Lecture 11
Writing a good paper

Management of Yourself

November 28, 2017
Final Speaker

• Don’t forget! the (TQFR) survey
• Also fill out the class questionnaire
Questionnaire

1. What went right about this class?
2. What needs improvement?
3. Rate speakers 1-10

Kent Kresa  Northrup Grumman
Rob Manning  JPL
Henry Kressel  Warburg Pincus
Josh Botkin  University of Michigan
David Baltimore  Caltech

1. Rate Cases 1-10

The Last Supper - northrup grumman
SIRI
Claire McCloud
Google
Approaches to writing a decent paper

• Avoid
  – Over-precision in projections- remember what you learned about significant figures
  – Too-long time lines - with detail in the future- except if you want to write a scenario
  – Believing enthusiasts without corroboration
  – Losing your objectivity
  – Excess Technical detail

• Do
  – Be at least *semi*-quantitative wherever possible
    • Your audience thinks in numbers
    • Relationships, comparisons, “goodness” can be shown with charts and numbers
    • Easier for people to understand
    • Sets up the questions for discussion
  – Give bands of uncertainty (optimistic, pessimistic, “best” cases)
  – Give roadmaps where appropriate – timelines showing components of invention being realized
  – Strongly argue well-defined benefits of the technology
    • Markets
    • Clear Business Model
    • Customer pull
Final thoughts from the class

• “Technology has changed our lives more in the last 10 years than ever before in human history.”
  – This statement has been invariant for the last 200 years!
  – See Paul Johnson’s The Birth of the Modern: World Society 1815-1830 Weidenfeld & Nicolson

• Although predicting the development of a technology is difficult, there are some simple tools which can give a basis of reference.
  – S curves, learning curves
  – Market analysis especially using hypotheses
  – Six Forces - Porter analysis
  – Delphi (talk to wise men and women)
  – Technology roadmaps and readiness charts

• Look for Disruptive Technologies (initially small underserved markets)

• Past success is not a great predictor of even medium term future success
Final thoughts from the class

1. There are several ways of misjudging a technology development
   – Alternative(s) are better than you think or can become so
   – Your technology really won’t work
   – Bought the snake oil
   – You get the timing off - too soon or too late
   – You miss the ancillary technologies that are necessary

2. “Luck” strikes when you seize the opportunity to exploit a change in the environment

3. Great technology doesn’t necessarily make a great company

4. Great companies are constantly innovating – and not just in technology

5. Look at the Leadership- Can they “see around corners”? Do they inspire?

6. Getting it right on Technology change is both exciting and rewarding
Summary

• The class stressed two overriding concepts
  – Innovation
  – Disruption
• The class covered several types of businesses
  – Aerospace
  – Materials
  – Financial
  – Personal Devices
  – Medical
  – Etc
• Principles discussed were transportable across businesses
• Most of the Learning occurs on your projects
• I hope what we have talked about is invariant – but I doubt it!
Questions on your projects

How do you get a handle on the timing of a new technology, i.e., assuming it is possible and even inevitable, when will it happen?

Consider “the secret of success in comedy”
• Consider “fondest dreams” analysis.
  – When addressing a multi-variable problem, it can be beneficial to analyze by assuming that each variable can be fixed in order to consider other variables. For example, *what if you postulated that the technology challenges will be overcome*.. then what about all the other stuff?
Questions on your projects

Consider the whole value chain. What needs to be done to make the technology viable?
Questions on your projects

What is the brainpower “tonnage” behind the idea?
Questions on your projects

On a scale of 1 to 10, how important are the benefits enabled by the new technology?
Questions on your projects

Could your technology be enhanced/retarded by standardization. Consider dominant design

Wintel

qwerty
Questions on your projects

What is the response of the conventional technology? Where are they on the S curve? Consider semiconductor lithography, consider magnetic drives.
Questions on your projects

Consider the extrinsic variables. Economic, social, political conditions. How could they change to enhance/retard the technology?
Questions on your projects

Rethink your hypotheses. What is proven/disproven/unaddressed?
“Management of Yourself”
or
Advice on an Industrial Career in a “Large” Company

Some thoughts on designing a career, beginning as a scientist or engineer, and rising to a position of responsibility as a Manager of Technology

Ken Pickar
Full Disclosure by
Full Disclosure by

Professor Ken Pickar
Caltech’s Renowned Expert
Full Disclosure by Professor Ken Pickar
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You are welcome to step into my office for advice
But be warned. . .

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? 

Thanks, You’ve ruined my life!
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Thanks, You’ve ruined my life!

Well, that was useless
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?  

Thanks, You’ve ruined my life!  
Well, that was useless

Thank you! Thank you! I will name my firstborn after you!
Odds are high you will not work for one company your whole life
- This is not a bad thing!

You do not owe the company (any company) job loyalty
- Don’t stick with the company as it goes down
- If there is a great offer from a competitor- take it

The company does not owe you loyalty
- They can get out of the business or the sector you are in and they can /no will lay you off

You can change your job
- Lincoln freed the slaves!

You can change your life
- you have more talents to give than are required by any particular business
- mistakes are recoverable

Your needs change
It is up to you to be sure that you remain employable
-in your company
-in your career
Education- Formal and Continuous

- PhD, MS, BS

- MBA
  - Not always necessary- but business knowledge is
  - If you are going to get an MBA go to a top tier skill
  - Preserve the Caltech Brand!
If a company does not have a serious educational program - reconsider joining them

- You *need* Continuous Skills development through OJT (on-the-job-training), formal courses, informal learnings.

- For example:
  - Technical Skills Development
  - Process Management
  - Program Management
  - Product Engineering
  - Business- esp. marketing and financial
  - Operations such as factory management
  - Communication- esp. presentations
  - Discussion Groups
  - Reading of Engineering books both technical and managerial, journals, etc. *Awareness of new technologies which could affect the business.*
If a company does not have a serious educational program - reconsider joining them

- You *need* Continuous Skills development through OJT (on-the-job-training) and formal courses.

- For example:
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– You need Continuous Skills development through OJT (on-the-job-training) and formal courses.

– For example:

  • General business. Awareness of what is going on in the market that could affect your business
  • Networking with others in allied (or even competitive) positions
  • Linkedin rules!
• Technical
  • Establish Technical Credibility early on
  • Papers, Technical Memos, Patents, Products
  • Consider that some companies like to publish- others don’t
  • You *need* Continuous Skills development through
    OJT (on-the-job-training) and formal courses.

• Start with a Leadership Company- a Caltech of industry
  • Not one on decline
  • Preferable to have your expertise in the companies main line
    of business- not in a peripheral area
  • Does the company have a quality innovation process?
• Consider the prospects in the companies main line of business
  • Growing? How Fast?
  • Market share? How many others?
  • It’s obvious- a growing company has a continuous (growing)
    share of opportunities
  • A shrinking company will be laying off people (look at the history)
• General business. Awareness of what is going on in the market that could affect you
• Networking with others in allied (or even competitive) positions
• Linkedin rules!
• Team
  – Engage in projects which require a large number of diverse interactions
    • Collaborations to show ability to work with others
    • Learn from others
    • Leverage your strengths
    • Gets you out of the lab
    • Makes contacts
• Organizational and Career Path
  • Move to project management or product marketing (and succeed!)
  • Don’t take on the impossible
    • Do risk assessment before jumping
    • Know what you are getting into
  • Look for programs that the company really cares about - high visibility
  • Get on some corporate-wide process improvement team
“Choose” an appropriate boss

• Person on a success track not person whose career is stalled
• Person with a record of helping the careers of his/her employees
• Makes time to talk to you
• A coach, A leader- not a “manager” or a bureaucrat
• Be sure to insist on at least one serious career discussion each year. Two are better
Find mentor(s)
Not necessarily your boss

• Someone you can confide in
• Someone you admire
• Someone who has your interests at heart
• Someone who has “been around the block”
• Someone not in HR!
• Can be more than one— for different aspects or your life
Other characteristics of Great Company

• **Integrity**
  – Are people treated with fairness?
  – What is the relationship with customers, with suppliers, with the community?
  – Do they pollute?
  – Do they obey the law?

• **Communication**
  – Is the boss visible?
  – Do you know how the company is doing on a periodic basis
  – Do you know what is expected of you?
  – Do you have periodic meetings with your boss to assess your performance (at least 2X/year)
Big company or small-advantages and disadvantages

• Small company
  – Agility - Fewer layers means faster decision making
  – Closer to customer
  – Closer to decision makers
  – Larger scope of responsibility
  – Overall Focus
Big company or small-advantages and disadvantages

• Large company
  – Staying Power
  – Economy of Scale
  – Greater numbers and diversity of people
  – Brand Recognition
  – Established Processes
  – A Successful baseline to improve upon
Why Business Leadership for a Technical Person?
Technical Promotions and Career track

*From* technical

to management of technical people

to next order of management of technical people

to *business leadership*

to highest order of technical management.
Technical Promotions and Career track

• Note the business leadership point above.
  – You are a much better Technical Manager if you have had to worry about a business, even a small one
  – If not leadership then a business function, e.g., marketing
  – Be prepared to take a “lateral” for business leadership post
  – Don’t wait too long
  – You might like it, be good at it and decide to stick with it
Simplified Career Tracks for Technical Contributor

- Technical Leadership Track
  - Build Technical strengths
  - Program Management or Marketing
  - Small P&L
  - Multi P&Ls

- Management of Technology Track
  - Build Technical strengths
  - Program, Process or business
  - Broad technical leadership

- Business Leadership Track
  - Build Technical strengths
  - Build Technical, Leadership strengths

The diagram illustrates a pathway for career development in different leadership tracks focusing on building technical and business leadership strengths.
Consider Program Management
(cf Rob Manning)

• Develops various skills
  – People assessment
  – Communication
  – Negotiation
  – Financial
  – Organizational
  – Managing Complexity
  – Measurement of Success/Failure
  – Execution
Always Think of the Next Job . . .

and the one after that

- Write an annually-updated, personal 5 year plan
  - Who are you?
  - What have you learned in the last year?
  - What is your rate of learning?
  - What do you like about your job?
  - What don’t you like about your job?
  - What is your next position?
  - What is your position after that?
Always Think of the Next Job . . .

And the one after that

- Look at last years plan
- Are you on track?
- Be prepared to change companies or locations if the right opportunities arise
- At a big company, if you are on a growth track, you will be asked to move—often to a place you don’t want to live.

Is this what you want?
I 've
Been
Moved
Always Think of the Next Job . . . and the one after that

• Don’t stay in a job more than 3 years (5 years tops).
• Change within a great company or leave the company if insufficiently challenged
• Keep your resume updated
• Be impatient- don’t settle in a groove
  • *If you have already shown you can do something well, why do you want to do it again?*
• Overriding question: Are you learning?
Compensation

• Don’t get bludgeoned into making a quick decision after an offer is made

• Stock options can be very valuable!
  – They cost you nothing
  – The lowest value is zero (but it can mean a lower salary)
  – The upside is life altering

• No compensation is better than a stock option in a growing public company or one that goes IPO
  – Even if the multiple falls, if the company is growing profitably at a rapid clip, you will be rewarded

• Company savings plans, equity portfolios are almost always better managed than those done personally by a busy executive

• But diversify- remember companies can go bankrupt!

• Whatever happened to pensions?
Compensation

• When negotiating, don’t accept the first offer— but also don’t get involved in lengthy haggling

• Right after they make the offer, they want you— they really want you

• As soon as you have accepted the offer, your negotiating power drops off precipitously

• If you need some time, ask for it. Don’t be a victim of an HR “bum’s rush”. They took a long time to hire you and they expect an answer back from you in a week!
What about a start-up?

• Can do it right from Caltech
• Or can be your second career after a few years (~3-5) working for a great company. You will learn more about what the culture of a great company is. Learn what you don’t know.
• If you wait 10 years plus, it is much harder
  – Too comfortable
  – Mind set reasons
  – Possibly for family reasons
• Best to be young
  – Less obligations
  – Less need for structure
  – More time to recover if (as is probable) the company fails.
What about a start-up?

• Most important characteristics of a good prospective company
  – Validated market- also known as customer (s)
  – Protected technology
  – Experienced CEO/Team (number 1 success indicator)
  – Market Timing (a la Bill Gross)
• Do you believe in the idea?!  
• Have you done your homework?! 

Remember
  – You will have no life! Worse than Caltech!
Incubators

• Lots in the LA area- rapidly growing institution across country
• If your Team is inexperienced, a great way to start
• They vary widely – in culture and expertise
Be prepared for setbacks—no successful manager I know hasn’t fallen on his face at least once.
• On any of these I am available to advise
  - *but remember my opening caveat!*
Some additional areas to consider

• How probable is it that the concept can be realized in a start up or an established company
• $P(\text{Lab Realization}) \times P(\text{engineering}) \times P(\text{Manufacturability}) \times P(\text{marketable}) \times P(\text{financial}) \times P(\text{competitive response})$
• Some Factors to consider
  – Track record/credibility
  – outside “expert” analysis
  – passion
  – physically possible
  – stage of development (prototype)
  – Manufacturability
  – Competitive response
  – Intellectual property
  – opportunity cost
More additional Areas

Then consider

– Distribution
  • How do you bring the innovation to the customer
  • Do you have to develop it yourself or can you form a partnership?

– Manufacturing and Manufacturability
  • Can you make it?
  • How much will it cost?
  • What is the learning curve?

– Service
  • How do you maintain the product?
  • How do you help the customer keep your product running?

– Finance
  • Do you have the “staying power” to develop the market. What if the schedule slips?

– Competition
  • If you were the competitor how would you respond?
Outsourcing

• What is your core competence?
  – What do your customers care about? Where do you provide value to them?
    • Consider value chain and how it addresses customer pain
    • Providing “complete” solution to pain
    • Ask them
    • Prioritize
    • Is what they say consonant with what you think?
Outsourcing

adopted from
http://entrepreneurs.about.com/cs/beyondstartup/a/uc041003a_2.htm

Do What You Do Best and Hire the Rest

1. Clearly define what you need. Don’t get sold into more than you need.
2. Evaluate a service provider as you’d hire a full-time employee
   Interview
   Check references for quality, reliability cost, etc
   Use gut for compatibility
3. Look for specific experience fit
   Have they done similar work before
4. Don’t choose a vendor based solely on price
Outsourcing

5. Review portfolios and samples
   Examine vendor’s previous work (their “portfolio”) to assure quality.

6. Start small
   Try first before long term commitment
   Consider competing vendors in a “phase 0” project

7. Tie payment to clearly defined milestones (~3-4, if appropriate)
   for a start-up
   minimize up-front payments
   Review at each milestone
   Look for payments “in-kind”
   Consider stock
   Consider barter
Outsourcing

8. Negotiate ownership of work up front
   Be clear who owns the resulting work product

9. Don’t forget about support after the project is complete
   Specify a warranty or support clause
   e.g., Specifying some amount of free support or negotiating discounted prices for future modifications

10. Get it in writing
    Original agreement
    Schedule, scope or payment changes
    Save copies of email exchanges but print is better.
Some references

• Economist Quarterly
• Using markets
• Methodologies
  – http://www.class.uh.edu/MediaFutures/forecasting.html
Finally

• This has been a great class and it has been a pleasure to work with you.