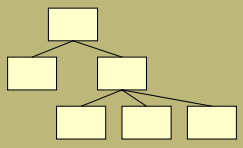
15.575: The Managerial View of the Firm and Knowledge Work

Steve Kahl

Agenda

1. Framing this week's reading
2. Change: The Importance of Complementarities
3. Information Processing Exercise
4. Limitations: The role of Bounded Rationality
5. Break
6. Organizational Structure
7. Discussion of assignments
8. Conclusions

Framing this week's discussion



Different ways to model firm
(Milgrom & Roberts, Drucker, Gailbraith)

What firm's must consider when changing strategies
(Milgrom & Roberts, Ichniowski et al. Brynjolffson et al., Drucker)

Limitations in our decision capabilities
(Radner)

Role of Information technology in organizational structure and decision making

Making change: The Importance of Complementarities

What are they (Milgrom and Roberts)?

- **Definition:**
  - **if the levels of any subset of the activities are increased, then the marginal return increases in any or all of the remaining activities.**
  - **It follows that if the marginal costs associated with some of the activities fall, it will be optimal to increase the level of all the activities in the grouping. (p.514)**

- **Mathematically:**

  Let $X = (X_1,.., X_n)$ be level at which activities acted

  Let $\Pi(X)$ be resulting profit function (assumed smooth)

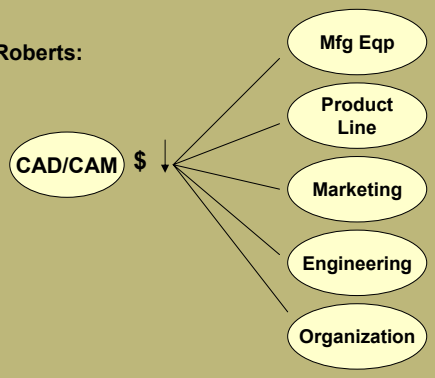
  Activities are mutually complementary if

  for all i j, $d^2\Pi / dX_i\, dX_j >= 0$

Making change: The Importance of Complementarities

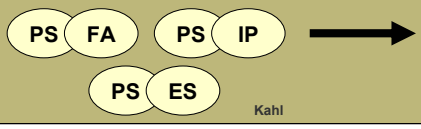
Examples:

Milgrom & Roberts:



Ichniowski:

Problem solving teams → **Worker productivity**



→ **Worker productivity**

Making change: The Importance of Complementarities

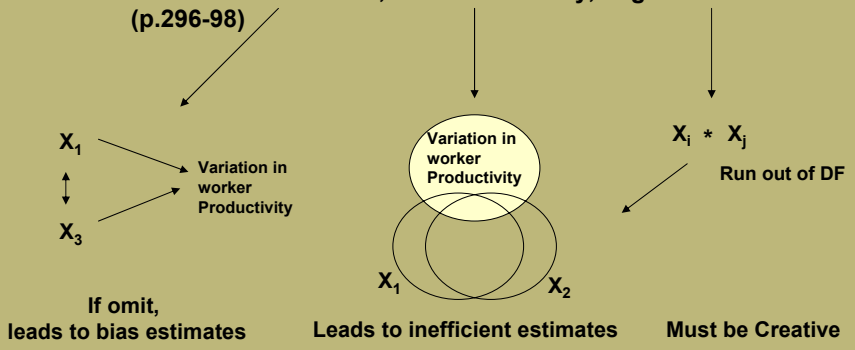
What are consequences of this view?

- When making change decision it is important to analyze activities not in isolation, but as part of a coherent system
  - Ichniwoski – does his study confirm this result?
  - Any real-life examples?
- Adoption of clusters of activities is not coincidental
- The adoption process may be erratic
  - Why?
  - But, should not see extended periods of time in which one activity is in place and its complement is not
- We must identify which activities are complements
  - Identification - Not just technology variables, also include organizational (Brynjolffson, Hitt)
    - Brynjolffson et al's matrix of change
    - Has Ichniowski left out any variables?
  - Operationalize – determine interaction effects

Making change: The Importance of Complementarities

What are consequences of this view?

- **Operationalizing Milgrom and Robert's model – Issues with complement activities in empirical analysis (Ichniowski)**
  - **Omitted variable bias, multi-collinearity, degrees of freedom (p.296-98)**



If omit, leads to bias estimates

Leads to inefficient estimates

Must be Creative

How does Ichniowski solve this problem?

Making change: The Importance of Complementarities

What are limitations of this view?

- **Discussion of complementarities is very internally focused. How has the Internet changed which activities we include in our analysis?**
  - **Change from "design for manufacturability" to customer-driven enterprise.**
  - **How is customer captured in his model? Is there a better way?**

- **What are the constraints on the model?**
  - **Non-convexities**
  - **Capital/budgeting constraints**
  - **Any information-based constraints not considered?**

Information Processing Exercise

Limitations – The Role of Bounded Rationality

What is bounded rationality ?

- **Definition: Expectations placed upon decision maker exceeds capacity of present day humans and computers. We are uncertain about the logical implications of what we know (Radnor)**
- **If we are bounded rational, what do we recognize about our situation?**
  - **Communication is costly**
  - **Understanding is flawed**
  - **Realize that not likely to find mathematically best solution – indeterminancy**
- **What are the resource requirements for decision making?**
- **If we decentralize decision making what are the additional considerations?**
  - **Creates cost of delay: computational delay must increase unboundedly with size of the problem**
  - **Memory and communication costs**
  - **Is it efficient to use every piece of information available?**

Is bounded rationality a cost issue or something more serious?

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-Gordon – short presentation and discussion of the paper. How much discussion do we want here as opposed to later?

-Aggregate numbers are impressive but the revival seems to have taken place within the 12 % whereas in the 88 % capital deepening has been unproductive.

Limitations – The Role of Bounded Rationality

What is Indeterminancy ?

- **Decentralized form and boundend rationality also impact whether an optimal decision is made and power relationships between groups**
- **How does game theory help illustrate indeterminancy?**
  - **Could be infinite number of Nash profiles, ranging from infinite to worthless. How does this result come about?**

This argument yields a difficult challenge: We are uncertain about the implications of what we know and our models do not yield sharp predictions

-Gordon – short presentation and discussion of the paper. How much discussion do we want here as opposed to later?

-Aggregate numbers are impressive but the revival seems to have taken place within the 12 % whereas in the 88 % capital deepening has been unproductive.

Limitations – The Role of Bounded Rationality

Technology to the rescue?

With lower cost of obtaining information, storing and accessing information, have decision makers become more or less bounded?

More bounded	Less bounded

From these observations, what can we conclude about how firms should use technology ....

-Gordon – short presentation and discussion of the paper. How much discussion do we want here as opposed to later?

-What is multifactor productivity? Can Erik explain or is it common knowledge?

-Two questions raised:1) Has the new economy reached into the 88 %? 2) The timeline is much shorter than for earlier “golden eras” (p 54) – raises the issue of permanence vs temporary.

-Lagging in labor hours and productivity (p 54-55)?

-What does p 56 mean? I have trouble getting my head around it...

-Supply graph move or demand graph move?? p 61-62

-Computers has been around for almost 50 years – perhaps the prod increases are in the past not in the future (p 65). Also cmp diminishing returns.

Break

Organizational Structures

What are the implications of bounded rationality on firm structure?

- **Firms may organize in certain ways to contain issues associated with bounded rationality**
- **Key issue is uncertainty (Galbraith)**

Galbraith's Argument:

Greater the uncertainty of the task, the greater the amount of information that has to be processed

3 different strategies to deal with uncertainty problem: increase planning, increase flexibility, lower performance

Costs dictate with strategy choose

Firms will act in one of 4 ways

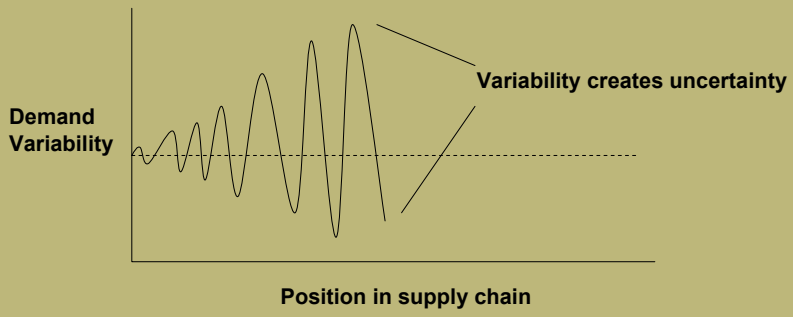
Organizational Structures

Galbraith's 4 strategies:

	Perspective	Effect	Cost	Example
Create Slack Resources				
Self-Contained Tasks				
Vertical information Sytems				
Lateral Relationships				

Organizational Structures

Are these 4 strategies exhaustive?

Can technology impact the environment in order to reduce uncertainty?

An Example: How technology can dampen the bullwhip effect