

# Validation of a Knowledge Based Engineering Tool for the Design of Injection Moulds

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**Abstract:** IST Project 1999-20645 (KBEMOULD) is concerned with the validation of a knowledge based engineering tool for the automatic and distributed design of plastic injection moulds for the plastic and toy sector. The project has the general objective of developing innovative capacities of SMEs of Plastic Injection Moulds sector, specially of traditional sector such as the toy sector and auxiliary industry by the detection of technological and business needs and the implementation and validation of technologies for the automation of the digital design of plastic injection moulds, accessible in a distributed environment, based on technologies used by other industrial sector (aerospace and automotive industry) in different countries. The main objectives of the project are:

- To reduce the Time to Market, specifically in mould design and construction phase for the plastic injection mould sector including toy sector.
- To adapt the selected technology for plastic injection moulds and to reduce the cost of the design of the mould.
- To validate and demonstrate the Selected Technology in a distributed working environment involving interaction between suppliers (mould-makers) and customers (plastic transformation industries) to maximise value and to facilitate the changes in the requirements definition and development of the design.

## 1. Introduction

IST Project IST-1999-20645 (KBEMOULD) deals with the validation of Technologies for the automation of the digital design in a distributed working environment for the design of plastic injection moulds in the injection plastic sector including toy sector, based on a previous experience in the aerospace industry. The project integrates different partners with complementary capacities and intends to offer a solution that can be used by plastic injection mould-makers and manufacturers in all Europe. The consortium members are: three Catalyst from Spain, France and Italy (AIJU, ISMO and UNIPG). Technological Centres and University from plastic industry (including toy sector) in order to perform the integration of different elements and to assist pilot final users in the plastic / toy. Eight SME's Pilot Users from the plastic and toy sector (mould-makers and plastic converters industry). Technology Provider: to transfer work procedures and technology at company level and to promote its design technology in a wide sector as a plastic and toy sector.

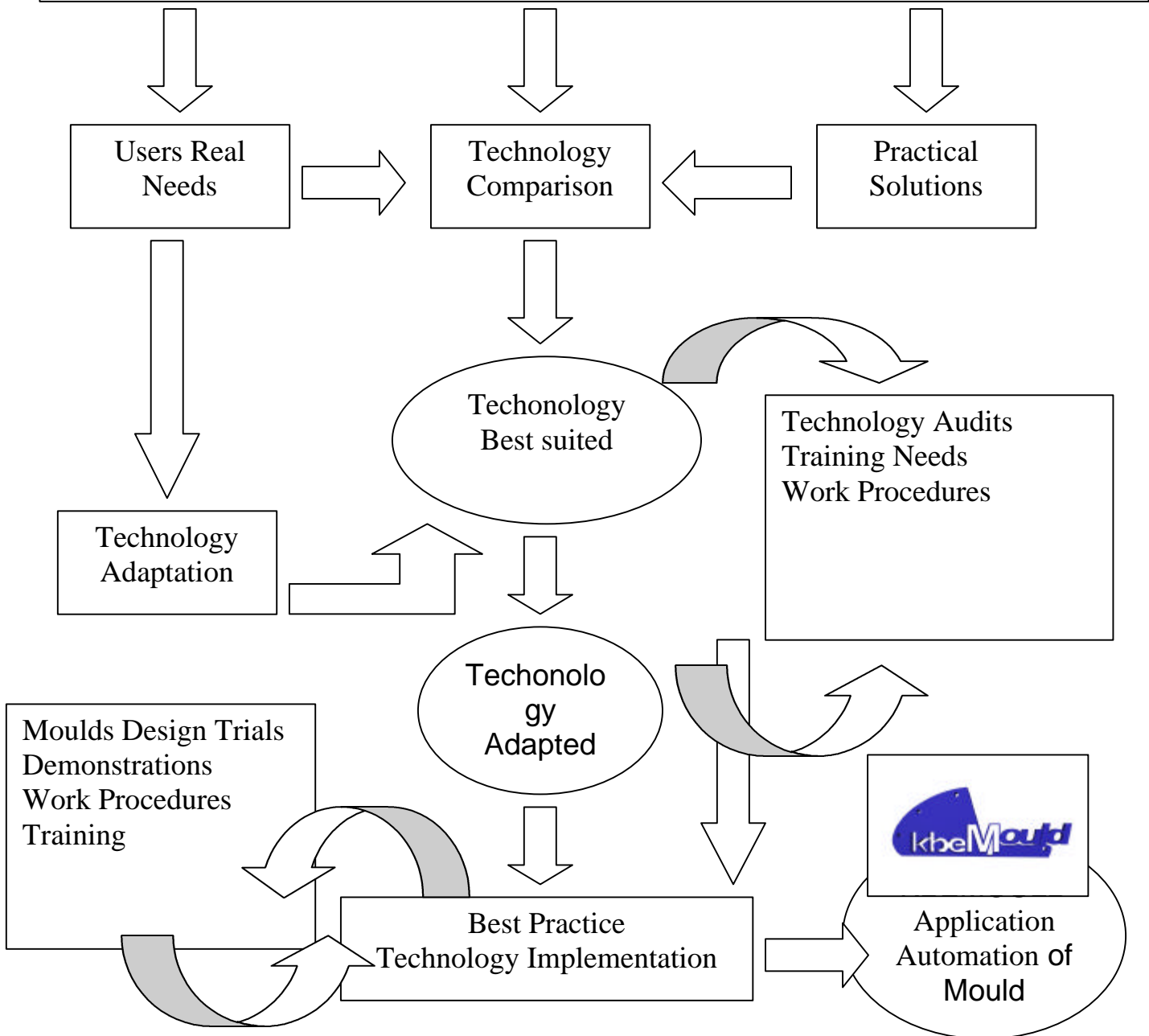
The expected results of the proeject are:

- To assimilate the procedures used by other sectors for automatic digital design of moulds in a distributed working environment. The quantification of this objective will mean to speed up the design of moulds by 70% in terms of time.

- To search and implement the best Technology for the automation of plastic mould design in plastic industry including toy sector.
- To integrate IST/ Design Technologies / CAD-CAM solutions for plastic component design and manufacturing.
- To design specific production methods for companies involved in the implementation of the new procedure.

**KBEMOULD PROJECT  
IST - 1999-20645**

**Objective:** developing innovative capacities of SMEs of Plastic Injection Moulds sector, specially of traditional sector such as the toy sector and auxiliary industry by the validation of Technologies for the automation of the digital design of plastic injection moulds, accessible in a distributed environment

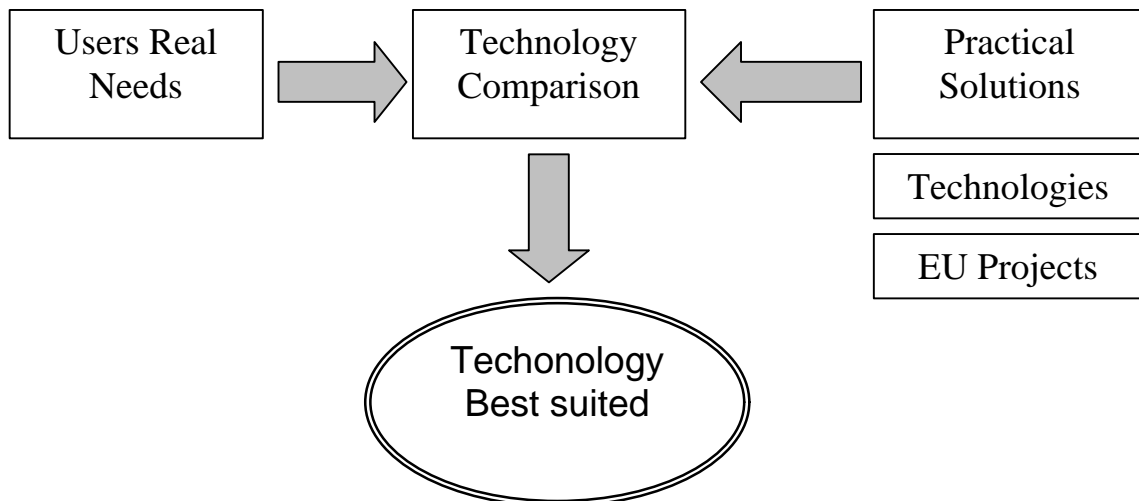


- To reduce the cost of the design of plastic injection moulds by 60% in terms of time for plastic and toy sector.
- To compare methods of mould design in a distributed working environment and to offer a good solution for plastic and toy mould-makers and manufacturers in terms of costs and time to market.

## 2. Technology Definition

Phase one of the project addressed technology definition. In this phase:

- Users' real needs have been determined by fulfilling a complete questionnaire to the eight SMEs involved in the Project and interviews and/or surveys to 51 enterprises from each country to detected needs. The real needs detected by questionnaires, surveys and interviews will be approved by all the Consortium members.
- An open search for practical solutions has been made so as to define the existing technologies .
- A comparison of the different solutions has been undertaken using a set of criteria pre-defined in collaboration with the users and including technology and business-related criteria. The consortium has decided the Technology best suited to adapt. This technology was developed in other European project which acronym is MOKA.



This is the only phase of the KBEMOULD project completed at the time of writing.

## 3. Technology Adaptation

This second phase of the project will be guided to the adaptation of Technology and preparation for its implantation in the SMEs. This second phase will be developed in two stages: The transfer of know-how and equipment to the Technology Centres (AIJU, ISMO and UNIPG) from Technology supplier and the technological adaptation to the specific problems of the eight pilot SMEs.

This phase is based on successful software (Knowledge Based Engineering Techniques in the design) integrated in a distributed working environment with SMEs from aerospace and automotive industries and the analysis of non technical aspects.

This phase can be divided into two tasks, technical activities and non-technical activities:

Technical activities are:

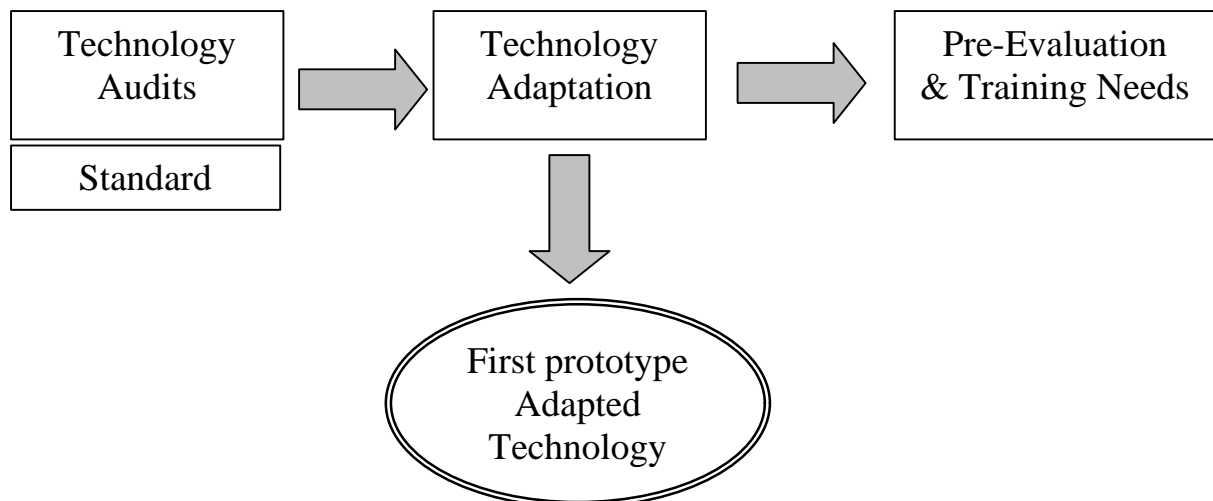
- **Acquisition of Technology and know-how from Technology Provider** in selected Technology for the automation of design of moulds.
- **Technological adaptation to the pilot SMEs.**

The adaptation problems will take into consideration different situation which can be found in other SMEs:

- Different moulds types.
- Specific quality requirements (depending on the types of clients)
- Different production lay-out configurations.

The non-technical activities are intended to provide information useful for the success of the whole transfer and validation process and can be divided in different subtasks:

- Development of technology audits at eight mould-makers and plastic pilot SMEs in order to gather data for the subsequent implementation phase, based on common European methodologies, with special attention not only to technological aspects (financial, organisational, etc..).
- Pre-evaluation of potential impact on employment at company level and productivity, by means of normal parameters used by the companies at internal level.
- Training needs analysis, by interviews to key employees and with special attention to computer use knowledge, 3D design and requirements.
- Evaluation and harmonisation of work procedures for “share knowledge in plastic injection moulds design” among the plastic processing sectors including toy sector.



#### 4. Technology Implementation

Once the Technology is adapted to the pilot cases to the injection moulds design cases, this phase is intended to demonstrate the advantages of the proposed technology and generate confidence in other companies towards the new procedure. All plastic industry from the

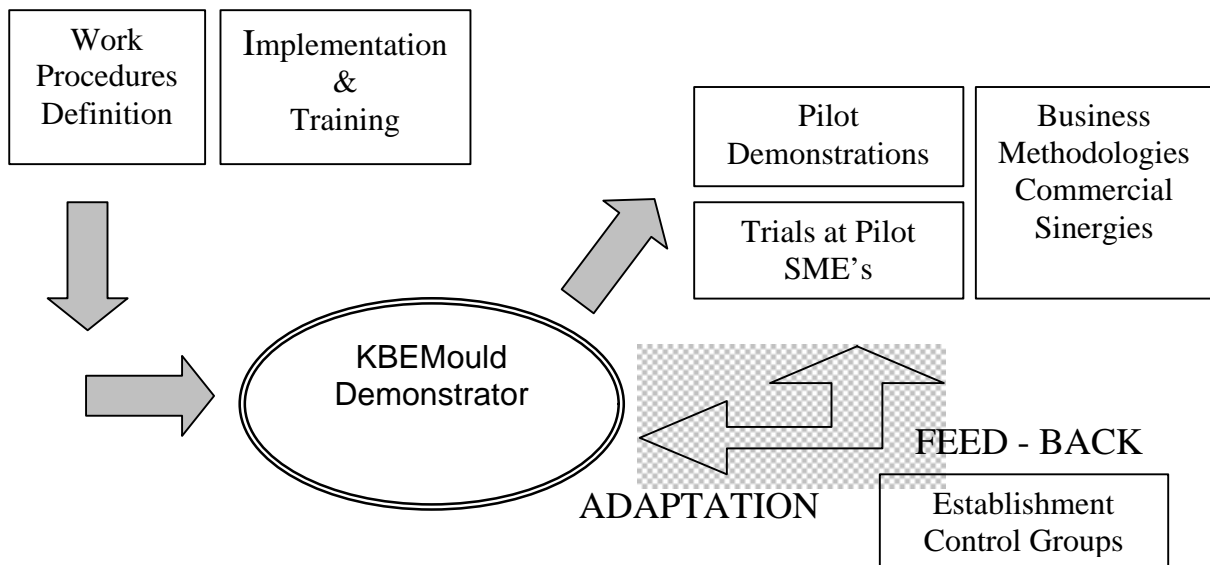
participating regions will be informed and will have the opportunity to attend the pilot demonstrations.

The pilot demonstrations will consist of:

- A number of pilot test of the selected technology showing the advantages of the system with different types of moulds, commercial requirements, production technologies and training needs.
- Moulds design trials: about eight different kinds of plastic injection moulds.
- A demonstration of the advantages of the dynamic supplier-client communication mechanism for electronic design exchange (remote access Intranet – Internet)
- Teleworking will be simulated with Internet exchange of 3D models between different countries.

Finally, the pilot actions will be analysed in terms of impact on the organisation, human resources, production, productivity and quality through the development of specific activities.

The human element can be one of the most critical factors for success of this Best Practice action. Its economical acceptance in companies is strongly linked to workforce participation in terms of adaptation and acceptance of the new situation.



This project envisages the adaptation of the technology and the training of the personnel according to the needs of the pilot SMEs. This training will be provided by the Technology Supplier and Technology Centres in the framework of the project. Nevertheless, training and expert advice of additional companies interested in the Knowledge technology is also envisaged. Three level of human intervention will be considered:

- Knowledge Updating and Automatic Plastic Injection Mould application Training: Important human intervention exists during the process of mould design. All this human knowledge should be taken into account for the adaptation and implementation of the selected technology, and an integrated training approach by the technology centres or by an expert consultant can be very useful. Short technical and organisational training has been foreseen in the demonstration at the pilot SMEs.
- Management and organizational training and support: Organisational solutions are usually more difficult to implement than technologies. Expert consultants in the

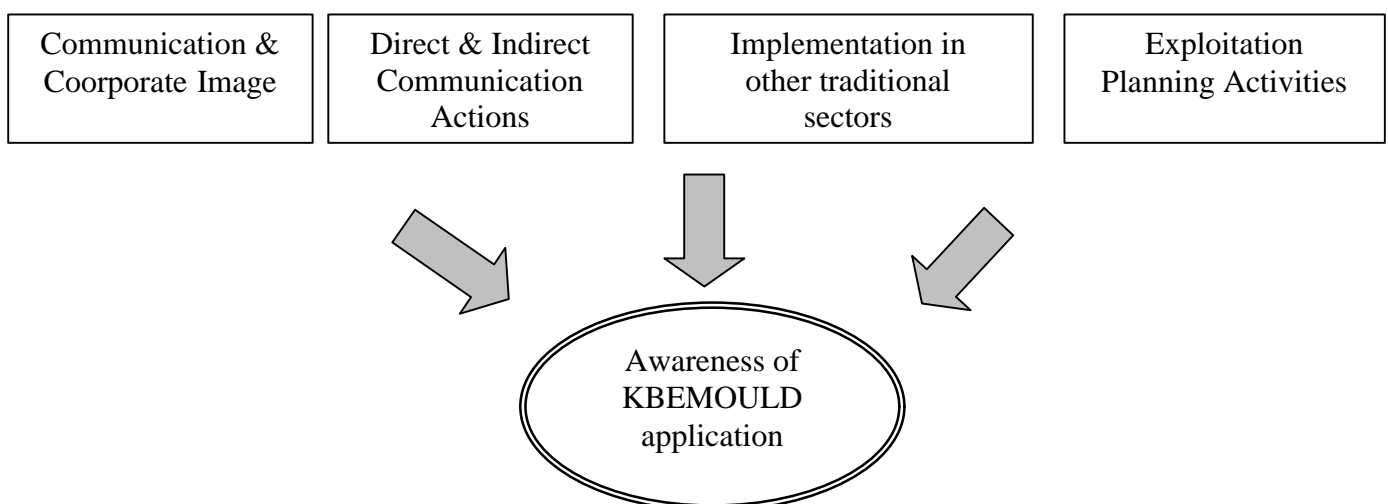
management of human resources will guide the active participation of the personnel in the process of change. As for the selected application training, also short management and organizational training is expected during the demonstrations.

- In those case where the training of internal personnel does not allow to reach the desired level of qualification, only recruitment of external personnel will allow to bridge the gap.
- Establishment of control groups for assessment of: productivity, impact on employment, impact on business (cost-benefit analysis), impact on the organisation and management of the company.
- Validation of the work procedures based on previous technology audits developed at Phase 1.
- Identification of other potential users by means of demonstrations at pilots and personal contact.

## 5. Dissemination Activities

The main objectives of the diffusion activities are:

1. Let the manufacturers of the countries involved know the validated technology, as well as the application results of the pilot experiences carried out in the eight SMEs, with special emphasis in its advantages against the actual situation.
2. Create a communication mechanism between companies and technology centres in order to maintain them permanently informed about the plastic injection moulds manufacturing technological situation.
3. Ensure technological and practice exchanges that enable future technology transfer agreements.
4. Allow other organizations not directly participating in the project the objectives, evolution and conclusions of the project.



With this aim, two basic communication types will be promoted:

- **Direct communication actions**, by means of direct contact with potential technology end-users and TT organisations:
  - Demonstrations in the pilot plants
  - Participation in seminars and international toy and plastic fairs.

- Workshops organized by the corresponding Technology Centres.
- **Indirect communication actions**, by means of indirect contact with potential technology end-users:
  - Mas-media publicity (press, television,...) & Mailings
  - Internet information and demonstration system through Internet.
  - Edition and diffusion of multimedia material (CD-ROM)
  - Edition and diffusion of video material

## **6. Conclusions**

The project has not yet reached completion and therefore conclusions about the success of the project cannot at this stage be made. Technology adaptation and implementation and pilot testing still need to be undertaken.

The consortium expects that the technology will have potential application in a number of sectors where injection moulds are used. These include Toys; Household furniture and wares; Furniture; Electronic & Electricity; Domestic Appliances; Packing; Footwear; Gardening; Sanitary; Any activity where plastic injection components are manufactured.