Framework of Outsourcing in Indian DPSUs for Avionics ToT projects and Statistical Analysis of its Operational Issue

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***Abstract*- Outsourcing in become one of the strategic tool for competitive & economic growth of Avionics DPSUs in present global aerospace industry. In this paper author define the need of outsourcing in DPSUs, its structure and activity flow diagram. The research formalized the main reason for failure of outsourcing in Indian DPSUs using statistical analysis (Cronbach's Alpha technique)and developed model for outsourcing in Indian DPSUs for avionics Transfer of Technology project. Analytical finding of this research paper point out the need of vendor development for outsourcing as major issue for DPSUs and it became one of the responsibility for DPSUs to cater the criticality of Avionics TOT project. Finally paper concluded with the vendor development model & criteria for vendor rating for outsourcing activity for Avionics TOT project.**

Keywords: ***Avionics; Transfer of Technology; Outsourcing; Vendor; Cronbach's Alpha***

1. Introduction

Outsourcing is nothing but 'strategic partnership which is nothing but formal alliance between two commercial enterprises usually formalized by one or more business contracts but falling short of legal partnership or agency or corporate affiliate relationship. The DPSUs may adopt 'outsourcing' as its business strategy for one or more of the following reasons:
Cost minimization, Resource access, Resource leverage, and Risk diversification.

The objective of outsourcing by Avionics Manufacturing DPSUs is to implement procurement and vendor operating strategies that streamline material/service flows, reduce manufacturer and supplier costs, improve quality and customer service, and create long-term buyer/seller partnerships along with confidentiality of sensitive information. The DPSUs has to be shift their strategy in a similar way from vertical integration business model to system integration business Model. By adopting such a strategic shift, avionics manufacturer in India can serve their ultimate customer IAF in a better way. The outsourcing effort by DPSUs will add to their capacity enhancement, attain cost effectiveness and improve competitiveness in global market.

1.1 Objective

The research paper aims to define need of outsourcing and develop a model for Indian Defense PSUs for outsourcing of different non-competency job to qualified vendors. It proposes modeling for activity flow in outsourcing and organization structure. Being the Government undertaking, it is responsibility of Indian Public Sector Unit to take care for development of vendors to stand the global requirement of avionics articles manufacturing.

1.2 Findings

The research work findings are

1. Formulated the Outsourcing structure for Indian Defense PSUs.
2. Outsourcing as a strategic tool for competitive development of Indian DPSUs and Vendor Development Model.
3. Identification of strategic element in Outsourcing for Indian DPSUs.
4. Statistically find out the main factor for improvement in Defense PSUs which result effective & efficient Outsourcing for Avionics TOT project.

1.3 Research Limitation

The research design used will be exploratory and causal in nature. The research is applicable for Indian Defense Public Sector Units & avionics articles related projects. Due to

confidentiality of information, the data collection from DPSUs to reach final conclusion is for limited scope. From the existing project of avionics articles in one of the Defense PSU which deal 90% of work in TOT projects, we tried to collect data and explore gaps along with procedural weakness in outsourcing strategy.

1.4 Practical Implication

The procedural issues in Government owned Public Sector Units is one of the major obstacles to implement outsourcing. Since the activity is related to security of nation in DPSUs, there is risk of leakage of confidential information, so different check points at every stage of outsourcing make the existing outsourcing policy ineffective. For competitive growth and cultural improvement in Indian DPSUs , the outsourcing taken as a strategic tool in project management.

2. Approach/ Methodology

The paper opted data collection from one of DPSUs HAL-Korwa and analysis by statistical tool. The exploratory study using the open-ended approach of grounded theory, including depth interviews and one expert group discussion with employees representing middle and senior management having mainly a outsourcing of avionics articles under transfer of technology. The data were complemented by documentary analysis, both quantitative and qualitative in nature along with its confidentiality due to its relation from DPSUs.

3. Literature Review

Ref. [1] analyzes national and international policy options to encourage the international transfer of technology, distinguishing between four major channels of TOT.
Ref. [2] focuses on the Outsourcing is nothing but 'strategic partnership. The paper addresses different issues for outsourcing in ordanance factory, vendor development and suggests some policy recommendation to ease the outsourcing within the government regulation.
Ref. [3] provides a guidebook on preparing technology transfer projects for financing, Issued by the Climate Change Secretariat (UNFCCC) Bonn, Germany is provide the basic understanding to prepare a TOT project proposal.

Ref. [4] accesses the need of outsourcing for global competitiveness. The researcher elaborate the different outsourcing strategies which are required to be implement for procurement and vendor operating policies that streamline material and/or service flows, reduce manufacturer and supplier costs, improve quality and customer service performances, and create long-term buyer/seller partnerships.

Ref. [5] has a systematic literature review which to throw light on the importance of supply chain (SC) coordination.
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Ref. [7] clarifies and classifies the different activities that may be included in an obsolescence management and investigate the new aspect, new trend for obsolescence management for avionics articles component under contractual agreement of TOT so that Indian Defense PSUs.

Ref. [8] discusses the challenges like Licensor support, production facility setup, Training for the project, Testing bench & its calibration related issues and Material supply in TOT project of Opto-electronics articles.

Ref. [10] highlights that successful SCM requires integrative system of all business activities by different departments such as collaborative work, joint product development shared information etc.

Ref. [11] have review of the different literature and specific situation analysis at HAL, Hyderabad, it has been deduced that there is a lack of comprehensive obsolescence management practices in HAL, Hyderabad and in many such organizations.

Ref. [12] finds out the challenges and areas where HAL Korwa is lagging and suggests recommendations. The statistical analysis of the data received was done using SPSS. The Descriptive analysis of all the statistical and develop the outsourcing model development for Avionics TOT projects in Indian DPSUs.

4. Discussion

4.1 Decision for Outsourcing in DPSUs

Most of the avionics article manufacturing DPSUs has their robust procurement process. However, in a SWOT analysis the supply chain would emerge as one of the weakness. They have a long procurement cycle time which has resulted in high levels of inventory. DPSUs's value of procurement exceeds our value of consumption which is resulting in the increase of our inventory every year. In aerospace industry wherein the lead time can exceed a year, a higher inventory is the way to mitigate the supply chain risk. However, by implementing effective supplier management techniques, it would be possible to achieve on time supplies and shifting the supply chain risks to the suppliers. On average DPSUs procurement throughput time exceeds 6 months. A study of the data would reveal that 50% of the procurement throughput time is the ordering time. By managing the

ordering time, we would be in a position to effectively manage the supply chain. The basis of this model is to classify the procurement according to potential supply risk and profit impact.

4.2. Structure of Outsourcing in DPSUs

The out-sourcing process in Avionics DPSUs is designed to encourage, enable and eventually develop long-term reliable partners who would support DPSU's endeavour. Various initiatives like sub contractor development, building long term partnerships in the areas of mutual interest, transparency, both as a buyer as well as seller, public-private partnership, adherence to quality and reliability, adequate vendor base etc. are become the guiding philosophy for Outsourcing. The TIER structure of Outsourcing proposed at different level by encouraging participation of entrepreneurs as below:

Table-1: TIER structure of Outsourcing

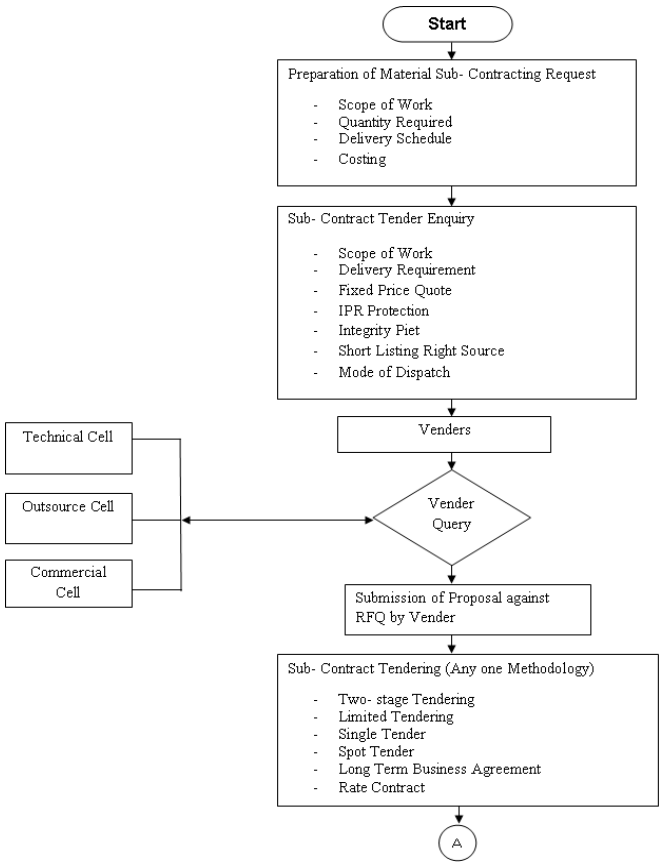
TIER 1: Financial and Technical Risk sharing Partnership. Parties capable of partnering/sharing across the spectrum of project design and development and execution, ability to explore and generate common business interest in avionics sector
TIER 2: Parties capable of manufacturing and supplying complex/major parts and assemblies with capability for tool design and development and potential to procure raw material on their own.
TIER 3: Parties capable of manufacturing components/ sub assembly, detail parts /providing support systems with company Support for technical Inputs.

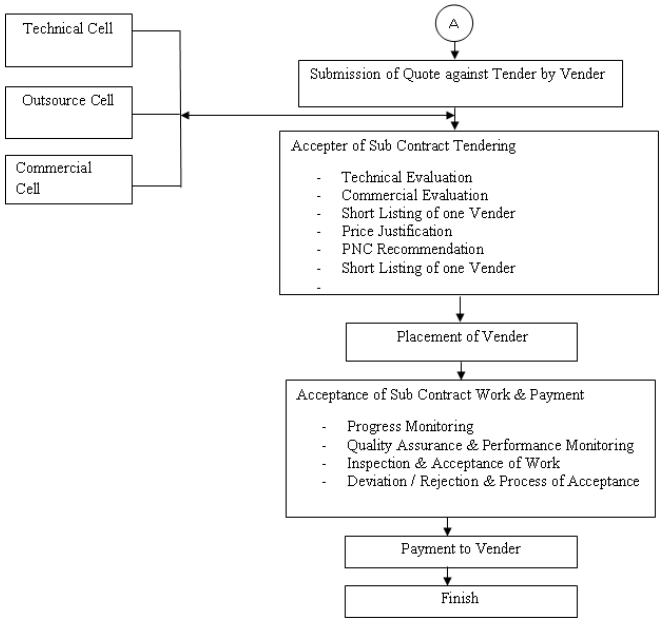
4.3. Organization Structure of Outsourcing in DPSUs:

Table-2 : Outsourcing Organization Structure

Subcontractor development group • Identification/Developing parties • Registration facilitation
Logistics group • Production Engineering + Material receipt/dispatch of • Raw-material/Consumable + Documentation/tooling • Semi finished parts for intermediate operations Finished parts Tagging and store crediting
Technical group • Co-ordination/monitoring for execution
Technical support(methodizing, tooling, design etc)
Quality Assurance group • Dedicated Inspection Group for PDI and inward inspection • Quality audits, QMS, Vendor Rating, Qualification of special processes • Co-ordination with certification agencies like DGAQA, DGCA etc.
Commercial group • Tendering and ordering • Payments
Finance group • Cost estimation • Financial Coordination of OS proposals Payments

4.4 Activity Flow in Outsourcing:





Figuer-1: Activity flow of Outsourcing

4.5 Quantitative Analysis of Outsourcing in Defense PSUs and Case Study at HAL-Korwa:

Ref [12] is used for collection of data at HAL-Korwa and some statistical calculation. The Scholar is working executive as Project Manager (TOT Project of Avionics Articles of Su30MKI Aircraft) at Hindustan Aeronautics Limited, Avionics Division, Korwa, Amethi . This division is in production of avionics articles for Su-30MKI under Transfer of Technology by Russia. The Su-30MKI was designed by Russia's Sukhoi Corporation beginning in 1995 and built under TOT by India's Hindustan Aeronautics Limited (HAL). In October 2000, a Memorandum of Understanding (MoU) was signed for Indian licence-production of 140 Su-30MKIs; in December 2000, a deal was sealed at Russia's Irkutsk aircraft plant for full technology transfer. Further contract for supply of additional 40 SU-30 MKI aircraft was concluded with IAF for 40 Su-30MKI in 2007 and In December 2012, HAL signed a contract with the Ministry of Defense and Rosoboronexport for the production and delivery of 42 Su-30MKI aircraft, bringing the total number of orders to 222. (http://www.airforce-technology.com/projects/su-30mki-multirole-fighter-aircraft-india)

The Hindustan Aeronautics Limited (HAL), Avionics Division-Korwa, Amethi-227412, UP is the one which has 80% work content related to TOT of avionics articles. The literature survey carried out on outsourcing and case study are made at HAL-Korwa. The findings from literature study found that the major work on outsourcing is being done in a reactive way and many of the organizations do not have a proper system for vendor management in outsourcing. Based on the literature survey the case study made hypothesis is formularized for analysis of the outsourcing in Indian DPSUs with the collected data by case study at HAL-Korwa.

The table below shows the extent of outsourcing achieved in HAL.

Table-3 : Outsourcing data

FY	Total Output (SMH In Lakhs)	Extent Of Outsourcing		Value In Rs. Crs.
		Outsourced SMH (In Lakhs)	% of Total Output	
2012-13	521	137	26	365.58
2013-14	517	130	25	379.70
2014-15	496	164	33	490.91
2015-16	481	160	33	387.52

4.5.1 Outsourcing Data of HAL-Korwa:

As can be seen there has been consistent rise in the extent of outsourcing from 26% to 33% and is continuously increasing. In an ideal scenario all the divisions should have the same data. However in reality it is not the case. Outsourcing initially was limited to mechanical parts and Korwa being an Avionics Division lagged behind due to its nature of work. However, as vendor developed in the field of Electronics, outsourcing in Avionics Industry increased. Ideally both Korwa and Hyderabad should have excelled at same pace. However, the data below shows a different picture altogether.

Table-4 : Outsourcing data of HAL-Korwa & Hyderbad

	Hyderabad		Korwa	
FY	Outsourced SMH (In Lakhs)	Value In Rs. Crs.	Outsourced SMH (In Lakhs)	Value In Rs. Crs.
2012-13	12.302	33.458	1.259	1.2033
2013-14	12.59	46.4568	0.45	0.9934
2014-15	13.209	33.7378	1.18	21.1217
2015-16	14.138	34.7201	0.0732	0.2013

The practical observation found during data collection at HAL-Korwa that we are not able to lower its operational cost impacting its revenue. It is not able to focus on its core activities i.e. on Design and Development and Internal resources could not be freed up which might have been utilized for other purposes.

With the above issue in HAL-Korwa , the data analysis is made for following-

- To find out the various probable causes of failure.
- To find out the most important factors with the help of Survey
- Based on the factors determined above, suggest recommendations.

4.5.2 Research Methodology Adopted:

The objectives of the research will be achieved through three stages:

Stage One

Identifying the major criteria and sub criteria that affects the attainment of objective based on Brainstorming and discussions.

Stage Two

The selected criteria and sub criteria that had been identified in stage one were used as a basis for formulating the questionnaire survey which consists of these criteria. Questionnaire was then floated in officers of HAL, Korwa. They are asked to rate the selection criteria in order of importance. Based on the survey conducted, the major influencing criteria and sub-criteria will be determined.

Stage Three

Statistical Analysis of the Survey is done to find the significant factors. The recommendations are then given against those factors.

4.5.3. Data Collection

4.5.3.1 Primary Data:

Brain storm analysis/Group Discussion were organised to find out the most contributing factors. A Questionnaire (Appendix-1) consisting of 17 attributes was framed on the basis of the discussions. Questionnaire survey was circulated amongst executives of HAL Korwa for their opinions. A total of 316 officers are on rolls of HAL Korwa at present and survey was circulated to one and all without any exceptions. They were asked to rate the factors on a scale of 1 to 5 depending on whether the factor is not significant to most significant factor.

4.5.3.2 . Determining Sample Size:

Sample Size n = Z2*S* (1-S)/ E2

Where Z = Z-score ; S = Standard Deviation ; E = Magnitude of Error

For 90% confidence interval Z-Score is 1.645; Since we have not yet started the survey hence it is safe to use standard deviation as 0.5.Margin of error for our survey will be +/- 10%.

Hence required Sample size is (1.645^2*.5*.5/.1^2)

= 2.706*.25/.01
= 67.65
= 68

Since our population size (N) is finite (316) hence we need to use finite population correction.
Hence Corrected Sample Size

n'= nN/ (n+N-1)
= 68*316/ (68+316-1)
= 21488/383
= 56.10
= 57

4.5.3.3 Secondary Data:

Since this study is very specific and limited to HAL Korwa hence no previous studies exist. However previous studies conducted for reasons of failure to outsource were used to identify the major criteria and sub criteria. The factors were selected by reviewing literature sources on failures/Challenges to outsourcing.Based on Brain Storming Analysis, Group discussion, Literature review and secondary data following 05 major criteria's identified are:

a) Vendor Related Factors

These factors are attributes which are attributable to Vendors. Vendors themselves are not interested in doing business with HAL Korwa. The vendor related attributes identified are:-

- Less Volume of Work

The Less Volume of Work discourages Vendors for showing interest. Less Volume means low profit for them. Moreover it doesn't ensure running their business on full capacity and hence their operational cost is high thereby affecting their profits.

- Absence of Long Term Contracts

Any business looks for sustenance and hence looks for long time partnership. Absence of Long Term Contracts discourages vendors.

- Absence of Rate Contracts

For suppliers, rate contracts provide access to an assured customer and large volume of purchases for a specific time period without having to respond to tenders frequently. Hence absence of it discourages vendors.

- Rules & Regulations

Too much rules and certification processes like FAI (First Article Inspection), Audits, Approval from RDAQA etc discourages vendors.

b) Psychological Factors

Psychological factors refer to thoughts, feelings and other cognitive characteristics that affect the attitude, behavior and functions of the human mind. These attributes are perception based.

- Poor Quality

There is an inherent fear that the main motive of any outsourcing vendor is profit and his first priority may not be Quality. HAL being in aerospace sector, where Quality comes first, may not push for outsourcing due to this inherent fear.

- Fear of Losing Job

Employees may resist outsourcing as they feel unsecured about their job. They perceive that their Job may be outsourced and may be forced to leave their job.

- Fear of Losing Control

The Management may feel that the flexibility and Control over production will be more if the items are produced in house rather than outsourced and hence may discourage outsourcing.

- Infrastructure Wastage

Since Aerospace sector is a highly capital intensive sector and HAL has already spent a lot on building its infrastructure. Now suddenly to move to outsourcing may lead to wastage of infrastructure present and hence may discourage outsourcing.

c) Cultural factors

These attributes are related to our work culture and the legacy being followed/ inherited.

- Top management Commitment

Being in manufacturing sector for so long and producing everything in-house, has made us to think in a particular way. The transformation process of change of orientation in mind-set is has just begun and hence the emphasis on Outsourcing may not be as much as it needs to be.

- Vendor Development

Vendor Development can be defined as any activity that a Buying Firm undertakes to improve a Supplier's performance and capabilities to meet the Buying Firms' supply needs. Most of the vendors of HAL Korwa are South based and hence vendors needs to be developed in North to have better control and reduce Lead time.

- Low Manpower

The required change in the mind-set is still on-going and hence Outsourcing department is not given as much priority as it needs to be and hence manpower is not allocated as it requires.

d) Motivational Factors

Motivation is defined as the process that initiates, guides, and maintains goal-oriented behaviors and pitfalls in motivations affects the achievements in outsourcing.

- Lack of Motivation

Since outsourcing in HAL Korwa is still in nascent stage and people are not fully aware of its advantages. Hence Employees do not feel motivated enough to encourage outsourcing.

- Union Opposition

The recognized labour unions are against outsourcing due to various reasons. Their opposition may one of the causes for slow pace of outsourcing.

e) Location Disadvantages

- Remote Location

One of basic motive of PSU's is regional upliftment. Hence they were always located at places away from the main city hubs. HAL Korwa, being in a remote place with poor connectivity, has its own challenges. This serves as great disadvantage and reduces control over vendors. Moreover Vendors may also feel uncomfortable to visit the factory and due to this co-ordination may be affected.

- Extended /liaisoning Cells

Since most of the good vendors are based in South and in major hubs like Hyderabad, Pune etc, hence absence of extended cells in these hubs increases the problems manifold and hence affects the level of outsourcing.

4.6 Data Analysis

Hypotheses Formulation

- H01 = Vendor related factors are not a significant factor
- H02 = Psychological factors are not a significant factor
- H03 = Cultural factors is not a significant factor
- H04 = Motivational factors is not a significant factor
- H05 = Locational Disadvantage is not a significant factor

- Cronbach Alpha

The first test was conducted to check the reliability and internal consistency of questionnaire. The analysis was done using and the results are tabled below:-

Table-5 : Cronbach Alpha Value

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.735	.735	17

The Cronbach Alpha Value is 0.735, which is considered as good value for the coefficient of reliability hence survey is now implemented on full scale.

- Response Rate

Out of 316 response received was 82 and 87 are not responded.

Response rate = 82/ (316-87) = 82/229 = 35.8%

Since the response rate is more than 35% it is adequate.

- Factor Analysis

Factor analysis using SPSS we try to reduce the number of variables. For the purpose of analysis loading factor is taken as 50%. By analysis it is observed that out of 17 variables, 12 can be reduced. The result of the analysis (Appendix 3) is as below:

Table-6: KMO & Bartletts Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.559
Bartlett's Test of Sphericity	Approx. Chi-Square	48.897
	Df	10
	Sig.	.000

KMO & Bartlett's Test is a measure of sampling adequacy that is recommended to check the case to variable ratio for the analysis being conducted. Since KMO test value is greater than 0.5 hence number of samples are adequate.

Table-7: Communalities

Communalities		
	Initial	Extraction
Q1	1.000	.530
Q2	1.000	.722
Q3	1.000	.650
Q4	1.000	.621
Q17	1.000	.629

Extraction Method: Principal Component Analysis.

All the extraction values are greater than our loading values (0.5) hence it is satisfactory.

Table-8: Total variance Explained

Total Variance Explained								
Component		Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadingsa
		Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
dimension0	1	1.792	35.833	35.833	1.792	35.833	35.833	1.789
	2	1.361	27.213	63.046	1.361	27.213	63.046	1.367
	3	.776	15.526	78.572				
	4	.595	11.905	90.476				
	5	.476	9.524	100.000				

Extraction Method: Principal Component Analysis.

a. When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

From the screen plot it observed that only two factors are dominant.

Table-9: Pattern Matrix

	Component	
	1	2
Q1	.710	
Q2		.847
Q3	.801	
Q4	.788	
Q17		.782

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.
a. Rotation converged in 3 iterations.

There is no cross loading in the Pattern matrix. Moreover the average values of each factor is more than 0.7 hence the result is satisfactory.

Factor 1 consists of Survey questions Q1, Q3 and Q4. These questions are covered under Vendor Related Factors.

Factor 2 consists of Survey questions Q2 and Q17. These questions are covered under Locational Disadvantage Factors.

4.7 Hypothesis Testing

- H01 = Vendor related factors are not a significant factor

One sample T-test is performed using SPSS (Appendix-4). Confidence interval is taken as 95% and the test value is taken as 3. The result obtained is as below:

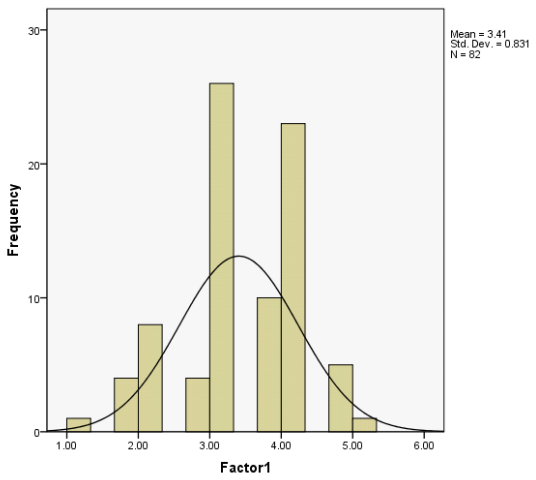
Table-10: One-Sample Statistics H01

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
Factor1	82	3.4085	.81148	.08962

Table-11: One-Sample Test H01

One-Sample Test						
	Test Value = 3					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Factor1	4.454	81	.000	.40854	.2302	.5868

Histogram is also plotted using SPSS and the graph is displayed below:



Figuer-2: Histogram plot

Since the mean value is greater than 3 and the Upper & Lower values of 95% confidence interval is positive hence null hypothesis is rejected.

Magnitude of Error E2 = Z2*S* (1-S)/ n
Where Z = Z-score ; S = Standard Deviation ; E = Magnitude of Error ; n = Sample Size

Since our population size (N) is finite (316) hence we need to use finite population correction.
Hence Corrected Sample Size n'= nN/ (n+N-1)

⇒ 82 = n *316/ (n+315)
82n + 82*315 = 316n
234n = 82*315
n = 110
Z value for 95% confidence interval is 1.96.
Standard Deviation = 0.8348

Therefore error = Sqrt (1.96*0.8348*(1-0.8348)/ 110)
= 0.049571029
= 4.95%
= Approx 5%

No of Respondents with response value greater than 3 = 65

% response value greater than 3 = 65/82 = 79.2% = Approx 80%

Thus it can be concluded that we are 95% confident that 75% to 85% of the HAL Korwa executives believe that Vendor related factors are significant reason for the unimpressive outsourcing performance of HAL Korwa.

- H02 = Psychological factors are not a significant factor
  Since all the Questions related to this factor have been reduced during Factor analysis hence null hypothesis is failed to reject.
  Thus Psychological factors are not a significant factor for the unimpressive outsourcing performance of HAL Korwa.

- H03 = Cultural factors is not a significant factor
  Since all the Questions related to this factor have been reduced during Factor analysis hence null hypothesis is failed to reject.
  Thus Cultural factors are not a significant factor for the unimpressive outsourcing performance of HAL Korwa.

- H04 = Motivational factors is not a significant factor
  Since all the Questions related to this factor have been reduced during Factor analysis hence null hypothesis is failed to reject.
  Thus Cultural factors are not a significant factor for the unimpressive outsourcing performance of HAL Korwa

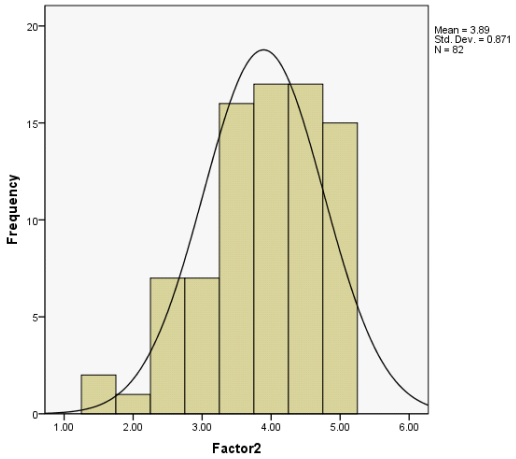
- H05 = Locational Disadvantage is not a significant factor
  One sample T-test is performed using SPSS (Appendix-4). Confidence interval is taken as 95% and the test value is taken as 3. The result obtained is as below:

Table-12: One-Sample Statistics H05

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
Factor2	82	3.8902	.87144	.09623

Table-13: One-Sample Test H05

One-Sample Test						
	Test Value = 3					
					95% Confidence Interval of the Difference	
	T	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Factor2	9.251	81	.000	.89024	.6988	1.0817



Figuer-3: Histogram H05

Since the mean value is greater than 3 and the Upper & Lower values of 95% confidence interval is positive hence null hypothesis is rejected.

Magnitude of Error E2 = Z2*S* (1-S)/ n
Where Z = Z-score ; S = Standard Deviation ; E = Magnitude of Error ; n = Sample Size

Since our population size (N) is finite (316) hence we need to use finite population correction.
Hence Corrected Sample Size n'= nN/ (n+N-1)

⇒ 82 = n *316/ (n+315)
82n + 82*315 = 316n
234n = 82*315
n = 110
Z value for 95% confidence interval is 1.96.
Standard Deviation = 0.87144

Therefore error = Sqrt (1.96*0.87144*(1-0.87144)/ 110)
= 0.044678992
= 4.46%
= Approx. 4.5%
No of Respondents with response value greater than 3 = 72
% response value greater than 3 = 72/82 = 87.8%
= Approx. 88%

Thus it can be concluded that we are 95% confident that 83.5% to 92.5% of the HAL Korwa executives believe that Locational disadvantage is a significant reason for the unimpressive outsourcing performance of HAL Korwa.

4.8 Results

4.8.1 Vendor Related Factors

Based on the survey, we can say that we are 95% confident that 75% to 85% of the HAL Korwa executives believe that Vendor related factors are significant reason for the unimpressive outsourcing performance of HAL Korwa.

The major attributes in this factor are:-

- Less Volume of Work
- Absence of Long Term Contracts
- Absence of Rate Contracts
- Rules & Regulations
- E-procurement rules and e-tendering

However during factor analysis two of the above attributes were reduced. Hence the major attributes related to Vendor which are a significant reason for the unimpressive outsourcing performance of HAL Korwa are:

- Less Volume of Work
- Absence of Long Term Contracts
- Absence of Rate Contracts

4.8 2 Location Disadvantages

Based on the survey we can say that we are 95% confident that 83.5% to 92.5% of the HAL Korwa executives believe that Locational disadvantage is a significant reason for the unimpressive outsourcing performance of HAL Korwa.

The major attributes in this factor are:-

- Remote Location
- Extended /liaisoning Cells

4.9 Vendor Development for Outsourcing in DPSUs:

Based on the survey we can we are 95% confident that 90.5% to 99.5% of the HAL Korwa executives believe that absence of concrete steps for vendor development is one of the major reasons for unimpressive performance of HAL Korwa in outsourcing. The result found form the data analysis of HAL-Korwa can be extrapolate to other DPSUS which are dealing in Avionics TOT projects. The ultimate test of success of the outsourcing strategy for avionics manufacturer DPSUs would depend on how it is able to develop and retain reliable and competitive vendors for supply of its required services/items. Hence there is a need for adopting integrated policy of outsourcing and creation of effective vendor development system by an organization. Vendor development can be done in more than one way depending on the type of the activities in which the organization is engaged in the prevailing market conditions. In case the items/services are easily available or could be available, the objective of the vendors' development could be 'to encourage more and more competition' so that the benefits of market competition are reaped by the organization. The commonly adopted and quite relevant in the Defense industry is what is called 'Hand Holding'. This option could include such policy measures as:

· Establishing in house facilities for the products,

· Providing testing facilities,

· Sharing of knowledge and resources,

· Joint investments,

· Making of firm commitments, and

· Long term associations and certain incentives.

4.9.1 Vendor Management Model

The vendor management model in a Defense supply chain has many layers, each focusing on a set of deliverables.

Table-14 : Flow of Vendor Management Plan

Assessment	• Audit technical and production capacity • Capability quality, organization management • Financial resources
Development	• Long-term relations and mutual confidence • Capacity building • Technology quality and management systems

Hand-holding	• Institutionalized consultancy on sourcing on technology, raw materials and equipment • Improvement in manufacturing practices and trouble shooting
Periodic Review	• Performance and efficiency • Transparency

4.9.2 Performance Rating of Vendors:

The performance rating is one of the criterion to measure the Performance of the registered sub-contractors on a scale of 1 to 100 with a weightage of 40% for quality, 35% for delivery and 25% for price, as per formulae given below:

Quality performance assessed for 50 marks based on the formula:

$$= \frac{\text{No. of Items accepted} \quad X\ 40}{\text{Total no. of items to be received}}$$

Delivery performance assessed for 40 marks based on the formula:

$$= \frac{\text{No. of Items received in time} \quad X\ 35}{\text{Total No. of items to be received during the said period}}$$

The vendor rating shall be generated through IFS / ERP system and the overall performance rating will be the sum of above three indices. Based on the overall performance rating, the sub-contractors shall be classified as:

Class-'A': those having performance rating of 75% and above

Class-'B': those with performance rating between 55% & 75%

Class-'C': those with performance rating less than 55%

The performance rating/ trend have to be communicated to the sub-contractors to give them an opportunity for improvement.Six Steps to build great supplier relationships for TOT project of Avionics article:

Table-15 : Step for Vendor Development

SN	Step	Activities
1	Understand how supplier work	• Learn about the suppliers' business • Go and see how suppliers work • Respect suppliers' capabilities • Commit to co-prosperity
2	Turn supplier rivalry into opportunity	• Source each component from two or three vendors • Create compatible production philosophes and systems • Set up joint ventures with existing suppliers to transfer knowledge and maintain control
3	Supervise your suppliers	• Send monthly report cards to core suppliers • Provide immediate and constant feedback • Get senior managers involved in solving problems
4	Develop suppliers' technical capabilities	• Build suppliers' problem-solving skills • Develop a common lexicon • Hone core suppliers' innovation capabilities
5	Share information intensively but selectively	• Set specific ties, places, and agendas for meetings • Use rigid formats for sharing information • Insist on accurate data collection • Share information in a structured fashion
6	Conduct joint improvement activities	• Exchange best practices with suppliers • Initiate kaizen projects at suppliers' facilities • Set up supplier study groups

5. Conclusion

There are plenty of reasons why Indian DPSUs go in for outsourcing. It become strategic decision of building capacity & competitiveness, changing aspiration of avionics product due to technology innovation and coupling innovation in all three area i.e. Products, Processes & People. There has been major shift in manufacturing & presently a lot of avionics manufacturer have outsourced not only their non-core activity but also one time core activity through third-party manufacturing / outsourcing / sub-contracting. There is need to have relook at on existing outsourcing policy & vendor development program in

DPSUs. There is also need to relook at concept of core and non-core activity as what is core today becomes non-core tomorrow. The proposed outsourced & vendor development model for Avionics TOT project in DPSUs will lead them over the capacity constraints and competitiveness.

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