# Conflicting Factors in Korean Construction Industry

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**Abstract**

Change is inevitable and is a reality of construction projects. Most construction contracts include change clauses and allowing contractors an equitable adjustment to the contract price and duration caused by change. However, the actions of a contractor can cause a loss of productivity and furthermore can result in disruption of the whole project because of a cumulative or ripple effect. Because of its complicated nature, it becomes a complex issue to determine the cumulative impact (ripple effect) caused by single or multiple change orders. Furthermore, owners and contractors do not always agree on the adjusted contract price for the cumulative impact of the changes. A number of studies have attempted to quantify the impact of change orders on project costs and schedule. Many of these attempted to develop regression models to quantify the loss. However, regression analysis has shortcomings in dealing with many qualitative or noisy input data. This study develops ANN models to classify and quantify the labor productivity losses that are caused by the cumulative impact of change orders. The results show that ANN models give significantly improved performance compared to traditional statistical models.

Keywords: Construction Projects, Conflicting Factors, Disputes, Successful Project, Korea

## 1. Introduction

In a perfect construction world there would be no conflicts, but there is no perfect construction world. The conflict problems encountered in the projects led to prolonged delays in implementation, interruptions and sometimes suspension. Due to attributable to various groups, large investments, low profits conflict continues to maintain its highly explosive character (Awakul and Ogunlana, 2002). Construction trend represents recognition that legal solutions (burgeoning ready-made contracts and preoccupation with preparing positions for possible adversary proceedings) were increasingly unsatisfactory (Stipanowich and Matthews, 1997).

Traditionally, even in current contractual provisions too, owner or consultant continually transferring the risks to the contractors, which have been resulted high contingencies to their bids to cover the costs of risk. For this imbalance in risk, the owners have been paid their risks twice - once in bidding contingencies and a second time in court (Fisk, 2000, p. 235).

"The total number of construction companies was rose by 2,538 to 64,703 last year, while the average amount of work carried out per company climbed 11.5 percent on the year to KRW 2.13 billion won" reported by statistical bureau of Korea (South Korean Construction, 2004). The sharp increase reflects the strong demand last year for residential, commercial and office spaces, which were spurred on by surging real estate prices.

Korean construction industry has been reported as a dispute avoiding culture domination. Cho (2003) has stated that Korean builders often try to develop the contractual relationships into a trust-based relationship. Some large private owners (firms) pursue more

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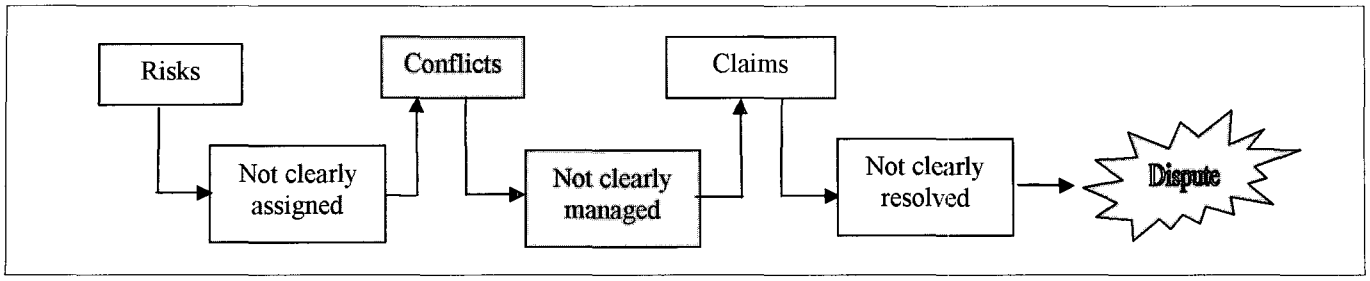


Fig 1. Risk, Conflict, Claim and Dispute Continuum Model

mature relationships with their contractors by providing distinctive rewards in pricing, long term transactions and employees' training (Cho, 2003). Therefore, most of the construction works have been completed without being trapped in complicated conflicts. Although, to our best knowledge Korean construction sites are not suffered from chronic disputes, there could be several problems causing friction between the contracting parties and deteriorating productivity. Therefore, the purpose of this study was to explore whether there are any conflicting factors existed in Korean construction industry.

Knowing the probable conflicting factors beforehand helps to tackle project proceedings strategically for project participants. A proverb "prevention is better than cure" rightly fits in the case of avoiding construction conflict. Therefore, in most cases, a better answer is to address site issues as early as possible before positions hardens, costs mount and conflict poisons the job environment, and to seek integrative solutions instead of defending positions and competing for tactical advantage.

Conflicts and disputes in construction sites affect performance of all the participants e.g. owner group, design and supervision consultant team, contractors, subcontractors etc. However this study concentrates only on three principal participants of construction project. They are: owners, design team (consultant) and contractors. It is believed that the outcome of this paper would contribute benefits to the owners, contractors, consultants and project managers to tackle the probable construction conflict seeds before those sown on the field.

## 2. Construction Risks, Conflicts, Claims and Disputes

There are confusion among construction professionals about what are the differences between risks, conflicts, claims and disputes in construction field. According to McCallum (2000) many factors those are unknown or unknowable at the start of the project and if occurred could have negative consequences then such exposure to possible loss is called construction risk.

To ensure the success of its undertaking a company/corporate owner embarking on a construction project must be able to recognize and assess these risks (McCallum, 2000). Inability to assess risks could be resulted in the conflicts later. Therefore the risks which are potential to transform into conflict have been defined as the 'Critical conflicting factors'. Here, conflict is defined as a serious difference between two or more beliefs, ideas or interests. If two beliefs, ideas, or interests are in conflict, they are very different from each other and it seems impossible for them to exist together or to each be true.

According to Fenn, Lowe and Speck (1997) conflict and dispute are two distinct notations. Conflict exists wherever there is incompatibility of interest, and therefore is disease. Conflict can be managed possibly to the extent of preventing a dispute resulting from the conflict. Dispute is associated with distinct justiciable issues. Claim is a disagreement as an extension of conflict, which come in effect to recover the loss. It cannot be resolved by mutual agreement and become construction disputes which must be resolved by arbitration, litigation or other alternative dispute resolution methods as set forth in the contract (Barrie and Paulson, 1992).

Disputes require resolution; this means they cannot be managed. The resolution process may lend itself to third-party intervention (mediator, arbitrator, court etc.). Occurrence of risk, conflict, claim and dispute in construction projects follows as per model shown in Fig. 1

## 3. Review of Common Conflicting Factors

According to Loosemore (1999) escalation of conflict in the construction sites could be the result of five factors: i) uncertainty of financial responsibilities ii) preconceived belief structures iii) personal interest iv) organizational policies and v) opponent's tactics.

Gardiner and Simmons,(1998) have illustrated that the people as important cause of conflict than procedures or systems in dysfunctional conflict process. Some other empirical studies and results of researches about construction conflicts and disputes conducted in different countries are depicted in table 1.

O' Brien (1998, p.2) said that the contractor will prefer to accept both additional work and extra work change orders if they do not obviously impede progress in the field, and if they can be negotiated at an equitable figure. Fisk (2000, p. 111) has dealt about the conflicts due to drawings and specifications, Drawings and specification are complement to each other. But often one document is changed during design and the other is overlooked. Specification is also plagued by the use of vague and unenforceable subjective terms. Contract document often fail to adequately describe, define, or delineate the work to be performed. This generates some of the so-called 'scope-of-work: disputes" (Fisk, 2000, p. 112).

One of the most misunderstood of all contract provisions, and the one that is frequently the cause of large contractor claims for additional work and change orders is the provision for differing site conditions (Fisk 2000, p. 145). Another common occurrence during construction is the constant search by the contractor to obtain products that cost less than those actually specified, and offer them to the architect/engineer as substitutes which invites conflicts later.

Because of the increasing complexity of today' s construction, shop drawings in recent years have become one of the largest sources of professional liability claims against the designer. Unreasonable delay in processing shop drawings and ambiguous wording in the shop drawing approval stamps are the principal sources of trouble. According to Casey (1979) design failures or constructability errors are becoming more and more apparent, and the architect/engineer should bear the true cost of such failures (cf. Fisk, 2000, p. 231). Even after 25 years back of Casey' s statement, it is unfortunate in construction industry that this trend is still continuing.

Various risk factors stated by Kartam and Kartam (2001), Rahman and Kumaraswamy (2004) have been found in line with factors mentioned by Casey (1979). Furthermore, Fenn et al (1997) have also reviewed a number of literatures about sources of disputes. Table 1 reveals different results and causes of conflicts and disputes in construction field.

The sources and reasons of conflicts are different according to the nature of the projects and conditions of a particular country. In fact, it is argued that reasons of conflict in construction field varied from country to country according to the local construction environment hence cannot be generalized for entire construction field in all over the world.

To our best knowledge, there are no such any studies exploring about conflicting factors pertinent in Korean construction industry. So this study has tried to find out the pertinent critical conflicting factors in domestic construction industry context.

Table 1. Common Construction Conflicting Factors

| S. N. | Conflicting Factors (Superscript numbers show reference) |
|---|---|
| 1 | Confusing requirements of owner 7,9 |
| 2 | Excessive change orders 2-9, 12-14 |
| 3 | Project scope definition not clear 3,5,9 |
| 4 | Site access delays 1,2,5,8,14 |
| 5 | Financial failure of owner1,4,5,7,8,9,15 |
| 6 | Financial failure of contractor 1, 4-8 |
| 7 | Differing site condition 1-6, 8 |
| 8 | Acceleration or suspension of work 1,2,4,14 |
| 9 | Defective design 1,2,3,7,8 |
| 10 | Errors and omission in design 2,5,6,8 |
| 11 | Excessive quantity variations 2,3,5,8,9 |
| 12 | Specification related 4,5,9 |
| 13 | Defective construction (quality) 1,2,8,13,15 |
| 14 | Accident/safety 1,3,5,8 |
| 15 | Incompetent contractor 2,5,7,8 |
| 16 | Change order negotiation 5,8 |
| 17 | Conflicts in document 2,3,4,8,9,11,12 |
| 18 | Change in government codes 1,2,5,7,8 |
| 19 | Labor disputes/Union strikes 1,2,5,6,8 |
| 20 | Inflation 1,5,7,8 |
| 21 | Labor, equipment, material shortage 5,7,8 |
| 22 | Adverse weather/acts of god 3,5,6,8,14 |
| 23 | Inadequate administration of participants 2,4,7,15 |
| 24 | Lack of communication 4,6,7,9,12 |
| 25 | Third party delays 2,3,5,8,15 |
| 26 | Attitudes of project participants/negligence 10, 15 |

References

1. Casey (1979, theoretical) 2. Barrie et al (1992, theo.) 3. Fisk (2000, theo.) 4. Levy (2000, theo.) 5. Kartam et al (2001, Kuwait) 6. Harmon (2003, Canada) 7. Long et al (2004, Vietnam) 8. Rahman et al (2004, Hong Kong) 9. Chan et al (2004, China) 10. Awakul et al (2002, Thailand) 11. Clegg (1992, UK) 12. Bristow et al (1995, Canada) 13. Diekmann et al (1985, USA) 14. Semple et al (1994, Canada) 15. Conlin et al. (1996, UK).- References serial no. 11 to 15 are cited in Fenn (2002).

## 4. Main Participants of Construction Project

Conflicts and disputes in construction sites affect performance of all the stakeholders e.g. sponsors, owner group, design and

Table 2. Involvement by Project Structure

| Structure | Frequency | Percent |
|---|---|---|
| Building | 17 | 13.7% |
| Road | 54 | 43.5% |
| Railway | 28 | 22.6% |
| Others | 25 | 20.2% |
| Total | 124 | 100% |

supervision consultant team, contractors, subcontractors, equipment/material suppliers and agents, labor force etc. However in simple terms, construction is an enterprise involving four major groups or parties, all of whose actions can influence productivity (Oglesby, Parker and Howell, 1989). They are: owners, designers, constructors and the labor force. The efforts of all these four major parties are essential if an owner' s project is to become reality. The cost, quality, and timeliness of the labor force depend not only on their skills and desires to work but also on the performance of the three other parties who control the ingredients necessary for productivity at the work face (Oglesby et al, 1989).

Table 3. Respondents by Project Delivery

| Project delivery | Frequency | Percent |
|---|---|---|
| Traditional | 92 | 74.2% |
| Design/Build | 22 | 17.7% |
| BOT/BOOT | 2 | 1.6% |
| Others | 8 | 6.4% |
| Total | 124 | 100% |

These four major parties work by own interest to fulfill the overall project objectives. The owners have of interest to get the quality structure as economic as possible. Designers convert the owner' s conceptions into specific and detailed directions through drawings and specifications. Designers may have interest to show their creativity or consider aesthetics rather than cost and time. Constructors (contractor/subcontractor) have interest of doing work in timeliness and minimum cost and handover the finished structure to a satisfied owner. Labor forces transform the directions depicted in plans and specifications into reality through their skills and efforts, working individually or in crews directed by foremen.

## 5. Field Survey

The intention of this study was to explore whether there are any conflicting factors in Korean construction industry. Therefore the study methods used were a literature search and field survey.

### 5.1. Design of Questionnaire

From the extensive review of related literatures, forty-three factors were identified as probable conflict sources treating as input variables. The questionnaire was designed in a five-point Likert scale to get the perception of the professionals involved in the different contracting parties and compare their perception about the particular variables. Respondents were asked to indicate their level of agreement or disagreement according to the following scale: 1 = strongly agree; 2 = agree; 3 = can' t say, 4 = disagree, and 5 = strongly disagree.

Table 4. Frequency by Conflict Knowledge

| Conflict knowledge | Frequency | Percent |
|---|---|---|
| Yes | 96 | 77.4% |
| No | 28 | 22.6% |
| Total | 124 | 100% |

### 5.2. Subjects of the survey and Responses

Three major project participants (e.g. client, consultant and contractor group) were the target population (subject) of this survey. The respondents were identified through personal contacts. The questionnaires were delivered through hand to hand, email attachments, and post mails. Altogether 200 questionnaires were distributed to the subjects in the construction field.

Responses were received immediately as well as through email attachments, faxes and post mails. Out of 200 questionnaires sent, 124 numbers of usable responses were received, which represents 62% response rate. Distribution of respondents by organization attachment is as follows: Clients 42% (52 nos.), Consultant 32% (40 nos.) and Contractors 26%. (32nos). Regarding construction field experience majority of respondents (56%) have more than 15 years while 29% have 10 to 15 years range experience and 15% professionals have less than 10 years of experience.

Similarly, out of 124 survey participants, 70% are working in senior level while 23% at middle level position. Tables 2 to 4 shows some more demographic information of respondents regarding experience by project structure (building, roads etc.), procurement

(delivery) method and knowledge of conflict in projects. As the senior and experienced professionals have been involved in the survey, the quality of data obtained is believed to having high quality.

### 5.3. Treatment of Data

Mean values of the level of agreement were used to analysis the survey questions. In order to classify the degree of agreement of the variables, the mean scores were categorized into intervals as follows: 1 ~ 1.5 'strongly agree', 1.5 ~ 2.5 'agree', 2.5 ~ 3.5 'mixed response', 3.5 ~ 4.5 'disagree' and 4.5 ~ 5 'strongly disagree (Awakul et al, 2000). The data obtained were analyzed using MINITAB statistical computer package.

A lower mean value indicated the agreement with the higher presence of the particular conflicting factor, whereas scale rating means greater than 2.5 was regarded as non-agreement. Subsequently value between 2.5 and 3.5 was considered as mixed response.

The output was treated as conflicting factors for the variables which have arithmetic mean of agreement level were less than 2.5 value. One way ANOVA analysis at 5% significance level was further performed for the confirmation of agreement by the all groups in order to get the inference of survey. This step was carried out especially to get the critical construction conflicting factors. As biasness in overall arithmetic mean value is greatly created by particular large cluster, hence only overall mean value will not ensure reliable result For example in this study, out of three groups, client group is large; hence this group' s perception has played big role to shift overall mean value towards their favor.

Since, ANOVA deals with the comparison of arithmetic mean of individual group, the results obtained from this process can be reliable. This tool has been widely used to test hypotheses in social sciences. The variables output which have alpha level less than 0.05 value have been considered as statistically insignificant (Hyperstat online, 2005), i.e the opinions vary widely each other and do not represent the critical construction critical factor.

### 5.4. Results of Survey

Tables 5-7 show the arithmetic mean values and ranks by overall and organizational groupwise as well as $p$ and $f$ values for all 43 perceived conflicting factors.

#### 5.4.1. Confirmation of Conflicting Factor by Overall Arithmetic Mean

As per the agreement level set out in 5.3 section, six perceived variables are agreed by the respondents as the prevailing conflicting factors in Korean construction industry. Six prominent conflicting factors shown in table 5 are i) differing site condition ($\bar{x} = 2.06$); ii) local people obstruction ($\bar{x} = 2.07$); iii) difference in change order evaluation ($\bar{x} = 2.22$), iv) errors and omission in design ($\bar{x} = 2.31$), v) excessive quantity of works ($\bar{x} = 2.38$) and vi) double meaning in specification ($\bar{x} = 2.39$). The results are also shown in Fig. 2, where the overall mean value can be observed between 2 and 2.4 values.

Likewise, overall arithmetic mean values of following six statements as shown in table 6 have been found to be between 3.5 and 3.75, so these statements are not perceived as the problems in construction sites. Disagreed statements with mean values are: i. late delivery or non-delivery of owner furnished material (Rank 38, $\bar{x} = 3.57$), ii) late delivery or non-delivery of owner furnished equipment (Rank 39, $\bar{x} = 3.60$), iii) public and political disorder in country (Rank 40, $\bar{x} = 3.63$), iv) labor union strikes/protests (Rank 41, $\bar{x} = 3.65$), v) delay in running bill payment (Rank 42, $\bar{x} = 3.69$) and, vi) issues of security in construction site (Rank 43, $\bar{x} = 3.72$)

Table 5. Arithmetic Means, Rank and ANOVA of Agreed Conflicting Factors

| Perceived Conflicting Factors | All Mean (124) | Rank | Organization mean and rank | | | | | | ANOVA | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Owner(52) | | Consultant(40) | | Contractor(32) | | F value | P (sig.) |
| | | | Mean | Rank | Mean | Rank | Mean | Rank | | |
| Change of site condition | 2.06 | 1 | 2.27 | 2 | 2.05 | 2 | 1.75 | 3 | 4.62 | 0.01 |
| Local people protest | 2.07 | 2 | 2.13 | 1 | 2.27 | 5 | 1.72 | 2 | 3.38 | 0.04 |
| Change order evaluation | 2.22 | 3 | 2.63 | 3 | 2.05 | 2 | 1.78 | 4 | 8.10 | 0.00 |
| Design errors | 2.31 | 4 | 2.69 | 5 | 1.97 | 1 | 2.09 | 8 | 8.49 | 0.00 |
| Excessive quantity variation | 2.38 | 5 | 2.65 | 4 | 2.35 | 6 | 2.00 | 6 | 3.62 | 0.03 |
| Double meaning in specifications | 2.39 | 6 | 3.06 | 18 | 2.25 | 4 | 1.50 | 1 | 24.39 | 0.00 |

The respondents have mixed responses for rest of 31 statements. Overall arithmetic mean value of these statements are between 2.5 and 3.5 (refer table 7), this scale reveals that the respondents are not aware about these problems. These could be the nature of Korean builders' culture to maintain contractual relationships into trust?based relationships as stated by Cho (2003).

### 5.4.2. Critical Conflicting Factors (CCF) by ANOVA Test

ANOVA test at 5% significance level was conducted to detect the agreement for the conflicting factors by all three groups. As p-value of all six factors is less than 0.05 alpha value (refer table 5), the test has not supported any conflicting factor for being critical as per criteria set out in section 5.3

While observing the results of survey, the table 5 clearly shows that for two top factors i. "change of site condition" (mean = 2.27, 2.05, 1.75) and ii. "local people interruption" (mean = 2.13, 2.27, 1.72) all three groups tended to express the same general opinion (they all agreed with the statement). Values in bracket above represent arithmetic mean values for owner, consultant and contractor group respectively. In this case, the statistical ANOVA test was able to detect a more subtle difference (significance level being less than 5% alpha) in the extent to which the different groups agreed with the statements. They all "agreed", but some groups had a slightly higher level of agreement than others (here in both cases is 'contractor' ). Even though the ANOVA test rejects the relationships for six conflicting factors by overall mean value, it is accepted as an exception case for these two factors (Pezzullo, 2005).

## 6. Discussion of Results

The survey results showed in table 5 gives many interesting facts. There are quite different perceptions found among the owners', consultants', and contractors' professionals. In comparison to consultant and contractor groups, owners' professionals are seemed to be quite neutral about the perceived factors.

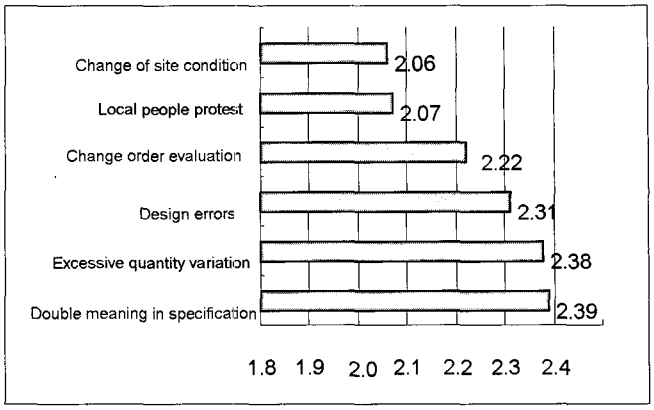


Fig.2 Mean value of agreed conflict factors

Some interesting differences can be noticed in the opinions of different participants groups in the survey results. One interesting result is for the supremacy of owner/consultant (Overall rank 28). This factor is in the 5th rank for the contractor, whereas the owners' and the consultants' professionals have ranked this in 34th and 37th position respectively. This result has clearly indicated about the motive (vested interest) of different groups, which is not exceptional in Korean context too.

Other discrepancies can be found for overall ranks 10, 11, 13, 15, 16 for "Unbalanced risk," "Interpretation of escalation/de-escalation," "Delay in decision by owner," "Late handover of construction site," and "Excessive extra works" respectively. Sources of differences for all of these factors are the owners. The contractors are suffering a lot from these situations. Hence, it is obvious that the contractors have different opinions for these factors than owners' or consultants' professionals.

Although in overall context, Korean construction industry has cordial contractual relationships and cooperative culture, however, if studied minutely, still we can find large differences in perceptions of different participants. These could be due to the organizational vested

Table 6. Arithmetic Means, Rank and ANOVA of Disagreed Conflicting Factors

| Perceived Conflicting Factors | All Mean (124) | Rank | Organization mean and rank | | | | | | ANOVA | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Owner(52) | | Consultant(40) | | Contractor(32) | | F | P |
| | | | Mean | Rank | Mean | Rank | Mean | Rank | value | (sig.) |
| Owner furnished material | 3.57 | 38 | 3.83 | 41 | 3.55 | 38 | 3.19 | 36 | 3.27 | 0.04 |
| Owner-equipment | 3.60 | 39 | 3.86 | 42 | 3.57 | 39 | 3.22 | 37 | 3.67 | 0.03 |
| Public disorder | 3.63 | 40 | 3.63 | 37 | 3.65 | 41 | 3.59 | 43 | 0.03 | 0.97 |
| Labor strike | 3.65 | 41 | 3.63 | 37 | 3.75 | 42 | 3.56 | 42 | 0.35 | 0.71 |
| Delay in running bill payment | 3.69 | 42 | 4.11 | 43 | 3.60 | 40 | 3.12 | 34 | 7.62 | 0.00 |
| Issue of security | 3.72 | 43 | 3.77 | 40 | 3.80 | 43 | 3.53 | 41 | 0.73 | 0.48 |

Table 7. Means, Rank and ANOVA of Mixed Response Conflicting Factors

| Perceived Conflicting Factors | All Mean (124) | Rank | Organization mean and rank | | | | | | ANOVA | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Owner(52) | | Consultant(40) | | Contractor(32) | | F value | P (sig.) |
| | | | Mean | Rank | Mean | Rank | Mean | Rank | | |
| Change in scope | 2.61 | 7 | 2.98 | 13 | 2.47 | 7 | 2.19 | 9 | 5.80 | 0.00 |
| Financial-failure of owner | 2.63 | 8 | 2.73 | 6 | 2.72 | 16 | 2.34 | 13 | 1.02 | 0.36 |
| 3rd-party delay | 2.68 | 9 | 2.79 | 8 | 2.75 | 18 | 2.41 | 15 | 1.59 | 0.21 |
| Unbalanced risk | 2.69 | 10 | 2.96 | 11 | 2.67 | 15 | 2.28 | 11 | 4.74 | 0.01 |
| Interpretation of escalation/ de-escalation method | 2.69 | 10 | 3.06 | 18 | 2.47 | 7 | 2.37 | 14 | 5.77 | 0.00 |
| Slow-work of contractor | 2.69 | 10 | 2.73 | 6 | 2.65 | 14 | 2.69 | 22 | 0.05 | 0.96 |
| Delay in decision by owner | 2.70 | 13 | 3.31 | 29 | 2.47 | 7 | 2.00 | 6 | 15.39 | 0.00 |
| Mentality of contractor | 2.77 | 14 | 3.11 | 24 | 2.52 | 11 | 2.50 | 16 | 4.75 | 0.01 |
| Late handover of construction site | 2.79 | 15 | 3.56 | 35 | 2.60 | 13 | 2.22 | 10 | 22.14 | 0.00 |
| Unavailable skilled labor | 2.83 | 16 | 2.81 | 9 | 2.72 | 16 | 3.00 | 32 | 0.70 | 0.50 |
| Excessive extra work | 2.84 | 17 | 3.44 | 32 | 2.50 | 10 | 2.28 | 11 | 18.53 | 0.00 |
| Subcontractor delay | 2.84 | 17 | 3.04 | 16 | 2.75 | 18 | 2.62 | 21 | 1.59 | 0.21 |
| Environ. hazards | 2.85 | 19 | 2.96 | 11 | 2.75 | 18 | 2.81 | 25 | 0.56 | 0.57 |
| Major defects in maintenance period | 2.85 | 19 | 2.90 | 10 | 2.77 | 22 | 2.84 | 29 | 0.16 | 0.86 |
| Non-payment to subcontractors | 2.86 | 21 | 3.00 | 15 | 2.75 | 18 | 2.78 | 24 | 0.66 | 0.52 |
| Change in codes | 2.89 | 22 | 3.10 | 22 | 2.87 | 25 | 2.59 | 19 | 2.26 | 0.11 |
| Necessity of environment improve… | 2.89 | 22 | 3.17 | 25 | 2.57 | 12 | 2.81 | 25 | 3.93 | 0.02 |
| Language of contract document | 2.91 | 24 | 3.10 | 22 | 2.95 | 28 | 2.56 | 18 | 2.66 | 0.07 |
| Subcontractor inefficiency | 2.93 | 25 | 3.08 | 21 | 2.85 | 23 | 2.81 | 25 | 0.78 | 0.46 |
| Defective design | 2.97 | 26 | 3.33 | 30 | 2.85 | 23 | 2.53 | 17 | 5.44 | 0.05 |
| Severe accidents | 2.97 | 26 | 2.98 | 13 | 3.02 | 30 | 2.87 | 31 | 0.18 | 0.84 |
| Supremacy of owner/consultant | 3.00 | 28 | 3.52 | 34 | 3.27 | 37 | 1.81 | 5 | 29.42 | 0.00 |
| Act of god | 3.00 | 28 | 3.04 | 16 | 3.20 | 35 | 2.72 | 23 | 1.62 | 0.20 |
| Market price increase | 3.06 | 30 | 3.19 | 27 | 3.07 | 32 | 2.81 | 25 | 1.28 | 0.28 |
| Defective construction | 3.06 | 30 | 3.06 | 18 | 2.87 | 25 | 3.31 | 39 | 1.36 | 0.26 |
| Unavailability of material | 3.09 | 32 | 3.17 | 25 | 2.92 | 27 | 3.16 | 35 | 0.75 | 0.48 |
| Lack of space in construction site | 3.10 | 33 | 3.27 | 28 | 2.95 | 28 | 3.03 | 33 | 1.12 | 0.33 |
| Difference in const. technique | 3.14 | 34 | 3.40 | 31 | 3.02 | 30 | 2.84 | 29 | 3.46 | 0.04 |
| Excessive correspondence | 3.18 | 35 | 3.58 | 36 | 3.12 | 33 | 2.59 | 19 | 7.85 | 0.00 |
| Material testing technique | 3.32 | 36 | 3.50 | 33 | 3.15 | 34 | 3.25 | 38 | 1.56 | 0.21 |
| Low quality material used | 3.45 | 37 | 3.65 | 39 | 3.25 | 36 | 3.37 | 40 | 1.94 | 0.15 |

interest at large. So, this study does not support the notion of people (project participants) caused conflict in projects of Gardiner et al (1998), rather results of this study strongly support the notion of project related factors as the main sources conflict in construction industry. Further discussions for each conflicting factors are briefly presented below.

## 6.1. Change of Site Condition

This factor is the first 'CCF' revealed by this study ($\bar{x} = 2.06 < 2.5$). Though calculated p value (= 0.01 < 0.05) from ANOVA test suggests the different opinion among the participants' group, nevertheless arithmetic mean values show this factor is accepted by all groups unanimously.

Change of site condition is a prominent problem in construction project globally. So, it is not surprising to find this result in the Korean context too. Unforeseen condition of site causes the difficulty in design phase. Usually, designers sometimes assume the design factors in difficult condition of site, which may be differ during construction works later. This research has found that the change of site condition is a number one conflicting factor. This finding is also in line with the empirical findings of research carried out by Al Sabah et al (2002) and Transportation research board (1995) and theoretical findings of Hewit (1991) and Epstein (2004).

### 6.2. Local People Protest

This is the second CCF revealed by the study ($\bar{x} = 2.07 < 2.5$). Opinion of the respondents' groupwise ($p = 0.04 < 0.05$) is also different for this factor; however, groupwise arithmetic mean support the acceptance of all groups being this factor as a CCF. This factor is one of the important factors which may cause substantial effect on construction projects. Many big civil engineering projects have been jeopardized due to the opposition or protest of local people or advocacy groups. Few of major incidences of people and groups protest in Korea are suspension of KTX high speed rail tunneling on Mt. Cheongseong due to Buddhist monk' s hunger strike and Green Korea along with local people protest against 15 billion won Sewage treatment plant in Seongnam city in Gyeonggi-do province (Kim 2003).

The conflict might be erupted when the owner tries to overlook and orders contractor to continue the work. In the mean time, the contractor might feel threat to continue the work due to the fierce local people protest. This conflict issue is the findings of this study.

Epstein (2004) and Hewit (1991) also have talked about the interferences in the work, but did not explain what types of interference. Again these are talked in theoretical context. There are no any empirical researches carried to support this factor. Interference could be from the owner himself, consultants or labors etc. However, conflict in projects due to local people interference is only suggested by this study.

### 6.3. Change Order Evaluation

Change order evaluation is found out to be one of the various problems in Korean construction industry. Although, this factor does not qualify for CCF as the respondents' group have different perception about this factor ($p = 0 < 0.05$), nevertheless it is a conflicting factor in construction sites ($\bar{x} = 2.22 < 2.5$). This finding is in consistent with other researches like Al-Sabah (2002) and Heath et al (1994). These results were also found through empirical study. It has been also acknowledged by many boards and courts that the disruptive impacts of changes in construction field cannot be fully and accurately anticipated (Flinke 1998).

### 6.4 Design Errors

Design error is the fourth problem factor ($\bar{x} = 2.31$) identified by this study. Design professionals also have accepted that some claims are caused by engineering consultants and designers' own errors and shortcomings (O' Leary, 2002). He has argued for this that considering the vast volume of documentation produced for a single building or project, it is impractical to expect completely error-free documents. Also considering the usually lengthy time span of design and construction of the average project, it is not realistic to expect flawless behavior.

This finding is also in line with the empirical study observations of Diekmann and Nelson (1985), Jones (1994) and Transportation Research Board (1995).

### 6.5 Excessive Quantity Variation

Fifth construction problem revealed by this study is the excessive quantity variations ($\bar{x} = 2.38 < 2.5$). Other researchers like Al-Sabah et al (2002), Hewit (1991), and Long et al (2004, Vietnam) also have found this as one of a conflicting factors in the construction sites.

### 6.6. Double Meaning in Specification

The sixth conflicting factor identified by this study is double meaning in specification ($\bar{x} = 2.39$). This is the only one factor related to the contract document. Empirically, no any researchers have mentioned this factor categorically. However, Epstein (2004) has described theoretically that inadequate specification is also one of conflicting factors.

Table 8 shows comparison and summary of the findings of this paper with previous researches.

## 7. Limitations of the Study

Like every research, this study also has some limitations. Firstly, the construction industry is very large, where so many disciplines work together. It will be difficult to reach every kind of construction stakeholders; therefore, the subjects (population) of this study was delimited to only 3 major participants of the project that is clients, consultants and contractors. Despite the major participants have been participated in the survey, non involvement of other groups may have affected the unanimous result of the study. Secondly, about 77% of

Table 8. Summary and Comparison between This Study and Previous Researches

| | Researches | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| This study(Korea) | Al-Sabah et al (2002) Kuwait | Diekmann et al (1985), UK | Epstein (2004) Theory | Heath et al (1994), UK | Hewit (1991) Theory | Long et al (2004), Vietnam | Rhys (1994) UK | Transp.Res. Board(1995) USA |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Change site··· | √ | - | √ | - | √ | √ | - | √ |
| Local people··· | - | - | √ | - | √ | - | - | - |
| Change order··· | √ | - | - | √ | - | √ | - | - |
| Design error··· | - | √ | - | - | - | √ | √ | √ |
| Excessive quantities··· | √ | | √ | √ | - | √ | - | - |
| Double meaning specific... | - | | √ | - | - | - | - | - |

Note: Researches mentioned in columns 1, 2, 4, 5, 7, 8 are referred from Fenn (2002)

respondents have the experience of construction conflict. However during data processing, the responses of conflict experienced participants were strange. For example, although some respondents have indicated that they have conflict experience, but they have responded all conflict cases for mixed response (neither agree nor disagree). This scenario might have also limited the quality of survey results.

## 8. Conclusions and Recommendations

Conflicts in construction projects are inevitable. Most of the conflicts in initial stage are minor in nature and if did not handle well, these could be resulted as claims, counter claims, pains, and bad relationship between project participants.

The purpose of this study was to explore the root causes of conflicts in construction industry. A survey instrument was developed and responses were collected from 124 respondents. Forty three construction problems were perceived as conflicting factors in Korean construction industry. However, from arithmetical mean method, only six were interpreted as conflicting factors. Furthermore, ANOVA test could not detect critical factors, however from descriptively analysis two factors have been detected as critical conflicting factors.

The survey results show that there are only two critical conflicting factors in Korean construction industry. Two critical factors are: i) differing site condition, and ii) local people interruption/protest. The first perceived conflicting factor is found to be generally consistent with the results of various researches but, the second factor is also ratified as one of the conflicting factors in Korean construction industry.

The survey has also revealed that another three factors are not construction problems by any means in Korean field. The non-agreed statements are: public/political disorder, labor/union strikes, and the issue of construction site security. These non-agreement results contradict the findings of those factors as construction risks in previous researches of Casey (1979), Barrie et al (1992), Harmon (2003), and Chan (2005). Furthermore, the professionals do not have any idea regarding majority of problem statements (31 nos.). It is believed that this may be because of Korean nature of non-contradicting contractual relationship.

Findings of this study clearly aware the project planners and implementers that differing site condition and isolation of local people (user group) from project activities are the serious concerns in Korean construction field. A widely recognized principal to combat differing site condition is spending more monies during planning and design phase, thus reducing the time and cost required to correct the problem if erupt during construction phase. In other words, spending more monies in planning with comparison to final saving is much negligible.

Local people often been affected from big projects by expropriation of property, disturbance of local natural setting etc. and happens to be causes of protests. In addition, if the projects do not fulfill the aspiration of people and does not apportion the benefit of the projects, local people certainly agitated and protests come into effect. Therefore, the planners and implementers should set out the projects objectives from the point of people' s interest, need and demand as well as should have encourage the local participation from planning to monitoring stage of the public-interest projects.

Regarding other conflicting factors, it is recommended that a strong program management firm and design team should be employed rather than a cheapest one towards avoiding design errors and omissions, double meaning specification and contract language

problems. A low bid contractor or low design fee consultant always on dire strait state and may offer only a low quality work as well as claim - oriented project.

It is hoped that the probable conflicting factors found out from this study would be useful to the project planners and implementers and would keep them conscious during the project implementation phase.

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