SOFTWARE ENGINEERING ECONOMICS

SE 361

Lecture No 7 and 8

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WORDS OF WISDOM

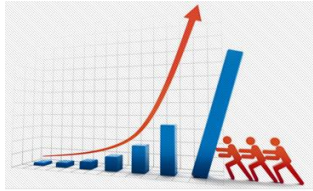
- "Nobody can go back and start a new beginning, but anyone can start today and make a new ending."

THE BUSINESS DECISION-MAKING PROCESS

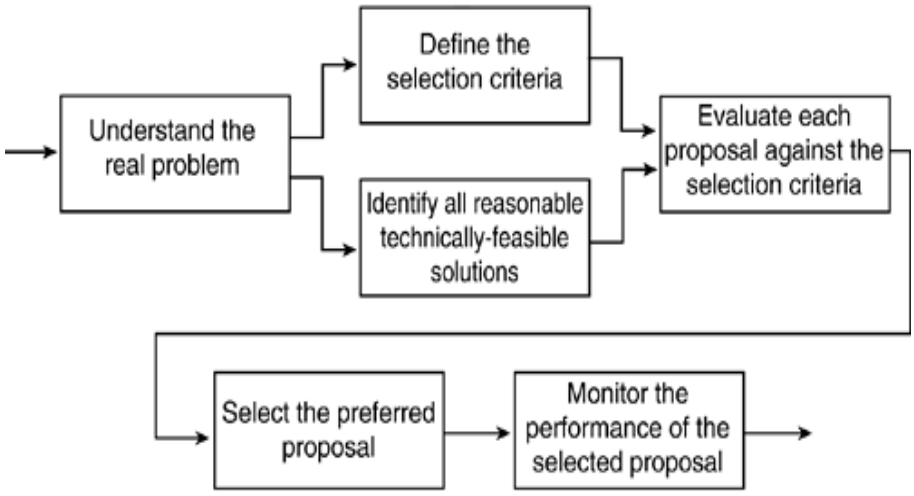
- For any technical problem, there is almost always more than one technically viable solution.
- If you want to make the most out of your organization's limited resources, then you, the technical person
  - should choose the solution that maximizes the return on your organization's software investment.

INTRODUCING THE BUSINESS DECISION-MAKING PROCESS

- Software professionals should already know how to come up with technical solutions to technical problems.
- But remember that for a single technical problem, there will almost always be more than one technically viable solution.
- We should be creating business-wise technical solutions to our technical problems. To do this, you, the technical person, should follow a systematic process for making decisions

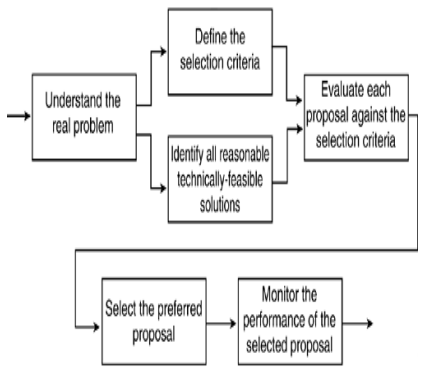


INTRODUCING THE BUSINESS DECISION-MAKING PROCESS



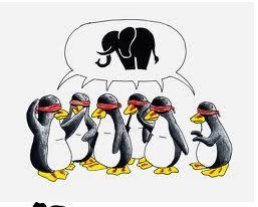
INTRODUCING THE BUSINESS DECISION-MAKING PROCESS

- shows the process as mostly stepwise and serial
- The real process is more flexible
- Sometimes the steps can be done in different order, and often several of the steps can be done in parallel.
- The important thing is to be sure that none of the steps are skipped or shortcut.
- It's also important to understand that this same process applies at all levels of decision making



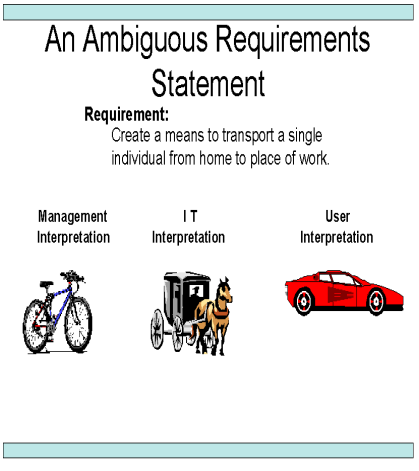
UNDERSTAND THE REAL PROBLEM

- Understand what that problem really is.
- In software, understanding the real problem means to know
  - eliciting, analyzing, specifying, and validating the requirements
- A few of the most important guidelines are worth mentioning here like
  - AMBIGUITY IN REQUIREMENTS STATEMENTS
  - MISTAKING(Mixup) A SOLUTION FOR THE PROBLEM
  - ANALYZING SEPARATE DECISIONS SEPARATELY



AMBIGUITY IN REQUIREMENTS STATEMENTS

- One of the biggest problems with software requirements, especially requirements stated in natural languages, is ambiguity.
- Different people can usually look at the same natural language requirement statement and interpret it entirely differently.
- avoid ambiguous requirements is to minimize to use of natural languages
- Languages such as the Unified Modeling Language (UML) [OMG03] can be used to specify requirements much more precisely



MISTAKING A SOLUTION FOR THE PROBLEM

- It's not at all unusual for people to mistake a solution for the problem
- but it's important to not be misled by solutions
- "five whys" technique
- you should refine the requirements statements.

ANALYZING SEPARATE DECISIONS SEPARATELY

- Another important principle in understanding the problem is that if two or more decisions are not necessarily connected, those decisions should be separated and analyzed independently.
- Example
  - Don't retire Product X, don't launch Product Y.
  - Retire Product X, don't launch Product Y.
  - Retire Product X, do launch Product Y.
  - Don't retire Product X, do launch Product Y.

DEFINE THE SELECTION CRITERIA

- Decisions are often based on more than just one criterion
- The decision to select the vendor for an outsourced software development project is likely to be based on
  - cost, delivery date, and the quality of the vendor's work.
- You'll need to be careful to identify all criteria that are relevant and be sure that all of those criteria are properly prioritized and considered
- IRREDUCIBLES
  - Financial impact on the company of laying someone off
  - what's the "worth" of a clean stream?
- PRIORITIZE THE SELECTION CRITERIA
  - Concept of peer reviews
  - Different people will end up applying their own prioritization.
  - Making sure that the priorities are clear helps everyone agree on the final decision

IDENTIFY ALL REASONABLE TECHNICALLY FEASIBLE SOLUTIONS (THE PROPOSALS)

- Considering both an economic and technical perspective.
- Consider all appropriate reasonable candidates.
- Use creative-thinking techniques
- Design reviews and peer reviews can also be very useful approaches

EVALUATE EACH PROPOSAL AGAINST THE SELECTION CRITERIA

- In this step, each of the proposals is evaluated against the selection criteria.
- This step is fairly self-explanatory, but one useful hint is to build a matrix with the proposals listed on one axis and the selection criteria listed on the other.
- The matrix helps you be sure you've evaluated every proposal against every selection criterion.

SELECT THE PREFERRED PROPOSAL

	Initial investment (Priority1)	Present Worth (Priority2)	Quality (Priority3)	Quoted Delivery Date (Priority4)
Vender 1	$52 k	$174k	Excellent	Dec 22
Vender 2	$47k	$139k	Very Good	Nov 20
Vender 3	$61k	$151k	Acceptable	Oct 25

MONITOR THE PERFORMANCE OF THE SELECTED PROPOSAL

- Estimation is a fundamental part of good decision making
- The quality of the decision depends on the quality of the estimates
- Use the difference between the original estimates and actual results to refine your estimation technique
- There are three parts to do this
  - Look at where you've been
  - Look at where you are
  - Look at where you're going in the future

MONITOR THE PERFORMANCE OF THE SELECTED PROPOSAL

Look at where you've been

- Is the estimated cash-flow stream matching the actual cash flows?
- Is the project on schedule?
- If not, are the estimates still close enough that it warrants continuing down this same path?

Look at where you are

- Use recent history to refine future estimates on this project
- If your project is 10% over cost and 15% behind schedule with only 25% of the work completed, the estimates for the remaining cost and schedule are most likely also low by at least 10% and 15%, respectively
- The concept Earned value use for assess the accuracy of the remaining estimates

LOOK AT WHERE YOU'RE GOING IN THE FUTURE

- Plan to use the history from this project (when completed) to refine estimates on future projects
- A very common mistake on schedule estimates is to assume that people will be allocated 100% to one project
- Vacations, sick time, training, getting pulled off for other crash projects, fixing problems in earlier versions, and such are all fairly typical interruptions making 100% allocation to the current project impossible

SUMMARY

Understand the real problem. This includes avoiding ambiguity, using the five whys technique to help avoid mistaking a solution for the real problem, and analyzing separable decisions separately.

Define and prioritize the selection criteria that are relevant in the decision. Some criteria are "irreducible" and can't be quantified in terms of money.

- Identify reasonable technically feasible solutions (the proposals).
- Evaluate each proposal against the selection criteria.
- Select the preferred solution.
- Monitor the performance of the selected solution to learn and improve from the experience.

- Time To Take a Break

- Questions if any

WORDS OF WISDOM

You will never achieve real success unless you like what you are doing. (Dale Carnegie)

TERMINOLOGY THAT FREQUENTLY USED IN THIS CHAPTER

- Borrower (Someone who receives something on the promise to return it or its equivalent or person who gets something)
- Depositor(The term '*Deposit*' *means* to keep something in safe custody)
- Lander (one who give something)

INTEREST: THE TIME VALUE OF MONEY

- One of the most fundamental concepts in business
- Money has time value
- Value of Money changes over time
- In this lecture we learn about
  - interest and how it affects business decision.
  - how interest is addressed in a business decision.

TIME IS MONEY

- A given amount of money today doesn't have the same value as an identical amount of money later on.
- how much better off is the person who gets the money today than the person who has to wait?
- People are almost always willing to pay more later to use someone else's money now.
  - A bank loan is exactly that
  - Banks operate on the difference between what they charge for borrowed money and what they pay on deposited money

INTEREST

- The difference in the time value of money is quantifiable
- It is measured in terms of interest—the money that someone pays to use someone else's money.
- The interest rate is the rate of gain received (when lending money) or paid (when borrowing money).

INTEREST

- Real interest rate is actually more complex
- **lender's perspective**
  - Probability that the borrower won't repay the loan
  - The cost of setting up and administering the loan
  - Probability that the interest rate will change significantly
- **Borrower's perspective**
  - Personal use
    - To finance a house, car, vacation, etc.
  - Business use
    - For example, to finance new office space, a new machine, or new product development
- interest can be thought of as the return that can be gained from the productive investment of money

NAMING CONVENTIONS IN INTEREST FORMULAS

Name	Meaning
P	**The principal amount. How much is the money worth right now? This term is also known as the present value or present worth.**
F	**The final amount. How much will the money be worth at a later time? This term is also known as the future value or future worth.**
i	**The interest rate per period. What is the rental fee for using someone else's money? (Assumed to be an annual rate unless stated otherwise.)**
n	**The number of interest periods between the two points in time.**

SIMPLE INTEREST

- The entire interest payment is due at the end of the loan.
- The interest payable can be calculated by multiplying the amount borrowed (P) times the interest rate (i) times the number of interest periods the money is being borrowed for (n).

Simple Interest Formula

$$I = P \times R \times T$$

Where:

I = the Interest Money created in dollars

P = the "Principal" starting amount of money

R = the Interest Rate per year (in decimal form)

T = the Time the money is Invested, or Borrowed, in Years

SIMPLE INTEREST

Simple Interest

Joe borrows **$200** from the bank at **6%** simple interest for **3 years**. What interest does he owe, and what is his total balance (amount to payback)?

Principal = 200 rate = 6% = 0.06 time = 3

Interest

$I = P \bullet r \bullet t$

$I = 200 \bullet 0.06 \bullet 3$

$I = 36$

Interest owed = $36

Balance

Balance = P + I

Balance = 200 + 36

Balance = 236

Balance = $236

SIMPLE INTEREST
BOOK EXAMPLE

- Example,
- suppose that Company A needs to borrow $10k for 3 years. They find a lender who is willing to loan the money and let them pay it back in full after the 3 years provided Company A[21] pays 11% simple interest. How much will Company A need to pay to the lender at the end of the 3 years?

- The total amount that they need to repay, F, is equal to the original amount borrowed, P, plus the interest, I.

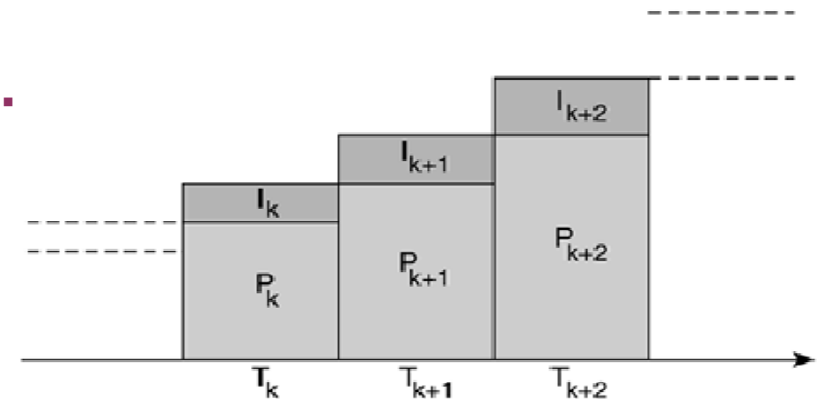
$$F = P + I = P + Pni = P(1 + ni)$$

- The answer to Company A's question is as follows:
  - $F = P(1 + ni) = \$10k(1 + 3*0.11) = \$13.3k$

  - How we can calculate the F?

$$P=F/(1+n*i)$$

DISCRETE COMPOUNDING OF INTEREST



DISCRETE COMPOUNDING OF INTEREST

- illustrates the idea of compound interest through a graph. At the beginning of period T_k, the borrower owes some principal amount, P_k. At the end of period T_k, the borrower owes I_k in interest where $I_k = P_k * i$. Assuming the borrower didn't make any payments on the loan during T_k, they would owe $P_k + I_k$ at the end of T_k. This is exactly the same as owing P_{k+1} at the beginning of T_{k+1} and the cycle repeats. At the end of T_{k+1} the borrower would owe $I_{k+1} = P_{k+1} *i$ in interest, for a total owed of $P_{k+1} + I_{k+1}$. And this is exactly the same as owing P_{k+2} at the beginning of period T_{k+2} and so on until the loan gets paid off.

FORMS OF COMPOUND INTEREST FORMULAS

1. Single-payment compound-amount (F/P)
2. Single-payment present-worth (P/F)
3. Equal-payment-series compound-amount (F/A)
4. Equal-payment-series sinking-fund (A/F)
5. Equal-payment-series capital-recovery (A/P)
6. Equal-payment-series present-worth (P/A)

- Three of these formulas allow you to calculate forward from a known present situation to an unknown future amount, and the other three allow you to calculate backward from a known, desired future to an unknown present situation

THINGS TO DO- YOU

1. First 3 group Presentation
2. Assignment No 1
3. Quiz 2

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- Question /Answer