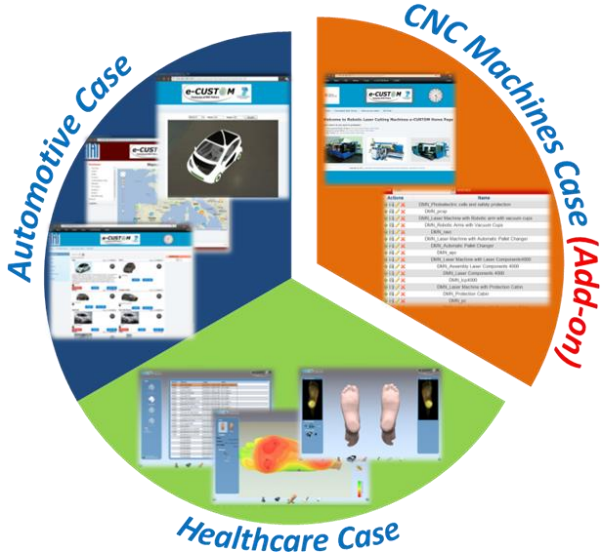
Final publishable summary report - Executive Summary

"Unique Products for Unique Customers"

Mass production no longer seems suitable for today's market and is being replaced by mass customisation. The need for **satisfying the individual customer's requirements** is now stronger than ever. Customers require that the product they buy fulfils their personal requirements in an individualised manner. New technologies can now make it possible to prepare **unique designs of products, manufacture these products and communicate on a mass basis.**

- BRIDGE THE GAP BETWEEN MASS PRODUCTION AND MASS CUSTOMISATION
- ENGAGE THE CUSTOMERS IN THE INITIAL DESIGN OF PRODUCTS
- MANUFACTURE PERSONALISED ADDED-VALUE PRODUCTS
- TO REACH AN EFFICIENT DECENTRALISED AND ECO-FRIENDLY MANUFACTURING

The *first objective* of the proposed research is to **engage customers in the design and development of personalised products from the initial product design phase up to the after-market segment**. A web-based system can now tailor information or products to the customer. Specifically, potential customers will be given the opportunity to modify a set of characteristics, including the choice of materials as well as the modification of the standard geometry and appearance specifications of parts belonging to a carefully chosen, personalisation-enabling, series of components of different models and variants. The *second main objective* is to reach an **efficient level of decentralised manufacturing.** The project aims to develop tools that will support the manufacturing and/or assembly of selected parts outside the central manufacturing site. Depending on the selected customisation options certain manufacturing processes will be possible to be carried out by the material/parts suppliers or by the local distributors and/or service providers in a coordinated manner. As a *third objective* the project aims to measure the **environmental footprint** of the possible solutions in order to be considered when deciding on the most appropriate manufacturing solution (where, how, who and when). In order to facilitate this process, the *final objective* is the **multi-layer data exchange infrastructure** that ensures the interoperability between all users.



*The e-CUSTOM project was evaluated together with 98 other FP7 FoF research projects and was selected as one of the two **Success Stories** of the overall research framework (http://ec.europa.eu/research/industrial_technologies/events-fp7-draft-programme-2010_en.html)*

Summary Description of Project Context and Objectives

e-CUSTOM aims to bridge the gap between mass production and mass customization, engaging the customer in the initial design of the products and realizing the manufacturing of these personalized added-value products in a novel, coordinated, eco-friendly and efficient decentralized approach.

Goals

Mass production does no longer seem suitable for today's market and is being replaced by mass customisation. The need for satisfying an individual customer's requirements is now stronger than ever before. Customers require that the product they buy fulfil their personal requirements in an individualized manner. The e-CUSTOM project aims to overcome the challenges that the European manufacturers are faced with, by developing innovative approaches, which can now make it possible to prepare unique product designs, manufacture these products and communicate them on a mass basis. The innovative approach of the e-CUSTOM will support the higher alignment of production with the actual customer demand, while shortening the design time for personalized products by up to 15%.

The e-CUSTOM consortium contains an excellent combination of partners coming from industry, research institutes and universities, with excellent expertise in the execution of RTD projects and strong commitment to cooperation, in order to deliver to the European manufacturing companies the best possible project results.

Pylons

Towards materialising the ambitious concept of e-CUSTOM, the partners accomplished a set of scientific and technical objectives, classified in accordance to the four Pylons of the project:

- **Pylon I:** User Adaptive Design System (UADS). The objectives under this Pylon focused on the development of user friendly design tools that allow the customers to perform unique design changes in their order, in a controlled way.

- **Pylon II**: Decentralized Manufacturing Framework (DEMAP). This set of technological objectives is based on the materialization of the decentralized production concept that e-CUSTOM promotes. Following the design of the highly customized products from Pylon I, the required supply and manufacturing schemes for its production are generated and verified by the developments of Pylon II.

- **Pylon III**: Environmental Assessment Module. The environmental impact of the supply / manufacturing schemes that are generated in Pylon II is among the most critical parameters for the selection of the most appropriate ones. e-CUSTOM developed the

required tools and metrics for the evaluation of the alternative schemes. These tools are supplemented by advanced Knowledge Management techniques so that the generated knowledge can be systematically re-used in future projects.

- **Pylon IV**: Network Infrastructure and Integration. To successfully implement the e-CUSTOM decentralized manufacturing concept, the objectives under Pylon IV, focused on creating the required infrastructures in terms of network and ICT technologies for the standardization of data exchange, the synchronous and asynchronous cooperation and communication among individuals and user groups, the efficient administration of personalised data files, the automated generation of supplying schemes and the evaluation of alternative ones.

Expected Impact

These innovations have already been deployed at the end-user and is it estimated that in the long term will offer a reduction to energy consumption by approximately 5%-10%, transportation costs by up to 20%, cost of raw materials by roughly 5%-10% , time-to-market by up to 15% and delivery time by approximately 15%-20%, thus resulting in increasing the market share by up to 10%.

Innovation

e-CUSTOM aimed at making radical changes to the organisational and operation structures of today's manufacturing industry, specially focusing on assembly intensive products such as in the automotive sector. The most critical innovations that are introduced by the project involve:

- ***Integration of the customer in the initial product design phase using cutting edge tools and exploiting the capabilities of web based communications and state of the art virtual reality platforms***

Within e-CUSTOM, the product's engineering phase is extended throughout the duration of the model's production. A web based user-friendly application for personalisation, virtual prototyping and advanced visualisation, ia one of the strongest assets provided by the project. The scope is to allow the customer to carry out some of the work that would otherwise be performed by the design engineer, so as to ensure that the final product conforms to the customer's unique specifications. Nevertheless, granting the designer role to the customer is carefully achieved by selecting the extent of customisation that the user will be able to handle. This is to ensure that critical elements for the functionality and safety of the final product are not altered in any way. At each stage, the customer is able to visualize the changes he performs on the vehicle using Augmented Reality functionalities, while in the background intelligent algorithms are elaborated to check the design and production's feasibility.

- ***Creation of a decentralised manufacturing framework to allow production of individualised products in a fast, cost-efficient and environmentally-friendly manner***

e-CUSTOM solutions will focus not only on the design phase of the product, but will also extend to provide solutions on how the e-CUSTOM generated individualised product will be manufactured. Towards this direction and based on the design that was carried in the previous stage, software tools will be developed to enable the semi-automated identification of the manufacturing processes that need to take place and facilitating information as to where each process can take place. In this direction, a platform will be developed that will utilize multiple cost, performance and energy efficiency criteria in order for the most efficient manufacturing scheme (who, where, how and when) to be determined.

- ***Environmental Assessment and Optimisation of the Customisation Implications***

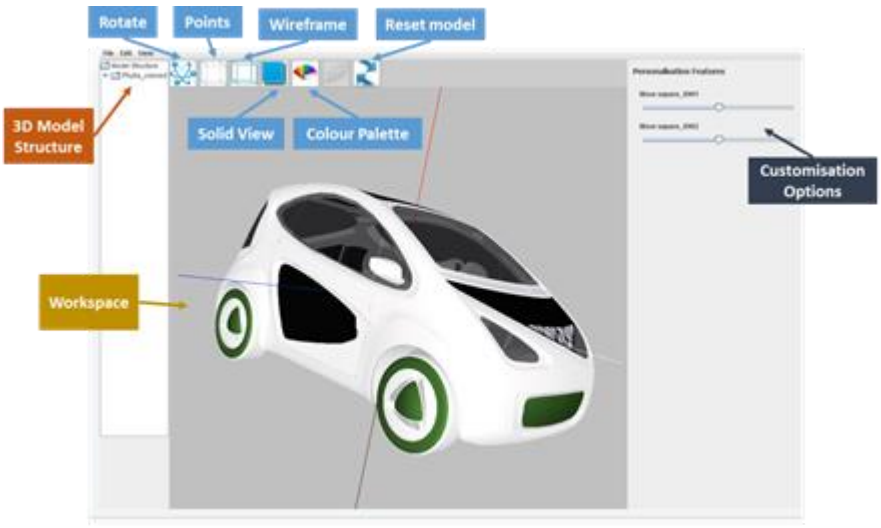
Special emphasis was given on the development of an intelligent decision support module to evaluate alternative operation scenarios that are quantified in terms of energy efficiency, CO_2 footprint, eco-toxicity. In this context the design and implementation of the e-CUSTOM Material and Process Environmental Impact Assessment was carried out, supported by an ontology for capturing, classifying, storing and retrieving environmental knowledge for each addressed process and material.

Case studies

"Domain Independent Solution Capable of Accommodating Various Industrial Domains"

Highly Customised Automotive Products

Production of low volume and high-value luxury cars

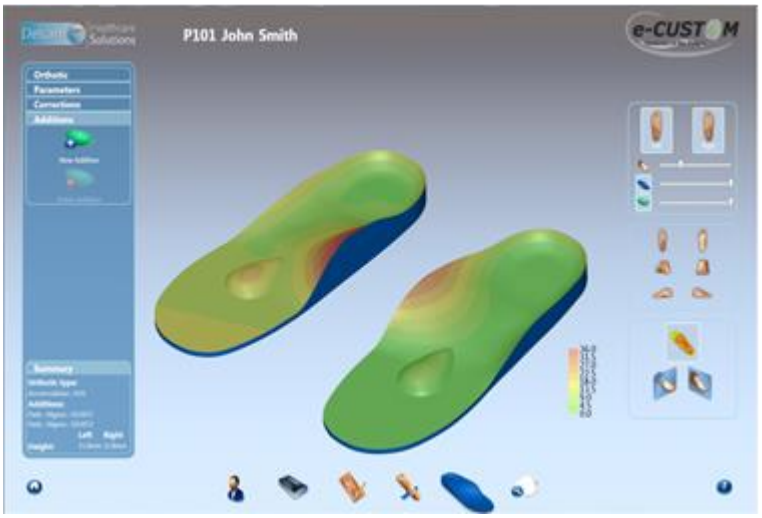


The final goal of the automotive use case is to support the collaboration between end user and OEMs by providing a direct interface between then. The final customer is involved in a process of car personalisation during the product development process. This approach allows customers to express their product requirements and carry out product realisation process, as well as to give a direct feedback to the producers. The scenario of the pilot case includes 2D or 3D visualisation of each car model

and web-based 3D product customisation module. An online conversion into 3D printed model is also allowed. The automotive pilot subseries also the maintenance of a database of dealers and suppliers.

Personalised Orthotic Insoles

Low scale production with high customisation requirements such as orthotics insoles

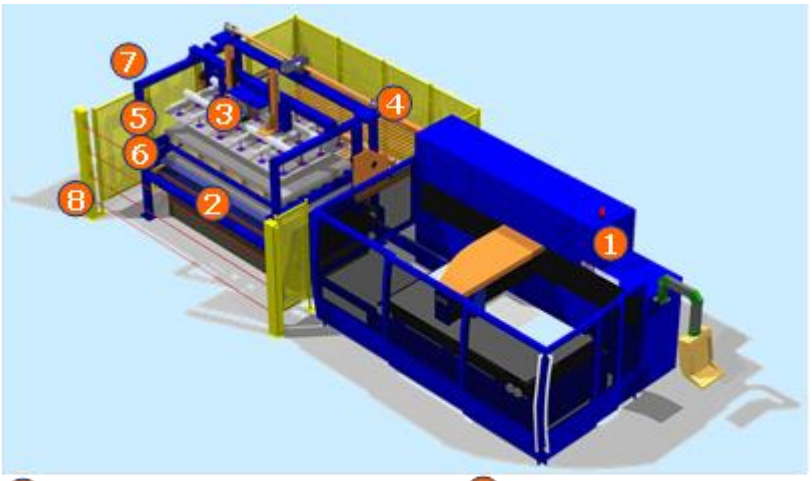


The orthotic insoles pilot demonstrates the collection of data, such as foot scans and type of orthotic required, and the digital transfer of this information to be used in the design and manufacture of customised orthotics.

Customer-configured Robotic Laser Cutting Machines

Customised robots that enable the realisation of customised products

When the automotive pilot case of the e-CUSTOM Framework was developed Prima Industry, interested on the developments, decided to exploit it in a new add-on pilot case from the CNC Laser robot machinery. This enabled to check the e-CUSTOM Framework in a completely different industrial case, with similar customisation needs.



Two CNC Robot Machine Systems have been chosen: PLATINO and RAPIDO System - the most popular products of PRIMA INDUSTRY for 2D Laser Metal sheet cutting and 3D Laser Cutting and Welding application.

Data related to components description like Plant, Suppliers and Sales, were collected and imported into the e-CUSTOM platform.

As shown in the figure above, components 6, 7 and 8 are customisation options, whose data could be transferred and analysed through the e-CUSTOM platform. The features for collaborative user design support the generation of BoM, BoP and Supply Manufacturing Network in order to simulate all possible configurations.

Consortium

The project consortium consists of eleven partners from six different EU countries.

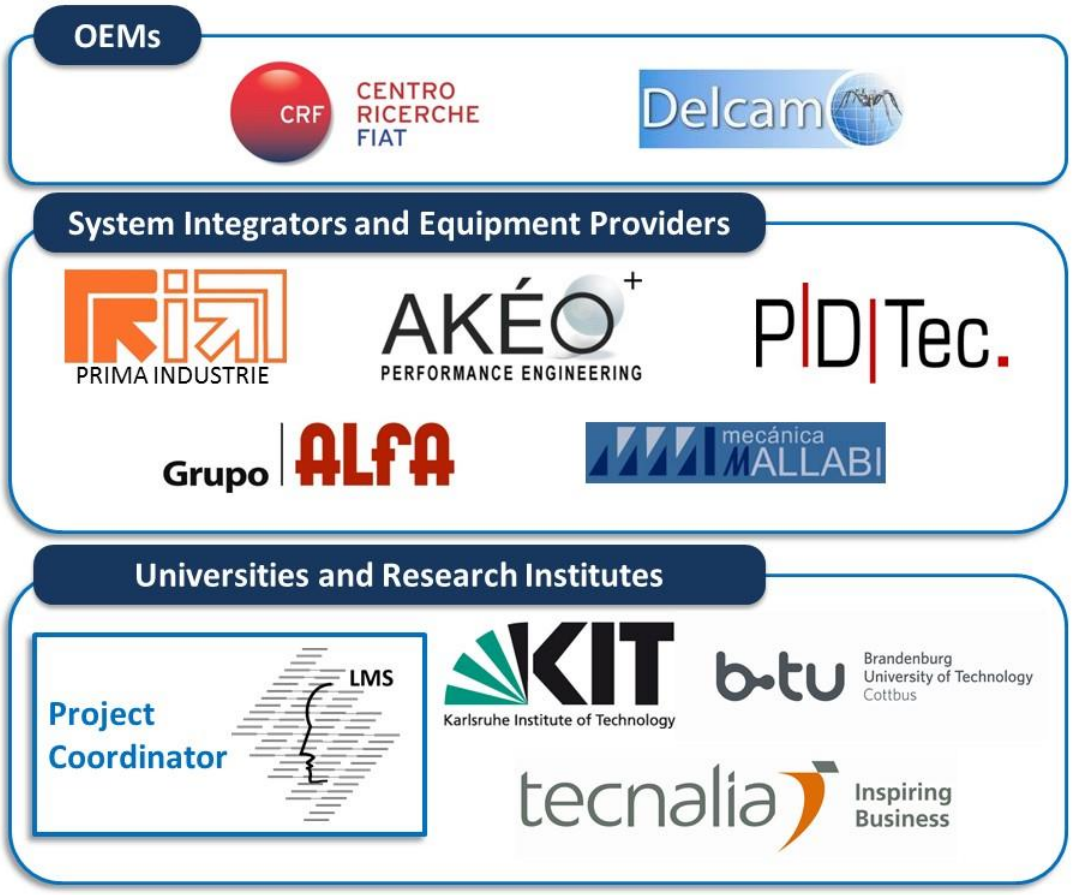


Fig. 1. The e-CUSTOM Consortium

Success story

The e-CUSTOM project was evaluated together with 98 other FP7 FoF research projects and was selected as one of the two **Success Stories** of the overall research framework (http://ec.europa.eu/research/industrial_technologies/events-fp7-draft-programme-2010_en.html)

Project Info

e-CUSTOM Portal URL: www.ecustom-project.eu
Start: June 2010
Duration 36 months
Investment: 4.5 Million Euro
EU Support: 68%
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