INVESTIGATION OF FIDIC CLAUSES PERTAINING PROJECT CHANGES ON PROJECT PERFORMANCE

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ABSTRACT
The aim of this paper is to demonstrate the high impact of FIDIC clauses pertaining alterations, additions, and omissions on project performance. Owners and contractors alike will benefit by taking a more discerning approach to the contractual arrangements of their projects. Variations (changes) in projects are common and considered causes of substantial adjustment to the contract cost and/or time, and in turn, may lead to disputes. The findings of this research indicate that project changes affect the cost, the scheduling, and the duration of projects, both directly and indirectly. Proactive contractual arrangements such as FIDIC contracts, and development of a project change management system before the project commences is a good step toward constructively managing change.

KEYWORDS: FIDIC, construction, performance, project changes

INTRODUCTION
Changes in projects are common and may be deleterious or beneficial - whether you see a change as a conflict or a valuable lesson depends only on your prospective. Variations should not invalidate the contract or in turn, lead to disputes. Changes in projects must be dealt with seriously as beneficial and valuable lesson. Project changes affect the cost, the scheduling, and the duration of projects, both directly and indirectly [1].

The local Construction Industry in Palestine is in need to improve project change management system that effectively minimizes delays, inflated cost, general claims, and even costly litigation associated with project change. It is hypothesized that significant savings in the total installed cost and schedule of any construction project may be achievable by improving the management of changes. Management of changes is seriously affected by contractual relationships. Therefore, as far as the FIDIC contracts are concerned they have traditionally been based on the principle of balanced risk sharing and, as such, have been widely accepted on the employer's and the contractor's side as a reasonable compromise [2].

BACKGROUND
Since changes are expected on most construction projects, the parties to the contract must be fully knowledgeable about the specific contract terms concerning changes. The specific wording of contract provisions for changes is very important [3]. Despite many articles and much discussion in practice and academic literature, there is a lack of information about systematic approaches to manage project change. Changes and conflicts in projects, at work, and even in our daily lives are very common, meanwhile, good communication can lead to changes that have a positive effect on the project, as
managers can learn valuable lessons from the conflict episode [4]. Any additions, deletions, or other revision to project goals and scope are considered to be changes, whether they increase or decrease the project cost or schedule. Most commonly, lack of timely and effective communication, lack of integration, uncertainty, a changing environment, and increasing project complexity are the drivers of project change [5].

In addition, these changes may affect other aspects of the performing organization that may have program management implications. In project management, changes in projects can cause substantial adjustment to the contract duration time, total direct and indirect cost, or both [6]. Therefore, project management teams must have the ability to respond to change effectively in order to minimize the impact to the project. Because changes are common to projects, it is critical to understand that managers confront, embrace, adapt, and use changes to impact positively the situations they face and to recognize changes as growth [7].

Kartam [8] has suggested that conflict will be minimized when a problem has been studied as early as possible, since the problems can be identified and beneficial changes can be made. Common project planning tools such as risk analysis can be used to reduce the destructive consequences of change, because they give insights and predictions to identify possible conflicts [9]. Before the project begins, another strategy may be considered, that is to think through the project and to use the tools previously described and their result from the study to prevent dispute. Development of a project change management system and good contractual arrangements before the project starts is a good approach toward constructively managing change.

**METHODOLOGY**

A structured interview was used to determine the most important clauses that impact the project performance. A sample of the most-experienced qualified owners, contractors, and consultants in Gaza Strip were questioned, where: 4 owners, 4 contractors, and 4 consultants were the targeted experts. The panel respondents (owners, contractors, and consultants) were requested to determine the most important clauses of FIDIC contract general conditions that impact the construction project performance. Table 1 illustrates (by consensus) point of view of the local experts regarding the most important clauses that may have an impact on project performance.

Table (1) FIDIC groups that may have an impact on project performance

<table>
<thead>
<tr>
<th>Contractors</th>
<th>Owners</th>
<th>Consultants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineer and Engineer's Representative</td>
<td>General Obligations</td>
<td>Engineer and Engineer's Representative</td>
</tr>
<tr>
<td>Contract Documents</td>
<td>Suspension</td>
<td>Contract Documents</td>
</tr>
<tr>
<td>General Obligations</td>
<td>Commencements and Delays</td>
<td>Materials, Plant and Workmanship</td>
</tr>
<tr>
<td>Suspension</td>
<td>Alterations, Additions and</td>
<td>Suspension</td>
</tr>
</tbody>
</table>
According to the previous table, each FIDIC group that at least selected by two parties is considered as a very important group that impacts the project performance as follows:

- Engineer and Engineer's Representative.
- Contract Documents.
- General Obligations.
- Suspension.
- Commencements and Delays.
- Alterations, Additions and Omissions.
- Procedure for Claims.
- Certificates and Payment.
- Special Risks.
- Release from Performance.
- Settlement of Disputes.

Alterations, Additions and Omissions group were selected by contractor, owners and consultants as an important group that affects project performance. This group deals with the construction project changes or variations. In this paper, the author chose this group in particular, for the purpose of studying its impact on the construction project performance.

The targeted contractors are those who are classified under the first and second class in the various types of work fields by the Palestinian Contractors Union (PCU). The targeted owners are represented by: ministries, municipalities, and other non-governmental organizations (NGO's). A total of 75 questionnaires were randomly distributed to targeted contractors, owners, and consultants as 25 questionnaires for each group. All of them have fully completed the questionnaires accordingly. The
The questionnaire was designed mainly according to previous studies related to the subject of this research [10].

The respondents were asked to give their perceptions regarding the impact of FIDIC clauses pertaining project changes on construction project performance on five-point Likert scale (1 for the strongly disagree to 5 for the strongly agree). The questionnaire has been validated by the criterion-related reliability test which measures the correlation coefficients between the factors selected for in one group and the whole groups, and structure validity test (Spearman test) [11]. To determine the relative ranking of the factors, these scores were then transformed to importance indices based on the next formula Tam et.al [12].

$$\text{Relative Importance Index (RII)} = \frac{\sum W}{AN} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + n_1}{5N}$$

Where $W$ is the weighting given to each factor by the respondent, ranging from 1 to 5, ($n_1$ = number of respondents for Strongly disagree, $n_2$ = number of respondents for disagree, $n_3$ = number of respondents for neutral, $n_4$ = number of respondents for agree, $n_5$ = number of respondents for strongly agree). $A$ is the highest weight (i.e. 5 in the study) and $N$ is the total number of samples. The relative importance index ranges from zero to one.

**Statistical Manipulation**

To achieve the research goal, researcher used the statistical package for the Social Science (SPSS) for Manipulating and analyzing the data.

**RESULTS**

**Relative importance index and ranking from owners' perspective**

**Alterations, additions, and omissions clauses**

This group contains three clauses that clarify the alterations, additions and omissions clauses. Table 2 shows that the surveyed owners ranked the clause "Variations" at the 1st and 2nd ranks regarding time, quality, safety, cost and satisfaction with RII = 0.827, 0.673, 0.600, 0.820 and 0.680 respectively. This result shows the high relative importance of this clause regarding project performance.
Table (2) Relative importance index and ranking for Alterations, additions, and omissions clauses

<table>
<thead>
<tr>
<th>Clause</th>
<th>Cost</th>
<th>Time</th>
<th>Quality</th>
<th>Safety</th>
<th>Satisfaction of Contract Parties</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RII</td>
<td>Rank</td>
<td>RII</td>
<td>Rank</td>
<td>RII</td>
</tr>
<tr>
<td>Variations</td>
<td>0.820</td>
<td>2</td>
<td>0.827</td>
<td>1</td>
<td>0.673</td>
</tr>
<tr>
<td>Valuation of Variations</td>
<td>0.853</td>
<td>1</td>
<td>0.787</td>
<td>2</td>
<td>0.653</td>
</tr>
<tr>
<td>Power of Engineer to Fix Rates</td>
<td>0.800</td>
<td>3</td>
<td>0.600</td>
<td>3</td>
<td>0.667</td>
</tr>
<tr>
<td>Group's Mean RII</td>
<td>0.824</td>
<td></td>
<td>0.738</td>
<td></td>
<td>0.664</td>
</tr>
</tbody>
</table>

The surveyed owners ranked the clause "valuation of variations" at the 1st, 2nd and 3rd ranks regarding cost, satisfaction, time, safety and quality with RII = 0.853, 0.720, 0.787, 0.580 and 0.653 respectively. The clause of "Power of engineer to fix rates" was ranked at the 2nd and 3rd ranks regarding quality, cost, satisfaction, time and safety with RII = 0.667, 0.800, 0.660, 0.600 and 0.560 respectively. The group's mean RII regarding cost, time, quality, safety, and contract parties’ satisfaction are 0.825, 0.738, 0.664, 0.580 and 0.687 respectively.

Relative importance index and ranking from contractors' perspective

Alterations, additions, and omissions of FIDIC clauses

Table 3 shows that the surveyed contractors ranked the clause "Variations" at the 1st rank regarding cost, time and satisfaction with RII = 0.932, 0.905 and 0.789 respectively, and at the 3rd rank regarding quality and safety with RII = 0.742 and 0.616 respectively. This result shows the high relative importance of this clause.
Table (3) Relative importance index and ranking for alterations, additions, and omissions clauses

<table>
<thead>
<tr>
<th>Clause</th>
<th>Cost</th>
<th>Time Schedule</th>
<th>Quality</th>
<th>Safety</th>
<th>Satisfaction of Contract Parties</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RII</td>
<td>Rank</td>
<td>RII</td>
<td>Rank</td>
<td>RII</td>
</tr>
</tbody>
</table>
| Variations                     | 0.932 | 1             | 0.905   | 1      | 0.742                           | 3
| Valuation of Variations        | 0.895 | 3             | 0.816   | 2      | 0.763                           | 2
| Power of Engineer to Fix Rates | 0.900 | 2             | 0.753   | 3      | 0.784                           | 1
| Group's Mean RII                | 0.909 | 0.825         | 0.763   | 0.630  | 0.781                           |

The surveyed contractors ranked the clause "valuation of variations" at the 2nd rank regarding time, satisfaction, quality and safety with RII = 0.816, 0.779, 0.763 and 0.621 respectively. This clause was ranked at 3rd rank regarding cost with RII = 0.895. The clause of "Power of engineer to fix rates" was ranked at the 1st rank regarding quality and safety with RII = 0.784 and 0.653 respectively. This clause was ranked at the 2nd rank regarding cost with RII = 0.900 and was ranked at the 3rd rank regarding satisfaction and time with RII = 0.774 and 0.753 respectively. The group's mean RII regarding cost, time, quality, safety and contract parties satisfaction are 0.909, 0.825, 0.763, 0.630 and 0.781 respectively.

Relative importance index and ranking from consultants' perspective

Alterations, additions, and omissions of FIDIC clauses

Table 4 shows that the surveyed consultants ranked the clause "Variations" at the 1st and 2nd ranks regarding time, satisfaction, quality, safety and cost with RII = 0.655, 0.655, 0.636, 0.600 and 0.691 respectively. This result shows the high relative importance of this clause.
Table (4) Relative importance index and ranking for alterations, additions, and omissions clauses

<table>
<thead>
<tr>
<th>Clause</th>
<th>Cost</th>
<th>Time</th>
<th>Quality</th>
<th>Safety</th>
<th>Satisfaction of Contract Parties</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RII</td>
<td>Rank</td>
<td>RII</td>
<td>Rank</td>
<td>RII</td>
</tr>
<tr>
<td>Variations</td>
<td>0.691</td>
<td>2</td>
<td>0.655</td>
<td>1</td>
<td>0.636</td>
</tr>
<tr>
<td>Valuation of Variations</td>
<td>0.673</td>
<td>1</td>
<td>0.582</td>
<td>2</td>
<td>0.618</td>
</tr>
<tr>
<td>Power of Engineer to Fix Rates</td>
<td>0.618</td>
<td>3</td>
<td>0.527</td>
<td>3</td>
<td>0.618</td>
</tr>
<tr>
<td>Group's Mean RII</td>
<td>0.661</td>
<td></td>
<td>0.588</td>
<td></td>
<td>0.624</td>
</tr>
</tbody>
</table>

The surveyed consultants ranked the clause "valuation of variations" at the 1st and 2nd ranks regarding cost, safety, satisfaction, quality and time with RII = 0.673, 0.600, 0.636, 0.618 and 0.582 respectively as shown in Table 4. The clause of "Power of engineer to fix rates" was ranked at the 1st, 2nd and 3rd ranks regarding time, quality, safety, cost and satisfaction with RII = 0.527, 0.618, 0.527, 0.618 and 0.564 respectively as shown in Table 4. The group's mean RII regarding cost, time, quality, safety and contract parties’ satisfaction are 0.661, 0.588, 0.624, 0.576 and 0.618 respectively.

**CONCLUSION**

This study has successfully demonstrated the high impact of FIDIC clauses pertaining alterations, additions, and omissions on project performance. The surveyed contractors, owners and consultants consider the FIDIC clauses pertaining project changes are satisfactory to them with a relative importance indices (RII) ranges from 0.781 to 0.618. They believe and according to FIDIC clauses that any variations are considered causes of substantial adjustment to the contract cost and/or time; and that by these clauses; no such variation shall in any way invalidate the contract and in turn, may lead to disputes. This illustrates that variations (changes) in projects are common and may be deleterious or beneficial whether the change is considered either a conflict or a valuable lesson. Meanwhile, They agree that the varied work will be valued at the rates and prices set out in the contract, but if the contract does not contain any rates or prices applicable to the varied work, the rates and prices in the contract will be used as the basis for the valuation so far as may be reasonable.

The surveyed contractors and owners agree that a suitable rate or price for the varied work will be agreed upon between the engineer and the contractor, and in the event of disagreement, the engineer shall fix such other rate or price as is, in his opinion,
appropriate. Rates of costs are a major cause for claims and consequently disputes unless to be agreed upon or fixed according to contract. Owners and contractors alike will benefit by taking a more discerning approach to the contractual arrangements of their projects, although the perfectly balanced contract, in which the interests of contract parties are treated equally, does not yet seem to exist. Conflict will be minimized when a problem has been studied as early as possible, since the problems can be identified and beneficial changes can be made.

Common project planning tools such as risk analysis can be used to reduce the destructive consequences of change, because they give insights and predictions to identify possible conflicts. The findings of this research indicate that project changes affect the cost, the scheduling, and the duration of projects, both directly and indirectly. Proactive contractual arrangements such as FIDIC contracts, and development of a project change management system before the project commences is a good step toward constructively managing change.

REFERENCES