International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 04 Issue: 08 | Aug -2017 www.irjet.net p-ISSN: 2395-0072

A Framework for Establishing Risk Impacts on Forecasted Construction Cash Flows of Building Projects

Kimata N. Malekela[1], Juma Mohamed[2], Stanslaus K. Ntiyakunze[3], Musa I. Mgwatu[4]

[1, 2, 4] College of Engineering and Technology, University of Dar es Salaam, Dar es Salaam, Tanzania
[3]School of Architecture, Construction Economics and Management, Ardhi University, Dare es Salaam, Tanzania

---

Abstract - *Basically construction cash flow forecasting is very important in managing the cash during execution of building projects. Researchers over some past years have employed forecasting methodologies which uses the various cash flow equation concepts. Despite many research efforts, it has been a difficult issue in attaining an accurate forecast of construction cash flows due to the risk factors involved in causing variations on forecasted construction cash flows in construction projects. Therefore, this paper develops a framework for establishing the relative contributions (impacts) of risk factors in causing variations on forecasted construction cash flows (FCCFs) based on various work parts in building projects. This paper reports part of an on-going research concerned with modelling the construction cash flows. The developed framework was based on critical literature review supported with an evaluation and clarification of the issues that centred on the concepts of construction cash flows and risks involved. The cash flow forecasting methodologies were critically evaluated whereby a conceptual framework for establishing the risk impacts on forecasted construction cash flows based on various work stages in building projects was developed. Advanced cash flow forecasting approach was also suggested to be used for forecasting cash flow profiles in developing this conceptual framework. This approach is detailed and confident approach to positive cash flow prediction. Also, a conceptual framework of cash flow forecasting methodologies for both short cut and advanced cash flow forecasting approaches is developed.*

Key Words: **Construction cash flows, Framework, Risk impacts, Variations, Risk Factors, Relative contributions, Building projects**

1. INTRODUCTION

There are several techniques developed for forecasting construction cash flows during implementation of the construction projects (Odeyinka and Lowe, 2001) [24]. These methods are mainly based on S-curve, logit model and advanced cash flow forecasting methodologies. An advanced approach and the 'short cut' approaches such as simulation, mathematical, statistical approach and the use of artificial intelligence techniques are adopted in forecasting construction cash flows (RICS, 2012) [34]. The usage of cash flow forecasting methodologies is beneficial for both the projects in tender stage and construction phase since the stakeholders want to know in all project stages if their forecasted construction cash flows are enough for covering the possible project financial problems (Odenyika, 2003) [21].

Despite many research efforts, it has been a difficult issue in attaining an accurate forecast of construction cash flows due to the risk factors involved in causing variations on forecasted construction cash flows in construction projects (Ojo, 2012) [30]. Due to the risk factors involved in construction projects, related studies (Odeyinka et al., 2002 [25]; Odeyinka, 2003 [21]; Odeyinka et al., 2003 [22]; Ojo, 2010 [29]; Odeyinka et al., 2012 [26]; Ojo, 2012 [30]) on cash flow forecast revealed that majority of construction projects experience large variations on FCCFs. Therefore, this paper reviews the cash flow forecasting methodologies used for both advanced approaches and short cut approaches. This evaluation of cash flow forecasting methodologies assists to develop a framework for establishing impacts (relative contributions) of risk factors in causing variations on forecasted construction cash flows (FCCFs) related to various work parts in execution of building projects (i.e. cash flows based upon completion of various activity parts of building projects).

Basing on various sources (includes Kaka and Price, 1993 [10]; Odeyinka et al., 2002 [25]; Odeyinka et al., 2003 [22]; Melik, 2010 [18]; Ojo, 2010 [29]; Ojo, 2012 [30]; Odeyinka et al., 2012 [26]; Odeyinka et al., 2013 [27]) indicate that a framework for establishing risk impacts in causing variations on forecasted construction cash flows (FCCFs) based on various work activities in building projects is yet to be investigated. Therefore, this study develops a framework for establishing the relative contributions (impacts) of risk factors in causing variations on forecasted construction cash flows (FCCFs) based on various work parts in building projects. Also, a conceptual framework of cash flow forecasting methodologies for both short cut and advanced cash flow forecasting approaches was developed.

2. METHODOLOGY FOR LITERATURE REVIEW

The study was carried out by reviewing the peer-reviewed journal papers, conference papers, books and MSc dissertations/PhD theses. Most of papers were published during a period of 1990 to 2015 with exception of some few classical papers which were established before 1990 and one current paper of 2017 for defining various terms. Conceptually, the review covered the concepts of construction cash flows, risks in construction cash flows

forecast and methodologies of forecasting construction cash flows. A total of 64 literature materials were reviewed, but after reviewing, only 38 literature materials were cited in this work and majority were papers as shown in Table 1 and 2.

It can be observed that the frequency of citations of literatures was dominated by the literature on the concept of construction cash flows forecasting methodologies followed by philosophical views on construction cash flows and which are cited twenty eight (29) and ten (10) respectively (Table 1). These two concepts have been widely researched compared to the risks and variations in construction cash flows forecast which was cited seven (7) times only in this work. This signifies that the risk impacts were not considered in forecasting construction cash flows.

Table - 1: Number of Cited Works per Concept

Literature material	Concepts used		
	Philosophical views on construction cash flows	Risks and variations in construction cash flows forecast	construction cash flows forecasting methodologies
Papers	5	4	23
Books	3	2	4
Dissertations/ Theses	2	1	2
Total	10	7	29

Source: Author's own construction

The trend shows that most publications cited in this paper were published from year 2001 to 2015 (Table 2). This signifies that author has reviewed recent literature. Also, observations from Table 2 indicate that before 1990 there were eight (8) citations in this paper.

Table - 2: Number of Cited Works over Time

Literature material	Years of publication		
	2001 - 2015	1990 -2000	Before 1990
Papers	15	6	7
Books	4	1	0
Dissertations/ Theses	3	1	1
Total	22	8	8

Source: Author's own construction

3. PHILOSOPHICAL VIEW OF CONSTRUCTION CASH FLOW

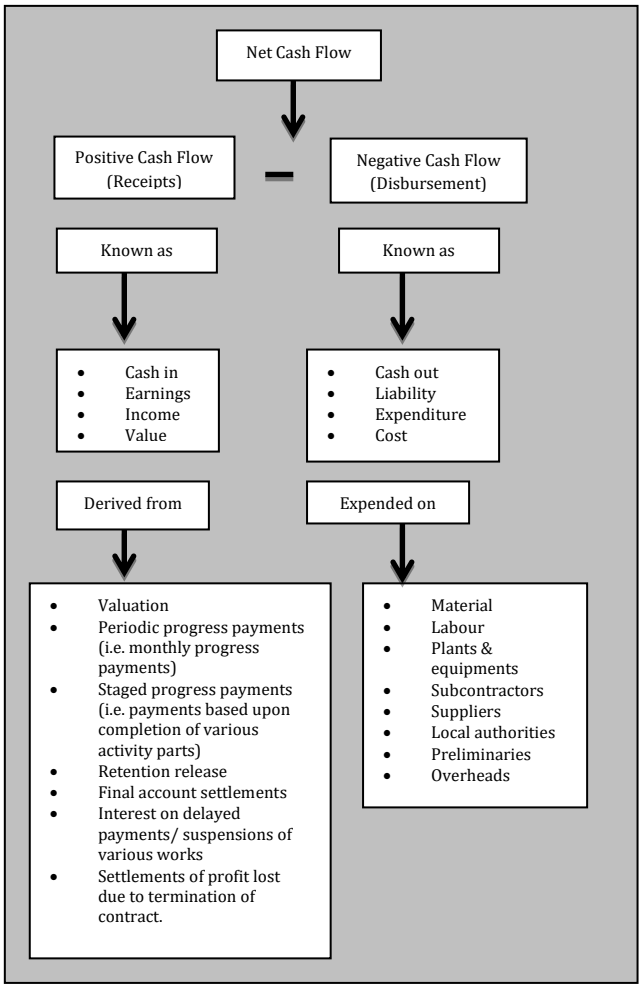
The philosophical view adopted in this study defines cash flow as the actual movement of money in and out of a business. Money flowing into a business is credited as cash received and called as positive cash flow while monies paid out are called as negative cash flow and are debited to the business. The difference between the positive and negative cash flows is called as the net cash flow (Cooke and Jepson, 1986 as cited out by Odeyinka et al., 2003 [22]). This concept is expressed algebraically as shown in equation 1.

Net Cash flow = Positive cash flow (receipts) - Negative cash flow (disbursements) *(1)*

Basing on this school of thoughts, positive cash flows are the monies received in the form of staged payments, monthly payment certificates, release of retention, settlements of final account, interest on delayed payments/suspensions of various works and settlements of profit lost due to termination of contract. In case of negative cash flows are related to monies expended on a contract such as wages, materials, plants, equipments, accounts rendered for subcontractors, local authorities and suppliers, general preliminaries and overheads expended during executing the construction projects. These receipts and disbursements are found from broad literature review done to various sources of literature like Malekela et al., (2017) [17], NCC (2006) [20], Odeyinka et al., (2003) [22]; Odeyinka and Lowe (2001) [24], and EAIA (1997) [6].

Payment systems for executing the positive construction cash flows involves monthly progress payments (or monthly cash flow), staged payments (or staged cash flows) and Turnkey cash flow. The contractors are paid using these main payment systems during execution of construction projects. For staged cash flows, contractor receives the funds in the form of staged payments to the performed work stage or element (Cheetham et al., 1995) [5]. For instance, these stages in buildings can be such as substructure, superstructure, finishings and services installations. While for monthly cash flows, contractor receives funds in form of monthly payments to the construction works performed (Kenley, 2003 [11]; RICS, 2012 [34]). For Turnkey cash flow, contractor receives only a single payment at the completion of the project (Kenley, 2003) [11].

For developing a framework for establishing the relative contributions (impacts) of risk factors in causing variations on forecasted construction cash flows based on various work activities of building projects, philosophical view expressed above is adopted and conceptualized as shown in Figure 1. Basing on this concept, when there is negative difference between positive and negative cash flows, it implies that the net construction cash flows will require extra fund from contractor in executing the construction project and when there is positive difference, it implies that the net construction cash flow is in surplus and the construction contract is self-financing.



Source: Author's own construction

Figure -1: Concept of Construction Cash Flow

4. RISKS AND VARIATIONS IN CONSTRUCTION CASH FLOW FORECASTING

Normally, there are lots of risk factors affecting the construction cash flows of the projects such as poor economic condition, lack of knowledge and experience to project stakeholders, client's unclarity of objectives, force-majeure events or the weather conditions (Melik, 2010) [18]. According to Ogunsanmi et al., (2011) [28], risks are the factors that can cause a project to fail in meeting its goals. Basically, cost objective includes construction cash flows as one of the aspects in project cost management (PMI, 2004) [33]. Therefore, in this study, risk factor means the factor that can cause variations on forecasted construction cash flows for a certain work part or element of building project as pointed out by (Malekela et al., 2017) [17].

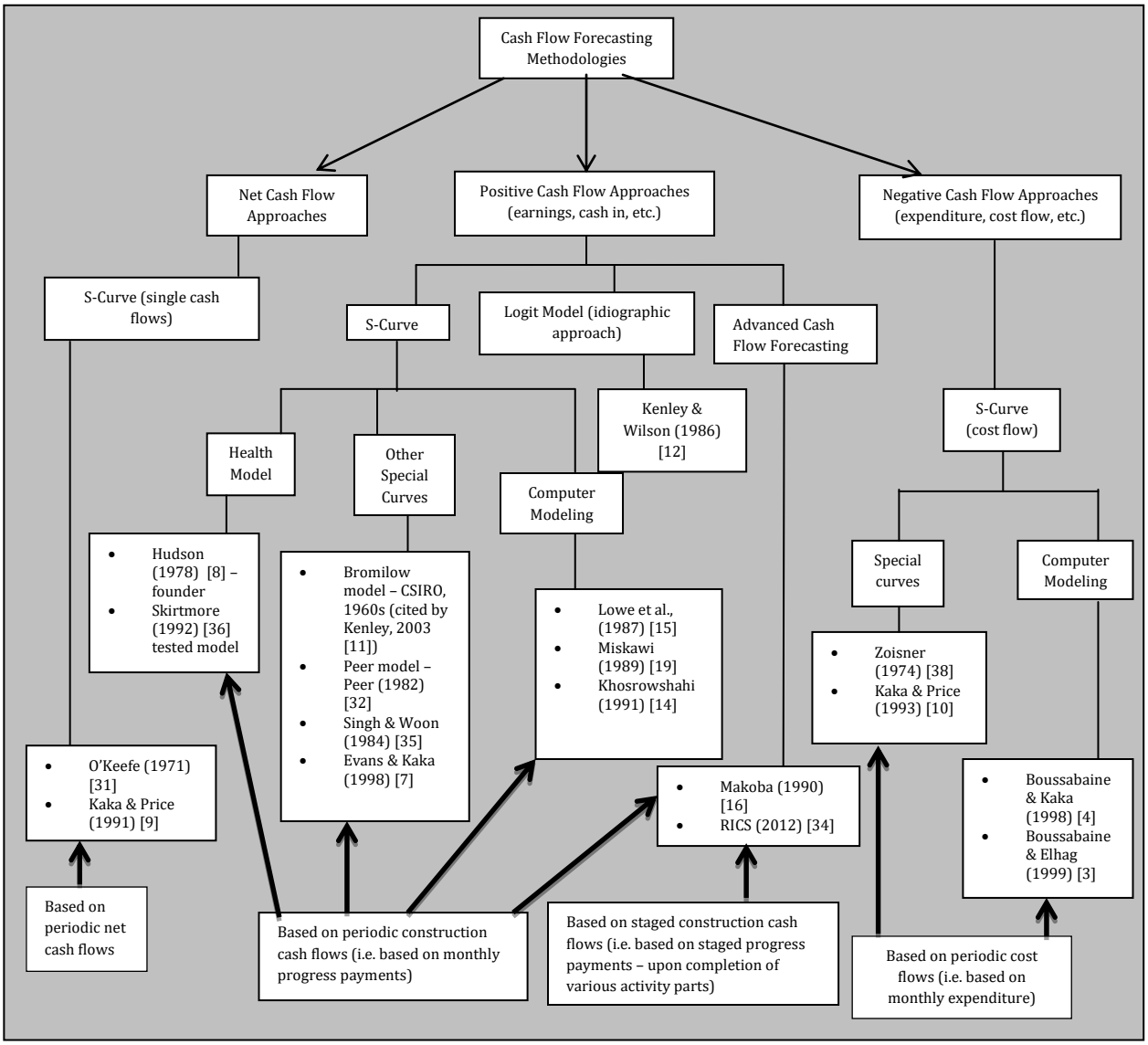
Therefore, variations on forecasted construction cash flows are caused by collection of risk factors, and the models which ignore the risk factors in construction cash flow research must be questioned (Kenley and Wilson, 1986) [12]. Variation is basically the difference between actual and forecasted construction cash flows in execution of the construction project. These variations cause to change the amount due to the contractor to most of the contracts (Odeyinka et al., 2002) [22]. According to Malekela et al., (2017) [17], actual construction cash flows are the actual amounts of money paid to contractor for the various completed work stages of the project after being valued at the site and certified. While forecasted construction cash flow is the estimated amounts of money to be paid to contractor from client after completion of various work stages of the project. when the forecasted construction cash flow is less than actual construction cash flow for the specific work stage performed, variation is positive and vice versa.

Furthermore, identification of risk factors causing variations on forecasted construction cash flows must be done before establishing their impacts (Odeyinka and Lowe, 2000) [23] and it is also a general rule for risk management (Kerzner, 2003) [13]. Normally, these risk factors are assessed basing on their impacts in causing variations on forecasted construction cash flows for various activity parts of building projects. This is the part of risk analysis as pointed out by Kerzner (2003) [13] and PMI (2004) [33]. Risk impacts are always recommended to be quantified in a good work breakdown structure (WBS) (Kerzner, 2003) [13]. Therefore, a framework for establishing the impacts of risk factors in causing variations on forecasted construction cash flows was based on detailed breakdown of various work parts in building projects.

5. A REVIEW OF CONSTRUCTION CASH FLOW FORECASTING METHODOLOGIES

It is very important to review construction cash flow forecasting methodologies so as to develop a framework for establishing impacts (relative contributions) of risk factors in causing variations on forecasted construction cash flows based upon completion of various work parts of building projects. Therefore, the researchers have employed various forecasting methodologies in dealing with the components of the construction cash flow as shown in Figure 2. For net cash flow approaches, the standard single net cash flow curves have been developed by some researchers such as O'Keefe (1971) [31] and Kaka and Price (1991) [9]. The periodic net cash flows delivery was the main base for developing these curves. But fluctuations of these curves due to the data available make them to be poor bases in forecasting net cash flow. Also, these curves ignored the issues of risk impacts on their forecasts. Therefore, this implies that it is impossible to achieve perfect cash flow curves for forecasting net cash flows.

In utilizing the negative cash flows, special cost curves using mathematical/statistical approaches have been developed by researchers in forecasting costs of projects such Zoisner (1974) (cited by Odeyinka and Lowe, 2001[24]); and Kaka and Price (1993) [10]. Other standard cost curves using computerized approach (e.g. fuzzy technique) were also developed by some researchers such as Boussabaine and Kaka (1998) [4], and Boussabaine and Elhag (1999) [3]. The



Source: Author's own construction

Figure -2: A conceptual framework of cash flow forecasting methodologies (together with modes of payments/expenditure)

periodic cost flow delivery was the base for developing all these curves too. Despite these efforts, some models were used for water pipeline projects not building projects. Also, the issues concerning with the variations caused by risk factors on forecasted cash flows were not addressed well in these forecasting methodologies. In fact, these techniques did not give accurate forecasts of the construction cost flows in execution of construction projects.

Many research efforts in utilizing positive cash flow have been done. Historical data were used to establish an ideal value curve in the form of health model, special curves and computerized approach. Many researchers (Hudson, 1978 [8]; Peer, 1982 [32]; Singh and Woon, 1984 [35]; Skirtmore, 1992 [36]; Evans and Kaka, 1998 [7]) have used historical data in establishing standard value curves by adopting mathematical/statistical approach. The polynomial regression or mathematical formulae (functions) were used to fit the results from the available data. Despite improvement done by Evans and Kaka (1998) [7] in using logit transformation for fitting value curves in positive construction cash flows, an accurate standard value curve was not achieved even when detailed work breakdown structure done to projects.

Also, computerized approach was used by researchers (Tucker, 1986 [37]; Miskawi, 1989 [19]; Khosrowshahi, 1991 [14]; and Lowe et al., 1987 [15]) in developing standard value curves. But some of these models are probabilistic rather than deterministic; some of these are also analytical rather

than predictive. Others are suited to the petrochemical projects rather than buildings as pointed out by Odeyinka et al., (2003) [15].

Furthermore, Kenley and Wilson (1986) [12] adopted the idiographic approach to forecast positive construction cash flows due to uniqueness of the construction projects. They applied logit transformation technique (simplest form of the sigmoid transformation) to fit data in forecasting the construction cash flows and allows S-curve to be presented in linear format. Therefore, the final sigmoid curve equation that describes the construction cash flow on a particular project is shown to be equivalent to equations 2, 3 and 4.

$$v = e^{\alpha}\left(\frac{t}{1-t}\right)^{\beta} \Big/ \left[1 + e^{\alpha}\left(\frac{t}{1-t}\right)^{\beta}\right] \quad (2)$$

$$\text{Or} \quad v = \frac{F}{1+F} \quad (3)$$

$$\text{Where} \quad F = e^{\alpha}\left(\frac{t}{1-t}\right)^{\beta} \quad (4)$$

Where v = dependent variable/value, t = time and F = cash flow

Although there is a special formula for transforming the cost and time, but it ignores the issue of risk factors which cause variations on forecasted cash flows. Additionally, Banki and Esmaeeli (2008) [2] highlight that the Logit Model can analyse effectively completed projects rather than new projects which is a drawback in this methodology.

In case of advanced cash flow forecasting approach, this approach involves preparation of cash flow which is based on either monthly progress payments or staged progress payments for various work parts of construction project upon their completion. It is also the detailed and confident method for construction cash flow forecasting (RICS, 2012 [34]; Makoba, 1990 [16]). In case of staged progress payment, preparation of construction cash flows is based on progress payments upon completion of various work parts of construction project. According to Melik (2010) [18], a cash flow chart summarizes and gives a summarized picture of the financial situation of the project to the users such as project managers, contractors, clients and financial suppliers.

A thorough review of the various forecasting methodologies found an advanced cash flow forecasting approach to be detailed and confident approach to positive cash flow prediction flows as pointed out by Odeyinka et al., (2012) [26] and RICS (2012) [34]. In that manner, this technique is therefore useful in establishing forecasted construction cash flows based on staged progress payments for various detailed work parts of building projects. Hence, this enables successful establishment of the impacts (relative contributions) of the risk factors in causing variations on forecasted construction cash flows. It should also be noted that this framework is delimited to positive construction cash flows derived from staged cash flows in building projects.

6. A CONCEPTUAL FRAMEWORK FOR ESTABLISHING RISK IMPACTS ON FORECASTED CONSTRUCTION CASH FLOWS

Basing on literature review and evaluation done, establishment of the impacts (relative contributions) of risk factors on forecasted construction cash flows for various activities in building projects recommends that an accurate cash flow forecast should take into consideration the impacts of risk factors. The risk factors are therefore included in a conceptual framework because they are the ones which cause variations on forecasted construction cash flows as pointed out by Odeyinka et al., (2002) [25]. These risk factors can be identified using various methods such as brainstorming, expert judgement as pointed out by Kerzner (2003) [13].

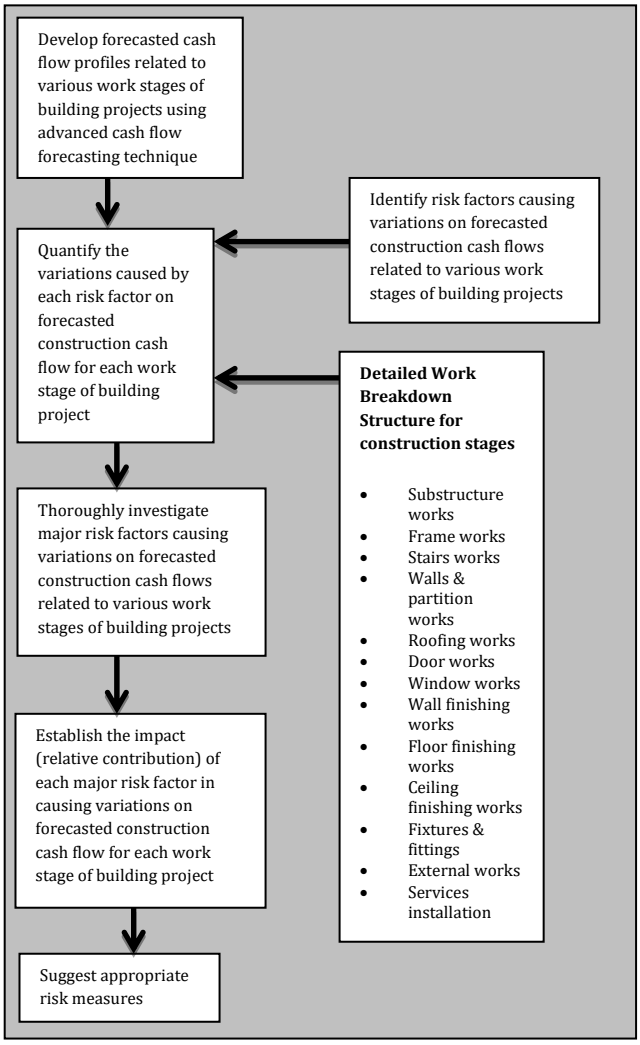
Furthermore, this framework needs to base on various work parts of building projects because work breakdown structure (WBS) is suggested to be used in analyzing properly the impacts of risk factors (Kerzner, 2003) [13]. Works breakdown structure used in this study includes substructure, frame, staircase, walls and partition works, roofing, door, window, wall finishes, floor finishes, ceiling finishes, fixtures and fittings, external works and services installations. These work elements have been employed in developing a conceptual framework for establishing the impacts of risk factors in causing variations on forecasted construction cash flows of building projects as shown in Figure 3.

Related studies (Al-Joburi et al., 2012 [1]; Banki and Esmaeili, 2009 [2]; Odeyinka et al., 2002 [25]) recommend historical data from completed construction projects to be used in cash flow studies. Therefore, for achieving the expected results using the proposed framework, construction cash flow data are collected from recently completed building projects. Furthermore, Melik (2010) [18] and RICS (2012) [34] suggest an advanced cash forecasting approach to be used in establishing positive cash flows with more confidence. Hence, this recommendation has been taken into consideration to use an advanced cash forecasting approach in developing forecasted construction cash flows for various work parts of building projects.

Therefore, the impacts of risk factors on forecasted construction cash flows are established using documentary reviews. This would be done by quantification of variations caused by each risk factor on forecasted construction cash flow for each work stage of building project. But thorough investigation would be carried out for determining the significant risk factors so as to establish properly their impacts and suggest appropriate risk measures. Also, Kerzner (2003) [13] supports identification of significant risk factors for further analysis in managing risks. Then, risk impact (relative contribution) for each significant risk factor in causing variations on forecasted construction cash flow for each work stage of building project is estimated properly.

Finally, conceptual framework for establishing the risk impacts on forecasted construction cash flows based on various work parts of building projects is shown in Figure 3.

In fact, this framework will facilitate the suggestion of appropriate risk measures to be taken for controlling major risk factors causing variations on forecasted construction cash flows based on various work parts in building projects.



Source: Author's own construction

Figure -3: Conceptual framework for establishing the risk impacts on forecasted construction cash flows

7. CONCLUSIONS

The cash flow forecasting methodologies were critically evaluated whereby conceptual framework for establishing the risk impacts on forecasted construction cash flows based on various work activities in building projects was developed. Furthermore, advanced cash flow forecasting approach was also suggested to be used in developing cash flow profiles in this conceptual framework. This approach is detailed and confident approach to positive cash flow prediction. The data related with construction cash flows are recommended to be collected from recently completed building projects.

Finally, a review of cash flow forecasting methodologies and clarification of methodological issues enabled to develop a conceptual classification of cash flow forecasting methodologies. This developed framework represents the concepts and procedures in effective manner.

REFERENCES

[1] Al-Joburi, K. I., Al-Omar, R. and Bahri, M. E, (2012). Analyzing the Impact of Negative Cash Flow on Construction Performance in the Dubai Area. Journal of Management in Engineering, 28(4), pp 382 - 390.

[2] Banki, M. T. and Esmaeeli, B., (2009). The Effects of Variability of the Mathematical Equations and Project Categorizations on Forecasting S-Curves at Construction Industry. International Journal of Civil Engineering, Vol. 7, No. 4, pp 258 – 270.

[3] Boussabaine, A. H. and Elhag, T. (1999). Applying Fuzzy Techniques to Cash Flow Analysis. Construction Management and Economics, 17(6), pp 745-55.

[4] Boussabaine, A. H. and Kaka, A. P., (1998). A neural networks approach for cost flow Forecasting. Construction Management and Economics, Vol. 16, pp. 471-9.

[5] Cheetham, D. C., Lewis, J. and Jones, S. T. (1995). The Effect of Stage Payments on Contractor's Cash Flow: Some Possible Consequences. Journal of Engineering, Construction and Architectural Management, 2 (3), pp 127–157

[6] EAIA, (1997). Agreement and Schedule of Conditions of Building Contract (with quantities). Nairobi, Kenya.

[7] Evans, R. C. and Kaka, A. P., (1998). Analysis of the Accuracy of Standard/Average Value Curves Using Food Retail Building Projects as Case Studies. Engineering, Construction and Architectural Management, 5(1), pp 58-67

[8] Hudson, K. W., (1978). DHSS Expenditure Forecasting Method, In: Kenley, R., (2003). Financing Construction: Cash Flows and Cash Farming. London: Taylor and Francis e - Library.

[9] Kaka, A. P and Price, A. D. F., (1991). Net Cash Flow Models: Are They Reliable? Construction Management and Economics, 9, pp 291 - 308.

[10] Kaka, A. P and Price, A. D. F., (1993). Modelling Standard Cost Commitment Curves for Contractor's Cash Flow Forecasting. Construction Management and Economics, 11, pp 271 - 283.

[11] Kenley, R., (2003). Financing Construction: Cash Flows and Cash Farming. London: Taylor and Francis e - Library.

[12] Kenley, R. and Wilson, O. D., (1986). A Construction Project Cash Flow Model: An Idiographic Approach. Construction Management and Economics, 4(3), 213-232.

[13] Kerzner, H., (2003). Project Management: A Systems Approach to Planning, Scheduling, and Controlling, 8th Edition. New Jersey: John Wiley & Sons Inc.

[14] Khrosrowashahi, F., (1991). Simulation of Expenditure Patterns of Construction Projects. Construction Management and Economics, 9, 113-132.

[15] Lowe, J. G., Mousa, N. and Lowe, H. C., (1987). Cash Flow Management: an Expert System for the Construction Client. Journal of Applied Expert System, 1(2), 134-152.

[16] Makoba, N. D., (1990). Cash Flow Forecasting in Construction Industry: Modelling Factors Responsible For Variations. Heriot-Watt University, Edinburgh, UK, MSc Dissertation

[17] Malekela, K. N., Mohamed, J., Ntiyakunze, S. K. and Mgwatu, M. I. (2017). Risk Factors Causing Variations on Forecasted Construction Cash Flows of Building Projects in Dar es Salaam, Tanzania. International Journal of Construction Engineering and Management, 6 (2), pp 46–55.

[18] Melik, S., (2010). Cash Flow Analysis of Construction Projects Using Fuzzy Set Theory. Middle East Technical University, MSc Thesis (Civil Engineering).

[19] Miskawi, Z., (1989). An S-Curve Equation for Project Control. Construction Management and Economics, 7, pp 115 – 125.

[20] NCC, (2006). Agreement and Schedule of Conditions of Building Contract (with quantities). Dar es Salaam, Tanzania.

[21] Odeyinka, H. A., (2003). The Development and Validation of Models for Assessing Risk Impacts on Cash Flow Forecast. Glasgow: School of the Built and Natural Environment, Caledonian University, PhD Thesis.

[22] Odeyinka, .H. A., Kaka, A. and Morledge, R., (2003). An Evaluation of Construction Cash Flow Management Approaches in Contracting Organisations. Proceedings of the 19th Annual Association of Researchers in Construction Management (ARCOM) Conference, September 3-5, University of Brighton, pp 33-41.

[23] Odeyinka, H. A. and Lowe, J. G., (2000). An Assessment of Risk Factors Involved in Modelling Cash Flow Forecast. Proceedings of the 16th Annual Association of Researchers in Construction Management (ARCOM) Conference, September 6-8, Glasgow Caledonian University, pp 557-565.

[24] Odeyinka, H. A. and Lowe, J. G., (2001). An Evaluation of Methodological Issues for Assessing Risk Impacts on construction cash flow forecast. Proceedings of the 167th Annual Association of Researchers in Construction Management (ARCOM) Conference, September 5-7, University of Salford, pp 381-389.

[25] Odeyinka, H., Lowe, J. and Kaka, A., (2002). A Construction Cost Flow Risk Assessment Model. Proceedings of the 18th Annual Association of Researchers in Construction Management (ARCOM) Conference, September 2-4, University of Northumbria, Vol. 1, pp 3-12.

[26] Odeyinka, H., Lowe, J. and Kaka, A., (2012). Regression Modelling of Risk Impacts on Construction Cost Flow Forecast. Journal of Financial Management of Property and Construction, Vol. 17, No. 3, pp 203 – 221.

[27] Odeyinka, H. A., Lowe, J. and Kaka, A. P., (2013). Artificial Neural Network Cost Flow Risk Assessment Model. Construction Management and Economics, 31(5), pp 423-439.

[28] Ogunsanmi, O. E., Salako, O. A. and Ajayi, O. M., (2011). Risk Classification Model for Design and Build Projects. Journal of Engineering, Project, and Production Management, 1(1), pp 46 – 60.

[29] Ojo, G. K., (2010). An Assessment of Risk Impacts on Construction Clients' Cash Flow Forecast. Ile-Ife: Obafemi Awolowo University, PhD Thesis.

[30] Ojo, G. K., (2012). Project Characteristics Influence on Risk Associated with Construction Clients' Cash Flow Prediction. Journal of Research in International Business and Management, Vol. 2(5), May, pp 142 – 150.

[31] O'Keefe, M. J., (1971). An Empirical Study of Cash Flow in Engineering Contracts, In: Odeyinka, H. A. and Lowe, J. G., (2001). An Evaluation of Methodological Issues for Assessing Risk Impacts on construction cash flow forecast. Proceedings of the 167th Annual Association of Researchers in Construction Management (ARCOM) Conference, September 5-7, University of Salford, pp 381-389.

[32] Peer, S., (1982). Application of Cost Flow Forecasting Models, In: Kenley, R., (2003). Financing Construction: Cash Flows and Cash Farming. London: Taylor and Francis e - Library.

[33] Project Management Institute (PMI) (2004). A Guide to the Project Management Body of Knowledge. 3rd Edition, Newton Square, PA.

[34] RICS, (2012). Cash Flow Forecasting. 1st Edition, Guidance Note, Coventry - UK: RICS.

[35] Singh, S. and Woon, P. W., (1984). Cash Flow Trends for High-Rise Building Projects. Proceedings of the 4th International Symposium on Organization ana Management of Construction, University of Waterloo, Canada.

[36] Skitmore, M. (1992). Parameter Prediction for Cash Flow Forecasting Models. Construction Management and Economics, 10(5), 397-413.

[37] Tucker, S. N., (1986). Formulating Construction Cash Flow Curves Using a Reliability Theory Analogy, In: Kenley, R., (2003). Financing Construction: Cash Flows and Cash Farming. London: Taylor and Francis e - Library.

[38] Zoisner, J., (1974). Erection Cost Flow Analysis in Housing Projects as a Function of Size and Construction Time, In: Odeyinka, H. A. and Lowe, J. G., (2001). An Evaluation of Methodological Issues for Assessing Risk Impacts on construction cash flow forecast. Proceedings of the 167th Annual Association of Researchers in Construction Management (ARCOM) Conference, September 5-7, University of Salford, pp 381-389.