

AEoM33PIS – Industrial Information Systems

Lecture Nr. 2

27. 2. 2017



Department of Cybernetics K13133
Centre for Knowledge Management K13393

Agenda

- AAR
- Definition of Information System
- Types of Information Systems



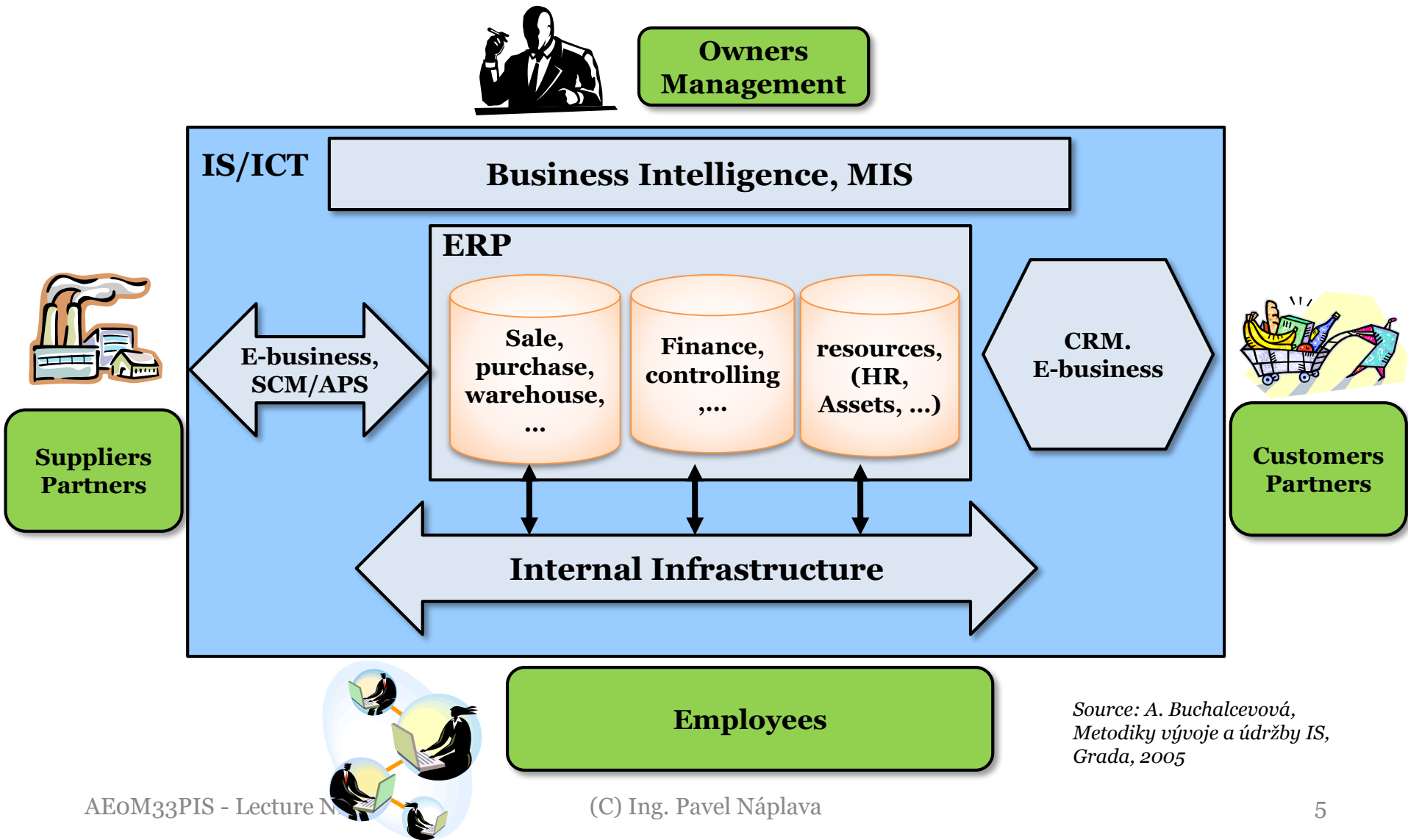
AAR

- **After Action Review**
- Borrowed from Military
- Main ideas of the 1st lecture:
 - Does IT matter?
 - Business vs. Technology View
 - Strategy
 - Did you think about the importance of strategy at home?



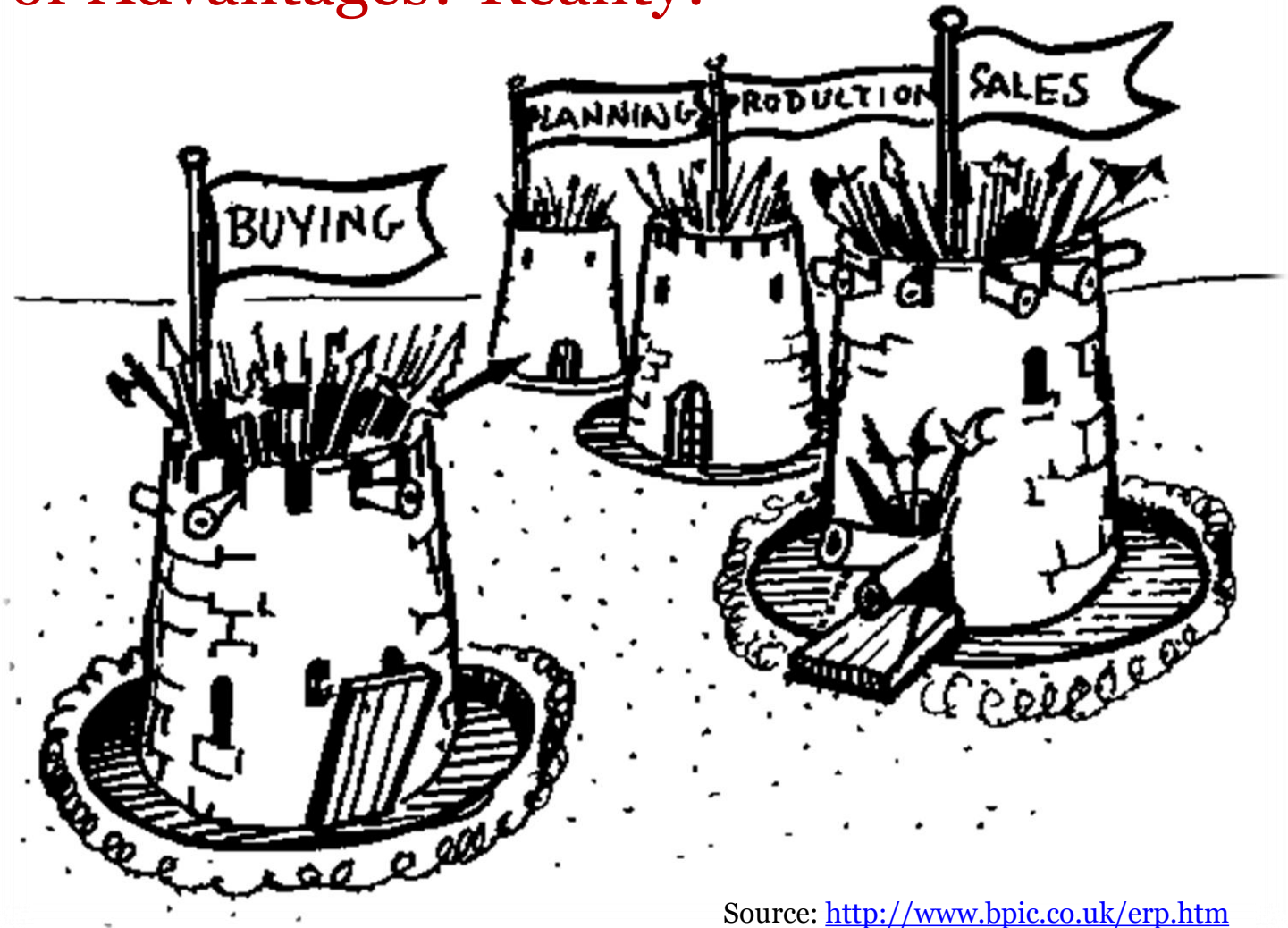


Typical IT Infrastructure



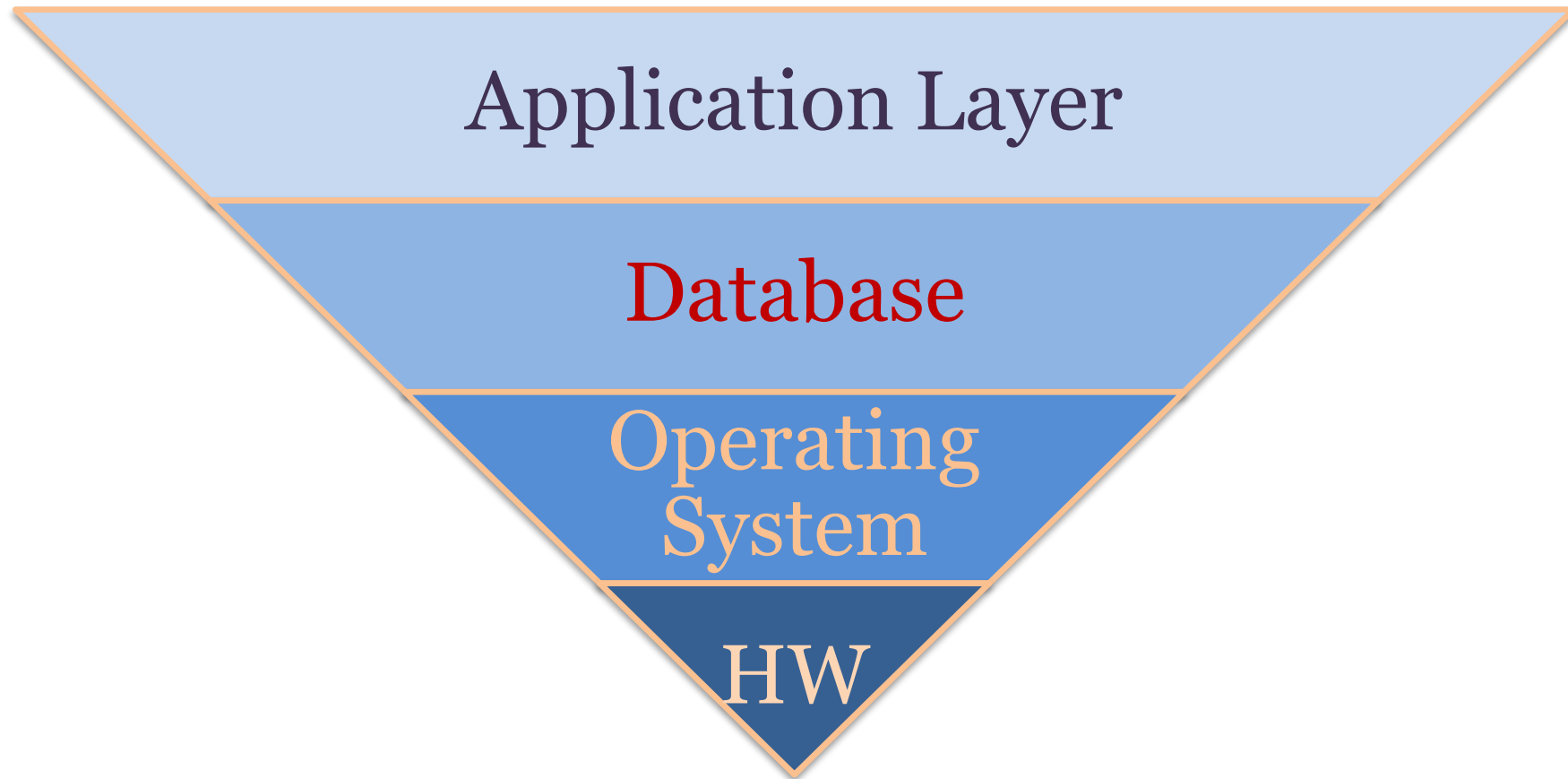
Source: A. Buchalceová,
Metodiky vývoje a údržby IS,
Grada, 2005

Obstacles or Advantages? Reality!



Source: <http://www.bpic.co.uk/erp.htm>

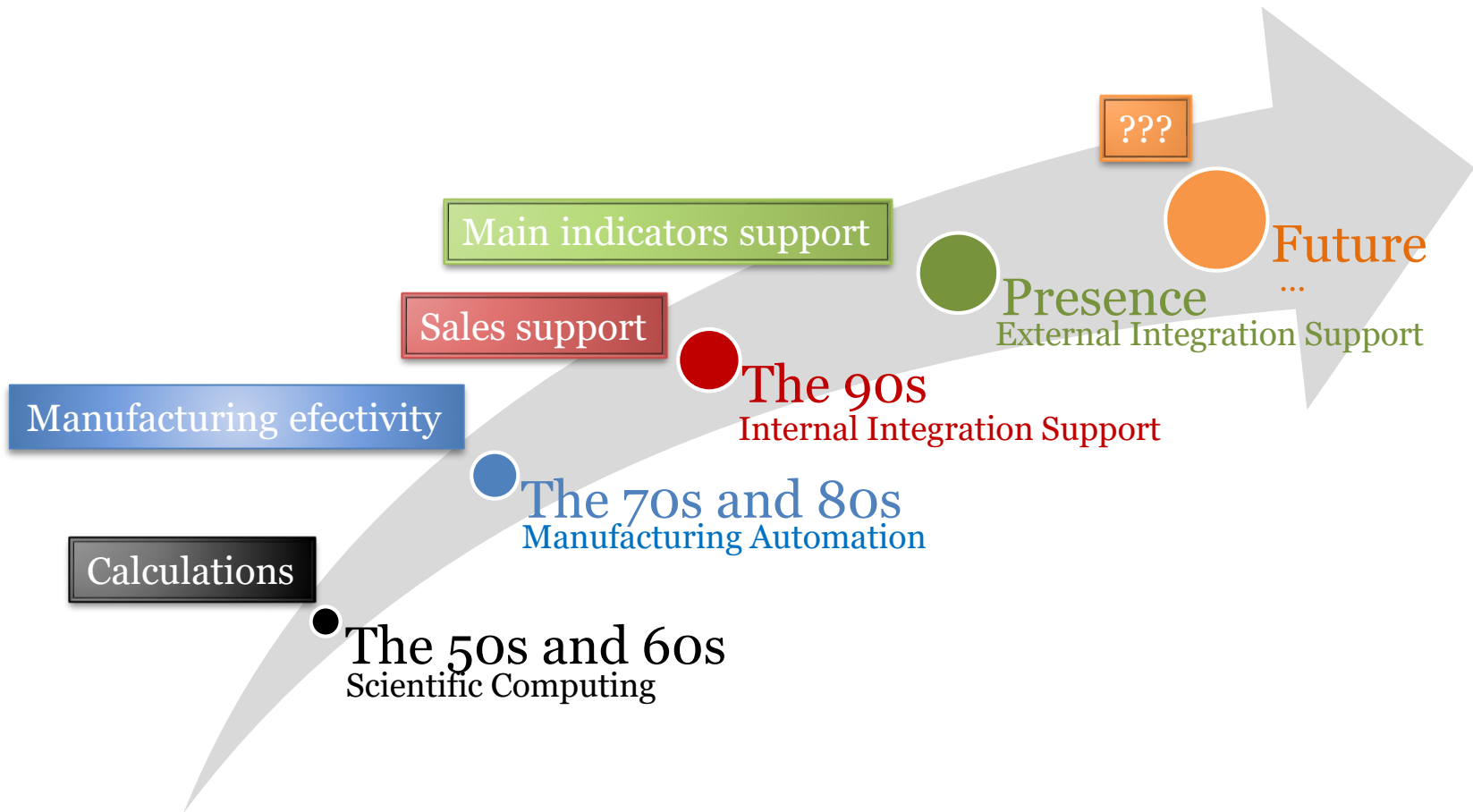
Typical layers of Information System



Information System (IS) Definition

- any organized system for the collection, organization, storage and communication of information.
- an integrated set of components for collecting, storing, and processing data and for providing information, knowledge, and digital products.
- a combination of hardware, software, infrastructure and trained personnel organized to facilitate planning, control, coordination, and decision making in an organization.

History of Information Systems



Revolution of IT Meaning in 90s

Beginning of 90s		End of 90s
Computers, devices	⇒	Information Systems, technologies
Mainframes, terminals, PCs	⇒	Client/server applications Intranet, Internet
In-house development	⇒	Customization of a standard Solution
In-house computer centers	⇒	Employers + external supplier
Integration of internal data to one database	⇒	Integration of suppliers and customers
Time effectivity, higher productivity	⇒	Decision and sales support

Pyramid model– types of Information Systems



Source: <http://rianti-rozalina.blogspot.cz/2012/04/week-5-in-fcc123.html>

Transaction processing systems (TPS)

Definition and purpose	Examples of use
(1) Records all daily routine transactions in an organisation	(1) Sales/marketing systems. Record sales transactions and provide details on marketing and promotional activities.
(2) Used mainly by operational level managers	(2) Manufacturing production systems. Records details of purchases, production and shipping of goods.
(3) Supplies summary data to DSS and MIS	(3) Finance/accounting systems. Maintenance of financial data in organisation.
	(4) Human resources – maintain details of employees.

Source: [http://kfknowledgebank.kaplan.co.uk/KFKB/Wiki%20Pages/Management%20Information%20Systems%20\(MIS\).aspx](http://kfknowledgebank.kaplan.co.uk/KFKB/Wiki%20Pages/Management%20Information%20Systems%20(MIS).aspx)

Management information systems (MIS)

Definition and purpose	Examples of use
<p>(1) Converts data into information and communicates that information in an appropriate form to managers at all levels.</p> <p>(2) Enables managers to make timely and effective decisions for planning and controlling the activities for which they are responsible.</p> <p>(3) Used extensively by tactical users.</p>	<p>(1) Product information – on-line categorised information at a keystroke.</p> <p>(2) Sales ledger – information relating to customer turnover and payment records. Trend analysis to identify customers whose business is growing/declining.</p> <p>(3) Supplier information – such as amount spent and reliability indicators to use when negotiating and making strategic decisions.</p>

Source: [http://kfknowledgebank.kaplan.co.uk/KFKB/Wiki%20Pages/Management%20Information%20Systems%20\(MIS\).aspx](http://kfknowledgebank.kaplan.co.uk/KFKB/Wiki%20Pages/Management%20Information%20Systems%20(MIS).aspx)

Decision support systems (DSS)

Definition and purpose	Examples of use
(1) An integrated, computer-based, user-machine system that provides information for supporting operations and decision-making functions.	(1) Supports structured decision making.
(2) Assists tactical or management level decision makers.	(2) Provides online access to TPS to obtain summary data.
(3) No typical system – depends on requirements in company.	(3) May provide external information on competitors.
	(4) Basic statistical analysis normally found in a DSS.

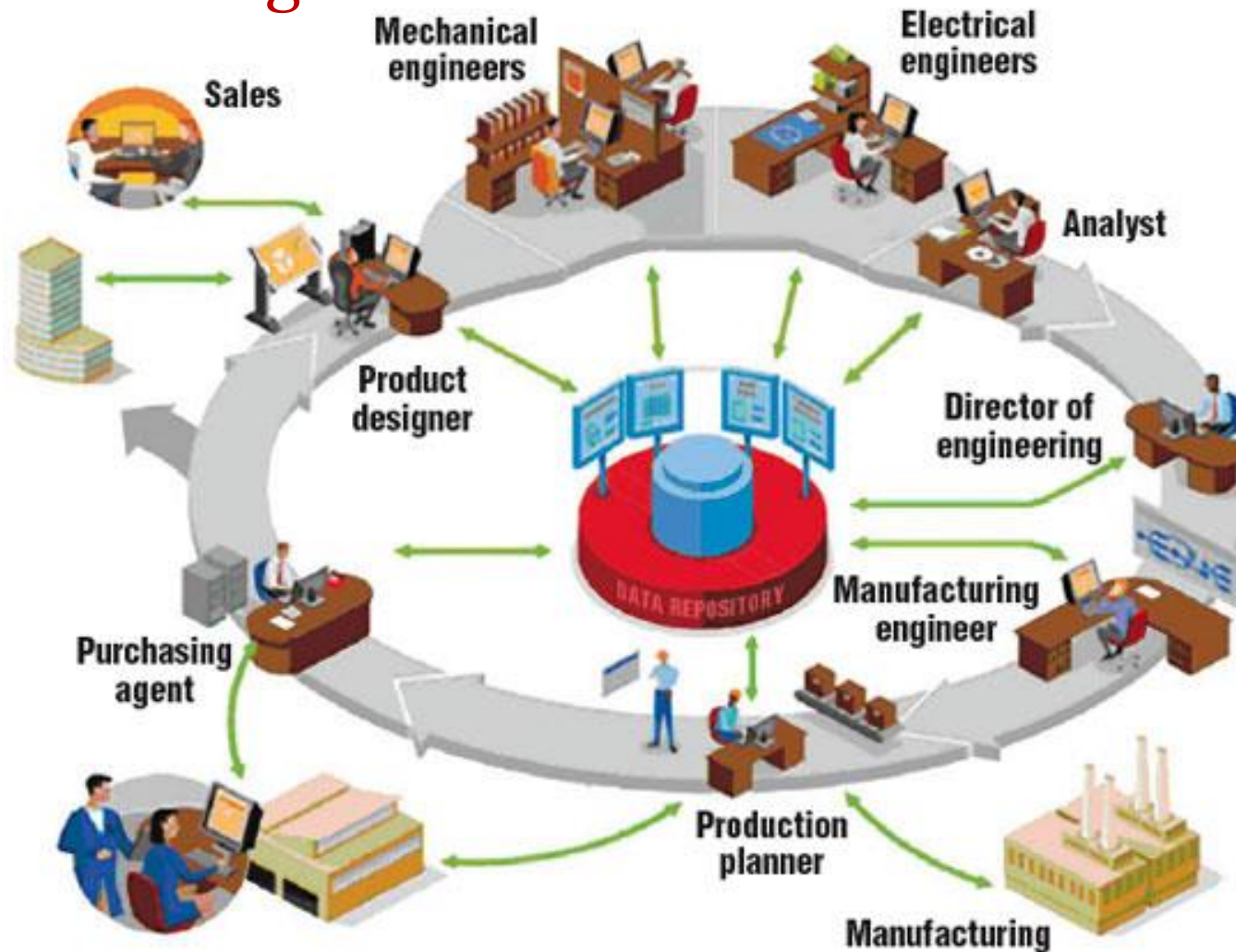
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Executive information systems (EIS)

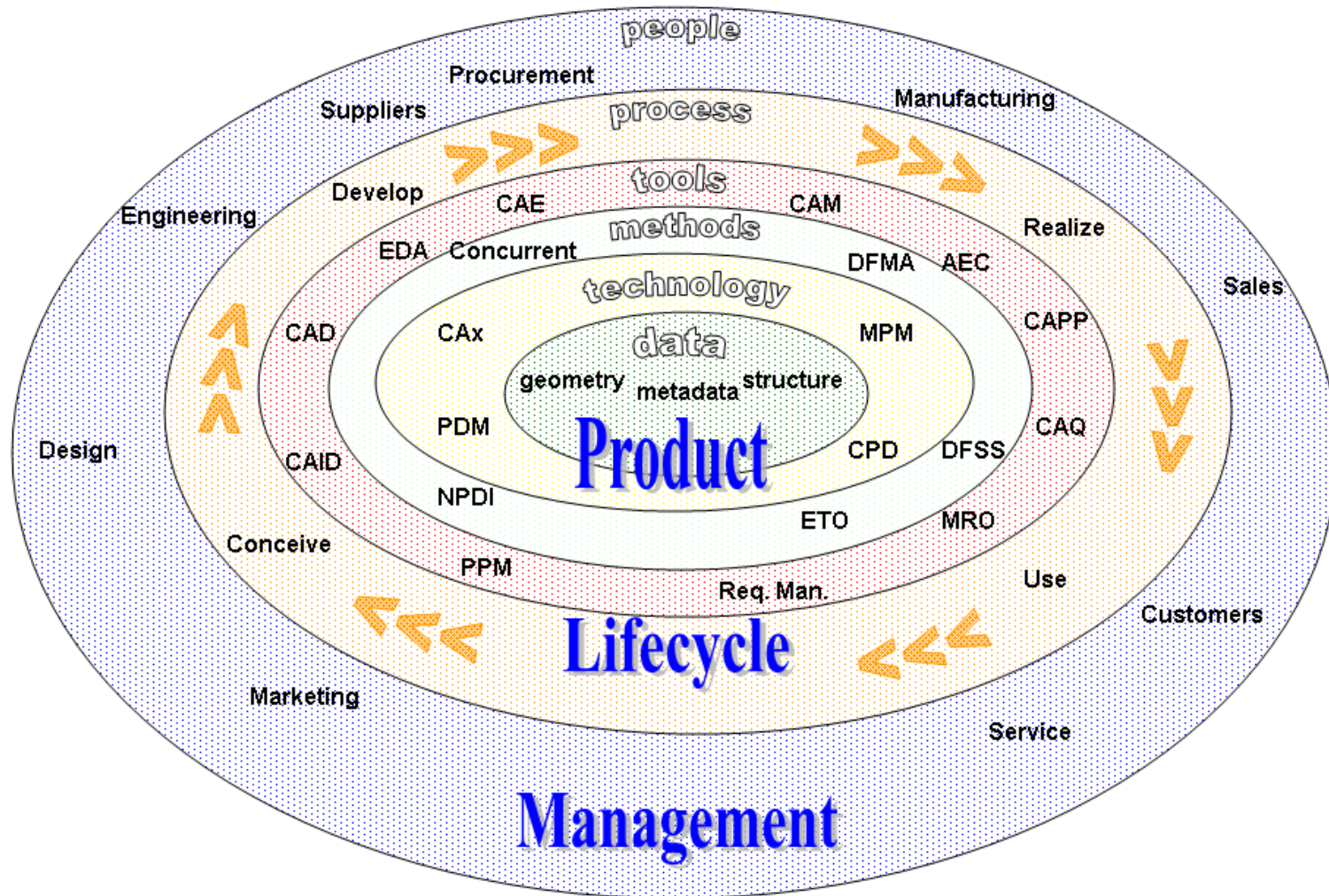
Definition and purpose	Examples of use
<p>(1) A system for total business modelling.</p> <p>(2) Monitors internal and external environment.</p>	<p>(1) Company performance data on sales, production, earnings, budgets and forecasts.</p> <p>(2) Internal communications such as personal correspondence, reports and meetings.</p> <p>(3) Environmental scanning for news on government regulations, competition, etc.</p>

Source: [http://kfknowledgebank.kaplan.co.uk/KFKB/Wiki%20Pages/Management%20Information%20Systems%20\(MIS\).aspx](http://kfknowledgebank.kaplan.co.uk/KFKB/Wiki%20Pages/Management%20Information%20Systems%20(MIS).aspx)

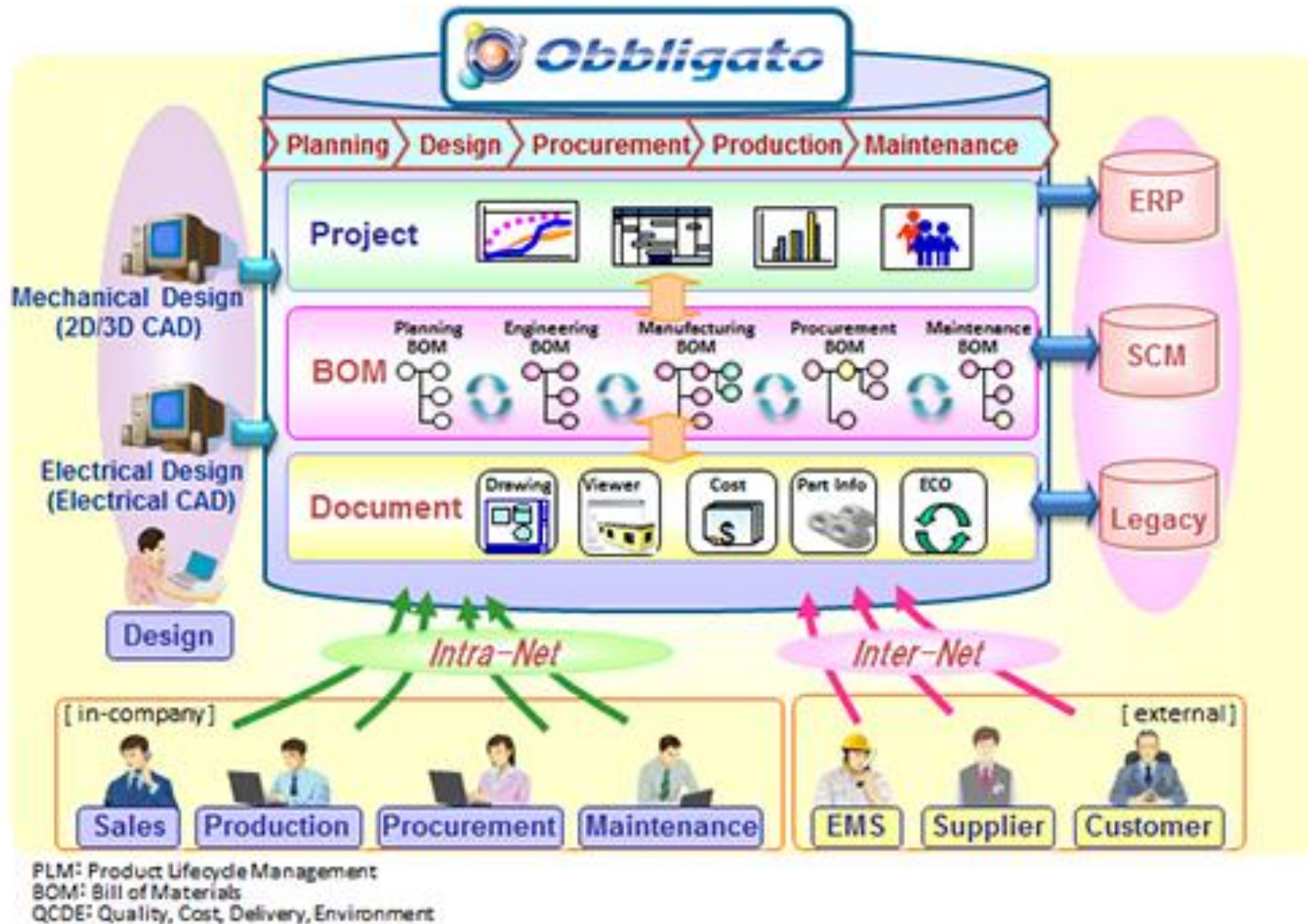
Machine Design

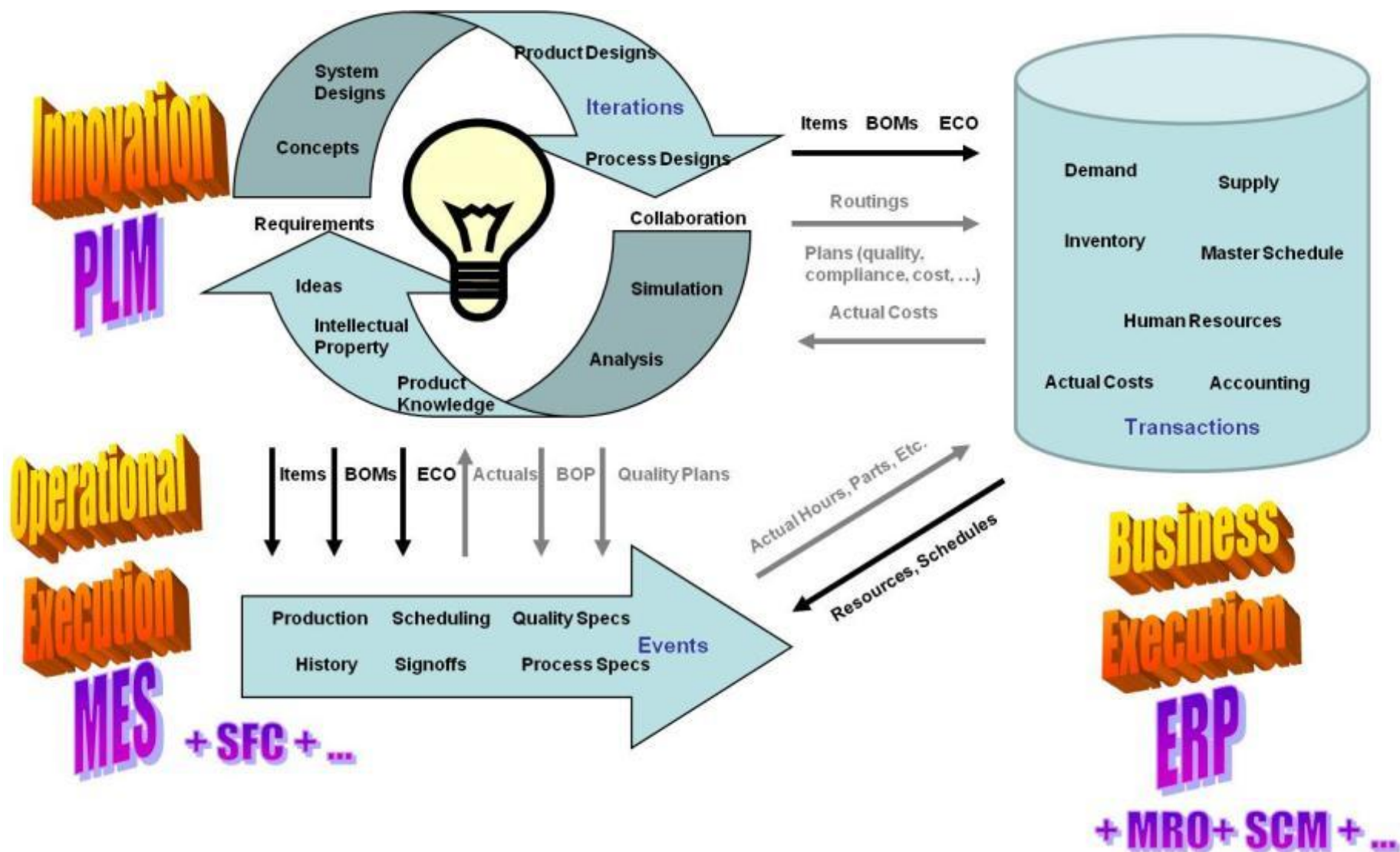


PLM (Product Lifecycle Management)



PLM – Complex Set of Activities

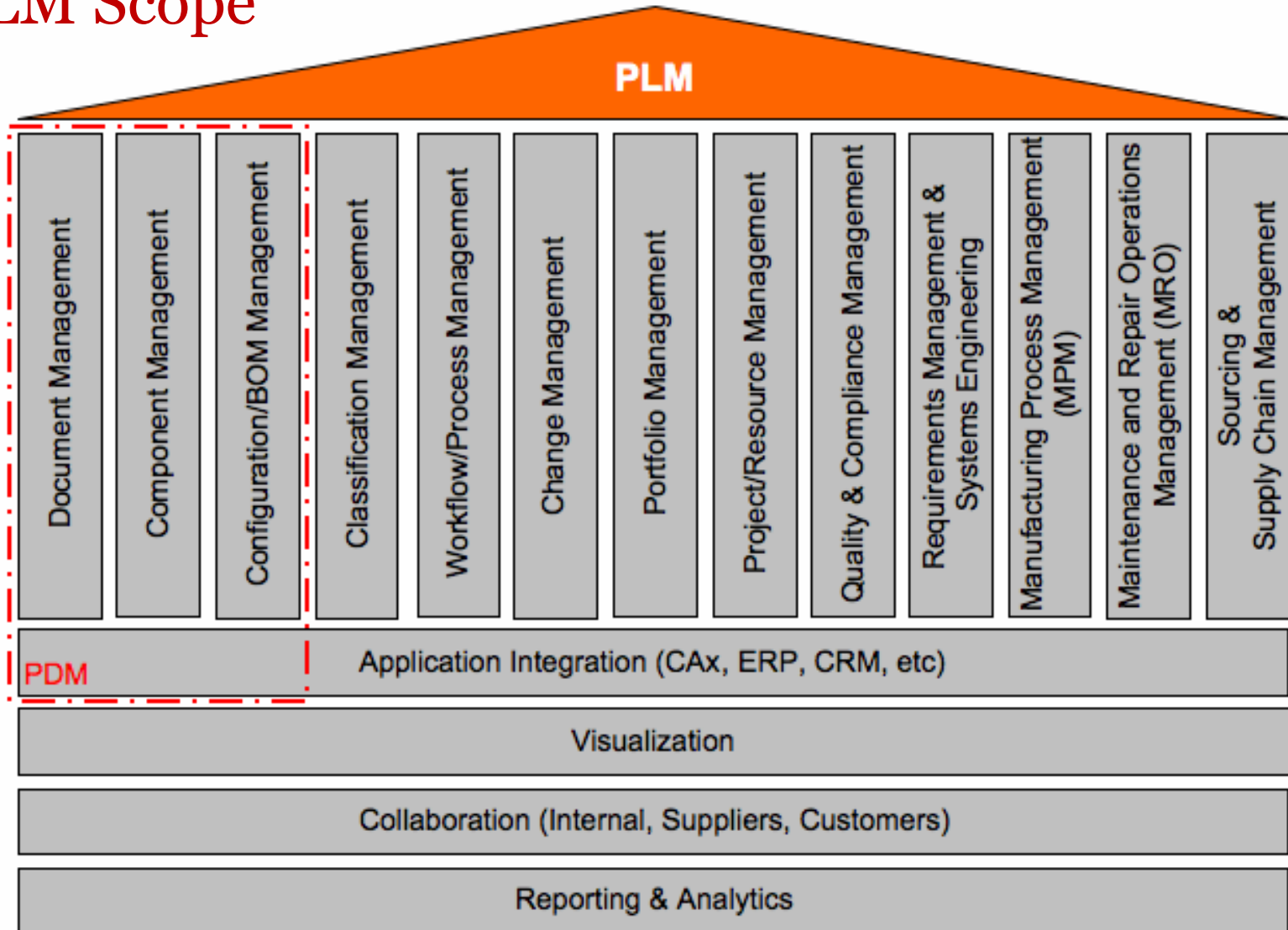




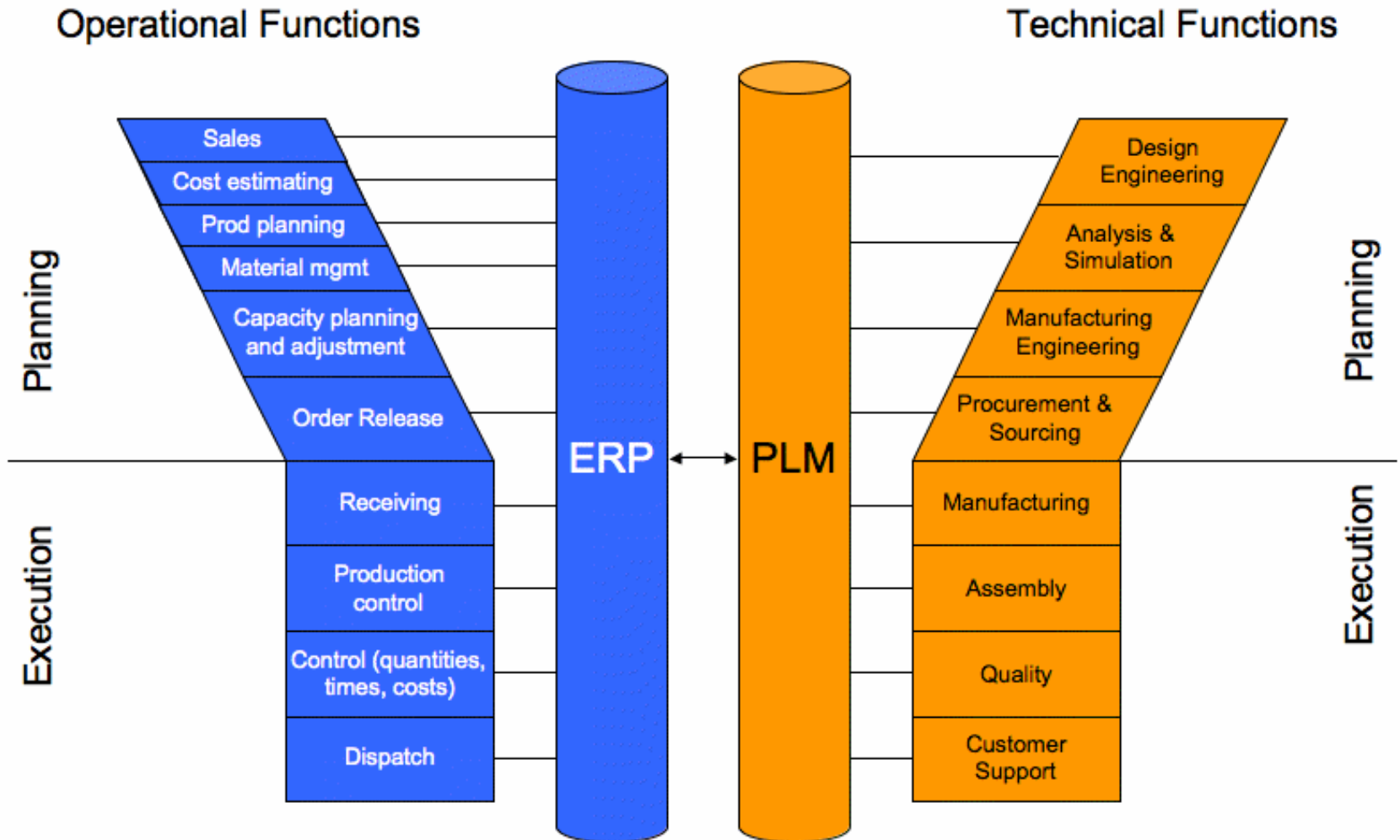
PLM Systems

- Product lifecycle management (PLM) is a systematic approach to managing the series of changes a product goes through, from its design and development to its ultimate retirement or disposal.
- The core of PLM (product life cycle management) is in the creation and central management of all product data and the technology used to access this information and knowledge. PLM as a discipline emerged from tools such as CAD, CAM and PDM, but can be viewed as the integration of these tools with methods, people and the processes through all stages of a product's life.
- It is important to note that PLM is not a definition of a piece, or pieces, of technology. It is a definition of a business approach to solving the problem of managing the complete set of product definition information-creating that information, managing it through its life, and disseminating and using it throughout the lifecycle of the product. PLM is not just a technology, but is an approach in which processes are as important, or more important than data.

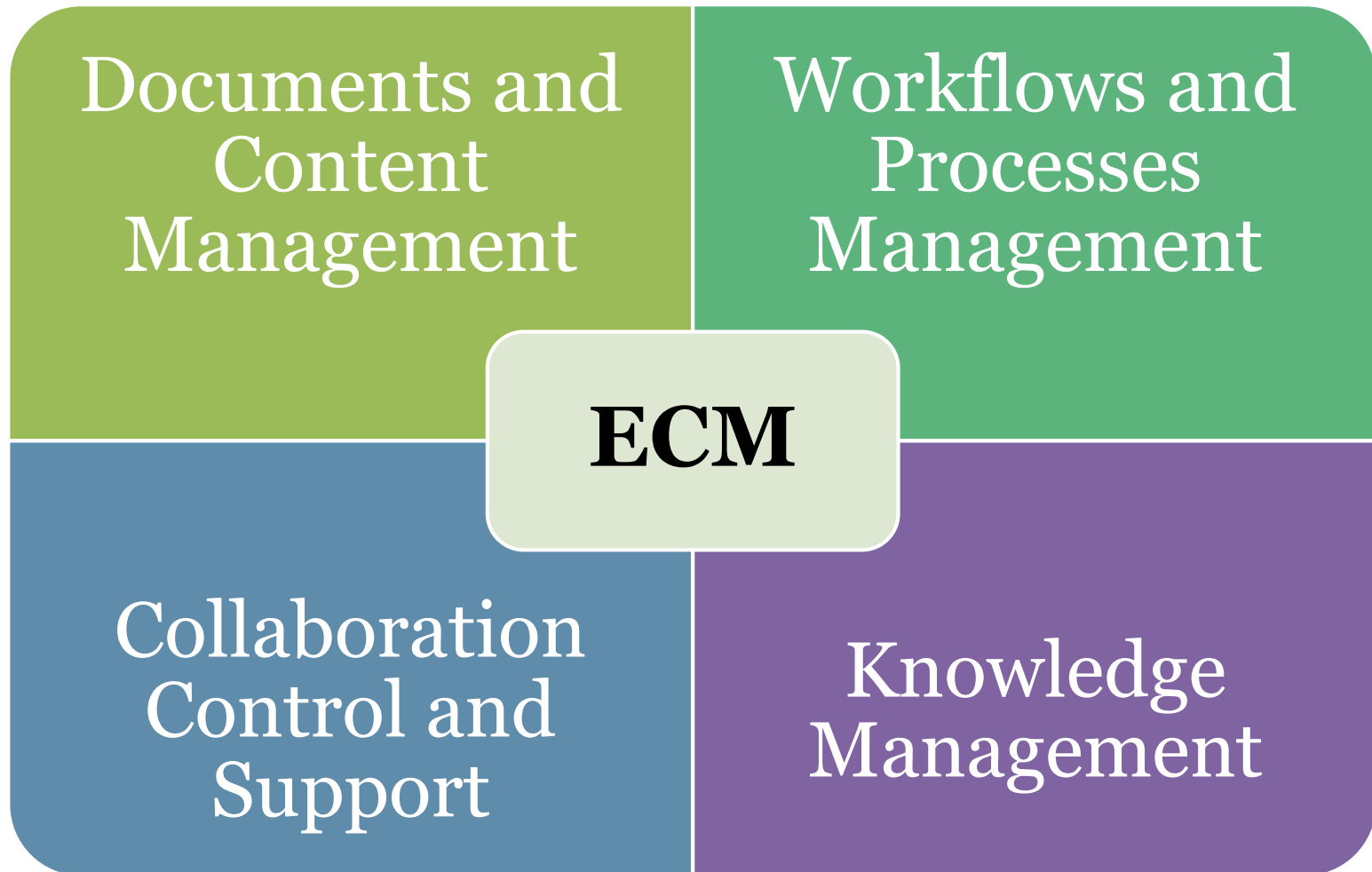
PLM Scope



PLM Processes



ECM – Possible System for PLM Support



Main Information Systems Domains

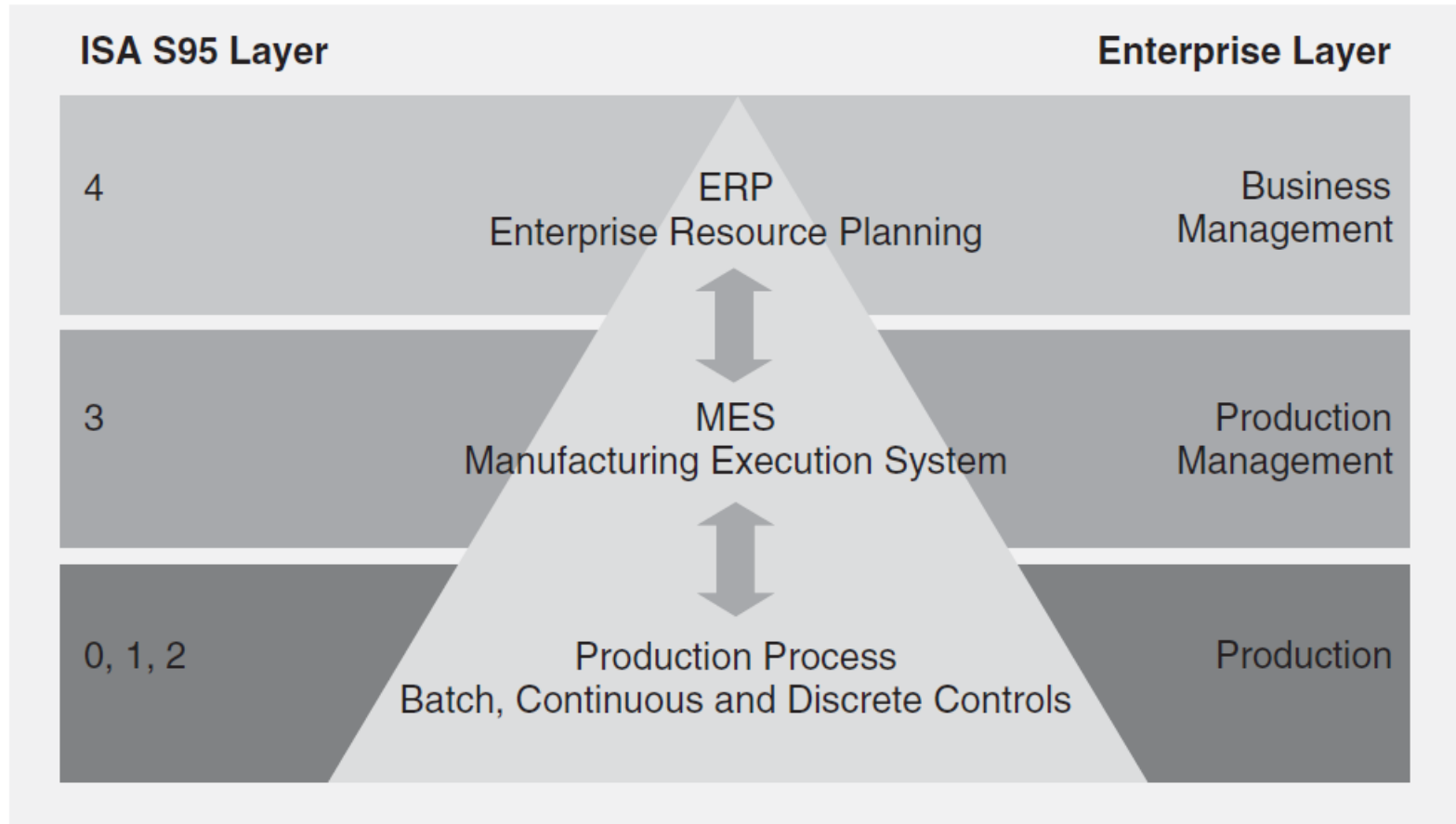
- Business Systems

- Time Horizons
 - Long-term view
- Model detail
 - Linear route structures
- Control emphasis
 - Product cost and overall profitability
- Modeling criteria:
 - Accounting reference points
 - Has inventory value changed significantly? If not, don't model separately
- View from the boardroom

- Manufacturing Systems

- Time Horizons
 - Real-time view
- Model detail
 - Complex routes with rework paths
- Control emphasis
 - Physical movement & accountability
- Modeling criteria:
 - material movement reference points
 - Does product stop moving? If not, don't model separately
- View from the workcenter

Instrument Society of America (ISA)



Heiko Meyer, Franz Fuchs, Klaus Thiel: *Manufacturing execution systems: optimal design, planning, and deployment*

ISA95.01 Levels

Level 4

Business Planning & Logistics

Plant Production Scheduling,
Operational Management, etc

Level 3

**Manufacturing
Operations & Control**

Dispatching Production, Detailed Production
Scheduling, Reliability Assurance, ...

Interface addressed
in the ISA 95.01 and
ISA 95.02 standard

Area addressed
in the ISA 95.03
standard

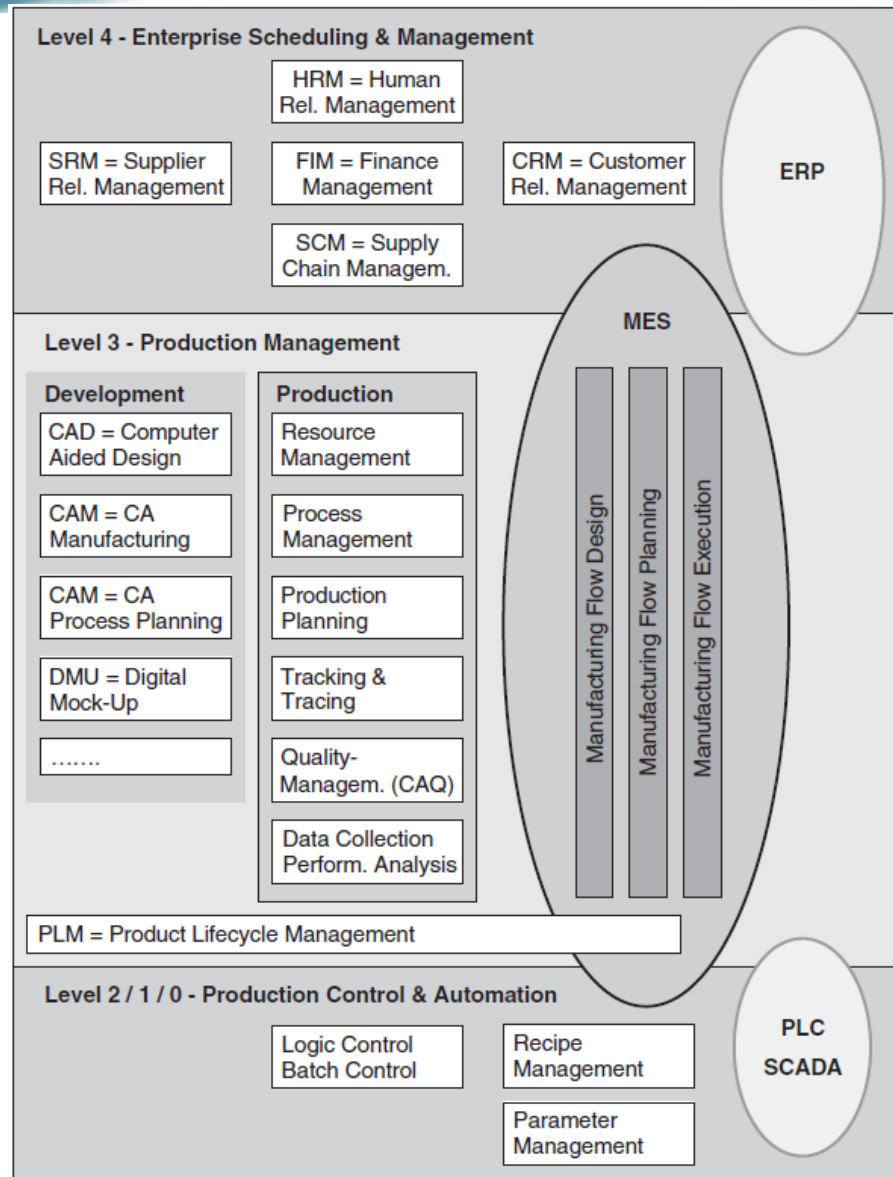
Levels

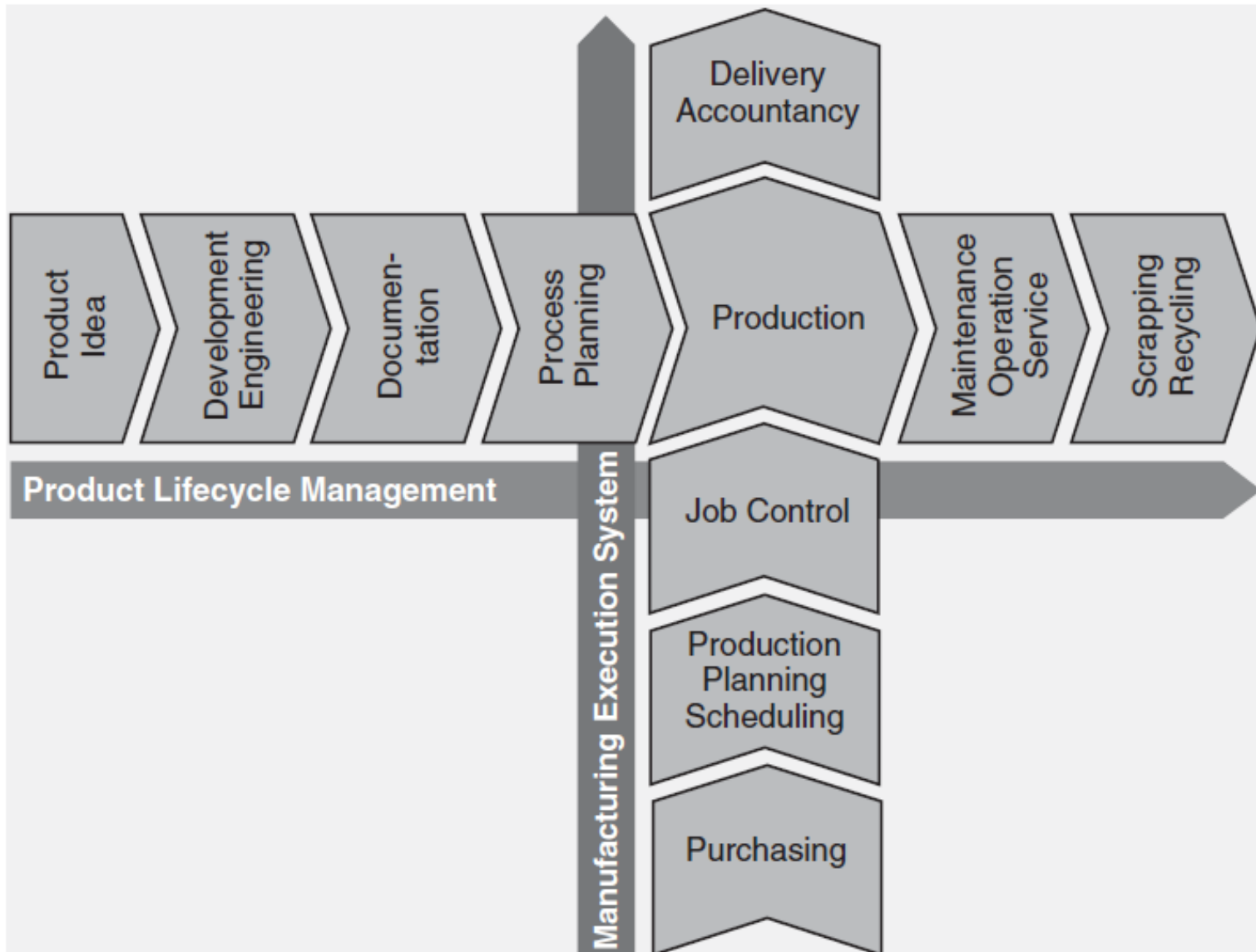
2,1,0

**Batch
Control**

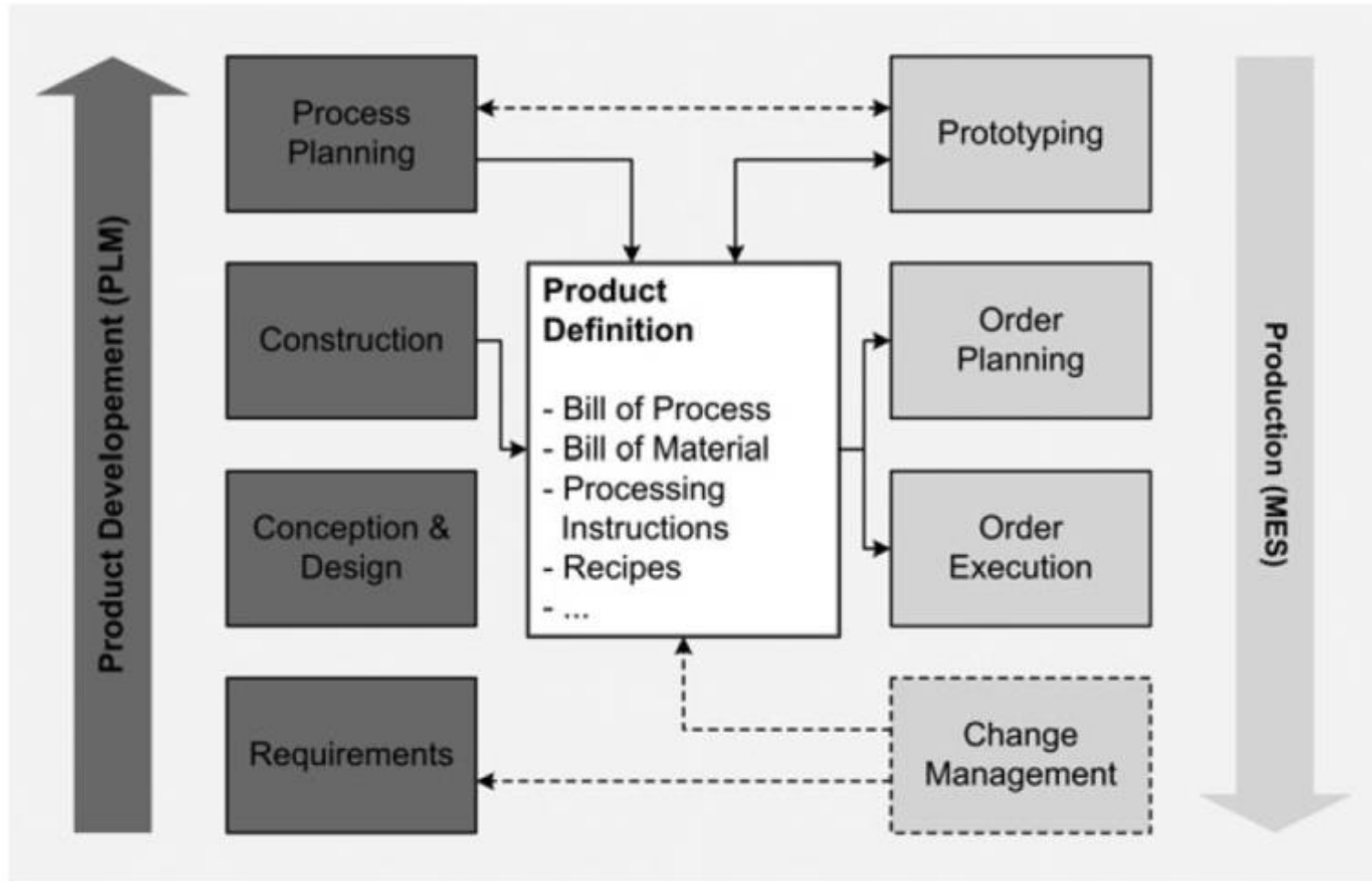
**Continuous
Control**

**Discrete
Control**





Manufacturing Support



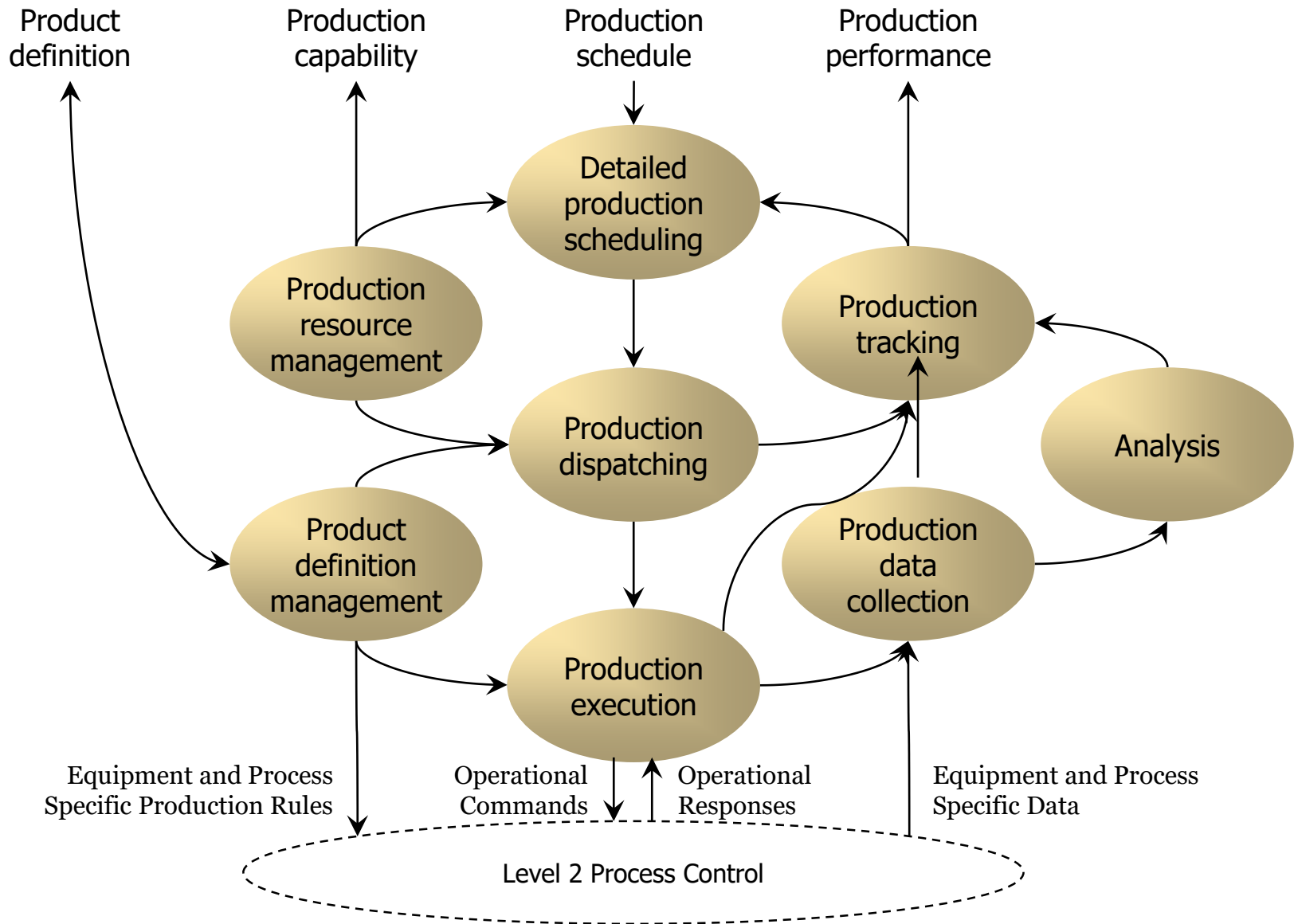
Heiko Meyer, Franz Fuchs, Klaus Thiel: Manufacturing execution systems: optimal design, planning, and deployment

MES

- **Manufacturing Execution System**
- The idea of *MES* might be seen as an intermediate step between, on the one hand, an Enterprise Resource Planning (ERP) *system*, and a Supervisory Control and Data Acquisition (SCADA) or process control *system* on the other.
- A manufacturing execution system (MES) is a control system for managing and monitoring work-in-process on a factory floor. An MES keeps track of all manufacturing information in real time, receiving up-to-the-minute data from robots, machine monitors and employees. Although manufacturing execution systems used to operate as self-contained systems, they are increasingly being integrated with enterprise resource planning (ERP) software suites. The goal of a manufacturing execution system is to improve productivity and reduce cycle-time, the total time to produce an order. By integrating an MES with ERP software, factory managers can be proactive about ensuring the delivery of quality products in a timely, cost-effective manner.

Benefits of MES Implementation

- Manufacturing Execution Systems [help] create flawless manufacturing processes and provide real-time feedback of requirement changes, and provide information at a single source.
- Other benefits from successful MES implementation might include:
 - Reduced waste, re-work and scrap, including quicker setup times.
 - More accurate capture of cost-information (e.g. labor, scrap, downtime, and tooling).
 - Increased uptime.
 - Incorporate Paperless Workflow Activities.
 - Reduced inventory, through the eradication of just-in-case inventory.
- Siemens, ABB, SAP, Honeywell, ---



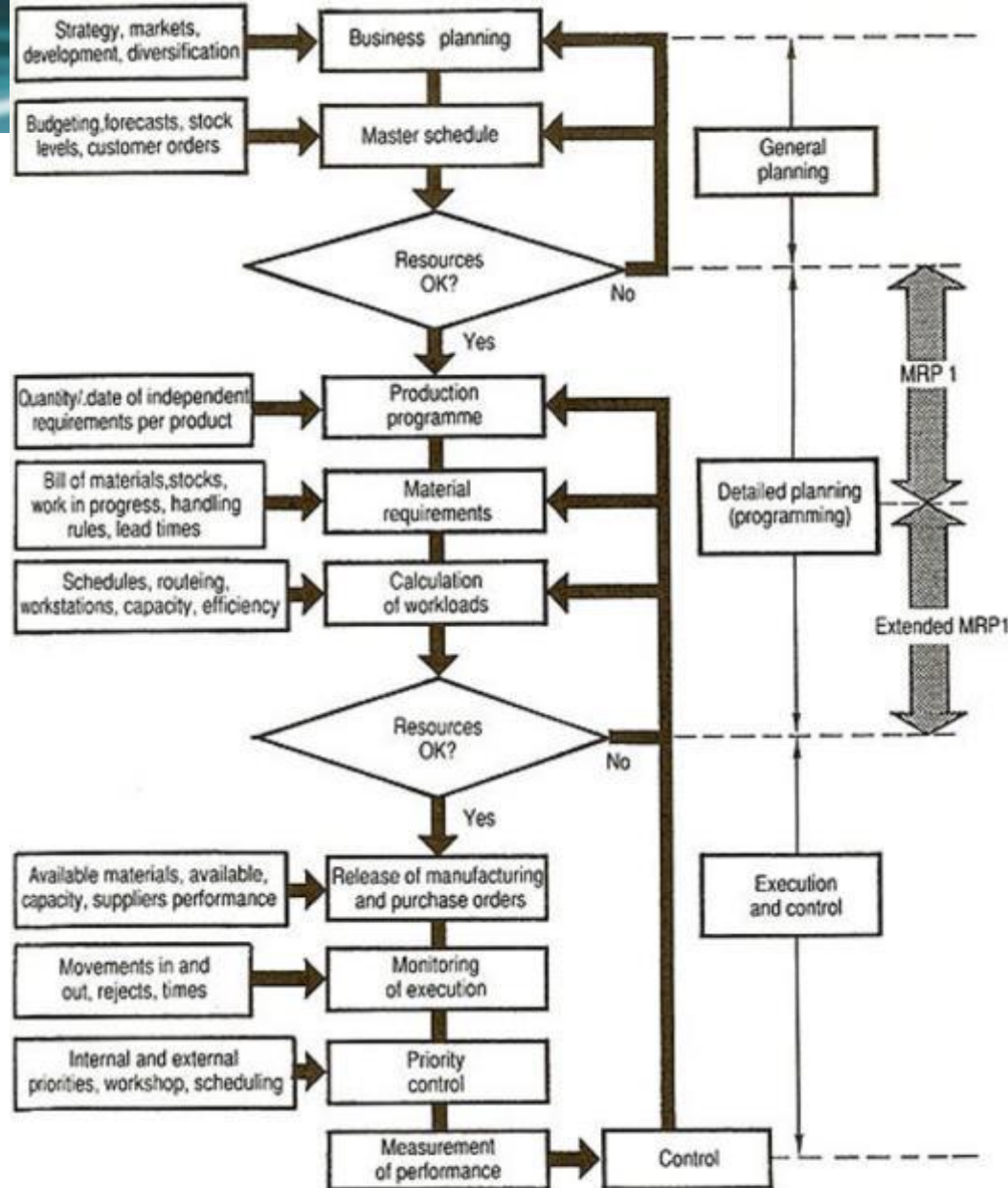
MRP

- **Material Requirements Planning**
- MRP is a production planning, scheduling, and inventory control system used to manage manufacturing processes.
- The basic functions of an MRP system include: inventory control, bill of material processing, and elementary scheduling.
- MRP helps organizations to maintain low inventory levels. It is used to plan manufacturing, purchasing and delivering activities.
- An MRP system is intended to simultaneously meet three objectives:
 - Ensure materials are available for production and products are available for delivery to customers.
 - Maintain the lowest possible material and product levels in store
 - Plan manufacturing activities, delivery schedules and purchasing activities.

MRP II

- **Manufacturing Resource Planning**
- It is defined as a method for the effective planning of all resources of a manufacturing company. Ideally, it addresses operational planning in units, financial planning, and has a simulation capability to answer "what-if" questions and extension of closed-loop MRP.
- MRP II extends MRP by adding the following functions:
 - Feedback from production (**Closed Loop MRP**).
 - **CRP - Capacity Requirements Planning**.
- QAD, SAP Manufacturing, BAAN, IFS, Microsoft Dynamics, ...

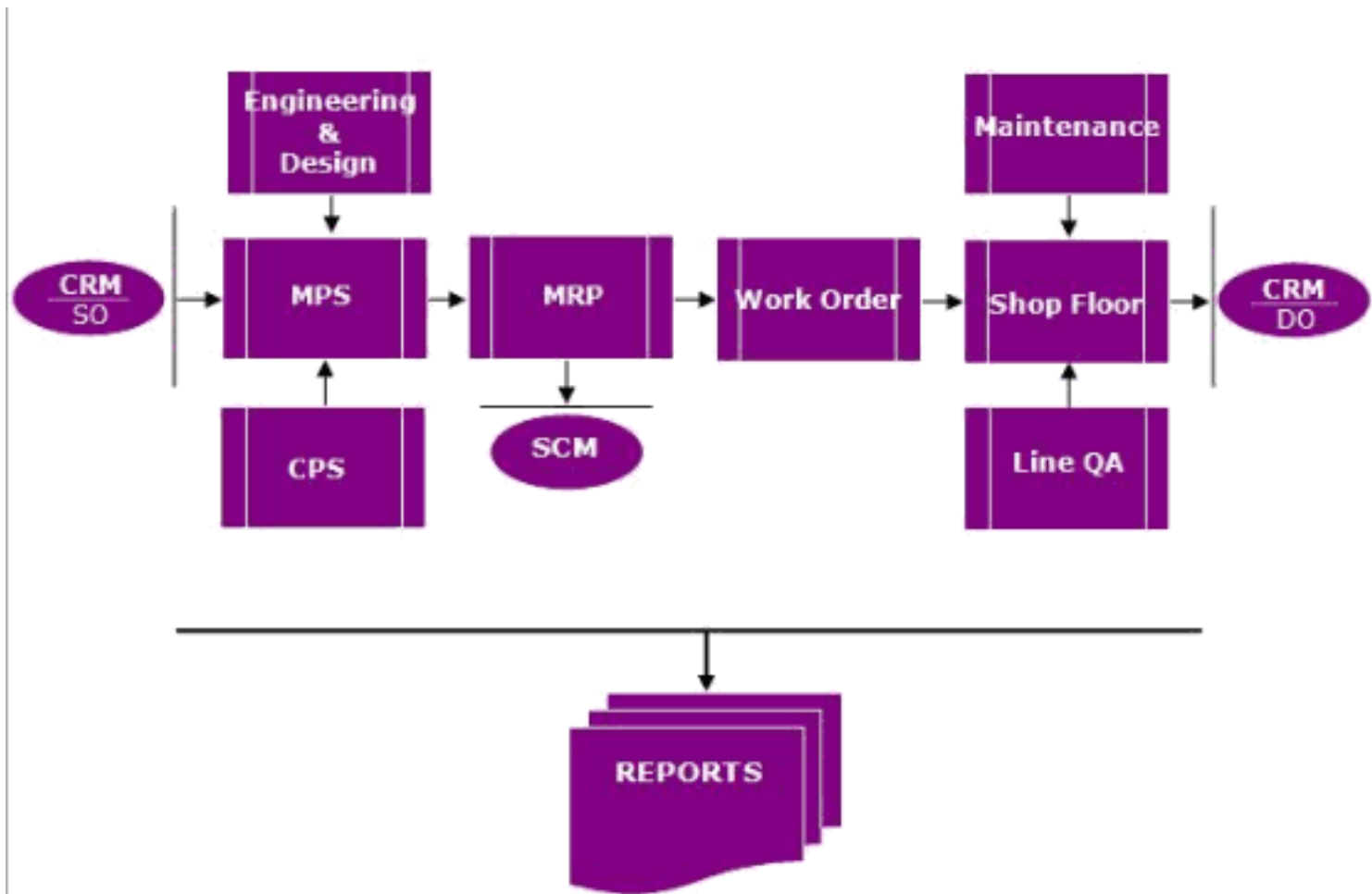
Planning Process in MRP II



Around 1980, over-frequent changes in sales forecasts, entailing continual reajustments in production, as well as the unsuitability of the parameters fixed buy the system, led MRP (Material Requirement Planning) to evolve into a new concept : Manufacturing Resource Planning or MRP2

Source: Wikipedia

MRP Workflow

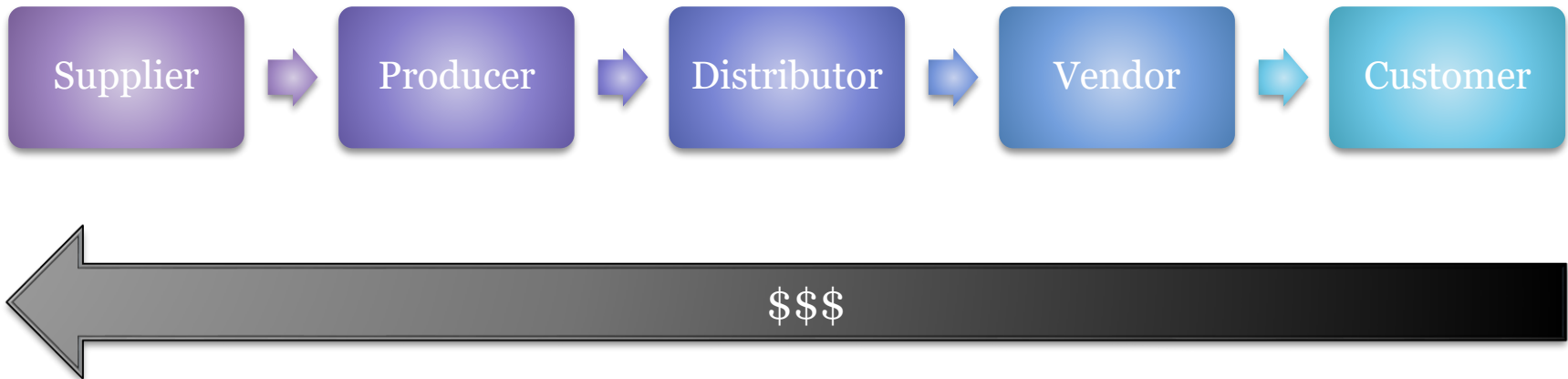


APS

- **Advanced Planning and Scheduling**
- APS systems plan and schedule the production process, based on existing materials, labor, and capacity.
- As part of the production process the Advanced Planning and Scheduling (APS) is responsible for the sequence and capacity planning.
- Typically APS systems take the generated production orders from the ERP and plan the optimized order sequence for processing.
- The APS software is allocating the production orders to the existing work stations, taking into account available resources and production capacities.
- APS systems are often used in production environments with many different products in one operation, in capital-intensive production processes with limited capacity, in the production of goods assembled with many single parts, or production processes, where production runs must be changed often and unexpectedly.
- SAP Advanced Planner and Optimizer, SAP Demand Planning, QAD (MFG/PRO), BAAN, ...

SCM

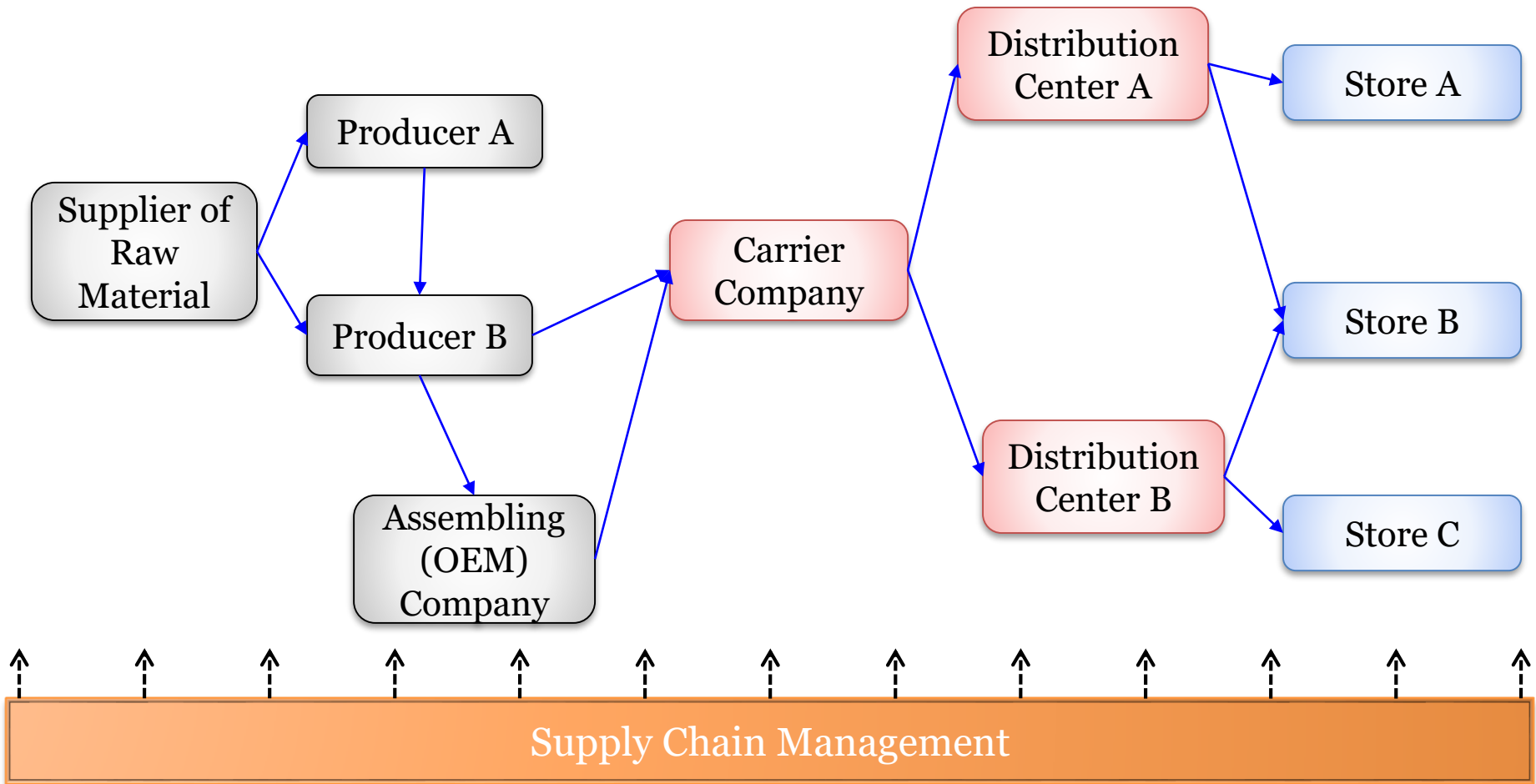
- **Supply Chain Management.**
- The management of the flow of goods and services.
- Requires high confidence of all Supply Chain Members.



Ideas of SCM

- Practically every product that reaches an end user represents the cumulative effort of multiple organizations. These organizations are referred to collectively as the supply chain.
- While supply chains have existed for a long time, most organizations have only paid attention to what was happening within their “four walls.” Few businesses understood, much less managed, the entire chain of activities that ultimately delivered products to the final customer. The result was disjointed and often ineffective supply chains.
- The organizations that make up the supply chain are “linked” together through physical flows and information flows. Information flows allow the various supply chain partners to coordinate their long-term plans, and to control the day-to-day flow of goods and material up and down the supply chain.

Example of a Supply Chain Complexity



Zdroj: [1]

SCM Definition

- The design, planning, execution, control, and monitoring of supply chain activities with the objective of creating net value, building a competitive infrastructure, leveraging worldwide logistics, synchronizing supply with demand and measuring performance globally.
- It includes the movement and storage of raw materials, work-in-process inventory, and finished goods from point of origin to point of consumption.
- Interconnected or interlinked networks, channels and node businesses are involved in the provision of products and services required by end customers in a supply chain
- Sap, Oracle, JDA Software, Epicor, IFS

CRM

- **Customer Relationship Management**
- One of the most popular information system types on the market. Especially in the crisis times.
- CRM is not only a system, it is a complex philosophy!
 - A management philosophy according to which a company's goals can be best achieved through identification and satisfaction of the customers' stated and unstated needs and wants.
 - A computerized system for identifying, targeting, acquiring, and retaining the best mix of customers.

CRM Definition

- It is an approach to managing a company's interaction with current and future customers. The CRM approach tries to analyze data about customers' history with a company, in order to better improve business relationships with customers, specifically focusing on retaining customers, in order to drive sales growth.
- One important aspect of the CRM approach is the systems of CRM that compile information from a range of different channels, including a company's website, telephone, email, live chat, marketing materials, social media, and more. Through the CRM approach and the systems used to facilitate CRM, businesses learn more about their target audiences and how to best cater to their needs.
- However, the adoption of the CRM approach may also occasionally lead to favoritism within an audience of consumers, leading to dissatisfaction among customers and defeating the purpose of CRM!!!



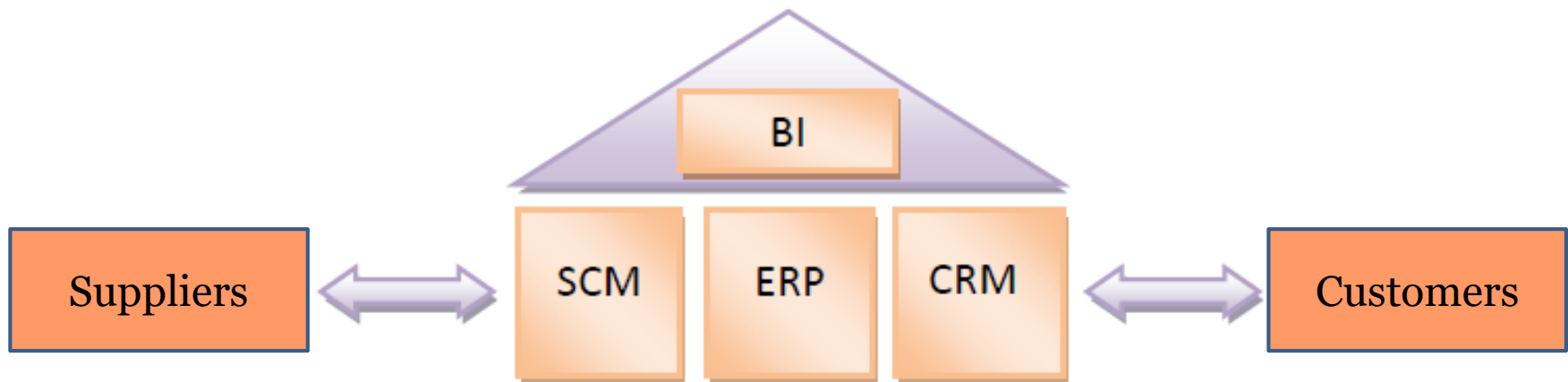
Types of CRM systems

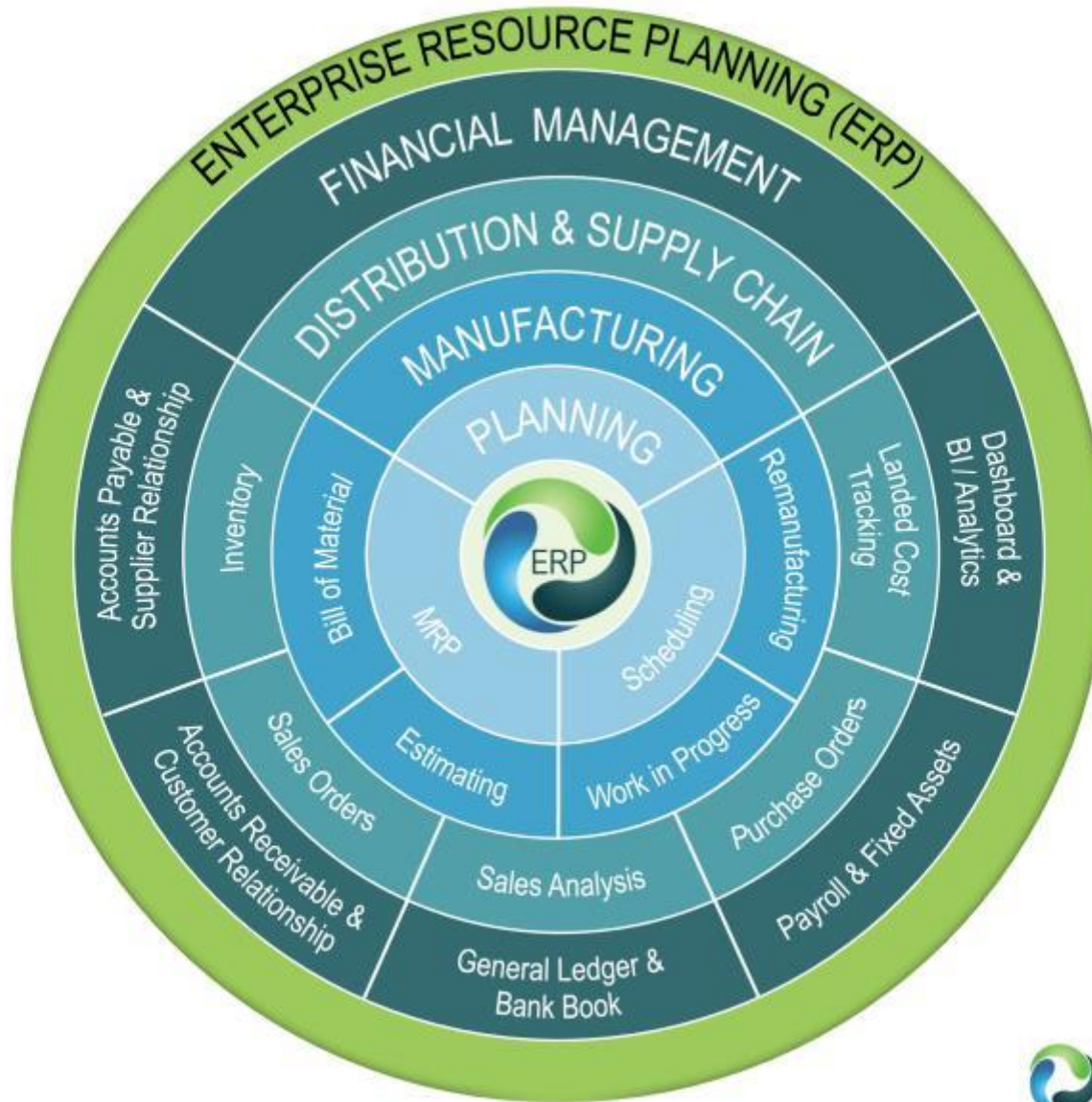
- **Operational CRM**– The primary goal of CRM systems is to integrate and automate sales, marketing, and customer support
- **Analytical CRM** - The role of analytical CRM systems is to analyze customer data collected through multiple sources, and present it so that business managers can make more informed decisions.
- **Collaborative CRM**– The third primary aim of CRM systems is to incorporate external stakeholders such as suppliers, vendors, and distributors, and share customer information across organizations.
- Oracle (Siebel, Peoplesoft), Microsoft, Salesforce.com, SAP

ERP

- **Enterprise Resource Planning**
- The most often used type of information systems in practice.
- IT is business process management software that allows an organization to use a system of integrated applications to manage the business and automate many back office functions related to technology, services and human resources.
- ERP software integrates all facets of an operation, including product planning, development, manufacturing, sales and marketing.

History of ERP Systems





ERP Definition

- Enterprise resource planning (ERP) is defined as the ability to deliver an integrated suite of business applications. ERP tools share a common process and data model, covering broad and deep operational end-to-end processes, such as those found in finance, HR, distribution, manufacturing, service and the supply chain.
- ERP applications automate and support a range of administrative and operational business processes across multiple industries, including line of business, customer-facing, administrative and the asset management aspects of an enterprise. However, ERP deployments tend to come at a significant price, and the business benefits are difficult to justify and understand.
- Look for business benefits in four areas: IT cost savings, business process efficiency, as a business process platform for process standardization and as a catalyst for business innovation. Most enterprises focus on the first two areas, because they are the easiest to quantify; however, the latter two areas often have the most significant impact on the enterprise.
- SAP, Microsoft, Oracle, Minerva, ...

Source: Gartner

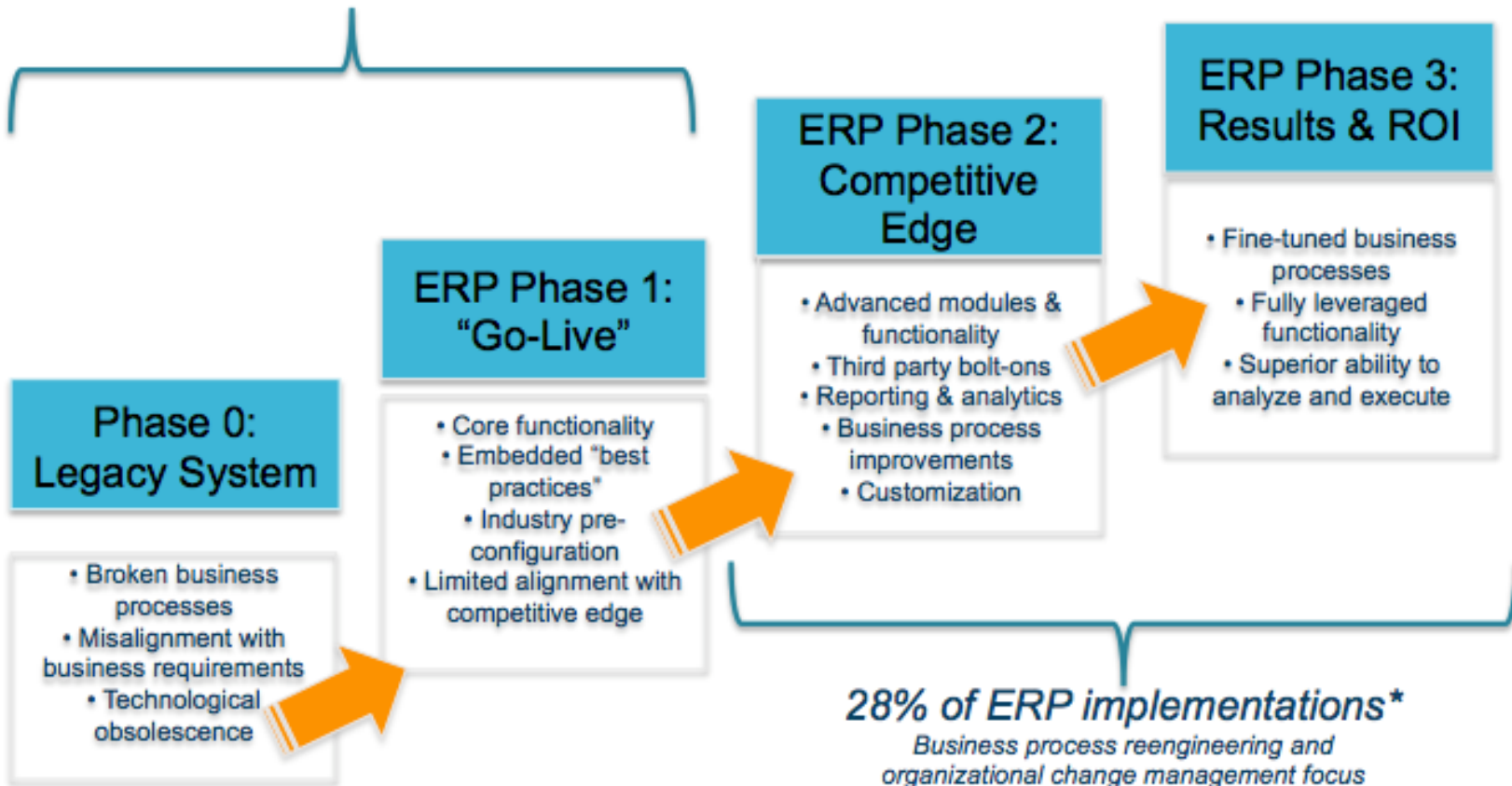
ERP Implementation

- ERP's scope usually implies significant changes to staff work processes and practices.
- Generally, three types of services are available to help implement such changes — consulting, customization, and support.
- Implementing ERP typically requires changes in existing business processes.
- Poor understanding of needed process changes prior to starting implementation is a main reason for project failure!!!

72% of ERP implementations*

Software focus

Business Benefits and
Competitive Advantage



* Data from Panorama's annual ERP Report, available at Panorama-Consulting.com

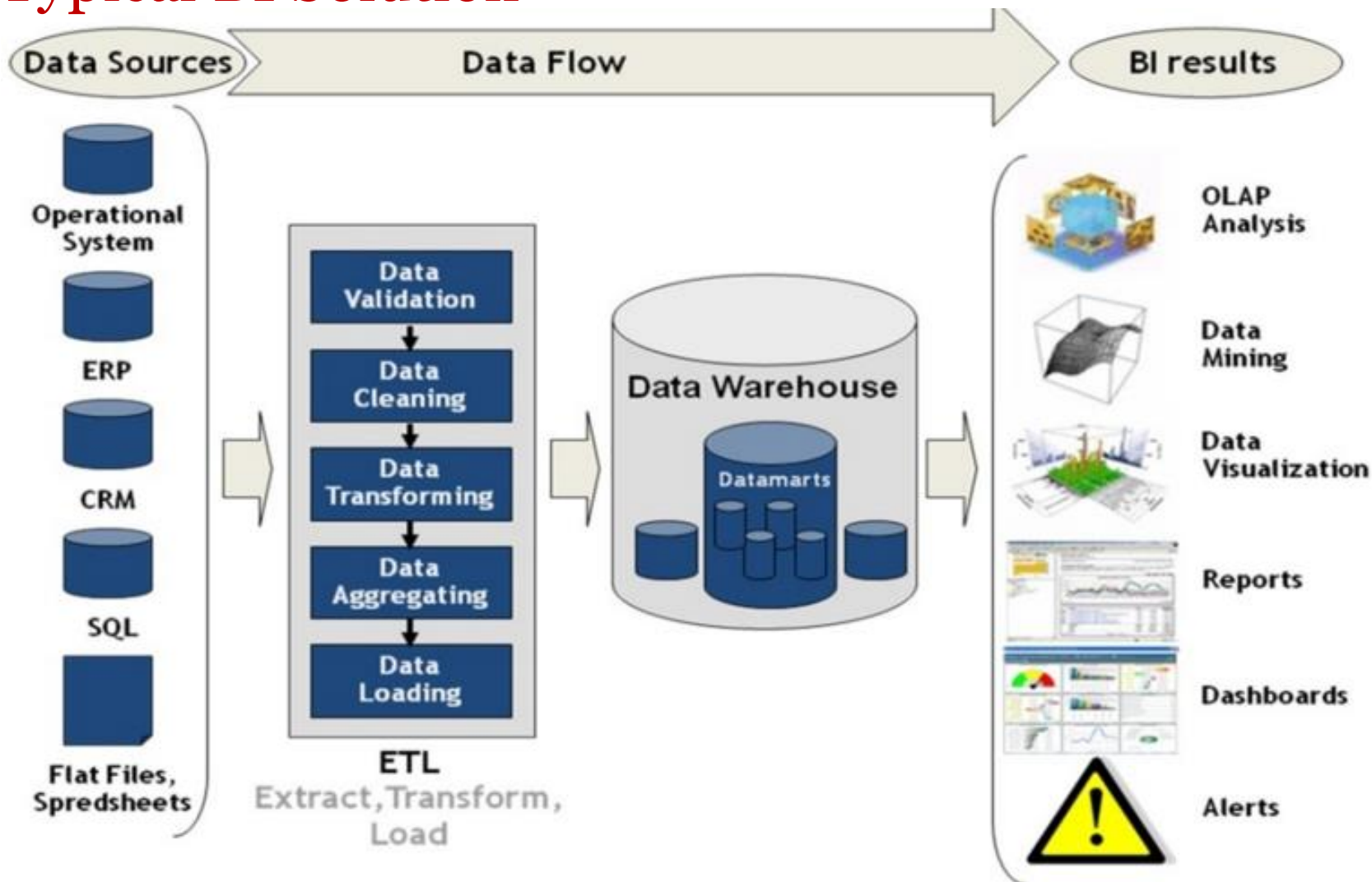
Management Information Systems

- **Management Information Systems**
- **Decision Support Systems**
- **Expert Information Systems**
- MIS = An organized approach to the study of the information needs of an organization's management at every level in making operational, tactical, and strategic decisions. Its objective is to design and implement procedures, processes, and routines that provide suitably detailed reports in an accurate, consistent, and timely manner.
- Computerized systems continuously gather relevant data, both from inside and outside an organization. This data is then processed, integrated, and stored in a centralized database (or data warehouse) where it is constantly updated and made available to all who have the authority to access it, in a form that suits their purpose.
- Sometimes called Business Intelligence (BI) systems.

Business Intelligence Definition

- BI can be described as a set of techniques and tools for the acquisition and transformation of raw data into meaningful and useful information for business analysis purposes.
- BI technologies are capable of handling large amounts of unstructured data to help identify, develop and otherwise create new strategic business opportunities.
- BI technologies provide historical, current and predictive views of business operations. Common functions of business intelligence technologies are reporting, online analytical processing, analytics, data mining, process mining, complex event processing, business performance management, benchmarking, text mining, predictive analytics and prescriptive analytics.
- BI can be used to support a wide range of business decisions ranging from operational to strategic.

Typical BI Solution



CPM

- **(Corporate) Performance Management** ⇔ **Business Analytics**
- Performance Management (PM) is the process of managing and controlling the business's performance in the context of the business's strategy.
- New generation of Business Intelligence.
- Main attributes of CPM:
 - Reports – present data.
 - Plans – „enter new“ data.
- New opportunities:
 - Speed, size, complexity.
 - End user: (Advanced) Business User.
 - integrability (vertical, horizontal).

Business Analytics Overview

Business Analytics

Key Questions

- What happened?
- How many? How often??

- Where is a problem?
- what's happening?
- What should we do?

- What happens next time?
- What if the trend will continue?
- What are the future opportunities and threats?

Historical view

Present view

Future view

Examples

- Balance sheet, income statement, cash flow
- Incomes / expenses

- Client, product, segment profitability
- Working capital analysis
- Market prices, Client/segment prices
- Actual sales, branch offices / channel / ...

- Planning, scenarios
- Strategic decisions support
- Predictive and behavioral modeling

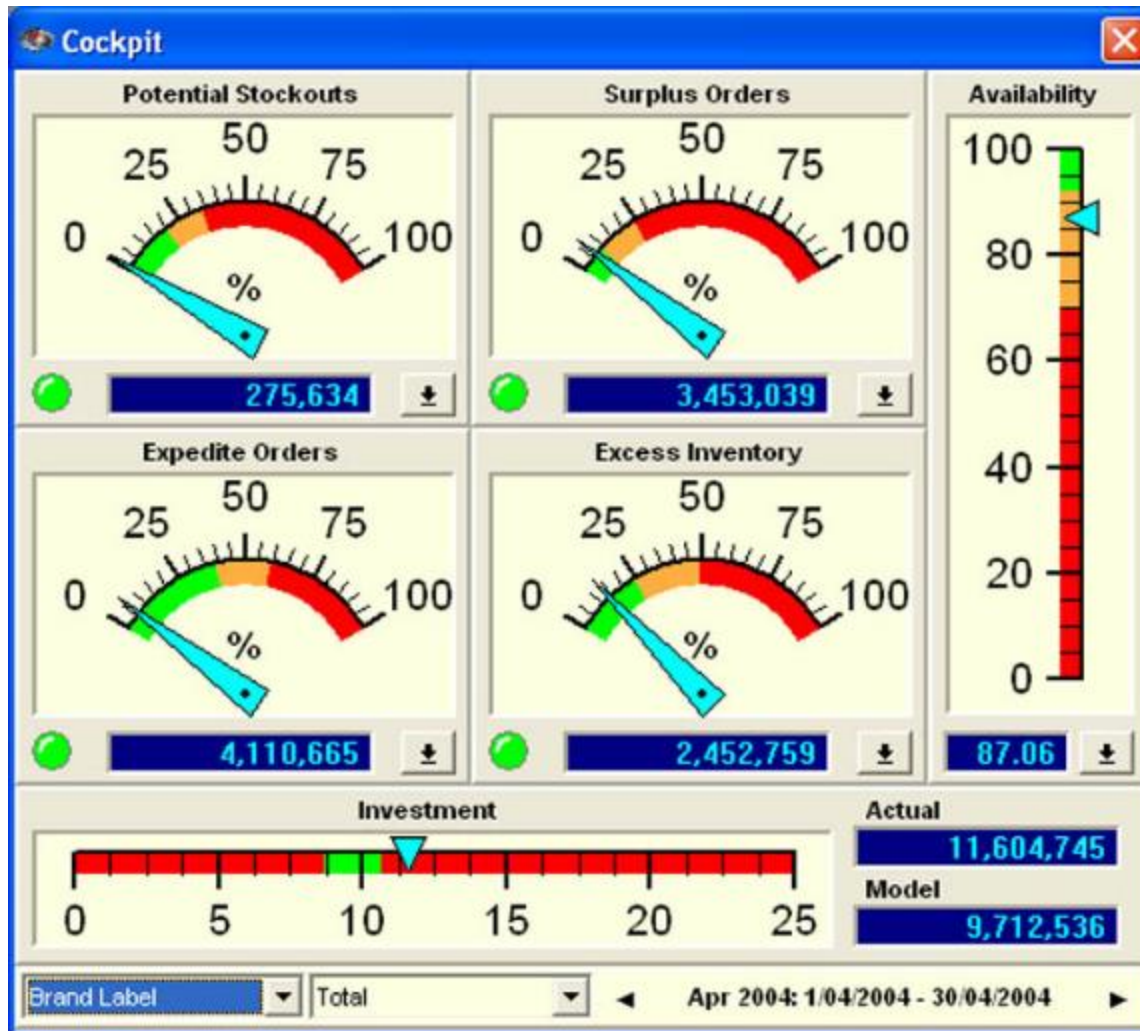
Business Informatics is Relevant Across the Enterprise



How to Present Important Information?



Management „Cockpit“



Management Cockpit = War Room

- Management cockpit is a management methodology designed to improve the efficiency of a company.
- The concept is based on 4 principles:
 - Ergonomic presentation.
 - Operational KPI: it integrates operational, tactical, strategic indicators.
 - Structural approach.
 - Automation: Data is updated periodically by IT systems or humans.
- Obvious questions and answers:
 - What are the targets?
 - What are the difficulties?
 - What are the resources?
 - What are the projects?

Key Performance Indicator

- It is a measurable value that demonstrates how effectively a company is achieving key business objectives. Organizations use KPIs to evaluate their success at reaching targets.
- A Good KPI has following attributes (S-M-A-R-T):
 - **Specific** - It has to be clear what the KPI exactly measures.
 - **Measurable** - The KPI has to be measurable make it possible to measure the actual value and to make the actual value comparable to the budgeted value.
 - **Achievable** - Every KPI has to be measurable to define a standard value for it.
 - **Relevant** - The KPI must give more insight in the performance of the organization in obtaining its strategy.
 - **Time phased** - It is important to express the value of the KPI in time.

Recommended Literature

- Laudon, K. C., Laudon J. P., *Management Information Systems*, Prentice Hall
- Scholten, Bianca, *MES Guide for Executives, Why and How to Select. Implement and Maintain a Manufacturing Execution System*, ISA, 2009
- Meyer, H., Fuchs, F., Thiel, K., *Manufacturing Execution Systems, Optimal Design, Planning and Deployment*, MCGrawHill, 2009
- Stark, John, *Product Lifecycle Management, 21st Century Paradigm for Product Realisation*, Springer, 2011
- Saaksvuori, A., Immonen, A., *Product Lifecycle Management*, Springer, 2008



Questions, Comments?