

Product Date Management

PDM

- **Product data management (PDM)** is the business function often within product lifecycle management(PLM) that is responsible for the management and publication of product data.
- In software engineering, this is known as version control.
- The management of version control is the only way to ensure that everyone is on the same page and that there is no confusion during the execution of the processes and that the highest standards of quality controls are maintained.

- Product data management is the use of software or other tools to track and control data related to a particular product.
- The data tracked usually involves the technical specifications of the product, specifications for manufacture and development, and the types of materials that will be required to produce goods.
- The use of product data management allows a company to track the various costs associated with the creation and launch of a product.
- Product data management is part of product lifecycle management and configuration management, and is primarily used by engineers.

PDM system status today

PDM systems coverage is more restricted:

- Current PDM systems do not include commercial data (stocks, purchase orders, invoices, cost accounting, etc.) of the company. They are managed by Enterprise Resource Planning (ERP) systems.
- Main interest of PDM lays on product support processes (R&D, etc.)
- Many PDM systems do not support configurable products and product individual and production process life-cycles
PDM system does not create new product data.

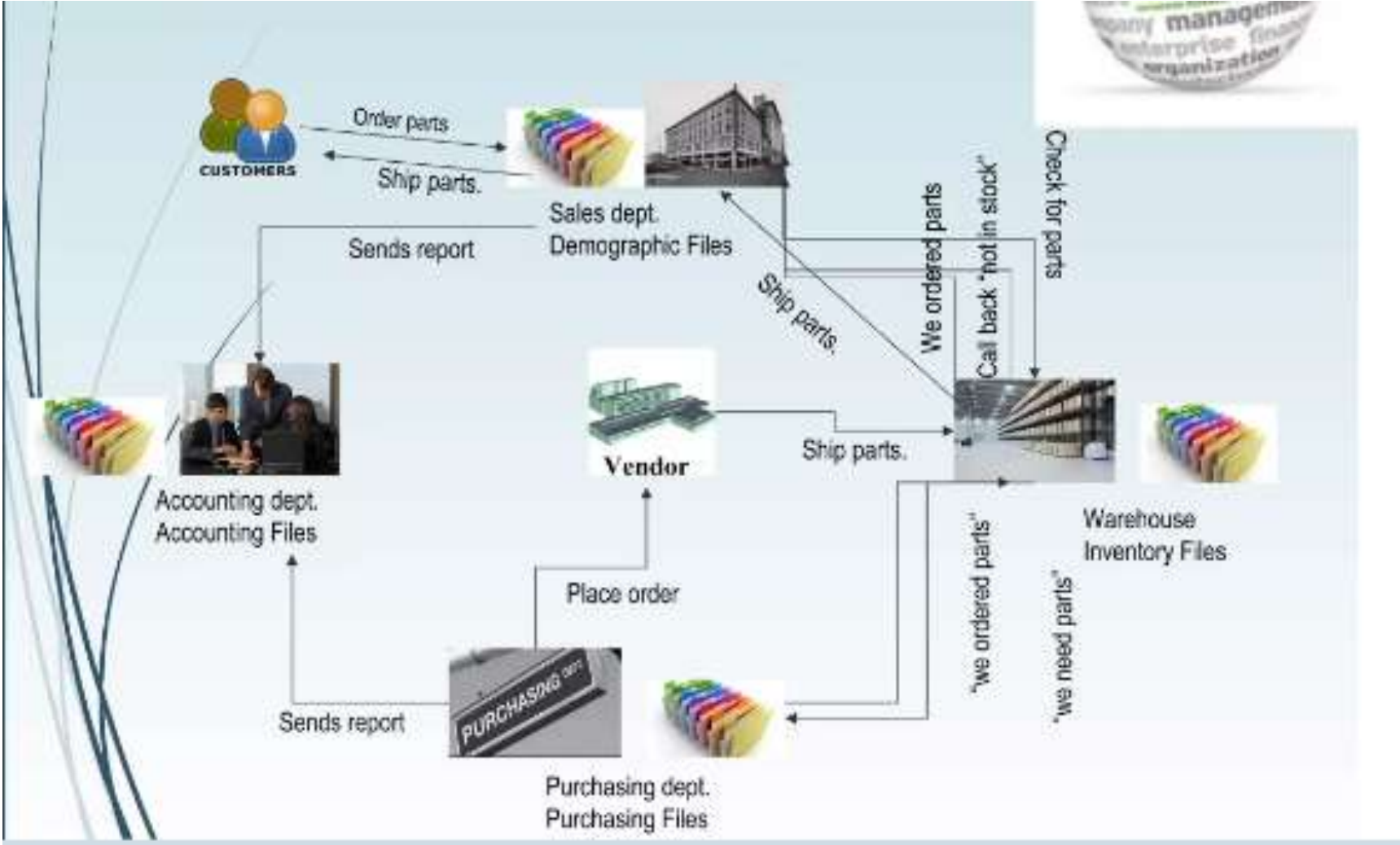
What is ERP?



Definition:

- ENTERPRISE RESOURCE PLANNING(ERP) is a cross-functional enterprise system driven by an integrated suite of software modules that supports the basic internal business processes of a company

Before ERP



ERP Application Components



Source : <https://www.linkedin.com/pulse/20140926221016-366028342-10-emerging-trends-in-erp>

Hidden Costs of ERP



Training

Integration and testing

Data conversion

Data analysis

Consultants

Replacing best and brightest staff after implementation

Implementation teams can never stop

Waiting for ROI

Post-ERP depression

Best Practices of ERP Implementation

- ▣ *Change Management*
- ▣ *Extensive Education and Training*
- ▣ *Data Clean up and Data Integrity*
- ▣ *Implementation is viewed as an ongoing process*

Characteristics of PLM

Lifecycle Focus: PLM encompasses the entire product lifecycle, from concept to disposal. It covers stages such as product design, engineering, manufacturing, marketing, and support. This end-to-end perspective helps organizations make informed decisions at every stage of the product's journey.

Centralized Data Repository: PLM systems provide a centralized repository for all product-related information, including CAD drawings, specifications, bills of materials (BOMs), documentation, and historical data. This centralization ensures that everyone involved in the product development process has access to up-to-date and accurate information.

Collaboration: PLM encourages collaboration among cross-functional teams, including designers, engineers, manufacturers, suppliers, and marketing professionals. It facilitates communication, file sharing, and workflow management, reducing the likelihood of miscommunication or information silos.

Version Control: PLM systems maintain version control for product-related data. This ensures that users always work with the latest and most accurate information and helps prevent errors caused by working with outdated data.

Change Management: PLM systems include change management capabilities, allowing organizations to track and manage changes to product designs, components, or processes. This helps ensure that changes are properly reviewed, approved, and implemented.

Characteristics of PLM

- **Regulatory Compliance:** In industries subject to regulatory requirements, PLM systems help organizations maintain compliance by documenting and managing regulatory data, certifications, and quality standards throughout the product lifecycle.
- **Cost Management:** PLM solutions help organizations control costs by providing visibility into the cost implications of design decisions, material choices, and manufacturing processes. This enables better cost estimation, cost tracking, and cost reduction strategies.
- **Risk Management:** PLM systems can assist in identifying and mitigating risks associated with product development. By analyzing data and historical information, organizations can make more informed decisions to reduce risks related to product quality, safety, and performance.
- **Integration:** PLM systems often integrate with other enterprise systems, such as Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), and Manufacturing Execution Systems (MES), to ensure seamless data flow and coordination across the organization.
- **Scalability:** PLM solutions are scalable, meaning they can adapt to the needs of both small and large organizations. They can accommodate a wide range of industries and product types, from discrete manufacturing to complex systems engineering.
- **Analytics and Reporting:** PLM systems offer advanced analytics and reporting capabilities, allowing organizations to gain insights into product performance, design efficiency, and other critical metrics. These insights support data-driven decision-making.
- **Sustainability:** Many modern PLM systems include features to track and improve the environmental sustainability of products. This includes assessing the environmental impact of materials and processes, as well as compliance with sustainability regulations.

Information mirror modelling or Digital Twin

A digital twin is a virtual representation of a physical object, system, or process. It's a digital replica that provides a way to simulate, monitor, and analyze real-world entities and activities. Digital twins are used in various industries and applications, including manufacturing, healthcare, urban planning, and more. Here are some key aspects of digital twins:

- **Representation:** A digital twin typically includes detailed data about the physical object or system it represents. This data can be in the form of 3D models, sensor data, CAD (Computer-Aided Design) drawings, historical data, and other relevant information.
- **Real-time Data:** In many cases, digital twins are connected to the real-world counterpart through sensors and IoT (Internet of Things) devices. This allows for real-time data to be collected and fed into the digital twin, enabling continuous monitoring and analysis.
- **Simulation:** Digital twins often include simulation capabilities that allow users to model various scenarios and predict how changes or events in the physical world will impact the object or system. This can be valuable for testing and optimizing processes.
- **Analysis and Optimization:** Digital twins are used for analyzing data, identifying trends, and making informed decisions. For example, in manufacturing, a digital twin of a production line can help optimize operations, reduce downtime, and improve efficiency.

Information mirror modelling or Digital Twin

- **Maintenance:** Predictive maintenance is a common use case for digital twins. By monitoring the condition of equipment in real-time and predicting when maintenance is needed, companies can reduce downtime and maintenance costs.
- **Healthcare:** In healthcare, digital twins can be used to model and simulate the human body, helping with personalized medicine, treatment planning, and surgical simulations.
- **Smart Cities:** Digital twins can represent entire urban areas, allowing city planners to simulate traffic flow, energy consumption, and other factors to make informed decisions about infrastructure and resource allocation.
- **AI and Machine Learning:** Digital twins often incorporate AI and machine learning algorithms to analyze data and make predictions. These technologies can help automate decision-making and uncover insights that may be challenging to discover manually.
- **Lifecycle Management:** Digital twins can span the entire lifecycle of an object or system, from design and development to operation and maintenance. This provides a holistic view and helps improve overall efficiency.
- **Security and Privacy:** Protecting the data and security of digital twins is crucial, especially when they represent critical infrastructure or sensitive systems. Robust cybersecurity measures are essential to prevent unauthorized access and data breaches.

Collabrate Product Development

Collaborative product development is a process that involves multiple teams, departments, or organizations working together to design, develop, and bring a product to market. Effective collaboration is crucial for successful product development, as it leverages the expertise and resources of various stakeholders. Here are the key steps in a collaborative product development process:

- **Idea Generation:** The process begins with the generation of product ideas. This can come from various sources, including customer feedback, market research, brainstorming sessions, and innovation teams. Collaborative input is essential at this stage to gather diverse perspectives and identify promising ideas.
- **Concept Development:** Once ideas are generated, cross-functional teams collaborate to refine these concepts. They assess feasibility, market potential, technical requirements, and potential risks. This stage often involves creating concept sketches, mock-ups, or prototypes.
- **Market Research:** Collaboration with market research teams is vital to validate the product concept. Market research helps determine if there is a demand for the proposed product, who the target audience is, and what the competitive landscape looks like.

Collabrate Product Development

- **Design and Engineering:** Collaborative teams of designers, engineers, and other experts work on detailed product design and development. This phase includes creating detailed product specifications, selecting materials, and developing the product's architecture.
- **Prototyping and Testing:** Collaborative efforts continue with the creation of prototypes or samples. These prototypes are used for testing and validation, ensuring that the product meets quality standards and user requirements. Multiple iterations may be required based on test results and feedback.
- **Manufacturing and Production Planning:** Collaboration extends to manufacturing and production teams. They work together to establish manufacturing processes, source materials, and plan production schedules. Close coordination ensures that the product can be manufactured efficiently and cost-effectively.
- **Supply Chain Management:** Collaboration with suppliers and logistics partners is crucial for a smooth supply chain. Effective communication and coordination with these stakeholders help ensure a steady flow of materials and components to support production.

Collabrate Product Developement

- **Quality Control and Assurance:** Cross-functional teams collaborate to establish quality control measures and standards. Regular inspections, testing, and quality assurance procedures are essential to maintain product quality.
- **Regulatory Compliance:** If the product is subject to regulatory requirements (e.g., safety standards, certifications, approvals), collaboration with regulatory experts is necessary to ensure compliance.
- **Marketing and Sales:** Collaborate with marketing and sales teams to develop a marketing strategy, create promotional materials, and plan product launches. Sales teams need to be well-informed about the product to effectively sell it to customers.
- **Feedback and Iteration:** Throughout the product development process, teams should continuously gather feedback from various stakeholders, including customers, and use it to make necessary adjustments and improvements.

Collabrate Product Developement

- **Documentation and Knowledge Transfer:** Document all aspects of the product development process, including design specifications, manufacturing processes, and quality standards. This documentation is valuable for future reference and knowledge transfer.
- **Launch and Post-Launch Activities:** Collaborate on the product launch, monitor its performance in the market, and gather customer feedback. Adjust marketing and product strategies as needed based on post-launch insights.
- **Continuous Improvement:** Encourage ongoing collaboration and a culture of continuous improvement. Teams should meet regularly to review the product's performance, identify areas for enhancement, and plan for future iterations or new product developments.

Engineering Vaulting

Product Lifecycle Management (PLM) is a comprehensive approach to managing a product from its conception through design and manufacturing to service and disposal. Engineering vaulting, in the context of PLM, refers to the use of digital repositories or vaults to store, manage, and secure all engineering and product-related data and documents throughout the product's lifecycle. Here's how engineering vaulting fits into the broader framework of PLM:

- **Data and Document Management:** Engineering vaulting provides a centralized repository for storing all engineering data, documents, and design files. This includes CAD models, drawings, specifications, bills of materials (BOMs), simulation results, test data, and more. Storing these assets in a secure vault ensures that they are accessible to authorized team members and can be tracked and versioned effectively.
- **Version Control:** One of the critical aspects of PLM is version control. Engineering vaulting systems maintain a history of revisions for all design and engineering data. This helps teams track changes, roll back to previous versions if needed, and maintain an audit trail of who made what changes and when.

Engineering Vaulting

- **Collaboration:** PLM systems with engineering vaulting capabilities facilitate collaboration among geographically dispersed teams and external partners. Team members can access the latest design data, collaborate on design changes, and provide feedback in a controlled and secure environment.
- **Security:** Security is paramount in PLM, especially for intellectual property protection. Engineering vaulting solutions implement access controls and permissions to ensure that only authorized personnel can access and modify sensitive design and engineering data.
- **Workflow Management:** PLM systems, including engineering vaults, often include workflow management capabilities. This allows organizations to define and automate engineering change requests (ECRs), engineering change orders (ECOs), and other processes to ensure that changes to the product are properly reviewed, approved, and documented.
- **Compliance and Regulatory Requirements:** For industries with strict compliance and regulatory requirements (e.g., aerospace, healthcare), engineering vaulting systems help manage and maintain records of compliance documentation and traceability of design decisions.
- **Integration:** PLM systems with engineering vaulting are typically integrated with other enterprise systems, such as enterprise resource planning (ERP) and customer relationship management (CRM) systems. This integration ensures that product data flows seamlessly throughout the organization, from design to manufacturing and beyond.

Engineering Vaulting

- **Product Lifecycle Traceability:** Engineering vaulting plays a crucial role in maintaining complete traceability of the product throughout its lifecycle. This traceability helps organizations address issues, recalls, and warranty claims efficiently.
- **End-of-Life Management:** As a product approaches the end of its lifecycle, engineering vaulting systems assist in managing decisions related to product discontinuation, obsolescence, and disposal.

Digital Mockup

Definition: Digital Mockup is a digital representation of a physical product, often a 3D model, that encompasses all relevant design and manufacturing information. It provides a virtual environment for visualizing, analyzing, and validating the product's design before it's physically built.

Key Aspects:

- **Visualization:** DMUs allow teams to visualize the product from various angles, zoom in on specific components, and perform virtual walkthroughs. This helps in understanding the product's form and function.
- **Interference Checking:** Engineers can use DMUs to check for interferences and clashes between components or systems early in the design process, reducing costly errors in physical prototypes.
- **Assembly Sequencing:** DMUs enable the visualization and validation of assembly sequences, ensuring that components fit together correctly during the manufacturing process.
- **Ergonomics and Human Factors:** In industries like automotive and aerospace, DMUs are used to assess the ergonomics of product designs, ensuring that they are comfortable and safe for human interaction.
- **Collaboration:** DMUs facilitate collaboration among cross-functional teams, allowing engineers, designers, and other stakeholders to review and provide feedback on the product's design.
- **Configuration Management:** DMUs help manage different configurations or variants of a product, making it easier to design and produce customized products for different markets or customers.

Digital Manufacturing

- Definition: Digital Manufacturing refers to the use of digital tools and technologies to plan, simulate, and optimize manufacturing processes. It involves the integration of various software applications to streamline production and improve efficiency.

Key Aspects:

- Process Planning: DM involves the creation of detailed manufacturing process plans, including selecting equipment, defining workstations, specifying tooling, and establishing production sequences.
- Simulation: Digital manufacturing tools enable the simulation of manufacturing processes, allowing organizations to identify bottlenecks, optimize workflows, and assess production feasibility.
- Quality Assurance: DM includes quality control and assurance processes, ensuring that products meet specified quality standards throughout the manufacturing process.
- Resource Management: It involves managing resources such as materials, labor, and equipment efficiently to minimize waste and production costs.
- Inventory Management: DM helps optimize inventory levels, ensuring that raw materials and components are available when needed without overstocking.
- Digital Twins: Some advanced DM systems incorporate the concept of a "digital twin" of the manufacturing process, where a virtual model mirrors the physical production line, allowing for real-time monitoring and optimization.
- Integration: Digital Mockup and Digital Manufacturing are closely integrated. The 3D digital mockup can serve as the basis for digital manufacturing simulations and planning. Changes to the product design in the DMU can be quickly reflected in the manufacturing process plans in DM, ensuring that the manufacturing process remains synchronized with the evolving product design.