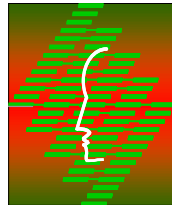# e-CUSTOM
"Unique Products for Unique Customers"

Dr. D. MOURTZIS Prof.

Lab. for Manufacturing Systems & Automation (LMS)
Director: Prof. G. Chryssolouris
Dept. of Mechanical Engineering & Aeronautics
University of Patras, Greece
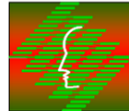
Contents

Project Details

- **Project full title:** A Web-based Collaboration System for Mass Customisation

- **Project acronym:** e-CUSTOM (260067)

- **Type of funding scheme:** Collaborative Project

- **Work Programme topic addressed:** FoF.NMP.2010-2: Supply chain approaches for small series industrial production

- **Project Budget**: 4.5 Million Euro (€)

- **Start Date:** 01-06-2010

- **Duration**: 36 months

(e-CUSTOM (260067) – Description of Work)

Project Details - Consortium

11 Partners from 6 EU Countries

Project Coordinator: Laboratory for Manufacturing Systems and Automation University of Patras Director: Prof. George Chryssolouris

Project Manager: Prof. George Chryssolouris, Prof. Dimitris Mourtzis

End Users

CENTRO RICERCHE FIAT

AKÉO+ PERFORMANCE ENGINEERING

PRIMA INDUSTRIE

Grupo ALFA

mecánica mALLABI

Software Developers

Delcam

P|D|Tec.

tecnalia Inspiring Business

Academic R & D

KIT Karlsruhe Institute of Technology

b-tu Brandenburg University of Technology Cottbus

(e-CUSTOM (260067) – Description of Work)

SEVENTH FRAMEWORK PROGRAMME

State of the Art – Evolution of Manufacturing Paradigms

1850 Craft Production
- Exactly what the customer wants

1913 Mass Production
- Low-cost manufacturing
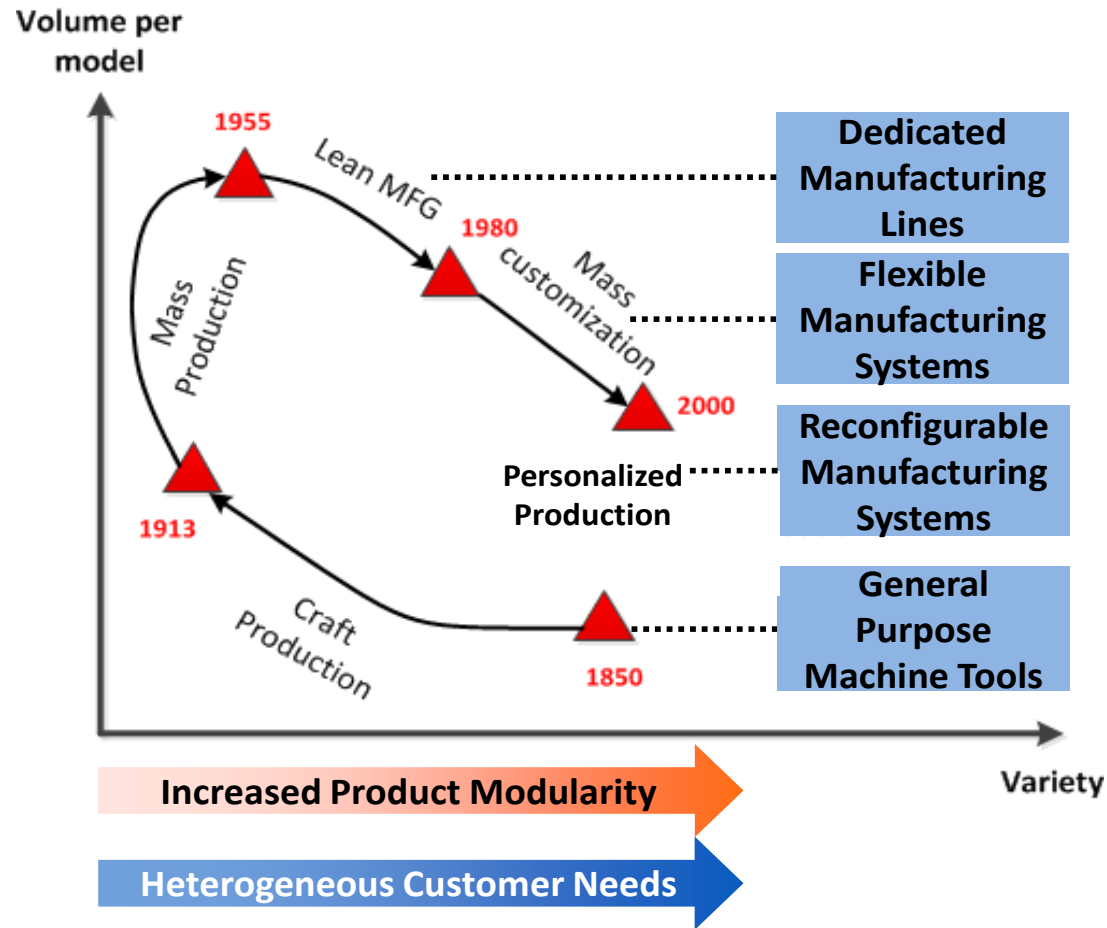- Large volumes

1955 Lean Manufacturing
- Reduction of wastes towards improving overall customer value

1980 Mass Customization
- High product variety
- Customer involvement

2000 Personalization
- Unlimited product variety
- Highly customer-driven

(Adapted from: Koren Y., "The Global Manufacturing evolution", John Wiley & Sons, 1st Ed., 2010.)

State of the Art – Product architecture

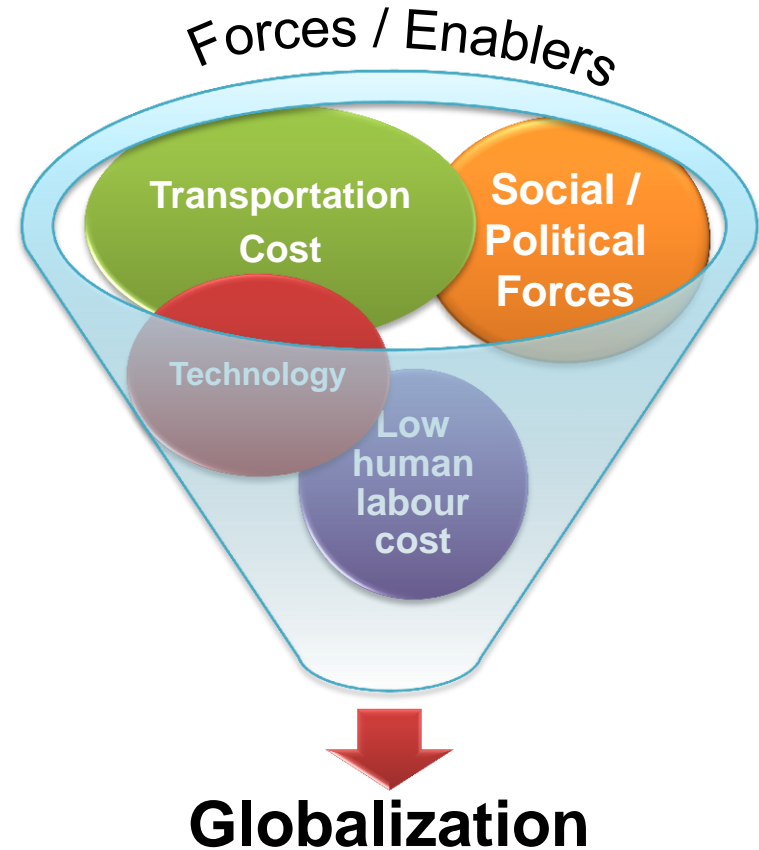|	Mass production	Mass customization	Personalized production
Goal	Economy of scale	Economy of scope	Value differentiation
Customer involvement	Buy	Choose	Design
Production system	Dedicated Mfg System (DMS)	Reconfigurable Mfg System (RMS)	On Demand Mfg System
Product Structure			

(Adapted from: Hu S. J., Ko J., Weyand L., ElMaraghy H. A., Kien T. K., Koren Y., Bley H., Chryssolouris G., Nasr N. and Shpitalni M., "Assembly system design and operations for product variety", CIRP Annals - Manufacturing Technology, (Volume 60, Issue 2, 2011), pp. 715-733.)

State of the Art – Globalisation

⬇ **Transportation Costs** for main intercontinental means

⬇ **Production cost** in locations with low human labour costs

⬆ Internet, software and hardware **technologies evolution**

✚ **Social** and **political** forces

⬇

Market Globalization

Forces / Enablers

Transportation Cost

Social / Political Forces

Technology

Low human labour cost
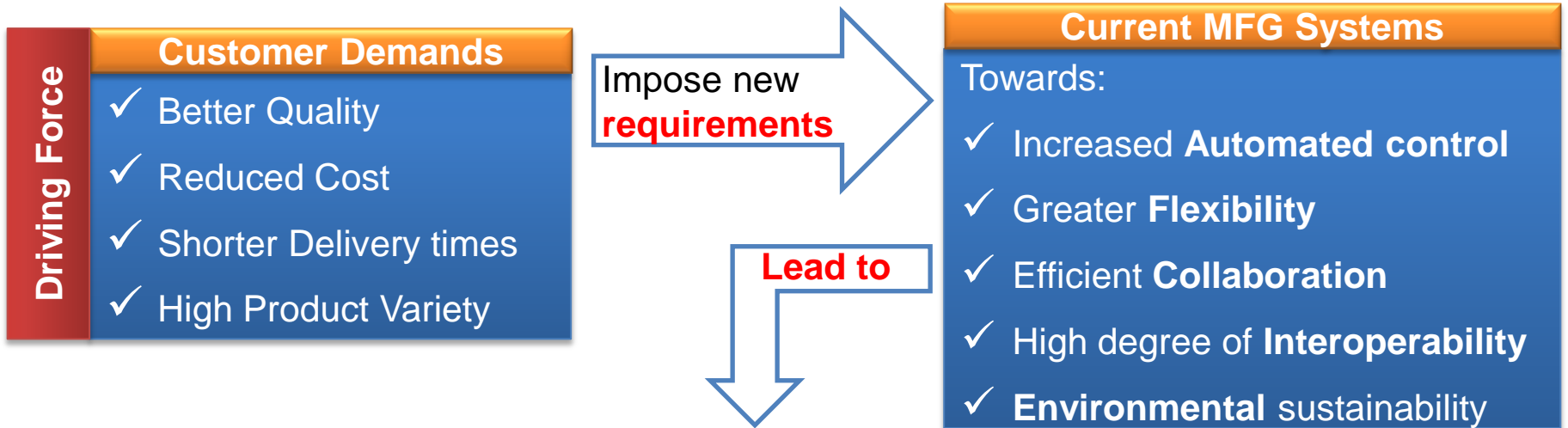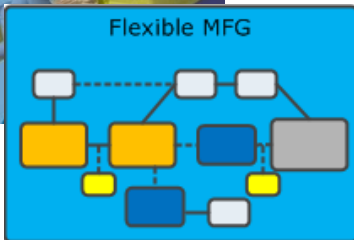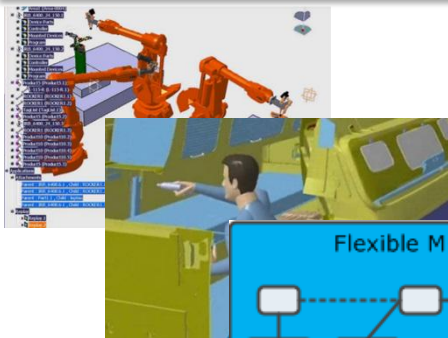
Globalization

(D. Mourtzis, M. Doukas, G. Michalos, F. Psarommatis, "A Web-Based Platform for Distributed Mass Product Customization: Conceptual Design", (DET 2011), ISBN 978-960-88104-2-6, 7th International Conference on Digital Enterprise Technology, Athens, Greece, pp. 604-613 (2011))

State of the Art – Customer Demands & MFG Systems

Driving Force

Customer Demands
- ✓ Better Quality
- ✓ Reduced Cost
- ✓ Shorter Delivery times
- ✓ High Product Variety

Impose new **requirements**

Lead to

Current MFG Systems

Towards:
- ✓ Increased **Automated control**
- ✓ Greater **Flexibility**
- ✓ Efficient **Collaboration**
- ✓ High degree of **Interoperability**
- ✓ **Environmental** sustainability

MFG systems of the future

Flexible MFG

- ✓ **Digital**
- ✓ **Decentralized**
- ✓ **Flexible**
- ✓ **Automated**
- ✓ **Collaborative**
- ✓ **Environmentally friendly**

D. Mourtzis, N. Papakostas, D. Mavrikios, S. Makris, K. Alexopoulos, "The Role of Simulation in Digital Manufacturing-Applications and Outlook", KEYNOTE(DET 2011), ISBN 978-960-88104-2-6, 7th International Conference on Digital Enterprise Technology, Athens, Greece, pp. 189-203 (2011)

SEVENTH FRAMEWORK PROGRAMME

State of the Art - Industrial Problem

Mass Customization / Personalization

Generates

- **High complexity in production**
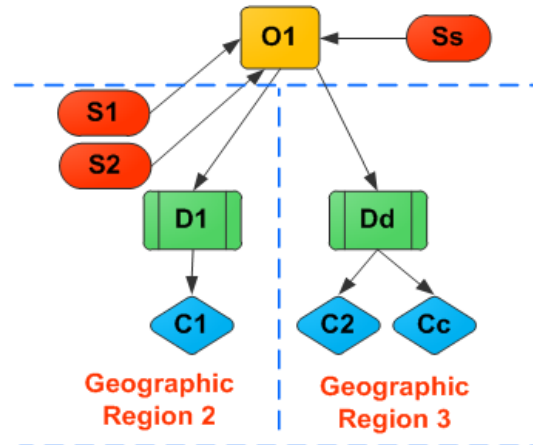- **Escalating costs**
- **Disturbances and Uncertainties**

Issues that

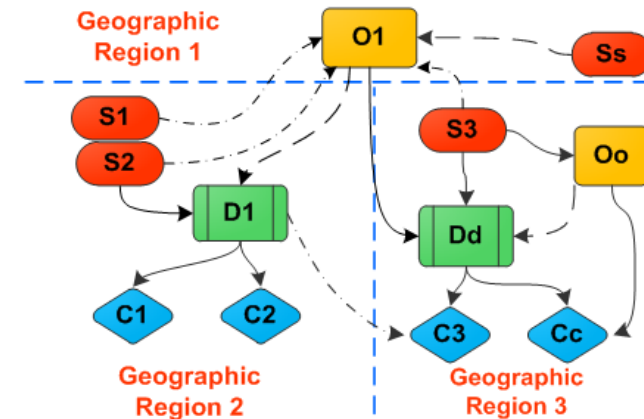**Centralised approaches cannot handle**

Call for innovative solutions

**Decentralisation of Manufacturing Activities**

Centralized Approach

Decentralized Approach

(Working Paper: Mourtzis D., Doukas M., "Decentralized Manufacturing Systems Review: Challenges and Outlook", RoMaC 2012 Conference)

State of the Art – Environmental Sustainability

Green Machines

Renewable Energy

Eco-friendly Manufacturing Processes
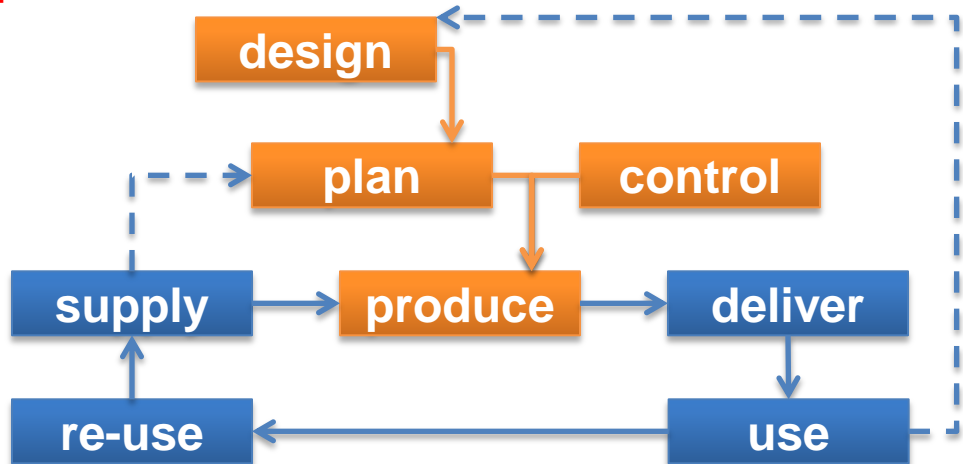
Green Products
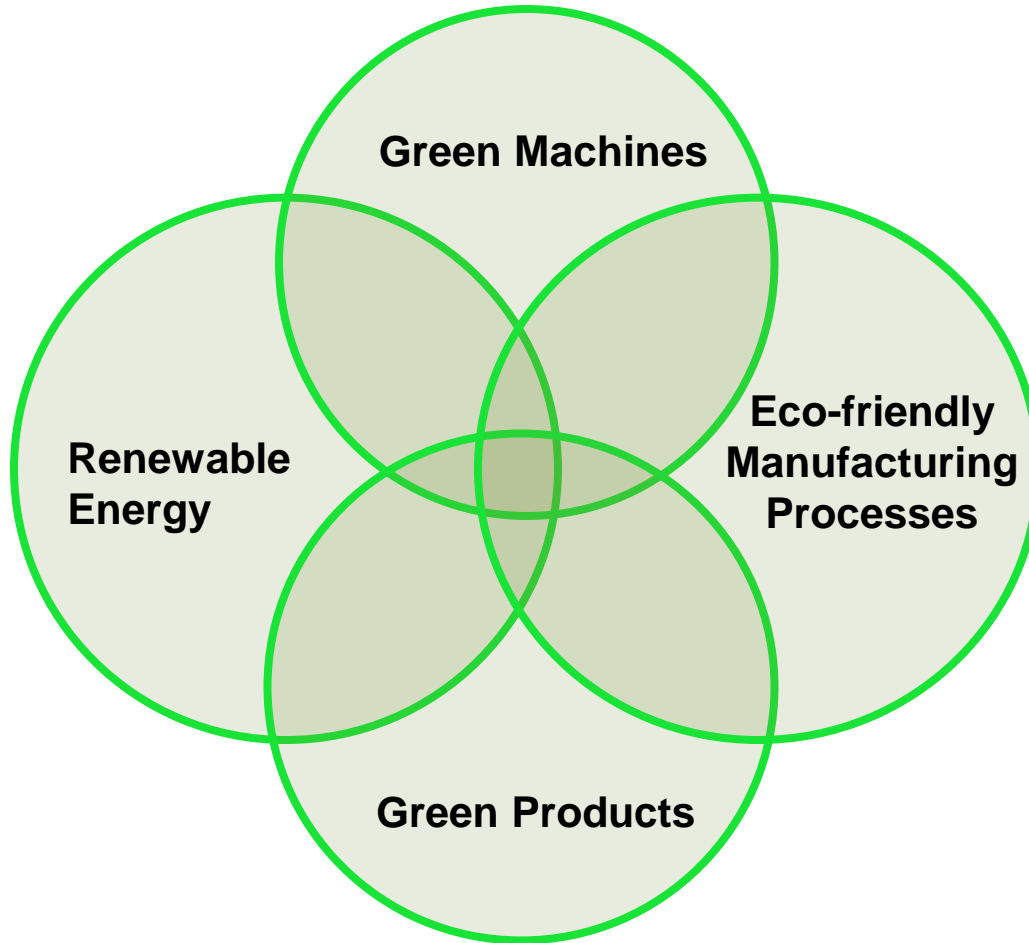
(Adapted from: IGPA Newsletter, TM Taiheiyo Cement, Japan, Dec. 2003)

State of the Art – Competitiveness

✓ The **competitiveness** of a company, nowadays, is based on its ability to perform well in dimensions of:

Regulate all the phases in the **lifecycle of a product**

State of the Art – Product Development

**Product design** and **development** is performed in **dispersed collaboration networks**

Reasons:
- Local competence expertise
- Low costs in specific areas

Enabler technologies:
- ✓ Virtual Reality (VR)
- ✓ Augmented Reality (AR)

Multi-user collaborative product design session, Collaborative decision making for evaluating alternative solutions

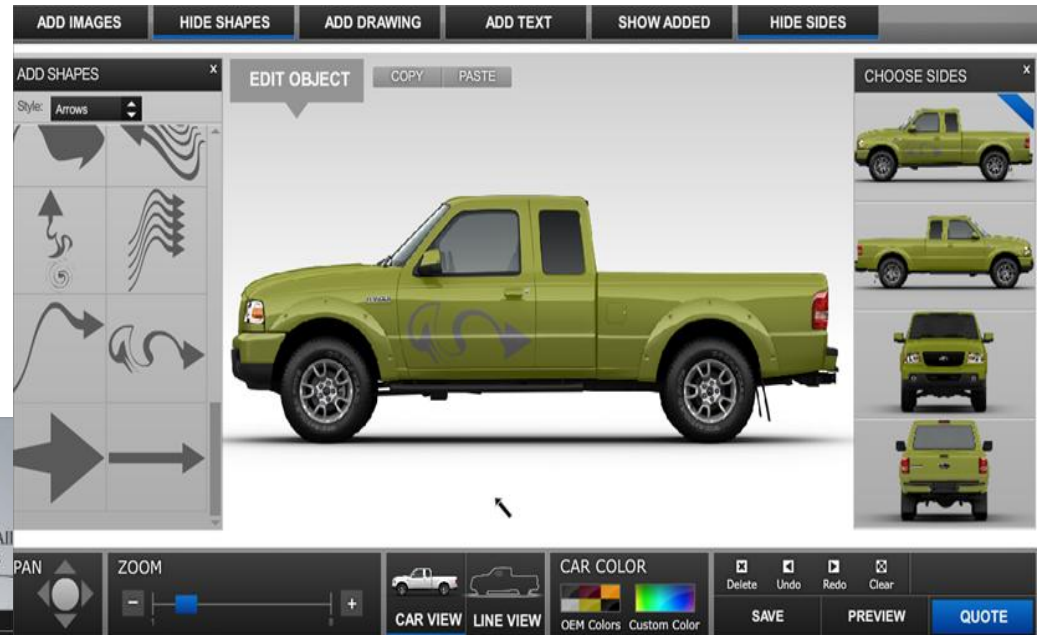**Advanced Visualisation Techniques**
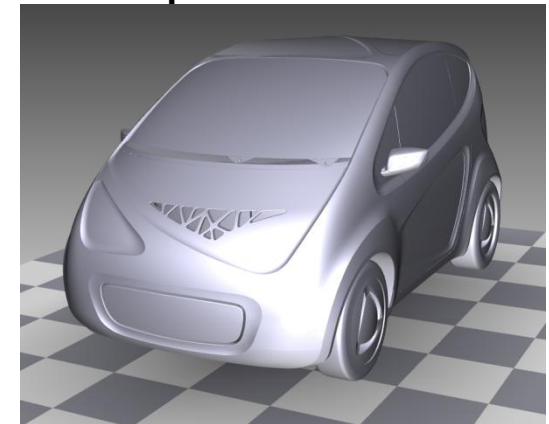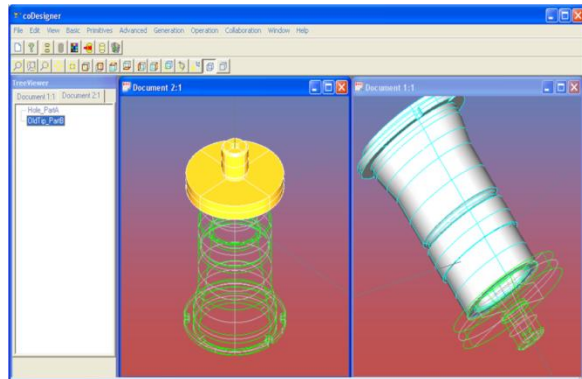
Collaborative Product Design (CPD)

(Working paper: Mourtzis D., Doukas M., "A wed-based virtual and augmented reality platform for supporting the design of personalized products", 45th CIRP CMS 2012)

State of the Art – Product Customisation

Nowadays

**"Customization is crucial in every existing market domain"**

Enabled by Online Product Configurators

(D. Mourtzis, M. Doukas, G. Michalos, F. Psarommatis, "A Web-Based Platform for Distributed Mass Product Customization: Conceptual Design", (DET 2011), ISBN 978-960-88104-2-6, 7th International Conference on Digital Enterprise Technology, Athens, Greece, pp. 604-613 (2011))
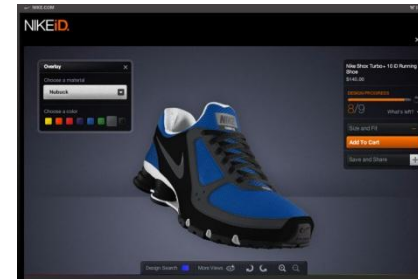
State of the Art – Product Customisation

✓ Digital manufacturing tools and applications that generate **more accurate** and **detailed** solutions for supporting **high product variety**
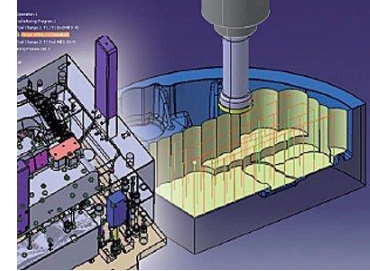
Smart Product Customization is enabled by:

✓ **Information and Communication Technologies**

  ➢ Collaborative Product Design

  ➢ Online product configurators

✓ **Advanced Visualization Technologies:**

  ➢ Virtual Reality

 ➢ Augmented Reality

State of the Art – Web-based Solutions

❖ **Service-oriented Architecture**

  ✓ Flexible design methodologies

  ✓ Interoperable services

  ✓ Cross-platform applications

Service Providers

Clients

❖ **Cloud computing**

  ✓ Distribution of services over Internet

  ✓ Computing as a service

  ✓ Software and data access to novice end-users

Server ← **Infrastructure**

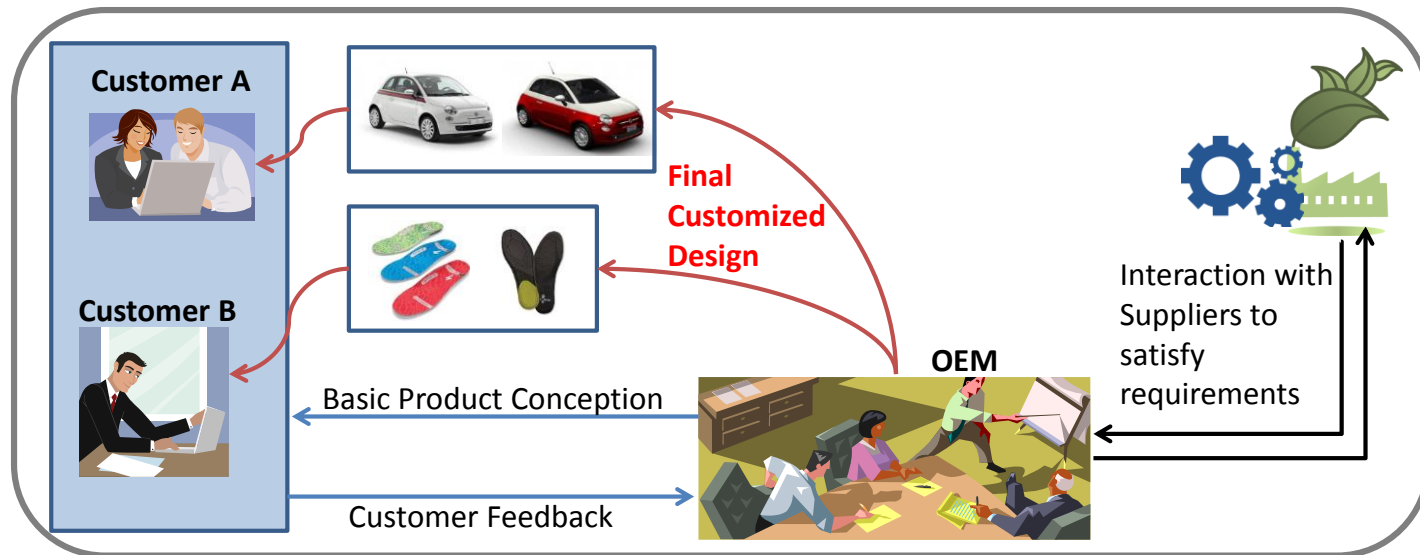**Platform**

Client → **Applications**
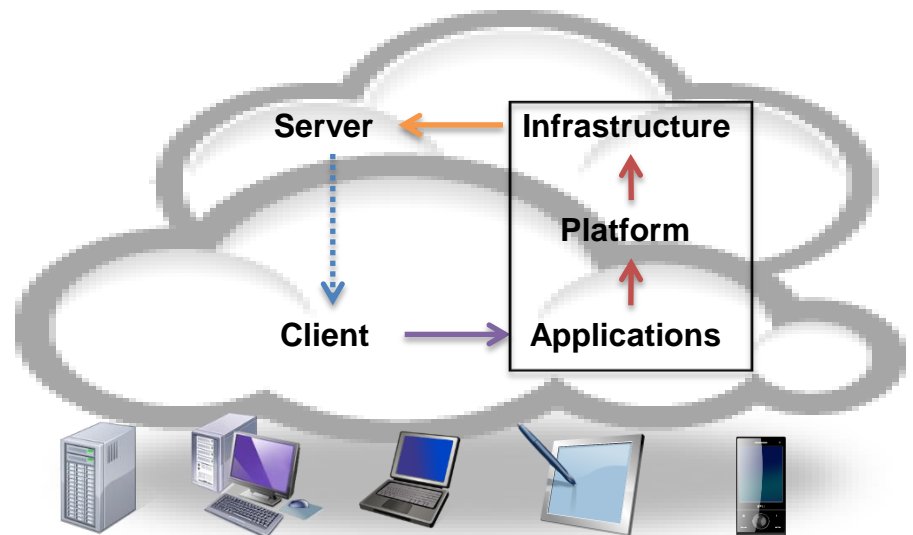
Objectives

"unique products for unique customers"

- ## S&T goals of the project

  ➢ **Bridge the gap between mass production and mass customization**

  ➢ **Engage the customer in the initial design of the products**

  ➢ **Manufacture of personalized added-value products in a novel, coordinated, eco-friendly and efficient decentralized approach**

(e-CUSTOM (260067) – Description of Work)

Objectives

- ## User Adaptive Design System (UADS)

  ➢ **Development of user friendly design tools that will integrate the customers and other stakeholders in the design of the product and allow to perform unique design changes in their order in a controlled way**

- ## Decentralised Manufacturing Platform (DEMAP)

  ➢ **Materialisation of a decentralised manufacturing framework that will define, guide and verify the required supply and manufacturing schemes and processes at the remote sites for massively producing highly customised products**

- ## Environmental Assessment Platform

  ➢ **Development of an environmental assessment set of tools and metrics that will measure the environmental footprint of different design, production and distribution alternative solutions**

Development of a set of tools and methods for supporting Mass Customisation NOT theoretically but with application on "Real World Products" with intensive Industrial involvement even from sectors often considered as typical Mass Production like Automotive

(e-CUSTOM (260067) - Description of Work)

Objectives

**"domain independent solution capable
of accommodating a variety of products"**

Automotive Pilot Case
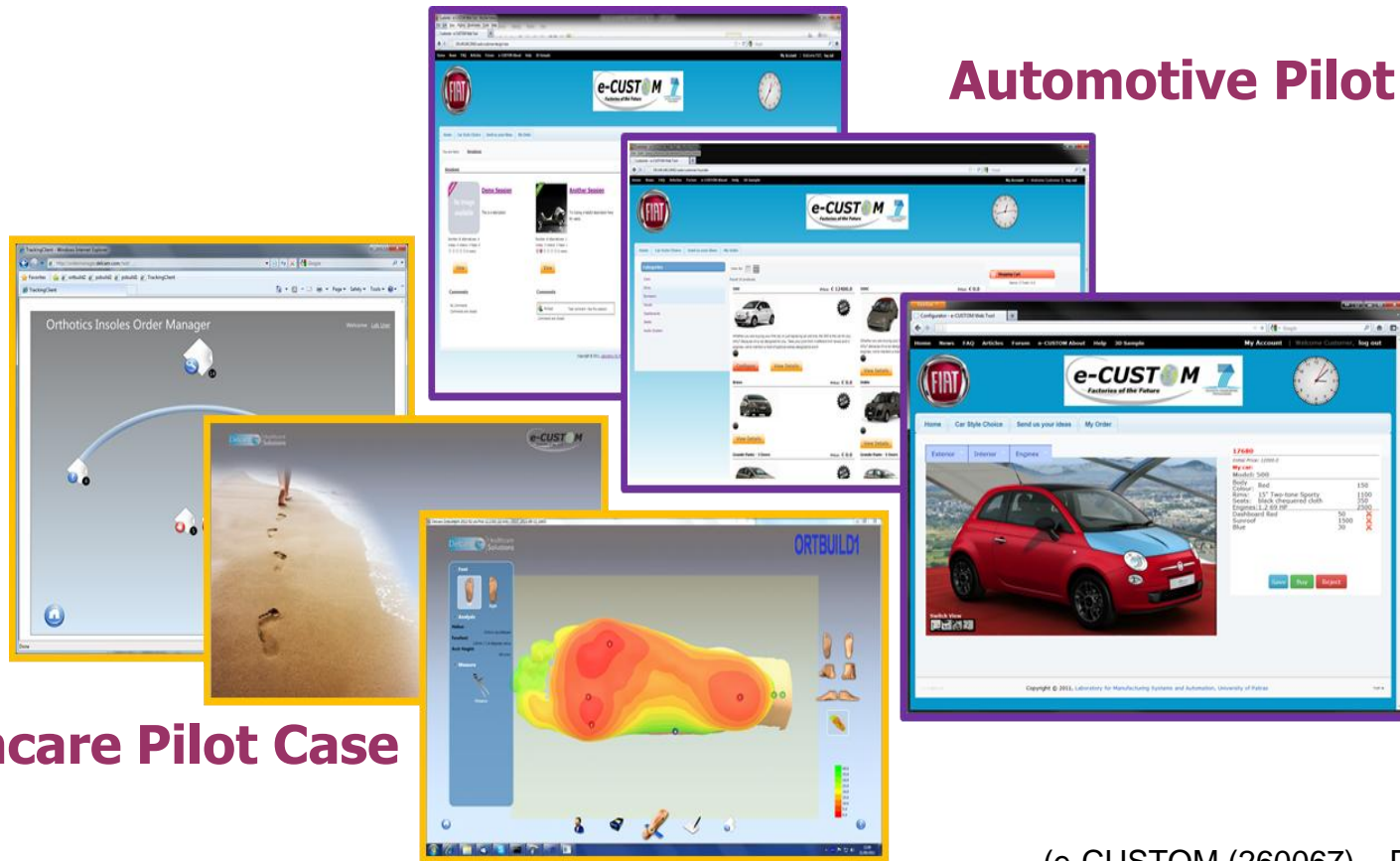
Healthcare Pilot Case

(e-CUSTOM (260067) – Deliverable 2.3a)

Expected Impact

- ➤ **Reduction of ca. 5%-10% in energy consumption**

- ➤ **Reduction of transportation costs by up to 20%**

- ➤ **Reduction of raw material costs by 5% - 10%**

- ➤ **Shortening design time for personalized products by up to 15%**

- ➤ **Increase market share by up to 10%**

- ➤ **Decrease time to market by 15%**

- ➤ **Decrease in delivery time by ca. 15 – 20%**
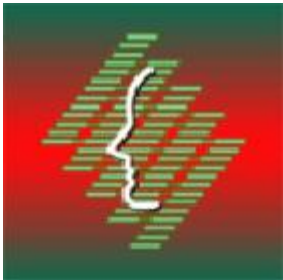
(e-CUSTOM (260067) – Description of Work)

For more information
please visit the e-CUSTOM project portal at the following link:

http://www.ecustom-project.eu/

Contact:

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