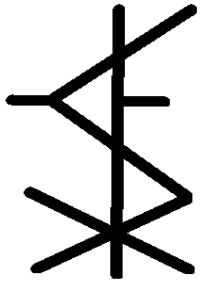


# Technology Management

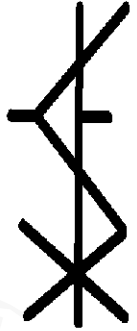

Vasos Panagiotopoulos

Samani Marions Panyaught
BioStrategist.Com

# Objectives

- How to manage technology in business
- Will learn all aspects of management as applied to technology
- For scientists/engineers as well as managers/financiers to learn how to deal with technology in business.
  - Team up with someone who complements not emulates your background

# Technology Management

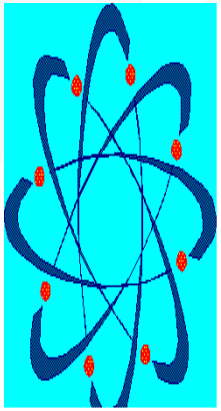


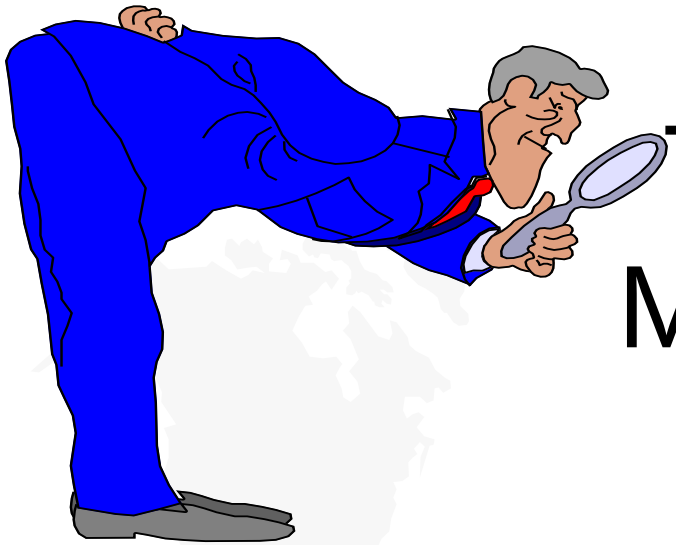
Samani

Marions

Panyaught

- Change the rules
  - Sometimes unexpected results
- Risk & Uncertainty
  - Need for integrated coordination
  - Need for combinatorial diversity
- Complexity (ie RFPs, matrix management..)
  - disempowering
  - arbitraged, not obeyed





# Technology Management

## *IS*

- Minimising steps for robotic assembly then making it even cheaper by hand.
- Designing drug molecules then making them.
- Using mammalian cultures instead of just fermentation.

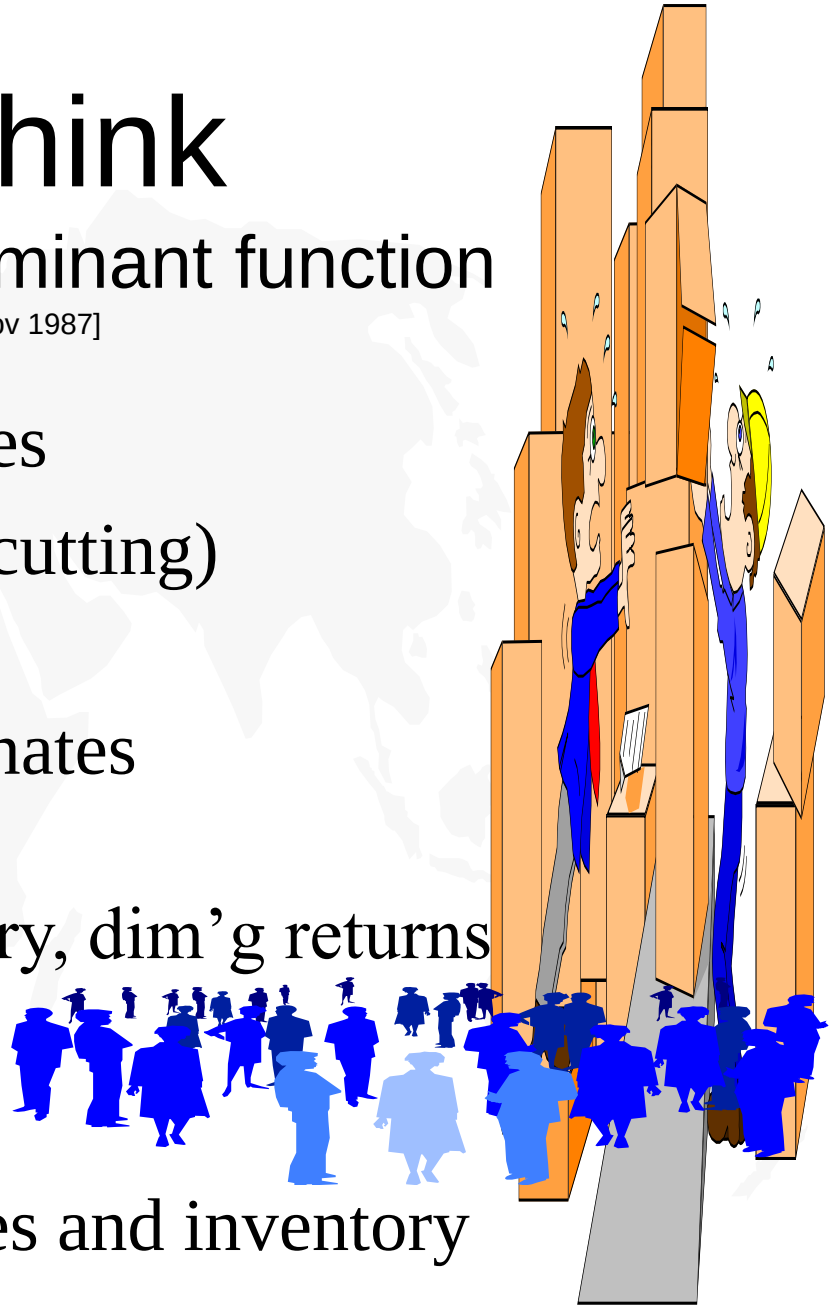
## *ISN'T*

- Replacing typewriter with a PC, without changing work habits.
- Putting the same forms on a computer screen.
- Cross-testing every possible resulting molecule the way you looked for new antibiotics

# Groupthink

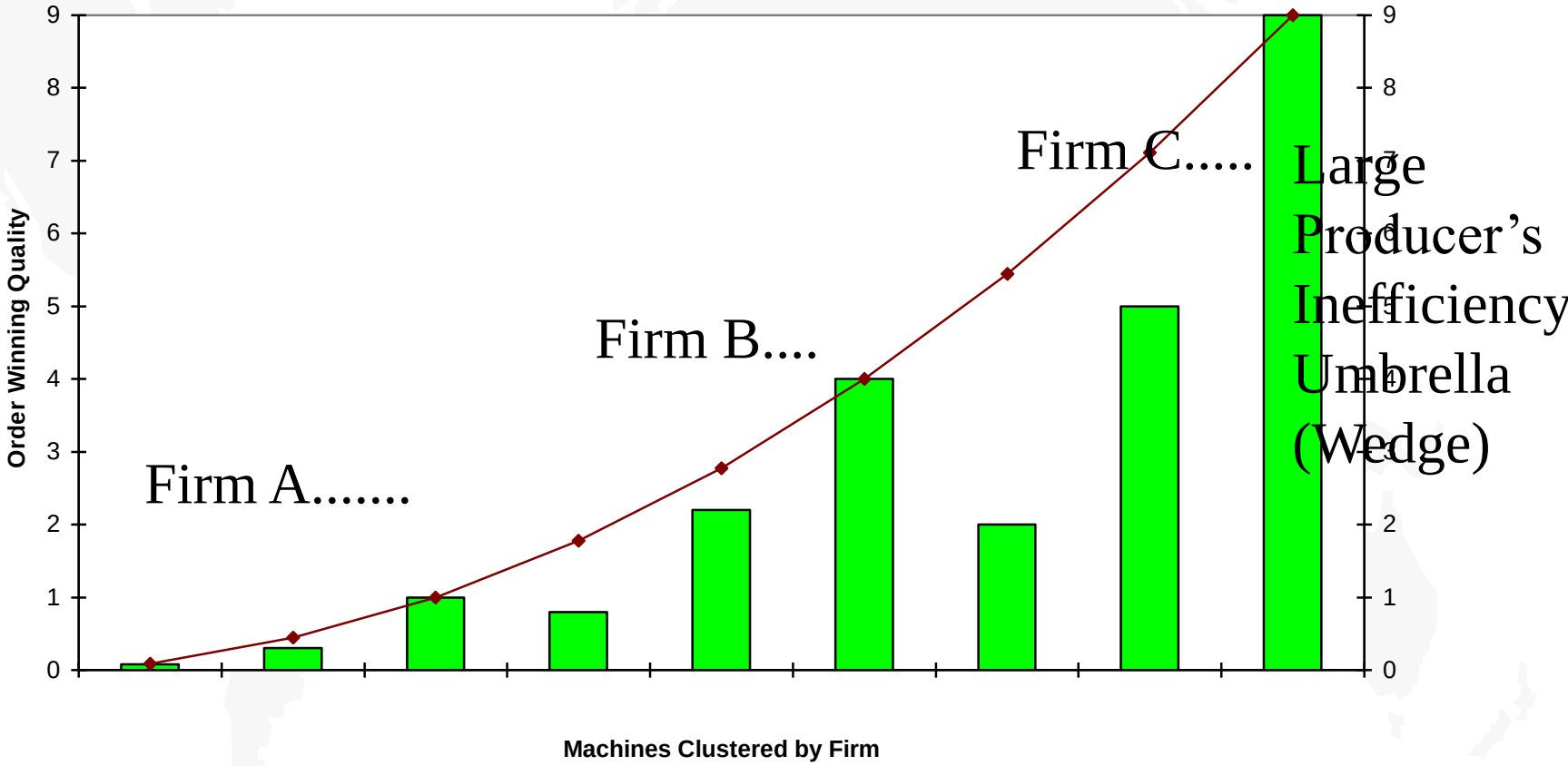
## doesn't question dominant function

[Arthur Rock HBR Nov 1987]



- Big Firm : Finance dominates
  - late PLC mentality (cost cutting)
  - ignores paradigm shifts
- Mid Firm: Marketing Dominates
  - Emphasis on incr. sales
  - Ignores scale-up, inventory, dim'g returns
- Small Firm: Tek Dominates
  - Thinks biz skills unintellectual
  - Ignores timing of payables and inventory
  - Emphasis on discovery

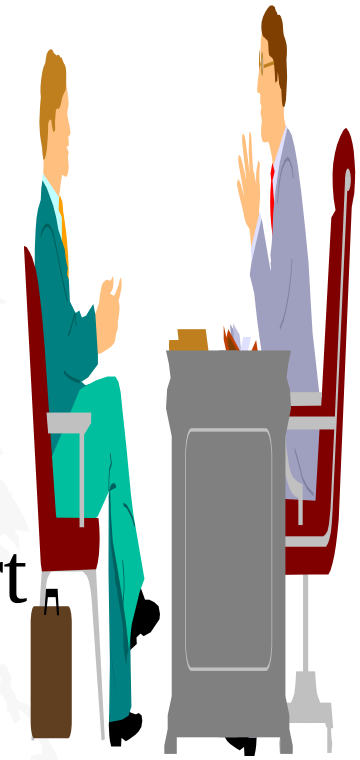
# Industry Structure



# Product vs Process
## Research & Design

- Freeze design as late as possible
- Include order-winning goals early in process & rewards
- Develop concepts, processes, platforms and product families before developing products (ie Intel 80x86).
- Speeding a strategic product to market will only accelerate commoditisation
- Scale-up capability before demand builds
- Improving processes keeps your competitive advantage.
- Knowing when to stop & redesign process model all over again

# Order Winner/Qualifier Decision Modeling
## (Interorganisational)

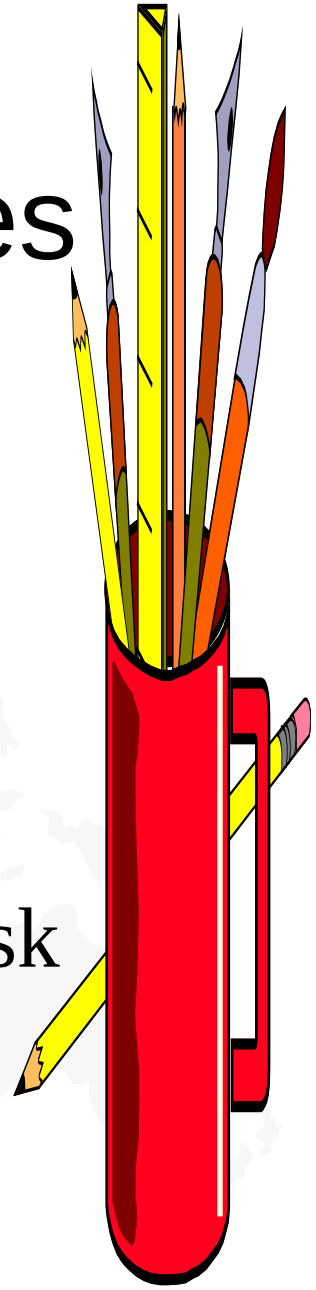


- Tek Sales or Licensing -- same method
  - Tune perfrmc measures to customers & strategy
- Search the decision tree & the org chart
- Relationship or Attribute selling?
  - Relationship might be heuristic abbrevn of attributes
- Who ***REALLY*** decides/influences/approves/uses?
- Is it price, quality, time, or some hidden agenda?
- Central buying or tek decentalisation
- Stage of budget/procure/design cycle, gating, benchmarking

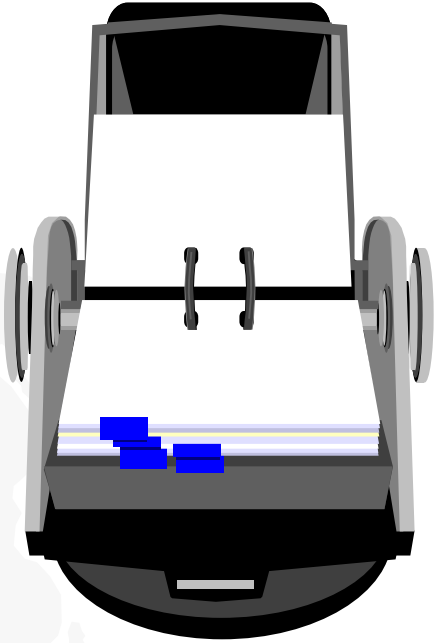
cf HBS-9-582-117 ,9-489-084

# Chosing Financing Vehicles

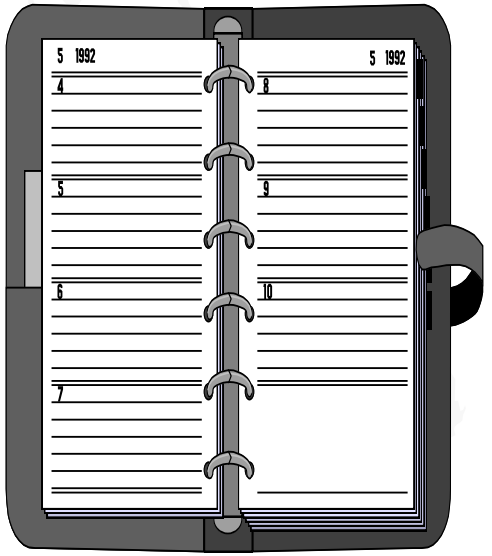
- **M&A**: get quickly, might lose people
- **Licence**: internal usability/fit
- **JV**: share, learn but conflicts
- **VC**: access but entrepereneurial
- **Option:** (warrant): unproven, modest risk
- **Grant:** expand R&D, poor incentive



# The Licensing Deal



- Research Presentation.....3 Months
- Deal Structuring.....1 Week
- Deal Pricing.....1 Month
- Due Dilligence.....3 Months
- Termsheet/Ltr Intent.....2 Weeks
- Development Visit.....1 Month
- Corporate Approval.....2 Weeks
- Legal Negotiation.....2 Months



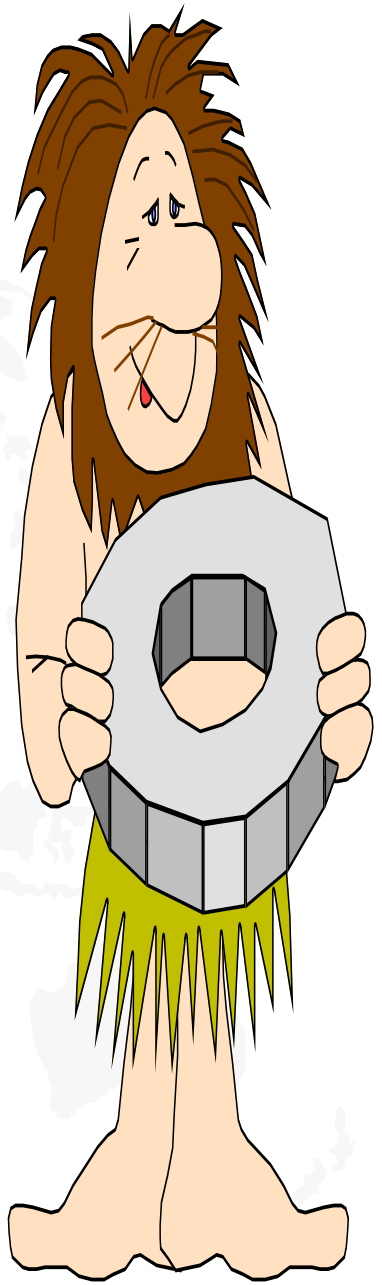
# Typical Royalties & Strategies

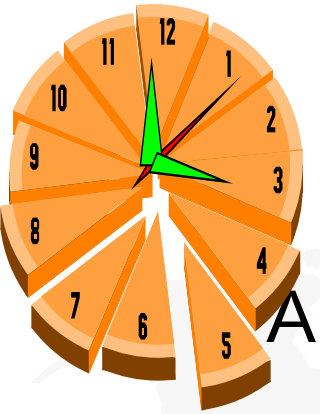
- 25% of Profits or 5% of Sales
- 1-4% of Sales: Semiconductors, Chemicals (Chem per kg, too)
- 5-15%  of Sales: Spec Chem, Drugs, Med Devices
- If you publish, you perish (novelty, prior art)
- Maybe the guy in Sweden wants the Korean to make it but would get billed double royalties. Allow collab betw your licensees.
- All JVs to learn.. are all temporary
- License the demo in case a rejected vendor takes it to your competitors.
- Cash flow valuatn:(mkt shar change,royalty relief, resid income,cost savngs)
- DEFINE: Strategic product identity criteria, royalty base, non cash consideration, income exemptions (tax, ship, commiss), min perf rqmt for licensee, triggering & terminating events, derivative products tol modfcns, field of use, need to know, inspxn of records, tol currency risk, tol sales-rel disclosures, indemnification for breach

# Hi Tek Finance
(for example)

- Beta = 3 software,
  7 biotek, not 1
- P:E= 40  not 12
- r= 20%  not 5%

beta(x)=covar(x,market)/var(market)





# Venture Capital Method

## And Overvaluation in the "New" Economy

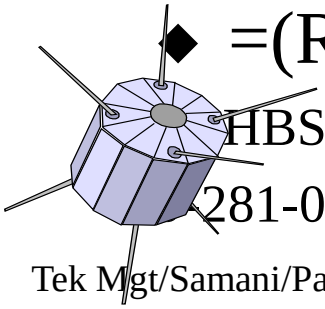
- INTEREST= REAL (4%=marg prodxvty capital)+RISK+INFLATION
- = RISKFREE (V LONG T 4%)+BETA*RISKPREM (V LONG T 4-6%)
- = ([1,1.5]+beta)*4%

(Cash flow, Value Added, Liquidity and risk make capital more costly in early ventures)

Finding the right variables or proxies is rarely done right. Which rate? Which growth?

(Mystical obfuscation of no dividend hi-tek and tax effects: Miller Modigliani JB 1961; Farrar Selvin NTJ 1967; Brennan NJT 1970; Miller Scholes JFE 1978. High future expected growth rates might create bubbles unanchored by actual dividends.)

- P:E=(1/(r-g)) =NPV([ONES],-4%(1+beta), neg=> forward looking
- =(1-growth/(ROI(1+beta))/(WACC-growth))
- =(ROE-DivddGro)/(DisctRt-DivddGro)/ROE



HBS VC Method 9-288-006 p12 footnote 5; HBS Valn Models 281-067 p5; Copeland, *Valuation*, Wiley, 1990 p79

# Options Pricing
## (Contingent Claims Analysis)

- Hi r diminishes NPV input from **distant earnings**
- Discounted Binomial ProbabilisticDecision Tree
  - matches milestone structure common in tek xfr
- Merck & J&J use Options for R&D budgets

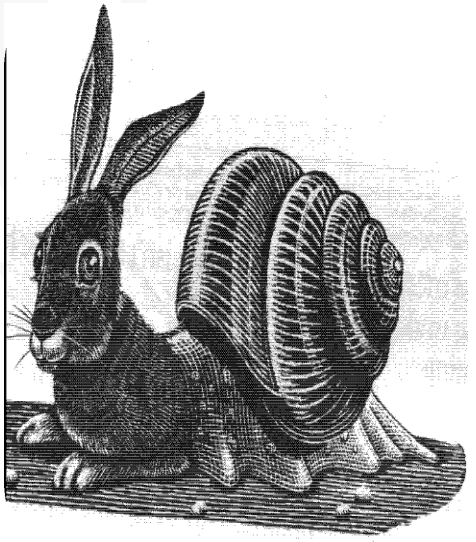
  (Lewent *HBR* 2/94; HBS Conting Clms 9-286-114, Trigeorgis, *Real Options*, MIT. Merck worked but not J&J because of trust – managers didn't arbitrage inputs)
- *Crudely* with Black-Scholes
  - S=PV(proj fin val); X=Launch Cost; t=time to launc
  - r=WACC for proj; Dividend Yeild = 0
  - sigma=est from pul-trad compar proje (subtract for attrbn)
- Russ Parr of *AUS* says can't measure Excercise price
- Volatility also hard to Guage

- **Complexity is disempowering**
- Look good if suggest but not if implement
  - Hire an expert to do it; for **strategic initiatives** only

# Hi Tek Proj Management

## Intellectual-Process PERT/CPM

- Teks are lousy estimators of cost and time
  - they simplify in order to think thru
    - good for tek
    - lousy for biz
  - rough fudge is 2.3 times their estimate

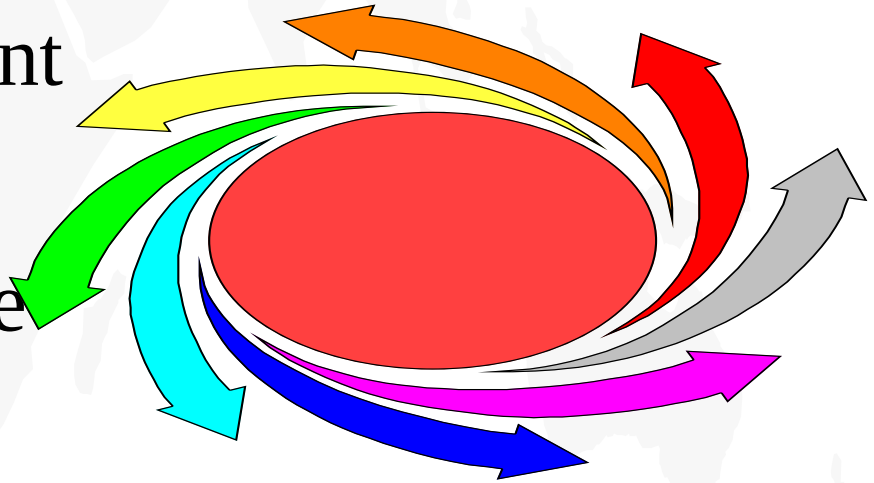


- Gurus do 80% of work for team
  - gurus overestimate not underestimate
  - never hesitate to grant gurus overtime
  - go out of your way to keep them for life

# Tek Life Cycle

Sales=a*tanh(b*t)+c

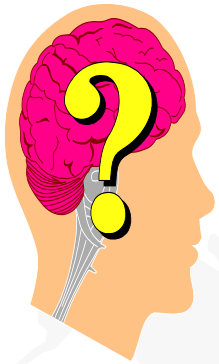
- **Idea**, plan, identify customers
- Prove **concept**, feasibility, id enabling tek
- Design, **protoype**, patent
- **Validation,** test
- **Scaleup**, commercialise
- Build up **market** share
- **Maintenance**, Creative destructn/substitn



# Pr Nelson Fraiman's
# 17 Step Tek Change
# (Columbia B9811x95,8827x96)

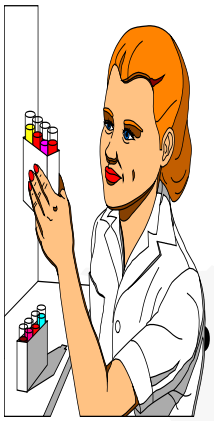
COLUMBIA BUSINESS SCHOOL

| | | |
|---|---|---|
| Customer Driven Focus | Envir Supportive of Qual & Contin Improvement | Schedule-based (details are paramount) Process |
| Champion of Key Processes | Strong Communication & Documentation | Culturally Sensitive Solution |
| Team Centered Approach with Diverse Composition & Info Shared acr fcts | Simple (Common Sence) Solutions | Enough Focused Resources for Implementation |
| Management Leadership, Committment and Involvement at All Levels | Challenge Conventional Wisdom | Use facts with Scientific Methodology |
| Agreement of Vision By All | Appropriate Measurement System | Do It Again and Make Sure All 17 Elements are Done |
| Implementation Supported with Sufficient Training | Change Sold to All Constintuencies | |



# INFORMATION TECHNOLOGY

- **Info is dear, data is cheap**
- Longterm firm-wide intercompatibility
  - Vendor reliability or source code in escrow
- INVARIANT:1 man-hr per line of code
  (fully debugged, documented,tested, maintained)
- Dominant design (microchannel vs AT)
  - Other issues: data-flow, work-flow, requirements, prototype, recovery, distrib contention/integrity..



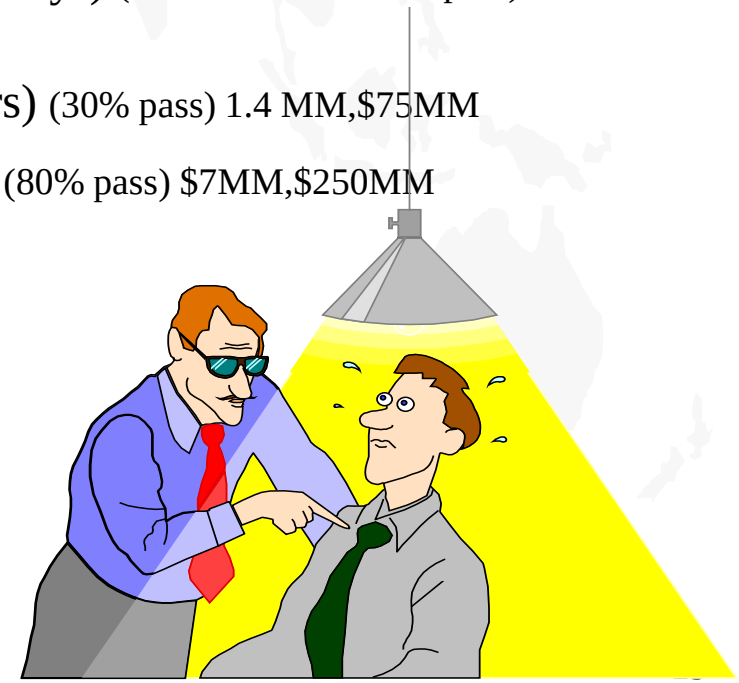
# Regulatory Effects

## eg Drug Discovery & Approval $2.5 BN

llars below are minimal prepartnering budgets, valuation reward

Difference is because failures aren't counted and attributed

- **Discovery (5yrs)** (10,000 compounds; Screening leads, rational synthesis)
- **Preclin** (lab & animal, pharmacology, toxicology) (6.5 yrs) (250 lead candidates) $.6MM
- IND (Investig New Drug) applxn; Corp IND vs Physician's IND
- GMP (Good Mfgg Proc) pilot plant built & subseq scale-up
- Phase I (25 non-ill voltrs for safety & dosage) (1.5yr) (80% of 5 candidates pass) $.7MM, $25MM
- Phase II (200 vol patients for efficacy & side-effects) (2yrs) (30% pass) 1.4 MM,$75MM
- Phase III (2500 vol patients to mon long-t rxn) (3.5 yrs) (80% pass) $7MM,$250MM
- NDA (New Drug Application, **100,ooo+ pages**!)
- FDA Review & Approval $.1MM
- Post-Marketing & Phase IV (1.5yr)
- Orphan Drug - fewer than 200k potl pt 7yr exclusivity
- Dx is right only on third try, fouls up trials, cf openclinical.org
- Adaptive Max Likelihood trials



# Where to get more information

- These Slides at

  biostrategist.com/*Bz***Tek***Mgt*.pdf
- Innovation Management Seminar
- IRI/RTM 1550 M NW #100 WDC 20005-1708
- Samani Marions Panyaught Consultancy