Many organizational innovations emphasize **learning*** via **job design**
- 1950s+: TQM; lean production; continuous improvement
- 1970s+: “high performance” work systems; decentralization
- 1990s+: ICT **augmenting** high-skilled work; data-driven mgt.

These are key topics in social psychology ... but in econ. & mgt. acct.?
- Lazear 1992: job = promotion slot
- Holmstrom & Milgrom 1991: job defined by performance measures
- Jensen & Meckling 1992: **specific v. general knowledge** → (de)centralization
- Lindbeck & Snower 2000: **multitask learning**

*info.; knowledge; improvements; creativity ... attention; retention; cognition
What Is Organizational Change in Britain?

<table>
<thead>
<tr>
<th>OC affecting nonmanuals</th>
<th>OC affecting manuals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Have more or less responsibility?</strong></td>
<td><strong>B. Have to work at a more or less skilled level?</strong></td>
</tr>
<tr>
<td>More</td>
<td>Same</td>
</tr>
<tr>
<td>0.462</td>
<td>0.465</td>
</tr>
<tr>
<td><strong>C. Effect on range of tasks performed</strong></td>
<td><strong>D. Have more interesting or less interesting jobs to do?</strong></td>
</tr>
<tr>
<td>Wider</td>
<td>Same</td>
</tr>
<tr>
<td>0.625</td>
<td>0.281</td>
</tr>
<tr>
<td>More</td>
<td>Same</td>
</tr>
<tr>
<td>0.639</td>
<td>0.235</td>
</tr>
</tbody>
</table>

These are the answers given by senior managers to various questions on the effects of organizational change asked in the 1984 WIRS. The questions were only asked if some organizational change had taken place over the past three years. The answers to the questions read as follows. For question A 46.2 percent of managers in the whole sample say that workers (as a whole) had more responsibility following OC (that mainly affected nonmanuals) 45.5 percent say responsibility has remained the same, and 2.5 percent say it has decreased. D/K = don’t know or not answered. There are 413 (436) observations for the nonmanual (manual) responses.

Modern” v. “Classical” Job Design

<table>
<thead>
<tr>
<th>Marginal Probabilities</th>
<th>Predicted</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>L (+ median)</td>
<td>M (median)</td>
<td>H (&gt; median)</td>
</tr>
<tr>
<td>Skills</td>
<td>0.251</td>
<td>0.540</td>
</tr>
<tr>
<td>Discretion</td>
<td>0.190</td>
<td>0.610</td>
</tr>
<tr>
<td>Multitasking</td>
<td>0.194</td>
<td>0.603</td>
</tr>
<tr>
<td>Interdependence</td>
<td>0.185</td>
<td>0.619</td>
</tr>
</tbody>
</table>

Source: Gibo, Levenson, and Zoghi (2010)

HHHH & LLLL both positively related to computer use; HHHH to R&D
Intrinsic motivation from job design is a key concept in social psychology, also mostly ignored in economics & accounting
- Becker 1970s; Skitovsky 1976; Frey 1990s; Bénabou & Tirole 2000s: pro-social i.m.
- Murdock 2002: incentives with “Task Significance” (see next)
- Prendergast 2007, 2008, 2013: incentives & selection with i.m. from some tasks
- no consideration of how intrinsic motivation relates to learning

empirical
- many lab experiments
- small # in organizational settings (appendix)
- Chen, Xu, Du & Zhang GMARS 2019

Controversy: do extrinsic rewards “crowd out” intrinsic motivation?
- Abdel-Rahim, Liu & Stevens GMARS 2019

“HUMAN BEINGS ARE HARD-WIRED TO LEARN”

Psychological Model of Intrinsic Motivation

Source: Hackman and Oldham (1976)
**NEUROSCIENCE OF INTRINSIC MOTIVATION**

[Oudeyer, Gottlieb & Lopes 2016; Domenico & Ryan 2017]

- “Intrinsic motivation is clearly visible in young **infants**.”
- “... situations with **novelty, complexity & prediction errors** fostered memory retention ... brain is equipped with neural circuits which consider information as an intrinsic reward, & thus actively searches for these situations ...”
- “... intrinsically motivated **exploratory & mastery behaviors** are phylogenetically ancient tendencies ... subserved by **dopaminergic** systems”
- “... curiosity, exploration & mastery behaviors pertain to specific types of novel stimuli, namely, those that present **optimal challenges or optimal inconsistencies with one’s extent knowledge** ...”
- “... whereas **too much** novelty relative to a person’s skill & knowledge produces anxiety, **too little** novelty produces to boredom.”

**JOB DESIGN & LEARNING**

- Worker performs **n** tasks, with **Intertask Learning** $\bar{k}$
  - doing a task has spillovers to other tasks
  - only relevant with multitasking, $n \geq 2$
  - $0 \leq \bar{k} < 1$
  - $E\bar{k} = k; controllable$ if worker observes, otherwise **uncontrollable**
- multitasking $\rightarrow$ **Skill & Task Variety**
- **Task Identity**: combine most interdependent tasks to maximize $k$ (modularize)

- Worker output: $Q = \sum q_i e_i = \sum_{i=1}^{n} (q + x_i + \bar{k} \sum_{j \neq i} (q + x_j)) e_i$
  - marginal product of effort = $q_i \geq 0$
  - task-specific: $q = \text{average}; x_j = \text{variation}, \sum x_j = 0$
  - **learning**: $\bar{k} \sum_{i=1}^{n} (q + x_i)$
**INTRINSIC MOTIVATION**

- Utility = \(\alpha E[Q] + E[Pay] - \frac{1}{2}R\sigma_{\text{pay}}^2 - \frac{1}{2}C(k, n)\sum_{i=1}^{n} e_i^2\)

- \(\alpha < 1\) = Task Significance: intrinsic motivation from the product itself

- \(C(k, n)\) = marginal disutility of effort
  - \(C_k < 0\) = Growth Need Strength: intrinsic motivation from learning \(k\)
  - \(C_n > 0\) for \(n \geq n_d\) = disutility from too much multitasking

- \(R\) = income risk aversion
  - interesting, ignored: effort risk aversion

**EVALUATION & INCENTIVES**

- Performance measure:
  \[P = \sum p_ie_i + \bar{\varepsilon} = \sum_{i=1}^{n}(q + y_i + \bar{k}\sum_{j\neq i}(q + y_j))e_i + \bar{\varepsilon}\]
  - \(P\) is a distorted (non-congruent) version of \(Q\) if \(\sigma_{xy} < \sigma_{x}^2\)
  - \(p_i < 0\) would motivate manipulation

- Pay = \(S + bP\)

- \(\max_{e_i} \alpha E[\sum q_ie_i] + S + bE[\sum p_ie_i] - \frac{1}{2}Rb\sigma_{\varepsilon}^2 - \frac{1}{2}C(k, n)\sum e_i^2\)
  \[\Rightarrow e_i^* = \left(\frac{\alpha E(q_i)+bE(p_i)}{C}\right)\]
LEARNING & MOTIVATION

\[ e^*_t = \left( \frac{\alpha E(q_i) + bE(p_i)}{C} \right) = \frac{\alpha(x_i + k \sum_{j \neq i} x_j)}{C(k,n)} + \frac{b(y_i + k \sum_{j \neq i} y_j)}{C(k,n)} \]

- Learning improves productivity ... & also has 3 motivational effects

\[ \frac{\partial e^*_t}{\partial k} = \frac{\alpha \sum_{j \neq i} x_j}{C} + \frac{b \sum_{j \neq i} y_j}{C} - \frac{\alpha E(q_i) + bE(p_i)}{C^2} \frac{C_k}{C} > 0 \]

- Direct: Growth Need Strength \( C_k \)
- Indirect: reinforces motivation from Task Significance & Incentives

MULTITASKING & MOTIVATION

- Effect of multitasking on effort is ambiguous

\[ \frac{\partial e^*_t}{\partial n} = \frac{\alpha kq + bkq}{C} - \frac{\alpha E(q_i) + bE(p_i)}{C^2} \frac{C_n}{C} \geq 0 \]

- More tasks \( \rightarrow \) more learning, but more disutility if too many tasks
  - optimal # of tasks depends on \( k \), costs of multitasking
    - lost specialization in skills & training
    - task coordination & switching costs
We are designing the job to *create* “knowledge”
- **controllability** is endogenous to job design

**Task & Skill Variety** → learning
- better information, improving decisions
- human capital
- continuous improvement
- innovation
  ✓ often complex, experiential, subjective → “specific” (costly to communicate)
  ✓ generated & used more effectively if worker can experiment & change methods

To capture this idea, assume
- **no delegation**: worker knows \( k \) but not actual rate of learning \( k \)
- **delegation**: worker observes \( k \) before choosing effort
- **Autonomy + Feedback** = decentralize to use specific knowledge

---

**SPECIFIC KNOWLEDGE & CONTROLLABILITY**

**OPTIMAL INCENTIVE**

Optimal \( b \) maximizes \( E[\text{total surplus}] \):

\[
\max_b (1 + \alpha) E \sum q_i e_i - \frac{1}{2} Rb\sigma_e^2 - \frac{1}{2} C(k, n) \sum e_i^2
\]

subject to \( e^* \) derived above

**No delegation** (does not observe \( k \)): \( b^*_d = \frac{\sum E(q_i)p_i}{\sum E(p_i^2) + RC\sigma_e^2} \)

**Delegation** (observes \( k \)): \( b^*_d = \frac{\sum E(q_ip_i)}{\sum E(p_i^2) + RC\sigma_e^2} \)
DECENTRALIZATION?

\[ b_d^* = \frac{\sum E(q_i)E(p_i)}{\sum (E(p_i))^2 + RC \sigma_E^2}; \quad b_d^* = \frac{\sum E(q_i(p_i))}{\sum E(p_i^2) + RC \sigma_E^2} \]

- If \( P = Q \), \( b_d^* > b_d^* \) & surplus are higher with delegation

- If \( P \neq Q \), \( b^* \) might fall with delegation
  - \( P \) highly distorted or manipulable \( \rightarrow \) learn how to do what is rewarded, not desired
  - for reasonable measures, would expect stronger incentive with delegation

Decentralization helps even with no incentive, if there is intrinsic motivation from Task Significance
- use knowledge to improve achievement of objective
- feedback can reinforce, but only if reasonably correlated with objective

HOW DOES LEARNING AFFECT OPTIMAL INCENTIVES?

\[ b_d^* = \frac{\sum E(q_i)E(p_i)}{\sum (E(p_i))^2 + RC \sigma_E^2}; \quad b_d^* = \frac{\sum E(q_i(p_i))}{\sum E(p_i^2) + RC \sigma_E^2} \]

- If \( P = Q \), \( \frac{\partial b^*}{\partial k} > 0 \) (with or w/out delegation)
  - \( k \uparrow \rightarrow \) marginal product of effort \( \uparrow \), while marginal disutility of effort \( \downarrow \)

- If \( P \neq Q \), \( b^* \) might fall with stronger learning
  - \( P \) highly distorted or manipulable \( \rightarrow \) learn how to do what is rewarded, not desired
  - for reasonable measures, would expect stronger incentive with stronger learning
DO INCENTIVES UNDERMINE INTRINSIC MOTIVATION?

\[ b_d^* = \frac{\sum E(q_i)E(p_i)}{\sum (E(p_i))^2 + RCa^2} \quad ; \quad b_u^* = \frac{\sum E(q_i)p_i}{\sum E(p_i^2) + RCa^2} \]

- Intrinsic motivation from Task Significance \( a \) is not affected by \( b^* \)
  - however, such intrinsic motivation reduces distorted behavior & manipulation

- Intrinsic motivation from learning (GNS) & incentives are complements
  - \( C_e < 0 \)
  - for same \( b \), effort is higher for employee with more GNS
  - for employee with more GNS, \( b^* \) is higher
  - true even for distorted performance measures \( P \neq Q \)

- Incentives can undermine creativity (via \( P \neq Q \)) ... but not motivation

EXTENSIONS

- Long-term benefits of learning \( \rightarrow \) ↑ effect on motivation & incentives

- Relationship of learning to
  - job rotation, teams, social networks
  - employee tenure, experience; firm-specific v. general learning; turnover rate

- Does learning \( \rightarrow \) degrading of measures is faster / more likely?
  - Courty & Marschke 2004

- Effort risk aversion?

- Don’t forget the other organizational design for learning
  - “Classical” / Taylorism: ex ante optimization; specialization; centralization
  - works well when best practices can be figured out, implemented cheaply
  - Labro, Lang & Omartian GMARS 2019
RESEARCH QUESTIONS

- Is learning an important source of intrinsic motivation?
  - how significant is variation in Growth Need Strength?

- Can jobs be designed to tap this form of motivation?
  - do firms modularize to put the most interdependent tasks in jobs, teams?
  - is augmentation via technology more prevalent with “Modern” job design?

- How does decision making vary with the importance of learning?

- How does evaluation vary with the importance of learning?
  - metrics: broader; outputs v. inputs; intangibles; improvement; innovation
  - more subjective evaluation; emphasis on coaching v. feedback

- How do incentives vary with intrinsic motivation?
  - esp. in jobs with significant learning
  - do incentives undermine intrinsic motivation, or just outcomes associated with it?

DATA: INTRINSIC MOTIVATION & LEARNING

- Intrinsic motivation
  - fMRI!
  - Growth Need Strength; e.g., Hackman & Oldham Job Diagnostic Survey
  - cognition, time allocation to different tasks
  - past behavior, performance, innovation
  - selection into org. (recruitment, non-profit)

- Learning (broadly defined)
  - changes in performance indicators
  - accumulation of skills
  - new ideas
  - creativity of output
  - collaboration, social networks
DATA: DECISION MAKING

- What types of decisions are delegated, how
  - what's controllable based on the job's design?
  - decision mgt. v. control; Fama & Jensen 1983

III. DECISION MAKING

Now we ask about decisions and responsibilities you have as department manager. For each decision listed, indicate whether the decision is:

1. Initiation
2. Ratification
3. Implementation
4. Monitoring

- tightness of monitoring & budgets
- exercise of discretion
- tools, information, training

DATA: THE JOB

- Technology Skills
- Tools Used
- Knowledge, Skills
- Work Activities, Context, Styles, Values
- Education, Credentials
“Human beings are hard-wired to learn”
- psychologists & neuroscientists suggest learning may be the most important source of intrinsic motivation
- firms can tap this via appropriate job design ...
- ... reinforced with decision making, evaluation, coaching, incentives, recruitment
- nicely complements common approaches in economics & management accounting

We can, & should, integrate learning-driven intrinsic motivation into economics & management accounting
- particularly relevant in modern economies
CAUSALITY?

- Field experiments

Change
- leadership / strategy / product / service emphasis
- new technology
- large-scale organizational change
- merger
- new regulation

RESEARCH ON LEARNING & INCENTIVES

- Significant literature in psychology, 1970s +
- Sprinkle TAR 2000: incentives increase intensity of effort at, & rate of, learning
- Campbell JAR 2008: higher promotion incentives → higher rate of learning
- Kachelmeier, Reichert & Williamson JAR 2008: inc. for creativity → creativity ↑, quantity ↓
- Campbell, Epstein & Martínez-Jerez JAR 2011: tighter monitoring → less use of decision rights or adjustment for new information
- Campbell JAR 2012: employee selected as mission-aligned → use discretion more, better
- Kolstad AER 2013: surgeon report cards → stronger intrinsic than extrinsic effect
- Abernethy, Dekker & Schulz JAR 2015: incentives & selection complements if org. committed to learning
- Casas-Arce, Lourenço & Martínez-Jerez JAR 2017: effective feedback detailed, not too frequent
- Gibbs, Neckermann & Siemroth 2017 REStat: incentives ↑creativity, don’t ↓intrinsic mot.
- Li & Sandino JAR 2018: information sharing improves creativity