IMPACT: International Journal of Research in Business Management (IMPACT: IJRBM)
ISSN (P): 2347-4572; ISSN (E): 2321-886X
Vol. 7, Issue 2, Feb 2019, 31-38

AN APPROACH TO KNOWLEDGE MANAGEMENT IN MILITARY AIRCRAFT DEVELOPMENT PROJECT

Devendra Singh[1] & B. Ashok[2]

[1]Research Scholar, Aeronautical Development Agency, Bangalore, Karnataka, India

[2]Research Scholar Guide, Aeronautical Development Agency, Bangalore, Karnataka, India

Received: 21 Feb 2019 **Accepted:** 25 Feb 2019 **Published:** 28 Feb 2019

ABSTRACT

Knowledge Management (KM) has become the most critical factor in military technology development and sustainability. KM has a profound impact on the performance of individuals and the organizations. In the current global scenario of highly restricted military environment, KM is a key resource, which needs to be protected, cultivated and shared with the right people at right time. The aim of this paper is to present KM strategy for its effective utilization in military aircraft development projects. KM strategy and elements have been discussed along with single view management framework. An integrated knowledge management system is elaborated with matrix multiplication. Decision Support System dashboard with KM elements will ensure optimization of resources and timely completion of the project within the stipulated timelines and budget provisions.

KEYWORDS: *Knowledge Management, Carrier Based Fighter Aircraft, Shore Based Test Facility, Single View Management Framework, KM Strategy and Elements, Integrated Knowledge Management System*

INTRODUCTION

Technology management has acquired extremely critical importance in military warfare around the world due to trade globalization, deregulation and new political alignment. The speed, scale, and skill, coupled with flexibility and precision, has become paramount to dominate the military environment. Currently, defense aerospace is facing both disruptive and transformational challenges to improve performance. The Knowledge Management (KM) plays a crucial role to fulfill the newly envisaged ever-changing requirements. Suitably customized defense aerospace services and solutions have become essential to succeed.

KM essentially means creating a system for feeding the right information to the right person at right time. This may look simple but practicing itin real time business environment involves a tool to store past data, experience, intuition values and context in system compatible format and conveying to the right person in user-friendly and interactive manner. In this paper, an attempt is made to share the experience of creating a workable KM framework, for use in military aircraft development, in successful project completion of Shore Based Test Facility (SBTF) [2,3], which is developed and built to undertake flight testing of Carrier-Based Fighter (CBF) Aircraft.

BASIC FRAMEWORK

Military Aircraft development is technically and managerially complex task and traditionally focuses on efficient Work Breakdown Structure (WBS) to ensure that the overall project is organized in simpler and manageable subtasks. It is a hierarchical decomposition of work with a deliverable oriented approach for the smooth completion of project. To achieve efficient WBS, it is crucial that the domain knowledge expertise is taken into consideration. Thus, the KM occupies paramount importance. The technical design and project management are two key elements of military Aircraft development. The technical design aspect is covered by expert departments, for example, mechanical systems, avionics systems, propulsion, structures, quality assurance, flight control design and flight test team etc. Project management experts monitor and ensure execution of the tasks to meet project objectives within timelines and allocated budget provisions. Additionally, efficient administration of material, men and money are adequately supported by the experts with a high degree of domain knowledge.

The cardinal principles are used for SBTF project with a focus on knowledge management. SBTF was technically and managerially challenging task and about 25 International and domestic stakeholders were involved [2,3]. Under such circumstances, implementation of proper KM tools ensured that the SBTF project was successfully completed within the defined timelines and funding. A large number of sub-tasks had commonality across varying specialization, for example, statutory requirements, international budget management coupled with the multi-cultural workforce, emphasizing, judicious usage of KM tools [5,6]. Under such special circumstances, certain work methods, designs, management process captured as KM were updated and modified to suit special needs. The concept of 3Rs - Reduce, Reuse and Recycle, was extensively-followed for work efficiency in KM for SBTF project, thus collective efforts made larger and considerable impact on SBTF project completion. The approach to complex tasks in the SBTF project ensured that all the best practices were followed and regularly updated, thus improving the operational efficiency. This will directly address the challenges that face military aerospace now and in the future. The most difficult part of translating individual knowledge and skills into organizational knowledge was also accomplished towards larger knowledge management. The successful completion of the SBTF project validates this concept.

PROBLEM DEFINITION

Development of military aircraft and SBTF project needs four critical components of knowledge assets as experiential knowledge, conceptual knowledge, routine knowledge and systemic knowledge [5,6]. It was meticulously planned to store, transfer, share, apply and capitalize knowledge of experts in SBTF project, as the participants were large in number and were widely spread across, both internationally and domestically [2,3]. An easily understood problem definition has arrived in consultation with all the stakeholders with a clearly defined purpose, scope, process, participants and utility. A successful KM model was designed with key drivers. Using the successful accomplishment of SBTF project, important KM elements have been kept in the repository with the scheme to reuse of KM elements. On this basis, the Problem Definition was – To find optimal method of capturing both tangible and intangible knowledge into the organization and make it available to the right person and the right time. The entire Knowledge-base being sliced and diced into manageable functional units so as to Maximize 3R's.

Knowledge Management (km): Strategy and Elements

In today's dynamic world order, the KM has gathered immense importance for the organizations and individuals and has become a strategic asset for military Aircraft development. KM approach will ensure the timely and successful development of Aircraft asset for combat use by the Nation, in time bound manner. The strategic view of KM will consider synergy between technology and behavioral issues of the organization, in the uncertain and restrictive military environment. In the new military business world, the essence of development is on uncertainty and unpredictability, and dynamic alignment with changing sustainability considerations by the Nation. Continuous and ongoing renewal of KM concept of 3Rs-Reduce, Reuse and Recycle, with focus on information technology and creative capacity of the human resource, is essential to remain relevant in the niche area of Aircraft development to anticipate future opportunities and threats.

It is necessary to build knowledge linked military Aircraft development strategy with carefully identified knowledge elements [5]. The model of strategy and knowledge link is depicted in Figure 1.

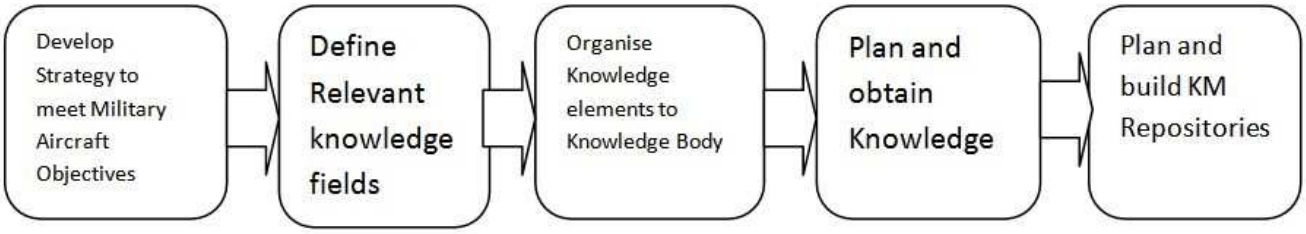

Figure 1: Strategy and Knowledge Links

Some key knowledge elements relevant to military Aircraft development are as follows:-

- Knowledge for efficient Management of Resources
- Process Knowledge and Maps
- People knowledge on process improvement
- Best Practices and Benchmarks
- R&D and Design knowledge
- Requirement knowledge
- Quality Assurance process knowledge

All the above elements are crucial for the successful completion of military Aircraft development and are judiciously implemented for successful SBTF project. SBTF being large scale project was incredibly complex. There being international

partners, widely spread with different types of management, simultaneous implementation and progress of various sub-tasks as per WBS, was greatly challenging, compounded by language barrier [2,3]. Smaller work modules based on knowledge management were derived so as to dovetail into the overall project planning. The WBS was simplified with a larger number of ship construction and equipment manufacturing activities with process knowledge. The expert domain knowledge of Individuals, from all the international and domestic stakeholders, was used towards improvisation of the process. Uncertainty in specialized construction work was given special attention, being the first ever such activity in India. SBTF project being joint cooperation with Russian Agencies received knowledge base of best practices and bench marking from stake-holders. SBTF project is a unique military asset and India is only the third Country in the world to build it, after USA and Russia. The tacit knowledge of SBTF and explicit knowledge of technology, material, R&D, design concepts and production of each and every stakeholder was key to knowledge management. The SBTF project team comprised of best organizational and individual knowledge. SBTF project is key support facility for Carrier-Based Fighter (CBF) flight testing. Thus, requirement knowledge of specifications were meticulously drawn in consultation with a large number of individuals and organizations, having expert knowledge in military Aircraft and Carrier operational exploitation. In-depth knowledge and best quality assurance process were adopted at every stage, to ensure successful completion of the project without compromising the flight safety of aircraft and ship.

Single View Management Framework

The military Aircraft development is a complex and expensive process. The success of the project is dictated by the maturity of technological level and usage of efficient management tools. The incredible scale of aircraft development complexity makes it essential to have a clear cut management structure to ensure simplicity of monitoring. In view of the critical nature of the project, Salapatas, James N, the concept of Nine Elements was utilized for SBTF project management [1]. Instead of having numerous benchmarks which could dilute the main focus, following the model of nine interrelated elements was adopted, as a Single View management framework. This concept was utilized for project planning, execution and monitoring.

- Defined life cycle and milestones
- Stable requirements and scope
- Defined organization, systems, and roles
- Quality Assurance
- Planned commitments
- Tracking and variance analysis
- Corrective action decisions

- Escalation and issue management
- Work authorization and change control

For executive summary and single view Decision Support System, the daily milestones were binary, in the form of Yes or No, in Luminescent Red color, so as to draw attention. Further drill down feature would have reasons and, still, further deep drill down would have key lessons learned which would be integrated with knowledge repository. The milestones can be reviewed fortnightly, monthly, quarterly or yearly. The data generated will help the creation and expansion of repository and self-learning. The dashboard screenshot on Decision Support System for three elements is indicated in Figure 1, however same can be expanded for all the elements for integrated knowledge management view also.

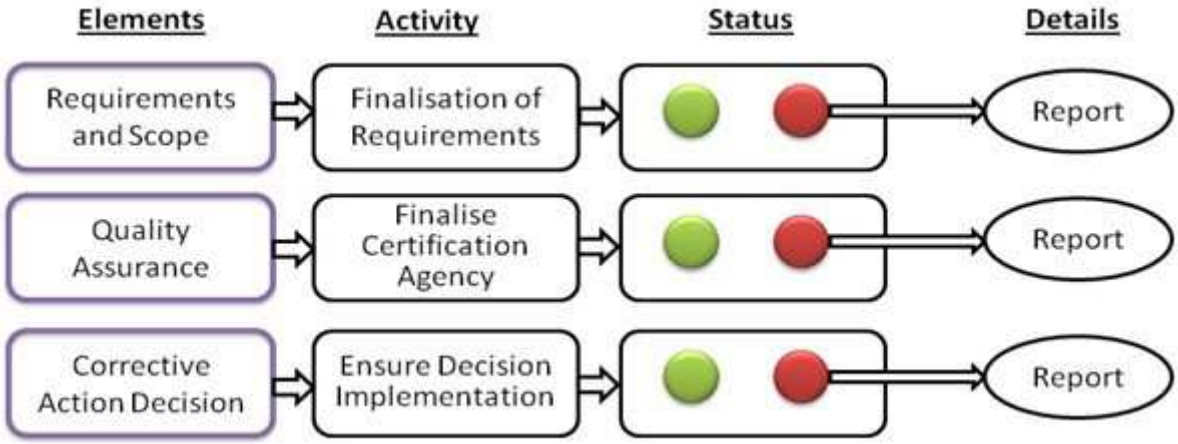

Figure 2: Decision Support System Dash Board Screen

The complexity of the SBTF project included concept design, readiness analysis, cost estimates, cost-benefit analysis, material plan, execution and monitoring mechanism, and risk management. The availability of expertise, maturity of technology and overall confidence level for military Aircraft development is key to success. Execution plan along with WBS and strict review mechanism is essential to ensure timeline compliance within the budget. The design, manufacturing and build-up aspects need constant and rigorous monitoring. The techno-commercial management in military Aircraft development field is extremely critical and essential for the success of the project.

INTEGRATED KNOWLEDGE MANAGEMENT SYSTEM

The military aerospace across the world is growing in competition in the scale of range and volume in a cost-effective manner. Thus, it has become imperative to preserve cost-effectiveness of the skills and capacity to ensure the best possible military Aircraft in the least possible time and budget. Knowledge Management (KM) coupled with the latest management tools has gained center stage for effectiveness. The spiraling cost and scare availability of human asset have laid to greater reliance on KM. In the current scenario of politically multi-polar global sustainability, fewer people with the right expertise are available. Thus, it becomes paramount to have integrated KM system to develop military Aircraft within the defined lines

of time and budget to prepare Country to face adversaries.

An integrated approachfor the SBTF project was prepared to keep in mind key elements of management and knowledge. The concept was used to plan WBS, execution, and monitoring with the relative importance of each element. The relative importance and correlation scale for each element were defined for the availability of expertise, a maturity of the technology, uncertainty and such other factors applicable to a particular element. Various elements of KM and single view management framework is indicated in Table 1 and 2. The scale for relative importance and correlation for KM elements and management elements are graded on the scale of relative importance and used for matrix multiplication.

Table 1: Knowledge Management Elements

S. No	KM Element	Symbol
1	Knowledge for efficient Management of Resources	ke1
2	Process Knowledge and Maps	ke2
3	People knowledge on process improvement	ke3
4	Best Practices and Benchmarks	ke4
5	Quality Assurance process knowledge	ke7

Table 2: Single View Management Elements

S.No	Management Element	Symbol
1	Defined life cycle and milestones	me1
2	Stable requirements and scope	me2
3	Defined organization, systems, and roles	me3
4	Quality Assurance	me4
5	Planned commitments	me5
6	Tracking and variance analysis	me6
7	Corrective action decisions	me7
8	Escalation and issue management	me8
9	Work authorization and change control	me9

The Matrix multiplication between the knowledge elements and management elements would give a single view relative scale of importance [4]. Same is indicated in Figure 2 below. Mathematically both Knowledge and management elements must be equal to perform matrix multiplication. If not, redundant matching elements can be introduced by giving a low dummy value.

CONCEPT VALIDATION

The above concept can be successfully validated by the following metrics:-

$$\begin{bmatrix} ke1 \\ ke2 \\ ke3 \\ ke4 \\ ke5 \\ ke6 \\ ke7 \end{bmatrix} \times \begin{bmatrix} me1 & me2 & me3 & me4 & me5 & me6 & me7 & me8 & me9 \end{bmatrix}$$

Figure 3: Matrix Multiplication of Elements

- a) The success of the project by measuring the gap between original goals and actually achieved.
- b) A test to show that the organization has become self-learning by measuring the outputs of the work and increasingly complex jobs handled.
- c) User satisfaction survey which demonstrates quicker job learning and reduced search time.

The project has been successful and achieved within the targeted time. And it requires large years and decades of observation to judge if the organization has become self -learning organization. Hence was not attempted. All users surveyed were unanimous that they had lots of apriori knowledge of the job and reduced search time for solutions to an everyday problem. Hence it can be said that at least to a limited extent this concept has been validated.

CONCLUSIONS

The paper presents the concept of an integrated approach for large scale complex military aircraft development project. It emphasises the correlation between KM elements and single view management elements. The concept analysis is carried out with a successfully completed SBTF project and validated for utilization aircraft development time compression requirements.

REFERENCES

1. *(Salapatas, J. N. (2000). Best practices—The Nine Elements to Success. Paper presented at Project Management Institute Annual Seminars & Symposium, Houston, TX. Newtown Square, PA: Project Management Institute.*
2. *Aeronautical Development Agency, Bangalore (2013,2015)- Pamphlet prepared and distributed for "Shore Based Test Facility"*
3. *Devendra Singh (2015) Project Shore Base Test Facility (SBTF), Goa Journal Article, pp 46 to 49, Published in AeSI Journal during 66th AGM and Seminar during 5-6 Jun 2015*

4. *C R Kothari (2003) -Research Methodology – Methods and Techniques, ISBN 81-7328036-3*
5. *Waman S Jawadkar (2015)- Knowledge Management- Text & Cases, ISBN(13) 978-0-07-070086-4*
6. *Donald Hislop (2014)- Knowledge Management in Organisations - a critical introduction, ISBN 978-0-19-870309-9*