

## **Prometheus unbound: Unraveling the underlying nature of disputes**

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### **Abstract**

Research has revealed that factors such as scope changes, poor contract documentation, restricted access, unforeseen ground conditions and contractual ambiguities are contributors of disputes. While this is widely known, disputes still prevail over such issues. Before disputes can be avoided an understanding of the pathogens that contribute to their occurrence needs to be determined so that mechanisms can be put in place to prevent them from arising. To determine the pathogens contributing to disputes, a total of 41 in-depth interviews were undertaken with industry practitioners who identified 58 examples of disputes in projects that they have been actively involved with. Analysis of the findings revealed that the pathogens of circumstance (arising from the environment), practice (arising from peoples' deliberate practices) and task (arising from the nature of the task being performed) accounted for 87% of dispute occurrences. The environment associated with the use of traditional lump sum contracting was found to be associated with 72% of the disputes. The practice of deliberately not adhering to policies, and procedures, undertaking design reviews and distributing tentative design documents contributed to the problems arising. The task of failing to detect errors and misinterpreting contract terms and conditions contributed to disputation. It is suggested that organizations need to fundamentally re-examine their work processes, policies and procedures as well as behaviors if disputes are to be reduced in construction.

*Keywords:* Australia, causal path, disputes, learning, pathogens.

## Introduction

The myth of *Prometheus*, the benefactor of the human race and the creator of science and crafts, has not lost its visual power despite the fact the story was recorded more than 2500 years ago. Modern scholars associate the story of Prometheus with revolutionary change (Wutrich, 1995:p.140). In 1820, Percy Shelly wrote his famous play: Prometheus Unbound. The title refers to the Aeschylus play 'Prometheus Bound' and reflects the second revolutionary change in human history: the liberation from the chains of feudalism and the emergence of the industrial revolution. Is there a lesson from the Prometheus legend that can enable researchers' to better address the issues surrounding disputation in construction? Myths are visions of fundamental truth and so it is not possible to extract from them lessons for the management of human affairs. Myths imply ambiguity, fuzziness, but can enable a holistic viewpoint to be attained (Pels, 1973:p.240). They are, however, reminders of the legitimate forces that are present in the making of new technological eras. They can act as a signpost through the clouds of uncertainty and ambiguity associated with new scientific advances and technological breakthroughs. Far from providing recipes for managing technologies and change, they can be used to provide an orientation toward 'understanding' the problems that continually materialize in construction. The myth of Prometheus is a reminder of the cultural disenchantment and issues that are related with disputes. The myth is also a reminder of the differing goals and objectives of participants as well as the historical and professional boundaries that prevail. The construction industry is still struggling for the reconciliation of change and cultural cohesion. Despite a plethora of research and the countless legal precedents that have emerged, disputes have become an endemic feature of the construction industry. Unfortunately, they have become a norm!

The determination of the causes of disputes has reached saturation point; consistently the same causal variables are identified (e.g., Diekmann and Nelson, 1985; Semple *et al.*, 1994; Kumaraswamy, 1997; Cheung and Yiu, 2006; Yiu and Cheung, 2007). Because most of the studies undertaken have been based upon questionnaires (e.g., Kumaraswamy, 1997) or derived from case law (e.g., Watts and Scrivener, 1992), the factors identified often lack contextual meaning. For example, poor communication has been identified as a cause of disputes (Bristow and Vassilopoulos, 1995; Kumaraswamy, 1997). Yet according to Busby (2001) problems do not arise because X does not communicate Z to Y, but the way Y interprets Z in light of some prior experience (or lack of), which X does not know about. Thus, X fails to make allowances for Z, and Y does not realize X does this because Y thinks both that their experiences are representative. Simply improving communication practices by improving information flow with technology or using Computer-Aided-Design will not reduce *per se* the incidence of disputes in construction. Fundamentally, work processes, policies, and procedures as well as behaviors need to change in concert if disputes are to be reduced in construction. Yet for change to have any significance a

better understanding of the underlying conditions associated with disputes is needed. Thus, in this paper the causes of dispute are re-examined through a different lens so that the process of situated cognition can be used as mechanism to avoid disputes.

## **DISPUTE CAUSATION**

The literature has propagated studies that have sought to determine the causes of disputes (Table 1). Fenn *et al.* (1997) previously suggested that there had been limited empirical evidence that has been structured to justify the theories that had been presented. It would appear that Fenn *et al.*'s (1997) observation is still pertinent some ten years on. Much of the research that has been undertaken simply seeks to identify a list of factors or triggers which show some association with disputes. In fact, many of the factors identified are not dissimilar in nature as identified in Table 1. The identification of such factors, while useful, does not explain the underlying causal nature of disputes. In an attempt to examine the causality of disputes, Kumaraswamy (1997) sought to determine the *root* (the underlying reason of the problem and if eliminated, would prevent recurrence) and *proximate* (immediately precedes and produces the effect) causes. Root causes identified by Kumaraswamy (1997) include: unfair risk allocation, unrealistic time/cost/quality targets by the client, adversarial industry culture, inappropriate contract type, and unrealistic information expectations. Proximate causes identified included: inadequate brief, slow client responses, inaccurate design information, inaccurate design documentation, inappropriate contract form, inadequate contract administration, and inappropriate contractor selection.

A close examination of root and proximate causes of disputes proposed by authors such as Kumaraswamy (1997) makes it difficult to determine what originally gave rise to the other in many instances. Here parallels can be drawn with the 'chicken or the egg causality dilemma' and the circular cause of consequence (Garner, 2003). There are many real world examples of circular cause-and-effect, in which the chicken-or-egg dilemma helps identify the analytical problem. For example, fear of economic downturn causes people to spend less, therefore reducing demand, resulting in an economic downturn. A lack of professionalism by design professionals because of reduced design fees can result in inadequate contract documentation being produced, and therefore lead to rework that manifests as a lack of professionalism and may eventually emerge in a dispute. Many of the root causes of disputes identified in the literature can be managed and controlled using various project management strategies, tools and techniques. For example, errors in documentation can be reduced through the use of design audits and reviews. The exception being uncontrollable external events such as weather, unforeseen ground conditions and the behavior of parties (Kumaraswamy, 1997).

Mitropoulos and Howell (2001) suggest that a combination of environmental and behavioral problems can lead to disputes. The inherent degree of uncertainty that prevails within construction projects can result in planning being a problematic issue, especially when information is not available. When uncertainty is high, initial drawings and specifications will invariably change, and the project team will have to solve problems as they arise during construction. Once changes arise they may be deemed to be ambiguous and as a result disagreements between parties can arise. This is because under the concept of *bounded rationality* not all potential contingencies are identifiable and can be assessed until they materialize (Williamson, 1979). When parties enter into a contract and a specific clause fails to account for an unforeseen event or it is interpreted to suit the particular circumstances that have arisen, then there is a potential for *opportunism*. In this instance there is likelihood for a party to opportunistically exploit or delay another to maximize own gains (Mitropoulos and Howell, 2001). The dispute causation factors of uncertainty, contractual problems and opportunistic behavior identified by Mitropoulos and Howell (2001) are similar to those recognized by Diekman *et al.* (1994): (1) project uncertainty, which cause change beyond the expectation of the party, (2) process problems, which includes imperfect contracts and unrealistic performance expectations, and (3) people issues, problems due to poor interpersonal skills, opportunistic behavior and cognitive dissonance.

Table 1. Claims and disputes in construction (Adapted from Kumaraswamy, 1997)

Author(s)	Factors contributing to claims/disputes
Blake Dawson Waldron (2006)	<p><i>Nine</i> key causes in disputes:</p> <ol style="list-style-type: none"> <li>1. Variations to scope</li> <li>2. Contract interpretation</li> <li>3. EOT claims</li> <li>4. Site conditions</li> <li>5. Late, incomplete or substandard information</li> <li>6. Obtaining approvals</li> <li>7. Site access</li> <li>8. Quality of design</li> <li>9. Availability of resources</li> </ol>
Cheung and Yui (2006)	<p><i>Three</i> root causes of disputes:</p> <ol style="list-style-type: none"> <li>1. <i>Conflict</i> - Task interdependency, differentiations, communication obstacles, tensions, personality traits</li> <li>2. <i>Triggering events</i> - Non performance, payment, time</li> <li>3. <i>Contract Provision</i></li> </ol>
Yiu and Cheung (2004)	<p><i>Significant</i> sources:</p> <ul style="list-style-type: none"> <li>• Construction related: variation and delay in work progress</li> <li>• Human behavior parties: expectations and inter parties' problems</li> </ul>
Killian (2003)	<ul style="list-style-type: none"> <li>• <i>Project management procedure</i>: Change order, pre-award design review, pre-construction conference proceedings, and</li> </ul>

	<p>quality assurance.</p> <ul style="list-style-type: none"> <li>• <i>Design errors</i>: errors in drawings and defective specifications.</li> <li>• <i>Contracting officer</i>: Knowledge of local statutes, faulty negotiation procedure, scheduling, bid review</li> <li>• <i>Contracting practices</i>: Contract familiarity/client contracting procedures.</li> <li>• <i>Site management</i>: scheduling, project management procedures, quality control, and financial packages</li> <li>• <i>Bid development errors</i>: estimating error</li> </ul>
Mitropoulos and Howell (2001)	<p>Factors that drive the development of a dispute:</p> <ol style="list-style-type: none"> <li>1. Project uncertainty</li> <li>2. Contractual problems</li> <li>3. Opportunistic behavior</li> </ol>
Kumaraswamy (1997)	<p><i>Five common category of claims:</i></p> <ol style="list-style-type: none"> <li>1. Variations due to site conditions</li> <li>2. Variations due to client changes</li> <li>3. Variations due to design errors</li> <li>4. Unforeseen ground conditions</li> <li>5. Ambiguities in contract documents</li> </ol> <p><i>Five common causes of claims:</i></p> <ol style="list-style-type: none"> <li>1. Inaccurate design information</li> <li>2. Inadequate design information</li> <li>3. Slow client response to decision</li> <li>4. Poor communication</li> <li>5. Unrealistic time targets</li> </ol>
Conlin <i>et al.</i> (1996)	<p><i>Six key dispute areas:</i></p> <ol style="list-style-type: none"> <li>1. Payment and budget</li> <li>2. Performance</li> <li>3. Delay and time</li> <li>4. Negligence</li> <li>5. Quality</li> <li>6. Administration</li> </ol>
Sykes (1996)	<p><i>Two major groupings of claims and disputes:</i></p> <ol style="list-style-type: none"> <li>1. Misunderstandings</li> <li>2. Unpredictability</li> </ol>
Bristow and Vasilopoulos (1995)	<p><i>Five primary causes of claims:</i></p> <ol style="list-style-type: none"> <li>1. Unrealistic expectations by parties</li> <li>2. Ambiguous contract documents</li> <li>3. Poor communications between project participants;</li> <li>4. Lack of team spirit</li> <li>5. Failure of participants to deal promptly with changes and unexpected outcomes</li> </ol>
Diekman <i>et al.</i> (1994)	<p><i>Three main dispute areas:</i></p> <ol style="list-style-type: none"> <li>1. Project uncertainty</li> <li>2. Process problems</li> <li>3. People issues</li> </ol>
Heath <i>et al.</i> (1994)	<p><i>Five main categories of claims:</i></p> <ol style="list-style-type: none"> <li>1. Extension of time</li> <li>2. Variations in quantities</li> <li>3. Variations in specifications</li> <li>4. Drawing changes</li> <li>5. Others</li> </ol>

	<p><i>Seven</i> main types of disputes:</p> <ol style="list-style-type: none"> <li>1. Contract terms</li> <li>2. Payments</li> <li>3. Variations</li> <li>4. Extensions of time</li> <li>5. Nomination</li> <li>6. Re-nomination</li> <li>7. Availability of information</li> </ol>
Rhys Jones (1994)	<p><i>Ten</i> factors in the development of disputes:</p> <ol style="list-style-type: none"> <li>1. Poor management</li> <li>2. Adversarial culture</li> <li>3. Poor communications</li> <li>4. Inadequate design</li> <li>5. Economic environment</li> <li>6. Unrealistic tendering</li> <li>7. Influence of lawyers</li> <li>8. Unrealistic client expectations</li> <li>9. Inadequate contract drafting</li> <li>10. Poor workmanship</li> </ol>
Semple <i>et al.</i> (1994)	<p><i>Six</i> commons categories of dispute claims:</p> <ol style="list-style-type: none"> <li>1. Premium time</li> <li>2. Equipment costs</li> <li>3. Financing costs</li> <li>4. Loss of revenue</li> <li>5. Loss of productivity</li> <li>6. Site overhead</li> </ol> <p><i>Four</i> common causes of claims:</p> <ol style="list-style-type: none"> <li>1. Acceleration</li> <li>2. Restricted access</li> <li>3. Weather/cold</li> <li>4. Increase in scope</li> </ol>
Watts and Scrivener (1992)	<p>Most frequent sources of claims:</p> <ol style="list-style-type: none"> <li>1. Variations</li> <li>2. Negligence in tort</li> <li>3. Delays</li> </ol>
Hewitt (1991)	<p><i>Six</i> areas:</p> <ol style="list-style-type: none"> <li>1. Change of scope</li> <li>2. Change conditions</li> <li>3. Delay</li> <li>4. Disruption</li> <li>5. Acceleration</li> <li>6. Termination</li> </ol>

### **Pathogens: Latent Conditions**

Pathogens are latent conditions that lay dormant within the project system until a problem comes to light. Before the problem becomes apparent, project participants often remain unaware of the impact upon project performance that particular decisions, practices or procedures can have. Pathogens can arise because of strategic decisions taken by top management or key decision-makers within a project. Such decisions may be mistaken, but they need not be. Latent conditions can lay dormant within a system for a

considerable period of time and thus become an integral part of everyday work practices. However, once they combine with *active failures* then the problem that arises and the subsequent consequences may be significant. Active failures are essentially inappropriate acts committed by people who are in direct contact with a system. Such acts include: slips, lapses, mistakes and procedural violations (Reason, 2000). Active failures are often difficult to foresee and therefore cannot be eliminated by simply reacting to the event that has occurred. Latent conditions, however, can be identified and remedied before an adverse event such as a dispute between parties occurs. Pathogens have been defined by a number of qualities (Busby and Hughes, 2004):

- they are a relatively stable phenomena that have been in existence for a substantial time before the dispute occurs;
- before the dispute occurs, they would not have been seen as obvious stages in an identifiable sequence failure; and
- they are strongly connected to the dispute, and are identifiable as principal causes of the disputes once it occurred.

According to Busby and Hughes (2004) pathogens can be categorized as:

- *Practice* – arising from people’s deliberate practices;
- *Task* – arising from the nature of the task being performed;
- *Circumstance* – arising from the situation or environment the project was operating in;
- *Organization* – arising from organizational structure or operation;
- *System* – arising from an organizational system;
- *Industry* – arising from the structural property of the industry; and
- *Tool* – arising from the technical characteristic of the tool.

Love *et al.* (2008) have suggested that before causal inferences can be made it is necessary to initially determine the latent conditions that contribute to the problem that is being experienced.

## **Research Approach**

To determine the pathogens that contribute to disputes in construction projects an exploratory research approach was adopted as there has been limited work that has sought to address these salient issues. Interviews were chosen as the primary data collection mechanism because they are an effective tool for

learning about matters that cannot be observed. Interviews were used as an attempt to understand the views of practitioners, to unfold the meaning of practitioners' experiences of dispute causation. In other words, interviews were used to gain an understanding and the underlying change needed to prevent their occurrence (Kvale, 1996). According to Taylor and Bogdan (1984:p.79), no other method "can provide the detailed understanding that comes from directly observing people and listening to what they have to say at the scene".

### *Interviews*

Three basic types of qualitative interviewing have been identified (Patton, 1991): the informal conversational interview, the interview guide approach, and the standardized open-ended interview. Although these types vary in the format and structure of questioning, they have in common the fact that the participant's responses are open-ended and not restricted to choices provided by the interviewer. A plethora of definitions as to what constitutes a dispute can be found in the normative literature. The operational definition of a dispute used for the purposes of the study reported is:

"When parties cannot resolve an issue relevant to the performance of the project in a proactive, timely and mutually acceptable manner, and each party forms an entrenched and contrary opinion with respect to that issue that requires resolution".

This definition focuses on dispute related to the performance of the contract, thus avoiding situations that are purely behavioral in nature.

The interview guide is the most widely used format for qualitative interviewing and was adopted for this research (Patton, 1991). In this approach, the interviewer has an outline of topics or issues to be covered, but is free to vary the wording and order of the questions to some extent. For example, the interviewees were asked to think of a recent completed project that they had been involved with where there had been a dispute. Background details of the project such as contract value, duration were obtained. Then the interviewer proceeded to ask the interviewee to select a dispute from the project and describe its antecedents from their perspective. This enabled the researcher to delve into the contextual backdrop so that inferences could be made. This type of interview requires relatively skilled and experienced interviewers who need to know when to probe for more in-depth responses or guide the conversation to make sure that all topics on the outline are covered. In this case, two interviewers with more than fifteen years research and industry experience were used to conduct the interviews.



Forty one in-depth interviews were conducted over a two month period with a variety of personnel such as project directors, quantity surveyors (QS), architects, arbitrators, project managers, contract administrators. Firms from the metropolitan area of Perth were *selected from the Yellow Pages*<sup>®</sup> using the technique of stratified random sampling and invited to participate in the research. The interviews were conducted at the offices of interviewees. Interviews were digitally recorded and transcribed verbatim to allow for the nuances in the interview to be apparent in the text.

The interviewees' details were coded to allow for anonymity, although all interviewees were aware that it might be possible to identify them from the content of the text. The format of the interviews was kept as consistent as possible following the themes associated with disputes identified from the literature (e.g., antecedents, costs, effect etc). The nature of the questions allowed for avenues of interest to be pursued as they arose without introducing bias in the response. Notes were taken during the interview to support the digital recording to maintain validity. Each of the interviews varied in length from 30 minutes to two hours. Interviews were open to stimulate conversation and breakdown any barriers that may have existed between the interviewer and interviewee.

### *Data Analysis*

Content analysis was used as the primary analysis technique on the collected data. In its simplest form this technique is the extraction and categorization of information from documents. Inferences from the data can only be drawn of the relationship with what the data means can be maintained between their institutional, societal and cultural contexts (Krippendorff, 1980). The text derived from the interviews was analyzed using QSR Nvivo (which is a version of NUD\*IST and combines the efficient management of Non-numerical Unstructured Data with powerful processes of Indexing and Theorizing) and enabled the development of themes to be identified.

One advantage of such software is that it enables additional data sources and journal notes to be incorporated into the analysis. The development and re-assessment of themes as analysis progresses accords with the calls for avoiding confining data to pre-determined sets of categories (Silverman, 2001). Kvale (1996) suggests that *ad hoc* methods for generating meaning enable the researcher access to 'a variety of common-sense approaches to interview text using an interplay of techniques such as noting patterns, seeing plausibility, making comparisons etc' (p.204).

Using Nvivo enabled the researchers to develop an organic approach to coding as it enabled triggers or categories of interest in the text to be coded and used to keep track of emerging and developing ideas

(Kvale, 1996). These codings can be modified, integrated or migrated as the analysis progresses and the generation of reports, using Boolean search, facilitates the recognition of conflicts and contradictions. This process enabled the pathogens and causal paths of disputes to be determined.

## **Research Findings and Discussion**

### *Project Characteristics*

The sample of 41 interviewed comprised of: 3(7%) public sector client, 6(15%) private sector client, 3(7%) consulting project managers, 11(27%) contractors, 4(10%) consulting engineers, 4(10%) architects, 3(7%) QS, 4(10%) arbitrators/mediators 3(7%) and subcontractor 1(2%). Each individual was initially asked to describe a recently completed project where they had been involved with a dispute. 11 respondents were not able to identify any particular project but were able to provide examples and their perceived causes of disputes. 30 respondents identified and described a specific dispute that they had been involved in, and in some cases were able to identify more than one example.

In total 58 projects and dispute examples were identified by interviewees (Table 2). The *most* common project types were: commercial – offices 6(10%), commercial – retail 6(10%), administration – authorities 9(16%), hospital/health 5(9%), administrative – civic 5(9%), and railway 4(7%). The procurement methods used to deliver the projects were traditional lump sum 42(72%), design and construct 10(17%), construction management 2(3%), alliance 2(3%) and traditional cost-plus 1(2%). The type of contracts used in the projects varied but the most popular form used was based on Australian Standard (AS) 2124 for 42(72%) projects. Other types of contract forms used were AS4902 2(3%), AS4000 4(7%), owner bespoke forms 3(5%), AS4300 (Amended) 2(3%), AS4916 (Amended) 1(2%), engineering and construction contract 1(2%), and NPWC3 1(2%). The total value of the projects sampled was approximately A\$4.47 billion. The contract value for the projects ranged from A\$250,000 to A\$1.8 billion with a mean of A\$77.23 million. The duration of the projects ranged from 3 to 60 months with a mean of 15.5 months.

### **Pathogens: Determination of Causal Paths**

A number of themes emerged from the analysis of the interview data as to the underlying causes of disputes from the 58 examples provided by interviewees. The most common issues were client influences and expectations, scope and design changes, contract documentation, inadequate planning and management, risk allocation and non-adherence to practices and procedures. Each of the examples provided by interviewees was examined in detail and the latent conditions contributing to the dispute determined. In almost all cases there appeared to be several pathogens working together and so related

pathogens for the examples that were provided are also identified and denoted using a prefix as noted in Table 2. It can be seen that the pathogens of *task*, *practice* and *circumstance* contributed to 87% of disputes. Examples of the common pathogens and the dispute trajectories using a causal path diagram are presented hereinafter.

*Example 1 - Task pathogen: Procedural violation*

In the following example a dispute arose because of a series of *omission errors*. Omissions errors can be defined as failures to follow due procedure when undertaking a task(s). Architectural and mechanical shop drawings were not checked and verified and as a result a very costly rework incidence occurred, which eventuated into a dispute between parties who were not willing to take responsibility for the error that arose. The project was a prison that was refurbished using a traditional lump sum contract AS2124. The contract value was A\$1.5 million and the schedule was 6 months. Because of the dispute that was raised the project was delayed by 8 months. The dispute was resolved through the process of negotiation at a cost of A\$200,000, which equates to 13% of the project's original contract value.

Table 2. Summary of pathogens occurring in the 58 construction disputes

Pathogen Category	Description	Dispute		Related pathogens
		Cause	Examples	
<i>Practice</i>	Pathogens arising from people's deliberate practices	<ul style="list-style-type: none"> <li>Failure to undertake design reviews</li> <li>Distribution of tentative design documents</li> <li>Failure to oblige by contractual obligations</li> </ul>	16	(T),(C)
<i>Task</i>	Pathogens arising from the nature of task being performed	<ul style="list-style-type: none"> <li>Failure to detect and corrects an omission/error in design documentation</li> <li>Misinterpretation of contract terms and conditions</li> </ul>	15	(P),(C),(CO)
<i>Circumstance</i>	Pathogen arising from the situation or environment the project is operating in	<ul style="list-style-type: none"> <li>Low design fees meant tasks were deliberately left out</li> <li>Failure to provide access to site</li> <li>Unforeseen scope changes</li> </ul>	19	(P),(T),(CO)
<i>Convention</i>	Pathogens arising from standards and routines	<ul style="list-style-type: none"> <li>Re-use of existing specification and design solutions</li> <li>Failure to adhere to company polices</li> </ul>	5	(C),(T)
<i>Industry</i>	Pathogens arising from the structural property of the industry	<ul style="list-style-type: none"> <li>The use of competitive tendering resulting in selection of lowest bid</li> <li>Contract forms and risk allocation (Limited incentives)</li> </ul>	2	(C),(CO)
<i>Tool</i>	Pathogens arising from a characteristic of a technical tool	<ul style="list-style-type: none"> <li>Ineffective use of CAD software (no checking for inconsistencies)</li> </ul>	1	(T),(P)

Key: Practice (P), Task (T), Circumstance (C), Convention (CO) Organization (O), System (S), Industry (I), Tool (TO)

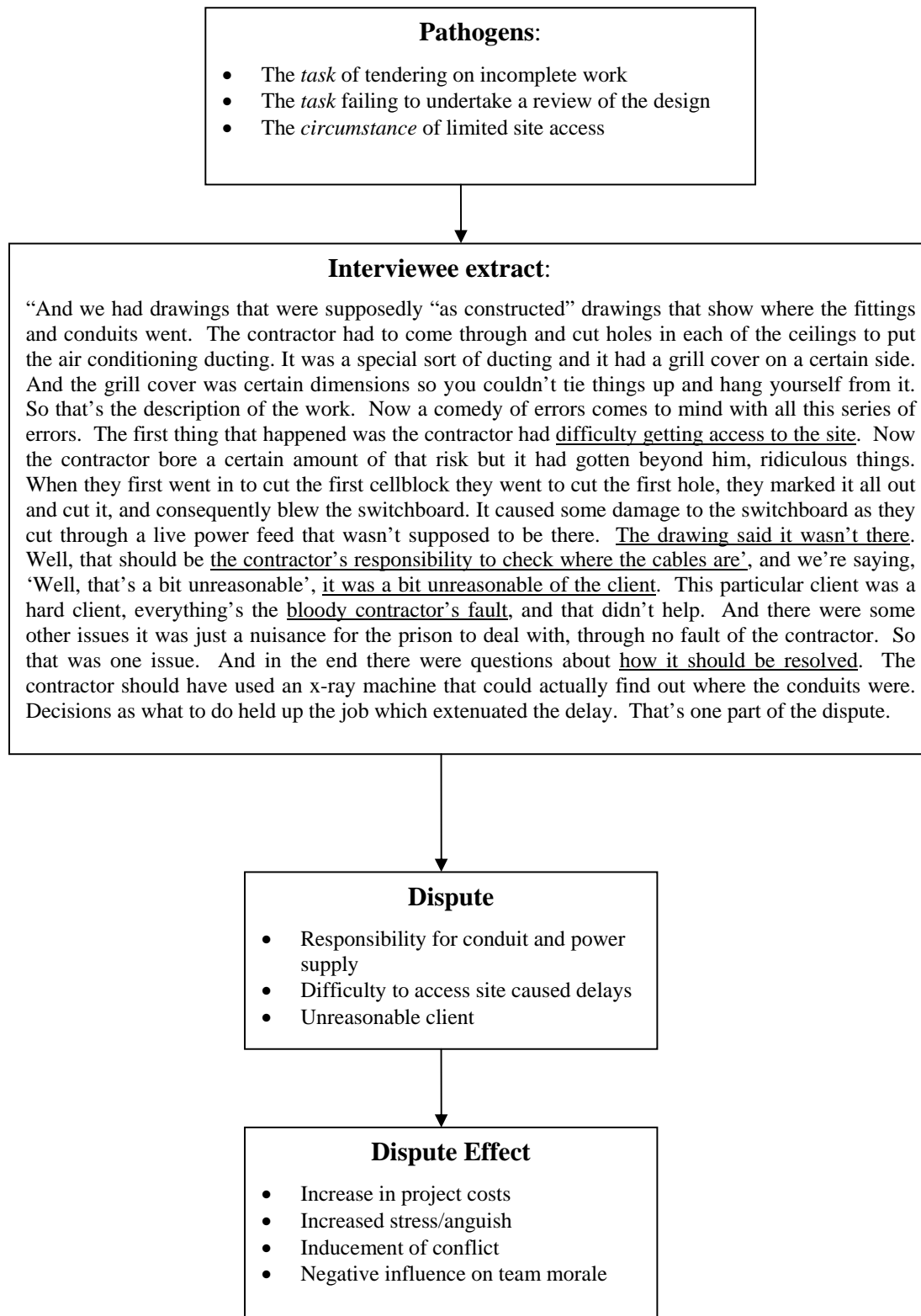


Figure 1. Causal path for a dispute: Task pathogen

Two major incidents were identified as contributing to the dispute in this project. The first related to access to the site and incomplete drawings, and the second related to erroneous drawings and unilateral decision-making on behalf of the lead consultant. Figure 1 identifies the causal path of for the initial dispute that happened because of incomplete information. Serendipitously, the previous as-built drawings for the prison did not correspond with what had been actually constructed. Penetrations were required for the installation of air conditioning (A/C) grills. The contractor was given limited access to prison cells and as result this affected the program of works. After 'setting-out' where the penetrations were required in the ceiling slab work commenced almost immediately. While undertaking the initial penetrations electrical conduits were severed, which caused a fault to occur and subsequently damaged the switchboard. A dispute arose as to who was responsible for fixing the conduit and replacing the switchboard. In addition, the issue as to how to overcome the problem associated with electrical conduit that had not been incorporated within the 'as-built drawings' took considerable time to resolve and delayed the project by two weeks with considerable costs being borne by the contractor. The costs of rectifying the damaged works were approximately A\$30,000.

*Example 2 - Practice pathogen: Failure to communicate an error*

While the aforementioned dispute came to light and was in the process of being resolved another began to manifest (Figure 2). The architectural drawings that had been produced were examined by the mechanical engineer and it was revealed that the size of the A/C grills shown on the drawings was wrong and thus would not meet the specified airflow requirements. The A/C documentation produced by the mechanical engineer simply did not marry with the architectural documentation; the A/C grills were deemed to be too small in size. The mechanical engineer informed the architect in writing about this error. The architectural documentation was not amended and tenders were called from subcontractors with incorrect information present. The mechanical subcontractor who was awarded the contract was not notified of the error contained within the documents. Shop drawings were produced by the subcontractor and instead of providing them directly to the contractor to gain the necessary approvals as noted in their contract; they were bypassed and given directly to the mechanical consultant for approval. The subcontractor did this because they had a close working relationship with the mechanical consultant. In addition, they needed the shop drawings to be approved as soon as possible so as not to delay their program and the project. The project was experiencing considerable delays at this point. Despite the mechanical engineer informing the architect of the error, it was revealed that the architect had amended the grill sizes to match their drawings without informing any other project team member. The mechanical engineer had assumed the architectural drawings had been altered as requested, but unknowingly they had not. Instead the architect had unilaterally made the decision to opt for the smaller size A/C grills without consulting the necessary

parties. The mechanical consultant approved the shop drawings and failed to notice that the A/C grills were the size originally specified by the architect. In fact, the shop drawings were not distributed to the architect for checking. No detailed checking had been undertaken. The drawings were passed on to the project superintendent's acting representative who approved the drawings without also checking them. The contractor on receiving the shop drawings also stated they had been checked by them, when in fact they had not been. Thus, on the basis of the approvals received the A/C grills were manufactured and delivered to site. During the installation of the A/C grills the subcontractor noticed they were too small as penetrations were larger than the grill size. For some unknown reason, penetrations were cut as required for the larger size A/C grills as originally specified by the mechanical consultant. The cost of manufacturing the smaller A/C grills was \$50,000. They did not fit and were inadequate. The architect apparently abrogated their responsibility for the problem by explicitly stating the architectural documentation were correct and if the shop drawings had been distributed to them then the error would have been identified.

*Example 3 - Circumstance pathogen: Appropriate procurement selection*

In the next example, the pathogen of *circumstance* is described, as noted in Figure 3. A number of pathogens and conditions interacted that contributed to the dispute that is examined. The selected project was procured using an alliance contract and the client placed considerable pressure on the project team to deliver the project as quickly as possible. Such pressure placed considerable strain on the design and engineering team, especially with the skills shortage being experienced, particularly in Western Australia (WA). The design team was not able to meet the required schedule and as a result it was perceived that they adopted a work of practice of purposefully not checking what they had designed with one another so as to meet their deliverables. The contractor made the following comment:

“We’re subjected to liquidated damages in our contract but designers weren’t. There was no stick in place to whack them with, they don’t have penalties. They just send crappy documentation and expect us to cop it.”

This set the scene for a battleground on the project despite an alliance being in place. The contractor accepted the terms under the contract but did not expect to be subjected to documentation that was so indecorously put together. Because the documentation was incorrect, scope changes had to be made, which had an impact on the program and the contractor's costs. Relations became strained and a great deal of tension was present at site meetings. It was perceived that personal agendas began to take a foothold and so it was agreed that the problems were to be resolved through negotiation.

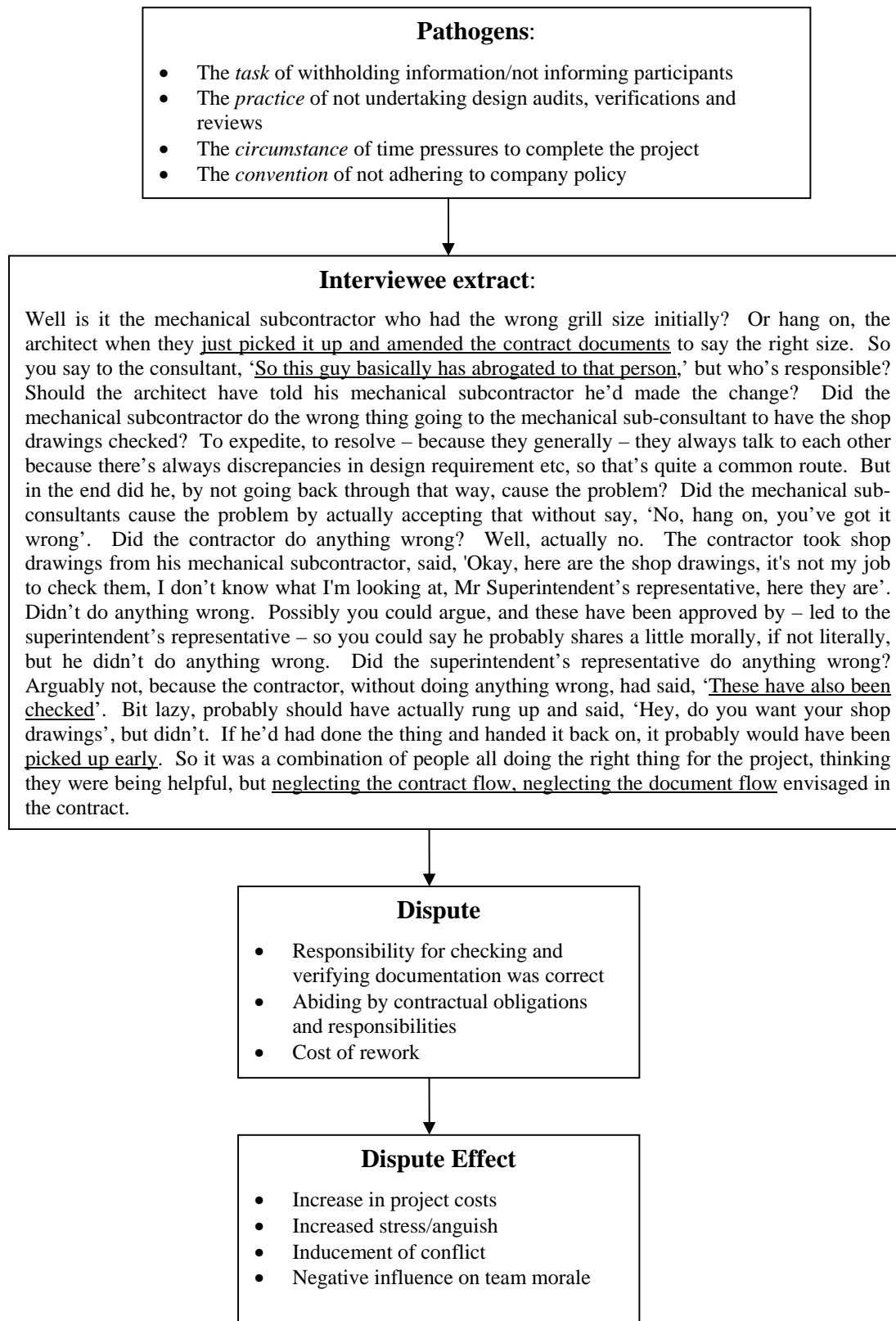


Figure 2. Causal path for a dispute: Practice pathogen

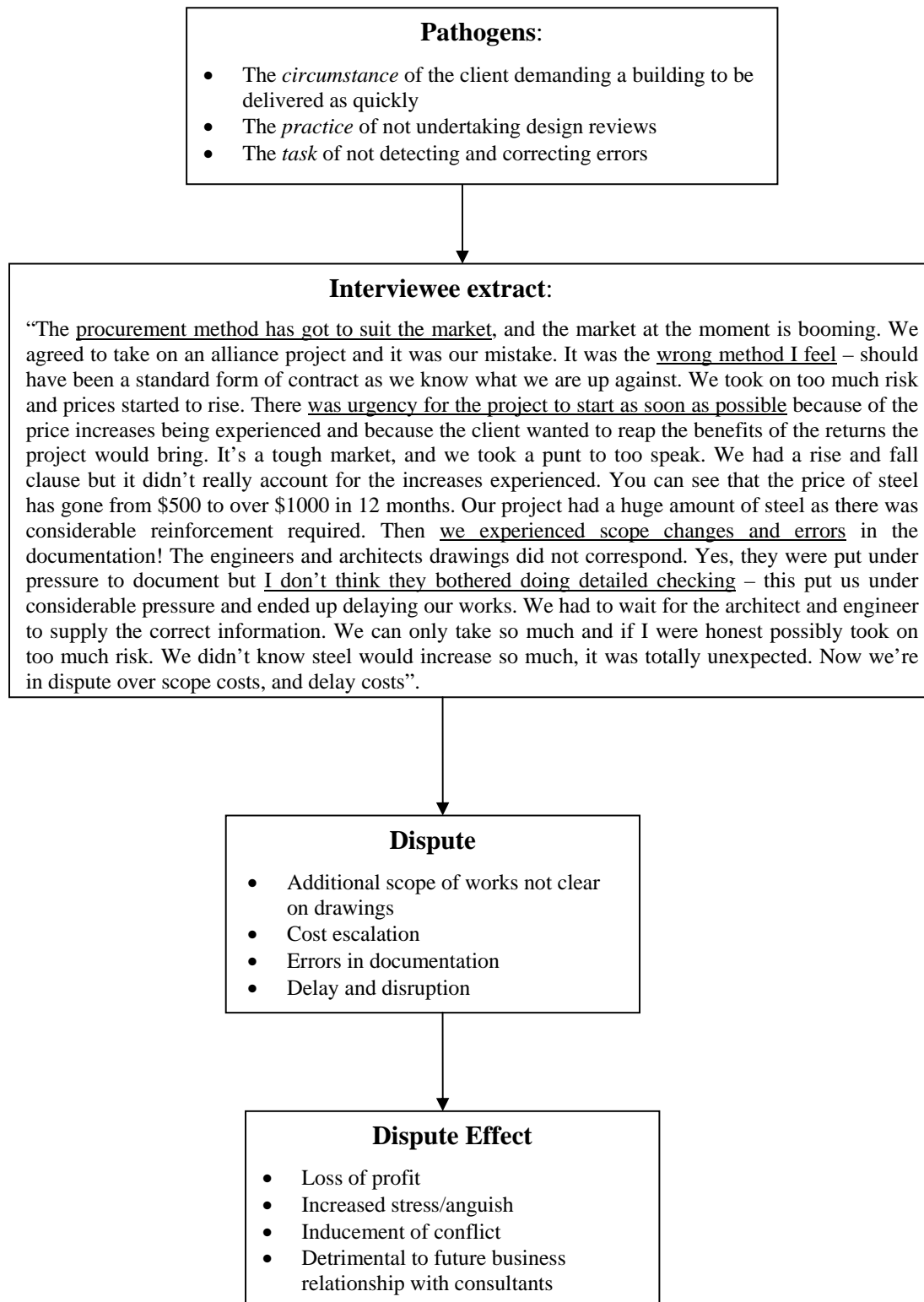


Figure 3. Causal path for a dispute: Circumstance pathogen



## Interrelationship of Pathogens

Figure 4 summarizes the relationship between the significant pathogens that have emerged from the analysis and interpretation of the data. These findings are similar in nature to the research reported in Love *et al.* (2008) where the underlying pathogens for errors were identified. However, the pathogenic influence of ‘*circumstance*’ was also found to be a prevalent feature. The circumstance within which a project is procured influences the work practices adopted and how tasks are performed. For example, a skills shortage had been experienced and there was considerable cost escalation being experienced because of the rising price of commodities. It was imperative, within WA for example, that projects were delivered as quickly as soon possible to meet the demands of clients. Unfortunately, there were instances where an inappropriate procurement strategy for projects was adopted.

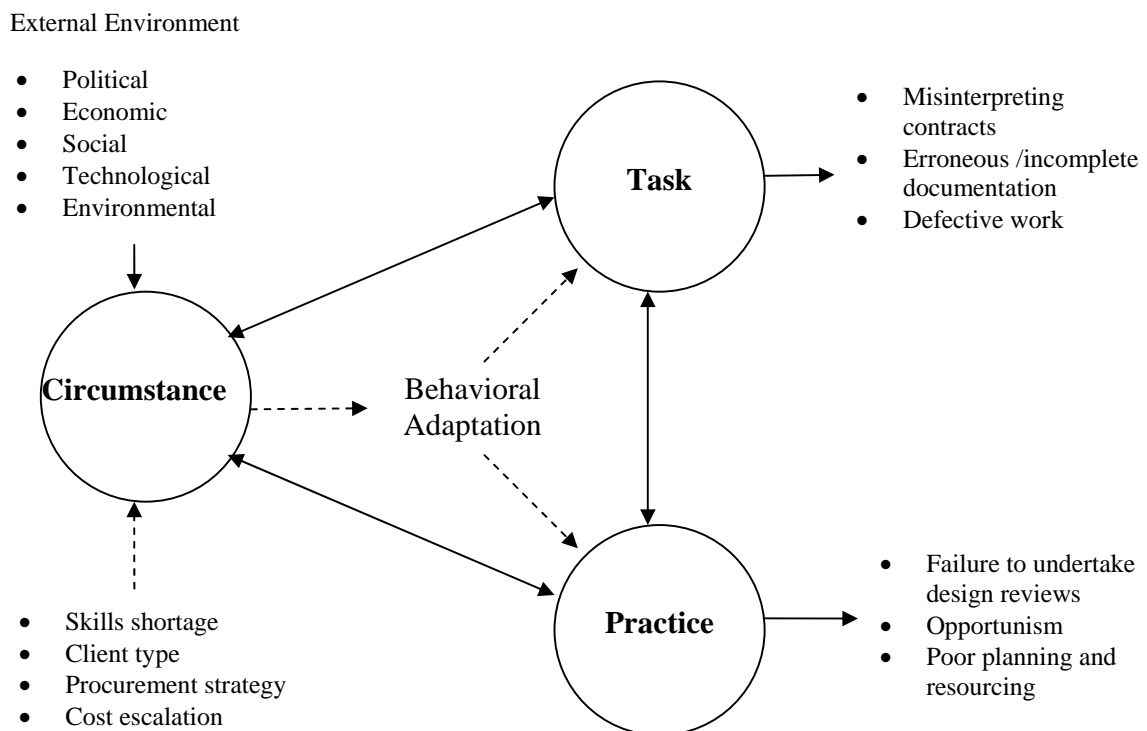


Figure 4. Interrelationship of pathogens

A traditional lump sum method, for example, was used for a project that was more than two years in duration and was in excess of A\$1 billion. The contract documentation contained many errors and omission because of the ‘schedule pressure’ placed on consultants and because resource constraints. Practices such as design reviews and distributing tentative information were adopted. Moreover, limited

time was spent on checking for errors. When the problem is identified then there is a potential for a dispute as there are invariably financial implications for the party who is affected by the error.

The circumstance may influence an individual's behavioral adaptation because of their personality and how deal with the environmental pressures imposed upon them. This can be further be exacerbated by the existent culture, strategy and policies that prevail within their organization and those that are subsequently transferred to the project. The environment within which projects are procured is constantly changing and it is important for organizations and project managers realize how it can influence the nature of tasks and practices are that employed. From the evidence provided from this exploratory study disputes appear to materialize because of an organization's inability to react effectively to environmental pressures (e.g., political, economic, social and technological) that they are subjected too as well as those being directly imposed upon the project. Consequently, this may impact project tasks and procedures and stimulate the occurrence of active failures. Such failures invariably lay dormant within the project system until they are identified. If issues associated with the active failure are not effectively remedied, then a dispute can materialize and have a significant impact on the performance of the project. Considering the underlying latent conditions associated with circumstance, task and practice it is suggested that strategies for avoiding disputes should initially focus on these areas.

Strategies for avoiding disputes were solicited by interviewees so as to identify pragmatic practices that could be readily adopted and possibly have a significant impact. Nevertheless, the reduction of issues such as scope changes, rework, and an overall improvement in productivity and performance would require the construction industry to make a dramatic 'paradigm shift' from being essentially adversarial; where there are only 'winners' and 'losers' to one that is based upon solidarity and collaboration where mutual gains can be attained and sustained for the benefit of all parties. This will require organizations to transform their businesses in terms of relationships, behaviors, processes, communications and leadership.

## **Conclusion**

While a considerable amount of knowledge has been accumulated about dispute causation, they continue to prevail and disharmonize the process of construction with considerable cost. The reason as to why they still continue to occur is that many firms have failed to learn from previous experiences and continue to adopt work practices that are opportunistic as well as posses a 'blame culture' that is used to dominate and control in an oppressive tyrannical manner instead of taking responsibility for their actions. This invariably translates to individuals' behavior and how they respectfully solve problems with other individuals.

An underlying condition contributing to how individuals address problems that arise pertains to the circumstances within which the project is being procured. The adoption of adversarial practices such as competitive tendering often leads to the lowest price being adopted. In hindsight, however, many clients and consultants have often regretted this choice when expected performance levels (in terms of time, cost quality, safety and even information flows) are not achieved. A re-examination of original selection processes often reveals decisions are dominated solely by price competition. This is particularly the case for consultants who are also often forced to competitively bid for their services and as a result provide minimal services for the fees charged, which often results in documentation being substandard. To obtain 'best value' there needs to be a shift toward negotiation rather than the use of competitive selection so as to ensure firms who have the capability and experience to undertake the project at hand. While negotiation is probably amenable to many private sector clients, those from the public sector will have to confront issues surrounding probity and the perception of public accountability.

There is a need for greater use of modern procurement methods, which by default promote the use of constructability. A significant proportion of the dispute examples provided pertained to traditional lump sum contracting. This procurement route by its very nature is adversarial and therefore it is not surprising that disputes occurred, though it should be acknowledged that many successful dispute free projects have been procured using this method.

Firms need to implement stringent policies and procedures that must be adhered to at all times (e.g., quality systems), but at the same time being cognizant of not initiating blame. When an individual is deemed to be non-compliant and 'procedural violations' arise, then behavior modification should be undertaken using intervention. Behavior after error occurrence is influenced by the presentation of positive heuristics, for example, "I made a mistake; I can learn from this!" Such positive heuristics are presented to facilitate emotional coping after the event's occurrence, thereby aiding people to consider that errors can also be interpreted as informative feedback. Learning from mistakes is pivotal to dispute avoidance. The use of communities of practices within organizations and projects can provide an opportunity to share knowledge, solve problems, and derive innovative solutions. The transformation from an adversarial to one of solidarity and collaboration can enable such discourse and learning to take place between individuals and organizations through *situated cognition*, which is necessary for dispute avoidance and resolution. While such actions are necessary, *hope*, remains locked away in Pandora's Box.

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