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LIFE CYCLE MANAGEMENT

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Abstract:
The necessity for a methodical, integrated, and comprehensive approach to system acquisition became obvious during last 20 years. Consequently it was important to develop an exhaustive method witch can explain the life cycle needs of a system, from the early beginning until the end, during its life. Lacking this, the product (or systems) performance through life can not be achieved at the expected level. Without a broad understanding of all aspect of life cycle component, a system in use involves spending more money after the acquisition phase than it was intended. Therefore, I think a summary of the concept of Life Cycle Management only provides some clarifications on issues that often are not taken into account when a product is acquired.

Key words: *life cycle management, life cycle cost, process, process planning, concept, NATO.*

1. Introduction

To better understand the life cycle management (LCM) it is necessary to point out what a life cycle of a product means.

Product life cycle (PLC) refers to the average lifespan of a product. The most used comparison is the analogy with biology when products, like living creature, are born, grow, mature and then get older. The whole product life cycle, from project and development to its final withdrawal, includes the following phases: raw material acquisition, manufacturing, packaging, distribution, use, recycling, and product recall from the market, or eventually refurbishing (which can generate another life cycle process).

One of lifecycle definition that refers to all the successive phases of mentioned above concept is : *"The life cycle includes the folowwing phases: conceptualization, development of project ideas, study engineering, process planning, manufacturing, operation, maintenance (repair) and withdrawal "*. [1]

The standard ISO 14040:2006 describes the principles and framework for life cycle concept and the general definition of the product life cycle which is : life cycle *is "consecutive and interlinked stages of a system-product, from raw material acquisition or generation of natural resources to post-use "*.[2]

During life cycle analysis, specialists can identify all potential impact regarding the product, compare one or more aspects of specific products or processes, establish baselines for further exploration, and improve permanently the expectation of the end user. Inside life cycle concept, we can use different tools for the decision-making process. These tools are generally used in conjunction with other tools such as risk assessment, environmental impact assessment etc.

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Product life cycle is highly dependent on the life cycle stages of the system. A life cycle of a product may consist of several phases: 1) concept / vision, 2) feasibility, 3) design / development, 4) production, 5) phasing in use. [3]

In a speech-focused approach, product life cycle stages are, design, engineering, manufacturing, and service. (Fig. 1. **Life cycle**)

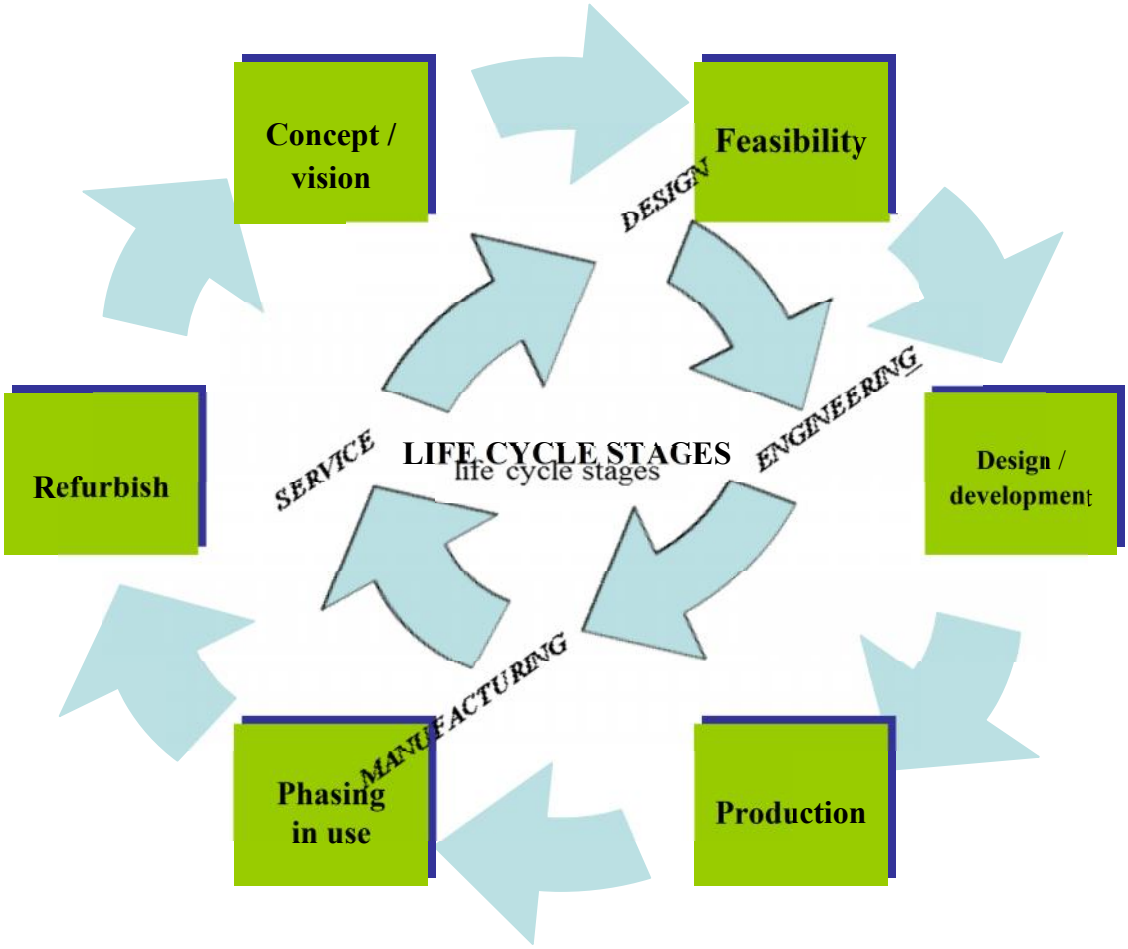

Fig. 1. Life cycle stages

Also in NATO, military specialists conclude that life cycle stages should by divided, estimated, and analyzed separately. Through the AAP-48 Life Cycle Stages and Processes [4], there has been adopted ISO 15288 System Engineering – System Life Cycle Process [5] for dividing the life cycle stages, as presented in **Figure 2.**

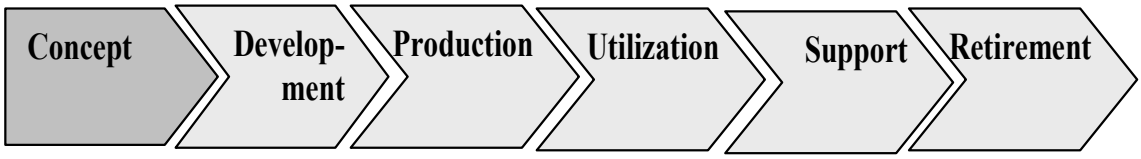

Fig. 2: Life cycle stages

The Life Cycle analysis should be taking into account from the early stages of developing a product, as the greatest opportunities to reduce life cycle costs (LCC) usually occur during the early phases of the programme (as shown in **Figure 3**).

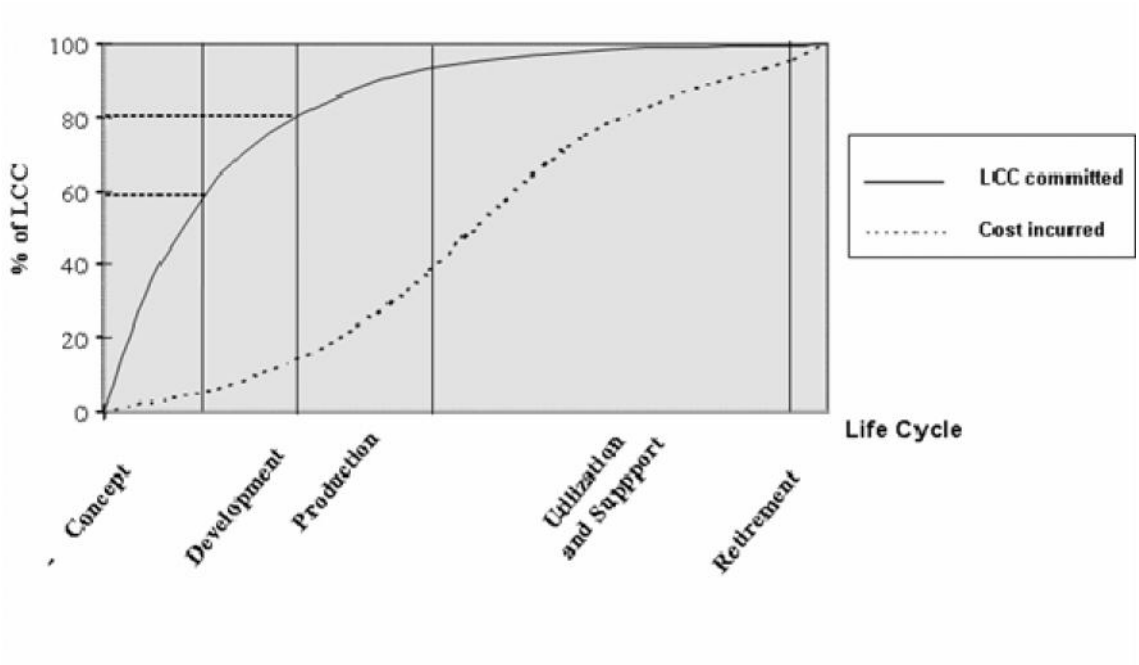

Fig. 3: Tradtional LCC committed Vs incurred cost curve

For a better understanting I consider necesaryy that all this stages should be explained as folows [6]:

Concept Stage *The concept stage starts after the decision to fill a capability gap with a materiel solution and ends with the requirements specification for this materiel solution.*

Development Stage *The development stage is executed to develop a system of interest that meets the user requirements and can be produced, tested, evaluated, operated, supported and retired.*

Production Stage *The production stage is executed to produce or manufacture the product, to test the product and to produce related supporting and enabling systems as needed.*

Utilisation Stage *The utilisation stage is executed to operate the product at the intended operational sites, to deliver the required services with continued operational and cost effectiveness.*

Support Stage *The support stage is executed to provide logistics, maintenance, and support services that enable the continued system of interest in operational and sustainable service. The support stage is completed with the retirement of the system of interest and termination of support services.*

Retirement Stage *The retirement stage provides for the removal of a system of interest and related operational and support services and to operate and support the retirement system itself. This stage begins when a system of interest is taken out of service*. [7]

2. What is Product Life Cycle Management or PLM ?

Product Lifecycle Management as a tool for managing the entire life cycle process, could be defined and understood in various ways. Numerous authorities deliver their own interpretation of PLM, several definition are listed below :

"PLM is a strategic business approach that applies a consistent set of business solutions in support of the collaborative creation, management, dissemination, and use of product definition information across the extended enterprise, and spanning from product concept to end of life-integrating people, processes, business systems, and information. PLM forms the product information backbone for a company and its extended enterprise." [7]

"Product life cycle management or PLM is an all-encompassing approach for innovation, new product development and introduction (NPDI) and product information management from ideation to end of life. PLM Systems as an enabling technology for PLM integrate people, data, processes, and business systems and provide a product information backbone for companies and their extended enterprise." [8]

"The core of PLM (product life cycle management) is in the creations and central management of all product data and the technology used to access this information and knowledge. PLM as a discipline emerged from tools such as CAD, CAM and PDM, but can be viewed as the integration of these tools with methods, people and the processes through all stages of a product's life." [9]

"Product life cycle management is the process of managing product-related design, production, and maintenance information. PLM may also serve as the central repository for secondary information, such as vendor application notes, catalogs, customer feedback, marketing plans, archived project schedules, and other information acquired over the product's life."[[1]] [10]

"It is important to note that PLM is not a definition of a piece, or pieces, of technology. It is a definition of a business approach to solving the problem of managing the complete set of product definition information-creating that information, managing it through its life, and disseminating and using it throughout the lifecycle of the product. PLM is not just a technology, but is an approach in which processes are as important, or more important than data." [8]

"PLM or Product Life cycle Management is a process or system used to manage the data and design process associated with the life of a product from its conception and envisioning through its manufacture, to its retirement and disposal. PLM manages data, people, business processes, manufacturing processes, and anything else pertaining to a product. A PLM system acts as a central information hub for everyone associated with a given product, so a well-managed PLM system can streamline product development and facilitate easier communication among those working on/with a product." [11]

The essential part of PLM (product lifecycle management) is in the conceptions and central management of all product data and the technology used to access this information and knowledge. PLM as a separate discipline occurred from tools such as CAD (Computer Aided Design), CAM (Computer Aided Manufacturing) and PDM (Product Data Management), but can be observed as the combination of these tools with procedures, people and the methods through all stages of a product's life. The entire process consists into a mix between software technology and a business strategy. [12]

The stages described above showed Fig. 4 in into another manner.

Fig. 4 Product Lifecycle Management

This figure tries to present the reality of PLM, which is more complex; people and departments cannot perform their tasks in seclusion and one activity cannot simply finish and the next activity start. [13]

3. Life Cycle Management in NATO

In the military area, especially in NATO, the life cycle approach was brought to attention at the Conference of National Armaments Directors (CNAD) in 2000 [14]. Then the Armaments Directors decided that the life cycle approach should be part of the work of the armaments community in NATO. In 2003, after CNAD reorganization was formed "Life Cycle Management Group" in the CNAD. The principal action of this group was to bring the concept of System Life Cycle Management to NATO. For that, the group invited the North Atlantic Council to support a NATO Policy for System Life Cycle Management. The core of this policy states that ISO/IEC 15288 should became the basis for the improvement of the life cycle approach in NATO capability development. The purpose of this approach consist of a better understanding of the life cycle costs of a system in the decision making process. [15]

This Standard used ISO/IEC TR 19760:2003 that provides guidance for application of the International Standard ISO/IEC 15288 *Systems Engineering - System life cycle processes* in regard to systems and projects irrespective of size and type [16].

The challenge for this initiative is to establish a unitary LCM in NATO. LCM provides a methodology capable to be tailored to specific programs and needs, adapted to

NATO or our nation, in order to deliver complex defense interoperable systems that support required capabilities. Achieving NATO interoperability is a complex challenge in itself. A common methodology, like LCM, facilitates nations being able to work multinational programs. LCM offers the tools and process architecture to deliver defense systems able to meet through life capability requirements.

The NATO Policy on SLCM states*: "the aim of Systems Life Cycle Management is to optimize defense capabilities taking into account performance, cost, schedule, quality, operational environments, integrated logistic support, and obsolescence over the whole life cycle"*[17]. NATO has adopted the System Life Cycle Management (SLCM) approach following the approval by the North Atlantic Council of a NATO Policy for SLCM in January 2006. [18]

The current work in the CNAD is to provide the SLCM implementation "tools" in the form of guidance documents that link acquisition requirements to the system life cycle. In this respect on 26 March 2012 was finished STANAG 4728 (Edition 1) (Ratification Draft 1) – System Life Cycle Management (SLCM) and nations are invited to examine their ratification of the STANAG and, if they have not already done so, advise the NSA of their intention regarding its implementation.[[2]] [19]Also in February 2007 were promulgated NATO System Life Cycle Stages and Processes (AAP 48 Edition 1). All this activity it is also supported by industrial experts through the NATO Industrial Advisory Group, who advise on industrial best practices and experience in SLCM.

AAP-48 needs to be complemented by additional document frameworks (covering for example management, quality, systems engineering), which serve as operational enablers. (Fig. 5) [5]

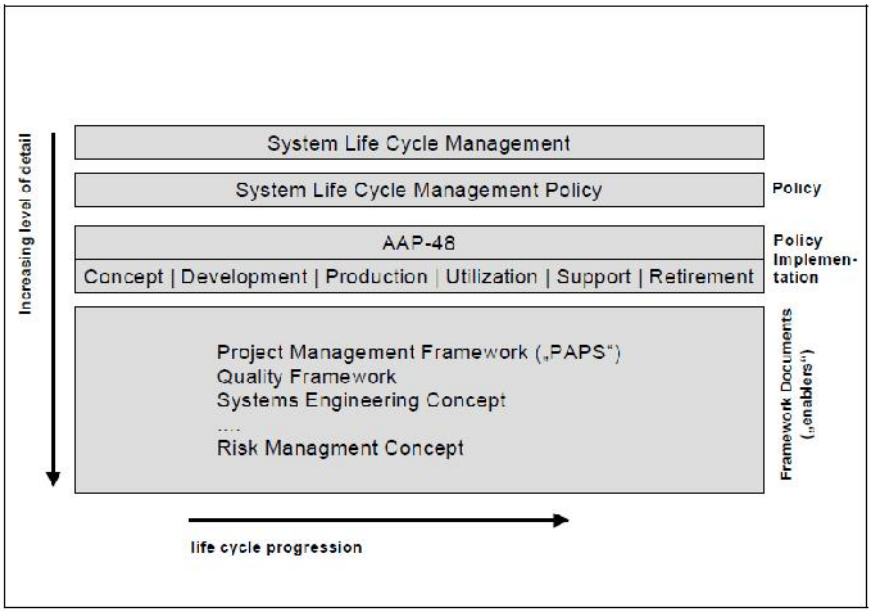

Fig. 5 Systems Engineering – System Life Cycle Processes

The purpose of AAP-48 is to provide guidance for putting into practice the SLCM, which was issued to diminish risk, decrease acquisition times, and to categorize, quantify and control Life Cycle Cost, from the initial possible opportunity. SLCM will assure that the processes used through projects are reliable, coherent, and that there is effective distribution and coordination of resources, information, and technologies. In

addition, SLCM used to achieve the identified stakeholders' requirements and support organizations of attaining customer satisfaction. (Fig. 6) [5]

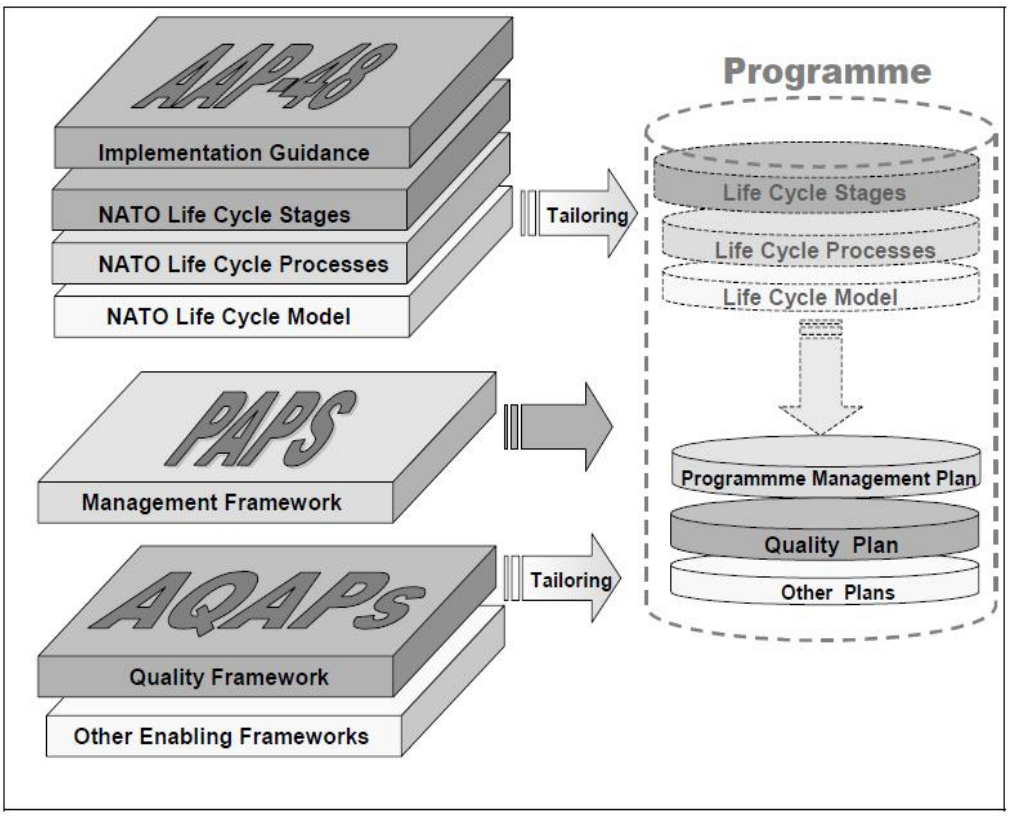

Fig. 6 Utilizing the conceptual framework of SLCM

In accordance with AAP-48, System Life Cycle Management Process assures implemented Life Cycle Management Processes are operational, effective and in accordance with policies and procedures defined by NATO Bodies and NATO Nations. Consequently, Life Cycle Management should:

- Identify the necessary System Life Cycle processes;
- Identify tailoring methods and their acceptance criteria;
- Establish assessment methods/measurements;
- Execute process surveillance and register the measured result;
- Execute trend analysis and propose necessary improvement of the processes.
- Measure process effectiveness

For this is necessary, some inputs consist of:

- Enterprise management decision to implement Life Cycle Management.
- Result from the Enterprise Environmental Management Process.

All this it is only to emphasis the complexity of Life Cycle Management Process without going into details.

4. Conclusion

Life Cycle Management will provide a "whole", joint, and mutual view of the aims of the project, particularly - what and who is it for - and thus guarantee broad purchaser satisfaction. This means that within Life Cycle Management, the purposes of each phase in the life cycle will be defined contributing to that overall accomplishment

and how they need to interrelate. This could be done after a complete and careful analysis which consists of:

- A wide and strong ability for mission analysis witch can look forward in time to recognize and prioritize needs before they become operational problems.
- Flawless long-term visions of the approach in which we expect our product develop.
- A strong capability for investment analysis witch can ensure rigorous and neutral treatment of substitute strategies for filling mission need.

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