Theories of delegation: information processing versus incentives

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Introduction

• Delegation should be an important topic within the theory of organizations.

• Not addressed much by "classical complete contract theory".

• Addressed partly by incomplete contract paradigm (ownership as "residual rights of control").

• This lecture: considers the issue of delegation from the point of view of information transmission (but see also Hart-Moore 2001 and Hart-Holmström 2002).

• Distinguishes two strands of literature: information processing in teams versus information transmission under incentive problems.
Outline:

1. Information processing and communication costs: internal organization and size of organization.

2. Incentive perspective:

   - 1. On the incentive not to be informed.

   2. Information and the exercise of "real" authority.

   3. Delegation and incentives to communicate.

   4. Delegation as a reputation-building device.

   5. Opening the "black box" of authority: "orders" versus "recommendations".
1. Information processing and communication costs

- Team-theoretic approach (no incentive problems).

- Takes "seriously" time to process information and to communicate it.

- Somewhat abstract: how much time does it take to communicate "summary information"?
Typical example (e.g. Radner 1993):

• Find the best investment project out of a set of $n$ projects.

• Evaluating one project "from scratch" takes one unit of time: \textit{information processing cost}.

• Reading one "report" about a project takes $\lambda < 1$ unit of time: \textit{communication cost}.

• Remark: can add variable communication cost (depending on "length" of report).
Reasons to engage in costly communication:

- Minimize delay (exogenous deadline, decay of information, ...).

- Exploit gains from specialization.

- Selected (recent) literature (see Van Zandt 1998 for a survey):
  
  - Radner (1992, 1993)
  
  - Radner-Van Zandt (1992)
  
  
  - Meagher-Orbay-Van Zandt (2001)
  
  
  - Garicano (2000)
  
  - Hart-Moore (2001)
1.1. Prediction 1: "who talks to whom"

- "Regular" hierarchy:
  - Delay: $n/4 + 4\lambda$ (with 7 individuals)
• Delay-minimizing one-shot hierarchy (Radner 1993)
  
  – Delay: $n/4 + 2\lambda$ (with 4 individuals).
  
  – Problem: "top" individual too busy.
Other ideas on internal organization:

- **Endogenous specialization:** with positive variable communication cost, longer reports should reach the top more quickly (Bolton-Dewatripont 1994).

- **Garicano (2000):** organization where less knowledgeable workers specialize in production and learn the most common problems, while specialized problem solvers focus on exceptions.

- **Hart-Moore (2001):** model of hierarchies based on the allocation of authority with limited time for individuals. Analyzes optimal chain of command with different tasks (coordination and specialization) and optimal boundaries of the firm. Also incentive interpretation.
1.2 Prediction 2: Endogenous project set and organization size

1.2.1. Example: constraint on delay

Organization that maximizes size of each project set (up to $N$) subject to maximum permissible delay, with costly processing time:
• Interpretation:

  – without time constraints, avoid communication costs: each individual works on a maximum project set (size $N$);

  – when time constraint become tighter, increase team size to benefit from parallel processing of maximum project set;

  – when tightness rises, start splitting work among smaller teams since forced to reduce project set.
• Other objective function that induces nonmonotonicity: deterioration of information over time (Radner-Van Zandt (1992) and Meagher-Orbay-Van Zandt (2001):

  – with costless processing time, size decreases in volatility of environment;

  – instead, with costly processing time, also inverted U-shaped relation with respect to volatility.
1.2.2. Time versus budget constraint (Bolton-Dewatripont 1995)

- Assume $\lambda = 1/2$.

- Assume each project ex ante worth 0 or 1 (with equal prob.).

- Have at most 3 individuals, that each cost $w$ per period.

- With one project that can be funded each period and $2w \leq (3/4 - 1/2) = 1/4$, have centralized organization, with one individual specialized in reading reports from the other 2.

- With 2 or 3 projects that can be funded each period, have decentralized organization, with 2 or 3 individuals identifying new projects and starting them each period.
2. Incentive perspective

- First wave of hierarchical models: efficiency wage perspective (Calvo-Wellisz 1978, 1979, Qian 1994): with more subordinates, less time to monitor each of them and need to raise their wage to induce effort.

- Second type of models: when principal has commitment problems, may be good to try and delegate/be less informed about agent, because:
  - it makes you tougher (Crémer 1994, Dewatripont-Maskin 1995).
– in any case, little information will reach you (Dessein 2002).

– it makes the agent trusts you more (Dessein 2001).

– it allows the principal to test the agent (Aghion-Dewatripont-Rey 2002).

• Question: how can delegation be made credible?

– Through asset sale?

– Through time constraints, as in team literature?
2.1. Incentive not to be informed about subordinates

2.1.1. Arm’s length relations (Crémer 1995)

- Two-period principal-agent problem, where the principal cannot commit to keep or replace agent after first period.

- In integrated firm, principal observes agent’s intrinsic talent, and prefers to keep him iff high talent, independently of first-period effort.

- Under delegation/arm’s length relation, only output is observed, and it becomes profitable to keep the agent iff high first-period output, which raises effort.
• Similar idea: sunk costs and *soft budget constraint* (Dewatripont-Maskin 1995): decentralization of credit reduces information about continuation value of the project and hardens budget constraints.
2.1.2. Outside hiring and the "chain of command" (Friebel-Raith 2000)

- Principal-supervisor-agent model where the principal has to rely on supervisor to hire/replace agent.

- Principal may want to commit not to communicate directly with agent about productivity of supervisor in order to lower the threat of being replaced by the agent, which might induce him to hire "less threatening", i.e. weak agents.

- Limiting communication in this way may be better than protecting supervisor through severance pay.
2.2. Formal and real authority: the Aghion-Tirole (1997) model

• Noncontractible action: "choosing a project" to work on.

• $N \geq 3$ potential (initially indistinguishable) projects.

• Project $k (= 1, 2, 3)$ gives the principal a private benefit $B_k$ and the agent a private benefit $b_k$.

• One project bad enough that choosing at random worse for both than doing nothing (gives them 0).

• Best project for the principal gives him $B > 0$ while gives the agent $\beta b > 0$; best project for the agent gives her $b > 0$ and gives the principal $\alpha B > 0$. 
• $\alpha$ and $\beta$ are the "congruence parameters" (positive but $< 1$).

• Remark: fair amount of congruence:
  
  – both parties agree that choosing at random is worse than doing nothing;
  
  – both parties prefer the other one to choose his/her favorite project rather than doing nothing.

• Information acquisition:

  – the principal can at cost $g_P(E)$ (increasing and convex in $E$) become fully informed with probability $E$ about project benefits, while he remains fully uninformed with prob. $1 - E$.

  – the agent can at cost $g_A(e)$ (increasing and convex in $e$) become fully informed with prob.
about project benefits, while she remains fully uninformed with prob. $1 - e$.

- **Timing:**
  - stage 1: contract;
  - stage 2: (simultaneous) effort to acquire information;
  - stage 3, a decision can be taken on which project to pursue, if any.

- Assuming away any monetary responsiveness for the two parties, the contract is a *formal* allocation of authority for stage 3: who has the *right* to take the decision.

- Different from *real* authority: who *actually* takes the decision:
– a party endowed with formal authority will choose a project only if he/she is informed about project benefits;

– otherwise, he/she will transfer authority to the other party (equivalently, ask the other party for a recommendation and follow it).

– this party will choose a project/make a recommendation only if he/she is informed about project benefits.

– otherwise no project is undertaken.

• Payoffs for a given pair \((E, e)\):

• Formal authority for the principal:

\[
U_P = EB + (1 - E)e\alpha B - g_P(E)
\]

\[
U_A = E\beta b + (1 - E)eb - g_A(e)
\]
First-order conditions:

\[(1 - \alpha e)B = g'_P(E)\]

\[(1 - E)b = g'_A(e)\]

- Higher effort \(E\) by the principal crowds out effort \(e\) by the agent: the agent understands that her effort matters with a lower prob.

- Potential gain for the principal to commit to exerting lower \(E\), for example by choosing an agent who is more congruent with him (higher \(\alpha\)).

- Another option for the principal to raise \(e\): delegate formal authority. In this case:

\[U^D_P = e\alpha B + (1 - e)EB - g_P(E)\]

\[U^D_A = eb + (1 - e)E\beta b - g_A(e)\]
First-order conditions:

\[(1 - e)B = g_P'(E)\]

\[(1 - \beta E)b = g_A'(e).\]

- The agent exerts more effort and the principal exerts less effort under delegation (the two effort levels are strategic substitutes).
2.3. Delegation and communication in organizations

- Dessein (2002): an uninformed principal may want to delegate authority to an informed-but-biased agent instead of trying to elicit necessarily noisy information from her:

  - decision to be taken: \( y \in [0, 1] \).

  - best decision: \( m \) for principal, \( m+b \) for agent.

  - only agent knows value of \( m \).

  - without delegation, agent only partially communicates value of \( m \): coarse partition (Crawford-Sobel 1982). Then principal takes best decision based on this imperfect information.
– with delegation, agent chooses best decision except for bias.

– when bias $b$ goes down, both outcomes become better (partition becomes finer without delegation).

– but whenever nonzero communication takes place without delegation, delegation is in fact optimal!
• Dessein (2001):
  
  – a partially informed principal may want to relinquish (partially effective) *formal* authority to a partially informed agent;
  
  – this *signals congruence* and increases the principal’s *real* authority when, ex post, only the principal is informed.

• Aghion-Dewatripont-Rey (2002): an uninformed principal may initially want to relinquish partial (formal) authority to an agent of unknown trustworthiness, in order to learn about her type.
2.4. Transferable control and reputation (Aghion-Dewatripont-Rey 2002)

- Two-stage project (design and implementation), preceded by a contracting phase.

- Design stage: several possible projects, including “agent’s favorite project” and “principal’s favorite project”, as in Aghion-Tirole.

- Implementation stage: principal decides to (have agent) implement the project, or to stop it.

- Agent can be “good” (i.e. highly congruent with the principal) or “bad” (not very congruent).

- Initially, principal has prior prob. $\mu$ that agent is bad.
Specifically:

- in stage 1, design decision has to be made; principal can either choose the project or let agent choose it (two cases: control over design contractible versus transferable); decision itself observed by both parties but not contractible.

- in stage 2, principal freely decides to implement the project or not; this decision is not contractible and cannot be delegated to the agent.
Payoffs of the principal and the agent:

• The project is worth implementing for the principal only if the agent is good, while the agent always favors implementation.

• Good agent happy with principal’s favorite design, but really cares that the project be implemented.

• Bad agent cares more about getting favorite design picked than about whether implementation actually takes place or not.

• Principal incurs a loss when her own favorite project is not selected, but an even bigger loss from implementing the project when the agent is bad; principal thus possibly willing to let a bad agent choose his favorite project to learn his type (and stop the project in stage 2).
• Incomplete information about agent type when implementation comes generates two problems: (i) when $\mu$ is too large, project is not implemented; (ii) when $\mu$ is small, principal implements project, but makes a loss when agent is bad.

• How can contracts get around this? With pure private benefits, contracts are revelation mechanisms to be played at the beginning of each stage: as a function of messages sent at the beginning of stage 1, control over project design is allocated to the agent or kept by the principal, and given the messages exchanged between the two parties up to stage 2, the principal decides whether to implement the project.

• Remark: generalizes to monetary responsiveness.
2.4.1. Contractible control

When control over stage 1 action is contractible, the optimal revelation mechanism for the principal is such that:

- she keeps control in stage 1 when agent announces a good type;

- she allocates control to agent with some probability when agent announces a bad type.

- in the associated equilibrium, when in control the (bad) agent chooses his favorite project while the project is implemented if and only if the agent announces a good type.
Intuition:

- giving away stage 1 control is costly when agent is bad;

- better therefore to limit the prob. it happens.

- this requires knowing agent type before control allocation: need *commitment ability* (once principal knows agent is bad, would like to keep control!).

- if not possible: transferable control case.
2.4.2. Transferable control

When control over stage 1 action is transferable but not contractible, the optimal mechanism for the principal is such that:

- no messages are sent, before stage 1 or afterwards;

- principal transfers control over stage 1 action to agent if $\mu$ (prob. that agent is bad) is not too high and keeps control (and stops the project in stage 2) otherwise;

- if agent obtains control in stage 1, he chooses principal’s favorite design if he is good and own favorite design otherwise, and principal implements the project if and only if her favorite design was chosen.
Intuition:

- “testing” agent by giving him control over stage 1 gives him an opportunity to build a reputation for trustworthiness, and allows principal to cooperate if and only if profitable for her.

- cost is that agent’s favorite design is chosen in stage 1 by the bad agent; when $\mu$ is too high, the stage 2 benefit for the principal is too small compared with this cost from a bad agent.

Remark: when control is contractible, optimum for principal is a direct revelation mechanism, not this trust-building scheme; better because bad agent obtains stage 1 control with lower prob.
2.4.3. Foundations for transferable control

Comparing with the Aghion-Tirole setup:

- information structure: in Aghion-Tirole, both parties initially uninformed about project returns but know the degree of congruence.

- here instead, principal knows project returns, but not the degree of congruence; important because may have to rely on agent in stage 2.
Transferable control:

- assume formal authority is contractible but agent *initially uninformed* about project returns; then, to make stage-1 decision, needs information from principal;

- assume principal *cannot commit to transmit appropriate information* (could decide to only tell agent about her own favorite design, not agent's).

- once principal has transmitted information, control has been *irreversibly* transferred: once agent has formal authority and knows his own favorite design, will choose it.

- transferring “real control” in stage 1 implies that principal informs agent about both favorite designs: *true delegation here (in contrast with Aghion-Tirole)*, *motivated by the concern for future cooperation*. 
Conclusion

• Both the communication-cost-in-teams approach and the communication-and-incentive approach offer rich predictions on delegation and therefore both on internal organization as well as on boundaries between organizations.

• Common elements in both approaches: in particular, role of time constraints in pushing for delegation, both when these constraints are exogenously given and when they are endogenously created (as a commitment device!).
• Some avenues for research:

  – investigate more in-depth the limitations on communication due to time constraints within organizations in the presence of incentive problems.

  – investigate further the question of partial communication/delegation (e.g. recommendations vs orders).

  – link the question of communication with that of delegation in the presence of heterogeneous tasks (Hart-Moore 2001) and heterogeneous preferences (e.g. Hart-Holmström 2002).