

IS A BUILDING CONSTRUCTION PROJECT A HIERARCHY OR A MARKET?
(A Review of Current Literature and Implications
for Organizational and Contractual Structure)

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SUMMARY

A new body of economic theory, the transaction cost approach, is used to augment traditional microeconomic theory in explaining the prevalence of subcontracting in the construction industry. Many problems connected with subcontracting can be analyzed using this approach. It indicates, however, that traditional administrative science theories may be inadequate to describe administration on the construction jobsite.

BACKGROUND ON BUILDING CONSTRUCTION

In all of the world's market economies, the construction sector is subject to large fluctuations in volume. While this is true at the national level, the demand fluctuations faced by a single firm, serving a local or regional market, are even more severe. Historically the fluctuations in volume in the commercial and industrial construction sectors were somewhat offset by countercyclical fluctuations in the residential construction sector, since the demand for new homes is negatively correlated with interest rates. But during the last five years, "stagflation" - sluggish economic growth combined with high inflation and interest rates - has resulted in all construction sectors being simultaneously depressed.

This introductory section will briefly outline some of the reasons for the demand fluctuation in construction, and describe the response of firms to this fact of life in their environment. In particular, we will focus on the building construction sector which makes extensive use of subcontracting as a means of coping with fluctuation in demand.

Reasons for Fluctuating Demand

The major reasons for the fluctuating demand in construction stem from the nature of the product: it is typically costly, immobile, and unique in some important respects (at least its foundations).

Being costly and durable, an investment in construction involves a major commitment of resources by an individual or a firm. Its timing will be significantly impacted by primary product demand (for an industrial facility) by the demand for office or retail space (for a commercial facility) and by the cost of capital (particularly for residential construction). These macroeconomic variables are further compounded by a

significant microeconomic variable - success in obtaining work through competitive bidding. By far the majority of construction in the U.S. and most other market economies is awarded through competitive bidding procedures. This introduces an additional degree of market uncertainty into the environment of construction firms.

With a few exceptions, most constructed facilities are never moved from the location where they are first assembled; and concrete, a major material in many structures, is often manufactured on site. Moreover, a single large project can constitute the bulk of the demand for construction in a given area. Hence, the immobility of the product means that those parts of the derived product demand that are local in nature - skilled craft labor and low value, bulk materials - will be subject to demand fluctuations even when national volume may be stable in the aggregate. Moreover, the demand for skilled craftsmen changes over the duration of the project. Excavation trades are followed by structural, mechanical, and then finishing trades. A general contractor who is hard pressed to deal with the overall fluctuation in output faced by the firm must deal with an even more severe problem, the fluctuating demand for specialist workers within the firm.

Response of Firms to Demand Fluctuation

Faced with this problem of drastic changes in output volume, and even more drastic fluctuations in the demand for key inputs, managers of construction firms have adapted in several ways.

In the public works construction sector, many firms have developed the ability to be mobile and to follow the work around the country - or the world. This requires a combination of mobile supervisory staff, sophisticated training programs for local workers, and the ability to move heavy equipment to jobsites. Since highways and dams were often in remote locations away from areas of population concentration, contractors in these markets had to adapt early to the strategy of geographical mobility.

In the building sector, on the other hand, most activity occurs in areas of existing population concentration. The strategy which has been adopted in this sector is one of specialization by subsystem. Specialized firms excavate for foundations; other firms drive piles or caissons to support the structure; yet others erect the structure, clad it and roof it; five to ten separate firms may be involved in the building's mechanical systems and upwards of twenty in its finish work. Machnik (1977, p.46) reports 35 firms engaged in a "typical" high rise building in Boston, USA, in 1972.

The reasons for this particular adaptation have been explained by Machnik and Eccles (1981) in terms of administrative science theories from Thompson (1967) and classical microeconomics. But the authors are unaware of any prior attempt to employ the transaction cost ideas of Williamson (1975) to analyse the reasons for subcontracting, and to describe the administration of work in an environment where virtually all of the workers at a place of work are hired through a large number of subcontractors. These are the aims of this paper.

REVIEW OF MARKETS AND HIERARCHIES LITERATURE

As formulated by Oliver E. Williamson, the "markets and hierarchies" theory provides a common framework for analyzing the organization of economic activity between and within markets and hierarchies.

"Whereas market transactions involve exchange between autonomous economic entities . . . hierarchical transactions are ones for which a single administrative entity spans both sides of the transaction [and] some form of subordination prevails" (1975, p.xi).

Accordingly, firms and markets are regarded as alternative governance structures to which transactions can be assigned. Drawing upon microeconomics, organization theory, and aspects of contract law, the approach tries to explain why one mode of organization is preferred to another under certain circumstances. The choice of a structure depends on its capacity to economize on transaction costs.

Transaction as Unit of Analysis

When a good or service is transferred across a technologically separable interface a transaction is said to take place. Such transactions, which can be made across market as well as nonmarket interfaces, do not occur totally frictionlessly. The costs of planning, adapting and monitoring the transactions have to be considered.

Starting out with market exchanges it can be illustrated why markets sometimes are replaced by organizations. Situations with much complexity and uncertainty have to be dealt with by carefully written contracts. But because of "bounded rationality" - the limited capabilities of human agents - it is "impossible or prohibitively costly to write, execute, and enforce complete, full-contingent contracts" (Teece, 1982, p.2). Furthermore, "small numbers" situations evolve in trading relationships when some exchange parties obtain advantages over their competitors. In such cases opportunistic actors can exploit or "hold up" a trading relationship by "recontracting" on more favorable terms to themselves.

Thus, it is clear that the functioning of markets may be impeded by "friction". Internalizing the exchange relationships within firms smooths the transactions considerably in these cases. Figure 1 summarizes the conditions under which markets fail and internal organizations are initiated.

<u>ENVIRONMENTAL FACTORS:</u>	<u>BEHAVIORAL FACTORS:</u>	<u>COMBINED RESULTS:</u>
Uncertainty/Complexity +	Bounded Rationality	= Contracting Problems
Small Numbers	+ Opportunism	= "Holdup" Problems

Figure 1. Factors that contribute to increased transaction costs
(adapted from Teece, 1982)

The discussion related above gives us the fundamental arguments of this approach. However, these arguments do not give us very much help if we want to operationalize transaction costs. What needs to be done is to define the dimensions with respect to which transactions differ.

The critical dimensions for describing transactions are: (1) the uncertainty to which they are subject, (2) the frequency with which they recur, and (3) the degree to which they are supported by durable transaction-specific investments (Williamson, 1981b). It should be said that occasional transactions under uncertainty will rarely be effective within the firm. The more uncertain and the more frequent the transactions, the higher are the incentives for governing such relationships through internal, "hierarchical" channels rather than through "market" contracting.

Idiosyncratic Transactions

The most interesting of the three dimensions is the third one. The issue here is whether the investment involves assets specialized to a particular transaction. Problems arise when the asset specificity causes the market to "shrink". In the extreme case there will be no alternative sellers or buyers. The transactions are then nonmarketable and "idiosyncratic" (Williamson, 1979).

Idiosyncratic transactions evolve from three different sources: (1) locational specificity, (2) technological specificity, and (3) knowledge specificity (Teece, 1982). The parties are effectively "locked into" the transaction. Accordingly, where asset specificity is great, the buyer and the seller will make special efforts to shelter the transaction from market forces and to establish an on-going relationship.

Locational specificity arises because of lack of proximate alternative trading partners. One example here is ready-mixed concrete. If there is just one concrete company within an acceptable radius from the job site the general contractor is left with two alternatives. He either has to rely on the concrete company or make the concrete himself. If for some reason he does not have the option of making the concrete himself, he will be locked into the market transaction. The holdup potential that the ready-mix supplier possesses is obvious in this case.

Technological specificity arises out of the need for technologically specialized inputs, materials or equipment. For example, when, on a construction project, there is a need for extremely heavy lifts, there might be just one company in the world with a suitable crane for the job. Here the classical make vs. buy problem applies. If there are no alternative suppliers common ownership will be the only effective mode, since common ownership will ensure continuous supply. Marine contractors may purchase their own high capacity floating cranes to avoid holdup problems of this sort, and rent them out to others or let them stand idle in between uses.

Knowledge specificity arises because of "first mover advantages". There might be a large number of competitors bidding for the initial contract; but as subsequent contracts are negotiated the first winner has acquired

valuable knowledge and experience and thus advantages over his competitors. A subcontractor who has won the first bid in a series of similar bids has a distinct advantage over others for subsequent bids.

Production Costs

Transaction costs are central to decisions like make-or-buy. But they are not the only decisive factor. Trade-offs between production costs and transaction costs have to be recognized. Considering just production costs, market procurement will be advantageous because of economies of scale, economies of scope, and risk pooling benefits. This is explained by classical microeconomic theory.

Large firms may be able to produce most components or services internally without sacrificing scale economies. But smaller firms do not create large enough demand to support "in-house" production of efficient scale. They have to rely on the market to aggregate the demand of a sufficient number of firms to achieve scale economies. Hence, market exchanges will be more efficient for them.

While economies of scale refer to declining average costs associated with increasing output of a single product, economies of scope are achieved where combining several product lines is less costly than separating them. By aggregating uncorrelated demands, a supplier can also realize a kind of risk pooling, thereby reducing fluctuations in output.

In addition to these conventional "production" arguments for markets, external procurement will be favored because it avoids many of the bureaucratic hazards of internal procurement. "Market exchange serves to attenuate the bureaucratic distortions to which internal exchange is subject" (Williamson, 1981b, p.1547).

Choice of Governance Structure

The decision how to organize transactions has to be based on cost economizing. The object is to economize on the sum of production and transaction costs. At the risk of oversimplification, figure 2 gives a concise summary of these ideas. "PC" and "TC" represent production cost and transaction cost respectively, while the subscripts "M" and "H" represent respectively market governance and hierarchical governance.

As depicted in the figure, asset specificity is of great importance when choosing governance structure. To summarize, the curves illustrate the following facts:

- Considering only production costs will never give an incentive for internalizing transactions (Figure 2a).
- As market demand becomes more specialized it becomes more difficult to benefit from scale economies. Hence, the relative advantage of market regarding production costs decreases with asset specificity (Figure 2a).

- Transaction costs increase considerably with asset specificity when using market procurement. This is because of the development of small numbers conditions. Hence, transaction costs considered alone, would lead to hierarchy as the choice beyond a very moderate level of asset specificity (Figure 2b).
- The aggregated costs show us at what level of asset specificity market or hierarchy, respectively, is the most effective organization mode (Figure 2c).

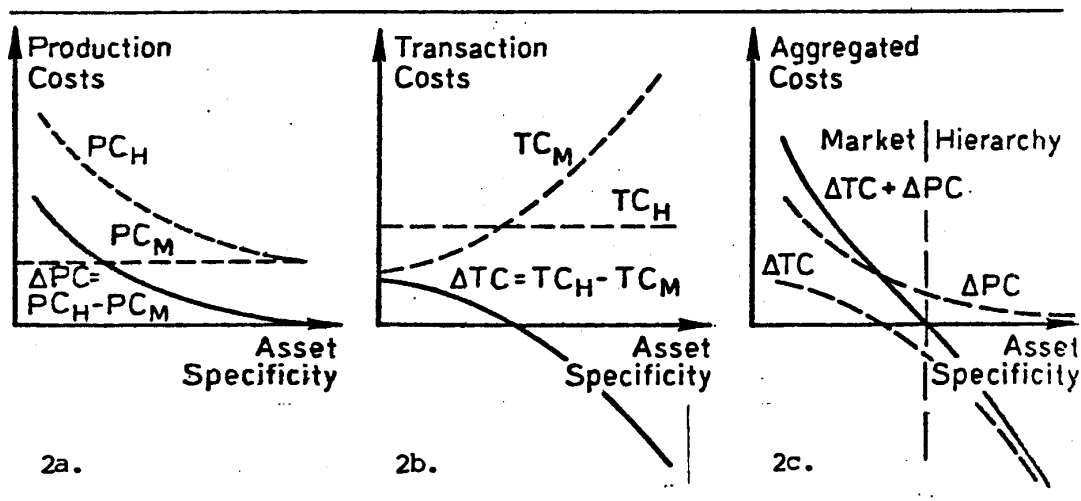


Figure 2. The choice between market and firm governance (adapted from Williamson, 1981a)

APPLICATIONS OF MARKETS AND HIERARCHIES FRAMEWORK

The transaction costs approach is very young compared to microeconomic or administrative science theories. In spite of this some attempts have been made to apply this framework to several organizational phenomena, such as vertical integration, and multidivisional structures. Other examples are listed in Williamson & Ouchi (1981). As has been pointed out elsewhere in this paper, the unique features of the construction project are challenging in this respect. Do these fit in to the markets and hierarchies framework or do they contradict the theory?

A typical building construction project is neither a pure market nor a pure hierarchy. The general contractor subcontracts certain portions of the project, which clearly resembles the market mode. But at the same time the general contractor assumes coordination responsibility over his own and subcontractors' personnel on the job site. This has to involve subordination of subcontractors' personnel to the authority of the general contractor's supervisors. Thus hierarchical relations exist, too.

Why Subcontracting Takes Place

With the help of figures 1 and 2 we will reconsider the assumptions of the markets and hierarchies framework. It is clear that within the construction industry there are no perfect markets. All facts, e.g. regarding the job site (subsoil conditions, weather, etc.) or regarding the construction team, cannot be known in advance. Sometimes, on very complex projects, design work is far from completed when the actual construction begins. Due to uncertainty or complexity, there are a large number of contingencies such as these. Considering the bounded rationality of man, it may be impossible, or at least extremely costly to specify responses to them all. Such contracting problems imply that construction contracts, by necessity, are incomplete.

The subcontracting practice is, as we have seen, very pervasive in the building construction sector (Machnik, 1977). Therefore, it will rarely be the case that a general contractor is left with no alternatives when choosing a specialty firm for a certain project. Thus, from the general contractor's point of view, holdup problems will seldom occur across projects. When one project is terminated, the next one will be negotiated separately from the first one. As the detailed requirements and conditions for the new project presumably will be quite different, any residual advantages in terms of, e.g. acquired know-how, will be irrelevant.

Thus, across several projects the market option, i.e. subcontracting, will be most effective because it reduces production costs without creating excessive transaction costs. The hierarchy option, based on the employment relation, would be a more costly form of contracting. There are several reasons for this. Two will be mentioned here.

Firstly, scale economies can be more fully exhausted. Typically, the operations of a single general contractor are not sufficiently extensive to allow full-time employment of all the skilled craftsmen that have to be involved in a building construction project. By subcontracting, the general contractor may have the work done when it is needed. At the same time the specialty firms may provide full-time employment to their employees by aggregating market demand. Secondly, although subcontracting implies responsibilities and liabilities for the general contractor, he may also profit from risk sharing benefits.

However, within a single project, asset specificity may be significantly higher than across projects. Because of highly interdependent work the use of specialty firms is critical. If they do not show up, no-one else is going to do their work. The potential holdup problem is obvious. Since each activity is preceded and followed by other activities, delays will have serious effects on the rest of the work. This points out the importance of scheduling and coordination in the construction industry.

Clearly, there are reasons both for and against "in-house" production. The prevailing use of subcontractors may primarily be attributed to scale economies, risk pooling benefits and other microeconomical aspects.

Contracting Practices

With increasing complexity and uncertainty, market transactions have to be supported by more elaborate contracting practices. This would tend to increase transaction costs in the market mode. But, construction firms have developed ways to minimize these. To deal with contingencies caused by communication or interpretation problems, standard contracts are employed. Well-prepared subcontract documents inevitably eliminate many potential disputes concerning the performance of work.

Once the parties have entered into a contract, there have to be strong incentives to see the contract through to completion. In the construction industry this is accomplished by an extensive use of what Williamson calls "third-party assistance (arbitration) in resolving disputes and evaluating performance" (1979, p.250).

So we see that production cost economies dictate the market, i.e. subcontracting. And the additional transaction costs that markets might normally create in this situation, construction firms have learned to live with.

Administration on the Job Site

One important feature of the construction industry is the job-site. Much of the work has to take place "in situ" under constraints of time and space. Because of the many interdependencies between tasks, often involving employees representing several trades and different companies, much effort has to be made to avoid unnecessary interferences. Space has to be shared and cranes or scaffolds have to be commonly used, all in a timely and coordinated manner.

It has been said before, that it is the general contractor's duty to coordinate. Supported by contractual agreements, the general contractor is placed in the rather unique management role of controlling the performance of personnel formally employed by other companies. Traditionally, administration on the construction site has been done according to "craft principles" (Stinchcombe, 1959). Emphasizing a nucleus of highly professional personnel, it has been possible to minimize tendencies toward bureaucratization. However, as building construction projects of today are characterized by increasing complexities and interdependencies, coordination problems are becoming more challenging.

It is the authors' contention that the mixed market-and-hierarchy nature of the site causes ambiguity in the administration of construction projects. Kreiner (1976) expresses this character in the following way.

"In spite of the conspicuously authority-free formal picture of site organizations, authority relationships exist. Strictly speaking, it is in conflict with the contractual agreements, but the functionality of these relationships for the performance of the site organization is raised beyond doubt" (p.81).

CONCLUDING REMARK

The authors see a lack in the administrative science literature of theories that explain the special features of the construction project. New models need to be developed that deal with the process of harmonizing market as well as nonmarket interfaces and the contractual implications of this.

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