A Brief Discussion on Product Improvement Strategies

Dr. Narayana Srikanthreddy
Assistant Professor, Department of Management, Presidency University, Bangalore, India,
Email Id-srikanthreddyn@presidencyuniversity.in

ABSTRACT:

The capacity of a product to continuously adapt, develop, and satisfy the changing requirements and expectations of consumers is crucial to a product's success in today's quickly changing technological environment. System engineering is essential to the creation and improvement of complex goods because it allows engineers to fully comprehend a product's lifespan and how it interacts with different subsystems. In order to increase performance and customer happiness, this abstract provides an overview of system engineering product improvement methodologies. The abstract first examines the significance of a structured strategy for product improvement within a framework of system engineering. It emphasises how important it is to combine stakeholder participation, data analysis, and feedback loops to pinpoint areas that may be improved throughout the product lifetime. System engineering is methodical and iterative, allowing for efficient problem-solving and optimisation, ensuring that goods are still competitive and able to meet consumer needs.

KEYWORDS:

Businesses, Customer, Performance, Product Improvement.

I. INTRODUCTION

Businesses that want to improve their services and remain competitive in today's quickly changing market must use product improvement techniques. Companies must constantly develop and enhance their goods to fulfil client expectations and acquire a competitive advantage in a time when consumer wants and tastes are changing quickly. Product improvement techniques use a methodical methodology to identify potential improvement areas and carry out modifications that improve the current product. These tactics include a range of topics, including boosting functionality, taking consumer input into account, upgrading quality, maximising features, and adopting new technology. Organisations may enhance their products and increase customer retention and market share by investing in product improvement. This proactive strategy not only supports long-term success but also increases revenue and customer pleasure [1], [2].

Product enhancement techniques are essential for being relevant and satisfying changing consumer wants in this age of rapid technological innovation. In the parts that follow, we'll look at some typical tactics used by companies to enhance their goods and spur expansion. It looks at several tactics used to promote product improvement. It talks about the idea of continual development and emphasises how important it is for businesses to promote an innovative and learning-oriented culture. Implementing reliable feedback methods, such as user input, field testing, and quality assurance procedures, makes it easier to find product flaws and potential improvement areas. Additionally, methods like failure mode and effect analysis (FMEA), value engineering, and root cause analysis are addressed as useful tools for identifying and resolving possible problems [3], [4].

II. DISCUSSION

Complex systems seldom exhibit static configurations. During a system's life cycle, a requirement for a change might arise from a variety of factors and have countless effects on the configuration. The issue with these modifications is that, in the majority of situations, it is impossible to forecast the kind and timing of these modifications at the outset of system development. As a result, methods of design or strategy have been created to lessen the risk connected to both known and unknowable changes [5], [6].

Effective tactics for improvement may assist manage challenging technical issues connected to:

1. Requirements that are not fully understood at the outset of the programme,
2. The development of technology, which will take longer than most system development;

3. Customer demands that have changed, improved, updated, or are in flux, such as the need to counter a new military threat;
4. Changes in policy, operational philosophy, logistics support philosophy, or other plans or practises from the eight main life cycle function groups result in changes to requirements;
5. The availability of technology that enables the system to operate more efficiently and/or affordably;
6. Potential improvements in maintainability and dependability that reduce the cost of usage, upkeep, or support, such as the creation of new supply sources;

The task of the DoD in the twenty-first century will be to enhance current products and create new ones that are readily upgraded. Given that a weapons system's service life is often in the range of 40 or more years, it is essential that systems be created with an understanding of potential future needs, both anticipated and unanticipated. Future needs might include large rebuilds, adjustments to lower the cost of ownership, or the need for updates to safety, performance, supportability, interface compatibility, or interoperability. The bulk of the post-production operations performed by a systems engineer consist of making these necessary enhancements or fixes [7], [8].

Plans for Product Improvement

Figure 1 illustrates how these tactics differ depending on what stage of the life cycle they are used in. Planned improvements, production or design adjustments, and implemented system upgrades may be classified as the tactics or design approaches that represent these improvement demands.

Intentional Developments

Strategies for planned enhancements include open systems, preplanned product development, and evolutionary acquisition. These tactics may be integrated in a programme development in a complementary manner; they are not mutually exclusive.

Evolutionary Acquisition: In the DoD, evolutionary acquisition is the favoured method for acquiring systems. It is necessary to transfer useful capability from development to the user as quickly as possible while laying the groundwork for further changes to occur at a later time in a world where technology is a quickly changing target and a technically superior force is the key to military superiority. An approach known as evolutionary acquisition establishes the needs for a system's fundamental capabilities with the assumption that the system will be enhanced and improved (evolved) until it satisfies the complete range of user needs [9], [10].

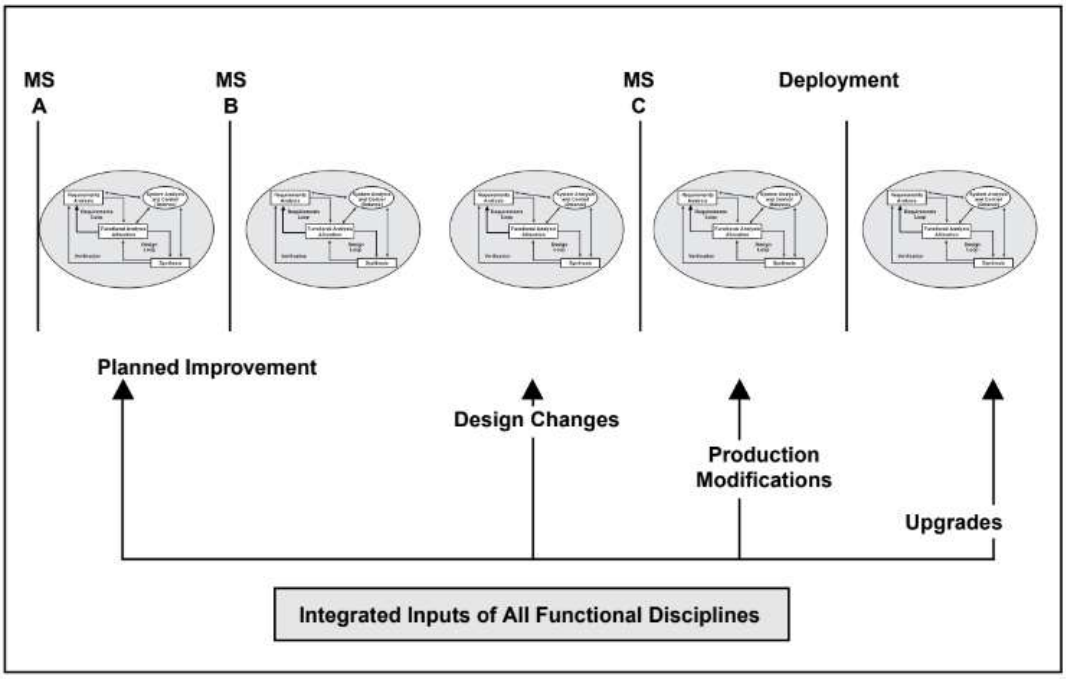

Figure 1: Types of Product Improvement Strategies.

According on user requirement, technological maturity, threat, and budget, the core capability is determined. As needs change and the previously indicated variables allow, the core is then enlarged. The utilisation of time-phased needs and ongoing contact with the ultimate user, which allows criteria to be staged to be met gradually

rather than in the conventional single grand design approach, are essential to accomplishing evolutionary acquisition. Planning for evolutionary acquisition also necessitates that engineering designs be based on open system, modular design ideas that allow for the gradual addition of new increments without having to totally redo and redevelop the system's already-in-service components. Open designs will make it easier to access current technological advancements and will help control costs by leveraging commercial competitiveness in the market. The C4ISR community, whose systems are often evolving over their entire lifecycles, has been using this notion for years.

Improved Product Prioritised (P3I): Preplanned product improvement, also known as P3I, is a good method where needs are clear and well-defined but when limitations (often related to either technology or money) prevent certain system components from being completed on time. P3I is applicable if it is determined that a militarily valuable capability may be deployed as a stopgap measure while the other component is still being developed. The basic strategy is to treat the enhancement as a separate, parallel development; test and deliver the system without the upgrade at first; then, when it becomes ready, demonstrate and give the expanded capabilities. The establishment of clear interface requirements for the system and the improvement is essential to a successful P3I. The initial cost, configuration management effort, and technical complexity associated with P3I use are likely to rise. Some of the factors that go into determining whether it's suitable are shown in Figure 2.

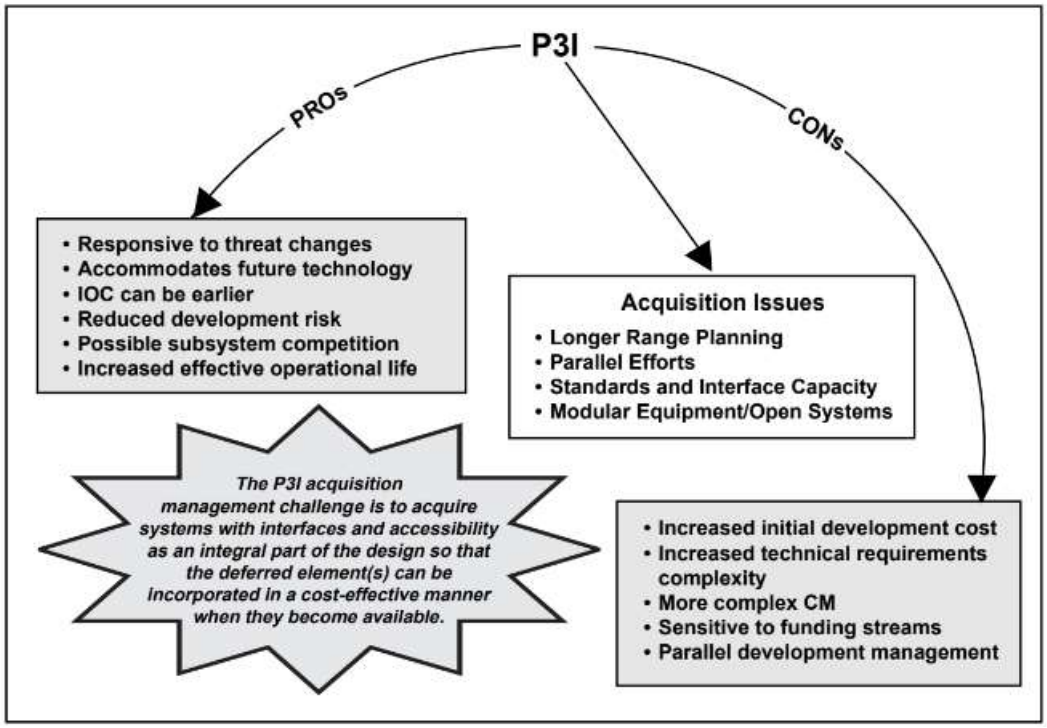

Figure 2: Pre-Planned Product Improvement.

The open system design method employs interface management to provide adaptable user interfaces that allow for the use of competing commercial goods and improve flexibility for future development. Whether the operational requirement is known or unknown, it may be used to plan for future demands when technology is not yet accessible. Using standard interfaces, modularity, acknowledged interface standards, standard components with acknowledged common interfaces, commercial and non-developmental goods, and compartmentalised design, the open systems goal is to build the system such that it is simple to alter. The discussion of open system design techniques continues towards the conclusion of this chapter.

Modifications to Production or Design

Engineering Change Proposals (ECPs): ECPs are often used to initiate changes that are to be applied throughout the development and production of a specific system. Since ECPs, when accepted, modify an established base-line, formal configuration management is responsible for handling changes to the documentation that specifies the system if the requested change is approved (often by a configuration control board). The extent and specifics of these adjustments are governed by ECPs. ECPs may solve a range of demands, such as the rectification of errors, cost reduction, and safety. ECPs may also be assigned different degrees of priority, ranging from regular to

emergency. The Configuration Management Guidance document, MIL-HDBK-61, is a great resource for assistance on matters relating to configuration modifications.

Before deployment, a block change is made in an effort to enhance configuration management by grouping and applying many changes such that they will consistently apply to blocks (or groups) of production items. In comparison to modification that is applied item by item and single change order by single change order, this significantly enhances management and configuration control of comparable things. The life cycle effect of block modifications should be carefully considered. Significant variations in block designs may need the development of distinct manuals, supply documentation, training materials, and constraints on the types of places or tasks to which the system may be allocated.

Upgraded Systems Deployed

A major rebuild is necessary when a system is required that is significantly different from or more complex than the one that is already in place, or when a system is nearing the end of its useful life and has to be preserved. The system will have updated needs in both situations and should be viewed as essentially a new system development. To define and manage configuration baselines for the rebuilt system based on the revised requirements, a new development process should be initiated. Remanufacturing, service-life extension programmes, and system innovations where key components of an earlier system will be reused are examples of major rebuilds. Rebuilding old systems may, in certain situations, significantly lower the cost of a new system; nevertheless, these economies of rebuild can be misleading, and whether to proceed with a rebuild can only be decided after thorough consideration of trade studies. The secret to designing such systems is to keep in mind that they are brand-new systems that need all of the basic- engineering's developmental concerns, the systems engineering process, and life cycle integration. As a system's component become obsolete, product changes are often required to sustain or enhance the system. Although these initiatives often lead to an increase in capabilities, the system continues to fulfil the same fundamental requirement for all practical purposes. Instead of a complete system update, these changes are often distinguished by an upgrade to a component or subsystem.

III. CONCLUSION

In conclusion, product improvement initiatives are essential to a company's performance and ability to compete. These tactics focus on improving current goods or services to satisfy client requirements, outperform the competition, and promote growth. Organisations may raise revenue, foster brand loyalty, and increase consumer pleasure by iteratively enhancing their goods. There are a number of crucial product enhancement techniques that companies may use. To find areas for improvement, one typical strategy is to obtain client feedback and carry out market research. This may include gathering opinions via focus groups, polls, or social media channels, as well as studying client feedback and assistance requests. Businesses may target certain areas for improvement and create solutions that cater to those demands by studying the preferences and pain points of their customers. Another tactic is to spend money on R&D to innovate and add fresh features, innovations, or functionality to current items. This may include making use of technological developments, investigating novel materials or production techniques, or adding cutting-edge design components. Businesses may bring in new clients, keep their current ones, and stand out in the market by consistently pushing the limits of what the product can give.

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