Impact of Delay and Escalation on Cash Flow and Profitability in a Real Estate Project

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Abstract

Real estate projects are generally financed through advance instalments from prospective customers. Timing of these instalments is vital for maintaining project cash flow. Based on DHSS expenditure model, this paper proposes a cash flow forecasting model that integrates impact of schedule delays and cost escalations on cash flow, revenue generation and profitability. Data from an ongoing USD 600 million public project of real estate redevelopment is used. Characteristics of the project include appointment of a state enterprise as project developer at cost plus contract and financing of project by leasing out a portion of facilities being developed. Due to initial delay in the project, cash flow analysis is performed on its six subprojects over ten delay scenarios. The study reveals critical points in cash flow, subsequent strategic remedies for augmenting revenues, optimum structuring of instalment schedules and decreasing profitability for developer under schedule delays and cost escalation.

Keywords: Real estate project; project cash flow; schedule delay; cost escalation; DHSS expenditure formula.

1. Introduction

Profit and loss statements as well as balance sheets give status of a business process at time intervals. Whether the business process has successfully sustained over this time interval or not, is recognized by the cash flow over this interval. Hwee and Tiong [1] noted cash flow as the most important factor affecting profitability for construction

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projects under execution. Cash flow assumes even greater importance in modern construction business as companies handle many projects simultaneously that necessitates precise planning for fund management [2]. This planning is done by combining cash flows of all projects over project durations. Most of the cash flow forecasting models proposed by researchers [3-5] primarily provide mathematical tools to prepare expenditure estimates over execution periods. A few researches delve beyond expenditure estimates and integrate impact of schedule delays, cost escalation and revenue generation with expenditure statements in preparing cash flow. Research work dealing with analysis and interpretation of cash flow statements to draw out critical information for supporting management decisions is also limited.

This research focuses on application of an existing cash flow forecasting model through case study using data from an ongoing project. Government of India (State) has appointed a public real estate development company as Project Management Agency (PMA) to take up Redevelopment Project (RDP) of a large housing colony with estimated project cost of Indian National Rupee (INR) 39000 million (USD 1 = INR 65). More details of PMA and RDP cannot be revealed due to confidentiality of information. Finance for the project was to be arranged by PMA through leasing out of part of total built up area to the State departments. The lease proceeds were, however, to be deposited with the State and PMA was to get only a fixed percentage of construction cost as agency fee. Though neither the State and nor PMA had committed any money for the project, delay in execution of RDP was apprehended to impact badly the working capital of the project and then the profitability of PMA. Cash flow analysis under different delay scenarios demonstrated in this paper, offers some valuable insights into fund management and profitability of developer.

1.1. Objectives and scope

The objective of this research work is to develop an integrated model that will facilitate preparation of detailed cash flow statements under impact of schedule delays and cost escalation. Application of the proposed model to analyze the cash flow statement is illustrated through a case study. Study of impact of schedule delays and escalation on profitability of the project developer is also included. Scope is limited to analysis of data from a single project along with Wholesale Price Indices (WPIs) and minimum wage rate bulletins over the last decade. Money values are expressed in INR to maintain consistency of data from different sources over a decade.

2. Cash flow forecasting models

The tools which predict the amount of money that will flow through a construction contracting organization for a given project, during the period of scheduled construction activities, are referred as cash flow forecasting models [5]. The simplest approach is 1/4:1/3 model in which, during first 1/3rd project duration only first 25% of the total project expenditure is incurred, followed by next 50% expenditure during second 1/3rd time and remaining 25% expenditure in last 1/3rd time. More advanced forms of forecasting models are also developed based on typical S-curve patterns most construction project expenditures follow.

2.1. S-curve models

Selection of an appropriate S-curve forecasting model for a given project is done based on its accuracy, reliability and resources required to perform calculations [7]. Skitmore [3] applied real project data from 27 projects on the six forecasting models (viz. Hudson, Kenley-Wilson, Berny-Howes, cumulative logistic and cumulative normal) to compare their outputs but no conclusive priorities of models appeared. Ross, Dalton and Sertyesilisik [5] reviewed a number of models including those proposed by Hudson, Sears, Kenley-Wilson, Khosrowshashi, Kaka-Fortune and Kaka-Lewis. After analyzing six models (viz. Bromilo, Hudson, Peer, Tucker, Miskawi and Boussabain i Elhag) and using data from projects in Croatia, Ostojic—Skomrlj and Radukovic [8] developed six degree polynomial regression equation for cash flow forecasting. Review of literature revealed that Hudson’s model developed in 1978 is one of the oldest and most popular models. Therefore Hudson’s model is selected for the case study.
2.2. Hudson’s DHSS expenditure model in Indian context

Hudson’s DHSS (the British Department of Health and Social Security) expenditure formula was developed by empirical analysis of data from large number of hospital building projects [5]. This model is shown in Equation (1).

\[ Y = S(x + Cx^2 - Cx - (6x^3 - 9x^2 + 3x)/K) \]  

(1)

Where \( Y \) is the cumulative value of work done before any deductions of retention money or addition of fluctuations in time \( t \) months since commencement of the project; \( x \) is the proportion of elapsed time \( t \) to the overall project duration of \( T \), i.e. \( x = t/T \); \( S \) is the contract sum; \( C \) and \( K \) are set of empirical parameters based on range of contract sums. Varying the value of \( C \) determines rate of expenditure at beginning and end of the project and varying the value of \( K \) controls the rate of expenditure over the central portion of the project duration. DHSS model also provides set of standard values for \( C \) and \( K \) for ranges of contract sums in GBP 2000 prices [5, 6].

To apply this model to Indian projects that were awarded during 2013, contract sum ranges from Standard DHSS table [5, 6] in GBP 2000 prices were converted to equivalent INR at 2013 prices. For this exchange rate (GBP/INR)2000price = 67.54, WPIs for all commodities, WPI2000 = 152.85 with base year 1994-95, WPI2013 = 177.64 with base year 2004-05, Linking factor = 1.873 to connect the WPIs of series 1994-95 and 2004-05, as published in Reserve Bank of India and Office of the Economic Advisor India bulletins [9, 10] were used. Multiplication factor to convert GBP at 2000 prices to INR at 2013 prices were then derived as presented in the Equation (2). It is observed that contract sums of the case study fell in range ‘more than INR 3386.2 million’ (more than 23 million at GBP2000price) hence respective values \( C = -0.028 \) and \( K = 3.090 \) are considered [5, 6].

\[ \text{GBP}_{2000} \text{price to INR}_{2013} = \left( \frac{\text{GBP}_{2000} \text{price}}{\text{INR}_{2000} \text{price}} \right) \times \left( \frac{\text{WPI}_{2013} \text{priceBaseYear2004-05}}{\text{WPI}_{2000} \text{priceBaseYear1994-95}} \right) \times \text{Linking Factor} \]

(2)

3. Salient features of Redevelopment Project (RDP)

The project site of RDP is located in the national capital region and consisted of a housing colony with 2444 residential units. The State planned to redevelop the colony by scrapping the old units and build new residential-cum-commercial units as all-inclusive modern infrastructure with increased capacity and better amenities.

3.1. Project financing and escrow account

To meet the investment needs of RDP, the State decided that PMA will lease out approximately 10% of residential space (0.69 million square feet), total office spaces (1.35 million square feet) and parking lots (1550 units) for a period of 30 years from the date of occupation by the lessee, to generate estimated revenue of INR 52437 million. PMA also had to maintain an escrow account with recognized bank under the authority of the State. Lease amount were to be collected in 10 instalments and deposited into the escrow account. The lease agreement stipulated that the first eight instalments amounting to 85% were to be collected on predetermined dates, while the ninth instalment (10%) and tenth instalment (5%) were to be collected after completion of construction work and handing over the facility to the lessee. Thus, any delay in completion would automatically affect delay in receipt of last two instalments. Contractors’ running account bills and fees of PMA (10% of the bill amount) were to be reimbursed from the escrow account on monthly basis. The bank would also pay an interest of 8% per annum calculated on monthly balance in the escrow account. Any balance left after project completion would go to the State.
3.2. Escalation clause and related data

To execute entire RDP, PMA broke it in 6 independent subprojects (SP) and engaged 6 contracts as shown in Table 1. Escalation clauses were also considered in the contracts to compensate any increase in construction costs during course of execution due to changes in labour wages and material (such as steel, cement and other commodities) prices. Escalation is worked out keeping in mind the date of submission of bid as the reference date or base date and corresponding indices as base indices. The escalation clause for RDP is shown in Equation (3).

Table 1. Details of six independent subprojects (SP) under RDP

<table>
<thead>
<tr>
<th>Sub Projects (SP)</th>
<th>Contract sums (S, INR million)</th>
<th>Base Date/Start date</th>
<th>Initial Dur. (months)</th>
<th>Revised Dur. (T, months)</th>
<th>WPI on base dates</th>
<th>Lo INR/Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP1</td>
<td>5470</td>
<td>01.09.2013</td>
<td>30</td>
<td>25</td>
<td>180.7</td>
<td>164</td>
</tr>
<tr>
<td>SP2</td>
<td>4896</td>
<td>01.09.2013</td>
<td>24</td>
<td>27</td>
<td>180.7</td>
<td>164</td>
</tr>
<tr>
<td>SP3</td>
<td>5621</td>
<td>05.11.2013</td>
<td>36</td>
<td>36</td>
<td>181.5</td>
<td>163.4</td>
</tr>
<tr>
<td>SP4</td>
<td>5631</td>
<td>28.11.2014</td>
<td>36</td>
<td>36</td>
<td>179.5</td>
<td>163.8</td>
</tr>
<tr>
<td>SP5</td>
<td>5623</td>
<td>22.02.2014</td>
<td>39</td>
<td>39</td>
<td>179.5</td>
<td>164.8</td>
</tr>
<tr>
<td>SP6*</td>
<td>5000</td>
<td>01.05.2015</td>
<td>32</td>
<td>32</td>
<td>194.5</td>
<td>168.9</td>
</tr>
<tr>
<td>Total</td>
<td>32231</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ \Delta P = P_0 \left[ W_L \left( \frac{L_i - L_0}{L_0} \right) + W_M \left( \frac{M_i - M_0}{M_0} \right) + W_C \left( \frac{C_i - C_0}{C_0} \right) + W_S \left( \frac{S_i - S_0}{S_0} \right) \right] \quad (3) \]

Where \(0\) and \(i\) corresponds to values on base dates and in \(i^{th}\) month in which construction work is executed; \(P_0\) is the contractors’ running account bill value or construction costs at the base prices usually calculated monthly; \(\Delta P\) increase in construction costs due to escalation clause; \(L_0\) and \(L_i\) refers to minimum wage rates for unskilled male worker in Delhi region; \(M_i\) and \(M_0\) are WPIs for all commodities; \(C_i\), \(C_0\) and \(S_i\), \(S_0\) are WPIs for cement and steel respectively; \(W_L\) (25%), \(W_M\) (41%), \(W_C\) (14.5%) and \(W_S\) (19.5%) are weightage given to costs of labour, other materials, cement, and steel in escalation clause, respectively. For each SPs, values of \(L_0\), \(M_0\), \(C_0\) and \(S_0\) as given in Table 1. differ hence escalations for subprojects are calculated separately. Methods of forecasting \(L_i\), \(M_i\), \(C_i\) and \(S_i\) are explained in next section. Escalated construction cost \((P_i)\) for work done in \(i^{th}\) month is given by \(P_i = P_0 + \Delta P\).

4. Forecasting WPIs for materials and minimum wage rates

The WPI data in India are published by the Office of the Economic Advisor [10]. Since WPIs are time series data, they can be extrapolated using methods like time series regression. However, as inflation in India is calculated by simple arithmetic of comparing price indices of a given week/month with corresponding week/month of the previous year, similar concept is adopted here. Equations (4, 5) show formulae for forecasting WPIs.

\[ %\Delta WPI_{(m,y|m,y-1)} = \frac{WPI_{(m,y)} - WPI_{(m,y-1)}}{WPI_{(m,y-1)}} \quad (4) \]

Where \(WPI_{(m,y)}\) stands for WPI of the month \(m\) in the year \(y\) and \(WPI_{(m,y|m,y-1)}\) stands for % increase in the WPI of the month \(m\) in the year \(y\) over the corresponding value of the month \(m\) in the previous year \(y-1\). Thus there are twelve series of \(%\Delta WPI_{(m,y|m,y-1)}\) for each month of January to December. Medians of these series are calculated from past data and median values for respective months are assumed to be the rate of % increase in WPI for that month over next few years.
\[
WPI_{(m,f)} = WPI_{(m-1)} \times [1 + (\% \Delta WPI_{(median,m)} \times 100)]
\] (5)

Where, \(WPI_{(m,f)}\) denotes forecasted value of WPI in the month \(m\) of the year \(f\) and \(\% \Delta WPI_{(median,m)}\) denotes the median of values of \(\%\Delta WPI_{(m,y|m,y-1)}\) calculated from Equation (4). Using data over January 2006 to December 2014 and applying Equation (4, 5) values of \(M_i, C_i\) and \(S_i\) are forecasted.

Minimum wage rates for unskilled male workers \(L_i\) are determined by government notifications. Wage rate data from January 1980 to October 2014 [11] revealed that the wage rates for Delhi region are revised, in general, twice a year in the months of April and October. Due to randomness in the dates of wage revision, wage rates averaged over a financial year from April to March is considered. Similar to concept described for WPI forecasting, averaged wage rates over financial years 2003-04 to 2014-15 is finally considered and median of values of annual % increase is found to be 7.9%. \(L_i\) values for 2015-16 onwards are forecasted increasing the wage rate of previous year by 7.9%.

5. Proposed integrated model for cash flow analysis

For easy comprehension, proposed model is subdivided into 7 steps and illustrated through 7 boxes in Fig. 1. Box 1 depicts process of forecasting price indices and wage rates by analyzing past data. This research has used median of values of % changes over consecutive years to determine rate of increase in price indices and wage rates. Box 2 describes selection process for values of \(C\) and \(K\) from Standard DHSS table [5, 6] in Indian context taking into account GBP-INR exchange rates and Indian price indices. Selecting \(T, S\) for respective projects and varying values of \(t\), cumulative expenditure \((Y_i)\) and monthly expenditure statements \((P_0)\) are prepared using DHSS expenditure model. In box 3, two sets of delay scenarios are assumed taking \(T\) values as \(T, T+1, T+2, T+3, T+4\) and \(T+6, T+12, T+18, T+24, T+30\) in months. Six monthly expenditure statements for six subprojects in each of 10 delay scenarios give construction cost at base price. Box 4 includes steps to calculate escalated construction costs for each subproject using values of \(L_0, M_0, C_0, S_0\) and \(L_i, M_i, C_i\) and \(S_i\). For a given delay scenario, combining escalated construction costs of all subprojects and adding 10% of this as PMA fee, total monthly project cost or outflow from escrow account is obtained.

Box 5 shows process of revenue generation by leasing out earmarked portion of total built up area. Instalments for first 85% of total revenue are due on predetermined dates. Last two instalments of 15% and 5% are subject to completion of construction work and handing over of the facility to lessee, thus being affected by schedule delays. Box 6 represents cash flow with respect to the escrow account. The project cost for all SPs per month forms the outflow and instalment receipts with interests on monthly balance in escrow account constitute inflow. Additional revenue generated through further leasing is to be included into inflow as shown by dashed arrow from box 7.

Box 7 shows instalments receipts in advance allowed enough cash in the escrow account to start construction work. As mentioned in section 3.1, if PMA had generated 100% of estimated revenue (INR 52437 million), the instalments receipts meet the escalated project cost in all delay scenarios. However, PMA has generated only 61% of the estimated revenue (INR 31,916 million) resulting in occurrence of negative cash flow during execution period in certain month referred as critical month. Therefore, instalments from additional revenue need to be planned to maintain positive cash flow and its first instalment must arrive at least just before critical month. Strategies of early or late action to augment revenue and instalment receipt schedule determines the minimum values of balance 39% revenue source that must be leased. This situation is typical of any real estate project where facilities are leased or sold in phases to generate revenue. This model illustrates cash flow from perspective of the escrow account. Impact of schedule delays and escalation on internal cash flow and profitability of PMA is analyzed in section 6.3.

6. Application of proposed integrated cash flow model on RDP

Application of the proposed model involves collection of data from RDP, making assumptions for delays scenarios, preparing outflow and inflow statements in cash flow, analyzing cash flow for critical information and measuring impact of delays and escalation on profitability of PMA.
Fig. 1. Proposed integrated model for cash flow analysis
6.1. Application of DHSS expenditure model under schedule delays

Based on detailed execution plans of SP1-SP5 and impact of delays in site acquisition, PMA has prepared 5 scenarios (T = T, T+1, T+2, T+3, T+4) of monthly construction cost expenditures. Another set of 5 scenarios is developed by the authors for SP1-SP5 assuming delays of 6, 12, 24 and 30 months in completion date, (i.e., T= T+6, T+12, T+18, T+24, T+30). T values for SP6 in each scenario are adjusted such that it starts in May 2015 and its completion coincides with latest of SP1-SP5 (Table 1). Since very small progress was achieved at the time of data collection, all earlier expenditures are reported as expenditures in October 2014 and balance subproject costs are forecasted over T-1 months. Total project duration in each scenario is from October 2014 to end of the latest SP.

Table 1. shows SP1-SP6 have contract sums (S) larger than INR 3386.2 million, hence C = -0.028 and K = 3.090 are used. In Equation (1) taking \( x = t/T \), values of T from Table 1. and varying t from 1 to T, statements of cumulative expenditures \( Y_i \) and monthly expenditures \( P_0 \) are obtained. For subproject durations T, S-curve generated by DHSS model for SP1-SP5 is plotted with S-curve prepared by PMA executives for SP1-S5. The two plots are found to be closely spaced justifying suitability of DHSS model for the case study.

6.2. Cash flow analysis using escalated construction cost and instalment receipts

Escalated project costs (\( P_i \)) are calculated separately for each SP using Equation (3). Total construction costs in \( t^{th} \) month for all SPs is given by sum of \( P_i \) values for SP1 to SP6, i.e., \( \Sigma P_{SP1-SP6} \). Monthly project costs for RDP is given by adding 10% of PMA fee to \( \Sigma P_{SP1-SP6} \), and this total value is outflow from escrow account.

For each delay scenarios, minimum additional revenue required as % of balance 39% revenue source is determined under two assumptions: (a) PMA adopts early strategy and receives first instalment in July 2015; (b) PMA adopts late strategy and receives first instalment just before the critical month. Table 2. presents a part of the result of analysis. Minimum value 38% in scenario T+18 decreases to 35% in scenario T+24 and project ends with higher escrow balance. This phenomenon is observed because of assumptions made for timing of instalment receipts thus highlights the importance of meticulous instalment planning. Sales price of lease is kept fixed due to limitations imposed on eligible customer base by the State.

Table 2. Result of early and late strategy analysis for additional revenue generation

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Description (Money value in INR million)</th>
<th>Delay Scenarios (Duration in Months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Critical month in cash flows May-17</td>
<td>T+6      T+12  T+18   T+24  T+30</td>
</tr>
<tr>
<td></td>
<td>Minimum additional revenue required (as % of balance 39% of revenue source)</td>
<td>23% 27% 29% 30% 31%</td>
</tr>
<tr>
<td>2</td>
<td>Early action (1st instalment in July 2015)</td>
<td>T+12  T+18  T+24  T+30</td>
</tr>
<tr>
<td>3</td>
<td>Late action (1st instalment before critical month)</td>
<td>T+18  T+24  T+30</td>
</tr>
<tr>
<td>4</td>
<td>Escrow balance (after completion, in early strategy)</td>
<td>T+24  T+30</td>
</tr>
<tr>
<td>5</td>
<td>Escrow balance (after completion, in late strategy)</td>
<td>T+30</td>
</tr>
</tbody>
</table>

6.3. Impact of schedule delays and cost escalation on profitability of PMA

Due to escalation clause, construction cost increases with schedule delays and 10% of this cost is fee for PMA. This creates notion of increasing revenue for PMA with increasing delays. Yet, to measure true impact of the delays on profitability of PMA, extra cost incurred by PMA during delay period has to be considered. In absence of actual data, to estimate the costs incurred by PMA during period of delays following assumptions are made.

Taking estimated construction cost without escalation INR 32231 million as basis, estimated revenue of PMA is INR 3223.1 million. Assuming 35% mark up, total cost internal to PMA is INR 2095 million. This cost consists of two parts, a variable cost which can be controlled over schedule delays and a fixed monthly cost of site and corporate overheads incurred till completion of the project. Table 1. gives implementation time without delay for RDP as 39 months. Assuming 50% fixed cost and 50% variable cost, fixed cost per month is calculated to be INR 26.9 million. This is the extra monthly cost incurred by PMA over extended delay period leading to increase in total cost and affecting its profitability as shown in Table 3.
Table 3. Impact of schedule delays and cost escalation on the profitability of PMA

<table>
<thead>
<tr>
<th>Sl no.</th>
<th>Descriptions</th>
<th>Delay scenarios (money value in INR million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Total project duration (months)</td>
<td>45, 51, 57, 63, 69</td>
</tr>
<tr>
<td>2</td>
<td>Escalated construction cost (contractors’ bill value)</td>
<td>3629.4, 3665, 3700.1, 3734.4, 3768.2</td>
</tr>
<tr>
<td>3</td>
<td>PMA’s revenue, 10% of (2)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>PMA’s variable cost (controlled amount)</td>
<td>1047.5, 1047.5, 1047.5, 1047.5, 1047.5</td>
</tr>
<tr>
<td>5</td>
<td>PMA’s fixed cost per month</td>
<td>26.9, 26.9, 26.9, 26.9, 26.9</td>
</tr>
<tr>
<td>6</td>
<td>PMA’s fixed cost over project duration, (1)x(5)</td>
<td>1208.7, 1369.8, 1531.0, 1692.1, 1853.3</td>
</tr>
<tr>
<td>7</td>
<td>PMA’s total cost over project duration, (4)+(6)</td>
<td>2256.2, 2417.3, 2578.5, 2739.6, 2900.8</td>
</tr>
<tr>
<td>8</td>
<td>PMA’s actual profit, (3) – (7)</td>
<td>1373.2, 1247.7, 1121.6, 994.8, 867.4</td>
</tr>
</tbody>
</table>

7. Conclusion

This paper illustrates application of DHSS expenditure forecasting model in Indian real estate project cash flow analysis. Close resemblance of S-curves from DHSS model and actual expenditure estimates from ongoing project highlights suitability of DHSS model. Adding impact of escalation clause in project cost statements give more accurate outflow forecast which when plotted with inflow objectively identifies critical points in cash flow. For given early or late lease projections of balance leasable space, the model forecasts as to when and how much revenue to be augmented as well as enables decision makers to draw optimal instalment schedule. Finally, cash flow analysis internal to PMA reveals that notion of marginal increase in revenue due to escalation payment as impact of schedule delays does not compensate the actual overheads incurred in extended duration, but decreases overall profit. The findings of the research work were presented before the PMA top management and were well received.

Proposed model is though applied for state owned projects, it should be equally valid for private projects as they too generate revenue through instalments by leasing or selling of facilities. Reliability of the model is limited by tools to forecast price indices and wage rates which are sensitive to future economic conditions. Besides, as actual data about proportions of mark up, fixed cost and variable cost was not available, some results may not be representative of the industry.

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