TIM 105/205, Lecture #18* (11/26/13)

1. NPV Basics

2. FMEA (failure modes...)

3. Integration... MDC framework

4. Project
   - Project presentations on Tuesday, Dec. 3

5. Financial modeling details
   - Product Life Cycle
   - Technology Strategy (revisit)

6. Return to you, graded HW #6

7. Team Project presentations
   - (5+1) minutes [NYC city]
   - Create (Title slide + 5 slides) in PowerPoint
   - Create a pdf of the PP presentation
   - E-mail the pdf to the TA
     no later than 5 PM on Monday 12/2
NPV Basics

Key Ideas:

1. It is important to understand and establish the cash-flows, present and future, associated with product development & commercialization:
   - Product dev. cost
   - Production costs
   - Sales Revenue

2. All cash flows are converted to present value.

3. Present value: "A dollar today (present) is worth more than a dollar a year from today."

4. Therefore, all future cash flows have to be discounted when brought to the present ➔ Discounted cash flows (DCF's)
5. The **Net Present Value (NPV)** is the sum of all of the DCFs.

6. Calculation of present value:

\[ P_1 = \text{present value of cash} \ (\$) \]

\[ 1 \rightarrow \text{period 1 or the present} \]

\[ F_n = \text{future value of cash} \ (\$) \ \text{in period} \ n \]

PV is simply the inverse of compound interest.

\[ F_n = P_1 (1+r)^n \]

\[ P_1 = \frac{F_n}{(1+d)^n} \]

\( r \) = interest rate per period

\( d \) = discount factor per period
7. Net Present Value = \( \sum DCFs \)

\[
NPV = C_1 + \frac{C_2}{(1+d)^1} + \frac{C_3}{(1+d)^2} + \ldots + \frac{C_n}{(1+d)^n} 
\]

\[
NPV = \sum_{i=1}^{n} \frac{C_i}{(1+d)^i} \quad \text{can be positive or negative}
\]
Failure Modes & Effects Analysis (FMEA)

Purpose: To improve the quality of the product by anticipating ways in which the product could fail and then either preventing or minimizing the effect of these failure modes before selling the product.

Process:

1. Create a FAST diagram for the product to:
   - Identify the key subsystems and components of the product
   - Understand the key sub-functions of these sub-systems

2. For each sub-system identify potential failure modes and characterize these failure modes using a Risk Priority Number (RPN) → see Step 3
3. Calculation of the RPN

Ask (and answer) 3 questions

(a) How severe is the effect of the failure mode? \( \Rightarrow \) severity \( S \) of the failure mode

1 \rightarrow 8

-benign (harmless)

\uparrow extremely severe (as in life-threatening)

(b) How frequently does this failure occur?

1 \rightarrow 8

-infrequent

\downarrow very frequently

\( O = \) frequency of occurrence
(c) How hard is the failure to detect

\[ D = \text{detection} \]

\[ \frac{1}{8} \]

easy to detect

very hard to detect

\[ \text{RPN} = (S) \times (O) \times (D) \]

\[ \frac{1}{(8)^3} = \frac{1}{512} \]

The higher the RPN, the more critical the failure mode \( \Rightarrow \) prescribe suitable actions

**Guideline:** RPN < 10 \( \Rightarrow \) no action is required
**Example:** Ball-point pen

<table>
<thead>
<tr>
<th>Sub-system</th>
<th>Failure-modes</th>
<th>Effects</th>
<th>S</th>
<th>O</th>
<th>D</th>
<th>RPN</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ball &amp; Seat</td>
<td>Ball is too loose</td>
<td>Splotchy writing</td>
<td>6</td>
<td>3</td>
<td>4</td>
<td>(6)(3)(4)</td>
<td>In-process inspections</td>
</tr>
<tr>
<td></td>
<td>Ball is too tight</td>
<td>Intermittent writing</td>
<td>7</td>
<td>4</td>
<td>4</td>
<td>(7)(4)(4)</td>
<td>In-process inspections, control tolerances of the ball &amp; seat</td>
</tr>
</tbody>
</table>

Ref: FMEA handout on the TIM 105 web-site - contains the Ball-point example worked out in detail

Exercise: Attempt to do an FMEA for your project
INTEGRATION

(of the course building blocks &
the project "components"
> e.g. strategy, functional
maps, ... conceptual
design)

(1) Use the MDC framework

(2) Carefully study the interactions
& inter-relationships between
the steps of the MDC framework

(3) In actual practice, many of
these steps need to be done
concurrently, i.e. in parallel
⇒ Concurrent Engineering (CE)

(4) The implement of CE in a
computer is called Virtual Concurrent
Engineering (VCE)

(5) Concurrent Engineering is typically
performed by a cross-functional team
- Engineering
- Marketing
- Manufacturing
- Finance
(a) Financial modeling

Sales

Volume

INTRO-

GROWTH

MATURITY

DECLINE

Time

3-5 years

Product life-cycle

Take the product life-cycle into account in your finance modeling/analysis.

(b) Tech Strategy (extended version) (TS)

The full TS would contain

(1) Focus

- technology areas of distinct competitive advantage [core competencies]

(2) Source (where?) / Resources

- In-house [Internal]
- Out-sourced [External]

(3) Timing (when)

- When to develop the technologies;
- When the products will be introduced

[See the INTEL/Apple product platform]