Integrated management of product heterogeneous data

iProd general aim is to improve the efficiency and quality of the Product Development Process of innovative products by developing a flexible and service oriented software framework that, reasoning and operating on a well-structured knowledge, will be the backbone of the computer systems associated with current and new product development processes.

At a Glance

The purpose of the project, which is co-funded by the European Commission, is to develop an ICT tool to improve the efficiency and quality of the Product Development Process of innovative products. Aerospace, automotive and home appliances industries will collaborate in the project, sharing their knowledge and common understanding of the Product Development Process to achieve this tool.

LMS International NV is leading the consortium; the other partners are the Fraunhofer Gesellschaft (the Institute for Production Systems and Design Technology, and the Institute for Technology Management and Working Organisation), Paragon, Screen99, Scai Polska, CENAERO, Pininfarina, EPFL, CIDAUT, TUDelft, KE-Works, Alessi, Electrolux Italia and NOESIS Solutions N.V..

Summary of project context and objectives

iProd general aim is to improve the efficiency and quality of the Product Development Process of innovative products by developing a flexible and service oriented software framework that, reasoning and operating on a well-structured knowledge, will be the backbone of the computer systems associated with current and new product development processes.

A reduction in lead time and cost during new product development and an improvement in productivity and quality are key objectives for company competitiveness. These objectives can be achieved through the integration of three fundamental elements: corporate strategy, business processes optimisation and ICT support. In particular corporate strategy must drive process improvements towards innovation and ICT is a mean to actuate processes and share data and knowledge among all corporate actors and industrial roles. The Product Development Process (PDP) is a strategic process for company success; it requires innovation, attention to costs, focus on market needs, achievement of quality criteria and respect of timings. Knowledge management technologies applied throughout this complex process are a key to success. Therefore an ICT framework which supports the interoperability of all corporate systems and processes (resources, tasks, people, products, etc.) and related knowledge sharing can be adopted to achieve reductions of lead time and cost.

The European FP7 Project iProd addresses these challenges and has the objective of supporting interoperability during the Product Development Process (PDP) in all its assertions:

- *organizational interoperability* which deals with organizational processes (e.g. integration of various organisational roles such as marketing, Designers, Planners, Testing people, suppliers and customers)
- *business interoperability* which deals with business processes, services and objects (product development processes, product lifecycle management, testing process, validation, etc.)
• technical interoperability which deals with ICT systems and their interfaces (virtual and experimental data, process knowledge, information exchange, etc.)

To improve productivity and quality of the PDP and achieve the objectives of reduction of lead time and costs, the iProd solution consists of a flexible and service-oriented software framework that, reasoning and operating on a well-structured body of knowledge, will be the backbone of the computer systems (software tools, PLMs, PDMs, etc.) associated with current and new PDPs. As a backbone it will be used across and along the entire PDP and will support decisions and integrate results of the various phases of the process.

iProd applies knowledge management, reasoning engines and software process integration and automation technologies in order to achieve the following benefits:

• support knowledge and competencies extraction, structuring and sharing it throughout the enterprise and also with suppliers
• make decisions more reliably by making available structured information and indicators along PDP activities
• strengthen the supplier network management and integration by means of result and performance monitoring

iProd addresses PDP in a general way for manufacturing companies, but wants to prove the approach and methodologies in three well defined application areas, i.e., the aerospace, the automotive and the home appliances industries. These three areas generate the largest impact in European economy and are here addressed as the main targets for the iProd application.

Description of the work performed and main results

In the first project year, four WPs were kick started: WP1, WP2, WP3 and WP6. Each of them had specific objectives related to the project activities for the first intermediate period. In particular:

- For WP1, the objectives were: Define and monitor quality standards for the whole project; define and implement communication procedures to be followed within the project and with external agents; schedule and organize project meetings
- For WP2: Build a deep understanding of the PDP in the three reference domains; identify commonalities and diversities between the different PDPs
- For WP3: Create a detailed architectural design for the whole framework; create detailed design for the knowledge base and reasoning engine components.
- For WP6: Promote Dissemination, Exploitation and industrial involvement

In the first project period a number of important project objectives have been met. The most important ones can be summarized as:

- All partners built a mutual understanding of each other’s expectations and motivations in the project, thus building a research team committed to project objectives.
- End users were interviewed and shared with all project partners their functional and non-functional requirements, thus giving a clear reference for further project activities
- Functional and non-functional requirements have been analysed and common and specific elements identified and separated. A set of kernel and domain specific requirements has been identified and expressed using a standard terminology. Based on these requirements, activity diagrams have been built to describe in detail how the users execute their product development processes.
- Based on the kernel and domain specific end user and framework requirements, all partners built a better and more concrete understanding of the envisaged IT architecture and its top-level functionalities and created a detailed functional specification of the iProd IT architecture. This architecture has been validated via the activity diagrams, thus ensuring that the functional specifications satisfy the end user requirements.
- The functional specifications for the iProd IT architecture have led to the detailed definition of the knowledge base and of the reasoning engine modules and to the draft identification of the needed functionalities for the other modules.
Preliminary dissemination and exploitation activities have been started, with the involvement of the members of the user group. Information on the project has been made available to the public (public website, project flyer).

These achievements were possible thanks to a very tight cooperation between the partners. End users have been often involved in a number of interview sessions to understand their processes, their knowledge and product structures. This first phase, done with a clearly agreed methodology has been crucial to collect and extract the knowledge that iProd needs to formalize and operationalize the product development process. Once this knowledge has been extracted and organized in a clearly recognizable end-user language, although not standard, it has been validated again with end users, to ensure proper match of what has been discussed with what has been formalized. This process triggered the extraction of more knowledge, some corrections and improvements. This validated set of requirements has then been used to create activity diagrams that describe the flow of the end-user actions, including notes on specific ‘gates’ or stages in the product development process. The generalization of this validated set of requirements has then been used to identify common and specific elements for each PDP and define an integrated set of requirements in a standard terminology. In parallel to this effort, the IT infrastructure design process has started to define the main software components and subcomponents, their relations and correspondence to the end-user requirements. In this phase, the input from the end-users has been critical to drive the design. The major outcome has been the detailed definition of two major building blocks of the iProd architecture – namely the knowledge base and the reasoning engine – together with their submodules.

**Expected final results and potential impact and use**

iProd aims to improve the efficiency and quality of the Product Development Process by developing a flexible, service oriented, customer driven software framework that will be the backbone of computer systems associated with current and new development processes. This framework will impact the product development process in order to reduce drastically product development costs and time by defining an optimised testing process, support knowledge and competencies extraction, structuring and sharing also with suppliers, improve focus of new product development with a fast and structured management of competitor and market analysis data.

The goals addressed in iProd have a clear European and international scope, explaining why a combined European research effort is needed. iProd success will strengthen European manufacturing and IT industries in their global competition because the project’s objectives are of general meaning for more or less every industrial company in the world. Industrial companies addressed by iProd (including their supplier networks) are clearly European and international players. Their marketing organizations as well as their design, engineering, and manufacturing networks span all over Europe and beyond. They collaborate with international partners in more or less every relevant aspect of their business. They need collaboration and information exchange on a European and international scale. The software systems provided by IT vendors in this area frequently used in more or less every industrial and developing country. The core ontologies to be built will address needs of every industrial enterprise all over the world.

The iProd project has identified three sectors of application for the software framework that intends to develop. These sectors together constitute the largest part of the European economy and have deep connections at many levels with the supply chain that depends on these three main sectors. This means that the application of the iProd framework in these sectors has a large and durable impact on the European economy and allows the meeting of always more demanding requirements. In the next sections, the impact in the three markets will be analysed and an overview of the benefits that will be gained with the adoption of the iProd framework will be given as well.

In summary, the expected iProd impacts can be outlined as follows:

- Response to rapidly evolving conditions with flexible and dynamic solutions
- Improve the quality and quantity of output information
- Management of reliable information to ensure interoperability across different processes and industries
- Reduction of the new product development time and product testing costs
- Reduction of product development, warranty claims and field repair costs and reduction of the corresponding design and manufacturing deficiencies and downtime
- Increase competitiveness across domains
- Assure EU leadership at every step of the knowledge management and product development process

**iProd will improve the efficiency and quality of the Product Development Process**

**iProd addresses PDP in a general way for manufacturing companies, but wants to prove the approach and methodologies in three well defined application areas, i.e., the aerospace, the automotive and the home appliances industries. These three areas generate the largest impact in European economy and are here addressed as the main targets for the iProd application.**

**Project website:**

[http://www.iprod-project.eu](http://www.iprod-project.eu)

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