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Focussing on Defence R&D: An Insight into DRDO

Introduction

The Defence Research and Defence Organisation (DRDO) is the premier R&D organisation under the Ministry of Defence (MoD). R&D organisations are normally esoteric and their management processes are considered challenging and complex.[2] DRDO's research is primarily for the benefit of the three defence services who also fall under the umbrella of MoD. This creates a unique and unusual situation in which the customers (viz. the three services) are fundamentally, similarly placed departments, like the R&D organisation, under the same ministry. Many literary excerpts on the subject point towards a feeling amongst the services that DRDO does not give the users ('user' is DRDO's term for customers) requirements, a competitively equal importance on a similar level as a private player would have given, in such a competitive environment[3]. It has been felt that there is a lack of mutual understanding and appreciation of the constraints faced by the services and DRDO. This feeling is only heightened by the fact that many important DRDO projects overshoot the budget and project timelines.

Many project related meetings do take place between the users and the concerned DRDO labs, from the working personnel to the top-management levels. The non-availability of a cognizant background narrative to each of them proves to be the nemesis of a clear two-way communication channel. This paper attempts to provide this narrative in respect to DRDO, in the manner of boundary spanning[4] wherein the primary research was carried out through a questionnaire based data collection exercise, in one of the premier and old labs of the DRDO. The data was then jointly analysed by the authors

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who are trained technology management exponents, from the academia, services as well as the DRDO. This makes the paper unique as the feedback from the lab is jointly analysed from the services as well as the DRDO perspective. It takes the necessary inputs from the academia as well who actually provide an expert and more detached third party perspective. The data pertains to an insight in the existence / requirement of an environmental framework for the laboratory that supports successful completion of R&D projects.

Questionnaire and Data

After a wide and thorough literature survey, factors that are considered critical for completion of an R&D project were homed in to.[5] These Critical Success Factors (CSFs) were found to be different for different organisations and even varied with the different types of projects. One thing was clear that the organizational climate or work environment played an important role in the success of projects. Hence, the present quantitative research for the representative establishment was taken up with the environmental factors in focus.

A questionnaire with 81 items/subjects was prepared to elicit responses from the scientists of the lab across the entire hierarchical spectrum. The questionnaire was designed keeping in mind the view that the main causes of project success or failure are related basically to factors of Man (e.g. involvement, knowledge, inter / intra group communication, Team work etc.), Machine (e.g. Technology, feasibility etc.), Material (e.g. availability, suitability), and Method (e.g. Procurement, Knowledge Management, financial procedures, audit etc.). The responses were graded for the top, middle and working level management. The questions pertained to all the factors given above and each factor was verified through positive affirmation on a Likert scale[6] of 1-to-5. Each factor carried more than two questions and in order to elicit honest responses, complete anonymity was maintained for the responses. The purpose of the exercise was explained and discussed with each scientist before asking them to fill the questionnaire.

Then, the success of a defence R&D project as perceived by the respondents categorized by their Management Levels is shown in table 1. Since the questions were in a multiple choice questionnaire form, each definition of success was independent of others. 100 per cent of top management level subjects stated that success meant ‘product meeting specified performance standards’. In general, it wasseen that for all three levels of managements, success meant ‘product meeting specified performance standards.’ This was followed closely by ‘User or Client Satisfaction’. ‘Timely Completion’ was also viewed as success by middle management but there was a wide variation in this variable, which would have to be analysed subsequently. The surprising part was that meeting the financial constraints was not a priority at all levels. Probable reasons for the same would also have to be analysed subsequently.

Table 1: What does Success Mean?

Variable	*Top Mgmt*	*Middle Mgmt*	*Work Level Mgmt*
Timely Completion	61.5	75.0	53.0
Within Financial Budget	30.8	35.7	24.3
Product Meets Specified Performance Standards	100.0	89.3	74.8
User / Client Satisfaction	84.6	60.7	75.7

The data collection on each of the CSFs and its observations using various statistical tools is given in table 2. For ease of understanding for a wider set of readers, the analysis is being given in descriptive mode and quantitative interpretation is not being mentioned here.

Table 2 : Summary of Data Observations

Sr.No.	*Success Factors*	*Observations from Data*
1.	**Feasibility of Design & Manufacturing** • Interpretation of understanding of the user requirement. • Availability of necessary resources or possibility of availability of same prior to undertaking projects.	All levels of management stated that feasibility studies were somewhat being done; This implies that there exists further scopefor a better study of the feasibility of Design and Manufacturing prior to the project. The present studies were failing to point out the precursors of failure.
2.	**User/Client Interaction** • Awareness of actual field conditions by the scientists. • Discussion and negotiations on intermediate changes in requirements. • Interaction between both parties during development trials and subsequent communication of results and/or changes suggested.	• Some kind of auser/client interaction can help in saving time and costs but needs to be strengthened further. • Users' intermediate suggestions for changes to initial requirement specifications poses problems and needs to be jointly addressed more effectively, e.g. the new time and cost requirements need to be negotiated in details to prevent failure at a future date
3.	**Vendor Management** • Procurement planning in advance • Time spent in procurement procedures • Procedural delays	• There is large scope for improvement in Procurement Planning & Purchase Procedures. • Involvement of scientists in this process lead to wast age of focused research efforts.
4.	**Outsourcing** • Clarity of the vendor with respect to the objectives. • Penalty for non-performance. • Assistance from vendor post supplies.	There is large scope for improvement in Outsourcing Procedures in that: • Technical competency of the various performers needs to be evaluated more effectively, • The drawings and specifications may have to be frozen after discussions with users. • After sales technical support needs improvement, and • Penalty as per existing standards may not be heavy enough or strict enough to pressurise the contractor to complete their work order properly and/or in time.

(*Contd…*)

5.	**Knowledge Management** • Recognition for sharing knowledge. • Availability of prior knowledge and a detailed knowledge bank. • Use of technology forecasting by each establishment. • Sharing of tech forecast by the users	Knowledge Management is the backbone of Technology Management. Again, there seems to be a large scope for Knowledge Management. • Technical Information Centre should be used more effectively as Knowledge Bank. • Knowledge sharing culture needs to be cultivated, by designing incentive policies. • Simultaneously, some methods of retaining tacit knowledge need to be derived and implemented. • Adopting methods like Exit Interviews so that knowledge does not go waste after project closure or after a person retires from service etc.
6.	**Project Management** • Equal credit for project completion to all concerned • Freedom of work with detailed guidance from Project Manager (PM) • Availability of adequate manpower for undertaking the project on hand. • Time and cost slippages beyond control	• Effective guidance needs to provided. • Scientists' work need to be reviewed properly. • Technical reviews need to be more effective. • Since there is a shortage of manpower, utilization must be optimum. • Curtailing of time and cost slippages. There is definitely some scope for improvement in Project Management.
7.	**Leadership** • Credit to team members • Established communication channels • Weightage given to convenience of members during the project phase.	• Leadership has been **weighed as the top most critical success factor** by Top Management. In this context there is scope for improvement in Leadership. • Intergroup and intra group communication can be more effective, and personnel of different teams may be encouraged by sharing the intermediate trials success. • Due credit needs to be given to team members and allotment of duties should be done keeping in mind the convenience of the various team players.
8.	**Human Resource** • Study and work in field not directly related to person's academic field. • Sense of belonging to the project • Change of members for different phases of project • Opportunity to work as PM	Everyone feels that the individual has leadership qualities and he/she would prefer to work as PM may indicate that either the PM's job is perceived to be easier (improper or insufficient information on job dictates and/or PM with poor leadership qualities) or is not being managed properly.
9.	**Communication with Support Service Groups** • Level of support • Use of modelling and simulation to reduce time • Open communication with support groups	Project Leader may not be sharing the project success with Support Service Groups due to lack of time or communication or a feeling of secrecy. Definite improvement desired.
10.	**Communication with Other DRDO Establishment/PSUs** • Ease of understanding in collaborative projects • Periodic meetings for ease of communications	In multi-lab collaborative projects, clarity about job responsibility is observed.

(*Contd…*)

11.	**Project Audit** • Allowing the project to continue even if it shows no promising progress.	Audit of Project seems to be a 'taboo' subject where management prefers to have no opinion.
12.	**Risk Management**	The results show that there is some disagreement between Top and Middle management & Working Level regarding acceptance of innovative ideas, suggestions from Failure Analysis, etc. This should be considered for improvement.
13.	**Time and Cost Management**	All levels homogeneously feel that the time and money spent for various trials is not excessive. Also Middle management and Working Level somewhat agree that Time and Cost estimates are prepared by authorities and hence may not be very accurate.
14.	**Winning Patent / Publication Culture**	All levels homogeneously feel that there is a need to promote the 'Paper Publication' / 'Patent winning' culture and young scientists need to get guidance on writing reports and journal articles.

An Insight

The prioritisation and analysis of 'what constitutes success' and observations of the CSFs mentioned above can help the top echelon in DRDO and MoD gain better appreciation of the interventions required to mange the HR, to optimise resource allocation and to provide an overall conducive environment for fructification of critical defence R&D projects. This may also be used by the services and the industry alike for better understanding of DRDO's internal perceptions/ thought processes so that they can collaborate more effectively. This analysis is presented below.

• Focus on the Users and Product Performance

There is a strong opinion that success means 'User Satisfaction'. A very strong (100 per cent) opinion that 'Success means product meets specified performance'. This may come as a surprise to the services but it points to a growing realisation along all levels of DRDO that meeting performance requirements should be their prime aim. The performance requirements itself have to take in to account the prevailing technology levels in the laboratories and the global technology changes during the development cycle. Thus, setting genuine performance standards by the services is very important.

The worrying part is that intermediate suggestions for changes in initial requirement specifications are negotiated for time and cost overruns before implementing in current project. This indicates that initially there is less clarity about 'User Requirements', and user actually becomes more clear about their own requirements only once the prototype is shown. This clearly shows that users' direct interaction with the scientists needs to be improved and further strengthened by exposing the working scientists to actual field conditions and vice-versa.

Thus user sharing their Technology Forecasts with DRDO and more openness in discussing 'Real User Requirements' is essential. DRDO and services needs to make serious efforts to gain mutual confidence and this can be realised by the personnel only after proper communication.

- **Primacy of R&D: Focus on Industry**

This happens to be a weak area probably because scientists are not trained for commercial transactions and do not even consider it their primary responsibility. Proper procurement planning needs to be done in advance, so that there is harmony while obtaining financial concurrences. Thorough documentation and communication about requirement specifications, market analysis for suppliers and costing needs to be prepared. On many occasions there are procedural delays when DRDO labs interact with vendors/ suppliers. Procurement procedure needs to be improved and training for the same needs to be imparted at mid-management levels.

Modifications to specifications or designs at a later stage on account of changes forced by users cause the labs to enforce the same through the vendors/ suppliers. This is seen to invariably cause delays and holdups. Avoiding intermediate changes by the user is the best option but if that is not feasible or practical, then better vendor management to take such changes in account becomes an imperative. Financial justifications for these also need to be simplified.

- **Focus on Project Management and Financial Constraints**

It may be a concern or a surprise to note that meeting the financial targets is not considered a prime responsibility by the entire hierarchy of scientists (Table 1). This could be because either a 'government mind-set' is prevalent or it is known that initial project estimates are not realistically made based on sound project management principles. The consequences of not adhering to financial targets are not being viewed through Return on Investment (RoI) calculations in a competitive environment. The bottom line is that lack of financial focus along the entire spectrum needs to be changed through imparting knowledge and implementation of project management tools. In addition, a risk assessment and stage-gate audit[7] of all projects need to be made the norm, much in the same way as the global best practices in R&D projects.

Normally, scientists are not moved from one project to another without proper adjustment. Project work does not start without proper planning and even then, manpower issues faced by the project manager are not resolved in advance. Therefore, scientific project review methods need to be implemented to ensure no slippages.

- **Focus on Timelines**

Even with 'perceived' slippages in many project delivery dates, the consensus is that these slippages are not excessive. There is a gap between the common perception and that which exists in the DRDO. What has emerged is really an eye-opener. The mid and working level scientists in the lab do not identify with the timelines of the project

set up by the top echelon and MoD. They feel that these are not realistic. This is one area where there is a definite need to follow a bottom-up approach because this has ramifications on how the entire organisation is viewed and how its performance is ultimately affected.

- **Motivational Factors**

The research work in DRDO requires knowledge and skill-set of many allied fields. Since no university or institute can offer degree courses perfectly suited to completely cover the vast technology and knowledge requirements of DRDO, scientists must gain it after completing basic graduation and joining DRDO. Thus middle and lower management, as well as other officers and staff working under them need to be motivated to study and gain knowledge in the fields not directly related to their academic qualification.

The issue of the younger generation not seeing bright careers in DRDO in spite of having challenging projects needs to be analysed through leadership issues. Leaders need to share success equally between project group as well as support service groups and showcase open communication between the two types of groups – giving credit where it is deserving can be a very big incentive.

- **Environmental Pressures**

The scientists are seen to be pressurised about completing the administrative documentation of the project. This type of non-focused environment may not be conducive for the focus required for research.

Patenting and publications by the scientists are viewed as more of individual growth vehicles and not really as value addition to the projects or to the entire organisation. Young scientists have little to emulate in this field even though all echelons realise the need to promote this culture. The incentive for the patenting and publication do not seem to be working.

Homogeneous Thinking

The variation of outlook is homogeneous across all echelons for all CSFs. This could be seen during the numerical analysis of all the CSFs. Please see figure 1. The similarity in thinking and outlook across the different echelons of decision-making tells a compelling picture of a strong culture and ethos in the DRDO organisation.

The strong culture can be effectively leveraged by the policy makers in the MoD for bringing about the necessary changes required as per the insight gained through this study, through judicious interventions. This kind of ethos is created through strong inter-personal bonding. This can be an asset while managing projects.

Conclusion

DRDO as a premium defence R&D organisation under MoD has significant stakes in projecting comprehensive national power of India. With this as the background, this

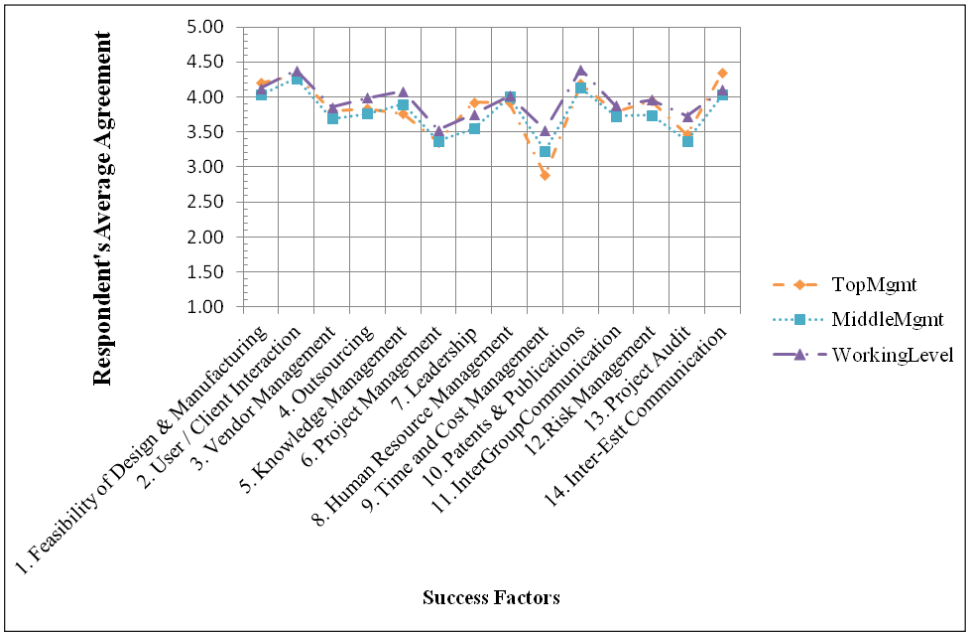

Figure 1: Comparison of Management Perspectives about Working Environment

study using primary data is probably the first of its kind that provides deep insight in the culture and working environment of the organisation. It clears the haze existing with regards to its working, in the minds of the common public and services alike. What emerges from the study is that with the right interventions, the organisation has excellent potential to become a global player in the strategic R&D field.

In the present context, the responsibility to provide the right environment for project completion rests squarely with the top most echelon of the organisation. The scientists are a well motivated group of personnel that need some strong leadership to emulate. Their undue focus on administrative matters is unwarranted and it would be better if they are freed from some of these encumbrances. Having said this, it is also essential that a stage-gate type of product audit become a norm and scientists are actually trained on quantitative project management techniques and these are implemented during the stage-gate audits.

The time and cost overruns of DRDO projects are well reported and cited in several texts and that was the main background reason for conducting this study. However, this study is the first time that the actual rationale for avoiding these overruns for most DRDO projects is clearly in sight. A bottom-up approach that involves the project team when the projects are taken up for consideration, would generate the sense of involvement so necessary for getting a buy-in. This approach would ensure that the objectives are set in consultation with the team who is to meet them.

All the CSFs described earlier do play a role but in varying degrees in ensuring a successful completion of the R&D projects. The priority of implementation of interventions is dependent on the relative weightage that is given to each of them by the scientists across the entire spectrum. It is easier to prioritise as for almost all the CSFs the thinking is same across the hierarchy. It would be better that such a study is conducted in at least couple of other labs that deal with different systems and the results validated for deciding pan-organisation interventions. These kind of studies are of utmost importance for planning the focus areas of policy formulations too.

Notes

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