MODEL FOR UNDERSTANDING, PREVENTING, AND RESOLVING PROJECT DISPUTES

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ABSTRACT: Based on the comparative analysis of 24 construction disputes, this paper presents a process model that explains the development of disputes. The model examines the combined effect of project uncertainty, contract, working relations, and problem solving effectiveness on the development of disputes. The model develops a classification of problem situations, and identifies the problem-solving requirements and the potential for dispute in each situation. The model indicates that the prevention of complex, high cost disputes depends more on the planning and problem solving ability of the project organization, and less on the contractual terms. The paper identifies the following actions that can reduce the number and severity of claims: reduction of project uncertainty, reduction of contractual problems, reduction of opportunistic behavior, increased the project organization's problem-solving ability, and use of alternative dispute resolution methods to reduce resolution costs.

INTRODUCTION

While there is little doubt that construction claims are a burden on the industry, how a problem turns into a claim remains something of a puzzle. Much of the research on construction disputes has focused on specific factors, such as contractual language and its judicial interpretation, the technical causes of claims (Semple et al. 1994), the importance of front-end planning (Vlatas 1986, Halligan et al. 1987), contractual equity (Ashley et al. 1989), and parties relationships (Kashiwagi et al. 1988). This paper moves beyond the consideration of individual factors and identifies how the interaction of technical, contractual, and behavioral factors affects the dispute development process.

The model presented here was developed during a research project for a state transportation department. The objective was to understand why a significant number of claims had occurred on projects managed by the department. The writers collected data from 24 claims, which occurred on 14 projects. These claims ranged from less than $10,000 to over $5 million. For each claim, the writers (1) assembled a timeline of events, (2) collected information about the facts of the claim through review of project documents (daily project reports, change orders, and correspondence), and (3) collected information about the parties' relationships, attitudes, and behaviors through interviews with project participants. In some cases, the data are incomplete because project personnel were not with the department or the contractor any more.

The data were analyzed in many different ways to identify similarities and differences across cases. The analysis examined: (1) the issues and basis of the initial disagreement, (2) how the parties attempted to solve the problem, (3) the type of magnitude of disputes that developed from the failure to solve the problem, and (4) the level of dispute escalation. The analysis indicated that there was not one overriding factor as the critical cause of the dispute, but a combination of key factors. The model presented in this paper was developed inductively as a result of the analysis, and provides a consistent way to understand and explain how each claim developed. The propositions of the model should be treated as hypotheses for further research.

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Note. Discussion open until November 1, 2001. To extend the closing date one month, a written request must be filed with the ASCE Manager of Journals. The manuscript for this paper was submitted for review and possible publication on September 17, 1998; revised August 24, 2000. This paper is part of the ***Journal of Construction Engineering and Management***, Vol. 127, No. 3, May/June, 2001. ©ASCE, ISSN 0733-9634/01/0003-0223–0231/$8.00 + $.50 per page. Paper No. 22137.

The paper first reviews theoretical background on contractual disputes. Then, it summarizes the data and presents the model. The last section develops recommendations for dispute prevention and resolution.

THEORETICAL BACKGROUND ON CONTRACTUAL DISPUTES

Williamson's framework of Market Failures (1979) explains how the combination of ''environmental'' and ''behavioral'' factors lead to contractual problems

$$\text{Environmental Factors} + \text{Behavioral Factors} = \text{Problems} \quad (1)$$

$$\text{Uncertainty} + \text{Bounded Rationality} = \text{Contracting problems} \quad (2)$$

$$\text{Small Numbers} + \text{Opportunism} = \text{Holdup} \quad (3)$$

The aforementioned factors are present in many construction projects. First, projects are long-term transactions with high uncertainty and complexity (high uncertainty). Second, it is impossible to resolve every detail and foresee every contingency at the outset (bounded rationality). As a result, situations often arise that are not clearly addressed by the contract (contractual problems). Third, once the project starts, the parties are tightly bound together, almost captives of one another. The owner's ability to turn to other contractors, and the contractor's ability to turn to another owner are limited (small numbers). In small number situations, an opportunistic party can take unfair advantage of the other party when an adjustment to the contract needs to be made. Thus, the basic factors that drive the development of disputes are (1) project uncertainty; (2) contractual problems; and (3) opportunistic behavior. Each is considered.

Uncertainty

Uncertainty is the difference between the amount of information required to do the task and the amount of information already processed by the organization (Galbraith 1973). The amount of information needed depends on (1) task complexity (the number of different factors that have to be coordinated) and (2) performance requirements (such as time or budget constraints). The amount of information possessed depends on the effectiveness of planning—that is, the collection and interpretation of information before the task.

Uncertainty means that every detail of a project cannot be planned before work begins (Laufer 1991). When uncertainty is high, initial drawings and specifications will be likely to change, and the project members will have to solve problems during construction.

Contractual Problems

The participation of different parties in a project is governed by a contract, which defines the exchange of construction materials and services for money. ''A Contract is a promise or the set of promises for the breach of which the law gives a remedy, or the performance of which the law in some way recognizes as a duty'' (MacNeil 1974, p. 693).

Classical Contracting

Classical contracting attempts to regulate the exchange through contingency clauses and complete ''presentiation.'' Contingent claims attempt to anticipate and resolve all possible contingencies at the outset. Presentiation means bringing the values associated with some future condition to the present moment. Classical contracting corresponds to the ideal market transaction where: 1) the nature of the agreement is carefully defined and limited, 2) remedies are prescribed for a party's failure to perform as promised, and 3) the parties' identities and relations are irrelevant. Buying a construction grade 8-ft-long piece of ''2 × 4'' pine at the local lumber-yard is such a transaction. The purchase of a machine—a car for example—includes presentiation and contingent claims insofar as there is an agreement by the seller to make repairs after delivery on certain conditions.

Classical contracting is less appropriate for long-term transactions executed under condition of uncertainty—such as construction projects. First, due to bounded rationality, not all potential contingencies can be anticipated. Second, the appropriate adaptations for many contingencies and their costs are not evident until the situation materializes. Finally, classical contracting gives rise to arguments over the truth, if changes are ambiguous (Williamson 1979).

Opportunistic Behavior

Since gaps in contracts are unavoidable, a mechanism is needed to govern contractual adaptations to the evolving circumstances. In the absence of opportunism, the gaps could be filled as they arose. However, because of the ''small number'' situation, either contracting party has power to bargain whenever a proposal to adapt the contract is made (Williamson 1979). Although both parties have a long-term interest in effective adaptations of a joint profit-maximizing kind, each also has an interest in gaining as much as they can on each occasion. An excessively opportunistic party can exploit or ''holdup'' the other in order to maximize its own gains. Thus, the identify, character, and relationships of the parties become more important because they affect their ability to reach agreement.

The three factors (uncertainty, contractual problems, and opportunistic behavior) are similar to the three causes of disputes identified by the Dispute Prevention and Resolution Task Force of the Construction Industry Institute (CII) (Vorster 1993): (1) Project uncertainty, which causes change beyond the expectation of the parties; (2) process problems, including imperfect contracts, and unrealistic performance expectations; and (3) people issues, problems due to poor communication, poor interpersonal skills, and opportunistic behavior.

EMPIRICAL DATA

This section summarizes the 24 studied disputes with a description of the case, the amount claimed and settled, and the level of resolution. The levels of dispute resolution in the studied cases are: (1) state district level, (2) claims review board (CRB), (3) arbitration, and (4) litigation.

Claim 1

The state and the contractor disagreed over the quantities of additional excavation and soil removal. The state's calculations were based on pit cross-section, while the contractor used the load-count figures (that were used for progress payments).

- Amount claimed: $203,297
- Amount settled: $168,270
- Level of resolution: district

Claim 2

The contractor selected to use a surface pit different than the one designated by the state, but did not submit a written request. That pit did not provide material of specified quality. The tests at the designated pit also found material of low quality. The contractor moved to a commercial pit and requested compensation for additional costs. The state argued that with some additional processing, the designated pit could produce material of acceptable quantity and that the contractor did not follow the formal process for pit change.

- Amount claimed: $101,552
- Amount settled: $90,610
- Level of resolution: CRB

Claim 3

The plans provided erroneous right-of-way information, which caused rework and delays. Disagreement existed regarding the extent of delay and rework.

- Amount claimed: $32,253
- Amount settled: $32,253
- Level of resolution: district

Claim 4

The contractor requested compensation for extra work caused by design changes. Disagreement existed regarding the amount of work beyond the original scope.

- Amount claimed: $4,690
- Amount settled: $3,290
- Level of resolution: district

Claim 5

The contractor requested compensation for additional costs that occurred when using the designated pit, claiming that these costs could not be anticipated from the interpretation of the plans.

- Amount claimed: $16,338
- Amount settled: $375
- Level of resolution: district

Claim 6

The state inspector directed a 3-hour shutdown of the paving operation. The contractor argued that the shutdown was not required and requested compensation for delays.

- Amount claimed: $3,312
- Amount settled: $1,898
- Level of resolution: district

Claim 7

The state inspector prevented the contractor from removing the truck scales from the site. The contractor requested com-

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pensation for extra costs. Disagreement existed whether the scales were still needed on site.

- Amount claimed: $3,160
- Amount settled: $0
- Level of resolution: district

Claim 8

The contractor requested compensation for additional fencing (when the state acquired additional right-of-way), and for resetting a fence (caused by a problem related to the right-of-way). Disagreement existed over the extent and the cost of extra work.

- Amount claimed: $1,243
- Amount settled: $1,179
- Level of resolution: district

Claim 9

In the beginning of the project, the contractor moved in the designated pit and started producing surfacing aggregates and borrow material. The contractor used the larger rocks as borrow material for embankments, and used the smaller rocks and aggregates to produce surfacing material (which needs to be of much higher quality than borrow material). However, the smaller rock and aggregates created excess waste. This problem created a chain of other problems: the contractor had to excavate deeper, base material was rejected and reprocessed, and large overruns in quantities occurred. In addition, because of traffic control requirements and site constraints, the contractor ran out of stock pile space and had to double-handle the waste.

The contractor requested additional compensation and time extension claiming that the problem was caused by the quality of the pit material (changed conditions). The state argued that the problem was caused by the contractor's method of using the pit and that the larger rock should also be used for production of surfacing material. The contractor continued to use the same method and the contractor's claim continued to increase.

- Amount claimed: >$3,000,000
- Amount settled: >$3,000,000
- Level of resolution: litigation

Claim 10

During a bridge renovation project, a design error (wrong dimension of sole plates) was discovered when the existing plates were removed. The contractor requested compensation for the procurement of new plates, while the department argued that based on the notes on the plans, the contractor was responsible to check the correctness of the plans.

- Amount claimed: $3,130
- Amount settled: $1,644
- Level of resolution: district

Claim 11

The contractor requested compensation for re-drilling holes for the bridge rail. The designer had changed the location of the holes before the bid, but the new drawings were not sent to the contractor on time.

- Amount claimed: $7,558
- Amount settled: $5,000
- Level of resolution: district

Claim 12

Contaminated soil was encountered during construction. The state directed the removal, treatment, and disposal of the contaminated soil, which resulted in extra costs and delays. Part of the delay was caused by slow decision making by the Environmental Improvement Division regarding how to treat that soil. The state and the contractor disagreed on the extent of delays and extra costs.

- Amount claimed: 60 days
- Amount settled: 42 days
- Level of resolution: district

Claim 13

At the end of the project, the state directed price reduction due to low-quality concrete pavement. However, at the time of the tests, the contractor had not been informed about the test results and protested the decision.

- Amount claimed: ⟨$2,185⟩
- Amount settled: ⟨$800⟩
- Level of resolution: district

Claim 14

The contractor requested compensation for extra work. Disagreement existed whether the work was part of the original scope, and the actual cost of the extra work.

- Amount claimed: $16,006
- Amount settled: $16,006
- Level of resolution: CRB

Claim 15

The contractor requested compensation for additional earthwork (removal of unsuitable material and soil cement), but there was disagreement whether the work was beyond the contract scope.

- Amount claimed: $153,195
- Amount settled: $143,094
- Level of resolution: arbitration

Claim 16

At the beginning of the project, the contractor was directed to stop his operation at the designated pit as a result of community complaints about noise and dust. The state and contractor agreed on the costs of delays and relocation, but disagreed on the unit price of haul costs.

- Amount claimed: $80,720
- Amount settled: $26,905
- Level of resolution: district

Claim 17

The contractor requested compensation for extra costs and delays caused by ground water in the surface pit.

- Amount claimed: $275,293
- Amount settled: $77,700
- Level of resolution: district

Claim 18

At the end of the project, the state withheld 90 days of liquidated damages. There was disagreement regarding the to-

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tal effect caused by the delay to start, the extra work, and weather conditions.

- Amount claimed: 90 days
- Amount settled: 58 days
- Level of resolution: district

Claim 19

The state withheld payment for concrete work that was exposed to freezing temperatures during curing. The contractor argued that corrective action had been taken. New tests were performed and found that the quality of the concrete was satisfactory.

- Amount claimed: $40,000
- Amount settled: $40,000
- Level of resolution: district

Claim 20

The contractor requested compensation for extra costs caused by several design inadequacies (detour design resulted in changes, which in turn, created new problems with drainage, permits, etc.), untimely responses to request for information, and rework directed by inspectors.

- Amount claimed: $3,078,691 +75 days
- Amount settled: $800,000 +75 days
- Level of resolution: settled during litigation

Claim 21

The contractor requested compensation for additional work caused by changes in the construction sequence (which were caused by design changes). Disagreement existed over the amount of work that should be anticipated, and the unit price of extra work.

- Amount claimed: $15,221
- Amount settled: $11,568
- Level of resolution: district

Claim 22

During a bridge project, vertical cracks appeared at three construction joints of bridge piers. The state directed corrective action on six piers and the contractor requested compensation for the additional repair work arguing that the construction of joints was performed according to the specs. As it was found later, the cause was improper installation of the mechanical coupling devices, but neither the contractor nor state personnel had been provided with an installation manual.

- Amount claimed: $118,000
- Amount settled: $88,500
- Level of resolution: CRB

Claim 23

The contractor requested compensation for acceleration costs caused by excessive unsuitable material, and conditions different than those described in the plans (removed asphalt was thicker than described in the plans).

- Amount claimed: not available
- Amount settled: $0
- Level of resolution: CRB

Claim 24

The contractor requested compensation for placing additional sand-barrel attenuators, and repairing them when they were damaged by vehicles.

- Amount claimed: $17,039
- Amount settled: $17,039
- Level of resolution: district

MODEL OF DISPUTE DEVELOPMENT

Fig. 1 presents the model of disputes, and the factors affecting the process. The arrows between factors illustrate that one factor causes another. An arrow pointing to another arrow mean that the factor influences the relationship between the two other factors.

In the problem development phase, uncertainty results in problems. The model shows that the problem complexity and the parties' positions on responsibility produce different problem situations. During the problem-solving phase, a solution must be found and responsibility must be established for any additional costs. The effectiveness of problem solving is influenced by the parties' behaviors, relationships, and problem-solving processes. The actual effect of the problem and the parties' positions on responsibility, determine the potential for dispute, which along with other factors, determines if a dispute will actually develop. If a dispute develops, a resolution process follows. The effectiveness of dispute resolution determines the cost of resolution, and the organization's ability to solve future problems.

Uncertainty

As discussed previously, significant uncertainty remains as late as the start of construction. High uncertainty means that more problems will arise during the project.

Problems

A problem is defined as an unexpected situation that may result in reduced performance, with respect to safety, cost,

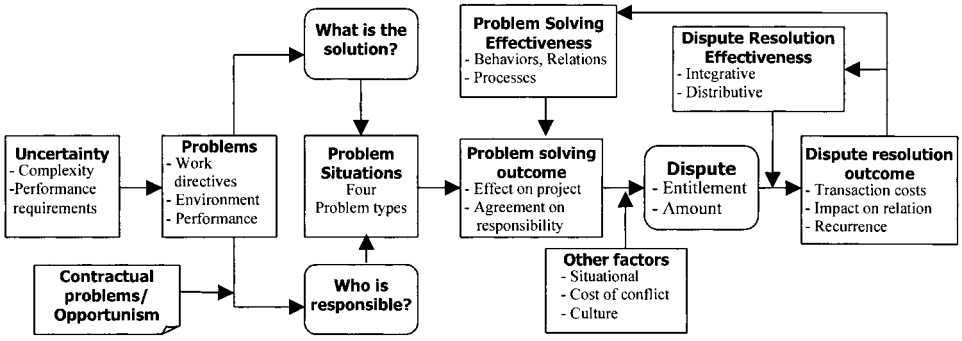

FIG. 1. Model of Dispute Development and Resolution

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timeliness, quality, or other project aspect held to be important. The problems that initiated the disputes in the study fall under three categories

Work Directives: 17 Cases

Such problems are caused by failure to clarify and communicate information or work requirements, and include ambiguity, errors, or omissions in scope of work, design, plans, and specifications. The study found: (1) problem with design/plans in 10 cases (Claims 3, 4, 8, 10, 11, 18, 20, 21, 23, 24), (2) problem with specifications in five cases (Claims 1, 5, 6, 7, 22), and (3) problem with unclear scope in two cases (Claims 14, 15).

Changed Conditions: Five Cases

Such problems result from a lack of information at the time of planning, and may include differing site conditions, weather, materials availability, future actions of third parties, etc. The study found: (1) problems with soil conditions in four cases (Claims 2, 9, 12, 17), and (2) problems with third party in one case (Claim 16).

Contractors' Performance: Two Cases

Such problems result when the actual performance of planning, production, and support systems varies from the anticipated performance (due to errors, misjudgment, or other reasons). Claims 13 and 19 are in this category.

Every time a problem arises, the project team has to decide: (1) what is the solution, and (2) who is responsible.

What Is the Solution?

The scope and complexity of the problem determines the solution uncertainty (whether the corrective action is known or not). A simple problem affects few activities, has an obvious solution, and can be resolved on site without involvement of designers or other specialists (e.g., in Claim 10, the solution was to purchase new plates with the correct dimensions). A complex problem affects several activities. Determining corrective action requires examination of several alternatives and involvement of more project participants. In Claim 12, the solution to the problem required decision by another department regarding the treatment of the contaminated soil.

Who Is Responsible?

Problems lead each party to evaluate its responsibility for any costs associated with the solution. The parties may agree or disagree on the issue of responsibility. Typically, the contract is the departure point for each party's position, as it allocates the risks and defines responsibilities for potential contingencies. Unfortunately, interpretation and application is not always straightforward due to the following contractual problems.

Contractual Problems/Opportunism

- The contract cannot predict all possible problem situations.
- The parties may have a different perception of the facts of the situation.
- Differences may exist in the parties' perception of risk allocation. A study of contract clauses found that there are significant disparities among owners and contractors with respect to the perception of risk allocation of contract clauses (Ibbs and Ashley 1987). In this study, the state and the contractors had different interpretations of some contractual elements (plans, scope, or inspection requirements) in seven cases (Claims 5, 6, 7, 9, 14, 15, and 24).
- The integrity of contractual terms may be questionable. Such terms include clauses which are unfair at the outset, or, because of later formal or informal agreement, invalidates the terms. A study of differing site conditions claims revealed (Halligan et al. 1987) that the hard contracting approach (where the owner attempts to clearly shift all risks to the contractor) does not prevent claims, despite the clear allocation of risk. No matter what contractual clauses are used, the contractors do not accept the responsibility for a differing site condition, and find a path to be compensated. Allocation of the risk to the parties that can best control it can increase the integrity and acceptance of the standards. In this study, the contractors did not accept the responsibility for design errors despite the clear contractual risk allocation (Claims 10 and 20).
- Both parties may have failed to perform some contractual duty, making cause and effect analysis difficult. In Claims 2, 11, and 13 both the state and the contractors had failed to perform a contractual duty.
- An opportunistic party may simply deny responsibility to avoid losses, or, claim that a problem existed in an effort to take advantage of the other party. However, it is often hard to tell if a party acts opportunistically, or, if there is an honest disagreement about the responsibility allocation. Misattributing the cause of the behavior by either party makes settlement difficult.

Problem Situations

Type of Problems

The analysis indicated that problems differ on: (1) the uncertainty of solution (known for simple problems—unknown for complex problems), and (2) the parties' position on responsibility (agree—disagree). These attributes produce a matrix of problem situations (Fig. 2).

- Category A: The solution is simple/known and the parties agree on the responsibility. An example is a small change order directed by the owner that results in extra work. Claims 1, 3, 4, 8, 17, 21, and 23 are in this category. Type A problems typically do not result in claims, unless there is a disagreement over quantities (as in Claim 1).
- Category B: The solution is simple/known, but the parties disagree on the responsibility. Although the corrective action is obvious, the parties disagreed on who should pay for them. Claims 5, 6, 7, 10, 11, 13, 14, 15, 19, 22, and 24 are in this category.
- Category C: The parties agree over the responsibility, but the problem is complex and the solution uncertain (e.g., Claims 12 and 16). In Claim 12, a differing site condition required examination of several alternatives and involvement of other parties.
- Category D: The problem is complex (and the solution is unknown) and the parties disagree over the responsibility.

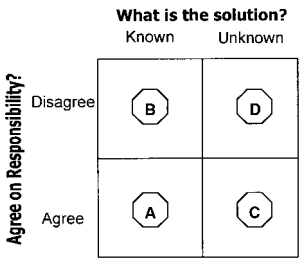

FIG. 2. Problem Situation Matrix

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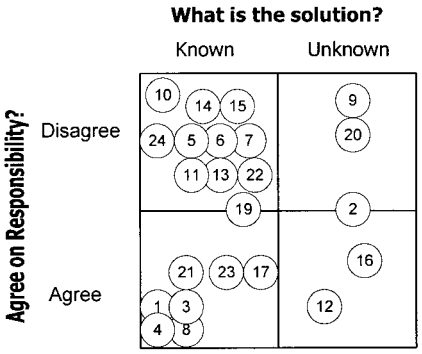

FIG. 3. Classification of Studied Claims

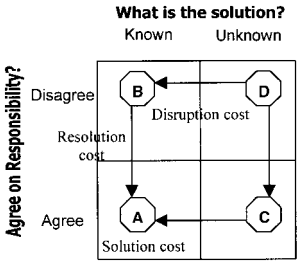

FIG. 4. Problem-Solving Costs

Claims 2, 9, and 20 are in this category. In Claim 9, the parties disagreed on whether a differing site condition existed, while at the same time, the required changes in the plan were unknown.

Fig. 3 classifies the claims in the four categories. Not all problems result in claims—many are resolved at the project level without becoming disputes. The outcome of a problem depends on the effectiveness of problem solving. However, each type of problem has different potential costs and problem-solving requirements.

Problem-Solving Costs and Requirements

The resolution of a problem requires finding a solution, and agreeing on responsibility. Thus, a problem needs to move from Category B, C, or D to Category A, as shown in Fig. 4.

There are three types of costs as a result of a problem. Solution costs are the costs of the corrective action (e.g., extra work, overtime, extra time and delays, etc.) and depend on the scope and quality of the corrective action. Disruption costs are the costs involved in finding a solution. Resolution costs include the time, money, and effort expended to resolve the issue of responsibility. Resolution and disruption costs depend on how long it takes to identify and implement the solution (that's why construction professionals often say that even a bad decision is better than no decision). Fast, effective problem solving can minimize disruption and solution costs. Each problem type has different problem-solving requirements and potential costs. Fig. 4 illustrates the costs related to the different type of problems.

- Category A: These problems have only ''solution costs'' which are typically low.
- Category B: Despite disagreement on responsibility, the corrective action can proceed before resolution (e.g., Claim 10). The potential costs include solution costs and resolution costs. The parties may split the costs in these situations if a definite basis for determining responsibility cannot be found. Often the determination may wait until later in the project. In some cases, the cost of a series of smaller problems is simply traded, while on distressed projects, these problems may well escalate into more serious matters. Problems in this category are not extremely dangerous, unless the determination of responsibility slows implementation of the solution—a small problem early in a project may have a tremendous impact if the solution is delayed.
- Category C: These problems result in solution and the disruption costs (e.g., Claim 12). Resolution costs are low, because there is agreement on responsibility. The effect of such complex problems depends on the organization's ability to find high quality solutions fast.
- Category D: In these cases, two paths to resolution may be followed. The first path is when a solution is found and the determination of responsibility follows. Because of the pressures to ''get the project built'' one party may also impose a solution. In Claim 2, the contractor's immediate decision to move to a commercial pit (without waiting the state's directions) provided a solution, bringing the problem in Category B. The second path is when the allocation of responsibility is addressed before a solution is found. This may delay problem solving as each party may consider the other one responsible for solving the problem. The results can be severe, as disruption costs increase. In Claim 9, neither party made a decision to change the work method and the costs continued to increase. In Claim 20, the slow decision making also resulted in higher costs.

The need for timely resolution of the issue of responsibility in complex situations has led to the establishment of dispute review boards (DRB) (ASCE 1987). DRB provides both rapid determination of responsibility and assistance in problem solving. Such problems have the highest potential costs, as they include potentially high resolution, disruption, and solution costs. However, the actual effect and costs of the problem depends on the effectiveness of problem solving.

Problem-Solving Effectiveness

An effective project team can minimize the effect of large complex problems, while an ineffective one, may allow small problems to grow into larger issues. The organization's ability to solve problems and agree on responsibility depends on the parties' behaviors, relationships, and processes.

Behaviors: Compete or Cooperate?

Every time a problem arises, the parties have to select between two behaviors: complete or cooperate. The key decision for each party is whether to cooperate to make the overall project function more effectively, or to compete in order to protect its own immediate interests. Competition results when either party acts on the belief (correct or not) that mutual gains are impossible or will not be shared equitably.

During competition, the parties typically focus on the issue of responsibility, rather than finding the best solution. However, delays in problem solving typically result in the problems growing. During cooperation, the parties focus on maximizing joint benefits (integrative bargaining) instead of maximizing their own immediate gains (distributive bargaining). Cooperation does not ignore the distributive aspects of a problem, but enables the parties to take a more creative approach to the distribution problem. The following techniques for reconciling interests are available (Brett et al. 1990): Tradeoff is when parties concede on low-priority interests in order to receive satisfaction of high priority interests. Bridging involves development of creative solutions to serve both parties primary interests. Cost cutting is when some parties take what they

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want in return for acting to reduce costs likely to be incurred by the other party. Non-specific compensation is when some disputants take what they want and the others receive some type of substitute compensation. ''Expanding the pie'' can be used when the dispute is over scarce resources—it involves finding new sources of value which can be traded for the missing resource.

Relationships

The parties' relations, and perceptions of each other, appear to affect the behaviors they will adopt, as well as how effectively they solve problems together. Relations are, in turn, affected by the following factors:

1. Previous experience with the same party: parties involved in long-term relations, are more able to solve problems, and resolve disputes faster (Kashiwagi et al. 1988). Competition is more likely when the relationship is limited in duration and the representatives of each organization see their future more tied to protecting a corporate position, than to improving overall project performance.
2. Perceived fairness of contractual risk allocation (Ashley et al. 1989).
3. Previous dispute resolution process: satisfaction with the process and the outcomes affects how parties will behave in a future dispute. In Fig. 2, this is indicated by the feedback arrow from ''dispute resolution outcome'' to ''problem solving effectiveness'' and ''dispute resolution effectiveness.''
4. Events and behaviors during the job: the importance of the individuals at the interfaces of the organizations must be highlighted. Personalities, attitudes, and skills affect how individuals resolve problems during the project. Good relations are needed at both the senior management and project level. Top management's attitude toward the other party often influences the behaviors of project personnel, and top management's attitude is affected by what their site representatives report back. Understanding the importance of relationships among the site personnel, many subcontractors do not assign a foreman until they know who the contractor's superintendent will be. The basis of this selection is how well the foreman and superintendent have worked together in the past (Birrell 1981).

Processes

Although cooperative behavior is essential for solving complex problems, it is not sufficient—the project organization requires agreement on project goals, effective decision-making processes, and problem solving and negotiation skills (so that the participants can identify and balance the interests of the different parties). Integration and cooperation can arise for reasons beyond the immediate project processes (Nam and Tatum 1992)—long term relations between organizations and individuals, owner's leadership in promoting cooperation between participants, and professionalism of participants. Table 1 summarizes the situational importance of the factors affecting problem-solving ability.

Problem-Solving Outcome and Potential for Dispute

The effectiveness of the problem-solving process determines: (1) the problem's effect on the project (small—large), and (2) the parties' position on responsibility (agree—disagree). With respect to these two factors, the outcome of problem solving can be classified in four categories on the Claims Matrix shown in Fig. 5. Each category has a different impact on the parties' interests and potential for dispute. The potential for dispute is defined as the difference between the owner's and the contractor's evaluations concerning the allocation of additional costs.

TABLE 1. Situational Importance of Factors Affecting Problem Solving

Factors	Type A	Type B	Type C	Type D
Common objectives	Not important	Not important	Important	Critical
Problem solving	Not important	Not important	Critical	Critical
Negotiation skills	Not important	Somewhat important	Critical	Critical
Relationship	Not important	Somewhat important	Important	Critical

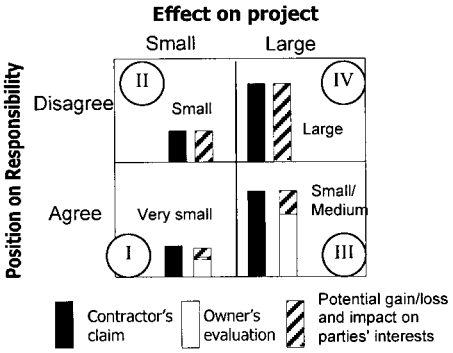

FIG. 5. Claims Matrix

- Category I includes problems with relatively small effect on the project and agreement on responsibility, as in Claim 3 where a design error resulted in extra work. The potential for dispute is small. Disputes in this quadrant are usually settled with project level negotiations.
- Category II includes problems with small effect and disagreement on responsibility. The potential for dispute is larger than Category I, but still relatively small, as in Claim 10.
- Category III includes problems with large effect and agreement on responsibility. The difference between the contractor's and the owner's evaluations may vary from small to medium, due to the difficulty of quantifying the effects of the complex problem (as in Claim 16).
- Category IV includes complex problems with large effect and disagreement on responsibility. These problems have the highest potential for dispute, because the potential loss is very high. Claim 9 is an example of an alleged different site condition, which (due to ineffective problem solving) resulted in large disruption costs and a host of continuing problems.

Other Factors

In addition to the effect on interests, the following factors determine whether a dispute will actually develop.

1. Situational factors: the contractor's financial position may affect the development of disputes. For example, if the contractor is experiencing losses and cash flow problems (e.g., due to errors in the bid) even small issues may result in disputes, as the contractor tries to recover losses through increased claims activity (Diekmann and Nelson 1985).
2. Cost of conflict: the cost of conflict may prevent a party from pursuing claims for small amounts (Zander 1982).

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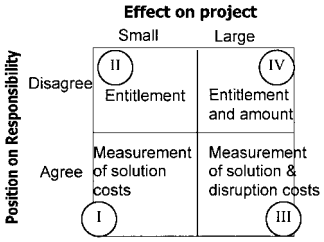

FIG. 6. Issue of Dispute

3. Culture: certain cultures admire display of anger or stubbornness, while others consider avoidance of conflict extremely important (Zander 1982).

Dispute

A dispute may be over the amount, or entitlement, as shown in Fig. 6. Disputes in Category I typically require measurement. In Category II the primary issue is entitlement (allocation of responsibility). Disputes in Category III require quantification of large/complex effect. Although measurement of solution costs is relatively easy, quantification of disruption costs may be extremely difficult, and this task may involve some allocation of responsibility. Disputes in Category IV require primarily assessment of liability and secondary calculation of disruption and solution costs, which is also a difficult task.

Dispute Resolution Costs

The dispute resolution process may be informal (negotiations, bribing, or coercion) or formal (mediation, arbitration, litigation, etc.). The first step is direct negotiations at the project level. If the project team cannot reach an agreement, the negotiations continue at higher organizational levels. If the parties cannot resolve the dispute between themselves, a third party may be called to make the decision. Litigation is the highest possible level of escalation.

The resolution costs have four components (Brett et al. 1990): (1) transaction costs include the time, money, and emotional energy expended in disputing, and increase with the time it takes to reach a resolution (Halligan et al. 1987); (2) satisfaction with process and outcome depends primarily on whether the outcome meets the parties' interests and secondarily on whether the parties believe the process was fair; (3) effect on the relation means both the outcome and the procedures affect the parties' ability to resolve future disputes and their ability to work together day-to-day; and (4) recurrence of disputes—that is, whether disputes stay resolved or recur. For example, a contractor may try to recover losses by filing more claims. The costs of dispute resolution depend on the speed, quality, and finality of the process.

Effectiveness of Dispute Resolution

There are two main approaches to dispute resolution: (1) the adjudicatory approach, and (2) the collaborative approach (Keating and Shaw 1990). Each is based on different assumptions concerning the causes of disputes and have different implications for dispute resolution.

Adjudicatory Approach

This approach is based on the assumption that disputes arise when people differ over the meaning and application of standards (whether derived from statutes, codes, contracts, or ''reasonableness'') to specific conduct. Under this approach, conflict resolution is retrospective in nature and requires a third party judge to evaluate the facts of the situation, select and apply the appropriate standards, and allocate liability to the parties. Once liability has been assessed, the second problem is the determination of appropriate remedies, which can also be a difficult task, especially in the case of complex problems.

The high cost of litigation has led to the development of less formal (thus, faster and less expensive) adjudicatory processes, such as binding and advisory arbitration. Adjudicatory processes typically require high cost procedures, and result in low satisfaction with the process and the outcome, more adversarial relationships, and high recurrence of disputes (Brett et al. 1990).

Collaborative Approach

This approach is based on the assumption that disputes arise when the behavior adopted by one party to fulfill interests, meet needs, or protect values, impacts adversely on the interests, needs, or values of the other party (Keating and Shaw 1990). Here, the parties seek to accommodate conflicting interests rather than establish liability. This approach focuses on maximizing joint benefits and is typically accomplished through meditation. The mediator facilitates the parties' understanding of each other's objective in order to find mutually acceptable solutions. Reconciling interests has lower costs and tends to produce higher satisfaction with outcomes, better relations, and less recurrence of conflicts (Brett et al. 1990).

Factors Affecting Dispute Resolution

The model proposes that two main factors determine the parties' ability to resolve the dispute through negotiations: (1) the potential impact on the parties' interest, and (2) the parties' relationships. Fig. 7 illustrates the level of escalation, the amount claimed, and the quality of work relationships. According to the contractors and the department's managers, the most important factor that prevented their resolution of the studied claims, was the strained relations between the contractors and the department.

Previous research on differing site condition claims has found that contractors tend to appeal adverse decisions until

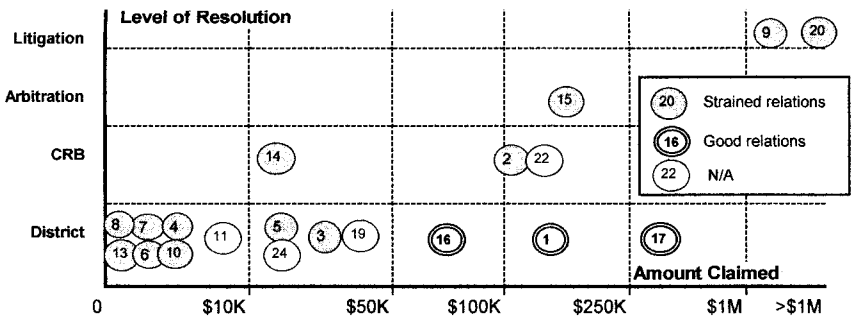

FIG. 7. Magnitude of Claim, Relations, and Level of Resolution

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they reach a level of dispute resolution where their interests are taken into consideration and the contract is interpreted loosely for the sake of fairness (Halligan et al. 1987).

RECOMMENDATIONS

The model identifies four main areas where actions can be taken to prevent disputes and/or minimize their costs: (1) reduce uncertainty, (2) reduce contractual problems, (3) increase ability to resolve problems, and (4) establish alternative dispute resolution mechanisms.

Actions to Reduce Uncertainty

Although elimination of uncertainty is impossible, the following measures can reduce problems during construction.

1. Conduct risk assessment to identify areas of potential problems before construction starts. Partnering-type meetings provide the forum for the project team to discuss the risks (design, existing conditions, labor availability, etc.) and identify actions to address them.
2. Use cost allowances for potential additional costs in areas of uncertainty.
3. Conduct constructability reviews to reduce the interaction between operations.
4. Establish reliable production management process to improve the reliability of workflow (Ballard and Howell 1998).
5. Improve the communication of plans from planners to users (e.g., have meetings to discuss work scope in detail with contractors).

Actions to Reduce Contractual Problems

1. Use standard contracts to avoid misinterpretations of risk allocation.
2. Allocate risks to the parties that can best control it. This measure increases the integrity and acceptance of the contract and has been found to have positive impact on parties' relationships (Ashley et al. 1989).

The contractual approach may be sufficient on relatively simple projects with low uncertainty and performance requirements. However, as already discussed, the traditional approach of up-front contractual allocation of responsibility for all contingencies is inadequate in complex, uncertain projects with high performance requirements. In such projects, the parties need to increase their ability to resolve problems.

Actions to Prevent Opportunistic Behavior

Promoting cooperation and establishing good relations reduce the potential for opportunistic behavior, so that the parties can work together to solve complex problems. Ways to improve relations include the following.

1. On complex projects, assign managers and superintendents with strong cooperative skills and attitudes.
2. Promote relations at multiple levels—senior management and project level.
3. Conduct teambuilding to develop common project goals and processes, and discuss interests and expectations.
4. Set up joint training in negotiations and problem-solving.
5. Keep each other informed about their actions during the project (i.e., do not send a letter to the other party without informing them ahead of time).

Finally, future research should address the factors that drive parties to behave opportunistically, and ways to limit opportunistic behavior.

Actions to Increase Problem-Solving Ability

To resolve problems with low solution and disruption costs, in addition to cooperative behavior, the project team must establish effective problem-solving mechanisms. This requires (1) problem-solving and negotiation skills, and (2) processes and policies to promote fast decision making at the project level, and fast escalation of issues that cannot be resolved on site. When uncertainty is high, a significant investment in such mechanisms may be needed. The development of skills, processes, and relations require significant effort and investment at the beginning of the project, because changes in attitudes and beliefs and learning of new skills and processes are necessary for successful cooperation.

Actions to Minimize Dispute Resolution Costs

In the beginning of the project, the owner and contractor must establish dispute resolution mechanisms that have the confidence of all parties. Provisions for low cost resolution methods need to be made in order to prevent fast escalation. Joint selection of a mediator and/or a dispute review board, increases the parties' confidence that their interests will be considered, and that a fair solution can be found.

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