Scenario Planning

“Thinking the Unthinkable”
In preparing for battle, I have always found that plans are useless but planning is indispensable.

*Dwight D. Eisenhower*

I love it when a plan comes together!

*Hannibal*
Scenario Planning:

Scenario planning provides a contextual basis for the four primary elements of strategic technology management.

To do scenario planning, we need to understand the art of “scenario thinking”
Scenarios are *imaginative pictures* of *potential futures*,

but the future they picture is just a *means to an end*.

These *conversations* ...

are designed to help a *group* of people see past their own *blind spots*.
Herman Kahn developed scenarios to see past the *cultural blind spot* that thermonuclear war must *never* happen.

What if it did happen? asked Kahn. What sort of world might the survivors face?

One critic coined the phrase "*thinking the unthinkable*".

But Kahn embraced the phrase.

Thinking the unthinkable, he argued, is the only way to keep one's *strategic vision* from getting stale.
• Two biggest contributors to technology development failure:
  
  • **Under-resourcing** (no project left behind).
  
  • **Self-delusion** (build it and they will come).

• Scenario building can reduce both problems:
  
  • Alerts you to the *magnitude* of problems and *uncertainty* of the environment you are working into.
  
  • *Enables you to develop a strategy that optimizes chances of success under all possible scenarios.*
Goal of scenario thinking:

1. Envision “alternate extreme futures” (worst/best case),

2. Create a *strategy* that works for *all* extreme futures.

*Don’t pick one and limit to this!*
• The practice of constructing stories of the future has no single method and dozens of techniques.
• Science fiction writers have been very effective in exploring future utopias and dystopias.
Kees van der Heijden has identified several general types:

- **Project-specific scenarios** - What's the best way to beat a rival, or clean a polluted river?

- **Crisis scenarios** - How can local, independent bookstores survive in the face of Amazon.com?

- **Exploration/consensus-building scenarios** - What are the possible futures for Colombia as a nation? How can we build democratic institutions in South Africa? How can American elections become free of financial influence?
Scenario planning is especially important for innovators and entrepreneurs.

- These people enter, and, in fact, create highly-uncertain environments.

- They have a strong tendency toward under-resourcing and self-delusion.

- Scenario thinking can help innovators and entrepreneurs “exploit the unthinkable”.

So, with no further ado, let’s see how this is done...
Scenario Planning Steps:

1. What problem are you trying to solve?
2. Gather information
3. Identify driving forces
4. Identify critical uncertainties
5. Create scenarios
6. Compose the stories
7. Scenario application
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There are many versions of this process.

Here is one that we will examine.
Scenario Building – Step 1: What problem are you trying to solve?

Returning to Kleiner...

- Scenarios only provoke genuine learning and strategies when they answer genuine concerns.

- If you are not responding to a specific crisis, then figure out the key question you need to answer.

- If you don't care about the question you are trying to answer, this is all a big a waste of time!
Scenario Building – Step 1: What problem are you trying to solve?

Returning to Kleiner...

Note: Sometimes you can "jump-start" the process of problem identification by interviewing people before you start the process.”

“If you could answer one question about the future, what would it be? “
Scenario Building – Step 1: What problem are you trying to solve?

When describing your problem, you need to specify a *time scale*.

- You say: “In *X* years, *event Y* will happen”.

- The key is choosing *X* as the *minimum* amount of time in which your *strategic* actions may produce results.

- If it takes at least 5 years for your actions to produce results, then your timescale must be at least 5 years.

- The point is that for *this* process, there’s no sense in addressing problems that need to be solved *before* your *strategy* can make a difference.
Scenario Building – Step 1: What problem are you trying to solve?

Second, it can be very beneficial for you to specify the “stakeholders” in the problem and solution.

In general, we can categorize stakeholders as:

1. Who experiences the problem?
2. Who causes the problem?
3. Who pays for the problems?
4. Who supplies the solutions?
5. Who pays for the solutions?

One person can be in different categories.
Scenario Building – Step 1: What problem are you trying to solve?

Here, we demonstrate Step 1 on a real-world problem.

- The Marquette University Master of Science in Engineering Management (ENMA) program addresses issues that are critically important to engineers and their employers:

  (program relevance = high $\rightarrow$ good).

- What happens if the ENMA program is not financially self-sufficient:

  (program costs > tuition income $\rightarrow$ bad).

Talk about thinking the unthinkable!
Scenario Building – Step 1: What problem are you trying to solve?

Our ENMA stakeholder list and key problems might look like this:

- **Students**: How can I keep my current job and advance in my profession?

- **Employers of students**: Where will my future leaders come from?

- **Marquette University**: How do I maintain/improve my image and balance my budget?

- **College of Engineering**: How do I enhance my “product portfolio” and balance my budget?

- **ENMA staff**: How do we maintain a program that attracts students?
Scenario Building – Step 1: What problem are you trying to solve?

The high-level problem that we are trying to solve is that ENMA program is not financially self-sufficient (loosing $).

We want to solve this problem so that all of our stakeholders are happy.

This could be solved by (and/or):

1. Increasing number of students in the program (tuition income),
2. Reducing program expenses,
3. Obtaining outside funding to support the program.
Scenario Building – Step 1: What problem are you trying to solve?

Here are three specific problem statements that we can consider:

Over the next five years:

1. How can we increase enrollment in the program?
2. How can we reduce program expenses?
3. How can we obtain outside funding to support the program?

For this example, we will focus on the first question.

Note that scenario thinking is really an ongoing process.

So maybe we do question 1 this year, and do the other questions over the following 2 years.

*It’s all about the conversation!*
Scenario Planning Steps:

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Increase enrollment in ENMA program
Scenario Building – Step 2: Information Gathering

• After defining the problem to be solved, you need to gather information relevant to the topic.

• This can be time-consuming, tedious, and frustrating, since you don’t really know all the types of information that you need (you are going to think the unthinkable).

• This is why scenario planning should be an ongoing process – your databases will continue to improve over time.

For our example, here are some things we know about ENMA...
Virtually all tuition-paying students

ENMA program enrollment

Scenario Planning 22
COE ENMA course credits by all MU students

Predict 63 students in 3 ENMA courses for Spring 2010

Scenario Planning
Tuition on MU credits taken by ENMA students ($800/credit)

Predict $255K

Scenario Planning
Scenario Building – Step 2: Gather Information

• Now, given this information, do we want to stick with the same problem statement?

• Do we want to revise our crystal ball questions?

• If we want to balance the budget by increasing enrollment (increasing tuition), which problem are we trying to solve:
  • Increasing enrollment in ENMA program?
  • Increasing enrollment in ENMA courses?

Well, of course, this depends on the University’s accounting practices!
Scenario Building – Step 2: Gather Information

**Important Note!!**

- Even though information gathering is a critical step in creating scenarios...

- Scenarios are **NOT** straight-line extrapolations from historical/statistical data – this is just thinking the thinkable.

- Again, the goal is to think the unthinkable – what are the alternate extreme futures?

- So, this is more like Chaos Theory (Catastrophe Theory).

*What small changes could have drastic impact?*
What Next?

- At this point, you might be tempted to seize on one strategy for increasing enrollment in the program.

- A more experienced person might come up with several strategies (see next slide), and then pick the “best” one.

- But which IS the best one? Why?

- According to scenario thinking..

  The ideal strategy is the one that leads to success under all possible future conditions.

The key to scenario thinking is to not select or eliminate any scenarios, but to optimize across all scenarios.
Four Possible ENMA Strategies

- **Strategy 1: The same, but more**
  No major program structural changes, heavy emphasis on local recruiting, initiate pro-active international recruitment.

- **Strategy 2: Go it alone**
  Sever bond with GSB, expand required ENMA courses to 9 (27 credits) plus 2 elective courses (6 credits) from any MU program.

- **Strategy 3: Take it outside**
  Terminate ENMA program, but maintain ENMA courses. Offer 12 credit ENMA certificates based on ENMA courses. Market primarily to local industry and COE grad students from other programs.

- **Strategy 4: Shut it down**
  Terminate ENMA program, eliminate ENMA courses/faculty.
**Scenario Planning Steps:**

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This is where the unique elements of scenario thinking come in
Scenario Building – Step 3: Identify Driving Forces

• OK, we’ve identified the primary problem to be addressed by our scenario planning process,

• And we have collected whatever data we could given the uncertainty of the situation.

• Now, we could just dream up some strategies off the top of our heads and randomly pick one.

• But no, we’ll try a more systematic route to developing strategies.

• Our approach will start by identifying “driving forces”.
Scenario Building – Step 3: Identify Driving Forces

- We will start by identifying “driving forces”.

- Different scenario planning approaches use different terms and describe driving forces in different ways.

- But by-and-large, these are “megatrend” forces, many of which are almost certain to occur.

- A good example is demographics.
Demographic Megatrends

World Population: 1950-2050

Annual World Population Change: 1950-2050

Source: U.S. Census Bureau, International Data Base, December 2008 Update.
Scenario Building – Step 3: Identify Driving Forces

Here is a list of categories of “standard” driving forces:

- Political
- Economic
- Societal
- Technological
- Environmental

- The ScenarioThinking.org website has a nice expansion of this standard list: [http://scenariothinking.org/wiki/index.php/Driving_Forges](http://scenariothinking.org/wiki/index.php/Driving_Forges)
ScenarioThinking.org has a format for describing driving forces –

http://scenariothinking.org/wiki/index.php/How_to_determine_a_driving_force%3F

**Name:** It helps to be specific, e.g. rather than “Demographics”, call it “The ageing of America” to indicate direction of the force.

**What:** A short description of the driving force.

**Enablers:** Factors which strengthen this driving force.

**Inhibitors:** Factors which weaken this driving force.

**Paradigms:** Changes in ways of thinking about the world due to driving force.

**Experts:** Sources for additional information about this driving force.

**Timing:** Dates for key milestones in the development of the driving force.

**Web Resources:** Useful resources on the web relating to this force.
Scenario Planning Steps:

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Here, we eliminate “uninteresting” drivers

Let’s look at a way to eliminate *uninteresting* driving forces and focus on *unthinkable* factors...
Scenario thinking is not straight-line extrapolation.

It is thinking the unthinkable...
Scenario Building – Step 4: Identify Critical Uncertainties

- First, come up with a list of **many** drivers impacting your problem.
- Next, plot your drivers on an **uncertainty/importance** plot.
- Now, choose drivers in the **high uncertainty, high importance** quadrant of the plot.
Scenario Building – Step 4: Identify Critical Uncertainties

- For example, the “ageing of America” has low uncertainty, and high importance.

- Thus, for scenario planning, it is “uninteresting”.

- The purpose of scenario thinking is to “think the unthinkable”.

<table>
<thead>
<tr>
<th>Driver</th>
<th>Uncertainty</th>
<th>Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driver A</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Driver B</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Driver C</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Driver D</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Driver E</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

[Diagram showing drivers A, B, C, D, E, and the “ageing of America” as a low-uncertainty, high-importance factor.]
Step 4: Identify Critical Uncertainties

- You can use other axes on the plot, as shown below.
- Whatever the axes, the point is to come up with drivers that will ultimately produce “interesting” scenarios.

![Diagram showing critical uncertainties and uncontrollability]

Uncertainty

Uncontrollability

Driver A

Driver B

Driver C

Driver D

Driver E

High Uncertainty

Highly Uncontrollable
Step 4: Identify Critical Uncertainties

- High Urgency
- High Importance

Task A
Task B
Task C
Task D
Task E

Urgency (Time)
Importance (Impact)
Scenario Building – Step 4: Identify Critical Uncertainties

Let us return to our example of the Marquette ENMA program,

One key factor for the program, obviously, is the need for engineering managers!

- It seems to be a given that the world needs more technology.
- Therefore, the world needs more engineers.
- Therefore, more engineering managers.

But these are obvious and “uninteresting” drivers for ENMA program.
Scenario Building – Step 4: Identify Critical Uncertainties

But this need for more engineering managers has some interesting dimensions, such as:

- **Where** will these engineering managers be working?

- What will be the primary **functions** of these managers?
Recall our ENMA stakeholder list:

- **Students** (current and future): How can I keep my current job and advance in my profession?

- **Employers of students**: Where will my future leaders come from?

- **Marquette University**: How do I maintain/improve my image and balance my budget?

- **College of Engineering**: How do I enhance my “product portfolio” and balance my budget?

- **ENMA staff**: How do we maintain an attractive program and keep our jobs?

*Are the questions on the previous slide interesting to these stakeholders?*
Scenario Building – Step 4: Identify Critical Uncertainties

• Are these questions important:
  - Where will engineering managers be working?
  - What will these engineering managers be doing?

• These questions are important to our stakeholders:

  • Students (current and future): How can I keep my current job and advance in my profession?
  • Employers of students: Where will my future leaders come from?
  • Marquette University: Where will my future students come from?
  • College of Engineering: What will my future student do?
  • ENMA staff: What should I teach??!!
Scenario Building – Step 4: Identify Critical Uncertainties

- Are these questions **uncertain**:
  - **Where** will engineering managers be working?
  - **What** will these managers be **doing**?

- Recall my observation:
  - Two biggest contributors to technology development failure:
    - **Self-delusion** (build it and they will come),
    - **Under-resourcing** (no project left behind).

- If you **think** you **know** the answers to these two questions, I suggest to you that you are:
  - Experiencing the first contributor, and
  - Will be experiencing the second, or
  - Fast-tracked to be the CEO of your company.
Scenario Building – Step 4: Identify Critical Uncertainties

Here are two interesting drivers for our example.

![Diagram showing uncertainty and importance with drivers A, B, C, D, and E.]

- Driver A: What engineering managers will be doing.
- Driver E: Where engineering managers will be working.
For this example, we will refine our scenario planning even further.

We said there were two interesting issues:

- Where will engineering managers be working?
- What will be the primary functions of these managers?

For this example, we will focus on only the second issue:

*What will be the primary functions of engineering managers?*

We can always address the first issue in a future scenario planning session.
Our primary question:

- **What will be the primary functions of these managers?**

Engineering managers have many functions, but most are “uninteresting”:
- Project management
- Balancing the engineering budget
- Hiring people
- etc...

In our example, we will focus specifically on two critical functions of engineering managers:

- **Innovation** – Devising new solutions to problems.

- **Entrepreneurship** – Bringing solutions to customers in new ways.
**Scenario Planning Steps:**

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Let’s use the innovation and entrepreneurship functions to create scenarios
Scenario Building – Step 5: Create Scenarios

• You have identified two highly important but highly uncertain drivers.

• Next, you must envision the extreme conditions for each driver:
  - Extreme positive vs. extreme negative,
  - Extremely optimistic vs. extremely pessimistic,
  - Etc...

• Now, draw another four-quadrant plot, with the extremes on the axes:

In this way, you generate four highly-differentiated scenarios:
  - Scenario 1: A-/B-
  - Scenario 2: A-/B+
  - Scenario 3: A-/B-
  - Scenario 4: A+/B+
Here’s our scenario diagram:

Scenario Dimensions:

**Innovation** – Devising new solutions to problems.

**Entrepreneurship** – Bringing solutions to customers in new ways.

Example:
In Scenario 4, engineering managers are highly involved in devising new solutions to problems and bringing them to customers in new ways.
Note:

- This is just one way to come up with scenarios.

- It’s systematic, and generates a manageable number (four) of highly-differentiated scenarios.

- It’s good way to start.

- But if you get into this way of thinking, you don’t need to be tied to this approach.

- You can even just come up with them off the top of your head, as long as they are interesting and highly-differentiated.
Scenario Planning Steps:

1. What problem are you trying to solve?
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6. **Compose the stories**
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Example:
In Scenario 4, engineering managers are highly involved in devising new solutions to problems *and* bringing them to customers in new ways.

**Innovation** – Devising new solutions to problems.

**Entrepreneurship** – Bringing solutions to customers in new ways.
Scenario Building – Step 6: Compose the Stories

- For each of your (4) scenarios, you must now write a short story.
- Each story should capture a vision of how the world will be under this scenario.
- It can be quite beneficial to come up with a catchy name for the scenario.
- Names stick in the mind and capture the essence of the scenario.
- You might attempt to describe the state of the world that characterizes your scenario.
- Or you might choose an archetypical person that would characterize your scenario.

For example...
Scenario Planning for
Nuclear-Powered Generation of Electricity

Tony Roder, Sharath Tadepalli, Keith Sherer, Matt Osburn
Dr. Mark Polczynski
Economic, political and environmental issues are expanding the demand for alternative energy sources.

As oil prices rise and reserves are depleted pressures to develop alternatives to petro-energy increase.

Reducing the dependence of the country on foreign oil is in the interest of National Security.

As awareness of global climate change rises there is a greater call for alternative energy sources.

The obstacle at hand is how to make the nuclear power industry a viable and desirable energy source for the future.
Critical Uncertainties:

**Social/Political Climate:** Political and social climates are historically very unpredictable in the realm of nuclear power.

**Technology:** Technology can play a very important role in giving nuclear power a new way to reuse or dispose of spent fuel.
Scenarios:

**Happy Homer:** Nuclear power is seen as environmentally friendly, safe and low-cost. New technologies have been developed to allow full reprocessing of spent fuel into more usable fuel to be placed back into a reactor.

**Yucca World:** Demand for nuclear power outweighs any opposition to the storage of nuclear waste.

**Not only No...!** Worst case scenario for the nuclear power industry. No new technologies emerge to help solve the problem of spent fuel and the general public and politicians do not want nuclear power.

**Who Needs It?:** Technology exists to cleanly and safely reprocess spent nuclear fuel, but a different alternative energy source has shown itself to be more efficient and more easily implemented.
Scenario Building – Step 6: Compose the Stories

For our ENMA example, two classic archetypes are:

- Engineer as Entrepreneurial Innovator → Westinghouse
- Engineer as Innovator → Edison

Or you might call the entrepreneurial innovator scenario “The Messiah”.

And you might call the engineer as innovator “The Geek.”
**Scenario 2:** *Edison*
Engineer as innovator

**Scenario 4:** *Westinghouse*
Engineer as entrepreneurial innovator

**Innovation** — Devising new solutions to problems.

**Entrepreneurship** — Bringing solutions to customers in new ways.

**Scenario 1:** (TBD)
Engineer as resource manager

**Scenario 3:** (TBD)
Engineer as entrepreneur
Example - **Scenario 4: Westinghouse**

In this world, the engineering manager is looked to as a leader in the global virtual village.

The engineering manager is capable of:

- Identifying and clearly defining current, emerging, and future economic, social, cultural, political, environmental, and technological problems,
- Conceptualizing technically and commercially viable new solutions,
- Packaging and delivering the solutions in a manner that delights the customer.

Scenarios can be more “lyrical”. You could write a short story on a “Day in the Life of G. Westinghouse”.

Scenario Planning Steps:

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Now the work starts!
Scenario Building – Step 7: Scenario Application

- Given your (4) short stories, it is time to return to the original question.

- When you first asked the question, you couldn’t come up with a good answer, because you did not know what the future looks like.

- But now you have (4) visions of the future!

- So now you must answer the original question for each of the (4) scenarios!

- Your strategy must work for all 4!
The key to scenario planning: The best strategy covers all possible futures!

The strategy for balancing the ENMA budget by increasing enrollment must work in all four of these alternative future worlds!
So What!?

- This set of 3 lectures on scenario planning is about creating the context for strategic technology planning and development.

- The scenarios that we develop are not the strategy, they are only stories about the future.

- The rest of this course is what we must do to develop the strategies.

- The point here is that the strategies we develop must work in all the scenarios that we create using the scenario planning tools we just reviewed.
OK, what is the strategy for increasing enrollment in the ENMA program?

College of Engineering Certificates in:
Engineering Innovation and New Product and Process Development

The Marquette University College of Engineering offers graduate-level certificates in:

- Engineering Innovation (ENIN)

The *Engineering Innovation Certificate* prepares engineers and engineering managers to pursue technically and commercially viable new technology-based products, processes, and services. The *New Product and Process Development Certificate* enhances capabilities of engineers and engineering managers to bring these new opportunities to market in a timely and efficient manner. In essence, the Engineering Innovation Certificate supports *doing the right things*, and the New Product Development Certificate supports *doing things right*.

The certificate programs are designed for practicing engineers and other qualified individuals with bachelor’s degrees who wish to:

- Augment their *Master of Science in Engineering Management* program (MS-ENMA) with associated certificates
- Update and/or expand their knowledge and experience in critical areas, but do not necessarily wish to pursue a master’s degree.
Certificates and courses intended for:
Innovators, entrepreneurs, and engineering resource managers.

New Product and Process Development (NPPD) Certificate (select four):

- ENMA 278 - Lean Manufacturing Systems
- ENMA 279 - Engineering Six Sigma Design and Development
- ENMA 281 - Engineering Project Management
- ENMA 282 - Reliability and Failure Analysis
- ENMA 286 - New Product and Process Portfolio Management
- ENMA 288 - System Design, Modeling, and Analysis

Engineering Innovation (ENIN) Certificate (select four):

- ENMA 283 - Innovation and Technology
- ENMA 286 - New Product and Process Portfolio Management
- ENMA 287 - Front-End Engineering Product Development
- ENMA 288 - System Design, Modeling, and Analysis
- ENMA 289 - Intellectual Property Generation and Protection (proposed)
- ENMA 291 - Engineering Innovation and Entrepreneurship
Are we done yet? Heck no!

Recall that your scenario planning should have a specified target date, for example, 5 years.

As your 5 year scenario target approaches, you need to know which (if any!) of your scenarios is closest to reality.

To do this, you need to identify a few key indicators relative to your scenarios that give some clues as to which way the world is evolving.

So, the last steps in the process are:

• Step 8: Identify Key Indicators
• Step 9: Monitor Key Indicators
• Step 10: Update Scenarios and Strategies

Here are examples of key indicators for the ENMA example...
Key Indicators for ENMA Program Strategy to Increase Enrollment:

Internal indicators:

- Enrolment in program and courses (OK).
- Completion of MS and Certificates (OK).

External indicators (TBD):

- Where are graduates working?
- What are they doing?

Benchmark other programs, too.

Original important and uncertain drivers!
Scenario Planning Steps:

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The benefits of scenario building rest not in the completed scenarios, but in the process of development itself, and in the subsequent common language participants in the process share.

They can use this common language as a tool to explore the benefits, costs, and trade-offs of any potential decision, initiative, or plan.

More specifically, they can consider the short-term trade-offs in comparison to long-term trade-offs; the scenario building process creates a language to facilitate that comparison.

In preparing for battle, I have always found that plans are useless, but planning is indispensable. 

Dwight D. Eisenhower