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HIGHLIGHTED HANDOUT

MGMT731

Theory & Practice of Enterprise Resource
Planning

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MGMT731**Theory & Practice of Enterprise Resource Planning****ERP Concepts, Architecture and Implementation — Study Handout**

This handout covers MGMT731 Theory & Practice of Enterprise Resource Planning, following the official VU course contents: ERP foundations, business process re-engineering, ERP architecture, ERP packages, manufacturing models, and the functional modules (sales, production, finance, HR, SCM). SAP R/3 is used as the running example because it is the market reference.

Exam questions mix definitions, architecture diagrams (describe in words), module-to-process mappings, and implementation case analysis. Learn the module names and what business process each supports. 

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Unit 1: ERP Foundations: Integrated Management Information

Lectures 1–4

Learning Objectives

- Define ERP and explain the integration concept
- Describe the problems of fragmented legacy systems
- Explain the integrated data model and single database idea
- List the benefits and costs of ERP

What ERP Is

An **Enterprise Resource Planning (ERP)** system is a suite of integrated software modules sharing one common database, supporting the core business processes — finance, HR, manufacturing, supply chain, sales — across the whole enterprise. The key word is **integrated**: a sales order entered once automatically updates inventory, production planning, invoicing, receivables and the general ledger.

The Legacy Problem

- **Islands of automation**: separate systems for accounting, inventory, HR that don't talk to each other.
- **Data redundancy and inconsistency**: the same customer stored three ways; reports disagree.
- **Delayed information**: month-end batch processing; managers decide on stale data.
- **High maintenance**: old code, retiring experts, expensive interfaces between systems.

Integrated Data Model

ERP replaces the islands with a **single logical database** (one version of the truth). Master data — customers, vendors, materials, chart of accounts — is created once and shared. Transactional data flows across modules in real time. Result: drill-down from a financial statement to the original sales order, and consistent reporting everywhere.

- **Benefits**: real-time visibility, process standardization, fewer errors, faster closing, better customer service, regulatory compliance.
- **Costs/risks**: huge license + implementation cost, business disruption, rigidity (best-practice processes may not fit), dependence on one vendor.

Exam classic: 'A company has separate billing, inventory and accounting software and its reports never agree.' Diagnose: fragmented legacy systems — no integrated data model. Prescription: ERP with shared master data and real-time posting across SD, MM and FI modules.

Unit Summary

- ERP = integrated modules on one database; enter once, use everywhere.
- Legacy pain: islands, inconsistency, stale data, high maintenance.

- Integrated data model gives one version of the truth; benefits are real-time control, costs are money and rigidity.

Exam Pointers

- ★ Define ERP and explain 'integration' with a sales-order example.
- ★ List four problems of legacy systems and how ERP solves each.
- ★ Give three benefits and three risks of ERP adoption.

Unit 2: Business Modeling and Business Process Re-engineering

Lectures 5–8

Learning Objectives

- Explain business modeling and process maps
- Define BPR and its principles
- Distinguish BPR from automation and TQM
- Describe BPR methodologies and their steps

Business Modeling

Before software, model the business: **process maps** (flowcharts of how work actually flows), **organization models** (who does what), and **data models** (entities like Customer, Order, Material and their relationships). Modeling exposes the as-is process so it can be redesigned into the to-be process that the ERP will support.

What BPR Is

Business Process Re-engineering (Hammer & Champy): fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in cost, quality, service and speed. The slogan: **don't automate, obliterate** — paving the cow paths (automating a bad process) just makes bad processes faster.

- **BPR vs automation:** automation keeps the process, changes the tool; BPR redesigns the process, then tools it.
- **BPR vs TQM:** TQM is continuous incremental improvement; BPR is one-time radical redesign.

BPR Principles and Methodology

- Organize around **outcomes**, not tasks (one case worker handles the whole order).
- Capture information **once, at the source** (the ERP single-database idea).
- Put the **decision point where the work is performed**; build control into the process.
- Typical methodology: 1) identify processes for redesign, 2) map as-is, 3) benchmark and envision to-be, 4) prototype in the ERP, 5) implement with change management, 6) measure results.

Case: Order processing takes 12 days across sales, credit-check, warehouse and billing desks, each re-entering data. BPR redesign: a single order-management team with ERP workflow — credit check automatic, warehouse notified in real time, invoice generated on shipment. Result target: 2 days. This is the classic order-to-cash re-engineering story — learn it.

Unit Summary

- Model as-is (process, organization, data) before choosing software.
- BPR = radical redesign for dramatic gains; don't automate broken processes.

- Principles: outcome-oriented, capture once, decide where work happens.

Exam Pointers

- ★ Define BPR and contrast it with automation and TQM.
- ★ State four BPR principles with a one-line example each.
- ★ Apply BPR to the 12-day order-processing case.

Unit 3: ERP System Architecture

Lectures 9–12

Learning Objectives

- Describe the three-tier/layered ERP architecture
- Explain presentation, application and database layers
- Describe ERP and Enterprise Application Integration (EAI)
- Compare two-tier vs three-tier designs

Layered (Three-Tier) Architecture

Modern ERP uses **three tiers**: 1) **Presentation layer** — the user interface (SAP GUI, web browser, Fiori apps); 2) **Application layer** — the business logic servers running the module code (order checks, MRP runs, posting rules); 3) **Database layer** — the relational DBMS (Oracle, SQL Server, SAP HANA) holding the single integrated database. Tiers can scale independently: add app servers when users grow, without touching the database.

- **Two-tier (client-server)**: fat client holds logic + thin DB — simpler but hard to scale and update.
- **Three-tier**: logic centralized on app servers — scalable, easier to maintain, supports web/mobile clients.

ERP and EAI

Enterprise Application Integration (EAI) connects the ERP with non-ERP systems (legacy apps, e-commerce sites, supplier portals) through middleware, message brokers and standard interfaces (APIs, IDocs/ALE in SAP, web services). Without EAI, every pair of systems needs a custom interface — with n systems that's $n(n-1)/2$ interfaces; a hub/middleware reduces it to n connections.

- **Interfaces**: batch file transfers (old), RFC/API calls (real-time), message queues (reliable async).
- Master-data synchronization through the integration layer keeps customer/material records consistent everywhere.

Exam diagram question: draw and label the three tiers with one example component each (browser → SAP app server → HANA database), and show where an EAI middleware sits between the ERP and a legacy warehouse system.

Unit Summary

- Three tiers: presentation (UI), application (business logic), database (single DB).
- Three-tier scales and maintains better than two-tier client-server.
- EAI middleware connects ERP to the outside world; hub beats point-to-point interfaces.

Exam Pointers

- ★ Draw and explain the three-tier ERP architecture.

- ★ Compare two-tier and three-tier on scalability and maintenance.
- ★ A firm has 6 systems to interconnect. How many point-to-point interfaces vs hub connections?

Unit 4: ERP Packages: SAP R/3, Oracle and E-Business

Lectures 13–16

Learning Objectives

- Describe SAP R/3's module structure
- Compare SAP with Oracle ERP offerings
- Explain ERP's role in e-business
- Outline package selection criteria

SAP R/3 — The Reference Package

SAP R/3 (the classic client-server ERP, ancestor of S/4HANA) organizes into modules: **FI** (Financial Accounting), **CO** (Controlling), **MM** (Materials Management), **SD** (Sales & Distribution), **PP** (Production Planning), **HR/HCM** (Human Capital Management), **WM** (Warehouse Management), **QM** (Quality Management), **PM** (Plant Maintenance). Modules share the same database — a goods issue in MM instantly hits FI inventory accounts.

Oracle and the Market

- **Oracle E-Business Suite / Fusion:** strong in finance and database integration; Fusion is cloud-native.
- **Microsoft Dynamics 365:** popular with mid-market; familiar Office-like UI.
- **Selection criteria:** functional fit (gap analysis), industry best practices, total cost (license + implementation + maintenance), vendor viability, technology stack, local support and references.

ERP and E-Business

ERP becomes the **backbone of e-business**: the web storefront (B2C/B2B portal) takes orders that flow straight into SD; available-to-promise checks hit live inventory; customers track orders via self-service portals. E-procurement catalogs punch out to suppliers through MM. Without ERP integration, e-commerce is just a pretty screen over chaos.

Case: An online retailer takes web orders but staff re-type them into accounting, causing daily mismatches. Solution: integrate the storefront with the ERP (SD module) via EAI — order, inventory check, invoice and payment post automatically; mismatches disappear because there is one data entry point.

Unit Summary

- SAP R/3 modules: FI, CO, MM, SD, PP, HR, WM, QM, PM — one shared database.
- Oracle Fusion, Dynamics 365 are alternatives; select on fit, cost, vendor, support.
- ERP is the e-business backbone: storefronts and portals transact directly against ERP data.

Exam Pointers

- ★ Name six SAP R/3 modules and one function of each.

- ★ List five ERP package selection criteria.
- ★ Explain how ERP integrates with a B2C web storefront.

Unit 5: Manufacturing Models in ERP

Lectures 17–20

Learning Objectives

- Distinguish MTS, MTO, ATO and ETO
- Explain how each model drives ERP planning
- Relate models to the customer-order decoupling point
- Give industry examples of each

The Four Models

Make-to-Stock (MTS) — produce to forecast, sell from inventory. Decoupling point at finished goods. Example: packaged foods, standard fasteners. ERP focus: demand forecasting, finished-goods inventory.

Assemble-to-Order (ATO) — stock components/subassemblies, assemble on order. Decoupling at components. Example: Dell PCs, custom furniture. ERP focus: component planning, final-assembly scheduling.

Make-to-Order (MTO) — manufacture after the order arrives. Decoupling at raw materials. Example: industrial pumps, specialized machinery. ERP focus: capacity planning, order-specific BOMs.

Engineer-to-Order (ETO) — design AND make after the order. Decoupling at the design stage. Example: bridges, ships, custom plants. ERP focus: project systems, engineering change control.

Decoupling Point Logic

The **customer-order decoupling point** is where forecast-driven activity meets order-driven activity. Moving it upstream (toward ETO) increases customization and lead time; moving it downstream (toward MTS) shortens delivery but risks wrong stock. ERP configures planning (MRP vs order-based), costing and promising logic differently on each side of the point.

Exam trap: 'A company stocks motors and gearboxes and assembles custom conveyor systems on order.' → ATO (components stocked, final product configured to order). 'A shipyard designs each vessel from scratch per contract.' → ETO.

Unit Summary

- MTS (forecast→stock), ATO (components→assemble), MTO (order→make), ETO (order→design→make).
- The decoupling point separates forecast-driven from order-driven planning.
- Each model changes what ERP plans: forecasts, components, capacity, or projects.

Exam Pointers

- ★ Define all four models with one example each.
- ★ Explain the decoupling point and its trade-off.

- ★ Classify: bakery bread, tailored suits, made-to-measure industrial boilers.

Unit 6: Functional Module I: Sales & Distribution and Materials

Lectures 21–24

Learning Objectives

- Trace the order-to-cash process through SD
- Trace procure-to-pay through MM
- Explain availability checks and delivery
- Describe pricing, billing and their FI integration

SD: Order-to-Cash

SAP SD flow: **Inquiry** → **Quotation** → **Sales Order** (availability check/ATP confirms what can be promised) → **Delivery** (picking, packing, goods issue — inventory and COGS post) → **Billing** (invoice — receivables and revenue post to FI) → **Payment**. Pricing procedures apply discounts, freight and taxes automatically from condition records.

MM: Procure-to-Pay

SAP MM flow: **Purchase Requisition** (internal need) → **Purchase Order** (to vendor) → **Goods Receipt** (inventory increases; GR/IR clearing account credited) → **Invoice Verification** (vendor bill matched against PO and receipt — the 3-way match) → **Payment** (FI clears the vendor). The 3-way match blocks paying for goods never received.

- **ATP (Available-to-Promise):** SD checks real inventory + planned receipts before committing a delivery date.
- **Integration:** goods issue debits COGS and credits inventory in FI automatically; billing debits receivables, credits revenue.

Case: Customers complain about promised dates missed. Diagnosis: sales promises without ATP checks against live inventory/production. Fix: enforce availability check in the sales order and let delivery dates derive from PP schedules — the classic SD–PP integration win.

Unit Summary

- SD: inquiry → quotation → order (ATP) → delivery (goods issue) → billing → payment.
- MM: requisition → PO → goods receipt → invoice verification (3-way match) → payment.
- Every logistics step posts automatically to FI — that is integration in action.

Exam Pointers

- ★ Trace order-to-cash with the FI posting at delivery and billing.
- ★ What is the 3-way match and what fraud/error does it prevent?
- ★ Explain ATP and why sales needs it.

Unit 7: Functional Module II: Production Planning and Finance

Lectures 25–28

Learning Objectives

- Explain MRP logic: BOM, routing, planned orders
- Distinguish discrete, process and repetitive manufacturing
- Describe FI (financial accounting) sub-ledgers
- Explain CO (controlling): cost centers, profitability analysis

PP: Production Planning

MRP explodes the master production schedule through the **BOM** (bill of materials — what goes into the product) and **routings** (operations, work centers, times) to generate planned orders for components and capacity requirements. **Discrete** manufacturing (cars, machines) uses orders per lot; **repetitive** (consumer goods) uses rate-based planning; **process** industries (chemicals, food) use recipes and batches.

FI: Financial Accounting

- **GL** (General Ledger): the central record; all modules post here.
- **AR/AP** sub-ledgers: customer and vendor line items, reconciled to GL control accounts.
- **Asset Accounting**: capitalization, depreciation runs, retirements.
- **Bank Accounting**: payments, statements, reconciliation.

CO: Controlling (Management Accounting)

- **Cost Center Accounting**: tracks where costs are incurred (departments).
- **Internal Orders**: collect costs of projects/events.
- **Product Costing**: standard vs actual cost of manufactured goods (variance analysis).
- **Profitability Analysis (CO-PA)**: profit by product, customer, region — management's favorite view.

Worked MRP: Product A needs 2× B and 1× C (BOM). Orders: 100 A. Gross need: 200 B, 100 C. On hand: 50 B, 20 C. Net need: 150 B, 80 C → planned orders (with lead-time offsetting). This explosion logic is the heart of every MRP exam question. 

Unit Summary

- MRP: MPS → BOM explosion → net requirements → planned orders; routings add capacity.
- FI = external accounting (GL, AR/AP, assets, banks); CO = internal (cost centers, orders, product cost, CO-PA).
- Discrete/repetitive/process manufacturing need different PP configuration.

Exam Pointers

- ★ Explode a small BOM to net requirements (numbers given).
- ★ Distinguish FI from CO with two sub-components each.
- ★ What are BOM and routing, and how does MRP use them?

Unit 8: Functional Module III: HR, Quality and SCM

Lectures 29–32

Learning Objectives

- Describe HR/HCM: personnel administration, payroll, time
- Explain QM across the supply chain
- Define SCM and contrast with traditional logistics
- Describe e-SCM: collaboration, CPFR, portals

HR/HCM Module

- **Personnel Administration:** employee master data, organizational management (positions, hierarchy).
- **Payroll:** gross-to-net calculation, tax and social-security deductions, bank transfers.
- **Time Management:** shifts, attendance, leave quotas — feeds payroll.
- **Talent:** recruitment, appraisals, training, succession (in modern HCM suites).

QM: Quality Management

QM embeds inspection in the logistics flow: **incoming inspection** (goods receipt blocked until lab approves), **in-process inspection** (production lots), **final inspection** before delivery. Non-conforming stock goes to blocked/QA status — it cannot be sold. Certificates of analysis travel with shipments in pharma/food.

SCM and E-SCM Overview

Supply Chain Management plans and executes the end-to-end flow from suppliers to customers: demand planning, supply planning, production, distribution, returns. Traditional logistics optimized each silo; SCM optimizes the **whole chain** (the bullwhip effect — small retail fluctuations amplifying upstream — is the classic justification). **E-SCM** does it over the internet: supplier portals, **CPFR** (collaborative planning, forecasting and replenishment with key customers/suppliers), track-and-trace, and EDI/API document exchange.

Case: A distributor's warehouse is full while stores stock out. Diagnosis: silo planning + bullwhip effect. SCM remedy: shared demand forecasts with stores (CPFR), DRP (distribution requirements planning) driving replenishment, and ATP promising from network stock — all standard SCM module functions.

Unit Summary

- HR: personnel admin, org management, payroll, time — the employee lifecycle.
- QM: inspection lots at receipt, production and dispatch; blocked stock can't sell.
- SCM optimizes the whole chain; e-SCM adds portals, CPFR and electronic collaboration; tames the bullwhip.

Exam Pointers

- ★ List HR sub-components and one function each.
- ★ Where does QM intervene in the MM and PP flows?
- ★ Explain the bullwhip effect and two e-SCM remedies.

Unit 9: ERP Implementation: Strategy and Change

Lectures 33–36

Learning Objectives

- Compare big-bang, phased and parallel implementation strategies
- Explain critical success factors for ERP projects
- Describe change management and training needs
- Analyze why ERP implementations fail

Implementation Strategies

Big bang — all modules, all sites, one go-live date. Fastest benefits, highest risk.

Phased — module by module or site by site. Manageable risk; needs temporary interfaces between old and new.

Parallel — run old and new systems together for a period. Safest, most expensive (double work).

Pilot — implement at one site, learn, then roll out (a phased variant).

Critical Success Factors

- **Top-management sponsorship** — without it, departments won't surrender their pet processes.
- **BPR before configuration** — fit the business to best practice where possible; customize only for real competitive advantage (custom code = upgrade pain).
- **Data cleansing** — migrate clean master data; garbage in, garbage out.
- **Training and change management** — users must understand new processes, not just screens.
- **Right team**: best internal people full-time + experienced consultants; clear scope control.

Why Implementations Fail

- No executive backing; scope creep; excessive customization; dirty data; under-training; underestimating change resistance; choosing software before redesigning processes.

Case analysis framework for exams: 1) Which strategy was used and was it appropriate? 2) Which CSFs were present/missing? 3) Was BPR done or was the old mess automated? 4) Data and training adequacy? 5) Recommendation. Apply this skeleton to any implementation case study.

Unit Summary

- Strategies: big bang (fast/risky), phased (balanced), parallel (safe/costly), pilot.
- CSFs: sponsorship, BPR-first, clean data, training, scope control, right team.
- Failures come from missing CSFs — analyze any case with the 5-question framework.

Exam Pointers

- ★ Compare the four implementation strategies on risk, cost and speed.

- ★ List six critical success factors with one line each.
- ★ An implementation failed after heavy customization. Diagnose using CSF theory.

Key Terms Glossary

All key terms from this handout in one place — use for quick revision.

Make-to-Stock (MTS) — produce to forecast, sell from inventory. Decoupling point at finished goods. Example: packaged foods, standard fasteners. ERP focus: demand forecasting, finished-goods inventory.

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