

## INTEGRATED COMPUTER SYSTEMS DEDICATED FOR PRODUCTS LIFECYCLE

Vasile POPA \*, Luminita POPA \*\*

\*," National Defence University ,Carol I" Regional Department for Defense Resources, Bucharest, Romania ([vasilepopa2001@yahoo.com](mailto:vasilepopa2001@yahoo.com)), \*\*, "Transilvania" University, Brasov, Romania ([mluminita2001@yahoo.com](mailto:mluminita2001@yahoo.com))

DOI: 10.19062/2247-3173.2016.18.2.39

**Abstract:** *PLM is a comprehensive vision for management of all data related to product design, production, support (service) and final withdrawal from the market of manufactured products. The article is focused on integration between PLM (Product Lifecycle Management) and Enterprise Resource Planning & data management programs (SAP).*

*Thus, were identified the correlation between the elements of integrated information systems (SAP-Systems, Applications and Products) and traceability of finished goods according with customer complaints.*

**Keywords:** *Product Lifecycle Management, Enterprise Resource Planning, SAP-Systems, Applications and Products.*

### 1. PRODUCT LIFECYCLE MANAGEMENT

Product lifecycle management (PLM) is the process of managing the entire lifecycle of the product, from conception, through design and manufacture, to service and market disposal. Product Lifecycle Management integrates people, data, processes and business systems and is the backbone of digital product data for enterprise and extended enterprise. PLM is associated with manufacture, but the management structure can be used for software development and service delivery. PLM concepts were initially placed where safety and control were highly important, namely aerospace, medical devices, military and nuclear industries. In recent years, manufacturers of instruments, industrial machinery, consumer electronics, packaged goods and other complex industrial products have discovered the benefits of PLM solutions and have adopted effective PLM software in increasing numbers. PLM has the next fundamental elements: people, processes and technology (CAD, CAM, CAE, PDM) (Fig. 1)

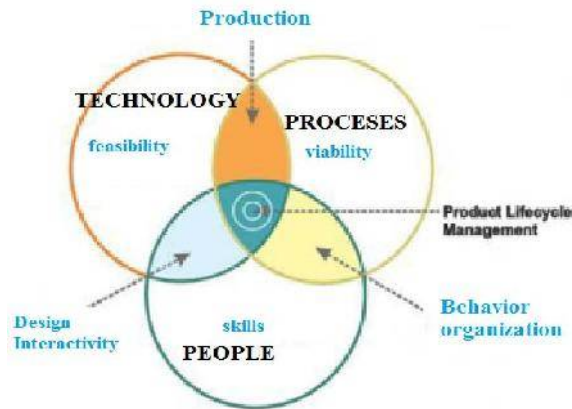


FIG. 1. The PLM Fundamentals elements

A company cannot simply buy PLM as software application, though software technology is essential component, the implementation must take into account all the PLM fundamentals.

Product lifecycle management (PLM) needs to be separated from trade lifecycle management product

While PLM is describing the engineering aspects of the product, from idea generation, to product development and operational life, trade lifecycle management refers only to the product commercial life management on the market, regarding with sales and costs. PLM aim is to include issues related to management and processes information, created and used during the "life" of the product. PLM objectives are to increase revenue on products, to reduce costs associated with products and maximizing the value of its product portfolio. PLM is considered as a part of flexible production model.

In any organization we can distinguish three components: management system; information system; operating system. An information system includes all internal and external information used within the organization and the data that formed the basis for obtaining it, procedures and techniques for obtaining information (based on primary data), dissemination of information and personnel involved in collection, transmission, storage and data processing. The PLM information system has two components: information storage component and information processing component.

The functions of an information system are as following: to collect information from operational and decision-making systems and the information coming from the external environment; to memorize this information as well as information resulting from its processing; to ensure the access to memory in order to communicate the stored information; to process the information at the request of operating system and management system. The concept of information system is linked to the computerization work of the organization, so using hardware and software for organizing and managing information. The use of computers in the information system (IS) of an organization leads to defining the component of the Automated Information System (AIS) – which comprises only the work carried out with the help of computers. The IS-AIS relationship is represented in Fig. 2.

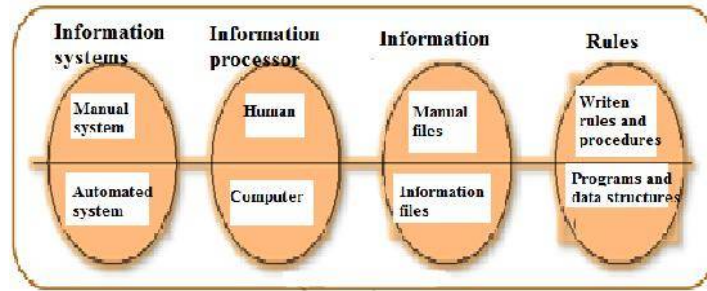


FIG. 2. The IS-AIS relationship (authors contribution)

The software systems for product life-cycle management enable companies to facilitate the control of product life cycles and manage the wide range of information on these products in an efficient manner.

Optimized processes in multiple locations are allowing rapid reaction to changes in market demand. Thus, the right product at the right time will appear on the market at the right price. The PLM software system should be used for coordination of training programs offered on the market to vocational training providers and to control processes and products portfolios offered by these providers, thus facilitating monitoring and optimal viewing of economic processes and products.

On the market were developed many PLM software such as: Teamcenter, Siemens PLM Software; ENOVIA MatrixOne and ENOVIA SmarTeam, Dassault Systems products; SAP PLM; Windchill, PTC product; Oracle PLM; Software as a Service (SaaS) - a software application company Arena Solutions.

In many applications, PLM refers to a set of software tools used for machining, analysis and manufacturing to support products from initial concept, continuing with the distribution and withdrawal from the market. Once assembled from different software, a PLM system will manage specifications and product formulas. PLM will provide a history of production and will follow overall quality of the product. Due to the nature and stages involved in PLM software, it tends to be centered on engineering.

PLM involves the next managerial activities: Document Management; Component Management. Configuration/BOM Management; Classification Management; Change Management; Portfolio Management; Project/Resource Management; Quality & Compliance Management; Requirements Management & Systems Engineering; Workflow/Process Management; Manufacturing Process Management (MPM); Maintenance and Repair Operations Management (MRO); Sourcing & Supply Chain Management.

## 2. SAP (SYSTEMS, APPLICATIONS AND PRODUCTS)

SAP (Systems, Applications and Products) is a German Software Company whose products allow businesses to track customer and business interactions. SAP is especially well-known for its Enterprise Resource Planning and its data management programs.

SAP DP (Systems, Applications & Products in Data Processing) is responsible for the production of software for other companies and organizations with a turnover of over €9 billion in 2006. The SAP program is very complex being helpful in Business, Technology Solutions in areas such as Accounting, Customer Relationship Management, Supply Chain and Procurement, Banking, Insurance, IT Infrastructure and Software Services.

With a strong global brand, SAP is the largest European software producer (generating 39% of software revenues in Europe, Middle East and Africa) and is the only

producer of software in the top 10 largest global players which are not from States United.

### 3. THE CORRELATION BETWEEN THE ELEMENTS OF INTEGRATED INFORMATION SYSTEMS (SAP-SYSTEMS, APPLICATIONS AND PRODUCTS) AND TRACEABILITY OF FINISHED GOODS ACCORDING WITH CUSTOMER COMPLAINTS

**3.1 Customer complaints registration .**Traceability of finished goods is essential for strong companies. Products tracking are a critical feature in the product life cycle management, its can improve the assembly process, eliminating unnecessary processes and materials from manufacturing and to reduce the time required for assembly. A finished product may present visual imperfections or performance out of customer specified tolerance. Where a product is claimed by a client, a notification is created in SAP database as following(Table 1)

Table 1

Internal identification ID	The responsible person
Customer identification ID	Customer and location
Type of complaint	Current Status
Creation date (completion)	General comments.

:

This notification is sent by officials of the company and begins the procedure for investigating the problem:

1. In the first phase the product necessary background information is filled in the *Event Registration* dialog box. (Fig. 3):

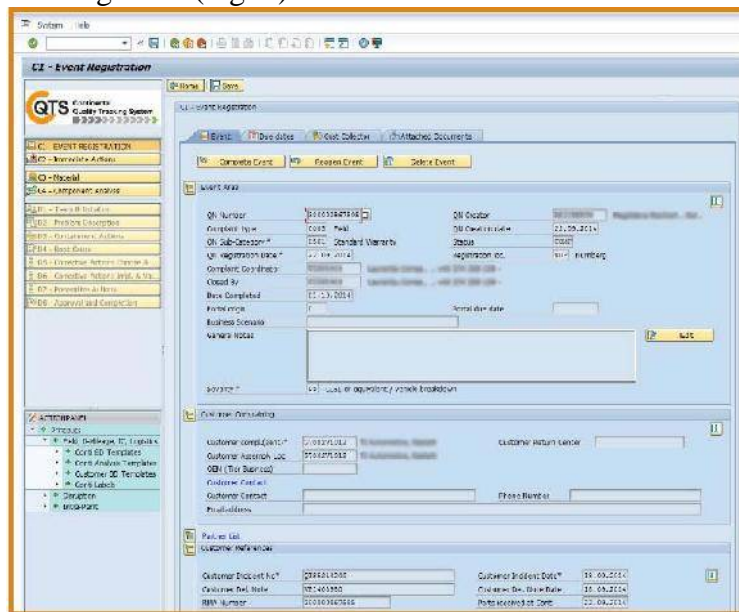


FIG. 3. *Event Registration* dialog box: the necessary background information about the product

**3.2 Immediate Actions** dialog box.- depending on the weight of the complaint (where applicable):If the customer requires immediate action on troubleshooting, the actions are put in the *Immediate Actions* dialog box. The dialog box is filled usually in complex cases. (Fig. 4):

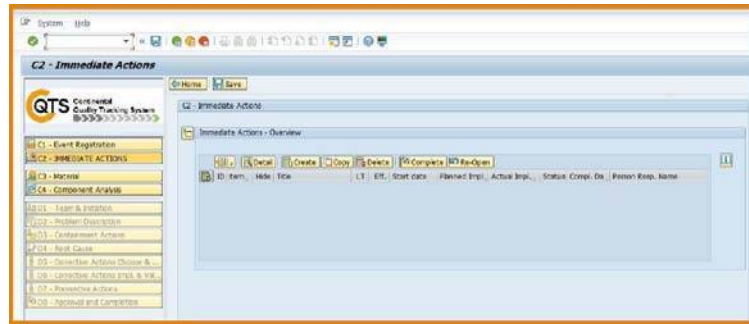


FIG. 4. Immediate actions

### 3.3 Material dialog box

**Material** dialog box will be filled with all the necessary information regarding: **Product:** Internal and external product ID - to identify and track their complaints; Coordinator noncompliance; Product Description (unique identifier code), date and location of manufacture; The number of execution and design review; The date of manufacture.

**Client:** Client ID; The assembly factory; Date of problem notification; Severity / importance; The amount claimed products; Decision: accepted / rejected.

**Description of the problem:** Concrete description of the problem (e.g. Engine Will not start); The used language.

**Vehicle data:** Information about the type of car; Country of origin, date of manufacture; Mileage.

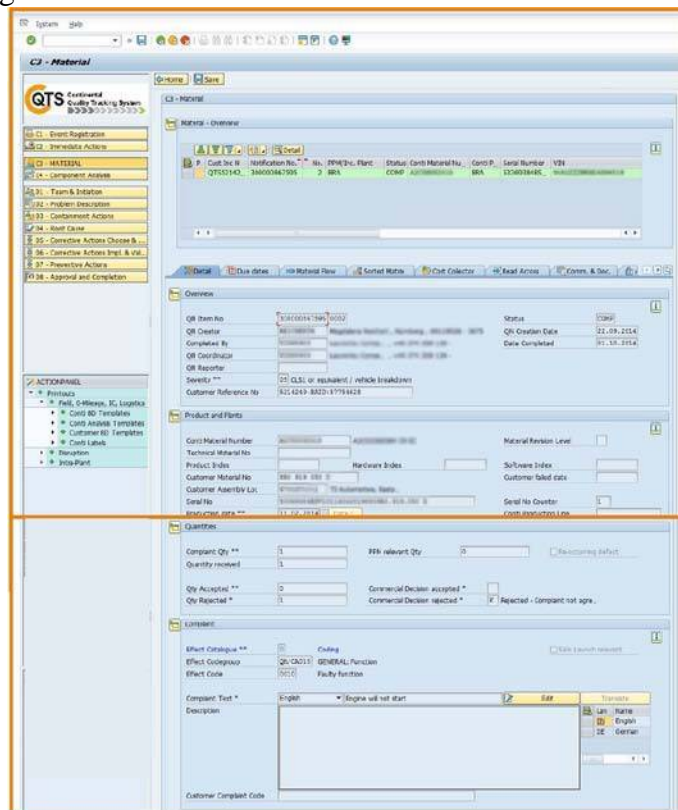


FIG. 5. Material dialog box

**3.4 The components analysis** dialog box will be filled with all product necessary information regarding (Fig. 6): Pre-analyzed – the first checks of the claimed product - usually visual inspection; Final test results (detailed) - description and analysis of

measurements taken (these results will be communicated to the customer); Type of failure.

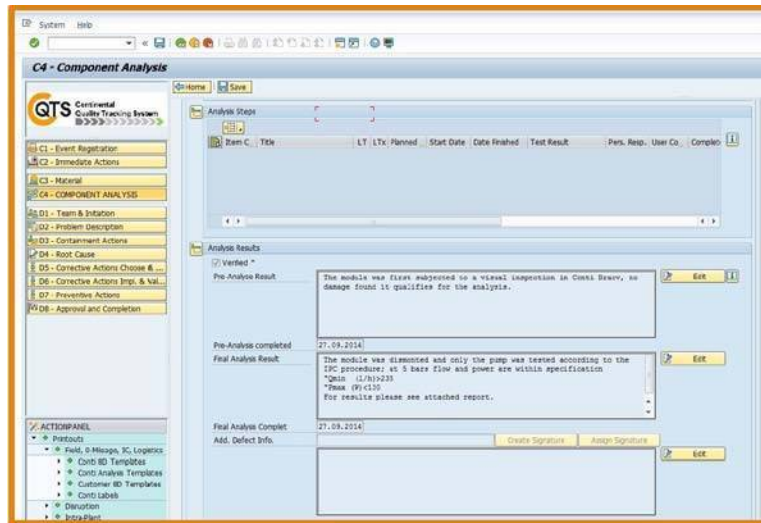


FIG. 6. Components Analysis dialog box

The filling of **Components Analysis** dialog box with the final results of the measurements is taken later. After necessary data collecting, is formed a group (analysis team) that will deal with the complaint. This group usually consists of: author (initialize), champion (with right of approval), specialists, internal members and/ or external members (engineers, laboratory assistants, heads of line, etc. - depending on the complexity of the complaint) - Fig. 7



FIG.7. The analysis team dialog box

### 3.5 Actions and improvements

In an assembly factory, products tracking after manufacture (traceability), product and complaint details are extremely important regarding improvement of assembly processes. Thus, if is known data about the product claimed, a group of professionals can determine the cause of the problem, take corrective and preventive actions in order to eliminate future incidents and problems. Teamwork is inevitable in this situation; the group of specialists has to communicate any information relating to the complaint. The main phases of tests and measures are:

1. **Establishing the root-causes of the problem** arisen (description) is made by filling the next dialog box Fig. 8). Problems can be caused by: the assembly station, operator errors, material errors or incorrect handling of parts. Malfunctions are not always caused at the factory. It happens that parts to be deteriorated during the transport or customer assembly process. These situations are also taken into account and analyzed by the team of specialists.

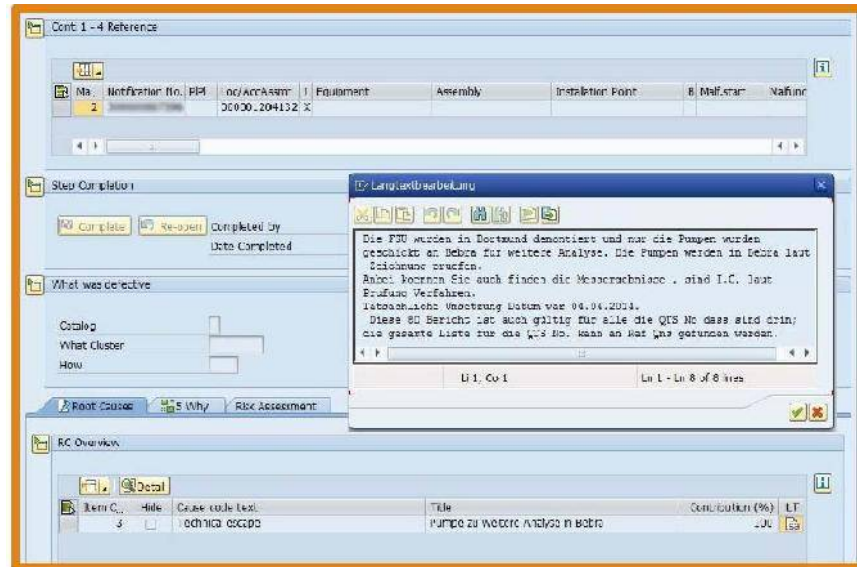


FIG.8. Root Causes of the problem dialog box

2. **Corrective action (testing and implementation):** Measures taken after establishing the causes of the problem may vary. If it is confirmed that the problem is caused after the assembly process, these measures may lead to station or assembly parameters change, warning and retraining of operators, additional checks or even change the finished product characteristics, material used, etc. Action communication to the customer is necessary; in some cases is required customer approval for various measures that can lead to change product performance characteristics (Fig. 9).

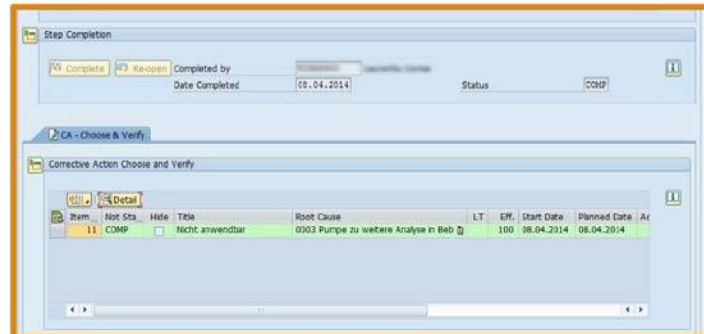


FIG.9. Corrective Actions dialog box

3. **Ensuring customer on eliminating the problem (providing stock):** Once assembly processes changes have been made, depending on the complexity of the problem, the client asks to be provided in terms of actual stock. Sometimes is necessary the parts re-sorting in the factory or customer magazine. These screenings can be made by quality inspectors or other external firms (which leads to additional costs).
4. **Preventive actions:** After eliminating the problem of the assembly process, inspectors create an alert for operators and line heads with the arisen adjustments from analyzes made. These alerts (usually) remain valid for a period of one month and are notified to operators (e.g. Table 2). If during this period we still have errors, the process of investigation opens again.

Table 2 Quality Alert

Quality Alert			
OK Part	NOK Part	<b>Reported on:</b>	04. June 2014
«picture»	«picture»	<b>Valid until:</b>	04. July 2014
Problem description:		«description»	

**5. Approval and completion dialog box (Fig. 10):**

At every complaint there is a leader, a specialist, with the approval rights of changes, communicating the results to his supervisor and to the customer. He is responsible for fixing the problem. A specialist may be a leader for several complaints in the same time.

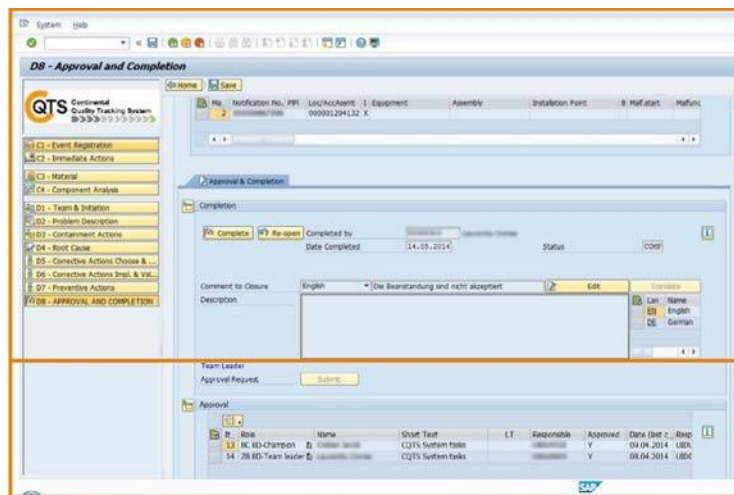


FIG.10. Approval and completion dialog box

**3.5 Response and confirmation:** Corrective actions following improvement processes are communicated to affected customers. If the analyzes it turns out that the problem appeared in the assembly process the complaint is accepted and the root causes will be studied. On the other hand, if damage, such nonconformities occur, for example after transporting or customer assembly process (inadequate assembly process, incorrect handling, etc.) complaint is rejection.

All data (information relating to the analysis, measurements, photos) are stored in the SAP database and are accessible by team analysis.

Observation: This ; “factory and customer” complaints system , is as valid and vice versa, in the case of providers, “supplier and factory” complaints system. Complaints may be initiated by the assembly factory, when misalignments occur on ordered products parts (Fig. 11).



FIG.11. Customer-Supplier Relationship



## CONCLUSIONS

Lifecycle Management Products focuses heavily on embedded computing systems. These dedicated systems to product life cycle are inevitable in the case of multinationals.

They pursue product assembly processes during the entire course: from raw materials to the sale and every day use. Following assembly steps can lead to high product quality, reduced production time, unnecessary costs elimination, etc.

Integrated computer systems are present not only in quality, but also in production (database of drawings, BOM - Bill of Material (components used), assembly processes), research and development, logistics (transport, stock, parts handling), sales (selling and negotiating prices) and purchasing (buying raw materials, negotiation), finance (database transactions), etc.

## REFERENCES

- [1] Soumaya El Kadiri ,Philippe Pernelle, Miguel Delattre, Abdelaziz Bouras, An approach to control collaborative processes in PLM systems, *Extended Product and Process Analysis and Design* , Bordeaux, March 2008;
- [2] Elena M. Sabau and Andreea I. Zamfir, *Proactive management and internal audit procedures in airports using BI solutions* , in *Henri Coanda Air Force Academy* (Eds.), Scientific Research and Education in the Air Force , pp.208-213, AFASES Brasov, Romania, May 26-28, 2011.
- [3]Enovia- *Managementul ciclului de viață al produsului*, Available at [http://www.cenit.com/ro\\_RO/plm/3ds-plm/software/enovia.html](http://www.cenit.com/ro_RO/plm/3ds-plm/software/enovia.html), accessed on 24 Apr. 2016;
- [4]SAP ERP Central Component Release 6.0,2006, Available at [http://help.sap.com/static/saphelp\\_rc10/en/43/44c442d36157c0e1000000a155369/Chap%2019%20PS%20Project%20System.pdf](http://help.sap.com/static/saphelp_rc10/en/43/44c442d36157c0e1000000a155369/Chap%2019%20PS%20Project%20System.pdf), accessed on 10 Apr. 2016

MANAGEMENT

# MANAGEMENT