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Life Cycle Sustainment: A Critical Attribute For Defence Procurement

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Abstract: Procurement of a timely and reliable war-critical weapon system is extremely important for any defence forces to build up their combat potential. But it does not end there. The procured system must continue to deliver its stated performance under various climatic conditions and over varied geographical terrains. The cost associated with sustaining such complex weapon systems adds another dimension during the procurement.

Improved operational readiness would be one of the most critical factors to achieve operational excellence, and operational readiness can only be achieved through improved operational effectiveness of our equipment. High reliability in equipment is certainly a desirable function, but so is maintainability and excellent logistic support. A Life-Cycle Sustainment Plan (LCSP) is required to be developed for each capital equipment to be procured henceforth, and included as a part of the acquisition strategy.

Index Terms - Life Cycle Sustainment, System Approach, Total Cost of Ownership, Operational Readiness, Reliability

I. INTRODUCTION

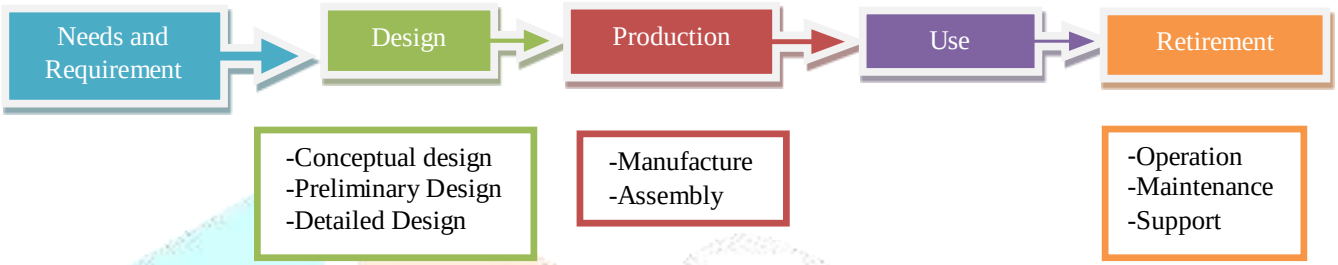
Ever since the Industrial Revolution, customers have always demanded better but economical products and wanted to ensure that they were getting value for money. Today's customers are no different. They want infinite performance of a product at minimum life cycle cost and with 100% availability from the day of delivery till it is disposed of. Now the onus is on the manufacturer to meet these extreme requirements as far as possible or, at the very least, to meet them better than their competitors do. Today, a piece of equipment is designed and manufactured to perform its stated function, and every customer would like the equipment to maintain its functionality until it has fulfilled its purpose over its stipulated life. Moreover, this objective is to be achieved with minimum maintenance, in minimum time, with minimum disruption to operation, requiring minimum support and expenditure. This constitutes the very concept of life cycle sustainment management.

The operational phase of any complex equipment, viz., Tanks, Guns, aircraft, Missiles, Radars, etc., is like an orchestra involving many agencies and different players carrying out a set of interconnected activities to achieve maximum effectiveness. But underlying all these operations, there are certain inherent characteristics (design parameters) of the product that play a crucial role in achieving overall effectiveness. Indian Army spends a lot of money every year as a direct consequence of procuring less reliable equipment (because of L_1 Vendor syndrome) and their inadequate maintainability and poor supportability. Failure to

ensure high reliability, maintainability and supportability of critical equipment can prove costly during War. Therefore, to ensure a Maintenance and Failure-free Operating Period (MFOP), we need effective sustainment management.

II. LIFE CYCLE OF A SYSTEM

Fundamental to any engineering design practice is an understanding of the cycle, which the product goes through during its life. The life cycle begins at the moment when an idea of a new system is born and finishes when the system is safely disposed of. In other words, the life cycle begins with the identification of the needs and extends through planning, research, design, production, evaluation, operation, maintenance, support and its ultimate phase out.



III. WHAT IS LIFE CYCLE SUSTAINMENT?

Life cycle sustainment involves the supportability of operational systems from the initial procurement to disposal. It assures the right balance between performance and overall product affordability by taking into account sustainment as part of design and development to optimise cost. Sustainment activities include design for maintainability, application of built-in test facility, diagnostics, prognostics and other condition-based maintenance techniques, implementation of logistics footprint reduction strategies, identification of technology insertion opportunities, identification of operations and support cost reduction opportunities and monitoring of key support metrics. Therefore, sustainment is a key task that influences product and service performance and support cost for the entire life cycle.

IV. APPROACHES TO LIFE CYCLE SUSTAINMENT

4.1. **System Approach**.

As a sustainment strategy, there is a requirement to undertake a system approach by considering all aspects of the equipment being fielded, including its role and the agencies involved in performing the activities of equipment management.

4.2. **Life Cycle Cost (LCC)/Total Cost of Ownership (TCO)**.

The actual procurement cost of the equipment is just a small portion of the LCC/TCO, and hence, we need to develop a strategy to reduce the LCC/TCO. As a sustainment measure, LCC/TCO need to be modelled at the procurement stage itself.

4.3. **Reliability**.

Correctly weighing the degree of reliability that needs to be incorporated in the equipment is important, as the degree of reliability has a direct bearing on cost.

4.4. **Maintainability**.

Maintainability is a design function and, therefore, needs to be given due emphasis in the design stage itself to achieve a high degree of sustainability.

4.5. **Standardisation**.

The aspect of standardisation is very critical for long-term sustainability and in reducing LCC, as it helps us manage inventory effectively and reduce repair time considerably.

4.6. **Value Engineering**.

Value engineering is aimed at identifying unnecessary costs involved in a product without sacrificing the required performance standards. This approach should be utilised to analyse operations, systems, methods, equipment and supplies to achieve the prescribed function at the lowest total cost.

4.7. **Value Analysis**.

While value engineering applies to a product in the design and concept stage, value analysis is required to be undertaken for equipment that is already in service.

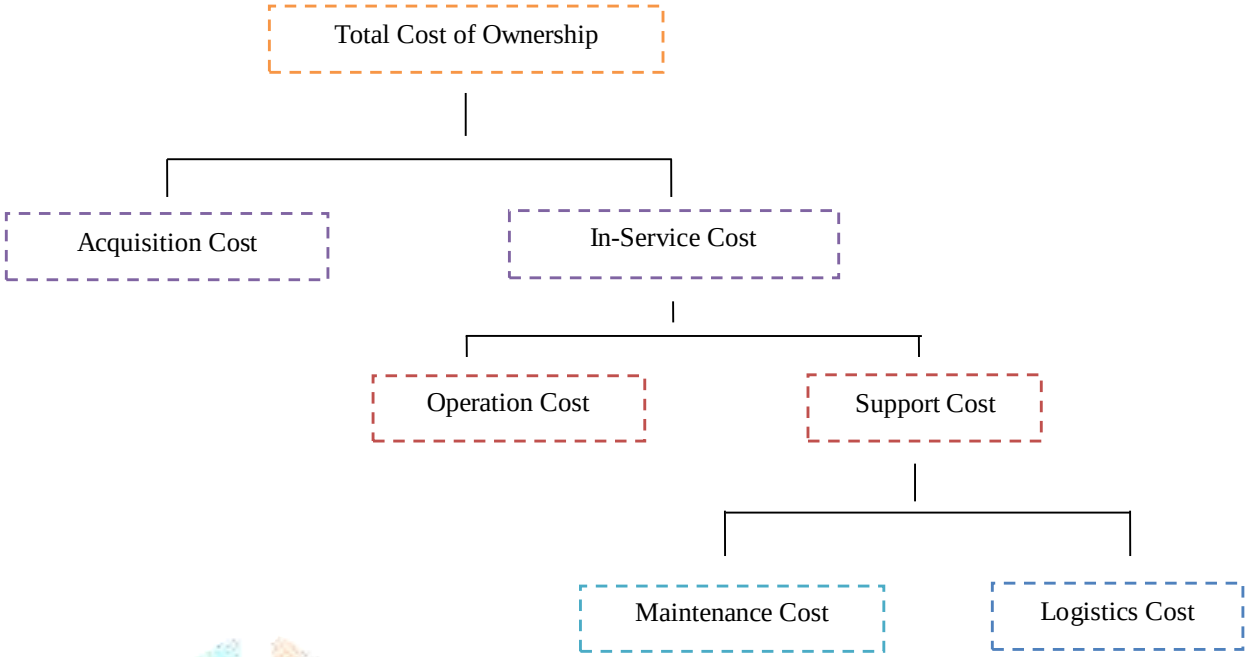
4.8. **Availability**.

Assured availability of spares and technical skill need to be viewed in a long-term perspective so as to ensure operational availability of the equipment.

V. RECOMMENDATIONS TO ENSURE EFFECTIVE LIFE CYCLE SUSTAINMENT

5.1. **Total Cost of Ownership (TCO)**.

The cost of ownership approach identifies all future costs and reduces them to their present value by use of the discounting techniques through which the economic worth of a product or product options can be assessed.



$$TCO = C_P + C_O + C_M + C_L + C_{MF}$$

Where,

TCO = Total cost of ownership of equipment over its designed life.

Cp = Total procurement cost.

Co = Total operating cost.

C_M = Total maintenance cost, which includes the cost of corrective maintenance, preventive maintenance and overhaul.

C_L = Total logistics cost

C_{MF} = One-time expenses of maintenance and support equipment.

Approximately 80% of the total life cycle cost is spent during operation and maintenance of the weapon system. The decision to purchase any capital equipment must be based on its total cost of ownership rather than the existing practice of procurement based on the initial purchase price. In recent years, TCO has become a part of strategic cost management, and the concept can be applied for effective procurement of defence equipment. It provides an insight into the total cost of acquisition and sustenance and thus effectively supports decision-making in the evaluation of various alternatives.

5.2. **Performance-Based Logistics (PBL)**.

PBL is a strategy for weapon system procurement and sustenance by setting specific performance targets to optimise system readiness. The current procurement strategies have failed to improve performance. PBL is the purchase of logistic support as an integrated, affordable, performance package designed to optimise system readiness and meet performance goals for a weapon system. The PBL arrangements have resulted in multiple benefits, including significant cost savings, increased weapons

availability, reduced customer wait times and smaller logistic footprints. But it would require multiple performance metrics viz., operational availability, operational reliability, total cost of ownership, logistic footprint and logistics response time.

5.3. **Terotechnology**.

"Terotechnology" means "to look after", "to guard over", "to take care of". Terotechnology is a combination of management, financial, engineering and other practices applied to physical assets in pursuit of economic life cycle costs. It is a multi-disciplinary concept and takes into account all aspects of equipment from design to discard, viz., design, manufacture, installation, commissioning, maintenance and removal of plant/equipment. This concept grew from the study of maintenance practices and is synonymous with total maintenance.

5.4. **Single Point Accountability**.

Presently, the responsibility of procuring capital assets and their sustainment generally remains with two different agencies. The involvement of multiple agencies may result in fragmented accountability to a certain extent and inadequate response from the Vendors in the post-warranty period. This has been a major factor in making the present system of equipment management sub-optimal. However, to achieve effective life cycle sustainment, it is recommended that both the acquisition and sustainment authorities be integrated and a single point of accountability be established.

VI. CONCLUSION

Although, the "hole in the wall" concept is gaining popularity in the outside World, where the only maintenance task the operator performs is to remove the Line Replaceable Unit (LRU) and passed through the mythical hole in the wall to the OEM in exchange for a replacement (serviceable) LRU, we, in the Armed Forces, are continuing with the "multi-indenture, multi-echelon" maintenance policy for our equipment. Any System or any component within it can only be in one of two states, i.e., in a state of functioning or that of failure. The transition between these two states can either be effectively instantaneous or gradual. But whatever be the failure function or mode of failures, we need to initiate maintenance action to recover or restore the functionality of the failed component and achieve better availability.

Improved operational readiness would be one of the most critical factors to achieve operational excellence, and operational readiness can only be achieved through improved operational effectiveness of our equipment. High reliability in equipment is certainly a desirable function, but so is maintainability and excellent logistic support. A Life-Cycle Sustainment Plan (LCSP) is required to be developed for each capital equipment to be procured henceforth and included as a part of the acquisition strategy and Defence Procurement Procedure so as to ensure implementation of the Effective Life Cycle Sustainment Strategy.