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Causes of Delay on Bist Hazer Water Supply Construction Project, Kabul Afghanistan

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Abstract– (AUWSC) the pioneer organization for supplying pipe borne drinking water to the nation. Every year it implements a large number of water supply projects throughout the country using local funds as well as foreign donor funds. Many of these projects experience extensive delays and thereby affect the socio economic development of the country. This study takes an attempt to identify the causes and effects of delays in construction of medium scale water supply projects. The method for this research is based on, a combination of qualitative and quantitative research. Data collection survey was obtained by secondary and primary method via interview to the contractor and consultants.

Results of the analysis of the responses to the questionnaire indicate that inclement weather conditions, contractors' financial difficulties, shortage of labor, rules and regulations of road authorities, delays in sub contractors' work, material import delays and ineffective planning and scheduling of project.

***Keywords*:** water supply project, causes of delay, ranking of delays factor, impact of delay

1.Introduction

Water sector management and development is one of the important sectors in the National Development Strategy (ANDS) of Afghanistan. In the ANDS, it is pointed out that the current water sector institutions are poorly coordinated or organized, water service infrastructure is at low efficiency and deteriorated, there is lack of trained staff and inequitable gender balance exists in the sector. One of Afghanistan's most critical national needs is safe and reliable supplies of water. The majority of Afghans do not have access to a safe drinking water supply and to adequate sanitation.

One of the MDGs relating to water supply and sanitation of Afghanistan describes that "access to water and sanitation, electricity, and livelihoods sources have been negatively impacted through the decades of war. Drinking water supplies reach only 23 percent of Afghanistan's total population – 43 percent in urban areas and 18 percent in rural areas. The country's total sanitation coverage of only 12 percent deserves attention. While around 28 percent of the urban population is covered, only 8 percent of the rural population had access to improved sanitation in 2006.

Beest Hazari is one of poorest residential areas located in Dasht-e Barchi under PD6 and PD13 of Kabul city, approximately 43 minutes driving from Hamid Karzai International Airport and 30 minutes driving from the Kabul Municipality. The site is located in an unplanned part of the city and accessible by all season roads. The community residing in the Beest Hazari are mostly ethnic Hazara, predominantly from the central regions of Afghanistan although some settled many years ago from the surrounding Kabul area. Displacements have resulted in an almost daily increase in members of the community, with some homes accommodating between two and three families. Based on conservative community counts, assisted by the government-appointed an advocate for the area, community elders and Mosques, the current population is estimated at approximately 17,000 individuals, in 2,400 families (2,200 households). The residents in the settlement do not have basic facilities or access to adequate water and sanitation; bore water is the only source of potable water. The majority of houses are built using un-fired clay bricks with timber roofs; they are densely packed together. There are only two high schools - one for girls and the other for boys.

The Project aims to provide: Improved access to a safe, potable water supply through the construction of a new water supply system for the Beest Hazari community. It is envisaged that this project will leave the door open for further expansions and upgrades. However, delivered facilities should be sustainable for the next 15 years - being set as a design horizon, and after which a new assessment would be required in the water supply sector. Training and guidance in health and hygiene for the Bist Hazzari community. Capacity building of local authorities and beneficiaries in operations and maintenance of water supply system.

Before the project idea is translated into the concrete decision, there are statutory requirements of the donor and the project implementation authority to conduct a (i) Baseline Survey in the project area, (ii) carry our one environmental and social impact assessment (ESIA) and (iii) preparation of a feasibility study. The narration contained in the following section is for the Baseline Survey of the assignment, where the existing status quo situation (pre-project status of the area) in terms of some basic requirements of the project is attempted to be highlighted. It may be mentioned that the baseline survey intends to provide a comprehensive idea of the project area in terms of basic socio-economic characteristics of the households, their knowledge, attitude and current practices of the proposed services that are likely to be made available through the project (drinking water in our case), effects of drinking water availability in human health and present situation related to hygiene and sanitation and their preparedness to change under the new paradigm, when safe and potable water would be made available to them.

Additionally, the baseline survey is also intended to appreciate how the women and other vulnerable sections of the society would potentially benefit from the water supply scheme especially in respect of leisure time, child care, practicing small income-generating activities, devoting more time for children's education, and taking part in different awareness and education program for improvement in the overall health status of the family members and women empowerment.

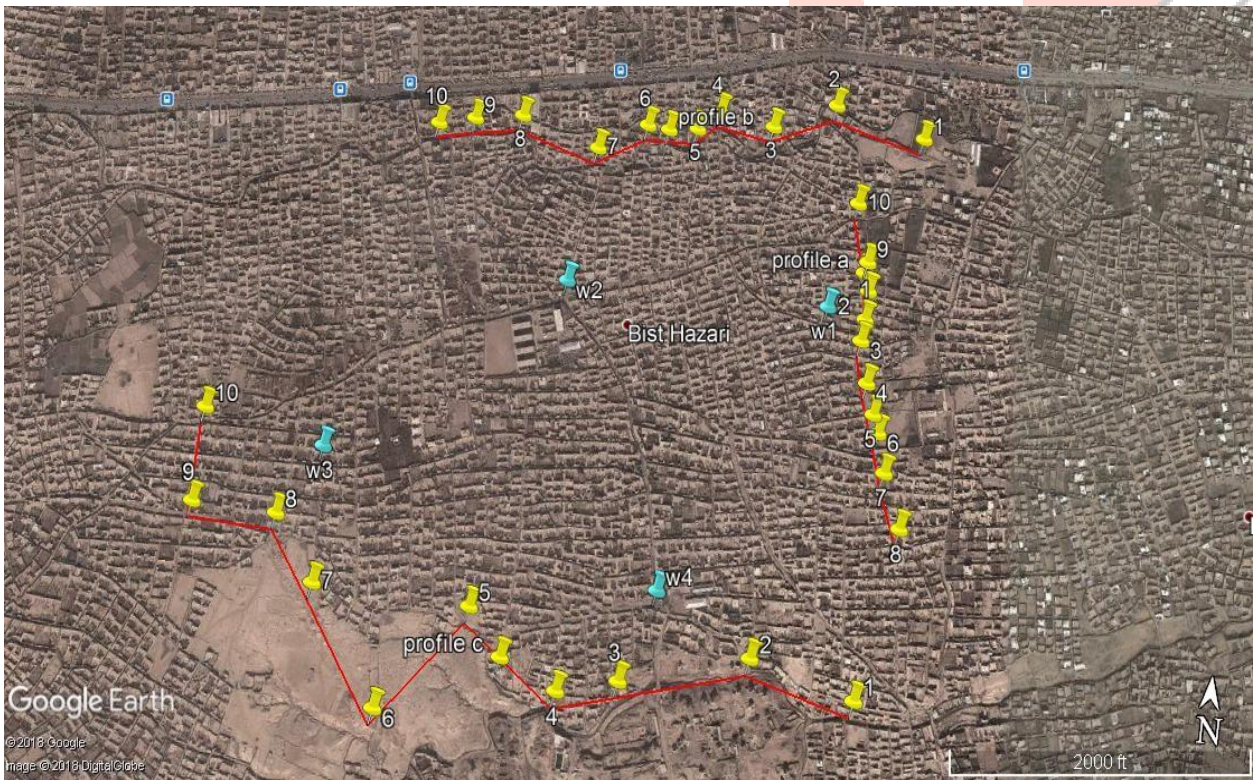

Figure1 project location

2. literature review

Delay happen in most construction project. Few researchers began to focus their attention on finding solution to existing shortcomings of delay analysis techniques. A number of solution method and delay analysis techniques were proposed.

Refer to the paper by Zaki M. Kraie and James E. Diekmann on Concurrent Delay in Construction Projects‖ published in Journal of Construction Engineering and Management, December, 1987 which conclude the present method for dealing with the concurrent delay. Concurrent delays are two or more delay occurring at the same time and have always been difficult to resolve. Basic construction delay is:

- Compensable
- Excusable
- Non-excusable

This delay should be considered carefully by making an adjustment on as-built schedule. The resulting as built schedule will then be adjusted to reflect events that have occurred during contract performance.

Refer to the paper by Mohammad Khoshgoftar Abu Hussain Abu Bakar and Omar Osman on causes of Iranian construction project: published in the international journal of construction management June 2010, In this study, researcher used the relative importance index method to determine the relative importance of the various causes of delays. The same method is used by Kometa et al (1994) and by Sambasivan and Soon (2007) in their studies. The five-point scale, from 1 (not important) to 5 (extremely important), was adopted and transformed to relative importance indices (RII) for each factor as follows:

$RII = \Sigma W/\Sigma (A*N)$

Where W is the weighting given to each factor by the respondents (ranging from 1 to 5), A is the highest weight (i.e. 5 in this case), and N is the total number of respondents. The range of RII was from 0 to 1 (0 not inclusive). The higher the value of RII the more important a factor is as cause of delays.

The RII was used to rank the different causes of delay. These rankings made it possible to cross-compare the relative importance of the factors as perceived by the three groups of respondents (i.e. clients, consultants and contractors). Each individual cause thus had an assigned RII as perceived by all respondents. The RII values were used to assess the general and overall rankings in order to give an overall picture of the causes of construction delays in Iran. These rankings made it possible to cross compare the relative importance of the items as perceived by the three groups of respondents. The weighted average for each item for the three groups of respondents was determined and the ranks (R) were assigned to each item representing the perception of the three groups.

Refer to the paper by W.D. Anuruddha Perera on "Cause and Effects of Delays in Constructions of Water Supply Projects" published in journal of advance research. February 2010 which conclude: delay is a serious problem in construction of medium scale water supply projects and it is costly for both owner and contactor. Investigation into this problem area is needed in order to better manage delay situations and mitigate their consequences. Usually, the vast majority of project delays occur during the "construction" phase, where many unforeseen factors are always involved (Chan &Kumaraswamy, 1997).

A total of eighty-four construction professionals who were engaged in construction of medium scale water supply projects participated in this study area and the related documents.

Refer to the paper by Borvorn Israngkura Na Ayudhya on "Evaluation of common delay causes of construction projects in Singapore" published in journal of civil engineering and architecture. 2011 which conclude the common delay factor among owner, consultants and contractors in building projects in Singapore. The interview and questionnaire method were used in the research. Randomly distribution questionnaires method was applied to select sample of seventy-four various construction practitioners consisting of owner. Consultants, main contractors to evaluate the severity of thirty-five delay factors. The result found that delay in progress payment by owner adverse weather condition, main contractor financial problem and act of God factor cause delay in construction projects.

3.objective of the study

- to identify the causes of delays on construction sector in Afghanistan
- to study the difference in perceptions of the two major parties involved in construction of drinking water supply projects namely client and contractors on causes and of delays in constructions of Bist Hazari water supply project
- propose measures to mitigate delay in construction project

4. research methodology

A detailed literature review was carried out to identify the previous studies in the research area and found the major causes and effect of delays in projects in Afghanistan and other countries. Then a careful identification of the factors related to the study were done and survey questionnaire was developed to assess the perceptions of contractors and clients who were involved supply projects on the relative importance of causes and effect of construction delays. The questionnaire consisted of four; part one: respondent's details part two causes of delays; part three effects due to delay; part four: mitigations actions. The first part of the questionnaire consisted of thirty-nine causes of delay that were categorized under seven major groups:

4.1 project related: inadequate project duration, improper contract formulation (large Nos. of contracts for a single project, intake civil construction work included in a pump contract, etc.), type of project bidding and award (tendency in awarding the contracts of lowest bidder)

4.2. Owner/consultant related: delay in progress payment by owner, delay in handing over the site to the contractor, delay in approval of shop drawings and samples, delay in inspection and testing of works, inadequate liquated damages, too many changes orders, slow decision making, poor contract management of owner/consultant

4.3. contractor related: contractor financial difficulties, mistakes during construction and rework, shortage of project staff with required experience, poor coordination/communication by the contractor with other parties, ineffective planning and scheduling of project by contractor, improper constructions methods implemented by contractor, delays in subcontractors work insufficient delegation of power to the site management team.

4.4 Design related: delays in producing constructions drawings, and unclear and inadequate details specifications for materials

4.5. Materials related: shortage of construction materials in market, change in materials type and specification during construction, restriction during issuing permits to transport materials, rejection of imported materials due to non-compliance with the contracts specifications.

4.6. Equipment and Labour related: frequent equipment breakdown, shortage of equipment and hiring delays low productivity and efficiency equipment, low productivity level of workers, shortage of labour, union actions

5.Data Analysis Method

The following statistical techniques and index were used for analyzing the data collected: importance index Ip. According long et al. (2008) to rank different factors from various groups of causes the relative importance index Ip is an appropriate index for analyzing construction delays. It is computed as below:

$$\text{Ip} = \frac{\sum_{i=1}^{5} a_{i \cdot n_i}}{5N}$$

Where: a=constant expressing the weight assigned to each responses (ranging from 1 very low effects to 5 very high effects), n= frequency of the responses for each cause and N = total number of responses

5.1 Spearman's Rank Correlation

According to Assaf and Al-Hejji (2006) spearman's rank correlation is a non-parametric test. Correlation is a relationship measure among different parties or factors and the and the strength and direction of the relationship. This method mainly used to show the degree of agreement between the different parties. The correlation coefficient varies between +1 and -1, where + implies a perfect positive relationship (agreement), while -1 results from a perfect negative relationship (disagreement). The value near to zero indicates little or no correlation. In this research this correlation is used to find out the degree of agreement between parties. This correlation is computed by the following formula:

$$r_{s\prime}=1-\left(\frac{6\sum d^2}{n(n^2-1)}\right)$$

Where: $r_{s\prime}$ is the spearman rank correlation coefficient between two parties, d is the difference between ranks assigned to variables for each causes and n is the number of pairs of rank.

Table -1 list of cause of delay categorized into nine group

No	Cause of delay	Group
1	Original contract duration is too short	project
2	Legal disputes between various parties	project
3	Inadequate definition of substantial completion	project
4	Ineffective delay penalties	project
5	Type of construction contract	project
6	Type of project bidding and award (negotiation, lowest price, etc.)	project
7	Delay in progress payment by owner	client
8	Delay to furnish and deliver the site to the contract or by the owner	client
9	Changes orders by owner during construction	client
10	Late in revising and approving design documents by owner	client
11	Delay in approving shop drawings and sample materials	client
12	Poor communication and coordination by owner and other parties	client
13	Slowness in decision making process by owner	client
14	Conflicts between joint-ownership of the project	client
15	Unavailability of incentive for contractor	client
16	Suspension of work by owner	client
17	Difficulties in financing project by contractor	contractor
18	Conflicts in sub-contractors schedule in execution of project contactor	contractor

19	Rework due to errors during construction	contractor
20	Conflicts between contractor and other parties (consultant and owner)	contractor
21	Poor site management and supervision by contractor	contractor
22	Poor communication and coordination by contractor with other parties	contractor
23	Ineffective planning and scheduling of project by contractor	contractor
24	Improper construction methods implemented by contractor	contractor
25	Delays in sub-contractors work	contractor
26	Inadequate contractor's work	contractor
27	Frequent change of sub-contractors because of their inefficient work	contractor
28	Poor qualification of the contractor's technical staff	contractor
29	Delay in site mobilization	contractor
30	Delay in performing inspection and testing by consultant	Consultant
31	Delay in approving major changes in the scope of work by consultant	Consultant
32	Inflexibility (rigidity) of consultant	Consultant
33	Poor communication/coordination between consultant and other parties	Consultant
34	Late in reviewing and approving design document by consultant	Consultant
35	Conflicts between consultant and design engineer	Consultant
36	Inadequate experience of consultant	Designer
37	Mistakes and discrepancies in design documents	Designer
38	Unclear and inadequate details in drawings	Designer
39	Delay in producing design document	Designer
40	Complexity of project design	Designer
41	Insufficient data collection and survey before design	Designer
42	Misunderstanding of owner's requirements by design engineer	Designer
43	Inadequate design-team experience	Designer
44	Un-use of advanced engineering design software	Designer
45	Shortage of construction materials in market	Materials
46	Change in materials types and specification during construction	Materials
47	Delay in materials delivery	Materials
48	Damaged of stored material while they are needed urgently	Materials
49	Delay in manufacturing in special building materials	Materials
50	Late procurement of materials	Materials
51	Late in selection of finishing materials due to in diversity in market	Materials
52	Equipment breakdowns	Equipment
53	Shortage of equipment	Equipment

54	Low level of equipment-operator's skill	Equipment
55	Low productivity and efficiency of equipment	Equipment
56	Lack of high technology mechanical equipment	Equipment
57	Wrong selection	Labor
58	Unqualified workforce	Labor
59	Shortage of labor	Labor
60	Nationality labor	Labor
61	Low productivity level of labors	Labor
62	Personal conflicts among labors	Labor
63	Weak motivation	Labor
64	Security	External
65	Warlords influence	External
66	Corruption	External
67	Natural disaster (flood, landslides ….)	External
68	Effects of subsurface conditions (e.g. soil high water table, etc.)	External
69	Inclement weather (very cold, very hot, rain ….)	External
70	Unavailability of utilities in site	External
71	Effect of social and cultural factors	External
72	Traffic control and restriction at job site	External
73	Accident during construction	External
74	Delay in providing service from utilities (such as water, electricity)	External
75	Permits from municipality	External
76	Permits for foreign laborers	External
77	Building cods	External
78	Bureaucracy in government agencies	External
79	Permits from the urban planning bureau	External
80	Permit from order of engineers	External
81	Changes in government regulation and laws	External
82	Poor government judicial system for construction dispute settlement	External
83	Market inflation	External

6.Recommendations for future studies

More research on construction delays should be done in order to develop guidelines, or methods of minimizing the effects of construction delays in Afghanistan. Furthermore, similar research should be performed in various provinces or cities of Afghanistan. In order to providing more reliable data, it is required to carry out studies for each specific type of construction projects, including highways, dam construction projects, utilities and etc. Surely, detailed surveys required to be performed to find out the effect of financing and cash flow problems on delays in construction projects.

7. Summary and Conclusion

Construction delay in Afghanistan is explained through literature review and field survey. Through in-depth literature review 83 causes of delay were identified, the factors combined into nine groups. Three major stakeholders, including 20 clients, 25 contractors and 15 consultants responded the questionnaire forms. The respondents reported that contract with less than 12months highly contributes to delays. The most common time spent for the most delayed projects in Afghanistan is between 1 to 6 months.

The importance index was used to rank the effect of each cause of delay. It was found that only two causes of delay are common between all parties, which are 'security' and 'corruption'. Clients like consultants agreed that ineffective planning and scheduling of project by contractor, poor qualification of the contractor's technical staff and difficulties in financing project by contractor are the most sever causes of delay by the contractors. Whereas, the contractor reported that delay in progress payment by the client is one of the significant causes of delay.

Contractor indicates that designer and client are the significant source of delays, while both client and consultant specified 'contractor', and 'materials' causes as sources of delay. The combined result of group causes shown that mostly the delay is caused by the 'contractor', followed by 'designer' and 'materials', while 'project related cause' is less important. The value of Spearman's rank presents that the highest degree of agreement is between clients and contractors which is 60.5%. The lowest degree of agreement is between contractors and consultants which is 54%.

The importance index was used to rank the significant causes of delay, and it was found that top 10 major causes of construction delays in Afghanistan are security and corruption followed by poor qualification of the contractor's technical staff, poor site management and supervision by contractor, ineffective planning and scheduling of project by contractor, and difficulties in financing project by contractor. Delay in progress payments by owner and type of project bidding and award (negotiation, lowest price) are another critical factors which contribute to construction delays.

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