

# DES429 Finals Summary

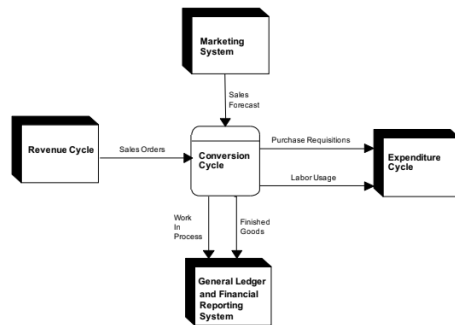
Accounting Information Systems

SIIT DE-ASD Y3T2/2021 – By Paphana Yiwsiw (@waterthatfrozen)

## Lecture 6 – Conversion Cycle

**\*\*ช่วงของหลังมิดเทอมไม่ค่อยได้สรุปเองแล้วนะครับ ส่วนใหญ่เป็นคำที่ดึงมาจากสไลด์อาจารย์หมดเลย\*\***

- Transforms input resources, raw materials, labour, and overhead into finished goods for sales.
- Two subsystems:
  - o Physical activity: production system
  - o Information activity: Cost accounting system



### Production System

- Involves the planning, scheduling, and control of the physical product through the manufacturing process. Such as:
  - o Determine required raw materials
  - o Authorize the release of raw materials into production
  - o Authorize work to be conducted in the production
  - o Direct the movement of work through the various stages of production

### Production Method

- Continuous processing: creates homogeneous products through a continuous series of standard procedures.
- Batch processing: produces discrete batches of products
- Make-to-Order processing: involves the fabrication of discrete products according to customer specifications.

### Traditional Batch Production Model

- Plan and control production
- Perform production operations
- Maintain inventory control
- Perform cost accounting

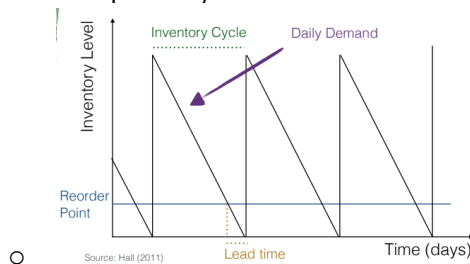
### Batch Production System

- Production planning and control
  - o Materials and operations requirements
  - o Production scheduling

- Materials and Operations Requirements
  - o Materials requirement: Difference between what is needed and available in inventory.
  - o Operation requirement: Assembly and manufacturing activities to be applied to products.
- Inventory Control
  - o Objective: minimize total inventory cost while ensuring that enough inventory exist of production demand.
  - o Provides production planning and control with status of finished food and raw materials inventory.
  - o Continually updates the raw material inventory during production process.
  - o Upon completion of production, updates finished goods inventory.

## EOQ Inventory Model

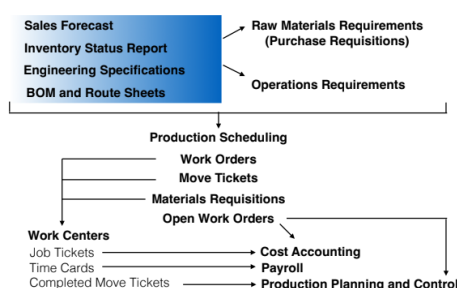
- Very simple to use, but assumptions are not always valid
  - o Demand is known and constant
  - o Ordering lead time is known and constant
  - o Total cost per year of placing orders decreases as the order quantities increase.
  - o Carrying costs of inventory increases as quantity of orders increases
  - o No quantity discounts



## Documents in the Batch Production System

- Sales Forecast: expected demand for the finished product
- Production schedule: production plan and authorization to produce
- BOM/Bill of Materials: specifies the types and quantities of the raw materials and subassemblies used to produce a single finished good unit.
- Route Sheet: Details the production path a particular batch will take in the manufacturing process / sequence of operations / time allocated at each station
- Work Order: uses the BOM and route sheet to specify the exact materials and production process for each batch.
- Move Ticket: records work done in each work centre and authorizes the batch movement.
- Materials Requisition: authorizes the inventory warehouse to release raw materials for use in the production process.

## Production Planning and Control



## Upon Completion of Production Process

- Finished Product & Closed Work Order → Finished Goods Warehouse
- Closed Work Order → Inventory Control
- Status Report of Raw Materials and Finished Goods → Production Planning and Control
- Journal Voucher → General Ledger

## Cost Accounting System

- Records the financial effects of the events occurring in the production process
- Initiated by the work order
- Cost accounting clerk creates a new cost record for the batch and WIP file
- The records are updated as materials and labour are used.
- Elements:
  - o Inventory control sends materials requisitions
  - o Work centres send Job tickets and Complete move tickets
  - o Standards
  - o Cost accountants: Update WIP accounts, DL (Direct labour), DM (Direct material), Mfg. OH. (Manufacturing overhead), Compute variances.
- Receipt of last move ticket signals completion of the production process
  - o Clerk removes the cost sheet from WIP file
  - o Prepares a journal voucher to transfer balance to a finished goods inventory account and forwards to the General Ledger department

## Internal Controls in Conversion Cycle

- Transaction authorizations:
  - o Work orders: reflect a legitimate need based on sales forecast and the finished goods on hand.
  - o Move tickets: signatures from each workstation authorize the batch movement through work centres.
  - o Material requisitions: authorize the warehouse to release materials to work centre.
- Segregation of duties:
  - o Production planning and control department is separated from the work centre.
  - o Inventory control is separated from materials storeroom and finished goods warehouse.
  - o Cost accounting function accounts for WIP and should be separated from the work centre in the production process.
- Supervision
  - o Work centre supervisors oversee the raw materials to ensure that all released materials are used in the production and waste is minimized.
  - o Employee timecards and job tickets are checked for accuracy.
- Access Controls
  - o Direct access to assets:
    - Controlled access to storerooms, production work centre, and finished goods warehouse.
    - Quantities in excess of standard amounts require approval
  - o Indirect access to assets:
    - Controlled use of material requisitions, excess materials requisitions, and employee timecards.

- Accounting Records
  - o Pre-numbered documents / work orders / cost sheets / move tickets / job tickets / material requisitions / WIP and finished goods files.
- Independent Verifications
  - o Cost accounting reconciles material usage (in material requisitions) and labour usage (in job tickets) with standards.
  - o GL department verifies movement from WIP to FG by reconciles journal vouchers from cost accounting and inventory subsidiary ledgers from inventory control
  - o Internal and external auditors periodically verify the raw materials and FGs inventory through a physical count.

## **World-class Companies**

- Pursue improvements in all aspects of operations continuously.
- Highly customer-oriented.
- Undergone fundamental changes from traditional production model
- Adopt a lean manufacturing model

## **Principles of Lean Manufacturing:**

TPS(Toyota Production System) Lean

1. Pull Processing
  - a. reduce set up time to a minimum
  - b. allowing for a greater diversity of products without sacrifice efficiency.
2. Perfect Quality
  - a. pull processing requires zero defects in raw materials, WIP, and FG inventory.
3. Waste Minimization
  - a. activities that do not add value or maximize the use of scarce resources are eliminated
4. Inventory Reduction: Hallmark of lean manufacturing
  - a. inventory costs money
  - b. inventory can mask production problems and precipitate overproduction
5. Production Flexibility
  - a. Reduce setup time to minimum, allowing for greater product diversity without sacrifice efficiency.
6. Established Supplier Relations
  - a. late delivery, defective raw material, or incorrect order will shut down production since there are inventory reserves.
7. Team Attitude
  - a. each employee must be vigilant of problems that threaten the continuous flow of the production line

## **Lean Manufacturing Model**

- Achieve production flexibility by
  - o changes in physical organization of production facilities
  - o automated technologies employment
  - o alternative accounting model usage
  - o advanced IS usage

## Physical Reorganization of Production Facilities

- Inefficiency in traditional plant layout increases handling costs , conversion time, and excess inventories.
- Employees tend to feel ownership over their stations, contrary to the team concept
- Reorganization is based on flows through cells which shorten the physical distance between activities. It reduces the setup and processing time, handling costs, and inventories.

## Progression of Automation in the Manufacturing Process

Progression of automation toward world-class status.

- Traditional Approach
  - o Many different types of machines which require a lot of setup time
  - o Machines and operators are organized in functional departments
  - o WIP follows a circuitous route through the different operations
- Islands of Technology
  - o Stand alone islands which employ computer numerical controlled (CNC) machines that can perform multiple operations with less human involvement
    - CNC
      - Reduces the complexity of the physical layout
      - Arranges in groups and in cells to produce an entire part from start to finish
      - Need less setup time
- CIM/Computer Integrated Manufacturing
  - o A completely automated environment which employs automated storage and retrieval systems (AS/RS) and robotics.
    - AS/RS
      - Replaces traditional forklifts and their human operators with computer-controlled conveyor systems
      - Reduces errors, improved inventory control, and lower storage costs.

## Automating Manufacturing

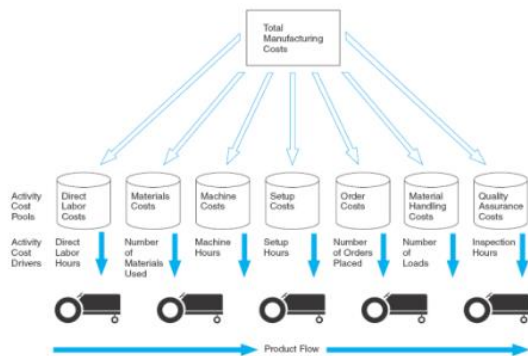
- Robotics
  - o Use special CNC machines that are useful in performing hazardous, difficult, and monotonous tasks.
- CAD/Computer-Aided Design
  - o Increase engineers' productivity, accuracy
  - o Allow firms to be more responsive to market demands
  - o Interface with CAM and MRPII systems
    - CAM/Computer Aided Manufacturing
      - Uses computers to control the physical manufacturing process / Provides greater precision, speed, and control than human production processes.

## Achieving World-class Status

- Needs new accounting methods + new IS
- Show what matters to its customers / Identify profitable products, customers, opportunities for improving operations and products / Encourage the adoption of value-added activities and processes / Efficiently support multiple users with both financial and non-financial information.

## Activity Based Costing (ABC)

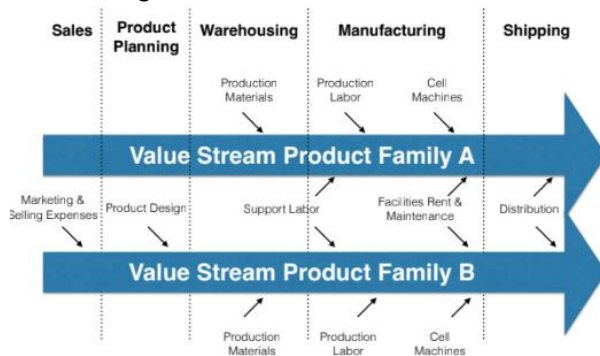
- An IS that provides managers with information about activities and cost objects
- Assumes that activities cause costs and that products (and other cost objects) create a demand for activities
- different from traditional accounting system since ABC has multiple activity drivers, whereas traditional accounting has only one (e.g., machines hours)
- Allocation of Overhead cost to products in ABC



- Pros and Cons
  - o Pros: More accurate costing of products/services, customers, and distribution channels / Identifying the most and least profitable products and customers / Accurately tracking costs of activities and processes / Equipping managers with cost intelligence to drive continuous improvements / Facilitating better marketing mix / Identifying waste and non-value-added activities.
  - o Cons: Too time-consuming and complicated to be practical / Promotes complex bureaucracies in conflict with lean manufacturing philosophy

## Value Stream Accounting

- Value stream: All the steps in a process that are essential to producing a product
- Value streams cut across functions and departments
- Captures costs by value stream rather than by department or activity / Simpler than ABC
- Makes no distinction between direct and indirect costs, inc. labor costs
- Cost assignment



## Lean Manufacturing-Supporting IS

- MRP/Material Requirements Planning
  - o Ensures adequate raw materials for production process
  - o Maintains the lowest possible level of inventory on hand
  - o Produce production and purchasing schedules and other information needed to control production

- MRP II/Manufacturing Resources Planning
  - o An extension of MRP
  - o More than inventory management and production scheduling
  - o a system for coordinating the activities of the entire firm
- ERP/Enterprise Resource Planning
  - o Huge commercial software
  - o Supports the information needs of the entire organization, not just the manufacturing functions
  - o Automates all business functions along with full financial and managerial reporting capability
- Electronic Data Interchange (EDI)
  - o External communications with its customers and suppliers via Internet or direct connection

## Lecture 7 – Lab Introduction / Business Model Canvas

### Accounting equation:

Assets = Liabilities + Owner's Equity

(Resources used in the business) = (Resources supplied by creditors and owners)

\*The accounting equation must be **BALANCED** after every recorded transaction in the system

### BMC: Business Model Canvas

- Strategic management template for developing new or documenting existing business models.

**The Business Model Canvas**

Designed for: \_\_\_\_\_ Designed by: \_\_\_\_\_ Date: \_\_\_\_\_ Version: \_\_\_\_\_

Key Partners	Key Activities	Value Propositions	Customer Relationships	Customer Segments
	Key Resources		Channels	
Cost Structure		Revenue Streams		

DESIGNED BY: Strategyzer AG  
The masters of Business Model Generation and Strategyzer

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- Value Propositions: Products and services you offer to meet customer needs
  - o Brand differentiation / Quantity vs Quality / Vary by customer
- Customer Segments: People and organizations for whom you create value
  - o Buyer personas
- Customer Relationships: Relationship types you want to establish with your customer segments
  - o Personal assistance / Community / Self service
- Channels: Points at which you interact with customers to deliver value
- Key Resources: Resources you need to sustain your business and create value
  - o Human / Financial / Physical / Intellectual
- Key Activities: Activities that enable you to fulfil your value proposition
  - o Supply chains / Processes / Training
- Key Partners: Other agents you rely on to create and deliver value
  - o Suppliers / Distributors / Joint ventures
- Cost structure: Description of the costs of operating your business
  - o Fixed costs / Variable costs
- Revenue Streams: What customers pay for and how they pay
  - o Purchases / Subscription



## Lecture 8 – ERP/Enterprise Resource Planning

### Non-ERP Systems:

- In-house design limits connectivity outside the company
- Tendency toward separate IS's within business: Lack of integration limits communication within the company
- Strategic decision-making not supported
- Long-term maintenance costs high
- Limit ability to engage in process reengineering

### ERP System

- Multi-module application software that helps company manage the important parts of its business in an integrated fashion
- Detailed Definition
  - o A business strategy and set of industry-domain-specific applications that build customer and shareholder communities value network system by enabling and optimizing enterprise and inter-enterprise collaborative operational and financial processes
- Key features/Capability
  - o Smooth and seamless flow of information across organizational boundaries
  - o Standardized environment with shared DB independent of applications and integrated applications
- Key rationales: Standard business practice, strategic competitive technology enabler.
- Main Application
  - o Core applications
    - Online Transaction Processing (OLTP)
      - Transaction processing systems (TPS)
      - Support the day-to-day operational activities of the business
      - Support mission-critical tasks through simple queries of operational DB
      - Include sales and distribution, business and production planning, shop floor control, and logistics modules
  - o Business analysis applications
    - Online Analytical Processing (OLAP)
      - Decision support tool for management-critical tasks through analytical investigation of complex data associations
      - Supplies management with “real-time” information and facilitates timely decisions to improve performance and achieve competitive advantage
      - Includes decision support, Modeling, information retrieval, ad-hoc reporting/analysis, and what-if analysis
- Why does a company implement ERP?
  - o Streamline financial: Speed process, development of supply chain, reordering
  - o Integrate customer order information: Order tracking
  - o Reduce inventory: Consolidated order, Visualizing inventory, Reducing dead stock
  - o Standardize HR process: Reducing man-hour
  - o Standardize manufacturing process

- Typical ERP Implementation Objectives
  - o Integration: Financial, customer order, accounting, purchasing
  - o Standardization: HR information, merge processes, eliminate variation
  - o Visualizing inventory: Realtime inventory, smooth business process flow, WIP
- Myths vs Realities
  - o Holy grail of IS?: Some can do improvement or replacement of legacy system
  - o Simplified process?: Customization, adopting of best practices
  - o Reducing costs and workers: BPR/Business Process Reengineering
  - o Integrating all locally and globally: Scopes and scales of implementation.
- Examples of Failed ERP Projects
  - o Hershey: Classics IT/IS fails
    - Effects: Delayed shipments → sales decline & higher inventory cost
    - Causes: High expectation / Multiple IT vendors / scheduling
  - o FoxMeyer Drug: Classics ERP fails
    - Effects: Late order / Incorrect and lost shipments
    - Causes: High expectation / Project management scheduling
  - o Nike
    - Effects: failed order system / sales lost
    - Causes: High customization / No testing plan

### **ERP Key Risk Factors**

- Organization fit: Insufficient of resources and failures of redesign process and data integration
- Skill mix: Insufficiencies of staffs, re-skilling, internal expertise, business analysis, retain ERP qualified developer
- Management: Lack of champion, communication, and control
- Software design: Lack of requirements and integration
- Involvement and training: Lack of full-time commitment, end-user training, change management
- Technology integration: Attempt to build bridge with legacy system
- Project management: Lack of measurement system
- Social commitment: Inability to recognize problem

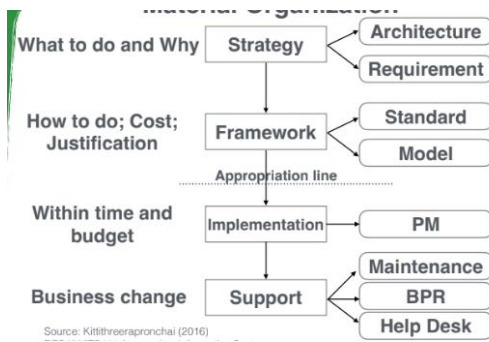
### **Strategic and Tactical Success Factors**

- Strategic: Top management support / Change management / Implementation strategy / Consultant selection / Visioning and planning / Project champion
- Tactical: BPR and software configuration / Training and job redesign / Project team / Balanced team / Communication plan

### **TERMINOLOGY**

- Best practice: Application deemed the best way for a certain process (coined by SAP)
- Best-of-Breed: Mixing ERP modules from different vendor
- Positive disaster: Technically successful, but get criticism from key users
- Negative disaster: Total failure (abandonment or major reversal) of project
- Vanilla ERP project: A basic version of ERP with no/minimal customization
- Customization: Modified software to meet specific requirements of an organization
- Federalization: Tailor ERP differently for each regional unit of an organization

## Material Organization



## Requirements

- Why needed?
  - o Reducing project efforts: Reveal hidden issues and key persons
  - o Establishing functional baseline: Agreement between users and project team
  - o Estimating project cost: 'Peer' comparison
  - o Documenting thought process for future changes
  - o Defining test, validation, and verification milestones
- Guidelines
  - o Do not lose sight of your business objective
  - o Define roles of technology in meeting requirement
  - o Document the requirement → enumerate and make them measurable
  - o Distinguish between functional and operational requirement
- Good Coverage
  - o Strategic: Expansion, practice, response time, control
  - o Analysis tool: Executive report, decisions
  - o Functional: Ex. Support Silver-Meal
  - o Technological: Ex. Support RF, RFID, Number of users/groups
- Key Questions
  - o Who are stakeholders?
  - o What must do and must be to add value?
  - o What are limitations on developers' choices?
  - o When to documents SDLC activities?
  - o How it compliments with surrounding issues?
  - o How to validate requirements?
- Techniques
  - o Requirements-Driven: Most popular / Slowest defining
  - o Solution-Driven: Rapid ERP implementation
  - o Configuration-Driven: Old system is a subset of new system / Good for replacement/ Existing system limitations
- Iterative Method
  - o Listen to your customer: High-level requirements → software supporting business
  - o Lead your customer: Illustrate software, gathering exceptions, validate business requirements
  - o Negotiate with your customer: Defining value-added business requirements, addressing all business exceptions and scenarios

## Frameworks

- Why needed?
  - o Focus and scope tasks
  - o Simply with standard: Existing, communication, flexibility
  - o Speed implementation and avoid pitfalls: Selecting 'right' project consulting and software vendor
- Components of Good Framework
  - o Assumption and constrain
  - o Data and process flow
  - o Data migrations and achieving: Storing historical data and make user of it
  - o User interface: Prioritize users

## Standard

- Standard is NOT permanently established practices
- Standard is transient (i.e., constantly change)
- How to live with transient of standards
  - o Stay tuned to the market
  - o Understand technology infrastructure: Benefit and necessity
  - o Establish 'meaningful' company standards: Few exceptions, not too rigid, key process
  - o Avoid last legs technology

## Model

- Why needed?
  - o Simplification: Understand, remove factor, communication
  - o Convey messages: Show trade-off, reason and connection
  - o Prediction: Capture ideal world
- Model awareness
  - o starting point and evaluation tool, NOT absolute
  - o NOT real environment
  - o does NOT guarantee to success
  - o must fit in 'right' context
  - o serves as communication and organization tool, check list, and ideal

## ERP System Configurations

- Two-tier Network Topology
  - o Common server handles both application and DB duties, especially in LANs
- Three-tier Network Topology
  - o Client links to the application server which then initiates a second connection to the DB server, especially in WANs
- DB Configuration
  - o Selection of DB tables & setting the switches in the system
- Bolt-on Software
  - o Third-party vendors provide specialized functionality software: Supply Chain Management (SCM) links vendors, carriers, logistics companies, and IS providers

## **Risks Associated with ERP Implementation**

- Pace of implementation
  - o Big Bang: switch operations from legacy systems to ERP in a single event
  - o Phased-in: independent ERP units installed over time, assimilated, and integrated
- Opposition to change
  - o User reluctance and inertia, need of upper management support
- Choosing the wrong ERP
  - o Goodness of fit: no one ERP product is best for all industries
  - o Scalability: system's ability to grow
- Choosing the wrong consultant
  - o Common to use a third-party (Big Four)
  - o Thoroughly interview potential consultants
  - o Establish explicit expectations
- High cost and cost overruns
  - o Common areas with high costs: Training / Testing and integration / DB conversion
- Disruptions to operations
  - o Involve business process reengineering (BPR)
  - o Expect major changes in business processes

## **Implications for Internal Control and Auditing**

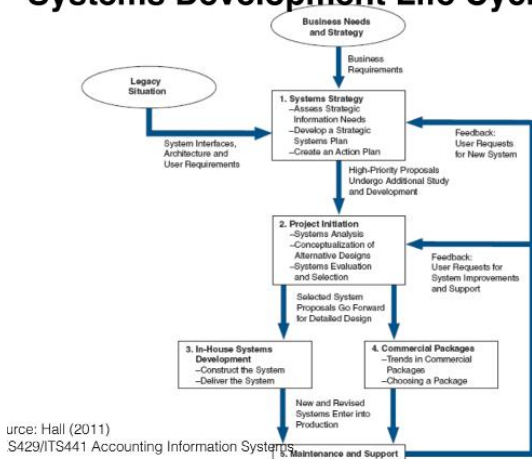
- Transaction authorization
  - o Controls are needed to validate transactions before they are accepted by other modules
  - o ERPs are more dependent on programmed controls than on human intervention
- Segregation of duties
  - o Manual processes that normally require segregation of duties are often eliminated
  - o User role: predefined user roles limit user accesses to certain functions and data
- Supervision
  - o Supervisors need to acquire a technical and operational understanding of the new system
  - o Employee-empowered philosophy should not eliminate supervision
- Accounting records
  - o Corrupted data may be passed from external sources and from legacy systems
  - o Loss of part audit trail
- Access control
  - o Critical concern with confidentiality of information (Ex. Data warehouses often involve sharing information with suppliers and customers)
- Contingency planning
  - o Keeping a business going in case of disaster
  - o Key role of servers requires backup plans: redundant servers or shared servers
- Independent verification
  - o Traditional verifications are meaningless
  - o Need to shift from transaction level to overall performance level

# Lecture 9 – SDLC/Systems Development Life Cycle

## SDLC/Systems Development Life Cycle

- A logical sequence of activities used to identify new systems needs and develop new systems to support those needs
- A model for reducing risk through planning, execution, control, and documentation

## Systems Development Life Cycle



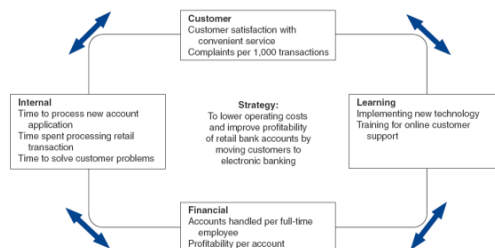
## Assessing Strategic Needs

- Information needs
  - o Strategic systems planning involves the allocation of resources at the macro level. Usually, a time frame of 3 to 5 years
  - o Key inputs in developing a sound system strategy include
    - Strategic business needs of the organization
    - Situations involving legacy systems
    - End user feedback
- Business Needs
  - o Vision and Mission
  - o Industry and Competency Analysis
    - Industry Analysis: The Driving forces that affect the industry and their organization's performance Ex. Important trends, significant risks, potential opportunities
    - Competency Analysis: A complete picture of the organization's effectiveness Ex. Resources, infrastructure, products/services, and customers

## End User Feedback

- Identifying user needs is fundamental to everything else
- During phase 1, pertains to substantial perceived problems rather than minor systems modifications
- Has five key phases at this point in the SDLC:
  - o Recognize problems
  - o Define problems
    - Avoid leaping to a single definition of a problem / Keep an open mind and gather facts before deciding / Learn to intelligently interact with systems professionals

- Specify systems objectives
  - The strategic objectives of the firm and the operational objectives of the IS must be compatible At this point, the objectives only need defined in general terms
- Determine feasibility and contributions of project
  - Preliminary Project Feasibility (TELOS)
    - Technical feasibility: is the technology necessary available?
    - Economic feasibility: are funds available and appropriate for the system?
    - Legal feasibility: does the system fall within legal boundaries?
    - Operational feasibility: can procedural changes made system work?
    - Schedule feasibility: can project completed by an acceptable time period?
- Preparing a formal project proposal
  - A systems project proposal provides management with a basis for deciding whether or not to proceed with the project
  - It summarizes the findings of the study and makes a general recommendation
  - It outlines the linkage between the objectives of the proposed system and the business objectives of the firm
- Strategic Systems Plan
  - The steering committee and systems professional evaluate the pros and cons of each proposal.
  - Assessing each potential project's benefits, costs, strategic impact.
- Action Plan: Balanced Scorecard
  - Translate strategy into action
  - Many businesses use Balanced Scorecard (BSC)
  - Primary Objective: To capture information in orthogonal dimensions that are important to every organization
    - Financial: how do we look to our shareholders?
    - Customer: how do we look to our customers?
    - Internal business process: what must we excel at?
    - Learning and growth: can we continue to improve?
  - Secondary Objective: To prevent the proliferation of reports and information and concentrate only on critical success factors to which everyone in the organization will pay attention
  - BSC for Online Banks



## Systems Evaluation and Selection

- A formal mechanism for selecting the one system from the set of alternative conceptual designs that will go forward for construction
- An optimization process that seeks to identify the best system
- A structured decision-making process that reduces uncertainty and risk

## Role of Accountants

- To ensure:
  - o Only escapable costs are used in calculations of cost savings benefits
  - o Reasonable interest rates are used in measuring present values of cash flows
  - o One-time and recurring costs are completed and accurately reported
  - o Realistic useful lives are used in comparing competing projects
  - o Intangible benefits are assigned reasonable financial values

## Cost-Benefit Analysis

- Identify Costs
  - o One-time Costs: Hardware/Software acquisition / Site preparation / Systems design / Programming and testing / Training
  - o Recurring Costs: Hardware/Software maintenance / Insurance / Supplies / Personnel
- Identify Tangible Benefits
  - o Increased revenues: Increased sales within existing markets / Expansion into other markets
  - o Cost reduction: Labour reduction / Operating cost reduction (Ex. supplies and overhead) / Reduced inventories / Less expensive equipment / Reduced equipment maintenance
- Identify Intangible Benefits
  - o Increased customer satisfaction / Improved employee satisfaction/ More current Information / Improved decision making / Faster response to competitor actions / More efficient operations / Better internal and external communications / Improved planning /Operational flexibility and Improved control environment.

## Comparing Costs and Benefits

- Net Present Value (NPV) Method
  - o Deduct the present value of costs from the present value of benefits over the life of the project The optimal choice is the project with the greatest net present value
- Payback Method
  - o Do break-even analysis of total costs (one- time costs plus present value of recurring costs) and total benefits (present value of benefits)
  - o After the break-even point, the system earns future profits. The optimal choice is the project with the greatest future profits



# Lecture 10 – Capital Budgeting

## Capital Budgeting

- a process of determining the viability of long-term investments on purchases or replacement of property plant and equipment, new product line or other projects.

## TIME VALUE OF MONEY

- The worth of money at the current moment is more valuable than in the future.

## Indicators

- Payback Period
  - o If the cash flow per period from the project is even.
    - Payback Period =  
(Initial investment) / (Cash inflow per period)
  - o If the cash flow per period from the project is uneven.
    - Payback Period =  
(Last period with a negative cumulative cash flow) +  
[ (Absolute value of cumulative cash flow at the end of period A) /  
(Total cash flow during the period after A) ]
  - o Pros and Cons
    - Pros: Simple to calculate / Consider liquidity
    - Cons: Ignore the time value of money & the cash flow after the payback period.
- Present Value vs. Future Value
  - o Formula:  
 **$PV = FV / (1+i)^n$**
  - o Present value (PV): how much a future sum of money is worth today
  - o Future value (FV): how much a present sum of money is worth in the future
  - o Discount rate (i) / Number of year (n)
- Discounted Payback Period
  - o Use the discounted cash flow by present value factor rather than the absolute cash flow.
- Net Present Value (NPV)
  - o a sum of discounted cash flow

$$NPV = -C_0 + \sum_{t=1}^T \frac{C_t}{(1+i)^t}$$

$C_0 = \text{initial investment}$   
 $C_t = \text{net Cash flow over period } t$   
 $i = \text{discount rate}$

- Internal Rate of Return (IRR)
  - o a discount rate that makes the NPV of all cash flows from a particular project = 0

$$0 = NPV = -C_0 + \sum_{t=1}^T \frac{C_t}{(1+IRR)^t}$$

$C_0 = \text{initial investment}$   
 $C_t = \text{net Cash flow over period } t$   
 $i = \text{discount rate}$

- Return of Investment (ROI)
  - o  **$ROI = NPV / \text{Initial Investment}$**

## Decision Rules

Indicator	Accept / Reject Criteria	
	Single/Independent Project	Mutually Exclusive Projects
Payback Period	Less than the Target Period	Shortest Payback Period
Discounted Payback Period	Less than the Target Period	Shortest Payback Period
NPV	Positive NPV	Highest positive NPV
ROI	Higher than the Target Rate	Highest ROI
IRR	Higher than the Target Rate	Highest IRR

## Exercise

Company C is planning to undertake another project requiring initial investment of \$50 million and is expected to generate \$10 million in Year 1, \$13 million in Year 2, \$16 million in year 3, \$19 million in Year 4 and \$22 million in Year 5. Calculate the payback value of the project.

*(cash flows in millions)*

Year	Cash Flow	Cumulative Cash Flow
0	\$ (50)	\$ <input type="text"/>
1	\$ 10	\$ <input type="text"/>
2	\$ 13	\$ <input type="text"/>
3	\$ 16	\$ <input type="text"/>
4	\$ 19	\$ <input type="text"/>
5	\$ 22	\$ <input type="text"/>

Payback Period =

discount rate: 5%			discount rate: 5%		
Year	Value	Future Value Factor	Year	Value	Present Value Factor
0	\$ 1,000	<input type="text"/>	0	\$ <input type="text"/>	<input type="text"/>
1	<input type="text"/>	<input type="text"/>	1	\$ <input type="text"/>	<input type="text"/>
2	<input type="text"/>	<input type="text"/>	2	\$ <input type="text"/>	<input type="text"/>
3	<input type="text"/>	<input type="text"/>	3	\$ <input type="text"/>	<input type="text"/>
4	<input type="text"/>	<input type="text"/>	4	\$ <input type="text"/>	<input type="text"/>
5	<input type="text"/>	<input type="text"/>	5	\$ 1,000	<input type="text"/>

*(cash flows in millions)*

$i=5\%$

Year	Cash Flow	Present Value Factor $1/(1+i)^n$	Discounted Cash Flow	Cumulative Cash Flow
0	\$ (50.000)	<input type="text"/>	\$ <input type="text"/>	\$ <input type="text"/>
1	\$ 10.000	<input type="text"/>	\$ <input type="text"/>	\$ <input type="text"/>
2	\$ 13.000	<input type="text"/>	\$ <input type="text"/>	\$ <input type="text"/>
3	\$ 16.000	<input type="text"/>	\$ <input type="text"/>	\$ <input type="text"/>
4	\$ 19.000	<input type="text"/>	\$ <input type="text"/>	\$ <input type="text"/>
5	\$ 22.000	<input type="text"/>	\$ <input type="text"/>	\$ <input type="text"/>

(cash flows in millions)

$i=5\%$

Year	Cash Flow	Present Value Factor $1/(1+i)^n$	Discounted Cash Flow	Cumulative Cash Flow
0	\$ (50.000)			
1	\$ 10.000			
2	\$ 13.000			
3	\$ 16.000			
4	\$ 19.000			
5	\$ 22.000			

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Good Luck!