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“SPECIES
Production Systems Evolution”

COLLABORATIVE PRODUCT AND PROCESS DESIGN, AND MANUFACTURING OPERATIONS SUPPORT

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Content

- Co-evolution aspect in product / mfg. system design & operations
- Interrelations among product, manufacturing system and service systems life cycles
- Acquisition of operational knowledge
- Industrial case: collaboration among automotive supplier and manufacturing system supplier
- Results and experiences
Motivation

- The customer-supplier relationship is undergoing a substantial transformation from the traditional, simple buy-sell relationship toward the current one, which is focused on partnership.

- Let us consider the relationship between a customer and a manufacturing equipment supplier. The customer is primarily focused on a product which he delivers just-in-time to his customer. Therefore, he requires not just a manufacturing equipment supplier but a partner who would develop, manufacture, install, put the equipment into operations and, later on, who would offer support in operations in terms of process optimization, maintenance, system improvement, upgrading, reconfiguration, etc.

- Companies focus on their own competencies. They acquire complementary expertise and resources over collaborative networks.

- Collaboration has been recognized as one of the most critical issues.
Model of collaborative product development and manufacturing

Source: Sluga, Butala, Peklenik; 2005
Co-evolution aspect in product / mfg. system design & operations
Product life cycle

Rem.: Notation according to GERAM
Co-evolution aspect in product / mfg. system design & operations
Product and mfg. system life cycles
Co-evolution aspect in product / mfg. system design & operations
Relations among product and mfg. system life cycles
Co-evolution aspect in product / mfg. system design & operations
Product, mfg. system and service systems life cycles
Co-evolution aspect in product / mfg. system design & operations
Product, mfg. system and service systems interrelations

[Diagram showing the interrelations between product identification, concept, requirements, preliminary design, detailed design, implementation, operation, decommission, manufacturing system identification, concept, requirements, preliminary design, detailed design, implementation, operation, decommission, and service system identification, concept, requirements, preliminary design, detailed design, implementation, operation, decommission.]

Legende:
- information flow
- operational knowledge flow
Co-evolution aspect in product / mfg. system design & operations
Product, mfg. system and service systems interrelations

![Diagram showing interrelations in product, manufacturing system, and service systems.]

Legend:
- Blue arrows: information flow
- Green arrows: operational knowledge flow
Crossection of product and mfg. system life cycles – a source of operational knowledge
Knowledge elicitation for mfg. system optimization and/or adaptation
Knowledge elicitation for product improvement
Knowledge elicitation for service improvement
Industrial case study: die casting of automotive components on die-casting cells

- A collaborative platform is developed and implemented in an industrial network interconnecting a producer of die-casting components for automotive industries, a manufacturer of die-casting manufacturing cells and several sub-system suppliers and service providers.

- Modules for on-line data acquisition and monitoring have been developed and integrated in die-casting manufacturing cells. These include acquisition of work orders data and related events, collection of process parameters and machine states, and product quality data.

- Monitoring information is visible to all involved parties from anywhere at any time.
Industrial case study: die casting of automotive components on die-casting cells
Surveillance and monitoring of die-casting cells
System architecture for collaboration
Visualization of process data
Visualization of production data (1)
Visualization of production data (2)
Visualization of production data (3)
Possible application of knowledge for maintenance

Source: MAKNET project proposal
Results of the pilot implementation

- The experience shows that
  - collaboration processes related to diagnostics, repair and maintenance are intensive and benefit in reactivity, short diagnostic and repair time and thus in higher system availability, and
  - the casting process is better controlled due to on-line surveillance and remote cooperation of related experts.

- The results are twofold:
  - the customer obtained a powerful information system for management, control and maintenance of a die-casting workshop and on-line support from the equipment supplier and various service providers,
  - the equipment supplier gained the access to on-line information from the production site which enables permanent observation of equipment performances and acquisition of operational knowledge for design assessment and improvement of equipment, real-time prediction of malfunctions and planning of maintenance and repair services
Thank you for your kind attention.