AN INFORMATION SYSTEM FOR PRODUCT DEVELOPMENT PLANNING

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ABSTRACT
Companies in every industry segment that design and manufacture products can benefit of a variety of information system solutions proposed by researchers and also available on the market. To reduce the possible negative impact of Product Data Management (PDM) systems into an organisation, we propose an incremental introduction based on a low-level Project Management (PM) and a Business Intelligence (BI) module respectively for planning and to monitor scheduling in new products development. A high-level PM package has also been considered. We have simulated and tested our solution within a two-wheel vehicle manufacturer and have evaluated possible extension to other medium-large traditional production companies by benchmarking.

1. INTRODUCTION

New product development is a complex task. According to actual Piaggio data, it may last 18 months, involving 180 technical staff and 120 engineers. The output is a product with 200 elements, external suppliers provide 70-90% of which. To ensure that new products (and up to 20 projects may be carried out concurrently) satisfy the requirements in term of quality, time and cost, *planning* is necessary. We address the task of controlling the product development and other related activities (from its concept to the first manufactured product and over) as PM. Keeping *planning* under control means that the project is monitored and checking that what is actually achieved is as planned with reference to time and resources usage (Figure 1). Since the 1980s corporate information systems have started evolving until today's PLM concepts widely dealt with in the literature. PLM systems can do many different tasks. They impact time to market and product quality by supporting development methods (concurrent engineering) that are faster and produce fewer errors. They integrate technical data (CAD/CAE) and can be linked with Enterprise Resource Planning (ERP) systems to include management, administrative, financial, logistics and other company areas.

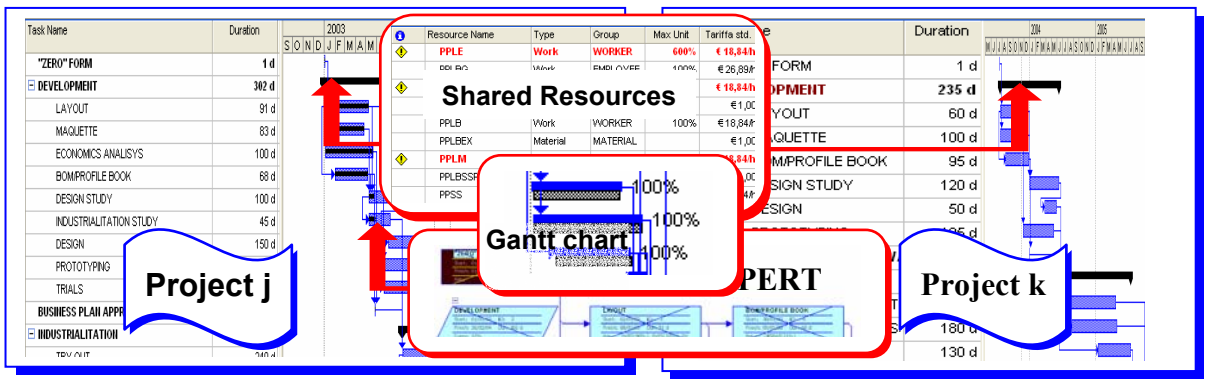

Figure 1 – The typical interface and use of a Project Management (PM) system

[1] The authors wish to thank ing. Carlo Barbato from Piaggio S.p.A., company supervisor for this project.

2. THE PROPOSED APPROACH

While a much greater impact will result when PLM/PDM becomes an enterprise-wide environment, the way the technology is introduced has the typical benefits and drawbacks of continual or radical improvement. In many traditional manufacturing companies, the incremental innovation has shown a better tolerance, lower risks and requires lower investments. Focusing on PM, the proposed solution can be considered as one of the steps in the implementation of a company-wide integrated information system. Modularity is a feature of PDMs. Our solution is based on the creation of two separate modules (Figure 2):

1. a general purpose PM software for *medium/long-term* planning on a *macro* scale; this module, called *PlanMod* is used to control only the main processes of each project;
2. a Business Intelligence (BI) software for *short-term* planning (scheduling) on a *micro* scale; this module, called *SchedMod* is used to browse among the already available databases to retrieve the necessary information regarding the operative processes. BI packages may be already available in many companies for other purposes and in other company areas, and allow retrieving information from different separate databases. The proposed use of BI is to control processes by controlling their resulting events.

The implementation of such system requires mapping the corporate processes, as required by the ISO 9000:2000 norms (Figure 2). The processes required to complete the project are ordered within the work breakdown structure (PlanMod), so resources and project schedule can be monitored (SchedMod). SchedMod is a *push* system and is driven by the operator. Query masks (Figure 4) should be defined to check the status of each micro-process in one or more critical points. *Relational* databases represent a prerequisite. The described solution does not include direct (software) link between the two described modules: PlanMod is manually updated with data from SchedMod, but the same user may run both modules on the same machine. Such virtual link, represented by an arrow in Figure 2, allows a bi-directional update when implemented in a PDM. Other typical technical functions such as document management and data vaulting and engineering are available in most firms respectively in the form of office automation software and CAD/CAE systems. Establishing a direct link among them represents another step towards PDM.

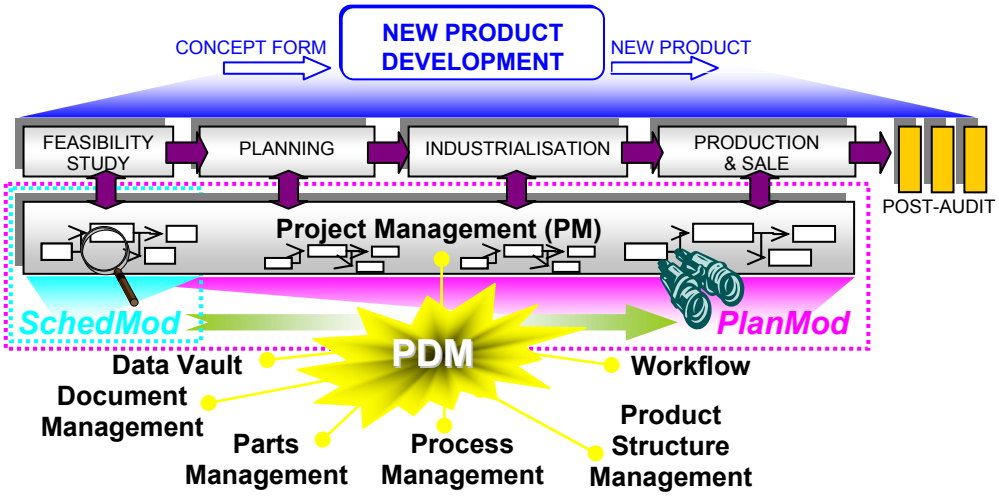

Figure 2 – An example of process mapping. Implementation of the two information system modules.

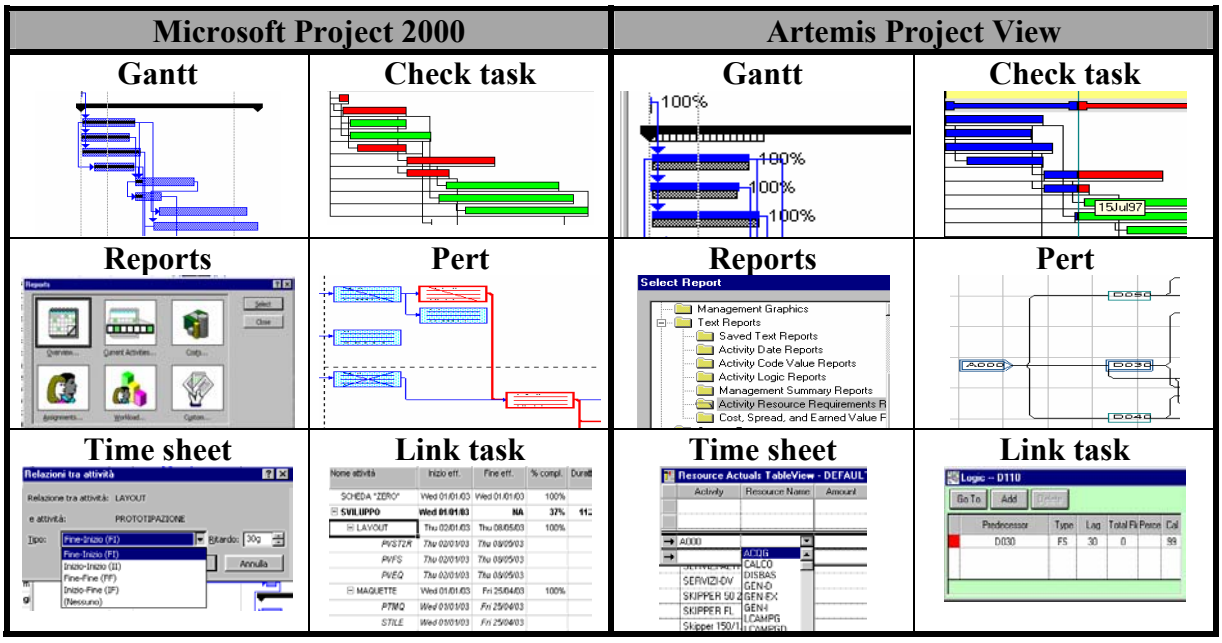

Figure 3 – Most functions of interest for Piaggio (some are cited in the table above) are available from both the tested low-level PM software [2] (left) and the high-level one [3] (right) already implemented.

3. CASE STUDY

Our approach has been tested within a medium size automotive firm. In the development of a two-wheel vehicle, more than 700 activities should be controlled. PlanMod controls about 30 activities, such as those in Figure 1 and design, prototyping, testing, etc. To test SchedMod, a query [1] has been implemented (Figure 4), to control the status of outsourced components engineering by retrieving information regarding their status from various company databases.

Father Description: MOT. 50 2T	**Plant: PVEME**
Part Name: 840176P	**Arrived Batch check-point [month]: 3** ②
BOM last update: 29/03/2003	**Arrived Batch quantity threshold: 10** ③

COMPONENT PART NUMBER	EXPONENT	COMPONENT DESCRIPTION	ARRIVED BATCH QUANTITY ①	SUPPLIER DESCRIPTION
833157	02	OIL SUMP (CARTER)	2	S.LI.MEC SRL
840596	00	PACKING	4	MAXIMA GRADI
840697	01	CYLINDER	3	ATHENA SPA
840941	01	BOLT	4	ANDIT SPA

Figure 4 – An example of a BI [1] query: if the quantity of arrived batches ① before month ② is greater than a threshold ③ (= product delivered), this implies that the development activity by a certain supplier has been achieved

4. LOW OR HIGH-LEVEL PM SOFTWARE?

A low [2] and a high-level [3] PM software package have been tested and a summary of a detailed comparison [4] is shown in

Figure **3**. High-level software represents an alternative solution to replace both PlanMod and SchedMod and is more suitable with multiple concurrent projects. Regarding PlanMod, most functions currently used in Piaggio are available on both packages, in addition, low-level PM packages are more widespread among small and medium size suppliers. It should also be stressed that [3] requires special skill for data entry and this has been two weeks late most of the time, making it practically useless for short-time planning. So low-level PM software is preferred. This result is not surprising if we consider that the distributed computing power of today's PCs exceeds that of a mainframe dating back to the nineties, when PDM systems were first introduced in companies of Piaggio's size.

5. EXTENSIONS AND CONCLUSIONS

A benchmarking of solutions implemented in 7 traditional manufacturing companies for product development planning and control is shown in Figure 5, considering three (normalised) indicators. Companies preceded by an asterisk are already implementing a PDMs in addition to a low (L-companies) or a high-level PM software (H-companies) package. One of the two modules is based on a low-level PM software package, so the proposed system is a viable solution for planning macro-processes in L-companies. From our case study (
Figure **3**) it has been shown that an H-company is suitable as well. The main limitation of low-level PM software is the maximum number of concurrent projects, so this is a possible indicator to assess the applicability of our approach (Figure 5). From this preliminary analysis, our system can be implemented below a threshold of about 15 concurrent projects sharing the same resources. We address future research to the extension of this analysis to additional companies (in different fields) and considering more indicators (such as the number of products and parts, the number of modifications, the total development time, etc.). Regarding the required investment, the cost of our solution is about 1.000€ for PlanMod and 1.000/3.000€ for SchedMod per workstation vs. 1.000/6.000€ for PDMs.

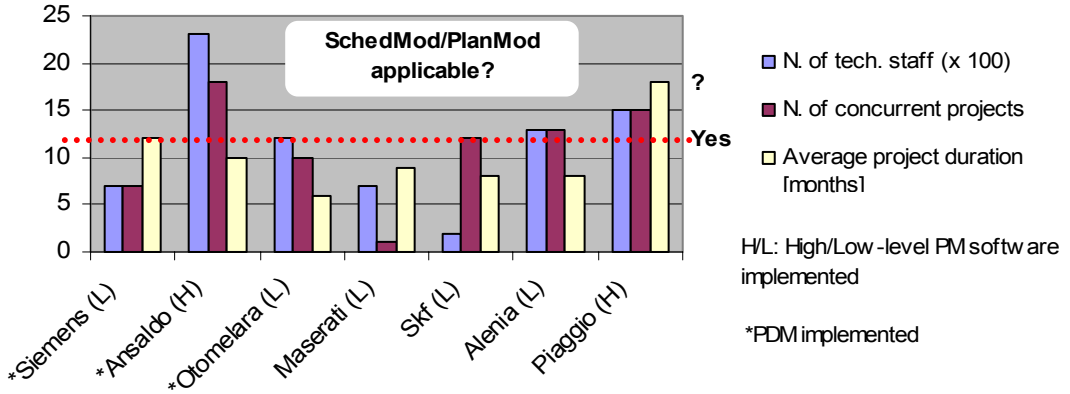

Figure 5 – Benchmarking of information systems in mechanical industries.

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