**Networks, Information and Information Worker Productivity**

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**Why Information Workers?**

Information and Non-Information Work as a % of Employment in the U.S. 1960 - 2000


- **Information Work**
  - 70% of labor force; 60% of GDP of US
  - Neo-Classical Production Theory & Task Level IT Productivity Studies
  - Focused Here

- **Non-Information Work**
  - IT & Information Arguably Most Important Here

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Why Information Workers?

“To make knowledge work productive will be the great management task of this century, just as to make manual work productive was the great management task of the last century.”

—Peter Drucker (1969)

“Alas, there is no Frederick Taylor equivalent for knowledge work. As a result we lack measures, methods and rules of thumb for improvement. Exactly how to improve knowledge work productivity... is one of the most important economic issues of our time.”

—Tom Davenport (2005)

Research Questions

Question 1: How do network structure and access to information impact the productivity of information workers?

Question 2: Does network structure impact the distribution and flow of information among actors? And, can this explain productivity differences?
Fundamental Questions for Yahoo!

- **Internal Organization:**
  - How do organizational structures, team assignment, job rotation, geographic dispersion and lines of communication impact the creativity, innovation, agility, and productivity of Yahoo! employees?

- **Value of a Networked Yahoo User:**
  - How does the network structure of user interaction within and across Yahoo! 'properties' impact users’ frequency of use, property uptake, the success of marketing dollars, and the “networked value” of a given user?
The Study: Executive Recruiting

The Data: Unusually Measurable Inputs and Outputs

- A medium sized E.R. firm, 13 locations throughout the U.S.
- Interviews with employees across org. levels
- ~1400 total projects over 5 years (2000 to 2005)
- A survey of employees’ IT and information seeking practices (87% response rate)
- 600,000 email messages over 10 months
- Analyses at the Individual Level and Team Level

Several Measurable Outputs

i. Revenues per person and per project
ii. Number of completed projects
iii. Duration of projects
iv. Number of simultaneous projects
v. Compensation per person

The Setting: Executive Recruiting

Executive Search Process

A Phased Search & Matching Process with Information inputs & outputs

Recruiters access information in two ways:

- Technological
  1. Executive Search System
  2. External DBs
  3. Internet (e.g. HotJobs, Monster etc)

- Social
  - Phone
  - eMail
  - F2F
**How** do Information and Networks impact productivity?

~ A Preview of the Results ~

- Interviews indicate that productivity can be measured by how many contracts the firm executes per unit time - Firm earns revenue by filling positions for clients
- But, employees also vary the number of projects they take on simultaneously.

**Email Habits Reveal Work Patterns**
Measuring Information Flows in Email

“Betweeness” “Constraint” “Reach”

Statistically controlled other factors

1. Project Characteristics
   - Job Type (CEO, CIO, COO etc.)
   - Revenue Value - Priority
   - Task Characteristics (Routineness, Interdependence – Survey)
   - City Characteristics — Can influence attractiveness of jobs
     Collected independent data on: cost of living, environmental conditions, tax rates, health care, crime rates, education, weather conditions and the average commute time to work.

2. Characteristics of Individual Recruiters
   - Traditional Human Capital: Education, Industry Experience, Managerial Level
   - Unobservable Characteristics (e.g., Ambition)

3. Team Characteristics: Size

4. Variation over Time
   - Seasonality — monthly
   - Transitory Shocks — yearly & month/year
What Drives Revenue Generation?

1. A worker generates $2149.19 per project, per day for the firm.
2. Multitasking associated with increases in completed projects & revenues.
3. Speed associated with increases in completed projects & revenues.
4. But, Multitasking slows you down.
5. Inverted-U shaped relationship between Multitasking and Output

"Everyone can only deal with so many balls in the air. When someone gets 'too far in' [takes on too many projects] they lose touch. They can't tell one project from another."

—CIO

Multitasking, Duration and Work Completion Rate

Completed Projects

Completed Projects

Time
## How do networks impact productivity?

<table>
<thead>
<tr>
<th>Betweeness</th>
<th>Multitasking</th>
<th>Productivity</th>
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<tbody>
<tr>
<td>Probability an actor falls on the shortest path between any two other actors</td>
<td>Up</td>
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<th>Constraint</th>
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<td>Degree to which an actor’s contacts are connected to each other</td>
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<td>Number of other people an actor can reach in two links or less</td>
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## IT Use Habits of Heavy Multitaskers

- More Face Time
- Asynchronous electronic communication: More Email, Less Phone.
- Heavy Users of Automated and Electronic Data – (DBs, Intranets)
  - Project Coordination – anti-poaching
  - Cross Project Info Seeking
  - Need more information relevant to more searches.
- Use DB and Email Together: Information Seeking and Information Communication are Complements
IT Use Habits of *Effective Multitaskers*

- Multitasking (~ 3 more projects) reduces project completion rate by ~ 15%
- Face to Face contacts do not speed work
- 10 more Phone Contacts speeds work by ~ 11%
- 15% more DB Use speeds work by ~ 12%
- DB Use is the most significant driver of speed

**Question 2**: Does network structure impact the distribution and flow of information among actors?

Are diverse network structures associated with access to diverse information?

Can network position impact access to strategic information?
Do Diverse Networks Access Diverse Information?

**Measuring Information “Diversity”**

**Vector Space Model**

Represent each email as a multidimensional vector of topic frequencies

Represent In-boxes and Out-boxes as collections of email vectors

Measure ‘variance’ of the vectors in someone's in-box or out-box

E.g. Variance of cosine distances between email vectors and information theoretic measures

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**Do Diverse Networks Access Diverse Information?**

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<th>Unique Information per Contact</th>
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Networks & Access to Strategic Information

- If a strategic piece of information entered the firm, could network position affect who became aware of it? Or who became aware of it sooner?
- “Strategic” Information: A job opening, a candidate name, rumors of dissatisfaction at a source firm, a news item...
- We categorized words by type based on usage statistics:

![Graphs showing Common Words, Event Words, and Clique Words]

- Analysis ongoing. Initial results: network position affects who sees strategic information and who sees it sooner.

The “Networked Value” of a Yahoo User...

- A proposal for research submitted to Bassel Ojjeh and Pavel Berkin in March 2006.
- Exploration of “local network externalities” in the use of Yahoo properties.
  - Network effects are ‘local.’
- How does the structure of relationships across users impact use behaviors, likelihood of revenue generation, value?
- How does the structure of relationships across properties impact use behaviors, likelihood of revenue generation, value?
Productive Information Workers

Work Flow / Work Process:
✓ Are Multitaskers,…
✓ Who know their limits! How many projects are too much?

Information Habits:
✓ Use automated and electronic data bases
✓ And have strong IT skills
✓ Use Email more to support Multitasking
✓ Use phone selectively for high impact
✓ Communicate with a diverse set of people
✓ Are “Go-Betweens” or “Communication Brokers”
✓ Have networks that reach deep into the organization

Symptoms of Ineffective Information Workers
✓ Use Technology, but don’t multitask
✓ Multitask, but don’t use Technology
✓ Take on too much… too many balls in the air
  ➢ Balls get dropped, Speed goes down
✓ Have poor technology skills
✓ Communicate with a limited number of people
✓ Communicate with the same types of people in the same department or on the same organizational level
✓ Are peripheral to the information flow
How Productive Are Your Information Workers?

Thank You!

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