Manufacturing Systems

Manufacturing Systems Knowledge Management:
Manufacturing Systems Ontology

Domain: A model of the structure and the relationships among the primary physical and virtual entities of a manufacturing system, including a description of the manufacturing attributes (Key Performance Indicators) domain

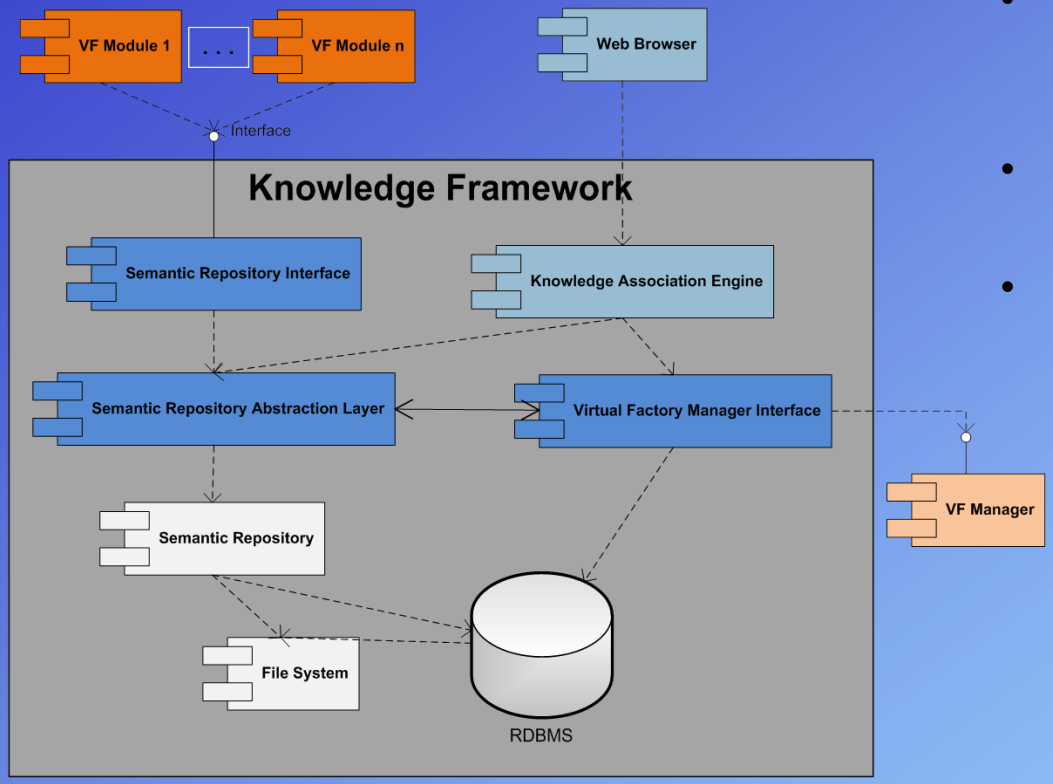
Purpose: Supporting the modelling and the analysis of alternative plant configurations useful for the design and planning of manufacturing systems

Questions (Answered): Association of manufacturing performance indicators with plant, processes, in the context of support decision making

K. Efthymiou, K. Sipsas, D. Melekos, K. Georgoulias, G. Chryssolouris, "A Manufacturing Ontology Following Performance Indicators Approach", (DET 2011), ISBN 978-960-88104-2-6, 7th International Conference on Digital Enterprise Technology, Athens, Greece, pp. 586-595 (2011)

Manufacturing Systems

Manufacturing Systems Knowledge Management: Integrated Knowledge Based Framework



- Capture, store and retrieve knowledge relevant to the initial phases of manufacturing system design.
- Re-use of past projects Knowledge by employing reasoning on semantic data.
- Reasoning is carried out by leveraging similarity mechanisms and inferencing rules

Similarity Mechanism

$$f(T, S_i) = 1 - \sqrt{(T_i - (S_i/T_i))^2}$$

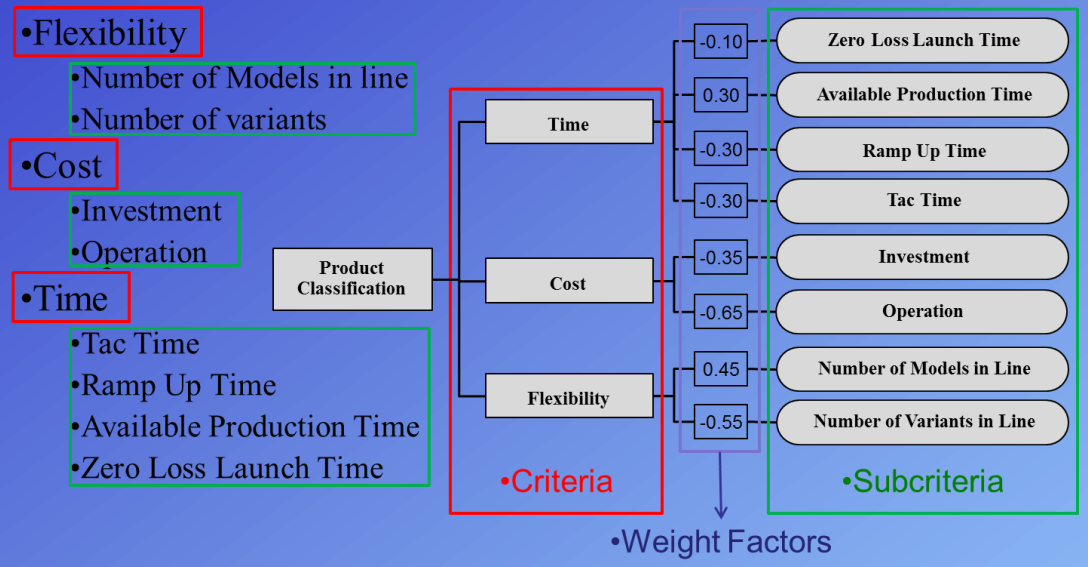
Rule-enabled **SPARQL queries** leveraging the SR's rule engine and inferred data

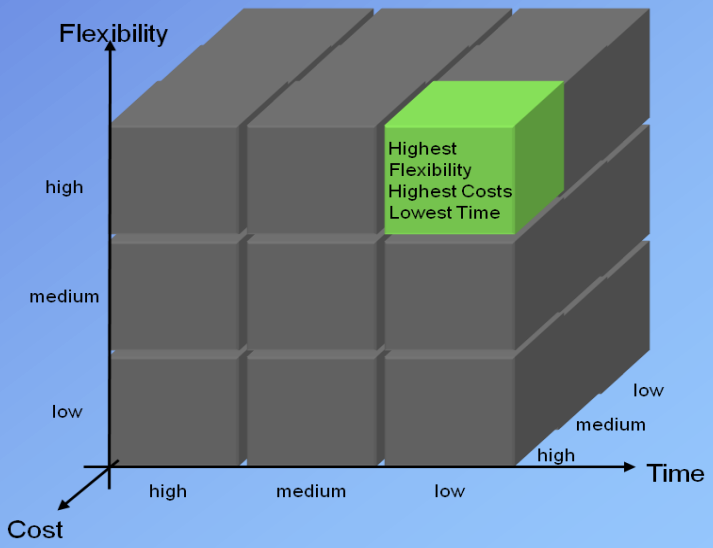
K. Efthymiou, K. Sipsas, D. Mourtzis, G. Chryssolouris, "On an integrated knowledge based framework for manufacturing systems early design phase", Procedia,(CIRPe2013) 2nd CIRP Global Web Conference, Volume 9, pp. 121-126 (2013)

K. Efthymiou, K. Alexopoulos, P. Sipsas, D. Mourtzis, G. Chryssolouris, "Knowledge management framework supporting manufacturing system design", (DET 2011), ISBN 978-960-88104-2-6, 7th International Conference on Digital Enterprise Technology, Athens, Greece, pp. 577-585 (2011)

Manufacturing Systems

Manufacturing Systems Knowledge Management:
Manufacturing Systems Template (Knowledge Cube)



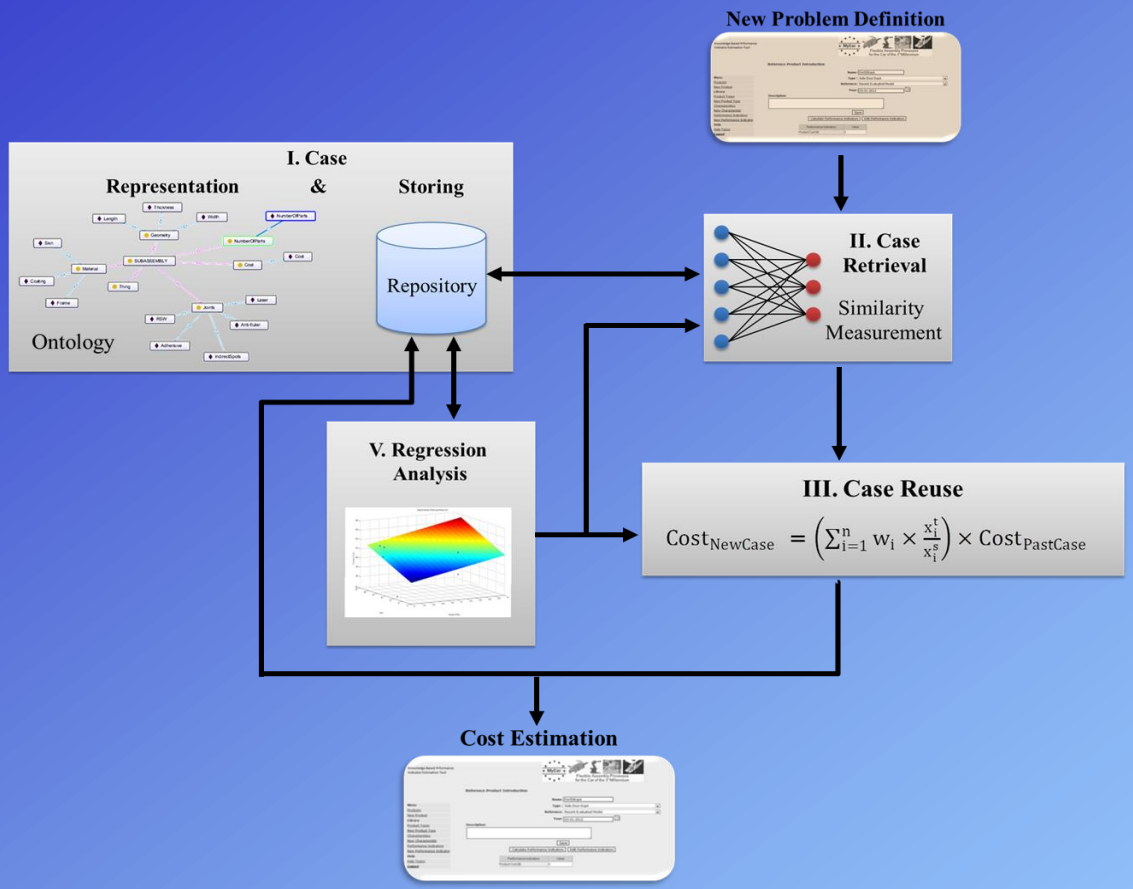


Classification of past projects including product, process and resource data in terms of time, cost and flexibility criteria

N. Papakostas, K. Efthymiou, G. Chryssolouris, S. Stanev, J. Ovtcharova, K. Schafer, R.-P. Conrad, A. Eytan, "Assembly Process Templates for the Automotive Industry", (CATS 10), 3rd CIRP Conference on Assembly Technologies and Systems, Trondheim, Norway, pp. 151-156 (2010)

Manufacturing Systems

Manufacturing Systems Knowledge Management:
Knowledge Based Product Cost Estimation



Two main obstacles due to the lack of information since:

- product is not fully defined yet
- nor the manufacturing processes

Aiming to Identify a Similar Past Product for a Quick Assessment of the new Product's Cost

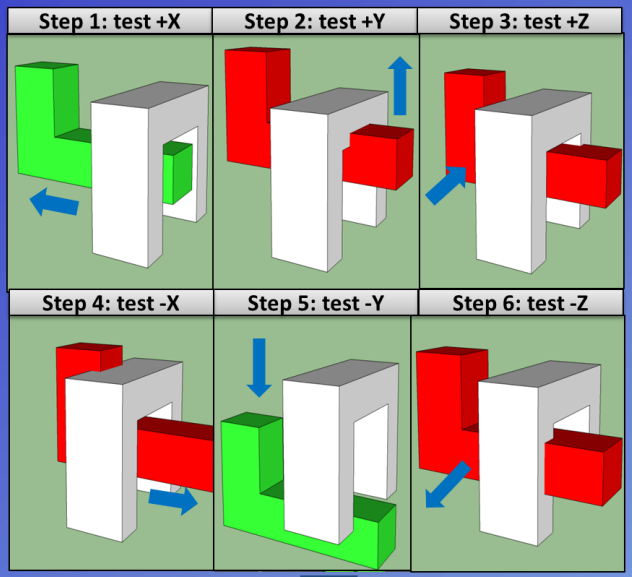
Product Cost Estimation Approach is based on two Pillars:

- Case Based Reasoning: retrieving past similar cases
- Regression Analysis: defining the weighting factors

D. Mourtzis, K. Efthymiou, N. Papakostas, "Product cost estimation during design phase", 44th CIRP International Conference on Manufacturing Systems, Madison, USA (2011)

Manufacturing Systems

Assembly based on automatic sequence generation



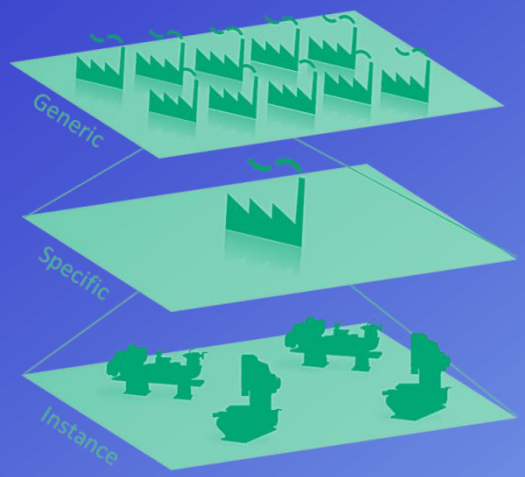
$$\begin{bmatrix} X_{pos} & Y_{pos} & Z_{pos} \\ X_{neg} & Y_{neg} & Z_{neg} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}$$

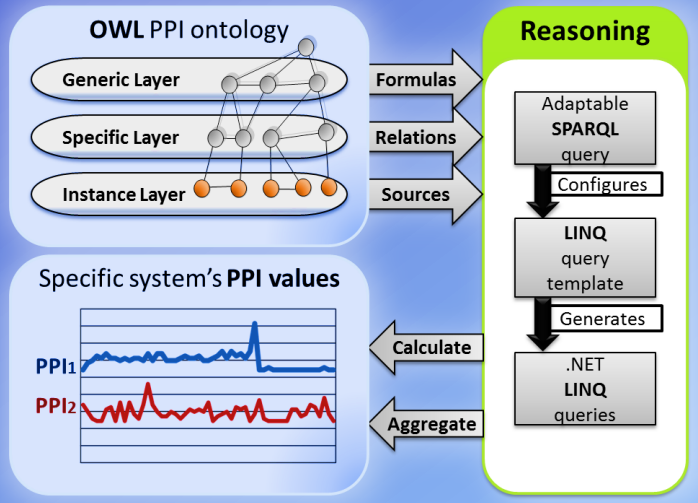
- Assembly sequence generation algorithm for the creation of assembly sequences and steps
- Support for production engineers only through the use of CAD data

REF: S. Makris, G. Pintzos, L. Rentzos, G. Chryssolouris, "Assembly support using AR technology based on automatic sequence generation", CIRP Annals – Manufacturing Technology, Volume 62, No. 1, pp. 9–12 (2013)

Manufacturing Systems

Manufacturing Indicators' Knowledge Model





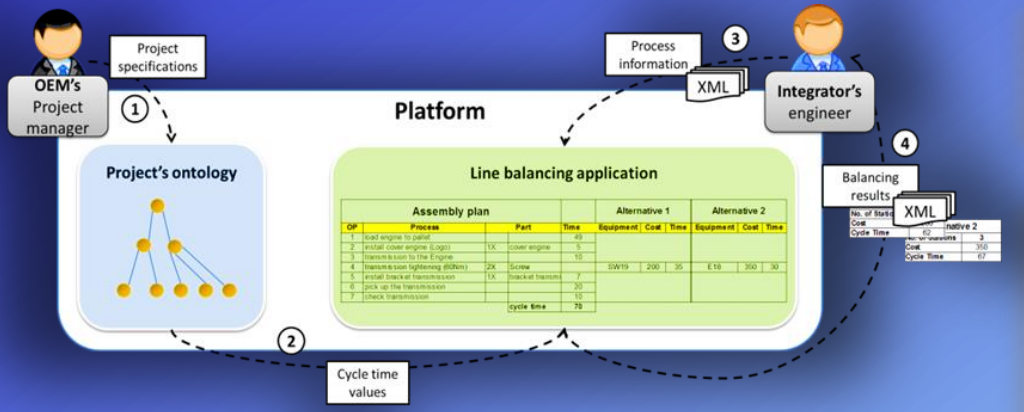
- Knowledge model for the common, structured description of manufacturing indicators for:
  - all manufacturing levels
  - different manufacturing systems
- Automatic generation of data from the shop floor and their translation into useful information for decision support on higher levels

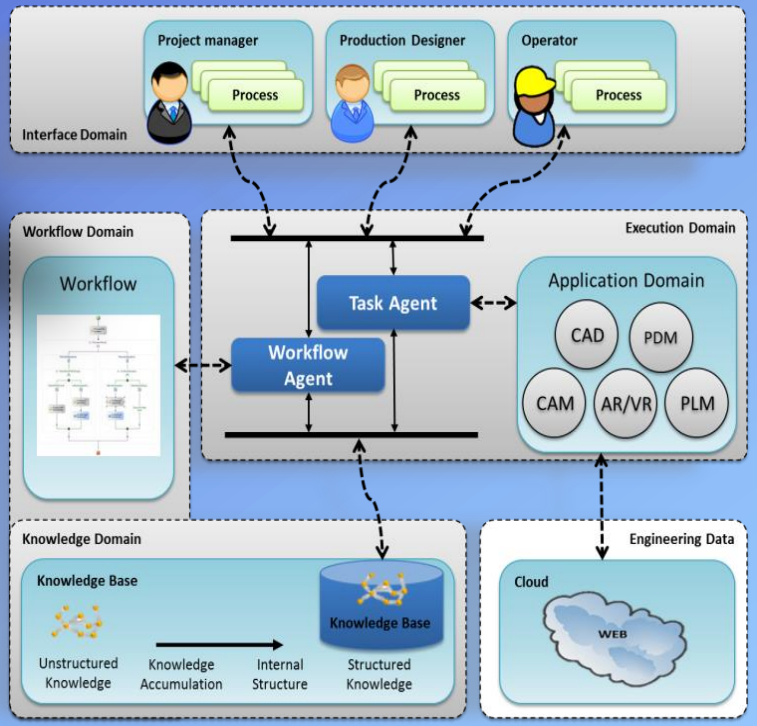
REF: G. Pintzos, M. Matsas, N. Papakostas,G. Chryssolouris, "Production Data Handling Using a Manufacturing Indicators' Knowledge Model", (CIRP CMS 46) Procedia CIRP, 46th CIRP Conference on Manufacturing Systems, 29-31 May, Sesimbra, Portugal (2013)

REF: G. Pintzos, M. Matsas, G. Chryssolouris, "Defining Manufacturing Performance Indicators using Semantic Ontology Representation", (CMS2012), 45th CIRP Conference on Manufacturing Systems, Athens, Greece, pp.7-13 (2012)

Manufacturing Systems

Knowledge based collaborative platform for the design and deployment of manufacturing systems





- Structured information regarding phases of assembly line design and deployment
- Common ontology model can be handled by different SW agents as well as by engineering related web-based applications
- Web-based applications regarding the design of manufacturing systems based on Cloud technologies

REF: G. Pintzos, L. Rentzos, K. Efthymiou, N. Papakostas, G. Chryssolouris, "A Knowledge based collaborative platform for the design and deployment of manufacturing systems", International Conference On Product Lifecycle Management, 6-10 July, Nantes (2013)