Information systems in logistics

Introduction Event

Prof. Dr.-Ing. Bernd Noche ■ 21.10.2016

Agenda

- Organizational

- Introduction to the terms Information system

- Types of Information systems in logistics planning

- Overview SAP in logistics planning

- Summary

- References

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Lecture downloads

http://www.moodle.de

Logistische Informationssysteme

Einschreibeschlüssel: tulwise

Lecture overview

1. Block	ERP, MRP, WWS, SCM Tools
2. Block	Introduction, Digital Factory
3. Block	Introduction to Business Process Modeling
4. Block	Forecasting 1
5. Block	Warehouse Management System
6. Block	Forecasting 2
7. Block	Manufacturing Execution Systems
8. Block	EDIFACT
9. Block	Heuristics
10. Block	SimAL

- To understand which meaning information systems have for logistics in practice, but also which problems come along with it.

- To know which information systems are used for supporting the logistic processes.

- To learn to know the functional range and structure of ERP, WMS and APS systems.

- To gain an insight into the functional ranges und its systems supported by SAP.

- To understand how to proceed with the implementation of standard software und which obstacles can arise from that.

„Information systems are socio-technical systems which involve the human and mechanical components and are applied for the objective of optimal provision of information and communication according to economical criteria." Source: WKWI (1996)

Quelle: Schönsleben (S.14)
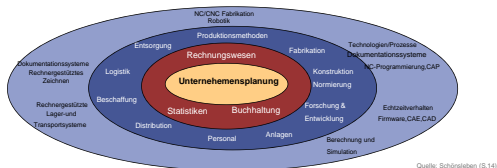
Main charcteristics of information systems:

- Open (multitude of relations for the system environment)

- Dynamic (can change the objects concerned during interaction)

- Complex (masy different information systems available in the company)

Problem area complexity

- Corporate reality: Large scale and various combinations of data, functions and processes that have to be represented

- Even, eventually, individual software, sure, however, integriated ERP systems are very complex as application on its own (handling, customizing, changes)
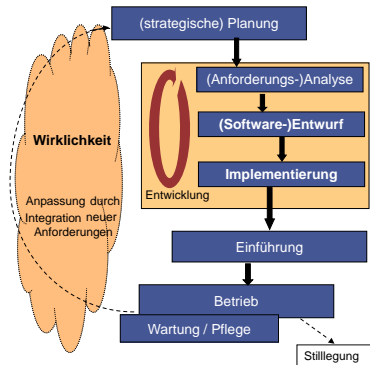

Quelle: Siemens ICN

Problem area integration

- Integration of business information systems enables an effective and efficient execution of business processes

- Integration features: object (user interface, functions, data), direction (horizontal, vertical) and degree of automation (completely, partially)
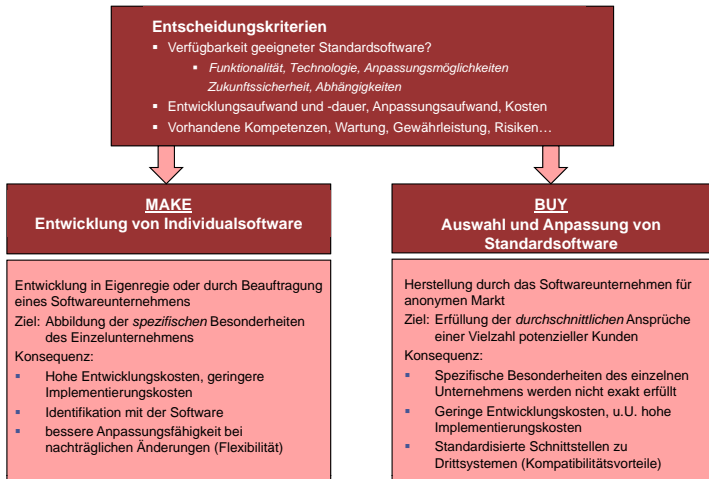
- Manifold creative challenges
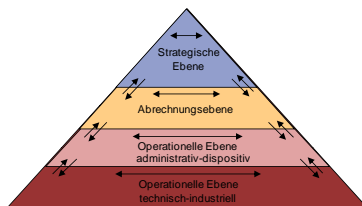
Problem area infexibility

- Theoretically large degrees of freedom with the design and change of software systems, then maybe adapts to reality (closing)

- Methods for handling changes

- It is very difficult to define the arbitrary customization of software systems in all phases of life cycle.
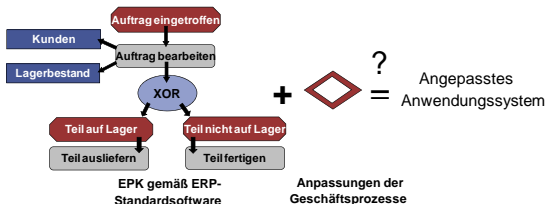
Entscheidungskriterien
- Verfügbarkeit geeigneter Standardsoftware?
  - *Funktionalität, Technologie, Anpassungsmöglichkeiten Zukunftssicherheit, Abhängigkeiten*
- Entwicklungsaufwand und -dauer, Anpassungsaufwand, Kosten
- Vorhandene Kompetenzen, Wartung, Gewährleistung, Risiken…

MAKE
Entwicklung von Individualsoftware

BUY
Auswahl und Anpassung von Standardsoftware

Entwicklung in Eigenregie oder durch Beauftragung eines Softwareunternehmens

Ziel: Abbildung der *spezifischen* Besonderheiten des Einzelunternehmens

Konsequenz:
- Hohe Entwicklungskosten, geringere Implementierungskosten
- Identifikation mit der Software
- bessere Anpassungsfähigkeit bei nachträglichen Änderungen (Flexibilität)

Herstellung durch das Softwareunternehmen für anonymen Markt

Ziel: Erfüllung der *durchschnittlichen* Ansprüche einer Vielzahl potenzieller Kunden

Konsequenz:
- Spezifische Besonderheiten des einzelnen Unternehmens werden nicht exakt erfüllt
- Geringe Entwicklungskosten, u.U. hohe Implementierungskosten
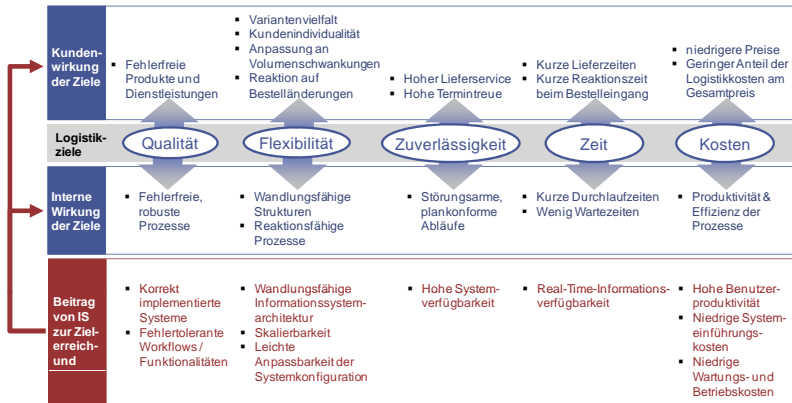- Standardisierte Schnittstellen zu Drittsystemen (Kompatibilitätsvorteile)

Problem area customizing

- Adaption of standard software (data, functions, processes) to the particular corporate specification

- Different kinds of customizing: E.g. usage of parametrization options / change and addition of source code
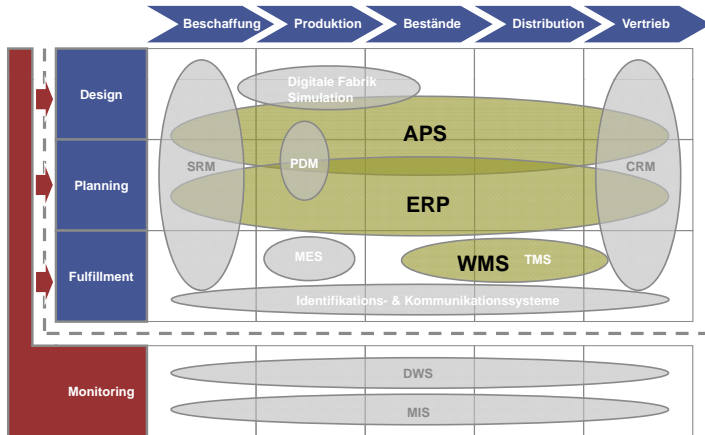

EPK gemäß ERP-Standardsoftware + Anpassungen der Geschäftsprozesse = ? Angepasstes Anwendungssystem

Kunden-wirkung der Ziele	Fehlerfreie Produkte und Dienstleistungen	Variantenvielfalt, Kundenindividualität, Anpassung an Volumenschwankungen, Reaktion auf Bestelländerungen	Hoher Lieferservice, Hohe Termintreue	Kurze Lieferzeiten, Kurze Reaktionszeit beim Bestelleingang	niedrigere Preise, Geringer Anteil der Logistikkosten am Gesamtpreis
Logistik-ziele	Qualität	Flexibilität	Zuverlässigkeit	Zeit	Kosten
Interne Wirkung der Ziele	Fehlerfreie, robuste Prozesse	Wandlungsfähige Strukturen, Reaktionsfähige Prozesse	Störungsarme, plankonforme Abläufe	Kurze Durchlaufzeiten, Wenig Wartezeiten	Produktivität & Effizienz der Prozesse
Beitrag von IS zur Ziel-erreich-und	Korrekt implementierte Systeme, Fehlertolerante Workflows / Funktionalitäten	Wandlungsfähige Informationssystem-architektur, Skalierbarkeit, Leichte Anpassbarkeit der Systemkonfiguration	Hohe System-verfügbarkeit	Real-Time-Informations-verfügbarkeit	Hohe Benutzer-produktivität, Niedrige System-einführungs-kosten, Niedrige Wartungs- und Betriebskosten

Quelle: in Anlehnung an: Straube,, Doch (2008): Mass Customization von Logistik Services

Quelle: in Anlehnung an: Straube,, Doch (2007): Entwicklungsrichtungen der e-Logistik

- **Digital Factory:** Integrated digital models, methods and tools (amongst others simulation and 3D visualization). The aim is the holistic planning, evaluation and continuous improvement of all essential structures, processes and resources of the real factory

- **Simulation:** Reproduction of a system (here: logistic system) with its dynamic processes in a model, in order to gain findings which are transferable to realty

- **APS (Advanced Planning and Scheduling System):** Finite planning (simultaneous planning of resources) , Optimization of production and logistics with limited resources in real time

- **ERP (Enterprise Resource Planning System):** Support of the corporate task to apply company resources (capital, equipment or staff) as efficiently as possible

- **SRM (Supplier Relationship Management System):** Strategic planning and central control of company's relationships with its suppliers

- **CRM (Customer Relationship Management System):** Structured and eventually automated collection of customer contacts and data and its use in analysis, planning and operational association with customers

- **PDM (Product Data Management System):** Definition, generation, processing, control, distribution and saving of product configurations (e. g. parts lists), CAD models and drawings

- **MES (Manufacturing Execution System):** Manufacturing management system with direct connection to production and logistics automation technology. Enables the control of production and logistics processes in real time. Mainly includes the production data acquisition (PDA).

- **WMS (Warehouse Management System):** A system for controlling and optimizing warehouse and distribution systems (quantity and bin location management, conveyor control and scheduling, collection of data)

- **TMS (Transport Management System):** Planning and control of transport processes (transport by land, air cargo and sea freight, but also vehicle fleet management, Taxi control system, etc.). Functionalities for vehicle monitoring, routing und optimization, volume optimization, order assignement, Planning of maintenance, etc.)

- **Identification** / **communication system:** Control of data collection (AUTO-ID technologies like RFID and bar code) and forwarding (communication standards like EDI)

- **DWS (Data Warehouse System):** Integration of data from distributed and differently structured data sets and separation of data according to application area, stakeholders, etc

- **MIS (Management Information System):** a system that provides users information that are relevant for their decisions and support them in the planning process.
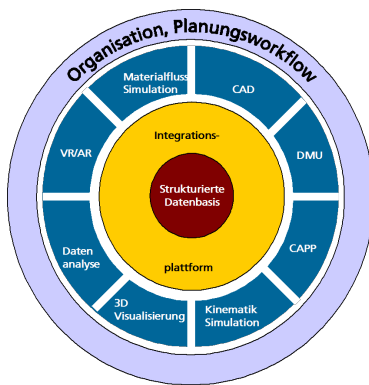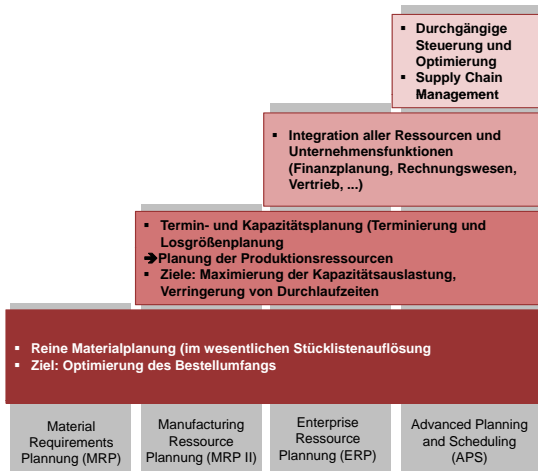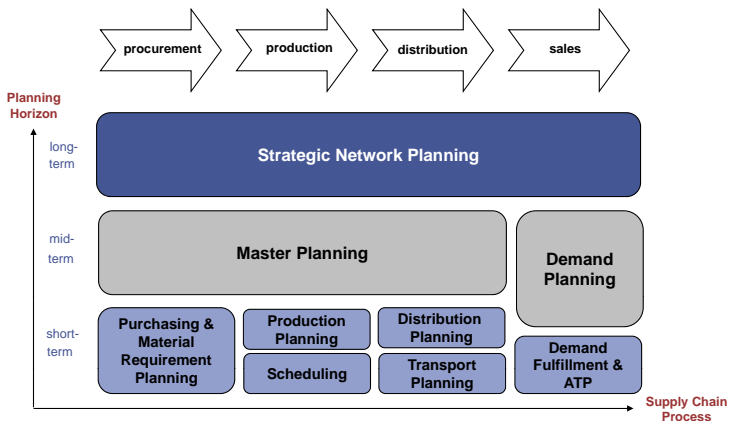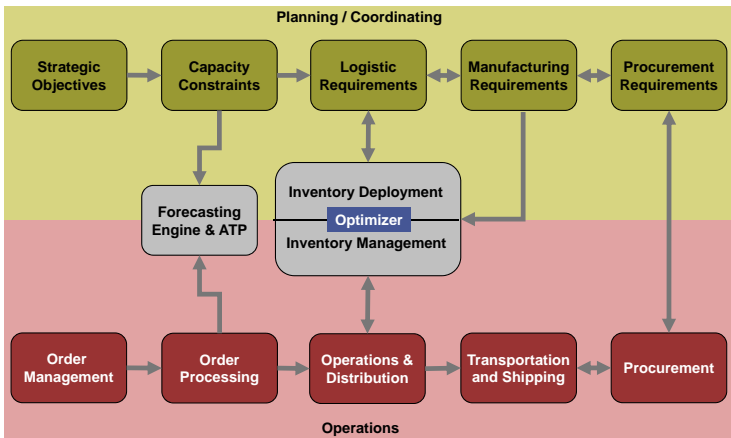
Abbildung: Fraunhofer Institut für Produktionstechnik und Automatisierung, Stuttgart

Origin of the terms ERP and APS

- **Durchgängige Steuerung und Optimierung**
- **Supply Chain Management**

- **Integration aller Ressourcen und Unternehmensfunktionen (Finanzplanung, Rechnungswesen, Vertrieb, ...)**

- **Termin- und Kapazitätsplanung (Terminierung und Losgrößenplanung**
- **➔Planung der Produktionsressourcen**
- **Ziele: Maximierung der Kapazitätsauslastung, Verringerung von Durchlaufzeiten**

- **Reine Materialplanung (im wesentlichen Stücklistenauflösung**
- **Ziel: Optimierung des Bestellumfangs**

Material Requirements Plannung (MRP)	Manufacturing Ressource Plannung (MRP II)	Enterprise Ressource Plannung (ERP)	Advanced Planning and Scheduling (APS)

Strategic Network Planning

Master Planning

Demand Planning

Purchasing & Material Requirement Planning

Production Planning

Scheduling

Distribution Planning

Transport Planning

Demand Fulfillment & ATP

procurement | production | distribution | sales
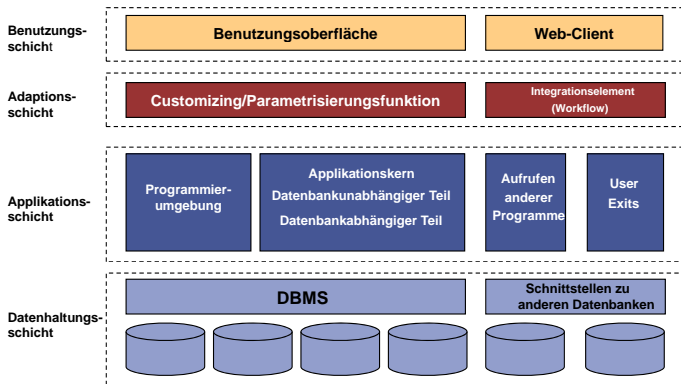
Planning Horizon

long-term

mid-term

short-term

Supply Chain Process

Source: Based on: Stadler, H.; Kilger, C.: Supply Chain Management and Advanced Planning; Springer Berlin et al. 2002, p. 99
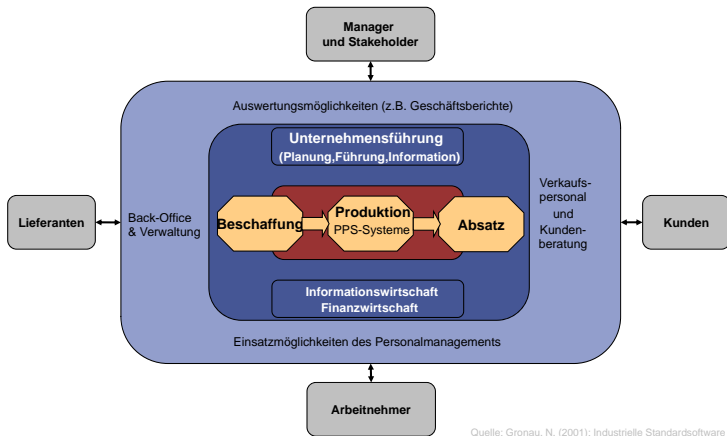
Typical APS system architecture
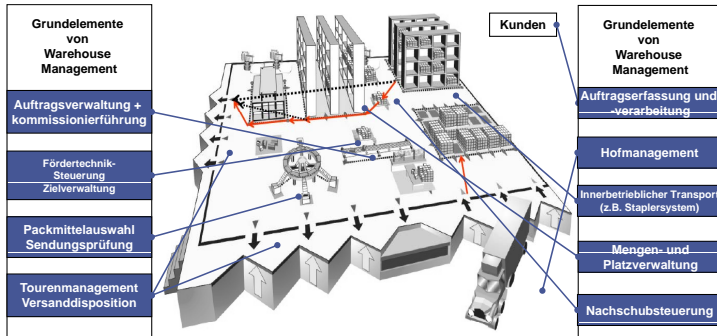

Planning / Coordinating

Strategic Objectives → Capacity Constraints → Logistic Requirements → Manufacturing Requirements ↔ Procurement Requirements

Forecasting Engine & ATP

Inventory Deployment
Optimizer
Inventory Management

Operations

Order Management → Order Processing → Operations & Distribution → Transportation and Shipping ↔ Procurement

ERP-System

Aufgabenkategorien

Einsatzbereiche

Administration
• Datenhaltung für Geschäftsvorfälle

Disposition
• Automatisierung von Routinevorgängen

Information
• Kennzahlenbildung

Analyse
• Auswertung, Zeitreihenmodelle

Fertigung
• Einkauf
• Materialbedarfsplanung
• Bestandsführung
• Produktionsplanung

Vertrieb
• Auftragseingang
• Rechnungsstellung
• Verkaufsanalysen

Rechnungswesen
• Forderungen und Verbindlichkeiten
• Budgetplanung –und überwachung
• Buchführung, Anlagenbuchhaltung

Finanzwesen
• Liquiditätsmanagement
• Finanzplanung

Personalwesen
• Lohn –und Gehaltsabrechnung
• Zuschläge und Prämien

Quelle: Gronau, N. (2001): Industrielle Standardsoftware

Benutzungs-schicht	Benutzungsoberfläche	Web-Client

Adaptions-schicht: Customizing/Parametrisierungsfunktion — Integrationselement (Workflow)

Applikations-schicht: Programmier-umgebung — Applikationskern, Datenbankunabhängiger Teil, Datenbankabhängiger Teil — Aufrufen anderer Programme — User Exits

Datenhaltungs-schicht: DBMS — Schnittstellen zu anderen Datenbanken

Quelle: Gronau, N. (2001): Industrielle Standardsoftware

Quelle: Gronau, N. (2001): Industrielle Standardsoftware

Grundelemente von Warehouse Management

- Auftragsverwaltung + kommissionierführung
- Fördertechnik-Steuerung / Zielverwaltung
- Packmittelauswahl / Sendungsprüfung
- Tourenmanagement / Versanddisposition

Kunden

Grundelemente von Warehouse Management

- Auftragserfassung und -verarbeitung
- Hofmanagement
- Innerbetrieblicher Transport (z.B. Staplersystem)
- Mengen- und Platzverwaltung
- Nachschubsteuerung

Quelle: ten Hompel

Quelle: Siemens DEMATIC

- Confusing total market with a multitude of heterogeneous providers
- Division into different segments
  - Systems for big companies / enterprises
  - Systems for medium-sized businesses
  - Industry software
  - Systems for small businesses

Marktanteile ERP-Systeme für Großunternehmen (2004)
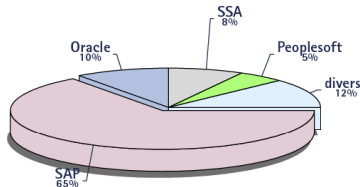
Marktanteile ERP-Systeme im Maschinen- und Anlagenbau (2001)
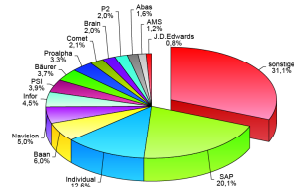
- Foundation of SAP in 1972 by 5 former IBM managers

- Origin of the name SAP: System analysis and program developement. Later: Systems, applications and products

- Largest European and worldwide third largest software producer

- The head office is in the Baden Walldorf

- Wordwide 43.800 employees, sales volume of 10,3 Mrd. EUR

- More than 10 million users and 36.000 installations

Products:

- SAP Business Suite
  - mySAP ERP, mySAP PLM, mySAP SCM, mySAP SRM, mySAP CRM
  - mySAP NetWeaver
  - Miscellaneous branch solutions based thereon
- Different products for medium-sized businesses
  - Business One
  - Business All-in-One
  - Business By Design

- SAP ERP Operations
  - In previous versions of SAP known as modules PP (production planning), MM (materials handling) and SD (sales department)
  - Essentially contains: parts lists management and work center maintenance, sales planning, production planning, demand and capacity planning, purchase department, inventory management, warehouse management, scheduling, sales department, shipping department, pricing, invoicing, accounting control
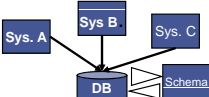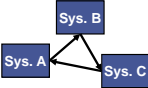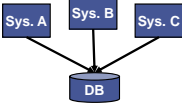
Functionalities of SAP WMS in logistics planning
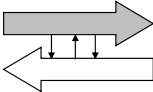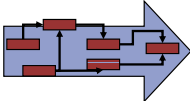
- **Storage location management and optimization:** storage location structure, Management of product inventories on bin locations

- **Storage and stock removal strategies:** Determination of suitable bin locations for storage an picking of products. Determiniation of the removal strategy to find the optimal picking place

- **Pick management:** Bundeling of items to be deliverd in workpackages for the control of storage processes and their joint execution in the sequential operations

- **Replenishment control:** demand-oriented control of inventory into the picking areas

- **Planning und monitoring:** Information about picking, storage and stocktaking as well as resource management, inventories, tasks and requirements

- **Quality management:** Verification of quality criteria for delivered products

- **Handling Units Management:** Integration of packaging means (carrier and package) and packed products to a physical unit that contains all information related to the product

- **Resource management:** Management and distribution of orders to the storage resources

- **Stocktaking:** Different methods of stocktaking (e.g. zero stock checks, complete annual stocktaking) and analysis and write-offs of differences

- New Functionalities for Yard Management, RFID, Transportpathoptimization, . . .

	Administrative Schicht
mySAP ERP	Planung, Bestände, MM, Stammdaten, …
	Warehouse Management
LES	Plätze, Quants, Paletten, Strategien, Pick, Pack, …
	Task & Resource Management
TRM	Transportsteuerung, Ressourcensteuerung
	Automatisierung
SPS	RBG, Fördertechnik, …

Quelle: SAP

Levels of integration of information systems
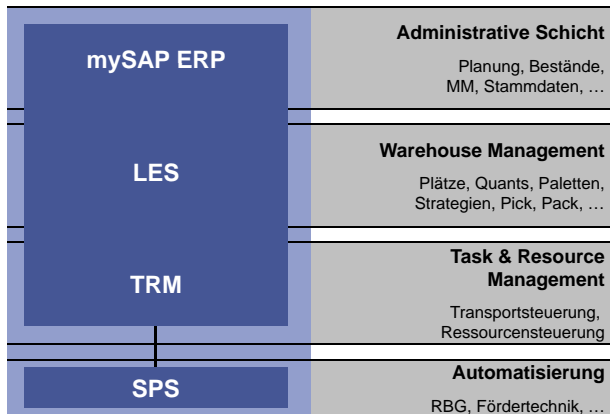
Integrationsebene	lose Kopplung	Enge Kopplung
Prozessintegration	Prozessschnittstellen	Integriertes Prozessmanagement
Modellintegration	Metamodelle/Austauschmodelle	Gemeinsames Datenmodell
Dateiintegration	Nachrichtenaustausch	Gemeinsame Datenhaltung
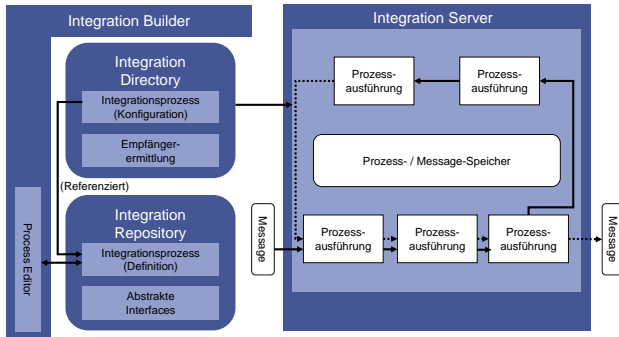
Quelle: SAP

- A multitude of different information systems are relevant for logistics. The systems can be classified corresponding to the **system of planning**.

- The potentials of information systems and associated problems should be identified for logistics in order to ensure the **contribution of IT to logistical target figures**.

- **ERP systems** support the corporate task to apply company resources (capital, equipment or staff) as efficiently as possible.

- **WMS** supports control and optimization of storage and distribution systems

- **APS-Systems** base on the finite planning (simultaneous planning of resources) and support the optimization of production and logistics with limited resources in real time.

- The later in the lecture treated central information systems in logistics are **digital factory, Business Process Management, ERP, WMS, MES, etc**.

- Schönsleben, P. (2001): Integrales Informationsmanagement. Springer Verlag, Berlin Heidelberg New York

- Straube, F. (2004): e-Logistik, Springer Verlag, Berlin Heidelberg New York

- Straube, F.; Doch, S. A. (2007): Umsetzungsstand und Entwicklungsperspektiven der e-Logistik. In: Schweizer Logistik Katalog 2007 - Jahrbuch für Materialfluss und Logistik, Laufenburg: Binkert Medien, Jg. 32, S. 48-49.

- Gronau, N. (2001): Industrielle Standardsoftware – Auswahl und Einführung. Oldenbourg, München Wien

- TU Berlin Bereich Logistik