Is there one best way? Aligning incentives for improved learning and greater efficiency

John Birge
University of Chicago
Booth School of Business
Themes

• Taylor’s “One Best Way” led to order-of-magnitude increases in productivity

• Lean and agile operations create even greater opportunities for both increased productivity and value

• Increases are limited by our capabilities in creating the right incentives

• Finding mechanisms to create the right incentives can yield broad improvements
Taylor’s One Best Way

- Principle: There is a best way to perform every task
  - By determining the operations to be performed and a consistent measure of performance, can find a sequence of processes to perform the desired transformation as efficiently as possible
  - (OR/Dantzig): define an objective and possible activities that can performed to optimize the objective

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Result of the One Best Way

• Order of magnitude improvement in productivity
• Rapid and wide spread of industrial revolution
• Dramatic reductions in costs (e.g., order of magnitude for automobiles)
• More recent: broad ranges of selection
Efficiency Improvements: Craft to Lean

Production Trends:
Craft => Mass => Lean

Increases in choice:
Agile/Flexible and Mass Customization
Additional Trends

Globalization

Consolidation
Limits to Expansion

• Despite increased productivity and choice (customization),
  - Limited success in services (e.g., health care, education)
  - Apparent increased susceptibility to broad disruptions (e.g., global financial crisis and sovereign defaults)

Why hasn’t the productivity success continued and why so varied?
Hypotheses

The “one best way” is open to interpretation:

• The metric of performance is open to interpretation;

• We may not always have the right perspective and create the right incentives, but:

• Our challenge is create systems that align incentives of agents and principals.
Finding the Right “Who”

• Two implementations:
  • NBA scheduling (Bean, JRB 1980)
  • Michigan State Senate (JRB 1983)

• Common story:
  • Knowing the decision-maker is critical
  • The decision-maker can always change his or her mind
NBA Schedule

Problem (as imagined):
Find a schedule of 82 games for 30 teams played over 165 days with minimum distance (cost) and:
- Available arena
- No road trips over 5 games
- <=2 games in 3 days….

Travelling salesperson problem (TSP) plus much more…

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League Schedule

CHI

BOS
NYK
NJ
PHL

GS
LAL
LAC
Decision Making Reality

- Schedule determined by league office
- League office does not pay for travel
- League office does not see the same issues
- Priorities for league:
  - Have flexible schedule
  - Satisfy each team (and especially “important” markets)
Michigan State Senate

• Background: at each census, states must re-define political districts to protect “one person-one vote”
• Michigan Supreme Court decides that State Senate district should “minimize the number of existing county lines broken to form districts subject to the one person-one vote restriction”
Societal Incentive Misalignment

• Examples
  • AIG’s role in the financial crisis
  • Health care, e.g., over-crowded hospital emergency departments

• Apparently poor decisions actually consistent with incentives
**AIG's Income Statement**

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Revenues</strong></td>
<td></td>
<td></td>
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<tr>
<td>General Insurance</td>
<td>$35,854</td>
<td>$51,708</td>
<td>$49,206</td>
<td>$45,174</td>
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<tr>
<td>Life Insurance &amp; Retirement</td>
<td>14,271</td>
<td>53,570</td>
<td>50,878</td>
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<tr>
<td>Financial Services</td>
<td>(16,016)</td>
<td>(1,309)</td>
<td>7,777</td>
<td>10,677</td>
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<tr>
<td>Asset Management</td>
<td>658</td>
<td>5,625</td>
<td>4,543</td>
<td>4,582</td>
</tr>
<tr>
<td>Other</td>
<td>531</td>
<td>457</td>
<td>483</td>
<td>344</td>
</tr>
<tr>
<td>Consolidation &amp; Eliminations</td>
<td>(436)</td>
<td>13</td>
<td>500</td>
<td>(16)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$34,862</td>
<td>$110,064</td>
<td>$113,387</td>
<td>$108,781</td>
</tr>
<tr>
<td><strong>Operating Income (Loss)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Insurance</td>
<td>$(393)</td>
<td>$10,562</td>
<td>$10,412</td>
<td>$2,315</td>
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<tr>
<td>Life Insurance &amp; Retirement</td>
<td>$(19,561)</td>
<td>8,186</td>
<td>10,121</td>
<td>8,965</td>
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<tr>
<td>Financial Services</td>
<td>$(22,880)</td>
<td>(9,515)</td>
<td>383</td>
<td>4,424</td>
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<tr>
<td>Asset Management</td>
<td>(2,709)</td>
<td>1,164</td>
<td>1,538</td>
<td>1,963</td>
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<tr>
<td>Other</td>
<td>(2,899)</td>
<td>(2,140)</td>
<td>(1,435)</td>
<td>(2,765)</td>
</tr>
<tr>
<td>Consolidation &amp; Eliminations</td>
<td>237</td>
<td>722</td>
<td>668</td>
<td>311</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$(48,205)</td>
<td>$8,943</td>
<td>$21,687</td>
<td>$15,213</td>
</tr>
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</table>

What Can We See from AIG?

- Even in 2007, large changes in their net income from financial services
- Evidence of involvement in activities with very volatile cash flows
- Decisions that do not recognize that would not be effective
- Result?
Dow Jones path: 80 years ago and today

Only the losses in the Great Depression rivaled the loss in equity value during the current crisis.

DJIA from 10/2007 to 3/2009: -52 %

Worst all-time 17 months: (1/1931 to 6/1932): -75%

CDS Insurance – AIG story

• Credit Default Swaps (CDSs) protect against default on underlying securities
• AIG sold $526 billion in CDSs
• Many at AAA level (1 in 10,000 default odds?)
• Problems? Large collateral requirement changes (+$6B in one month out of $18B for all uses)
Collateral Requirement

• Consider $562 billion in protected debt
• Chance of default each security is 1/10000
• On any single security, collateral is 10 times the premium (or about 0.1% of notional amount)
• Total collateral required: ~$600 million
• If $562 billion is composed of ~3000 independent securities, chance of loss>$600 million is very small but …
Expected Loss and Collateral Changes

• What happens to expected loss if all the securities are actually linked (i.e., correlation from 0 to 1)?
  • Expected Loss: <$1 million => $60 million
• But, AIG still has $600 million in collateral, so what is the problem?
• What happens to collateral if correlation is high and all downgraded (AAA to A: 0.01% to 0.1%)
  • Collateral up 10 times: $600 million => $6 billion
Problems for AIG

• Collateral requirement in the event of a downgrade can bring ruin
• Chance of downgrade if systemic (highly correlated) is ~ 1/10
• If AIG knew this, should they have sold $562 billion in CDS’s?
Decision Tree for AIG Shares

Sell more CDSs

Hold CDS issues

+$10

+$8

0.9

+$20

0.1

-$100

Best decision:
Do not issue more CDSs
Expected share value up $10

Did they just not do the analysis?
If not, then what could have happened?
AIG Decision Structure

• Traders with bonus compensation to improve share price
• Relatively small movement in the share price can yield large increases in compensation
• Low downside risk due to severance terms
**Decision Tree for AIG Trader**

Best decision: Issue more CDSs  
Expected comp +$85MM  
All the analysis could have been correct – just with a different form of payoff.
Health Care Productivity Status

• Apparent decreased productivity in USA
• Wide variation in the quality of care and following of standard protocols
• Increased waiting times in emergency departments
• Paradoxes with principles:
  • Improvement by isolation as opposed to pooling
  • Increased inputs often yield decreased outputs
Incentive Issues in Health Care

• Agents compensated based on input not output
• Customers perceive utility from inputs before outputs
• Individual variation creates opportunities to exploit information asymmetries
• Fee-for-service favors over unnecessary tasks while capitation favors waiting time price controls
Hospital Emergency Departments

• Problem: Emergency departments appear to be over-crowded and over-used
• Why would this happen if everyone knows how to improve efficiency?
• Given that we observe this, what can be the explanation?
Decision Making for Hospital

• Suppose net income for a patient admitted directly is $2000/day
• Net income from a patient admitted from a patient from ED is -$1000/day
• Admitting from ED is $3000/day in lost opportunity
• Increasing efficiency in ED would increase losses
Improving Systems

• Inefficiencies:
  • Sports/entertainment
  • Politics
  • Finance
  • Health care

• Common:
  • Performance depends on perspective
  • Social optimum depends on aligning incentives
How to Align Incentives?

• Understand the goals and motivation of all those involved:
  • Customers
  • Suppliers
  • Employees
  • Politicians...

How to understand behavior?

• Structural estimation: observe actions and infer preferences
Understanding Incentives

• Production choices:
  • Electric power generation:
    ▪ Risk aversion and cross-market power
  • Health care
    ▪ Value of patients from the ED versus those from other services
    ▪ Value to physician of increased testing versus health outcomes
  • Finance
    ▪ Motivation for choices in economic capital

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What Can IE’s Do?

• Recognize the situation
• Model the decision-maker’s self interest (who) and show how to construct systems that align incentives at the outset
• Ensure the use of all the available information (what you know)
• Recognize and model what you do not know
Conclusions

• IE has done a great deal to improve lives of many and to increase productivity dramatically in the past 100 years
• IE is not always effective in areas such as services with many possible output measures and varying perspectives
• Being more effective requires recognizing:
  • Who is making and affecting decisions
  • What their interests are
  • An integrative view of all system components
• Expanding IE’s effectiveness in broader services is possible by examining choices, using data, and creating proper incentives
Thank you!

Questions?