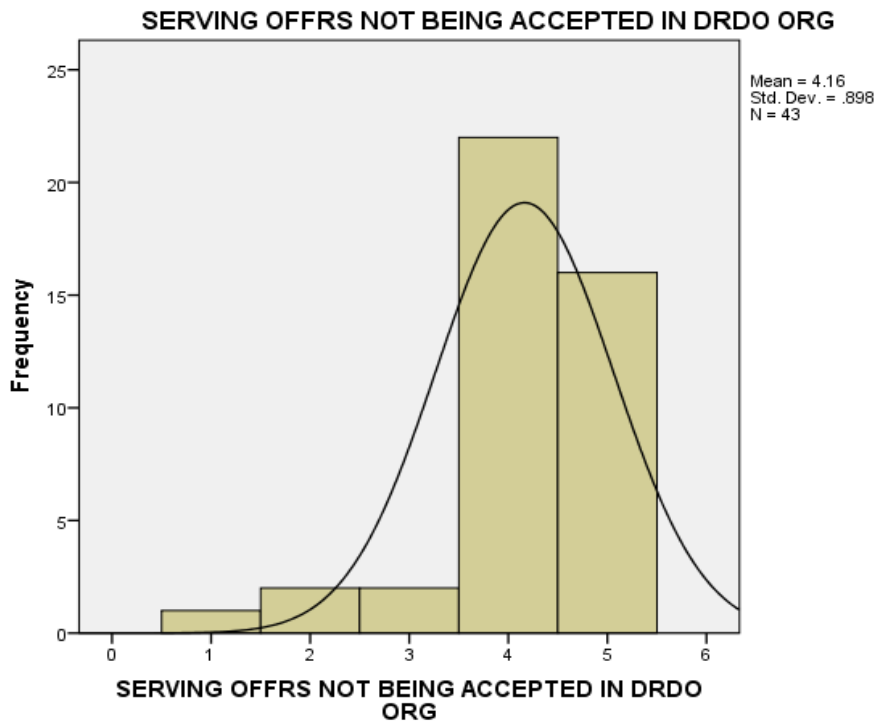
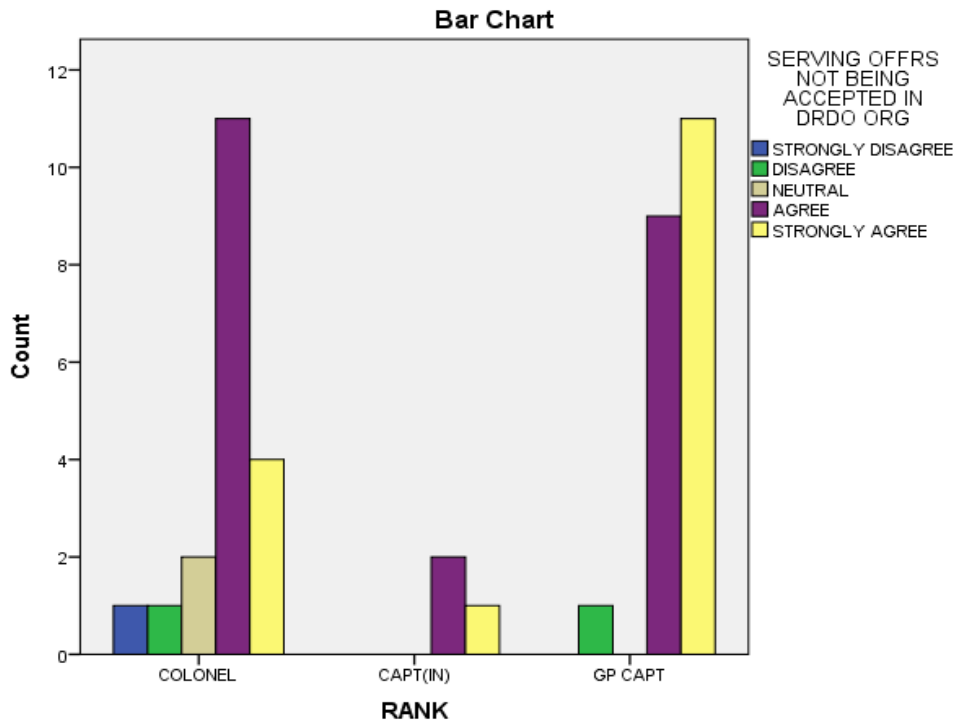
**Crosstab**

			SERVING OFFRS NOT BEING ACCEPTED IN DRDO ORG					Total
			STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE	
RANK	COLONEL	Count	1	1	2	11	4	19
		Expected Count	.4	.9	.9	9.7	7.1	19.0
		% within SERVING OFFRS NOT BEING ACCEPTED IN DRDO ORG	100.0%	50.0%	100.0%	50.0%	25.0%	44.2%
	CAPT(IN)	Count	0	0	0	2	1	3
		Expected Count	.1	.1	.1	1.5	1.1	3.0
		% within SERVING OFFRS NOT BEING ACCEPTED IN DRDO ORG	0.0%	0.0%	0.0%	9.1%	6.3%	7.0%
	GP CAPT	Count	0	1	0	9	11	21
		Expected Count	.5	1.0	1.0	10.7	7.8	21.0
		% within SERVING OFFRS NOT BEING ACCEPTED IN DRDO ORG	0.0%	50.0%	0.0%	40.9%	68.8%	48.8%
Total	Count	1	2	2	22	16	43	
	Expected Count	1.0	2.0	2.0	22.0	16.0	43.0	
	% within SERVING OFFRS NOT BEING ACCEPTED IN DRDO ORG	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	

**Chi-Square Tests**

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.181 <sup>a</sup>	8	.517
Likelihood Ratio	8.532	8	.383
Linear-by-Linear Association	4.236	1	.040
N of Valid Cases	43		

a. 11 cells (73.3%) have expected count less than 5. The minimum expected count is .07.



**RANK \* VACANT POSTS TO BE FILLED BY IAF TECH OFFRS WITH  
DOMAIN KNOWLEDGE**

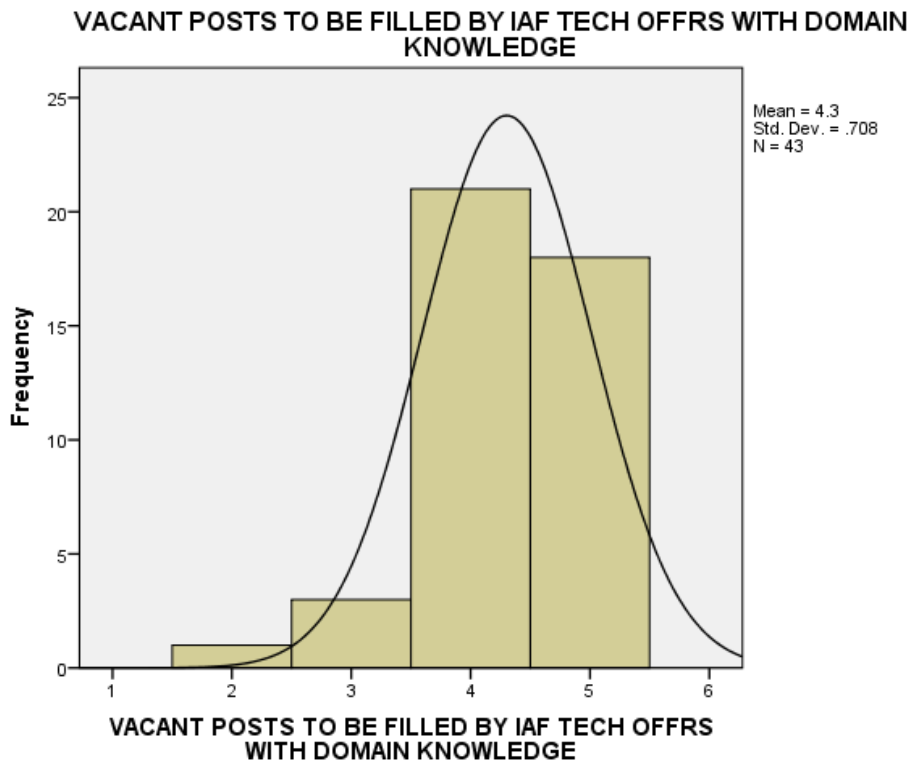
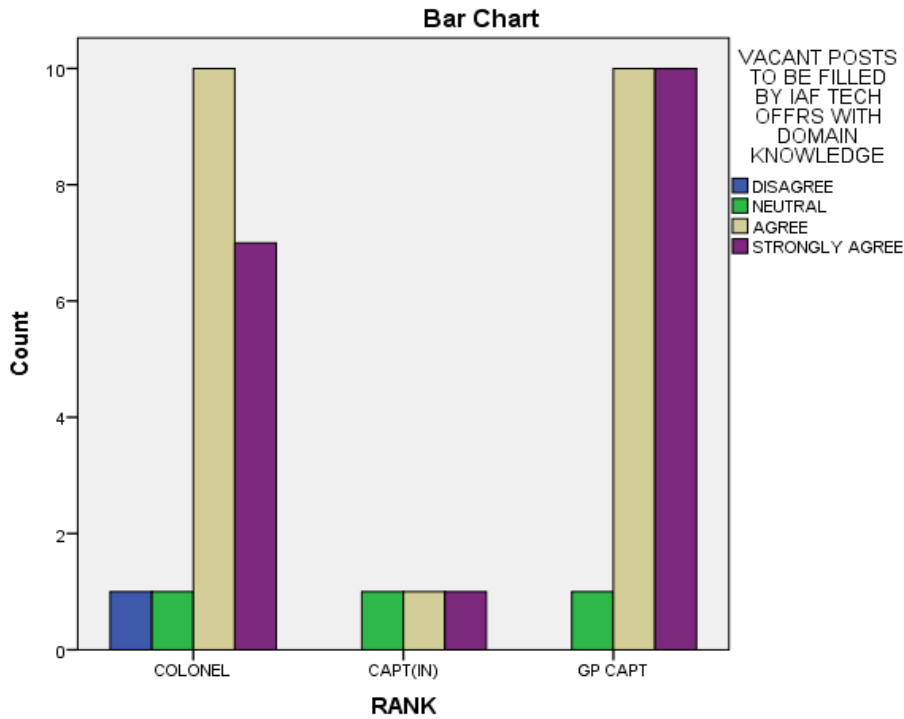
**Crosstab**

			VACANT POSTS TO BE FILLED BY IAF TECH OFFRS WITH DOMAIN KNOWLEDGE				Total
			DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE	
RANK	COLONEL	Count	1	1	10	7	19
		Expected Count	.4	1.3	9.3	8.0	19.0
		% within VACANT POSTS TO BE FILLED BY IAF TECH OFFRS WITH DOMAIN KNOWLEDGE	100.0%	33.3%	47.6%	38.9%	44.2%
	CAPT(IN)	Count	0	1	1	1	3
		Expected Count	.1	.2	1.5	1.3	3.0
		% within VACANT POSTS TO BE FILLED BY IAF TECH OFFRS WITH DOMAIN KNOWLEDGE	0.0%	33.3%	4.8%	5.6%	7.0%
	GP CAPT	Count	0	1	10	10	21
		Expected Count	.5	1.5	10.3	8.8	21.0
		% within VACANT POSTS TO BE FILLED BY IAF TECH OFFRS WITH DOMAIN KNOWLEDGE	0.0%	33.3%	47.6%	55.6%	48.8%
Total	Count	1	3	21	18	43	
	Expected Count	1.0	3.0	21.0	18.0	43.0	
	% within VACANT POSTS TO BE FILLED BY IAF TECH OFFRS WITH DOMAIN KNOWLEDGE	100.0%	100.0%	100.0%	100.0%	100.0%	

**Chi-Square Tests**

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.021 <sup>a</sup>	6	.541
Likelihood Ratio	3.996	6	.677
Linear-by-Linear Association	.965	1	.326
N of Valid Cases	43		

a. 8 cells (66.7%) have expected count less than 5. The minimum expected count is .07.



**RANK \* DEPUTATION SHOULD OF GP CAPT AND ABOVE**

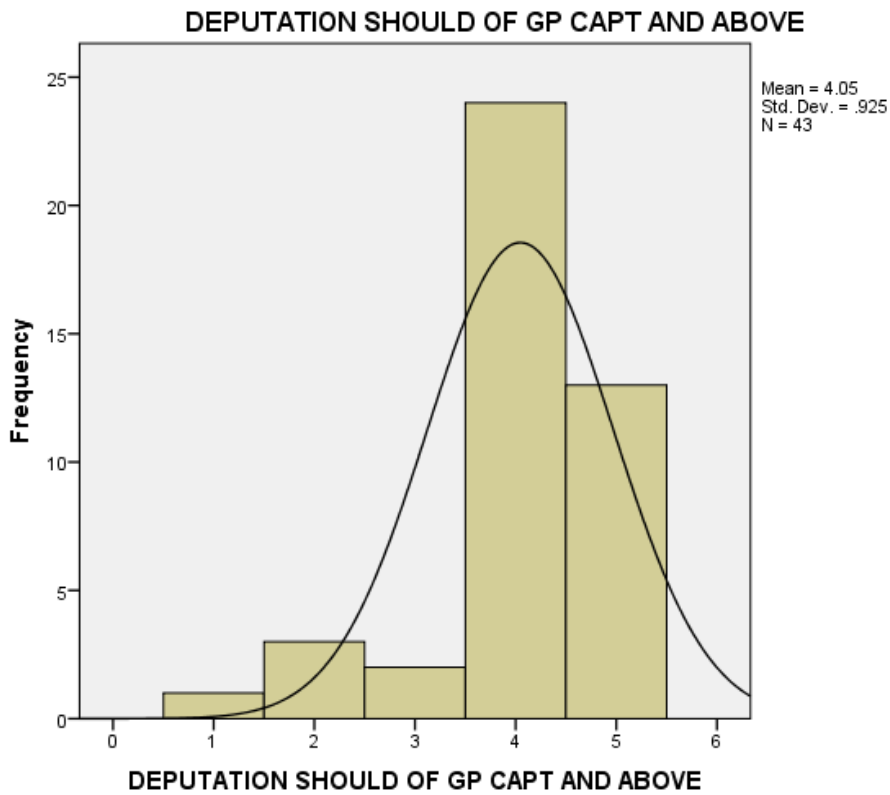
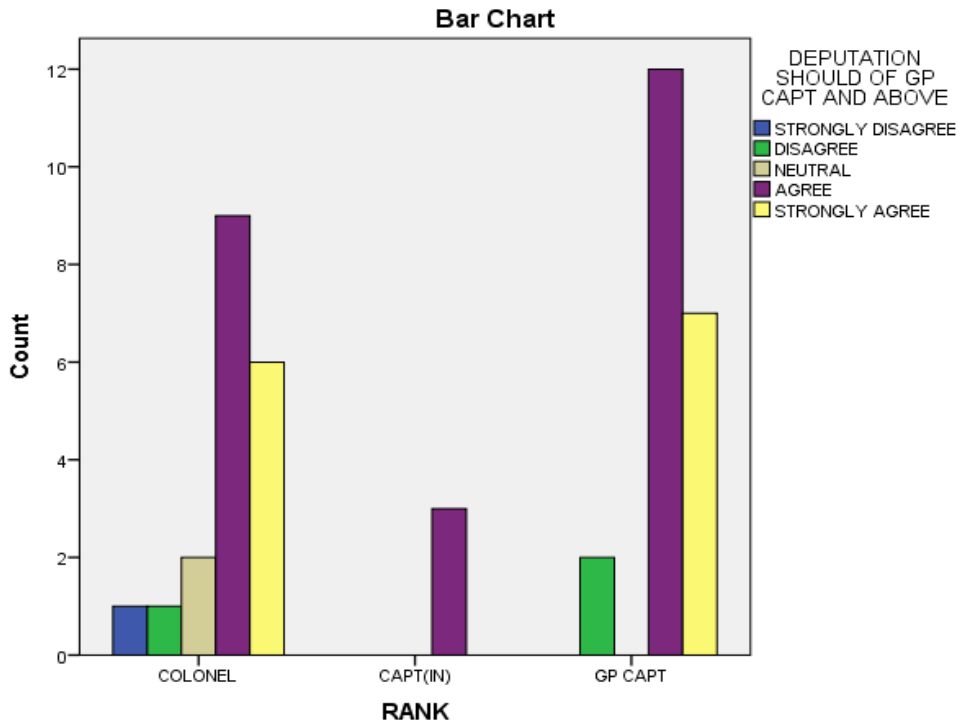
**Crosstab**

			DEPUTATION SHOULD OF GP CAPT AND ABOVE					Total
			STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE	
RANK	COLONEL	Count	1	1	2	9	6	19
		Expected Count	.4	1.3	.9	10.6	5.7	19.0
		% within DEPUTATION SHOULD OF GP CAPT AND ABOVE	100.0%	33.3%	100.0%	37.5%	46.2%	44.2%
	CAPT(IN)	Count	0	0	0	3	0	3
		Expected Count	.1	.2	.1	1.7	.9	3.0
		% within DEPUTATION SHOULD OF GP CAPT AND ABOVE	0.0%	0.0%	0.0%	12.5%	0.0%	7.0%
	GP CAPT	Count	0	2	0	12	7	21
		Expected Count	.5	1.5	1.0	11.7	6.3	21.0
		% within DEPUTATION SHOULD OF GP CAPT AND ABOVE	0.0%	66.7%	0.0%	50.0%	53.8%	48.8%
	Total	Count	1	3	2	24	13	43
		Expected Count	1.0	3.0	2.0	24.0	13.0	43.0
		% within DEPUTATION SHOULD OF GP CAPT AND ABOVE	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

**Chi-Square Tests**

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.558 <sup>a</sup>	8	.585
Likelihood Ratio	8.582	8	.379
Linear-by-Linear Association	.447	1	.504
N of Valid Cases	43		

a. 11 cells (73.3%) have expected count less than 5. The minimum expected count is .07.



**RANK \* DEPUTATION OF PPO OFFRS WITH CALIBRE WILL ENHANCE  
INDIG DEF PRODN**

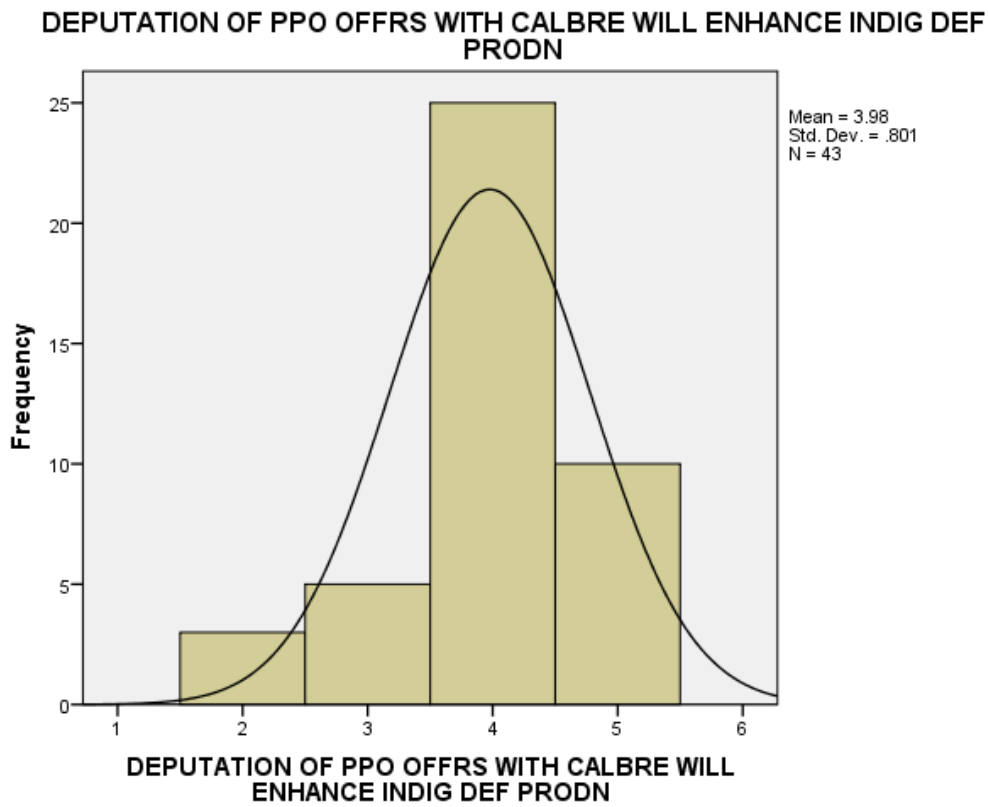
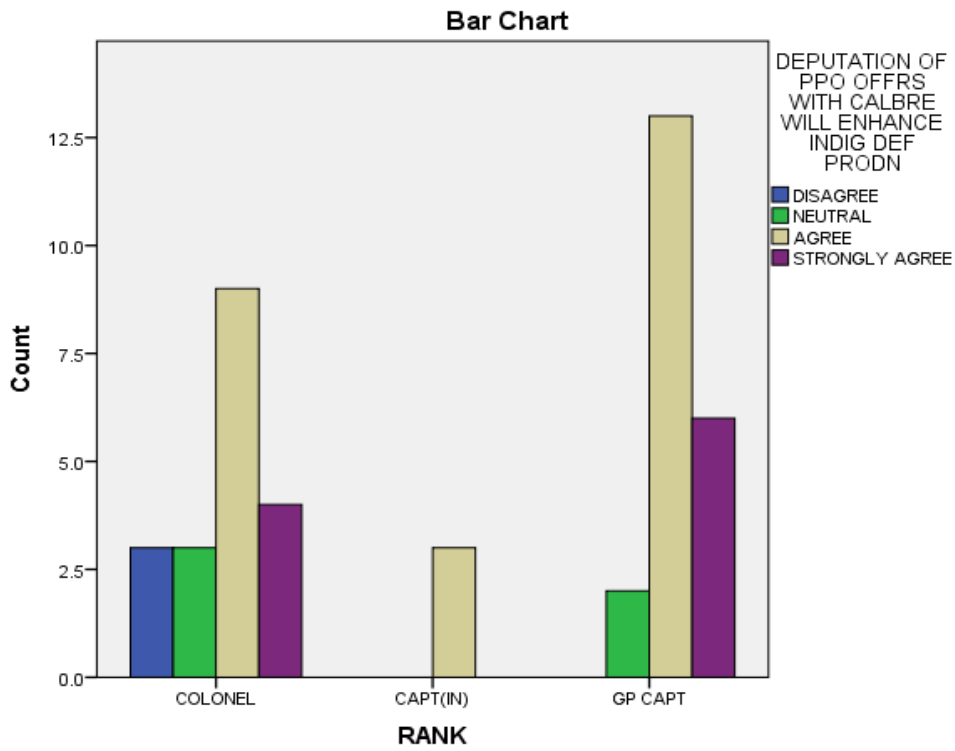
**Crosstab**

			DEPUTATION OF PPO OFFRS WITH CALIBRE WILL ENHANCE INDIG DEF PRODN				Total
			DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE	
RANK	COLONEL	Count	3	3	9	4	19
		Expected Count	1.3	2.2	11.0	4.4	19.0
		% within DEPUTATION OF PPO OFFRS WITH CALIBRE WILL ENHANCE INDIG DEF PRODN	100.0%	60.0%	36.0%	40.0%	44.2%
	CAPT(IN)	Count	0	0	3	0	3
		Expected Count	.2	.3	1.7	.7	3.0
		% within DEPUTATION OF PPO OFFRS WITH CALIBRE WILL ENHANCE INDIG DEF PRODN	0.0%	0.0%	12.0%	0.0%	7.0%
	GP CAPT	Count	0	2	13	6	21
		Expected Count	1.5	2.4	12.2	4.9	21.0
		% within DEPUTATION OF PPO OFFRS WITH CALIBRE WILL ENHANCE INDIG DEF PRODN	0.0%	40.0%	52.0%	60.0%	48.8%
Total		Count	3	5	25	10	43
		Expected Count	3.0	5.0	25.0	10.0	43.0
		% within DEPUTATION OF PPO OFFRS WITH CALIBRE WILL ENHANCE INDIG DEF PRODN	100.0%	100.0%	100.0%	100.0%	100.0%

**Chi-Square Tests**

	Value	df	Asymp. Sig. (2- sided)
Pearson Chi-Square	6.828 <sup>a</sup>	6	.337
Likelihood Ratio	8.809	6	.185
Linear-by-Linear Association	3.193	1	.074
N of Valid Cases	43		

a. 10 cells (83.3%) have expected count less than 5. The minimum expected count is .21.





## RANK \* PLACEMENT OF RETIRING OFFRS IN PVT SECTOR AS SECOND CAREER

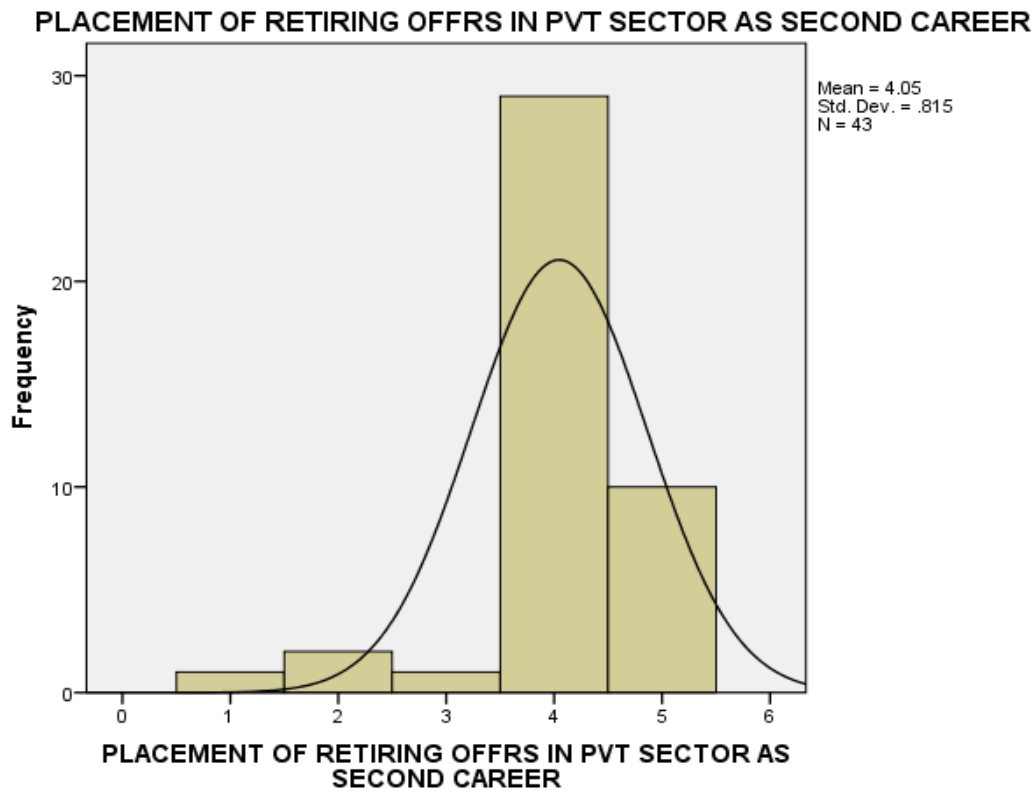
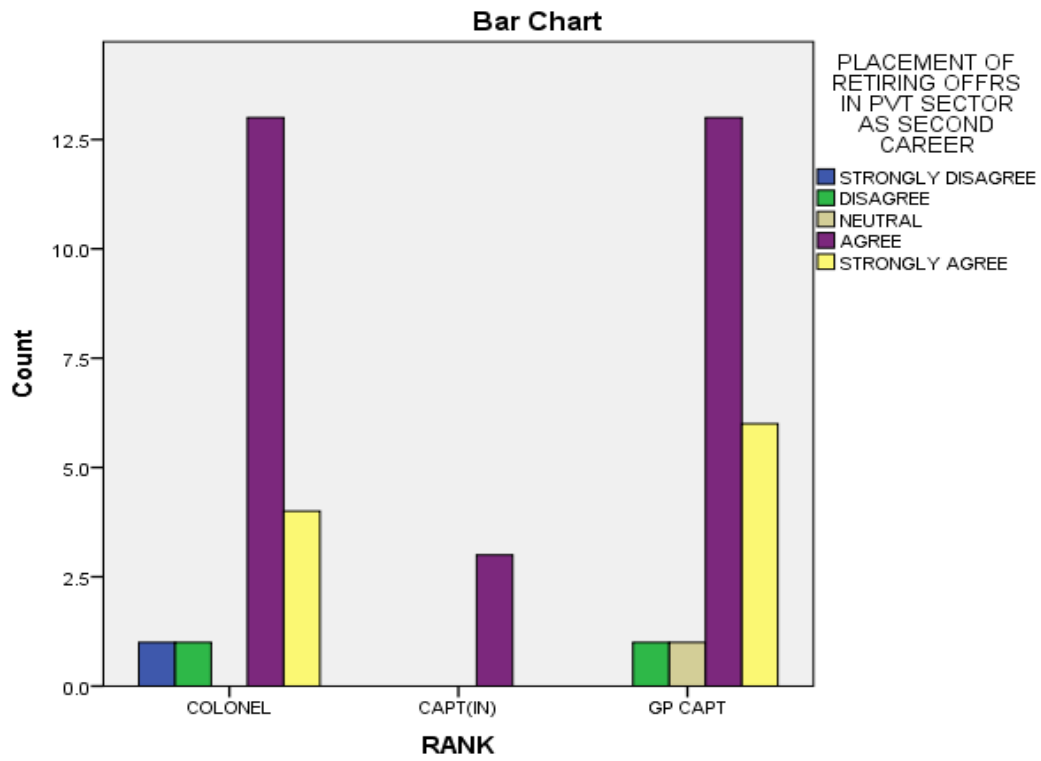
**Crosstab**

			PLACEMENT OF RETIRING OFFRS IN PVT SECTOR AS SECOND CAREER					Total
			STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE	
RANK	COLONEL	Count	1	1	0	13	4	19
		Expected Count	.4	.9	.4	12.8	4.4	19.0
		% within PLACEMENT OF RETIRING OFFRS IN PVT SECTOR AS SECOND CAREER	100.0%	50.0%	0.0%	44.8%	40.0%	44.2%
	CAPT(IN)	Count	0	0	0	3	0	3
		Expected Count	.1	.1	.1	2.0	.7	3.0
		% within PLACEMENT OF RETIRING OFFRS IN PVT SECTOR AS SECOND CAREER	0.0%	0.0%	0.0%	10.3%	0.0%	7.0%
	GP CAPT	Count	0	1	1	13	6	21
		Expected Count	.5	1.0	.5	14.2	4.9	21.0
		% within PLACEMENT OF RETIRING OFFRS IN PVT SECTOR AS SECOND CAREER	0.0%	50.0%	100.0%	44.8%	60.0%	48.8%
Total		Count	1	2	1	29	10	43
		Expected Count	1.0	2.0	1.0	29.0	10.0	43.0
		% within PLACEMENT OF RETIRING OFFRS IN PVT SECTOR AS SECOND CAREER	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

### Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.028 <sup>a</sup>	8	.855
Likelihood Ratio	5.546	8	.698
Linear-by-Linear Association	.576	1	.448
N of Valid Cases	43		

a. 13 cells (86.7%) have expected count less than 5. The minimum expected count is .07.



## RANK \* LEVERAGE MAKE IN INDIA CONCEPT TO ENHANCE DEF PRODN

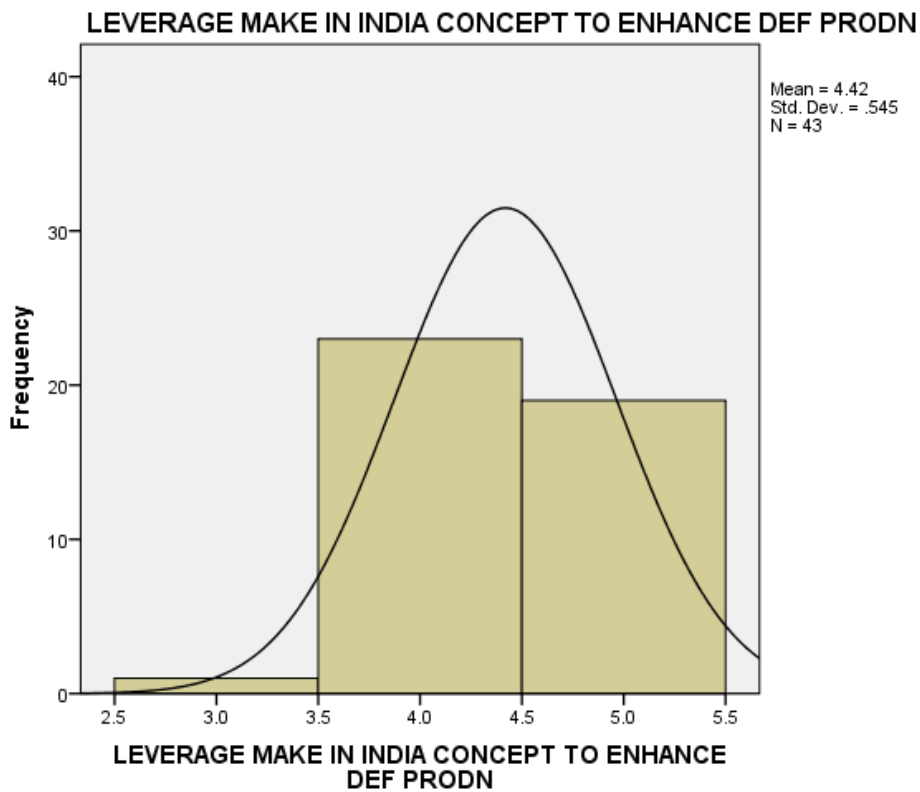
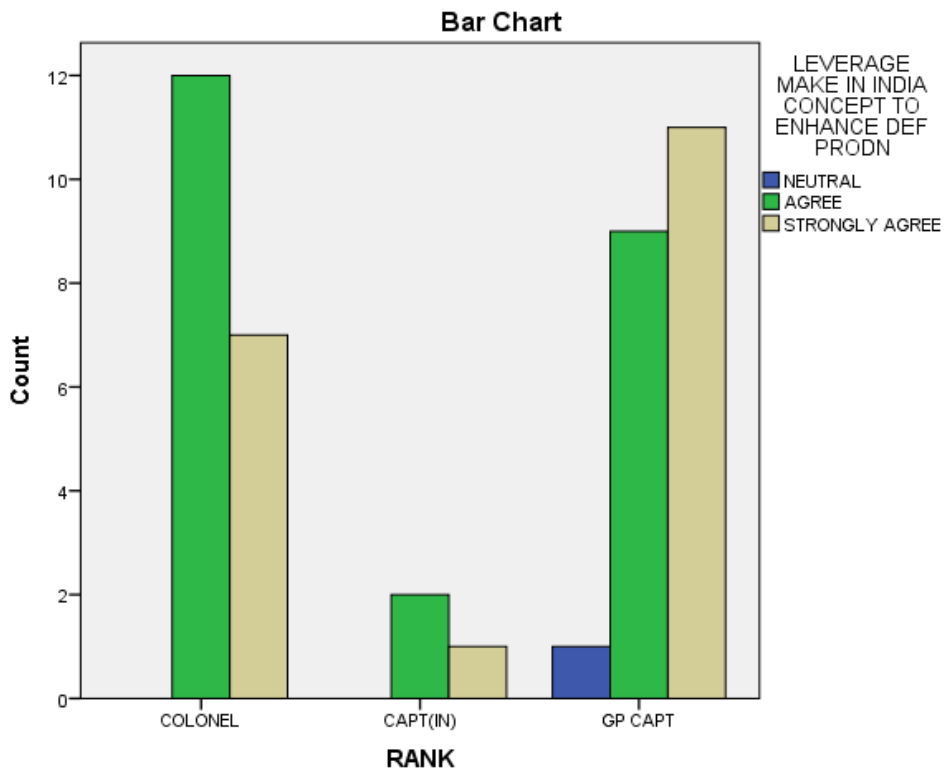
**Crosstab**

			LEVERAGE MAKE IN INDIA CONCEPT TO ENHANCE DEF PRODN			Total
			NEUTRAL	AGREE	STRONGLY AGREE	
RANK	COLONEL	Count	0	12	7	19
		Expected Count	.4	10.2	8.4	19.0
		% within LEVERAGE MAKE IN INDIA CONCEPT TO ENHANCE DEF PRODN	0.0%	52.2%	36.8%	44.2%
	CAPT(IN)	Count	0	2	1	3
		Expected Count	.1	1.6	1.3	3.0
		% within LEVERAGE MAKE IN INDIA CONCEPT TO ENHANCE DEF PRODN	0.0%	8.7%	5.3%	7.0%
	GP CAPT	Count	1	9	11	21
		Expected Count	.5	11.2	9.3	21.0
		% within LEVERAGE MAKE IN INDIA CONCEPT TO ENHANCE DEF PRODN	100.0%	39.1%	57.9%	48.8%
Total	Count	1	23	19	43	
	Expected Count	1.0	23.0	19.0	43.0	
	% within LEVERAGE MAKE IN INDIA CONCEPT TO ENHANCE DEF PRODN	100.0%	100.0%	100.0%	100.0%	

**Chi-Square Tests**

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.552 <sup>a</sup>	4	.635
Likelihood Ratio	2.948	4	.567
Linear-by-Linear Association	.395	1	.530
N of Valid Cases	43		

a. 5 cells (55.6%) have expected count less than 5. The minimum expected count is .07.



## RANK \* SHARE LTIPP WITH PVT FIRMS FOR THEM TO PLAN AND MAKE INVESTMENTS

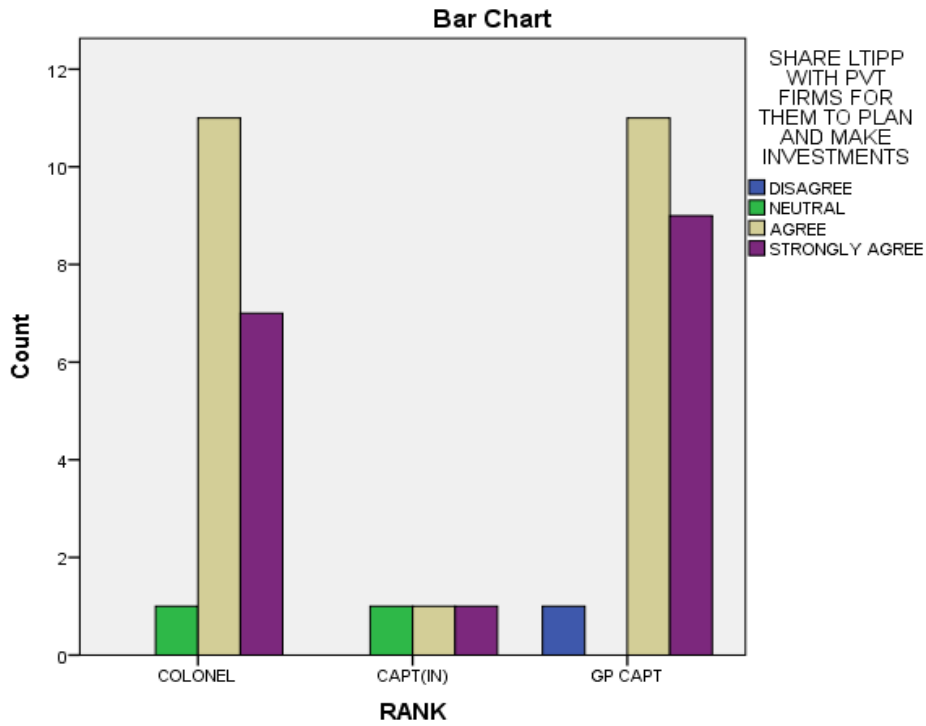
Crosstab

			SHARE LTIPP WITH PVT FIRMS FOR THEM TO PLAN AND MAKE INVESTMENTS				Total
			DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE	
RANK	COLONEL	Count	0	1	11	7	19
		Expected Count	.4	.9	10.2	7.5	19.0
		% within SHARE LTIPP WITH PVT FIRMS FOR THEM TO PLAN AND MAKE INVESTMENTS	0.0%	50.0%	47.8%	41.2%	44.2%
	CAPT(IN)	Count	0	1	1	1	3
		Expected Count	.1	.1	1.6	1.2	3.0
		% within SHARE LTIPP WITH PVT FIRMS FOR THEM TO PLAN AND MAKE INVESTMENTS	0.0%	50.0%	4.3%	5.9%	7.0%
	GP CAPT	Count	1	0	11	9	21
		Expected Count	.5	1.0	11.2	8.3	21.0
		% within SHARE LTIPP WITH PVT FIRMS FOR THEM TO PLAN AND MAKE INVESTMENTS	100.0%	0.0%	47.8%	52.9%	48.8%
Total	Count	1	2	23	17	43	
	Expected Count	1.0	2.0	23.0	17.0	43.0	
	% within SHARE LTIPP WITH PVT FIRMS FOR THEM TO PLAN AND MAKE INVESTMENTS	100.0%	100.0%	100.0%	100.0%	100.0%	

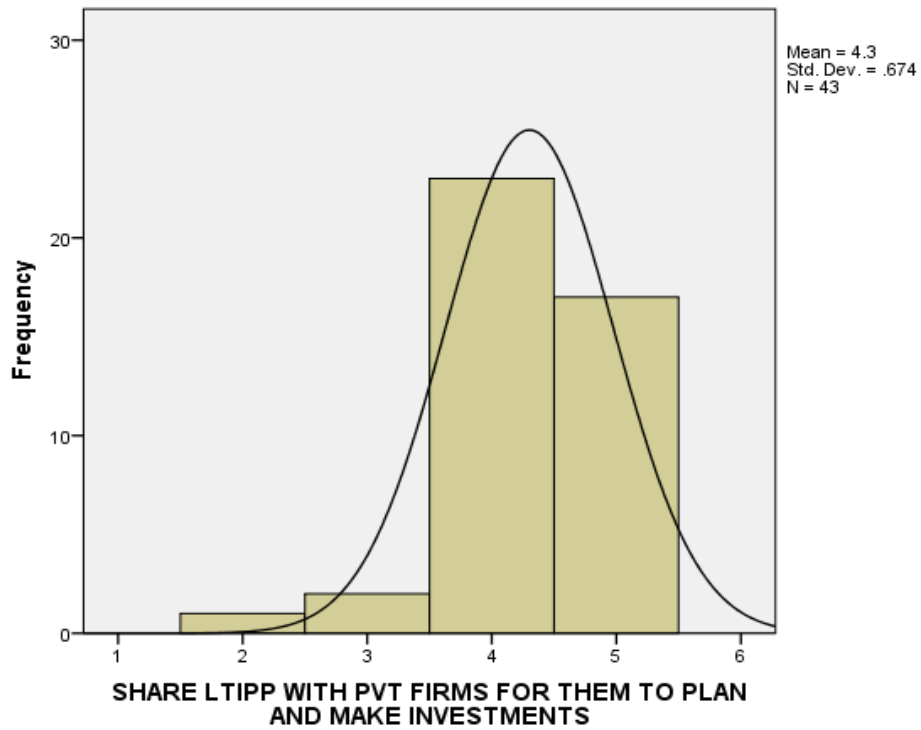
### Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.770 <sup>a</sup>	6	.255
Likelihood Ratio	6.079	6	.414
Linear-by-Linear Association	.009	1	.926
N of Valid Cases	43		

a. 8 cells (66.7%) have expected count less than 5. The minimum expected count is .07.



**SHARE LTIPP WITH PVT FIRMS FOR THEM TO PLAN AND MAKE INVESTMENTS**



**RANK \* PEEL FACTOR OF AVSC II REC NOT IMPLEMENTED DUE TO PAROCHIAL INTERESTS OF OTHER ORG**

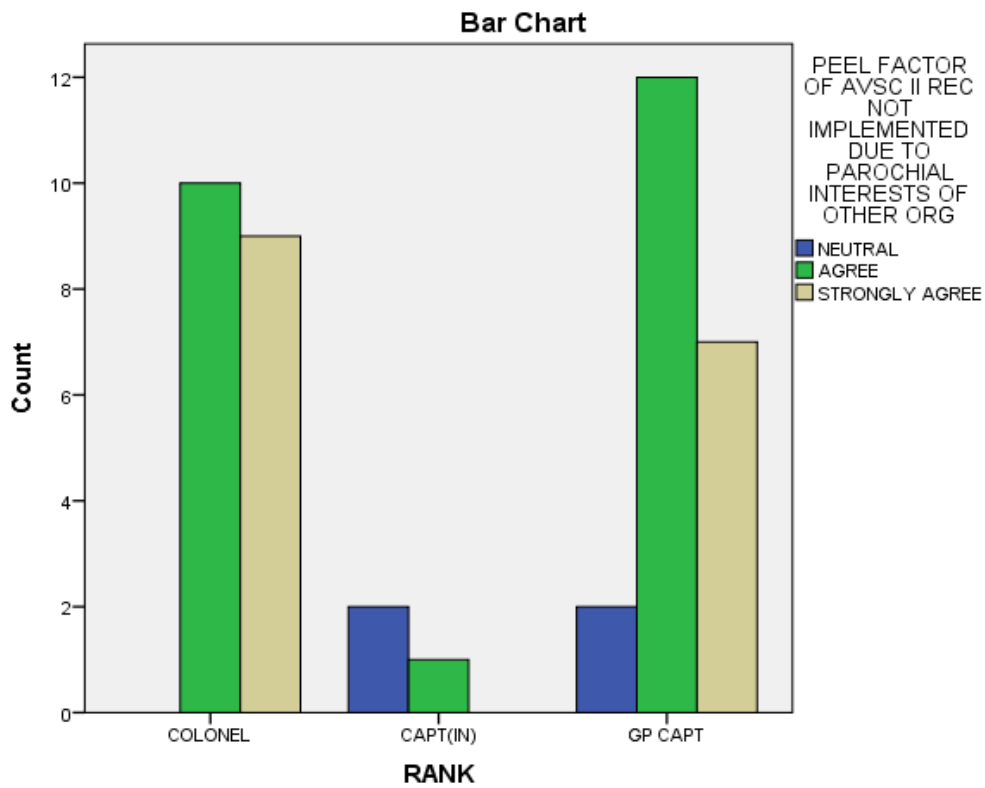
**Crosstab**

			PEEL FACTOR OF AVSC II REC NOT IMPLEMENTED DUE TO PAROCHIAL INTERESTS OF OTHER ORG			Total
			NEUTRAL	AGREE	STRONGLY AGREE	
RANK	COLONEL	Count	0	10	9	19
		Expected Count	1.8	10.2	7.1	19.0
		% within PEEL FACTOR OF AVSC II REC NOT IMPLEMENTED DUE TO PAROCHIAL INTERESTS OF OTHER ORG	0.0%	43.5%	56.3%	44.2%
	CAPT(IN)	Count	2	1	0	3
		Expected Count	.3	1.6	1.1	3.0
		% within PEEL FACTOR OF AVSC II REC NOT IMPLEMENTED DUE TO PAROCHIAL INTERESTS OF OTHER ORG	50.0%	4.3%	0.0%	7.0%
	GP CAPT	Count	2	12	7	21
		Expected Count	2.0	11.2	7.8	21.0
		% within PEEL FACTOR OF AVSC II REC NOT IMPLEMENTED DUE TO PAROCHIAL INTERESTS OF OTHER ORG	50.0%	52.2%	43.8%	48.8%
Total	Count	4	23	16	43	
	Expected Count	4.0	23.0	16.0	43.0	
	% within PEEL FACTOR OF AVSC II REC NOT IMPLEMENTED DUE TO PAROCHIAL INTERESTS OF OTHER ORG	100.0%	100.0%	100.0%	100.0%	

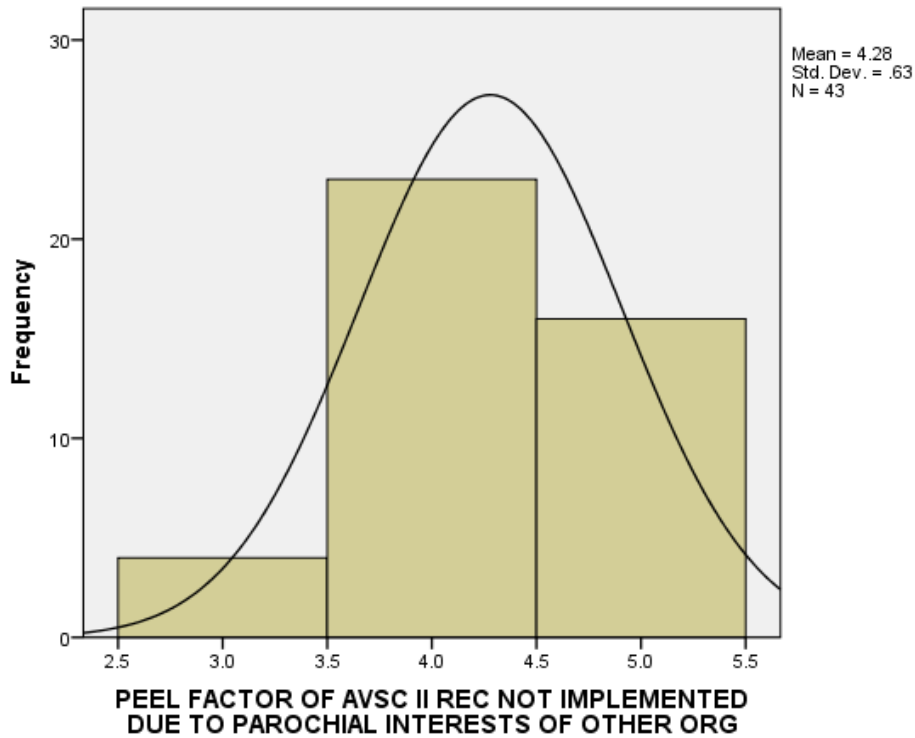
**Chi-Square Tests**

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14.392 <sup>a</sup>	4	.006
Likelihood Ratio	11.094	4	.026
Linear-by-Linear Association	1.313	1	.252
N of Valid Cases	43		

a. 5 cells (55.6%) have expected count less than 5. The minimum expected count is .28.



**PEEL FACTOR OF AVSC II REC NOT IMPLEMENTED DUE TO PAROCHIAL INTERESTS OF OTHER ORG**





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