CONTRACTUAL IMPLICATIONS OF CASH FLOW ON OWNER AND CONTRACTOR IN VILLA CONSTRUCTION PROJECTS

Mohammed Al Mohsin[1], Ali Alnuaimi[2], Sumayia Al Tobi[3]

[1]*Assistant Professor, Civil and Architectural Engineering Department, College of Engineering- University of Buraimi-Sultanate of Oman*

[2]*Associated Professor, Civil and Architectural Engineering Department, College of Engineering- Sultan Qaboos University, Sultanate of Oman*

[3]*Quantity surveyor, Ministry of Regional Municipalities and Water Resources- General directorate of technical affairs-Department of quantities and project contracts – Sultanate of Oman*

Abstract

Cash flow forecasting is one of the most essential tools toward assessing the distribution of expenditure and revenues of construction projects with respect to the time of the project. The work presented in this paper aims to find out the minimum fund required for cash outflow in case of delay in payments and to identify contractual implications and consequences due to failure of meeting planned cash flow on both the owner and the contractor. Data from record files of 25 villas, in Muscat, Oman, with different sizes was analysed to identify the minimum fund required with the contractor to maintain the progress of work in-case of delay of interim payments. The analysis also included identification of consequences of delay of interim payments. It was found that the minimum fund required is 8.5 per cent of the contract value for maximum interim payment delay of four weeks. The value of required minimum fund increases as the period of delay increases. In most cases the percentage of the required minimum fund increases with the increase of the contract value. Work stoppage, delay in completion, penalties and incompletion of projects are major consequences of delay on interim payments.

Keywords: *Cash flow, Villa construction contract, Oman*

----------***----------

1. INTRODUCTION

Execution of construction projects can make substantial demands on a contractor's cash. Initially, the contractor faces mobilization of workers and equipment, and setting up costs. The contractor's expense on a project typically exceeds its monthly progress payment income over an appreciable part of the construction period. The cash deficit on the project must be made up from the contractor's working capital, or money must be borrowed to provide the necessary operating funds. ''Cash flow'' refers to a contractor's income and outlay of cash. The net cash flow is the difference between disbursements and income at any point of a time. A negative net cash flow means disbursements are exceeding income which is a usual situation on even a highly profitable project during the greater part of its duration. A determination of the future rates of cash disbursements and cash income, together with their combined effect on the project cash balance, is called a cash flow forecast. It is the intent of the contractor to accrue income faster than it accrues costs. At the end of the project, this difference represents the contractor's profit. The problem is that the cost of the work put into a project is not directly related to the resulting income. Additionally, the time delays between the accrued costs and the cash disbursement are not the same as the time delays between the accrued income and the cash receipts.

To forecast the amount of money the contractor must invest in the project, it is necessary to estimate the amount and the timing of the cash disbursements and the cash receipts [1]. The importance of modelling and optimizing cash outflows versus inflows can hardly be overstated. Combining these disparate and shifted phenomena gives an uneven 'saw-tooth' pattern that typically will result in shortfalls [2]. Project cash flow projections relate the schedule of the values to the construction schedule, projecting the progress payments through the duration of the project. The cash flow projection approximates the progress payments for each payment period during the construction contract. This projection is used by the owner to make financial arrangements, which makes funds available for the payments and optimizes investment opportunities. The contractor uses the cash flow projection for anticipating revenue for future periods. Projection of cash flow is directly related to the construction schedule which is a cost estimate of planned activities and achievements at the site. Many factors influence the actual amount of interim payments which may produce variances from the projection; i.e. late or early delivery of materials; late or early completion of work activities; revisions in sequencing of work activities; and the disproportionate completion of work activities as planned. An approximate range can be established for the cash flow curve, using early-start early-finish and late-start late-finish dates defining the limits of

the range. Some contractors prefer to present a range to the owner, as the cash flow projection is approximates. Other cash flow projections use a single curve, with disclaimer that amounts are approximate. Updating the cash flow projection is necessary as the project progresses to provide current and more accurate projections. Because the cash flow relates to the amounts that will be requested for each progress payment, some factors differ from those relating to the construction schedule. The actual payments may not be equally distributed in the work activity period [3]. Odeyinka and Kaka [4] used 6-point Likert-type scale field survey on UK construction contractors to assess their level of satisfaction with identified payment terms influencing construction cash flow. Results showed that while contractors were satisfied with most of the contractual factors investigated under both procurement systems, they were dissatisfied with two of the factors, namely; time lag between entitlement to receive and actually receiving cash payment and percentage of contract sum retained. Park et al [5] developed a project-level cash flow forecasting model in construction stage based on the planned earned value and the cost from a general contractors view on a jobsite. Odeyinka et al [6] identified 11 significant financial risk factors out of 26 risk variables studied to assess the impact of variation between the forecast and actual construction cash flow. They applied a structured questionnaire administered to UK contracting organizations and used mean response analysis and uni-variant analysis of variance (ANOVA) based on extent of occurrence. The factors were grouped under three generic factors: changes in the design or specification, project complexity and natural inhibition. Senouci and El-Rayes [7] presented a multi-objective optimization model that is capable of generating and evaluating optimal/near-optimal construction resource utilization and scheduling plans. The aim was to minimize the time and maximize the profit of construction projects. Three modules were developed as part of the model: (1) a scheduling module that develops practical schedules for construction projects; (2) a profit module that computes the project profit; and (3) a multi-objective module that searches for and identifies optimal/near optimal trade-offs between project time and profit. The model was tested on a large scale project and found to optimize trade-offs between construction time and profit. Al-Ali et al [8] built a financial model that helps decision makers to select a path required to plan cash flow based on a multivariate approach from the expected cash inflow, priority, likelihood, and time of construction. The model builds a chain of possible outcomes and incorporates cash inflow from different projects when a project is temporarily put on hold. Abdel Halim et al [9] studied factors that lead to financial failure of contracting firms in Malaysia. The found that problems related to cash flow and cash flow management partially cause failure of contracting firms. They developed a model that help contractors to project level cash flow at tender stage. The model addresses the possible time gaps between planned and actual payments. Liu and Wang [10] investigated cash flow for profit optimization and handles scheduling problems in multi-project environment. They proposed a model that can identify the amount and timing of individual inflow or outflow at the end of each period. The contractors can observe the cash flow at any specific time according to project progress. They tested their model on a hypothetical example involving three projects to illustrate capability of the proposed model with various constraints, including credit limit (CL) and due dates, for scenario analysis. The results showed that setting CLs ensures smooth financial procedure by properly shifting activities, and assigning due dates for projects, and helps planners to avoid project duration extension while maximizing overall project profit. Memon et al [11] focused on identification of significant causes affecting large projects construction cost in MARA district in Malaysia based on a field survey via a questionnaire. They concluded that cash flow and financial difficulties faced by contractors, contractor's poor site management and supervision, inadequate contractor experience, shortage of site workers, incorrect planning and scheduling by contractors are most severe factors while changes in scope of project and frequent design changes are least affecting factors on construction cost.

2. PROBLEM STATEMENT

Failure to meet cash flow requirements or minimum fund needed for a construction project would cause many problems or failure of contracting companies which can be reflected on the contractual obligations between owner and contractor. As the cash flow forecasting is an approximate based on planned site activities, the chances of inability to meet cash inflow requirement, during construction stage, are significant. In construction projects, it is a must to fix and meet specific dates for regular cash outflows, such as salaries, loan repayments, taxes and other administration expenses. Countless research works have been directed towards the study of cash flow and cash flow management due to their importance in the progression of construction projects. Models have been developed to help contractors planning their cash flow during the tender stage. However, most of the existing models are either project specific or do not address the consequences of failure to meet minimum fund required for cash outflow. This research work aims to find out the minimum fund required for cash outflow in case of delay in payments. In addition, it elucidates contractual obligations of cash flow on both the owner and the contractor and the probable consequences of failing to meet planned cash flow.

3. METHODOLOGY

A critical key to cash flow forecasting, during tender stage, is how to build a cash outflow model. Validation of such a model involves application of data from on-going projects. The data should be recent, say during the last 12 months, projects should be similar in terms of type, environment and location, and governing laws are the same. Cash flow can be positive or negative depending on payments received and expenditure made on the site activities. The cash flow is affected by profit margins, payment retention, payment delays and credit agreements. In this research, data about 25 villas constructed in

Muscat, Oman was collected from projects' files. The collected data included the following:

1. Cash-inflow forecasting represented by:
   a) Time schedule plans
   b) Cost estimate of planned execution of works based on the time schedule and detailed cost estimate
   c) Contractual conditions such as contract value, retentions, deductions, payment delay penalty
2. Cash-outflow calculation; mainly in a function of cost estimate of planned execution of works. Mark-up is to be removed from work executed to get cash outflow represented by the cost incurred from production process
3. Calculation of minimum required fund to offset the difference between the cash inflow and the cash outflow.

The data was analysed to identify the minimum cash required to cover different periods of payment delay and the effects of payment delay on contractor and owner. Payment delay was sequentially incremented from no delay case to cases of four weeks payment delay. Each one of the five delay cases (0, 1, 2, 3, 4 -week) was subjected to cash flow forecasting calculation to find the minimum fund required to overcome the consequences of delay. Interim profit is calculated for the purpose of comparison with the expected profit. This comparison would point out cases where the interim profit value exceeds the maximum expected interim profit which is seriously looked out. Table 1 shows the process of cash flow calculation and the minimum fund required.

Table 1: Cash flow forecasting calculation

Week #	1	2	3	4	5
Value of work executed	As estimated by contractor				
Retention	In Oman 5% of the work done				
Expected revenue after retention	C1=A1-B1				
Expected revenue after retention and delay					C1 is to be shifted due to payment delay
Cumulative revenue	D1	D1+D2	D1+ D2+ D3	D1+D2+D 3+D4	D1+D2+D 3+D4+D5
Expenditure					Value of work executed/ (1+ mark-up)
Cumulative expenditure	F1	F1+F2	F1+F 2+F3	F1+F2+F3 +F4	F1+F2+F3 +F4+F5
loss/profit	Difference between cumulative revenues and cumulative expenditure (E-G)				

4. RESEARCH SAMPLE

The 25 villas used as research sample can be considered as a homogenous sample due to the fact that all of cases are:

1. Accomplished during one year (2011)
2. All contract types were lump sum
3. All villas are located in Muscat.

The collected data for the sample was:

1. Time schedule of villa construction
2. Breakdowns of payment scheme
3. Advance payment amount
4. Expected mark-up percentage.

5. RESULTS

All the studied 25 villas were subjected to cash flow analysis using five different payment's delay periods (0, 1, 2, 3, 4 -week). Table 2 shows results of the cash flow analysis and required minimum fund to keep the execution continues. Table 3 shows the maximum profit earned during the process of construction to be compared with respect to the expected profit for the research sample in different payment delays.

6. DISCUSSION

The minimum fund required keeping the sample projects running in case of the five delay periods and the interim maximum profit compared payment delays were shown in Tables 2 and 3 using the procedure set in Table 1. Here discussion of results is presented

6.1 Effect of Payment Delay on the Minimum Fund

As to be expected, the minimum fund required for villa construction is directly proportional to the time of payment delay. The rate of change of the percentage of minimum fund required becomes very pronounce in the three-week delay period. In most cases, as the contract value increases the percentage of the minimum fund increases. The average percentage of minimum fund for four weeks delay was found to be 8.5 per cent of the contract value. This fund should be reserved by the contractor, from the working capital, for the four-week scenario of delay in payment. Standard deviation of 1.29 per cent reflects homogenous and consistency of sample regardless of the diversity and random selection of villas. For a medium size villa with contract value of Rial Omani 50,000(USD 129,000)), the contractor has to ensure availability of about R.O. 4,250 for possible delay in payment of four weeks, which is considered reasonable for villa contractors. This low amount of required fund would lead to high competition among villa contractors leading to good quality and

performance in construction industry, at the same time it exposes villa construction business to high competition market. The contractor may proceed with the execution of works without reserved fund utilizing the advance payment of 10 per cent provided that no delay more than one week is guaranteed (rarely happens). Assuring minimum fund for possible delay in payment would assure business continuity and avoid stoppage or delay and enhance contractor reputation. The availability of minimum fund for possible delay would relieve the client from the worry of possible delay in completion and handover of the property.

Table 2: Minimum fund vs. payment delay time

Villa No.	Contract value	% Percentage of minimum fund required based on the delay in payments				
		0	1	2	3	4
1	40000	N/A	0.86	0.86	10.36	10.85
2	41300	N/A	2.98	2.98	8.61	8.61
3	24100	N/A	N/A	N/A	5.74	5.74
4	43300	N/A	3.77	3.77	3.77	3.77
5	44100	N/A	N/A	N/A	9.58	9.58
6	55000	N/A	2.98	2.98	8.04	8.04
7	80000	N/A	4.11	4.11	9.37	9.73
8	38260	N/A	7.68	7.68	7.68	7.68
9	67500	N/A	N/A	N/A	8.45	8.45
10	47800	N/A	3.03	3.03	8.67	8.67
11	64000	N/A	2.98	2.98	8.61	8.61
12	58800	N/A	2.98	2.98	8.61	8.61
13	49100	N/A	2.98	2.98	8.61	8.61
14	56600	N/A	N/A	N/A	8.61	8.61
15	47100	N/A	N/A	N/A	8.59	8.59
16	74800	N/A	N/A	2.98	8.61	8.61
17	59700	N/A	3.14	3.14	9.08	9.08
18	60700	N/A	2.98	2.98	8.61	8.61
19	59850	N/A	N/A	N/A	9.58	9.58
20	69000	N/A	2.98	2.98	8.61	8.61
21	120000	N/A	3.3	3.3	3.3	8.05
22	157100	N/A	3.38	3.38	3.38	8.91
23	133000	N/A	3.3	3.3	3.3	8.92
24	145000	N/A	3.3	3.3	3.3	8.92
25	127800	N/A	3.3	3.3	3.3	8.92
Average		N/A	3.335	3.32	7.37	8.49
Std. deviation		N/A	1.22	1.19	2.37	1.29

Table 3: Interim maximum profit vs. payment delay

Villa No.	Contract value	Advance payment	Total expected profit	% Interim maximum profit earned				
				0	1	2	3	4
1	40000	5700	6666.67	5611.11	5611.11	5611.11	5611.11	5611.11
2	41300	4130	6883.33	4908.34	4908.34	4908.34	4908.34	4908.34
3	24100	5510	4106.67	5027.48	5510	5510	5510	5510
4	43300	10735	7216.67	10735	10735	10735	10735	10735
5	44100	4655	7350	5251.8	5251.8	5251.8	5251.8	5251.8
6	55000	5225	9166.67	6536.54	6536.54	6536.54	6536.54	6536.54
7	80000	6700	13333.33	8607.7	8607.7	8607.7	8607.7	8607.7
8	38260	5111	6376.67	5111	5111	5111	5111	5111
9	67500	7125	11250	8038.46	8038.46	8038.46	8038.46	8038.46
10	47800	4515	7966.67	5653.85	5653.85	5653.85	5653.85	5653.85
11	64000	6080	10666.67	7606.15	7606.15	7606.15	7606.15	7606.15
12	58800	5586	9800	6988.14	6988.14	6988.14	6988.14	6988.14
13	49100	5586	8183.33	5835.35	5835.35	5835.35	5835.35	5835.35
14	56600	5377	9433.33	12103.69	12103.69	12103.69	12103.69	12103.69
15	47100	4465	7850	10059.52	10059.52	10059.52	10059.52	10059.52
16	74800	7106	12466.67	8889.692	8889.692	8889.692	8889.692	8889.692
17	59700	5671.5	9950	7095.115	7095.115	7095.115	7095.115	7095.115
18	60700	5766.5	10116.67	7213.962	7213.962	7213.962	7213.962	7213.962
19	59850	6317.5	9975	7127.436	7127.436	7127.436	7127.436	7127.436
20	69000	6555	115000	8200.385	8200.385	8200.385	11327.5	11327.5
21	120000	11400	20000	14177.19	14177.19	14177.19	14177.19	14177.19
22	157100	14905.5	26183.33	18554.18	18554.18	18554.18	18554.18	18554.18
23	133000	12635	22166.67	15713.06	15713.06	15713.06	15713.06	15713.06
24	145000	13775	24166.67	17130.77	17130.77	17130.77	17130.77	17130.77
25	127800	12141	21300	15098.71	15098.71	15098.71	15098.71	15098.71

6.2 Contractual Implications of Cash Flow Forecasting

Contractual issue is one of the most essential factors in cash flow forecasting. This factor might help the contractor to increase or decrease the minimum fund required for a construction project. Payment delay is the most effective parameter to be taken into consideration which directly affects the minimum fund required, which has to be recorded clearly in the agreement between the owner and contractor. It would be more beneficial for both parties to include minimum payment delay, to allow certainty of budgeting and cash flow forecasting on contractor's side. The client has to ensure timely payment because any delay in payment leads to penalties and may cause stoppage of site works.

Most of villa construction agreements are lump sum type in which payments are distributed based on the accomplished works or stage of construction such as (earthworks, substructures, super structure finishes, etc.). A percentage of contract value should be paid after each stage or milestone of the work executed. The distribution of payments on the time schedule is the second spot to be controlled, this distribution should assure minimum payment for contractor and avoid over payment by owner.

Contractor's inability to meet minimum fund required for cash outflow would prevent achievement of contractual obligations and lead to delay of some activities at the site. The failure to

fulfil contractor's obligation towards suppliers and subcontractors is another consequence of this problem. Inability of payment by client is a source of disturbance for contractor time schedule in this and other projects and affects his whole operations of contracting. Some contractors keep their contractual side free of surprises in terms of client payment inability by assuring availability of different projects to utilize his workforce and equipment in case of stoppage at one site. Usually, this type of contractors stop the work till payment and penalties of delay are received. On the other side, there is a risk generated through the problem of payments which lead to higher interim profit than the maximum expected. In this case the contractor has received his profit in advance and the future interim payments will be much less or of no profit. This case has been noticed in the collected records particularly in case no. 14 and 15. Here, the possibility of the contractor leaving or stopping the works is higher as he knows future cash inflow may not be enough to cover the cash outflow.

7. CONCLUSIONS

From the study made in this research, the following concluding remarks can be made;

- Cash flow forecasting and management are perfect tools to avoid risk of incompletion of construction projects.
- Properly planned and sized, timely interim payments reduce the risk of imbalance cash in and out flows.
- There is a proportional relationship between payment delay and minimum fund required for villa construction. It was found that the contractor can start construction without any minimum fund by utilizing the advance payment, provided that delay in interim payment is guaranteed to be less than one week.
- The distribution of payments should be carefully designed based on milestone achievement related to detailed cost estimate to avoid fund shortage leading to stoppage of the construction process and to ensure that contractor does not receive large profit at early stages of the project.
- The minimum fund required for a contractor to secure completion of villa construction is 8.5 per cent of the total contract value. This percentage is required for a maximum delay in interim payment of four weeks.
- A clear record should be made in the contract that explicitly defines ways of handling payment delays, penalties and work stoppage allowances.

REFERENCES

[1] Sears S. K., Sears, G. A., and Clough, R. H., (2008). "Construction Project Management -A Practical Guide to Field Construction Management", 5th Ed., John Willey, 272-274

[2] Lucko, G. and Richard, C. Th. Jr. (2012), "derivation and assessment of interest in cash flow calculations for time-cost optimizations in construction project management" Proceedings of the 2010 Winter Simulation Conference.

[3] Mincks ,William R., and Johnston, H., (2004). Construction Jobsite Management, 2nd, Thomson Delmar Learning, 388-389

[4] Odeyinka, H. A., Kaka, A. (2005) "An evaluation of contractors' satisfaction with payment terms influencing construction cash flow", Journal of Financial Management of Property and Construction, 10(3), 171 - 180

[5] Park, H., Han, S., and Russell, J. (2005). "Cash Flow Forecasting Model for General Contractors Using Moving Weights of Cost Categories." Jouranl Management in Engineering, 21(4), 164–172.

[6] Odeyinka, H. A., Lowe, J., and Kaka,A. (2008) "An evaluation of risk factors impacting construction cash flow forecast", Journal of Financial Management of Property and Construction, 13(1), 5 - 17

[7] Senouci, A. and El-Rayes, K., (2009). "Time-Profit Trade-Off Analysis for Construction Projects" Journal of Construction Engineering and Management, 135(8), 718–725.

[8] Al-Ali,A. , Ustadi, A., Abdulla, Galadari, A., and Al-Yousuf (2010) "Deciding the Way Forward of Construction Contracts during Cash Flow Deficits", International Conference on Financial Theory and Engineering

[9] AbHalim, M.S., Jaafar, M., Osman, O. and SherAkbar, (2010). "The Contracting Firm's Failure and Financial Related Factors: A Case Study of Malaysian Contracting Firms", International Research Journal of Finance and Economics, Oct. 52 , 28-39

[10] Liu, S. and Wang, C. ,(2010)." Profit Optimization for Multiproject Scheduling Problems Considering Cash Flow" Journal of Construction Engineering and Management, 136(12), 1268–1278.

[11] Memon, A. H., Abdul Rahman, I., Abdullah, M. R., Abdu Aziz, A. A. (2010) "Factors Affecting Construction Cost in Mara Large Construction Project: Perspective of Project Management Consultant" International Journal of Sustainable Construction Engineering & Technology, 1(2), 41-54