

12. Organising a Network of Subcontractors

This follows Chapter 13 of McMillan closely.¹ He makes some assumptions about the material under incentives and contracts in Chapters 8, 9, and 10 that we haven't covered in class.

How do firms set incentives for their subcontractors? Illustrate the ideas of bargaining, contracting, and bidding.

Japanese (J) industry: close and extensive links between manufacturers and their parts suppliers. MITI: "J manufacturing industry owes its competitive advantage and strength to its subcontracting structure". Perhaps a $\frac{1}{4}$ of J cost advantage?

J firms with fewer than 50 employees account for 23% of the value of manufacturing-industry shipments: ratio of inputs purchased to outputs averages 69%.

1. See his article, "Managing Suppliers: Incentive Systems in Japanese and U.S. Industry," *California Management Review*, **32**(4), Summer 1990.

US industry began to change, to more closely resemble J in these measures: because of the success of J methods of organising production. Gains and losses from making increasing use of subcontractors?

12.1 Principal-Agent Theory and Business Practice

Principal-agent theory recognises the difference in bargaining power between the large buying firm and the smaller suppliers. The principal — here the buying firm — is modelled as being able to design the transaction and set the terms of exchange.

The agent — here the supplying firm — has two things going for it:

- its ability to reject a proposed contract, which it will rationally do if it has a more profitable alternative;
- knowledge is power: as a specialist, the supplier knows more about the production conditions than does the buyer. It can use this to advantage in negotiations.

J subcontracting firms are not without alternatives:

single customer	17% of suppliers
two customers	20%
three to five customers	26%
six or more customers	36%

Over $\frac{1}{2}$ subcontractors said they wanted increase their number of buying customers.

12.2 Incentives for Cooperation

Ongoing relationships can serve in place of formal contracts in creating incentives for cooperative behaviour.

An alternative to contracts is an on-going relationship. Buyer–seller relationships can have the character of a PD: each party's pursuit of immediate gain can lead to a non-Pareto outcome, with no gains to trade. Contracts are one way around this, but in a repeated relationship, concern for the future may prevent a firm from squeezing its trading partner.

In repeated game, players cooperate now for fear of future retaliation. But this is not guaranteed: repetition may support cooperation but not necessarily. Other repeated outcomes reflect rational players seeking all short-term gain. No one player can ensure the efficient outcome of cooperation in a repeated PD: it requires a coordinated change. Instead of mutual cooperation, the system might be stuck without formal contracts.

Maintenance of ongoing cooperative relationships is easier in J industry than in US

- J firms deal with far fewer suppliers than do US firms,
- equity ownership and interlocking directorships too

Suppliers are identified: “Mitsubishi group,” “Nissan group”, etc.

But dangerous to exaggerate this:

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Toyota owns more than 50%	7 suppliers
Toyota owns less than 50%	25
Toyota owns no equity	148

- suppliers are not monogamous (cars, semiconductors)

12.3 Specific Investment

The manufacture of an item requiring some specific investment cannot be contracted to another firm unless short-term profit seeking can be curtailed, and can be seen to be curtailed.

Car manufacturer Helixmobiles negotiating with an electrical manufacturer Sparks for a contract to supply some generators. Requires specific investment by the subcontractor, only valuable for the Helix account. Sparks look forward and reasons backward: “Once the price is agreed and the investment made, Helix has us. Even if the price as negotiated was high enough to cover the investment costs, what’s to stop Helix renegotiating the price down? So long as we cover variable costs, it’s rational for us to agree, even if we can’t cover the fixed costs of the investment.”

This perverse outcome might prevent gains from trade being realised, if the supplier baulks — an inefficient outcome. Requires a *credible commitment* not to renege on the part of the buyer.

Ways out of this dilemma:

1. an irrevocable contract not to renegotiate; but never specify all possible contingencies, so loopholes exist
2. the incentives in ongoing relationships: Helix’s reputation for honest dealing is valuable, since renegeing on this would make future business more expensive for Helix

3. obviate the need for commitment if the supplier and the purchaser were the same firm — no perverse incentives: produce generator in-house.

The *make-or-buy* decision is conditioned by specific-capital effects: Ford and GM, complex or highly specialised items in US aerospace. (i.e. 3.)

But in J different: Toyota subcontracts to “first-tier” subcontractors not just parts manufacture but also some models’ entire design and manufacture. Considerable specific investment by first-tier subcontractors: those with the longest-standing relationships with the buyer, the most. (i.e. 2.)

Common practice in semiconductors is a firm with a new proprietary product to licence its manufacture to *competing* firms. Contrary to its interests to abandon its monopoly? Well, perhaps *an efficiency-enhancing form of commitment*: if a monopoly, buyers might be loath to undertake necessary specialised investment, lest they be squeezed in later renegotiation. By licensing the technology, the innovator makes *an irrevocable commitment* not to renege, since buyers have alternatives. Expand the market for new technology, even if the innovator ends as one of several competitors instead of monopoly supplier.

12.4 Subcontracting v. In-House Production

A firm should contract out the production of a component when outside production costs less than in-house production.

- *Opportunity cost.* Not only direct costs (outgoings) but also indirect costs (sacrificed). A firm's opportunity cost is the actual cost of production plus any profits it could have earned from the next-best alternative uses of its capital and labour resources.

For make-or-buy, a firm is contractually bound to at least part of its work force: firm is not free to hire and fire solely on its level of work, so the opp. cost of in-house production is higher when they're already fully employed than when some are underemployed. In-house production is less costly when demand falls, so contracting-out contracts in a recession: make rather than buy.

- *Quality.* Quality is the inverse of quantity, so cost should include quality, since low-quality parts can be expensive for the buyer even if the price is low. Reliability and timely delivery are further aspects of quality.
- *Capability of in-house production.* Having the option of in-house production strengthens the buyer's bargaining position. Both Ford and Toyota have expanded their in-house electronics capacity, on the grounds of the increasing importance of electronics in modern cars.

Cost comparisons are the strongest predictor of the make-or-buy decision. Stated reasons in order of popularity: “

1. subcontractors have expert skills that the parent company doesn't have
2. parent company can concentrate on its area of speciality by subcontracting
3. costs of production by subcontractors are low
4. the parent company can respond readily to changes in output quantities
5. subcontracting is more efficient because parts are produced in small lots
6. organisational efficiency fails if the parent company becomes too big ”

Why cost differences?

- Larger companies pay more to their employees, and not just in J.
- a shorter chain of command in smaller firms
- computerisation of small firms (CAD/CAM)
- (last but not least) how well the procuring firm *manages* its subcontractors.

12.5 Risk Sharing v. Incentives

The fraction of production-cost increases that the buyer permits the supplier to pass on in price increases should be higher:

- *the less scope there is for discretionary cost reductions by the supplier; and*
- *the more risk-averse the supplier relative to the buyer.*

In J cars and electrics, a contract lasts for the life of a model (up to four years). No exact prices or quantities initially specified, instead, the procuring firm specifies target quantities and delivery dates, and the contract specifies the means by which the price is determined.

An initial price from detailed cost estimates submitted by the subcontractor. Every six months adjustments in response to production-cost changes, but while the procuring firm will allow an increase because of a jump in *costs of materials*, less ready to agree to an increase because of *labour and energy costs*. Plus *design changes*.

Provided the subcontractor has little discretionary ability to vary the cost of its material inputs, these price-adjustment rules generate the *appropriate incentives for cost control*, assuming it can control its labour and energy input costs.

If a firm is risk-averse, and is willing to forgo expected profits to reduce its risk, then trade with a risk-neutral firm can be mutually profitable. Small firms, with only few projects, are likely to be more risk averse than a larger firm with a more diverse project portfolio.

A simple fixed-price contract leaves the small supplier bearing all the risks of unforeseen production-cost increases; the small firm would accept a lower price in exchange for lower risk (to pay an insurance premium). The large firm is happy to pay less, and is indifferent to any extra risk. Mutual gain occurs.

Such a risk-sharing contract gives the subcontractor little incentive to limit his costs. Over J manufacturing as a whole, buyers allowed sellers to pass on about 70% of cost increases as price rises (from 40% textiles, to 80% in transportation equipment).

J car makers guarantee the amortisation charges for any specific investment of the subcontractor's, raising the price, if need be, to cover the supplier's full investment costs. GM brings in-house the production of items with large volume uncertainty.

Against the stereotype of the subcontractors being screwed by the buyers. To do so would be acting against own self-interest of the procurers.

12.6 Multiple Sourcing

When multiple sourcing is used, the buyer should make the price paid to one supplier vary with the other suppliers' costs.

Should the buyer use multiple suppliers?

- disadvantage: forgo economies of scale. Cost of retooling must be duplicated if two suppliers, so for high set-up costs single sourcing is optimal.
- advantage: technological knowledge shared throughout the supplier industry, which ensures effective bidding competition for the next contract, to the buyer's advantage
- plus: if the buyer in effect imposes a *contest* with a prize for the best performer, then stronger incentives for cost-reducing or quality-improving effort by making the price paid to each supplier dependent on relative performance (See Ch. 9 + GG's Contracting).

	Toyota	Honda
single sourced	28%	38%
two suppliers	39%	44%
three suppliers	19%	16%
four or five		4%
four to seven	15%	

(In-house = single supplier). Multiple sources protects against interruptions in supply and gives the firm a standard for comparing suppliers on cost, quality, reliability, etc.

12.7 The Trajectory of Prices

If the supplier's costs are expected to fall during the course of a contract owing to learning by the supplier, then the buyer shouldn't plan to adjust the price downwards in response to cost improvements. Rather, he should announce in advance the trajectory of the price, based on his prediction of a reasonable rate of innovation, and then keep to this trajectory.

An achievable rate of cost improvement. Compare alternative buyer policies:

- buyer closely monitors the supplier's costs, and sets price as cost plus a mark up;
- buyer commits in advance to a price trajectory

Under the first, the supplier has little incentive to cut costs, since price will follow down: exerts little effort. Under the second, the supplier is rewarded for cost-reducing innovation by extra profits; and the buyer can capture some of the expected extra cost reductions with the initial trajectory.

12.8 Bidding Competition?

By promising to discriminate in favour of incumbent suppliers at the next contract-renewal time, the buyer can induce the incumbents to undertake cost-reducing innovations to achieve high-quality outputs. But by doing so, the procuring firm forgoes some of the price-lowering it could get from bidding competition.

Which effect is larger?

- suppose there are actions an incumbent can undertake during the course of the initial contract that improve productivity or quality, but *the buyer can't immediately observe these activities* and so can't directly reward them by payment provisions in the current contract. Then the supplier can be encouraged by promise of favourable consideration at contract-renewal time.
- if the incumbent has a marked cost advantage as a result of its incumbency, then it faces only weak bidding competition and can bid for large profits. The buyer can correct this by favouring new entrants at renewal time, so stimulating competitive pressure on the incumbent.

Among small J manufacturers:

never changed buyer	68%
changed once	15%
changed twice	10%
changed more than twice	7%

Implies special treatment for incumbents, not simply to the lowest bidder. Why do J procurers forgo the lower prices from bidding competition among potential suppliers?

J policy of maintaining long-term relationships to encourage good performance by subcontractors:

- quality
- delivery
- technological level
- cost-reducing effort
- cooperativeness towards buyer's requests

How can prices that are reasonable from the buyer's point of view be obtained without making full use of bidding competition?

1. competition not completely absent from multiple sourcing: suppliers selected on the basis of their past performance as well as their current bids, in competition among capable firms (usually incumbents)
2. buyer can monitor the suppliers, since bidding is partly to reveal specialists' cost information:
 - with many bidders, buyer suffers little from info disadvantage since bidding competition tends to force the bids down to actual costs
 - with fewer buyers, bids higher; buyer must learn suppliers' costs, by for example regular inspection of suppliers' production lines and accounts (J)
3. The closer the bidders, the fiercer the bidding, and so the lower the buyer's price. It's in the buyer's interests to offer technical assistance to its potential suppliers, ensuring that each of them uses efficient techniques: if each of two bidders would be roughly equally efficient at supplying, then aggressive bidding.
4. Even with only a single supplier, competition with potential in-house production by the buyer.

12.9 The Subcontracting Hierarchy

Subcontracting can be organised either in a single tier, with the buyer directly controlling them all, or in multiple tiers, with the buyer dealing directly only with a few first-tier subcontractors, who in turn control second-tier subcontractors. The benefit of the multi-tier hierarchy is that the buyer then doesn't need to know as many of the details of low-level production. The cost to the buyer of operating a multi-tier hierarchy is that some profits that would otherwise go to the buyer are ceded to the first-tier subcontractors.

Classical benefit of decentralisation: economise on costly activities of acquiring and processing information. A single-tier hierarchy requires buyer's understanding of all the production processes involved. A multi-tier hierarchy requires lower collection and collation of information since control is closer to the source of information.

But in a multi-tier subcontracting system, the buyer cedes some profits to high-tier subcontractors. The right to set contractual terms is valuable: extra profits can be earned by the person who defines the contract.

When a first-tier subcontractor sets the rules for a second-tier subcontractor, these rules reflect the first-tier subcontractor's interests, not the ultimate buyer's, who loses some profits.

J subcontracting has a pyramidal, multi-tier structure: down to third- or fourth-tier suppliers; the lower the firm, the lower its technical expertise. Toyota in 1980: 169 first-tier, 4,700 second-tier (1:28), and 31,600 third-tier (1:7).

In 1986, GM (6 million cars) employed 6,000 buyers; Toyota (3.6 million cars) only 340 buyers.