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Cash Flow Analysis and Management of Project Portfolio Using Percentile Points

Kenneth Miebaka Oba

Senior Lecture, Department of Civil Engineering, Rivers State University, Port Harcourt, Nigeria

ABSTRACT- Effective financial and cash flow management are essential elements of an effective project execution plan. For this study, five projects were being executed simultaneously by SOFTSTRUCT CONSULTANTS, a construction company based in Port Harcourt, Nigeria. The company has an overdraft limit of $1,200,000. They are to commence on different dates starting from September 2022 and ending at February 2026. The percentile point (PP) method was used to generate the cash flow analysis and management. It was found that the company arrived at a maximum overdraft of $1,200,000, which was less than the limit. This means the company is on the safe side to succeed with her project portfolio, and likely remain afloat to execute more projects in the future, using this kind of cash flow management technique for all her projects.

KEYWORDS- Cash Flow, Financial Management, Percentile Points, Project Portfolio Management

I. INTRODUCTION

Money is the most significant resource in every project. It is in fact arguably the most significant man-made resource on earth. It drives and dictates development. When a construction or engineering project is awarded, money is usually channelled from the owner down to the least goods and/or service provider in the supply chain to ensure the project cost, quality, and scope delivery at the scheduled time. The inflow of funds from the owner to the contractor and the outflow of funds from the contractor to other relevant avenues needed in the project is described as the cash flow. According to [1], 60% of failed Small and Medium Scaled Enterprises (SMEs) were caused by poor cash flow management. It is therefore necessary to ensure adequate management of funds flowing in and out of a project to avoid problems of cost overruns, delays, and inadequate quality of work delivered. Oftentimes, companies handling multiple projects have run into difficulties encountered because of several factors ranging from political, and social, to cash inflow from the owner [2]. Project cash flow often helps project managers to balance project constraints of cost, time, and scope [3]. In a study carried out by [4], 23 factors were found to have affected the management of cash flow in construction companies in Vietnam. [5] have also in a similar study, attributed construction business failures in the United Kingdom to cash flow problems and shortage of working capital. In fact, they actually tagged cash flow as ‘a major issue’ in that article. To this note, several forms of research [6, 7, 8, 9, 10, 11, 12, 13, 3] have been carried out to boost or better manage cash flow. Some even resulted in mathematical model development.

Financial management usually consists of financial planning, control, and decision-making stages, all of which contribute to the overall profit-making of an organization. The financial planning deals with the operational and strategic activities such as interest rates, profit margin, project scheduling and durations, contract sum, budgeting and overdraft limit. Controls on spending must be ensured, in order to maximize profit and satisfy the clients. The management of the company has to ensure that the right decisions are made, in order to move the company forward. For this study, cash flow forecasting, analysis, and management were carried out on a SOFTSTRUCT CONSULTANTS, an engineering and construction company based in Port Harcourt, Nigeria. The aim was to determine an effective cash flow management to ensure an effective execution of the five projects simultaneously.

II. METHODS

SOFTSTRUCT CONSULTANTS is the construction company for which this study was carried out. The project portfolio details are shown in Table 1. The company embarked on five projects with the durations and contract sums shown. The company has an overdraft limit of $1,200,000.

Table 1: Project Portfolio Summary

	Project 1	Project 2	Project 3	Project 4	Project 5
Contract sum	$1,200,000.00	$850,000.00	$2,000,000.00	$980,000.00	$1,050,000.00
Duration	36 months	18 months	42 months	20 months	12 months
Commencement date	Sep-22	Feb-23	Jul-23	Jan-24	Mar-25

The Gantt chart in Figure 1 shows the scheduling of the five projects with durations, start and finish dates. This was extracted from Microsoft Projects.

ID	Task Mode	Task Name	Duration	Start	Finish
1		Project 1	36 mons	Sat 24/09/22	Fri 15/08/25
2		Project 2	18 mons	Fri 03/02/23	Tue 16/07/24
3		Project 3	42 mons	Tue 27/06/23	Wed 11/11/26
4		Project 4	20 mons	Tue 09/01/24	Mon 18/08/25
5		Project 5	12 mons	Wed 12/03/25	Thu 26/02/26

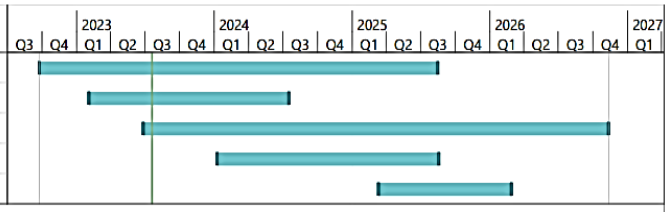

Figure 1: Project Portfolio Schedule

The percentile point chart in Figure 2 was used to analyse the cash flow for the five projects using eq. 1.

*P P=n/N*100%* (1)

*Value=PP*contract sum* (2)

Overdraft=∑_1^PnValue (3)

Where;

N, n, PP, and Pn are the total number of months in each project, the n^{th} month, Percentile Point, and the n^{th} project in the portfolio respectively.

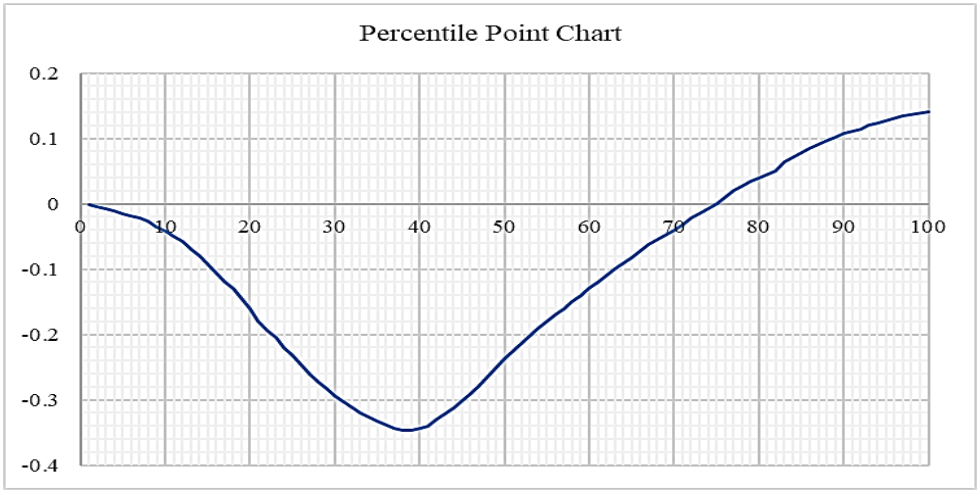

Figure 2: Percentile Points Chart

Eqs. 2 and 3 were used to determine the value of each project after taking into account the percentile points, and the total value respectively.

III. RESULT AND DISCUSSION

Use the percentile point values were determined and their corresponding results were displayed in Tables 2 to 6 for projects 1 to 5 respectively.

Table 1: Cash flow Analysis of Project 1

S/N	Month	PP	Graph	Contract sum	Value
1	Sep-22	3	-0.008	$ 1,200,000.00	$ -9,600.00
2	Oct-22	6	-0.018	$ 1,200,000.00	$ -21,600.00
3	Nov-22	8	-0.027	$ 1,200,000.00	$ -32,400.00
4	Dec-22	11	-0.049	$ 1,200,000.00	$ -58,800.00
5	Jan-23	14	-0.079	$ 1,200,000.00	$ -94,800.00
6	Feb-23	17	-0.119	$ 1,200,000.00	$-142,800.00
7	Mar-23	19	-0.125	$ 1,200,000.00	$-150,000.00
8	Apr-23	22	-0.194	$ 1,200,000.00	$-232,800.00
9	May-23	25	-0.233	$ 1,200,000.00	$-279,600.00
10	Jun-23	28	-0.271	$ 1,200,000.00	$-325,200.00
11	Jul-23	31	-0.3	$ 1,200,000.00	$-360,000.00

12	Aug-23	33	-0.32	$ 1,200,000.00	$-384,000.00
13	Sep-23	36	-0.338	$ 1,200,000.00	$-405,600.00
14	Oct-23	39	-0.46	$ 1,200,000.00	$-552,000.00
15	Nov-23	42	-0.33	$ 1,200,000.00	$-396,000.00
16	Dec-23	44	-0.312	$ 1,200,000.00	$-374,400.00
17	Jan-24	47	-0.28	$ 1,200,000.00	$-336,000.00
18	Feb-24	50	-0.237	$ 1,200,000.00	$-284,400.00
19	Mar-24	53	-0.202	$ 1,200,000.00	$-242,400.00
20	Apr-24	56	-0.17	$ 1,200,000.00	$-204,000.00
21	May-24	58	-0.15	$ 1,200,000.00	$-180,000.00
22	Jun-24	61	-0.12	$ 1,200,000.00	$-144,000.00
23	Jul-24	64	-0.09	$ 1,200,000.00	$-108,000.00
24	Aug-24	67	-0.063	$ 1,200,000.00	$ -75,600.00
25	Sep-24	69	-0.052	$ 1,200,000.00	$ -62,400.00
26	Oct-24	72	-0.022	$ 1,200,000.00	$ -26,400.00
27	Nov-24	75	0	$ 1,200,000.00	$ -
28	Dec-24	78	0.027	$ 1,200,000.00	$ 32,400.00
29	Jan-25	81	0.045	$ 1,200,000.00	$ 54,000.00
30	Feb-25	83	0.065	$ 1,200,000.00	$ 78,000.00
31	Mar-25	86	0.085	$ 1,200,000.00	$ 102,000.00
32	Apr-25	89	0.102	$ 1,200,000.00	$ 122,400.00
33	May-25	92	0.115	$ 1,200,000.00	$ 138,000.00
34	Jun-25	94	0.124	$ 1,200,000.00	$ 148,800.00
35	Jul-25	97	0.135	$ 1,200,000.00	$ 162,000.00
36	Aug-25	100	0.141	$ 1,200,000.00	$ 169,200.00

Table 2: Cash flow Analysis of Project 2

S/N	Month	PP	Graph	Contract sum	Value
1	Feb-23	6	-0.018	$ 850,000.00	$ -15,300.00
2	Mar-23	11	-0.049	$ 850,000.00	$ -41,650.00
3	Apr-23	17	-0.119	$ 850,000.00	$ -101,150.00
4	May-23	22	-0.194	$ 850,000.00	$ -164,900.00
5	Jun-23	28	-0.271	$ 850,000.00	$ -230,350.00
6	Jul-23	33	-0.32	$ 850,000.00	$ -272,000.00
7	Aug-23	39	-0.46	$ 850,000.00	$ -391,000.00
8	Sep-23	44	-0.312	$ 850,000.00	$ -265,200.00
9	Oct-23	50	-0.237	$ 850,000.00	$ -201,450.00
10	Nov-23	56	-0.17	$ 850,000.00	$ -144,500.00
11	Dec-23	61	-0.12	$ 850,000.00	$ -102,000.00
12	Jan-24	67	-0.063	$ 850,000.00	$ -53,550.00
13	Feb-24	72	-0.022	$ 850,000.00	$ -18,700.00
14	Mar-24	78	0.027	$ 850,000.00	$ 22,950.00
15	Apr-24	83	0.065	$ 850,000.00	$ 55,250.00
16	May-24	89	0.102	$ 850,000.00	$ 86,700.00
17	Jun-24	94	0.124	$ 850,000.00	$ 105,400.00
18	Jul-24	100	0.141	$ 850,000.00	$ 119,850.00

Table 3: Cash flow Analysis of Project 3

S/N	Month	PP	Graph	Contract sum	Value
1	Jun-23	2	-0.005	$ 2,000,000.00	$ -10,000.00
2	Jul-23	5	-0.015	$ 2,000,000.00	$ -30,000.00
3	Aug-23	7	-0.021	$ 2,000,000.00	$ -42,000.00
4	Sep-23	10	-0.042	$ 2,000,000.00	$ -84,000.00
5	Oct-23	12	-0.058	$ 2,000,000.00	$-116,000.00
6	Nov-23	14	-0.079	$ 2,000,000.00	$-158,000.00
7	Dec-23	17	-0.119	$ 2,000,000.00	$-238,000.00
8	Jan-24	19	-0.145	$ 2,000,000.00	$-290,000.00
9	Feb-24	21	-0.179	$ 2,000,000.00	$-358,000.00
10	Mar-24	24	-0.22	$ 2,000,000.00	$-440,000.00
11	Apr-24	26	-0.247	$ 2,000,000.00	$-494,000.00
12	May-24	29	-0.282	$ 2,000,000.00	$-564,000.00
13	Jun-24	31	-0.307	$ 2,000,000.00	$-614,000.00
14	Jul-24	33	-0.32	$ 2,000,000.00	$-640,000.00
15	Aug-24	36	-0.338	$ 2,000,000.00	$-676,000.00
16	Sep-24	38	-0.347	$ 2,000,000.00	$-694,000.00
17	Oct-24	40	-0.344	$ 2,000,000.00	$-688,000.00
18	Nov-24	43	-0.321	$ 2,000,000.00	$-642,000.00
19	Dec-24	45	-0.301	$ 2,000,000.00	$-602,000.00
20	Jan-25	48	-0.259	$ 2,000,000.00	$-518,000.00
21	Feb-25	50	-0.237	$ 2,000,000.00	$-474,000.00
22	Mar-25	52	-0.22	$ 2,000,000.00	$-440,000.00
23	Apr-25	55	-0.18	$ 2,000,000.00	$-360,000.00
24	May-25	57	-0.16	$ 2,000,000.00	$-320,000.00
25	Jun-25	60	-0.13	$ 2,000,000.00	$-260,000.00
26	Jul-25	62	-0.11	$ 2,000,000.00	$-220,000.00
27	Aug-25	64	-0.092	$ 2,000,000.00	$-184,000.00
28	Sep-25	67	-0.063	$ 2,000,000.00	$-126,000.00
29	Oct-25	69	-0.052	$ 2,000,000.00	$-104,000.00
30	Nov-25	71	-0.032	$ 2,000,000.00	$ -64,000.00
31	Dec-25	74	-0.008	$ 2,000,000.00	$ -16,000.00
32	Jan-26	76	0.024	$ 2,000,000.00	$ 48,000.00
33	Feb-26	79	0.034	$ 2,000,000.00	$ 68,000.00
34	Mar-26	81	0.046	$ 2,000,000.00	$ 92,000.00
35	Apr-26	83	0.065	$ 2,000,000.00	$ 130,000.00
36	May-26	86	0.085	$ 2,000,000.00	$ 170,000.00
37	Jun-26	88	0.097	$ 2,000,000.00	$ 194,000.00
38	Jul-26	90	0.108	$ 2,000,000.00	$ 216,000.00
39	Aug-26	93	0.12	$ 2,000,000.00	$ 240,000.00
40	Sep-26	95	0.13	$ 2,000,000.00	$ 260,000.00
41	Oct-26	98	0.138	$ 2,000,000.00	$ 276,000.00
42	Nov-26	100	0.141	$ 2,000,000.00	$ 282,000.00

Table 4: Cash flow Analysis of Project 4

S/N	Month	PP	Graph	Contract sum	Value
1	Jan-24	5	-0.015	$ 980,000.00	$ -14,700.00
2	Feb-24	10	-0.042	$ 980,000.00	$ -41,160.00
3	Mar-24	15	-0.099	$ 980,000.00	$ -97,020.00

4	Apr-24	20	-0.16	$ 980,000.00	$-156,800.00
5	May-24	25	-0.233	$ 980,000.00	$-228,340.00
6	Jun-24	30	-0.293	$ 980,000.00	$-287,140.00
7	Jul-24	35	-0.333	$ 980,000.00	$-326,340.00
8	Aug-24	40	-0.344	$ 980,000.00	$-337,120.00
9	Sep-24	45	-0.301	$ 980,000.00	$-294,980.00
10	Oct-24	50	-0.237	$ 980,000.00	$-232,260.00
11	Nov-24	55	-0.18	$ 980,000.00	$-176,400.00
12	Dec-24	60	-0.13	$ 980,000.00	$-127,400.00
13	Jan-25	65	-0.321	$ 980,000.00	$-314,580.00
14	Feb-25	70	-0.041	$ 980,000.00	$ -40,180.00
15	Mar-25	75	0	$ 980,000.00	$ -
16	Apr-25	80	0.04	$ 980,000.00	$ 39,200.00
17	May-25	85	0.075	$ 980,000.00	$ 73,500.00
18	Jun-25	90	0.108	$ 980,000.00	$ 105,840.00
19	Jul-25	95	0.13	$ 980,000.00	$ 127,400.00
20	Aug-25	100	0.141	$ 980,000.00	$ 138,180.00

Table 5: Cash flow Analysis of Project 5

S/N	Month	PP	Graph	Contract sum	Value
1	Mar-25	8	-0.027	$ 1,050,000.00	$ -28,350.00
2	Apr-25	17	-0.119	$ 1,050,000.00	$ -124,950.00
3	May-25	25	-0.233	$ 1,050,000.00	$ -244,650.00
4	Jun-25	33	-0.32	$ 1,050,000.00	$ -336,000.00
5	Jul-25	42	-0.33	$ 1,050,000.00	$ -346,500.00
6	Aug-25	50	-0.237	$ 1,050,000.00	$ -248,850.00
7	Sep-25	58	-0.15	$ 1,050,000.00	$ -157,500.00
8	Oct-25	67	-0.063	$ 1,050,000.00	$ -66,150.00
9	Nov-25	75	0	$ 1,050,000.00	$ -
10	Dec-25	83	0.065	$ 1,050,000.00	$ 68,250.00
11	Jan-26	92	0.115	$ 1,050,000.00	$ 120,750.00
12	Feb-26	100	0.141	$ 1,050,000.00	$ 148,050.00

In Table 7, the entire values of all five projects were presented. The total overdraft was negative in the first month (September 2022). This means that the company will be making a net negative expenditure within that period. This is normal during the start of any project. The overdraft increases from the beginning to a maximum of $1,088,720 on August 2024. This is the maximum overdraft, and is less than the limit of $1,200,000. This signifies that the spending pattern is safe and the company would not run into financial crises running the five projects simultaneously. However, if the overdraft was exceeded, the company would have smoothed out by adjusting the durations of some of its projects, or, rearranging the start dates of some of its projects. The analysis would then be re-run until the maximum overdraft becomes less than or equal to the overdraft limit. The overdraft begins to reduce until it becomes positive in December 2026 which indicates profit till the end of the last project.

Table 6: Comprehensive Cash flow Analysis of Project Port Folio

S/N	Month	Project 1	Project 2	Project 3	Project 4	Project 5	OVERDRAFT
		Value	Value	Value	Value	Value	
1	Sep-22	$ -9,600.00					$ -9,600.00
2	Oct-22	$ -21,600.00					$ -21,600.00
3	Nov-22	$ -32,400.00					$ -32,400.00
4	Dec-22	$ -58,800.00					$ -58,800.00

S/N	Month	Project 1	Project 2	Project 3	Project 4	Project 5	OVERDRAFT
		Value	Value	Value	Value	Value	
5	Jan-23	$ -94,800.00					$ -94,800.00
6	Feb-23	$ -142,800.00	$ -15,300.00				$ -158,100.00
7	Mar-23	$ -150,000.00	$ -41,650.00				$ -191,650.00
8	Apr-23	$ -232,800.00	$ -101,150.00				$ -333,950.00
9	May-23	$ -279,600.00	$ -164,900.00				$ -444,500.00
10	Jun-23	$ -325,200.00	$ -230,350.00	$ -10,000.00			$ -565,550.00
11	Jul-23	$ -360,000.00	$ -272,000.00	$ -30,000.00			$ -662,000.00
12	Aug-23	$ -384,000.00	$ -391,000.00	$ -42,000.00			$ -817,000.00
13	Sep-23	$ -405,600.00	$ -265,200.00	$ -84,000.00			$ -754,800.00
14	Oct-23	$ -552,000.00	$ -201,450.00	$ -116,000.00			$ -869,450.00
15	Nov-23	$ -396,000.00	$ -144,500.00	$ -158,000.00			$ -698,500.00
16	Dec-23	$ -374,400.00	$ -102,000.00	$ -238,000.00			$ -714,400.00
17	Jan-24	$ -336,000.00	$ -53,550.00	$ -290,000.00	$ -14,700.00		$ -694,250.00
18	Feb-24	$ -284,400.00	$ -18,700.00	$ -358,000.00	$ -41,160.00		$ -702,260.00
19	Mar-24	$ -242,400.00	$ 22,950.00	$ -440,000.00	$ -97,020.00		$ -756,470.00
20	Apr-24	$ -204,000.00	$ 55,250.00	$ -494,000.00	$ -156,800.00		$ -799,550.00
21	May-24	$ -180,000.00	$ 86,700.00	$ -564,000.00	$ -228,340.00		$ -885,640.00
22	Jun-24	$ -144,000.00	$ 105,400.00	$ -614,000.00	$ -287,140.00		$ -939,740.00
23	Jul-24	$ -108,000.00	$ 119,850.00	$ -640,000.00	$ -326,340.00		$ -954,490.00
24	Aug-24	$ -75,600.00		$ -676,000.00	$ -337,120.00		$ -1,088,720.00
25	Sep-24	$ -62,400.00		$ -694,000.00	$ -294,980.00		$ -1,051,380.00
26	Oct-24	$ -26,400.00		$ -688,000.00	$ -232,260.00		$ -946,660.00
27	Nov-24	$ -		$ -642,000.00	$ -176,400.00		$ -818,400.00
28	Dec-24	$ 32,400.00		$ -602,000.00	$ -127,400.00		$ -697,000.00
29	Jan-25	$ 54,000.00		$ -518,000.00	$ -314,580.00		$ -778,580.00
30	Feb-25	$ 78,000.00		$ -474,000.00	$ -40,180.00		$ -436,180.00
31	Mar-25	$ 102,000.00		$ -440,000.00	$ -	$ -28,350.00	$ -366,350.00
32	Apr-25	$ 122,400.00		$ -360,000.00	$ 39,200.00	$ -124,950.00	$ -323,350.00
33	May-25	$ 138,000.00		$ -320,000.00	$ 73,500.00	$ -244,650.00	$ -353,150.00
34	Jun-25	$ 148,800.00		$ -260,000.00	$ 105,840.00	$ -336,000.00	$ -341,360.00
35	Jul-25	$ 162,000.00		$ -220,000.00	$ 127,400.00	$ -346,500.00	$ -277,100.00
36	Aug-25	$ 169,200.00		$ -184,000.00	$ 138,180.00	$ -248,850.00	$ -125,470.00
37	Sep-25			$ -126,000.00		$ -157,500.00	$ -283,500.00
38	Oct-25			$ -104,000.00		$ -66,150.00	$ -170,150.00
39	Nov-25			$ -64,000.00		$ -	$ -64,000.00
40	Dec-25			$ -16,000.00		$ 68,250.00	$ 52,250.00
41	Jan-26			$ 48,000.00		$ 120,750.00	$ 168,750.00
42	Feb-26			$ 68,000.00		$ 148,050.00	$ 216,050.00
43	Mar-26			$ 92,000.00			$ 92,000.00
44	Apr-26			$ 130,000.00			$ 130,000.00
45	May-26			$ 170,000.00			$ 170,000.00
46	Jun-26			$ 194,000.00			$ 194,000.00
47	Jul-26			$ 216,000.00			$ 216,000.00
48	Aug-26			$ 240,000.00			$ 240,000.00
49	Sep-26			$ 260,000.00			$ 260,000.00
50	Oct-26			$ 276,000.00			$ 276,000.00

IV. CONCLUSION

Cash flow analysis, forecasting, and management are essential tools and techniques for the effective execution of projects. The use of the percentile point method of cash flow in this study has given the company an advantage by

knowing beforehand, the month in which they will be on a red zone financially. This gave them an insight into how to proactively make expenses to fulfil their project obligations while making profit and satisfying their various clients. With this, the company will remain afloat, and ready for greater responsibilities ahead.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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ABOUT THE AUTHOR

Kenneth Miebaka Oba holds a Bachelors degree in Civil Engineering, a Masters degree in Construction Project Management, and a Doctorate degree in Civil Engineering. He has published scholarly research articles in several local and international journals. He is specialized in Construction Engineering, Construction materials, and Construction Management. He is a registered Engineer with COREN, and a member of ASCE, SPE, PMI, and several other professional associations. He has designed, managed, and supervised the construction of several civil engineering facilities. He has also trained and mentored several engineers.