

Status of Time and Cost Overrun of Health Building Construction Projects in Nepal

Shashi Kumar Yadav¹, Dr. Anjay Kumar Mishra^{2*}

¹Engineer, GoN, ²Associate Professor, Madan Bhandari Memorial Academy Nepal and Pokhara University Uurlabari 3, Morang 33700, Nepal

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*Corresponding author: Dr. Anjay Kumar Mishra

Email: anjaymishra2000@gmail.com

Abstract

Original Research Article

Time and cost is the two most focused performance indicator of construction project. Department of Urban Development and Building Construction (DUDBC) implements public health building construction projects for the last ten years. Like other projects time and cost are major concern of these projects. Therefore, the overall objective of the study is to analyze Time Overrun and Cost Overrun of public health buildings implemented by DUDBC. 35 projects have been studied for time and cost overrun. Published literature, reports and journals were referred as secondary source of infirmities. Library consultation along with relevant text books regarding time and cost overrun, publications of DUDBC, prevailing acts and rules of Nepal were also consulted for secondary data. From the study of 35 public health building projects, it has been observed that more than 65% projects were found suffered from time overrun ranging from 21% to 248% of their original schedule. Khilung Deurali Ayurved Aushadhalay Constructed in Syangja District was found to have the lowest value (21%) of time overrun whereas Maternity Room addition in Health Post Bhulutar constructed in Kavre District was found to have the highest value (248%) of time overrun than intended completion date and It has been observed that 11% projects were suffered from cost overrun more than 15% compared to their agreement amount. It has been found that only few projects suffer from cost overrun ranging from 0.58% to 19.62%. BEOC Building Construction, Rampur, Palpa was found to have the lowest value (0.58%) of cost overrun whereas Birthing Center building construction in Saldang Health Post, Dolpa was found to have the highest value (19.62%) of cost overrun than the agreement amount.

Keywords: Time overrun percent, cost overrun percent.

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INTRODUCTION

The construction industry is one of the largest businesses in the world. Growth in this business in fact is an indicator of the development of a country [1]. In developing country; construction industry is significant to provide employment as well as infrastructure. Nepalese Construction Industry contributes around 10 to 11 percentages to GDP and it uses around 35 percent of government budget. It is estimated that this sector is creating employment opportunities to about one million people so as to generate employment next to agricultural sector in the country. Similarly about 60 percentages of the nation's development budget is spent through the use of contractors [2]. It has been emerged as an important part of development sector of Nepal as almost all the infrastructure development projects solely rely on construction activities. It uses a lot of construction materials and equipments and hence generates substantial amount of cash flow which in turn increases economic activities and supports for social

and economic development of the nation. The construction industry is fragmented because of the involvement of many parties, such as consultants, contractors, employers, suppliers, and many others.

The construction industry plays vital role in the overall development of a nation. Optimum utilization of resources within a limited period in construction industry helps to accelerate the overall growth in the country. Department of Urban Development and Building Construction (DUDBC) is one of the oldest public departments in Nepal. It is responsible for town planning, urban development as well as in the construction of public buildings. During the last ten years from 2006 to till date, it has been involved in the construction of numerous Public Health Buildings with multi donor support. Building construction work occupies a major share of the construction in Nepal.

Construction is a very important phase of project life cycle where actual implementation of project is started. Time and Cost overrun, which are in fact the most important effects of delay, are very common Problems in the construction sectors. Delay in the intended completion date causes substantial financial burden to the stakeholders of the industry. In this context, Nepalese construction industry is also not an exception [3]. Most of ongoing projects in Nepal, whether they are donor funded or not, are being delayed mostly due to various issues of project management, project administration, contract management, safe guards and multidimensional interest of stakeholders and also because of the underlying uncertainties and political liquidity.

The situation has become so harsh that no construction project at national level has been completed on time without any delay at the specified cost. Also, most of the projects in the national level are having significant cost overrun. To overcome the situation and to prevent from the slow pace development activities, a culture of completing projects within the project time period should be developed. Effective management of project is vital for the development of the economy because development itself is the effect of successfully managed projects. The Health Buildings serve to save numerous lives in time by constructing it in project time period. A contract is said to be successful when it is completed within budgeted cost, specified quality, stipulated time and delivered safely. The possible consequences of all these actions are increased project cost, late completion of projects and, sometimes, termination of contract [4]. Therefore every effort should be made to ensure that parties do not unnecessarily hamper the timely execution of projects. This research study is an initiation of a series of An Analysis of Time Overrun and Cost Overrun of Public Health Building in Nepal.

The overall objective is to assess the status of time and cost overrun in public health building construction projects.

LITERATURE REVIEW

Time and Cost Overrun

Construction time has always been as one of the bench marks for assessing the performance of a project and the efficiency of the project organization. Timely completion of a construction project is one goal of the client and contractor because each party tends to incur additional costs and lose potential revenues when completion is delayed [5].

Delay and time overruns are very similar terms frequently used to represent the lack of progress in construction industry replacing each other, but there is a slight distinction between them. Delay refers to lack of project progress within the baseline construction schedule as compared to it, whereas time overrun is any

delay beyond the baseline construction schedule. Time overrun itself is the most important effect of construction delay, which is followed by cost overrun. According to [6], delay is a situation when the contractor and the project owner jointly or severally contribute to the non-completion of the project within the original or the stipulated or agreed contract period.

In construction, delay can be defined as the extension of time in the completion of project. In short delay means failure to complete project in targeted time & budgeted cost as agreed in contract. The occurrence of delay may concurrently with other delays and all of them can impact the project completion date. When the project completion date is exceeded, the amount of time by which the project completion date is exceeded is known as time overrun of the project [7].

Time overrun means the actual delay of construction beyond stipulated date of completion. The actual measure of time overrun means the difference between the actual construction completion periods minus the planned construction completion period [8].

According to Kamings [9] time overrun is defined as the extension of time beyond planned completion time dates traceable to the contractor.

Choudhury & phatak [10] said time overrun is the difference between the actual completion time and the estimated completion time of project.

The time within which construction work is to be completed is important to both owner and contractor. In most contracts, dates will be specified for starting and completing the works. The contractor is bound to do the work by the due date, and will be liable in damages if it fails to complete. Generally, full and complete performance is required to discharge contractual obligations. However, the concept has developed in construction contracts of substantial or practical completion. This is achieved, when the work is complete except only for minor items, which do not affect the occupation or use of the works. The purpose is not to release the contractor, but to allow it to leave the site, so the principal can takes possession of the works.

During the conception stage of any project, the time schedule for the execution and completion of the project is prepared. It is very difficult and requires high degree of project management skills to complete as per schedule. Time is valuable and the time lost in project completion is equivalent to money lost. The client would expect quick return for the investment made. Several case histories show that the engineering personnel work on pressure and underestimate the period of completion. Usually, when a project is scrutinized technically at higher levels, attention on the aspects of optimized time is not given, as it deserves.

Time overrun can simply be expressed by the following equation [3].

$$\text{Time overrun} = \frac{\text{Extended time}}{\text{Initial contract period for project completion}} \times 100\% \quad \text{Equation (1)}$$

Cost overrun of projects means the actual cost increase to the client during construction period of a project. It is merely the excess of value over the originally envisaged spending for the project (Contract sum stated in the latter of acceptance [8].

According to Nyabwari [11], cost overrun is defined as excess of actual cost over budget. Cost overrun is also, sometimes called cost escalation, cost increase or budget overrun. Cost overrun can also be defined as the change in contract amount divided by the original contract award amount.

Keeping in mind the cost aspect, all the projects are conceived and planned. When the detailed planning of the project is accomplished, we can

estimate the approximate cost of it. If proper project management techniques are not followed, the project cost increases, depending upon the condition due to which, delay will be occurred. Cost overrun is considered to be a common feature in the construction project. The reason is innumerable. The cost overrun has negative effect on every party; the client, the contractor, the consultant and society as a whole. Cost overrun is more common due to the fact that once the project gets delayed the price of the construction material escalates every year and additional cost gets involved in the project. Therefore most difficult and challenging aspect cost control is determining the estimated final cost of the project. Cost overrun can simply be represented by the following equation.

$$\text{Cost Overrun} = \frac{\text{Increased cost for project work}}{\text{Initial Contract cost}} \times 100\% \quad \text{Equation (2)}$$

Therefore, cost overruns can be defined as the difference between the original cost estimate of project and actual construction cost on completion of works of a commercial sector construction project [11].

Scenario of Time and Cost overrun

Thapa [12], in his research for four small hydropower concluded that all sample projects have suffered from time overrun from 57% to 132% than estimate time.

With a view to avoid responsibility of time overrun all parties are blaming each other. There are

differences in information and coordination among project parties and also the problem in participation of all parties in setting the goal process. Time is not main factor for cost increase of the project. There should be other factor for 69.22% responsible while time overrun only contribute for 38.78% causing on total cost overrun of project. However time overruns increases indirect cost significantly which is not significant in comparison to direct cost.

Chitrakar [3] had concluded that there were significant time and cost overrun in the projects and they are tabulated in the table 2.1.

Table-2.1: Scenario of Time and Cost overrun

S. N.	Site	District	Contract Amount NRs.(000,000)	Uptodate Paid amount NRs.(000,000)	Project duration (Month)	Completed duration (Month)	% of time overrun	% cost Overrun	Remarks
1	Building Project, Yadukuha	Dhanusha	8.26	8.71	16	23	43.75	5.50	
2	Gaushala	Mahottari	7.47	8.42	16	23	43.75	12.78	
4	Betani	Makwanpur	3.41	2.88	16	33	103.13	-15.31	
9	Chitithala	Lamjung	3.40	3.31	16	15	-7.81	-2.46	
12	Biratnagar	Morang	3.52	3.50	9	60	566.67	-0.43	
13	Teku	Kathmandu	6.73	6.68	9	61	577.78	-0.74	
80	Raniban	Dailekha	5.35	5.88	9	35	288.89	10.83	
83	Banktawa	Banke	4.82	5.68	10	36	260.00	17.90	
87	Nepalgunj	Banke	1.48	2.11	14	30	122.22	41.85	
93	Sripur	Kanchanpur	7.23	6.67	11	35	213.64	-6.43	
97	Walling	Syangja	7.80	8.14	11	14	29.55	4.42	
99	Srikhandpur Primary School	Kavre	3.10	2.99	12	14	16.67	-3.58	
101	Jan Jati school, Birganj	Parsa	5.13	5.17	9	9	0.00	0.78	
104	Municipal Office of Cum Gest House	Doti	1.59	1.85	12	15	25.00	16.17	
105	shree Krishna S. school	Surkheta	1.78	1.76	9	13	44.44	-1.22	
106	Gaur Municipality Building	Rautahat	7.57	7.89	12	20	69.57	4.22	
111	Lalitpur Municipality Building	Lalitpur	23.49	27.38	14	27	89.29	16.56	
112	PTTC & DEO	Lalitpur	44.89	47.18	19	30	57.89	3.89	
114	Office cum Commerical Building Complex of Karmachari	Lalitpur	131.80	127.23	24	31	29.17	-3.47	

(Source: Chitrakar, [3])

Introduction of Health Buildings

Department of Urban Development and Building Construction (DUDBC) has been executing construction works of Health facilities under Nepal Health Sector Program (NHSP) of Ministry of Health and Population (MoHP) since fiscal year 2061/62. It is a part of the broad range program of NHSP which covers infrastructure (Building and equipment) development, capacity building and institutional improvement. This parts of program covers design and construction of different types of health buildings ranging from health posts to district level hospitals and supporting facilities, (Design Catalogue of the Health Buildings, DUDBC, 2072).

District Hospital (DH)

District Hospital is the comprehensive health care in district level which is also run under DPHO. The Health institution constitutes few specialist services such as pediatrics and gynae. This type design accommodates OPD with five specialist's service, Emergency department, CEOC unit, inpatient department with ICU and infectious words; diagnostic facilities such as pathology lab and x-ray, USG and ECU; Operation services other support services such as laundry, CSSD, blood Bank etc.; and administration. National Health policy 2048 states that at last one district Hospital would be established in each district. Till now there are 65 districts Hospital nationwide. GoN in process of upgrading district Hospital to regional and zonal Hospital where those referral Hospitals are yet not established. Now district hospital

will need to be constructed where existing DH are upgraded or new DH established as per Health care demand. (DUDBC, 2072)

Primary Health Care Center (PHCC)

Primary Health Care PHCC) is the basic Health care facility run under the DHO. This is first health instruction with the appointment of a doctor in the lowest of the hierarchy. It is conceptualized as an mini-hospital constituted of OPD with Dental service, 15 bed and inpatient ward; BEOC unit; other support services such as laundry and CSSD, blood Bank etc.; and administration. National Health policy 2048 states that one PHCC would be established in each electoral constituency may affect the establishment of PHCCs. Till now there are 205 PHCCs nationwide. GoN in process of upgrading Health posts into PHCC as per the formation constituencies and Health Care demand of the locality. Hence the number may subject to increase in future. (DUDBC, 2072)

Post mortem Block

This unit constructed in Hospital and PHCC for the post mortem and forensic investigation. This block should be placed be in such location such that the circulation of the dead body and the normal people flow do not intersects. Possible mass gathering and conflicts must be taking in care while placing the block in site. (DUDBC, 2072).

Health Post

Health post (HP) are the basic health care facilities that were intended to establish one in each llaka[1]. VDC where there is no HP, health services is provided through sub-health post. GoV has decided to upgrade all sub-health post to Health post gradually. Currently there are 1680 health post all over the nation. This number may increase after upgrading more sub-health posts. Health posts are headed by health assistant and run under the DHO. (DUDBC, 2072)

CEOC/BEOC

These are the units of health institution dedicated for obstetric care where comprehensive facility for maternity and new born care is provided. In integrated design they come together in district hospital and PHCC. These separate units are constructed to append the existing district hospital or PHCC where the existing infrastructure is sound and adequate. BEOC (Basic Essential Obstetric Care) is associated with PDCC where as CEOC (Comprehensive Essential Obstetric Care) is associated with district hospital. Both type designs are similar in nature and size. CEOC is more comprehensive only in terms of it accommodates Operation Theater and bigger new born care room. CEOC has capacity to handle caesarian case.

When placed in the compound of existing hospital or PHCC it should be in proximity to the inpatient wards because nurses may need to move back and forth in between these functions. BEOC/CEOC must be connected with Hospital block or PHCC with the covered pathway so that the movement of patient, attendants and staffs would be convenient during rain and sun (DUDBC, 2072).

District Public Health Office (DPHO)

Public Health Office is an office which looks after all the health related issues from sub-health post to district hospital. The government has currently endorsed its policy that all the 50 bedded hospital is going to be an independent entity having its own administration. Hence, the district headquarters which consist of only the district hospital have District Health Office and where it consist zonal or hospital of higher rank would have District Public Health Office (DPHO). To simply understand, DHO runs district hospital too where as DPHO do not run hospital. In the case of DPHO, hospital and DPHO are two different entities. However, type designs for both DPHO and DHO are same. District medical store comes in conjunction with DHO/DPHO. (DUDBC, 2072)

District Medical Store

District Medical Store is the facility associated with Public Health Office. It is the district level store which collects different drugs, vaccines, IEC (information, Education and Communication) materials distributed by department of Drugs Management. As GoN has announced for the free health service and

expansion of its services, the intake of the materials has increased and eventually the space requirement has increased. These materials are distributed to the respective health posts, primary health care centers and sub-health posts. (DUDBC, 2072)

Doctor's/Staff's Quarter

Doctor's /Staff accommodation is an important facility that is necessary to encourage the presence of the qualified health staff in the health institution. Hence, construction of the health facilities. From health posts to PHCC, staff quarters are integrated in the health building itself. Doctors quarter are made separately also in case of PHCC. Services type designs have developed as one bed room quarter, two beds room quarter; one unit quarter to four unit quarters. (DUDBC, 2072)

METHODOLOGY

Research Approach

The study adopted both the quantitative and qualitative approach. Quantitative data of the projects and case study were collected and analyzed on the other hand, through questionnaire survey, qualitative data acquired from the employee; consultant and contractors respondents were analyzed.

Study Area

The study area covers altogether twenty five Department of Urban Development and Building Construction Division Offices

Department of Urban Development and Building Construction

Department of Urban Development and Building Construction (DUDBC) is one of the oldest public departments executing civil engineering works for the government of Nepal. It is a branch organization of Ministry of Urban Development in Nepal. It is responsible for controlling haphazard urbanization process by carrying out the planning and construction of urban infrastructures and the construction as well as the maintenance of public buildings. During the last three decades, it has been involved in the construction of numerous public health buildings funded by World Bank, public buildings as a part of rehabilitation project funded by GoN and various town development infrastructure projects with financial grant and loan of ADB, JICA, DANIDA, and USAID [13]. Mainly DUDBC has set three institutional objectives as follows [14].

- Urban Development: to carry out sustainable development of Urban areas by strengthening the interrelationship between rural and urban areas and by providing modern physical infrastructures, to preserve historical and cultural places.
- Housing: to promote well managed housing by providing safe and economical residences.

- **Building Construction:** to put emphasis on earthquake resistant, economic, environmental friendly building materials and technologies as well as indigenous architecture while constructing buildings.

Under DUDBC, there are altogether twenty five division offices located in different districts of the country. Each of these division offices has separate jurisdictional limit ranging from two to four districts

and work in the public buildings construction sector as well as the development of physical infrastructure of urban areas in Nepal. In addition, there are several independent projects and town development committees working under DUDBC in the urban development sector throughout the country [14].

All projects location is indicated by point in circle in the map of Nepal and project details are given in appendix D serially.



Fig-3.2: Location of Projects

Secondary Data

Secondary data were collected from the following sources:-

- Published literature, reports and journals.
- Relevant text books regarding time and cost overrun.
- Publication of Department of Urban Development and Building Construction.
- Office records of DUDBC, Babarmahal and DUDBC, Parsa, Birgunj.
- Prevailing Acts and Rules.
- Case study of thirty five completed Public Health Building for the study of existence of time and cost overrun in the projects.

RESULTS AND DISCUSSION

Time overrun and cost overrun in public health building projects

The figure 4.1 represents the details of the existence of Time and Cost overrun of the Public Health Building construction projects of gathered data from the Health Building Unit of DUDBC. The source of this figure is attached in the annex D. X-axis represents the Projects name and the Y-axis represents the percentage of time and cost overrun.

From the study of 35 Public Health Building Projects, it has been observed that more than 65% Projects were suffered from 85% of time overrun compared to their indented completion

date. Khilung Deurali Ayurved Aushadhalay Construced in Syangja District was found to have the lowest value (21%) of time overrun whereas Maternity Room addition in Health Post Bhulutar constructed in Kavre District was found to have the highest value (248%) of time overrun than indented completion date.

From the questionnaire survey in figure 4.2 reflected that majority (61%) respondents replied that the Public Health Building Projects were suffered from more than 75 % time overrun than their indented completion date therefore it can be concluded that the findings from the questionnaire survey and the desk study is near most at the same point.

Looking at the provisions regarding time overrun in the PPA and PPR-2007, when the procurement contract has to be inevitably extended due to force majeure and any other reasonable causes, the authority may extend the period. The tender approving authority may extend the period up to six months but the departmental head may extend even more than that. There is no strict rule to restrict time overrun in certain percentage like cost overrun. The soft corner of the rule in PPA and PPR should be one of the important causes behind the health buildings having more than 100 % time overrun from data.

It has been observed that 11 % Projects were suffered from cost overrun more than 15 % compared to their agreement amount. BEOC Building Construction, Rampur, Palpa was found to have the lowest value (0.58%) of cost overrun whereas Birthing Center building construction in Saldang Health Post, Dolpa was found to have the highest value (19.62%) of cost overrun than the agreement amount.

From the questionnaire survey in the figure 4.3 reflected that majority respondents replied that the Public Health Building Projects were suffered from more than 15 % cost overrun than their agreement amount therefore it can be concluded that the findings from the questionnaire survey and the desk study is near most at the same point.

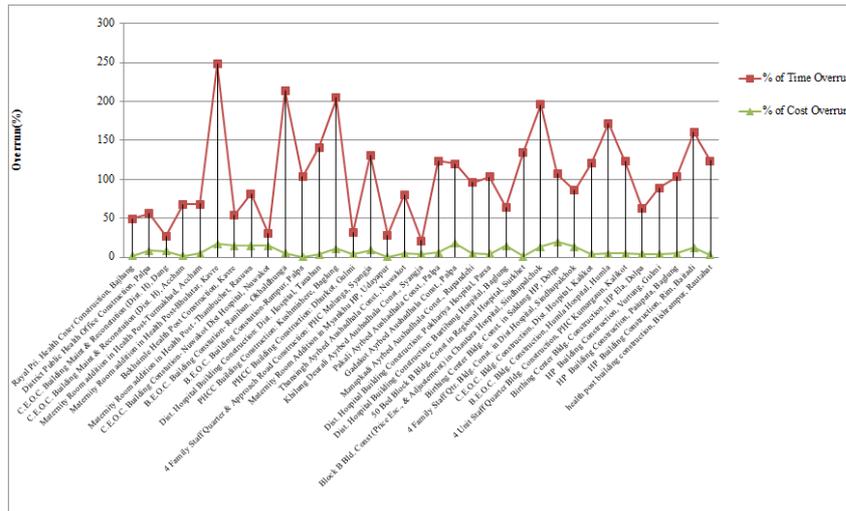


Fig-4.1: Existence of Time and cost overrun

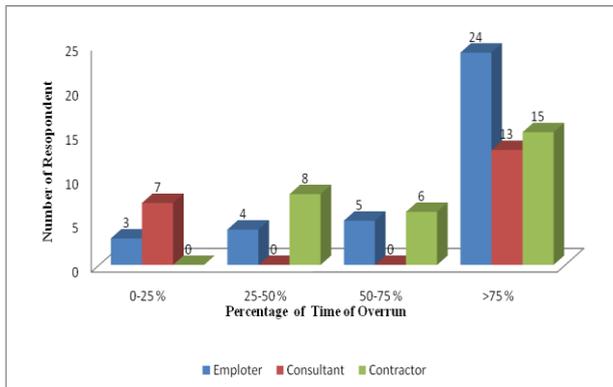


Fig-4.2: Time overrun in the projects comparing to the contract period

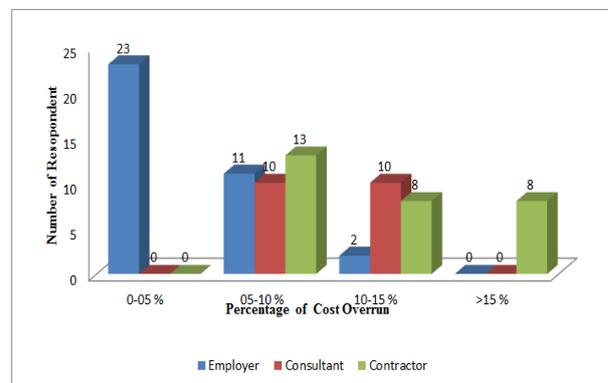


Fig-4.3: Cost overrun in the projects comparing to the contract period

While looking at the above figure, the cost overrun in the above health buildings was found to be confined within 20% of the contract amount irrespective of the amount of time overrun, however, some health buildings have even more than 100 % of time overrun. This is due to the fact that there is a strict clause in the PPA-2007 to confine the amount of cost overrun up to 15% only. The clause states that if there is a variation greater than 15% of the contract amount, the Council of Ministers, Government of Nepal only has the authority to prove the variation order. But there was found to be more than 15% in cost overrun and more amounts in time overrun of the Projects also.

As a result of the above said and there may be other hidden reasons and complex variables in the construction industry too; the construction of the public health building was completed with a huge time overrun of 248 % and a cost overrun of grater then 15%.

Time and Cost Overrun Variation with contract amount

It is important to determine how the rate of time and cost overrun varies with the project size. In this part of research, we deal the relationship of time and cost overrun with project size separately. The figure 4.5 shows the relationship between the project size and percentage time overrun occurred in the projects.

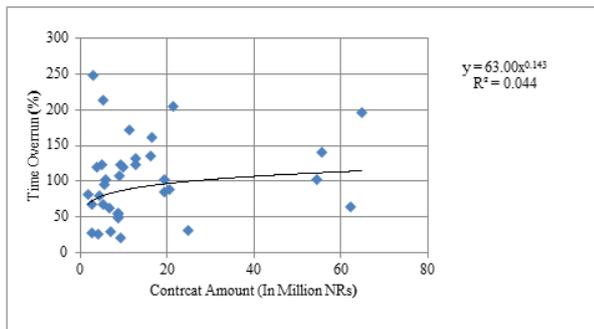


Fig-4.4: Time Overrun Variation with contract amount

The graph 4.5 is obtained by plotting contract amount in X-axis and percentage of time overrun in the Y-axis. For obtaining the best fit curve, all the possible curves were plotted and value of R^2 were compared. The values were found to be 0.39, 0.031, 0.029, 0.032, and 0.044 for exponential, linear, logarithmic, polynomial and power curves respectively. Hence, it can be concluded that the best fit curve for the data is a power curve having the value of R^2 as 0.044. The time overrun data is very much scattered which is also indicated by the smaller value of R^2 . However from the graph 4.5, it can conclude that the percentage of time overrun is dependent and almost directly proportional to the size of project (contract amount) in the Public Health Building Projects implemented by DUDBC.

The figure 4.6 shows the relationship between percentages of cost overrun with respect to the size of the projects. The size of the project is plotted in the X- axis and percentage of cost overrun is plotted in the Y-axis. After plotting all the points, a line was drawn fitting to all the points which would help us to predict the possible percentage of cost overrun, if the size of the project is known.

For obtaining the best fit curve, all the possible curves were plotted and value of R^2 were compared. The values were found to be 0.018, 0.006, 0.00003, 0.046 and 0.007 for exponential, linear, logarithmic, polynomial and power curves respectively. Hence, it can be concluded that the best fit curve for the data is an exponential curve having the value of R^2 as 0.046. The cost overrun data is very much scattered which is also indicated by the smaller value of R^2 .

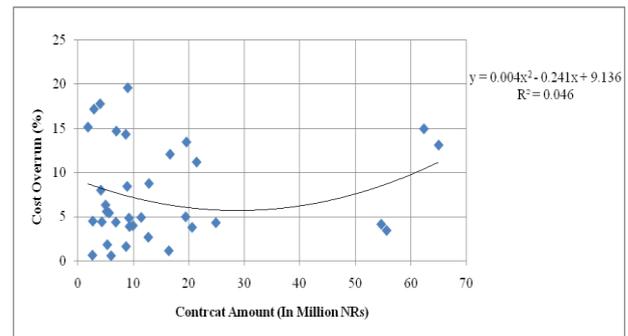


Fig-4.5: Cost Overrun Variation with contract amount

From the figure 4.6 it can be concluded that relation between cost overrun and contract amount of Public Health Building Projects implemented by DUDBC is more reliable at the average amount of these project. The Contract Details of Health Building Construction Projects under DUDBC are shown in the Appendix-D.

CONCLUSIONS

- From the study of 35 Public Health Building Projects, it has been observed that more than 65% Projects were suffered from 85% of time overrun compared to their indented completion date. Khilung Deurali Ayurved Aushadhalay Construced in Syangja District was found to have the lowest value (21%) of time overrun whereas Maternity Room addition in Health Post Bhulutar constructed in Kavre District was found to have the highest value (248%) of time overrun than indented completion date.
- It has been observed that 11 % Projects were suffered from cost overrun more than 15 % compared to their agreement amount. BEOC Building Construction, Rampur, Palpa was found to have the lowest value (0.58%) of cost overrun whereas Birthing Center building construction in Saldang Health Post, Dolpa was found to have the highest value (19.62%) of cost overrun than the agreement amount.

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