

Enterprise resource planning (ERP) Product life-cycle management (PLM)

Information systems in industry ELEC-E8113

Start at 12.15



- Enterprise resource planning (ERP)
- Product lifecycle management (PLM) and product data management (PDM)

Rationale of the lecture: ERP and PDM/PLM are important business processes and information systems in industry but not exactly our focus. There is data transfer between them and MOM/MES and automation. That is why we need to know about



The situation





Basic concepts

- Enterprise resource planning (ERP) is a very essential information system existing in (almost) any industrial company. It is used for supporting management of business and logistic operations at enterprise level (business operations management, BOM).
- Product life-cycle management (PLM) refers to the business processes and information systems used for management of information about products during all stages of their life-cycle.
- Product data management (PDM) can be regarded as part of PLM particularly supporting product design.



Enterprise Resource Planning (ERP)

- ERP means management, i.e. planning, coordinating and monitoring the core business processes (particularly customer order deliveries) of a manufacturing enterprise, and management and communication of information about it
- ERP covers both logistic and business processes
- ERP usually refers the supporting information system. The business process is sometimes called business operations management (BOM)





Interface between ERP and MOM

- The interface between BOM and MOM (and ERP and MES) vary in different companies and types of manufacturing
- Several important parts of customer order delivery process are within ERP
- BOM and ERP are at the enterprise level of the automation pyramid while MOM and MES are at site level





Functionality of ERP

- ERP is often divided into modules according to different supported business process
- Core modules include inbound, outbound and internal logistic, production planning, accounting and controlling
- The modules share a database representing information of the enterprise
- Modules communicate with each other and update status information of the enterprise consistently





Example: customer order delivery process

- The process starts with sales forecasting and processing of orders
- Production planning involves material requirements planning and master scheduling
- Orders are released to SFC (i.e. MES) and feedback monitored
- The process ends with shipping, delivery and billing

MOM/MES





Data of ERP

- The database of an ERP contains various data, including:
 - Organizational data: customers, suppliers, production sites, etc.
 - Product data: products, material and capacity requirements of products, product inventory, product shipments, etc.
 - Material data: materials, material inventory, material shipments, etc.
 - Resource data: resource groups, capacity, availability, also human resources, etc.
 - Demand forecast, production plan and performance, possibly also other types of plans e.g. maintenance
 - Business information for accounting and controlling
 - Business performance indicators



Location and people views to ERP

- Global ERP (i.e. just one ERP in the enterprise) is not the only option in practice
- Partial centralization either with respect to location or function is not uncommon
- ERP has several different user groups with different access rights in various parts of an enterprise. Many of them are office workers.



Number of sites in the same IT system



ERP system architecture

- ERP is a database-oriented server application with multiple user groups and functionality supporting BOM
- Data exchange with several other information systems
- 3-tier system architecture is common
 - Thin user interface containing just presentation, e.g. web browser
 - Application server containing application logic of various modules
 - Database server providing common data storage





Other systems than ERP

- ERP is not the only information system for enterprise activities, e.g. Customer relationship management (CRM), Supplier relationship management (SRM), Supply chain management (SCM), Product lifecycle management (PLM), integration platform, custom add-ons and even more other systems
- The combination of diverse information systems in an enterprise varies considerably depending on type of industry and individual companies





Objectives and challenges of ERP

Intended benefits of ERP include

- Faster and more efficient operation, and decreased unproductive work
- More precise and more real time information about the status of the enterprise
- Unification of the operations of the enterprise, e.g. through so-called best practices

Potential issues with ERP

- High cost of commissioning e.g. due to delays in the project
- High cost of making changes afterwards
- Issues with usability
- Objectives are not necessarily met, evaluation of results is difficult
- Vendor lock-in



Product data management

- PDM and PLM are data management business processes and information systems that store and deliver product data to other business processes of an enterprise
- PDM has narrower scope, typically product design. PLM is needed e.g. for after-sales services





Products

- The concept "product" has multiple meanings, be careful which one you are talking about
- Products both as types or instances
- Possible meanings:
 - Result of an industrial production process
 - Product model (or type) that needs configuration before it can be produced
 - Product configuration that could be produced
 - Product individual that has been produced



Product data and items

• Any data related to products

- Data in databases
- Electronic documents
- Paper documents
- Data from any phase of product lifecycle
 - Product types: product development, subcontracting, production, commissioning, usage, maintenance, revisions, disposal
 - Product individuals: similar phases for each separate individual product

 Items are the basis for managing product data

- Item is an element that is repeatedly referred to, e.g. product, part, material, document, etc.
- Identification, a string given systematically, may be classifying
- Description as human readable text
- Items are different in separate companies
- Classification to hierarchies which are typically compromises between needs of different users
- Revisions, variants and status
- Suppliers and manufacturers
- Other data, possibly > 100



Structures, documents, versions and status

- Structures of items
 - There several structural views a product, e.g. design, function, production and materials
 - Hierarchical and recursive data structures e.g. with "has part" and "made of" relations
- Document items
 - Typically a document item is stored to database with a link to the actual content
 - From the data management viewpoint documents are non-structured data

- Items can have different versions that may be either revisions or variants
 - A revision replaces the original one whereas variant does not
- Items have lifecycles with different statuses during it
 - The statuses control the utilization of items in different activities, e.g. "accepted to production"



PDM system architecture

- PDM systems are data management systems that combine product data stored both in a database and documents
- Items are stored into a (meta)database
- Documents are typically stored separately
- Multiple user groups with different access rights
- Data exchange with several different other information systems (e.g. ERP)





Objectives and challenges of PDM

Intended benefits of PDM include

- Faster access and delivery of product data within an enterprise leading to decreased number of errors and less unproductive work
- Better updated information about products in the enterprise
- Particularly faster product design through concurrent work and efficient reuse of existing product data
- Better management of changes in product data
- Potential issues with PDM
 - Large number of items, complexity of product structures
 - Product data management in an enterprise network



After-sales services and PLM

- After-sales services are an important motivation for PLM
- After-sales services include services of equipment vendor for several stages of product usage:
 - Commissioning, e.g. installation, training, start-up
 - Usage, e.g. condition monitoring, fault diagnostic, maintenance, performance monitoring
 - Changes, e.g. extension, modernization, relocation, disposal, recycling
- Although many of these activities utilize product data they also require other types of data
- PDM is not enough for these activities, e.g. ERP support for services is needed and CBM for maintenance. Need for PLM

