

Fostering Innovative Ideas and Accelerating them into the Market

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Abstract. This paper introduces a new IMS project with the goal of developing a system to support the collection of innovative ideas and relevant knowledge throughout the extended enterprise for new and existing process and product developments, and to develop these ideas and knowledge into a means of fostering industrial innovations. The main objective of the Project **AIM (Acceleration of Innovative Ideas into the Market)** is to develop a means of stimulating the creation of innovative ideas in general, and specifically on problem solving and on potential product/process improvements, and collecting them from people involved with the products and processes.

This paper will present an overview of the methodology and functionality of the **AIM** system illustrated with some of the business cases that the project is dealing with (both large multinational enterprises and SMEs).

1. Introduction

Innovation is a critical factor in the success of industrial companies. Innovation is important for all companies, and just as important is the need to get innovative products to the marketplace quickly. To achieve this it is essential to concentrate on good, innovative products, and at the same time to focus on process innovations (flexible, agile production) to bring these novel products quickly to market.

People inside and outside the physical boundaries of the industrial organisation are an untapped resource for innovative ideas and knowledge. If the collective talents and knowledge of the people involved with the products and processes of industrial organisation (including the customers and the suppliers) could be collected, processed and developed into a repository of innovation ideas and knowledge, then the potential benefits in terms of innovation could be enormous.

The challenge industrial companies have to face is first how to set up a system supporting the collection of innovative ideas and relevant knowledge throughout the extended enterprise for new and existing process and product developments. Second: how to develop these ideas and knowledge into a means of fostering industrial innovations. Innovation is to be achieved by combining the ideas and feedback from all parts of the product life cycle, including customer interaction with existing products and new product/process ideas, and including customer service and field engineers, including suppliers, and including pooling of knowledge between multiple sites. Such a system will enable organisational learning by providing a means to collect, store and use/develop innovative ideas over the extended enterprise.

The basic assumption is that innovative ideas and product/process knowledge can be collected either (a) by requiring innovative solutions of identified product/processes problems

and improvement potentials, or, (b) by directly and continuously collecting ideas from all involved actors in an extended enterprise (independently of the identified problems). Therefore, the concept is to provide an effective collection of innovative ideas, product/process knowledge and information/knowledge on products/processes problems/improvement potentials, to combine/integrate, process and evaluate these ideas and knowledge and deliver them to product/process designers.

2. Extended Enterprise

Extended enterprise concept aims to add value to the product by incorporating to it knowledge and expertise coming from all participants on the product value chain. Manufacturers need to benefit from Extended Enterprise techniques by involving all actors throughout product life cycle: suppliers, customers, design, production, servicing.... They will provide their own product knowledge to enhance product development and support. This knowledge needs to be saved and managed. Loss of this knowledge results in increased costs, longer time-to-market, reduced quality of products and services. This new paradigm implies a quite new scenario: knowledge capturing and sharing, new forms of interrelationship between companies and persons, etc.

The novelty of the approach is to focus on product knowledge, which is not managed today, and which comes from suppliers, customers and employees (and tacit or informal knowledge generated by internal staff) involved in the development and support and use of products. It represents the next evolution of product information systems, taking standards and practices forward to support co-operative working and partnerships.

The key idea behind the projects presented here is to develop means supporting the collection of all useful knowledge throughout the extended enterprise for new and existing process and product developments. This knowledge will then be developed into a means of fostering industrial innovations. Innovation by combining the ideas and feedback from all parts of the product life cycle, including customer interaction with existing products and customer's new product ideas; service and field engineers; suppliers and knowledge pooling among multiple sites. Innovation is a critical factor in the success of industrial companies.

3. AIM

The Project AIM: Acceleration of Innovative ideas to Market (IST-2001-52222) has started in June 2002. It runs under IMS programme with partners from Europe, Australia and USA by the moment, since the consortium is running negotiations with partners from Japan and Switzerland which have showed interest for joining the group.

The project goal is to develop a system to support the collection of all useful knowledge throughout the extended enterprise for new and existing process and product developments, and to develop this knowledge into a means of fostering industrial innovations. Innovation by combining the ideas and feedback from all parts of the product life cycle, including customer interaction with existing products and new product ideas, and including customer service and field engineers, including suppliers, and including pooling of knowledge between multiple sites. Innovation is a critical factor in the success of industrial companies.

The objectives of the project are:

- To develop a means of stimulating the creation of innovative ideas and collecting them from people involved with the products and processes. Specifically to increase the number of innovative suggestions, concepts and new designs by 50% in all user companies.
- To develop a way of processing these ideas and storing them into a structured knowledge repository. To ensure that all useful knowledge (innovative information) is saved.
- To develop a means of analysing innovative knowledge to determine which is useful, and which is not. That is, to enable the viability of ideas to be assessed.
- To develop the best means of delivering the innovative ideas to product and process designers for maximum effect.

This should lead to the following business benefits:

- Reduction of product innovation cycle-time by at least 30% (specifically for SME business case no. 1, and business case 3 for engineering services, and business case 5 electronic industry)
- Reduction of time and efforts for solving product/process problems by at least 25 % (all business cases)
- Improvement of process efficiency by 15 % and reduction of wastes by 12 % (specifically within manufacturing process in business cases no. 2 and 4).

The key idea behind the project is to develop means supporting the collection of all useful knowledge throughout the extended enterprise for new and existing process and product developments. This knowledge will then be developed into a means of fostering industrial innovations.

The project fits into the objectives of both IST (II.1.2 Knowledge Management) and Sustainable Growth (Targeted Research Action 1.7 “Extended Enterprise”) programmes and directly addresses the IMS technical themes: Corporate technical memory and "Virtual / extended enterprise issues".

4. Innovation

The project is novel as it seeks to encourage innovation creation in all people who are involved with the product lifecycle, and the production processes. It also encourages team working between people from different sites (and working off-site), and between organisations, customers and suppliers.

The accelerated pace of technological development continuously increases time and market pressures on manufacturers’ capacity to innovate new products and designs and to develop the manufacturing processes that produce these products. The relentless race to develop new, higher quality products, simultaneously reducing time to market, reduce product cost, improve quality is a major challenge for all companies. Many companies lack the financial capacity either to invest in the latest technology as it reaches the market or to hire specialists to integrate new methodologies and systematically to improve their products.

Many companies have the required corporate breadth-of-experience to improve their products, improve their processes if they could only make best use of their knowledge resources internally and in partnership with their suppliers and customers. Stimulation of ‘Innovation’ is a means by which these knowledge resources could be channelled.

Major difficulties for innovation are related with two main topics (which will be addressed by this project):

- a) Intangibility of the inventive knowledge. The inventive capacity is usually considered

more as an inherent property of the genius than something that may be learnt. Intangibility makes the inventive knowledge difficult to accumulate and transfer. Emerging theories say that the capacity for innovation observed in some inventors is not more than an instinctively applied methodology for abstraction, which gives sense to the words “inventive knowledge” (or “innovative knowledge”), defined here as “the knowledge necessary for finding solutions at any abstraction level”. Therefore intangibility will be overcome by establishing rules, methodologies and tools for abstraction and concretion of problems, allowing to accumulate them and their solutions in a hierarchical database with the abstraction level as hierarchy separator.

- b) Individualisation of the innovation process. Investigations performed during the last 20 years have demonstrated that innovation is better achieved by working in team. In the first conceptualisation steps the working teams should include the best experts in several fields available world-wide which is completely impractical for many manufacturing companies. Due to this problem, innovation thinking is usually tried by individuals on their own, which becomes almost impossible in the current stressed and time limited working environments.

Such problems could be minimised by employing innovation methodologies during the development process and incorporating tools to support innovation along the process. However, even when enterprises try to incorporate new methodologies, many problems appear due to human- and methodology-specific factors. Human factors include problems of encouraging and convincing people to use new and innovative methodologies. It is noted that new methodologies, however enthusiastically received, are frequently discarded in favour of familiar methods shortly after they are taught and personnel trained. Implementation of new methodologies is also frequently inefficient in time-management terms due to complexity, dependence on worker experience and interpretation, as well as processing of results. Methodology factors: available engineering methodologies are frequently theory-overloaded and do not integrate well with one another, if at all. In the chain of methodologies there is lack of transparency in planning, cost, technological and quality data's.

5. Approach

5.1 AIM system

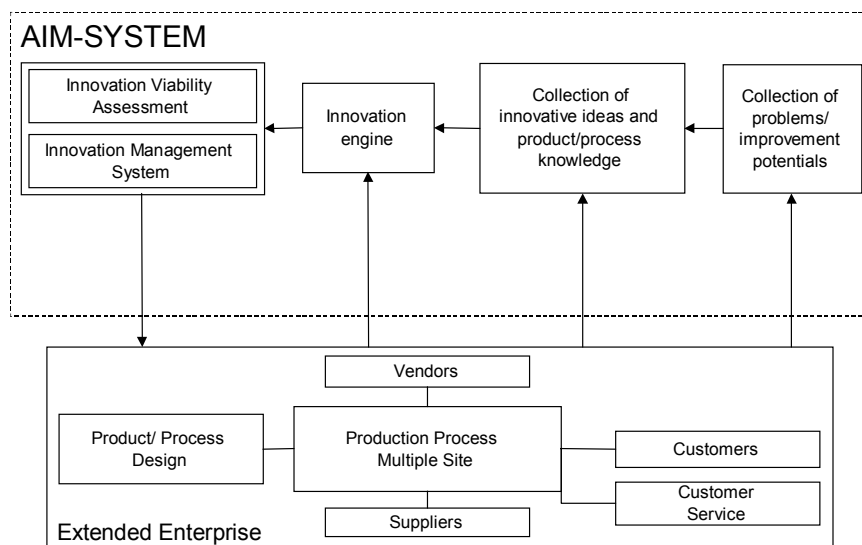


Figure 1. AIM basic concept

Figure 1 shows the basic AIM approach. AIM system will include methods and tools

(modules) for collecting innovative ideas and knowledge on products/processes. The system will also contemplate another important source of innovative knowledge coming from problems and potential improvement points. The system will also support assessment on these innovative ideas and help to manage them in order to provide the best way of using them for innovative product and process designs.

In summary, the AIM system will support the collection of **innovative ideas and relevant knowledge** throughout the extended enterprise for new and existing process and product developments. These ideas and knowledge will later be developed into a means of fostering industrial innovations. It will enable **organisational learning** by providing means to collect, store and use/develop innovative ideas over the extended enterprise.

5.2 Functional approach

The main functional elements of the AIM system appear in the following figure 2. A brief description of them can be found below:

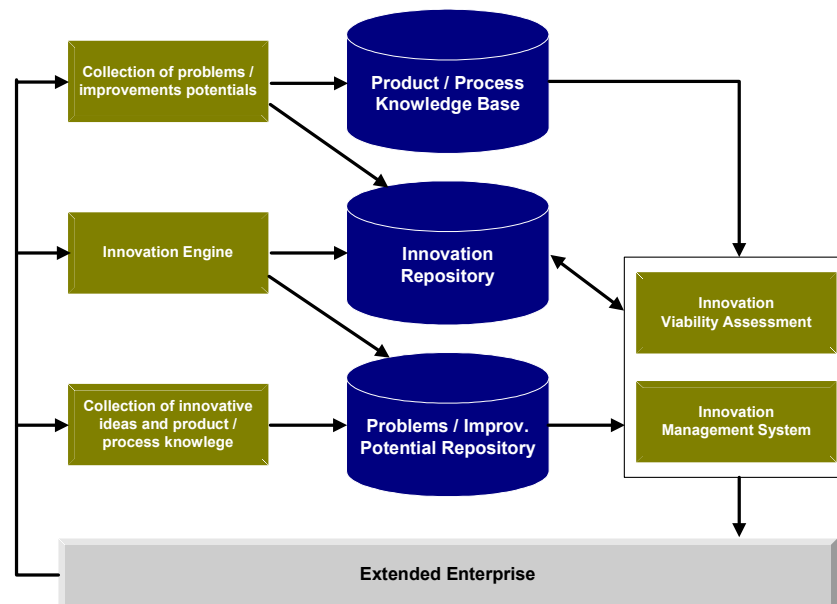


Figure 2. Functional Approach

- **Innovation Repository:** This repository will classify ideas using an ‘innovation’ meta classification, and will store them for rapid access. The overall meta classification of the (innovative) ideas and innovations will be defined as a basis for all AIM modules. The problem is how to enable appropriate classification for different specific products and processes, as well as within a specific company concept. This will include: Product/process knowledge base, Problems/Improvements potential repository, (Innovative) ideas and Innovations.
- **Product/process knowledge base:** This knowledge base will include all relevant information and models as well as experience-based knowledge of products and processes related to the information systems available in the enterprise.
- **Problems/Improvements potential repository:** This repository will include knowledge on problems and potential improvements regarding products/processes. This will cover knowledge on problems identified, their reasons and/or ways which were used to solve them in the past.
- **Collection of innovative ideas and product/process knowledge:** This module will be

based on combination of ‘classical’ approaches/commercial tools together with new developments required to provide means to efficiently collect innovative ideas, but also to collect knowledge on product and process problems for which the innovative ideas are needed. This module will include an appropriate user interface to introduce ideas and knowledge on products/process and about the identified problems.

- **Innovation Engine:** This is a collection of methods oriented to finding innovative solutions following a systematic methodology. This is the facility that provides a structured means for **the development of ideas into innovation concepts**. The ideas collected within previous module and stored in the repository will be further developed. This will involve taking the most appropriate parts from state of the art methods for innovation development approaches as well, and developing these into a specification for the development of an innovation engine, which can be used to develop thoughts and ideas into innovative solutions. This will be the means by which raw, creative ideas can be organised and developed by sharing and working on these ideas in a structured framework. The specific requirement is to provide robust solutions to be applied in the industrial environment. TRIZ methodology is likely to serve as a baseline approach for this module.
- **Innovation Viability Assessment:** This facility will provide a structure (based on decision-tree criteria) to assist users in assessing the feasibility of new innovative ideas. Innovations which cannot be turned into reality, for commercial or socio-economic benefit are of little use. It is important to focus on feasible, good innovative knowledge, and develop this. This facility will involve taking the state of the art innovation assessment methods and specifying a solution to provide viability assessments of ideas at the collection stage, and innovation assessment facilities for design teams.
- **Innovation Management System:** This will be a means of providing structured delivery of the innovations/ideas to the process and product Design Teams. This module will assist graphically the work of the Design Teams in designing new process and products in the companies. It will also provide an efficient way for planning and monitoring the use of the innovation knowledge during the design activities.

This architecture will be finally deployed following a multi-level architecture based on Internet technologies. Integration with other tools inside each enterprise will carefully be studied and adapted to specific needs.

6. Business Cases

The project will be based on several business cases, one from each user. These will be used to ensure that the project is driven by industrial needs, and that these needs are met (by validations and assessments of the results at strategic phases of the project). These business cases will be focused on innovations for product development and innovations for process developments. The business cases will therefore use the AIM system in different ways, e.g. while some business cases will be oriented to directly collect innovative ideas and knowledge, in some the motivation for collection of ideas will be realised via identification of problems/improvement potentials asking for innovative ideas. This will enable to develop and test AIM system for different scenarios, ensuring its general applicability.

6.1 Business Case 1: Product innovations in SMEs

This business case concerns rapid product innovation in an SME, developing new innovative products internally by getting everyone involved, including field engineers working with customers to generate product ideas. This business case will focus on

providing a structured and rapid approach to product innovation, so that the time to market is reduced. This is extremely important for most companies, particularly SMEs which have to produce innovative products for the marketplace, and where it is essential to have a minimal time to market.

6.2 Business Case 2: Multiple site process innovations in high volume manufacturing

This business case will focus upon innovation in multiple site manufacturing process based on the identified problems and improvement potentials. The end-user is a large multiple site company producing high volume products. Currently, many innovative ideas from employees are not used since there is no system to collect such ideas, assess them and deliver them to process designers. In order to collect information on problems in production, for which innovative ideas are needed, the integration and expansion of the IT-Systems implemented in production will be applied. The extension of the systems should mainly be concentrated on knowledge-based methods for the improvement of the production & quality data analysis, providing faster problem causes identification. The special challenge of this business case is that it will address manufacturing process distributed over multiple sites. The industrial partner has several plants in Germany and Europe, but also in US and other regions. Several sites will be involved in this business case. The goal is to collect problems/improvement potentials and innovative ideas from these multiple site manufacturing plants, i.e. to provide means to put together ideas from actors in different plants. The teamwork on developing the ideas across the multiple site will be supported by AIM system as well.

6.3 Business Case 3: Product and process innovations in engineering services and customer and supplier focus

A medium size company, being part of a larger industrial group is a system provider to industry and is strongly oriented towards sales, service, marketing and after-market.. The company is working closely with their suppliers/partners. Therefore, a system for collecting of innovative ideas from both employees and suppliers is an urgent need. The business case scenario will involve collection ideas internally and at supplier sites. Specifically the benefits from collecting ideas at supplier site could be high, taking into account a high interest of suppliers to provide ideas to improve services with their products.

7. Conclusions

The overall objective of the AIM project is twofold: Increasing Innovation and accelerating their introduction to the Market. We expect that the project will be a good help to push manufacturing companies moving towards increasing innovation rates throughout the new paradigms of Extended Enterprise and Knowledge Management.

The project is still in its preliminary stages and the main RTD challenges to be faced along it are already known and assessed. Basically they will be the combination of methods for generating innovative ideas (*i.e.*: TRIZ) with “classical” methods for collection of knowledge on products/processes and their problems, and the development of specific ontologies needed to **enable efficient exchange of ideas** between different experts/actors within the extended enterprise.

Specific achievements expected out of the full implementation of the AIM system may be listed as:

- Developing means of stimulating the creation of innovative ideas and collecting them from people involved with the products and processes.
- Developing ways of processing these ideas and storing them into a structured knowledge repository. To ensure that all useful knowledge (innovative information) is saved.
- Developing means of analysing innovative knowledge to determine which is useful, and which is not. That is, to enable the viability of ideas to be assessed.
- Developing means of delivering the innovative ideas to product and process designers for maximum effect.

This should lead to the following **business benefits**:

- Reduction of product innovation cycle-time by at least 30%
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