

Factors Engendering Cost Misrepresentation of Public Sector Projects in Ghana

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Abstract

The main purpose of this research was to identify the core factors that engender construction cost overruns in public buildings in Ghana. Adopting a positivist, realist and value free philosophical approach, the research employs a multiple research strategy emphasized by the funnel technique principle. Twenty two dominant factors generated from a combination of exploratory interviews and extensive literature in the context of GCI was designed into a structured questionnaire targeting 240 clients, consultants and contractors. With a 55% return rate, the response of the participants were analysed using a combination of severity, frequency and relative importance indices. The five most important factors according to all three participants are (1) delay and uncertainty surrounding payment for work done (2) lack of enforcement of contract provisions by parties (3) variations and additional works resulting from changes in site conditions (4) lapses and challenges within PPL (5) excessive material and labour price fluctuations. Even though the Spearman's rank correlation test showed a strong agreement between clients and consultants, there was however a weak correlation between clients and contractors and consultants and contractors which is normal considering the allegations and counter-allegations regarding each other's contribution towards cost overruns. However a fair degree of objectivity and validity can be credited to the results considering the average level of experience of the respondents in the GCI.

***Keywords:** cost overrun, frequency indices, public sector projects, severity indices, relative importance indices*

1.0 Introduction

Completing projects within their initial budget is an indicator of an efficient, professional, competent and successful construction industry [1]. However worldwide, cost overruns are becoming a norm rather than the exception greatly affecting project delivery and public relations. Cost overrun is defined as the situation where the actual final cost of a project exceeds the initial contract sum. In spite of its pervasiveness worldwide, their frequency and magnitude differs from country to country. This is confirmed by a global study by [2] as cited by [3-4] which reveal that cost overruns are least in North America (24%) and Europe (26%) and highest in developing countries with an average of 65%. Furthermore Ahsan & Gunawan [4] posit that cost overruns in India are 26% while (Memon, Rahman, & Azis [33] and Holloum & Bajracharya [50] reveal 89% and 93% of projects in Malaysia and Abu Dhabi experience cost overruns respectively.

Although the construction process is primarily divided into three phases (*project conception, project design and project construction*) the 'construction' phase has often been of key concern and more prone to cost overruns because of the myriad of unforeseen factors that characterises it. Contractors have traditionally relied on high mark-ups, claims and pricing strategies [5], while clients have either increased contingency margins or adopted several forms of procurement, contractual arrangements, securities and damages as a means of hedging the risk of cost overruns. Nonetheless profit margins

continue to reduce while high contingencies margins either encourages project mismanagement making them uneconomic [5]. According to Flyvbjerg [6] cost overruns result in deception because on hindsight knowledge of the actual cost of project would prompt one of four decisions; (i) proceed to implement (ii) complete abandonment (iii) implement the project but at a later date or (iii) implement other competing projects.

Government is the biggest client in the construction industry in Ghana which contributes 8% of GDP [7]; higher than the sub-Saharan average of 6% [8]. In spite of the contribution of the industry to the economy, not many studies have been dedicated to addressing the specific factors that engender cost overruns in public sector projects. As a first step, this paper focuses on

- Identifying and ranking the specific factors that engender cost overruns in public sector projects
- To examine the importance of causes of cost overruns
- To study the strength of agreement amongst the three groups of respondents namely clients, consultants and contractors.

It is intended that the results gathered would lead to the recommendation of proposals to assuage cost overruns

2.0 Theoretical Framework

Several studies have been conducted over the past few years aimed at identifying the factors that influence cost overruns in various countries.

For instance Durdyev et al. [9] conducted a survey to identify and analyse the main factors that cause cost overruns in residential buildings in Turkey using the relative importance indices. Questionnaire of 40 factors gathered from literature and divided into 5 subgroups were ranked by project managers, consultants, clients and contractors. The results revealed that planning, inaccurate project cost estimation, high cost of needed resources (money, men, materials and machinery), lack of skilled workforce, price of construction materials and high land prices were the main causes of cost overruns.

Kasimu [10] in a similar approach as [9] identified 41 factors from literature which was sub divided into 5 sub groups. The results of the quantitative survey using the significance indices revealed that the 5 most significant causes of cost overruns are: materials price fluctuation; insufficient time; lack of experience in contracts works; and incomplete drawings.

Mansfield et al. [11] studies focused on the causes of delays and cost overruns in the Nigerian construction industry. 16 potential variables were selected from literature with additional seven that could cause cost overruns without necessarily leading to delays. Overruns were attributed to finance and payment arrangements, poor contract management, and shortages in materials, inaccurate estimation and overall price fluctuation.

Kaming et al. [12] identified 17 causes from literature in a study aimed at analysing the causes of delays and cost overruns of high rise buildings in Indonesia. The questionnaire targeted 31 project managers who were subsequently interviewed. The results using relative important indices and factor analysis revealed that cost overruns were more frequent and severe than delays. Furthermore, the major factors causing cost overruns were found to be material cost increase due to inflation, inaccurate material estimation, and degree of complexity.

Frimpong et al. [13] conducted a survey aimed at identifying and evaluating the relative importance of factors contributing to delays and cost overruns of groundwater projects in Ghana. A questionnaire of 26 factors from previous preliminary investigations between 1970 and 1999 were administered to both private and public clients, consultants and contractors. The findings reveal the main causes of delays and cost overruns are monthly payment difficulties from agencies, poor contract management, material procurement, poor technical performance and escalation of material prices.

Rosenfeld [14] adopted the expand-focus principles and techniques to assemble an initial 146 large data pool of potential causes from both international professional literature and prominent local experts. Through two cycles of expand-focus, the initial causes were filtered and merged into 15 universal root

causes. 200 local construction practitioners were targeted using cross-sectional survey approach. The survey revealed that the most significant local factors were premature tender documents, too many changes in owner's requirements and definitions and unrealistically low tender-winning prices (suicide tendering).

Meanwhile, most of the challenges highlighted and discussed fundamentally relate to lack of efficient project management which involves managing and controlling resources such as humans, materials, finances, plants and equipments. Nevertheless the studies conducted in the past fall short of establishing meaningful insights into the roles and responsibilities of the three major participants within the building industry even though understanding of these protocols of responsibility sharing is key for efficient management.

3.0 Methodology

3.1 Questionnaire Development and Data Gathering Process

From the point of view of epistemological, ontological and axiological philosophy, a positivist, realist and value free approach is adopted as the paradigm underpinning this research. Within this context a multiple research strategy (qualitative and quantitative) is applied emphasized by the funnel technique principle. The two-tier strategy began with extensive review of literature from past professional publications and available contract reports which helped to position the research in the right theoretical perspective. In order to narrow the factors of cost overruns in the context of Ghana, an exploratory interview targeting 18 experts with a minimum of 12 and an average of 21 years working experience was conducted which offered the opportunity to gain insight and understanding of the peculiar challenges confronting the construction industry in Ghana. The dominant factors eventually led to the design of a structured questionnaire of 22 factors. Respondents were required to rank the factors according to their severity and frequency of occurrence based on a Likert scale of 1 to 5 with the following interpretation: 1=not severe/frequent, 2=rarely severe/frequent, 3= moderately/frequent, 4=very severe/ frequent and 5= extremely severe/ frequent. An initial draft of the questionnaires were pretested with 15 construction professionals and academics in order to check for clarity and verify completeness of the questions in capturing the relevant variables. Gill & Johnson [15] observe that piloting is necessary because it is difficult to predict how respondents will interpret and react to the questions. The necessary feedback received after the pre-testing was assessed and then considered where necessary, thus ensuring the questionnaire addressed the core issues of the research.

Reasons such as absence of a comprehensive list of contractors, poor addressing system from which an accurate sampling frame could be developed, anticipated difficulty in gaining the support of potential respondents, time and resource constraints necessitated the application of non-probability sampling method. A minimum of 30 questionnaires as suggested in previous studies by [16-17] is regarded as a sufficient general rule of thumb to provide an effective normal approximation irrespective of the population and frequency of distribution. The selection of any sample size beyond this is indeed a positive compromise based on degree of accuracy, fore knowledge of the population, time, availability of funds and the need to get relatively large samples for a meaningful data analysis. According to (Akintoye & Fitzgerald [18] questionnaires administered by post in the construction industry normally receive a response rate between 20-30%. Likewise, past studies carried out in the Ghanaian construction industry suggest that the expected response rate in Ghana is between 20 to 60% [19-22]. Based on experiences of previous researchers in similar surveys, a total of 240 questionnaires divided equally into three (80 each) were administered in three out of the ten regions in Ghana (*Greater Accra, Eastern and Ashanti Region*) to the three groups of respondents; contractors, consultants (*architects, engineers and quantity surveyors*) and clients. In all a combination of convenience and snowball sampling techniques were used.

In order to increase the response rate and also ensure that all questions were answered, the face-to-face (hand delivered) approach adopted by [23-25] was preferred over the e-mail and post methods.

3.2 Instruments for Analysis

3.2.1 Test for Internal Consistency

The Cronbach's alpha measures the internal consistency of a measurement instrument such as a survey questionnaire by testing its validity and reliability and it is expressed as

$$\alpha = \left(\frac{k}{k-1} \right) * \left[1 - \frac{\sum \sigma_i^2}{\sigma_{sum}^2} \right] \dots \dots \dots \text{eqn 1}$$

where: k is the number of items, σ_i^2 variance of each item, and σ_{sum}^2 the total variance.

According to Tavakol & Dennick [26] validity is concerned with the extent to which the questionnaire measures what it is intended to while reliability is with the ability for the instrument to measure consistently. The less variation a questionnaire produces in a repeated measurement of a factor, the higher its reliability. Cronbach's alpha coefficient less than 0.50 is considered poor, between 0.50 and 0.70 is satisfactory while greater than 0.70 is good. The Cronbach's alpha for internal consistency reliability tests for frequency of occurrence and severity of the variables are 0.75 and 0.79 respectively.

3.2.2 Calculation and Ranking of Importance of Factors

A descriptive statistical approach with a direct interpretation of the survey results was adopted aimed at identifying the most critical variable based on relative importance indices (RII). The RII approach is seen as one of the key statistical instruments in ranking factors based on the Likert scale of ordinal measure and presents a good indication on the relative merit of an attribute based on the frequency and severity of occurrence [8,17,24,27-30]. Similarly Apolot et al. [31], Mansfield et al. [11] Le-Hoai [23] applied a more detailed approach by evaluating the factors based on their respective severity and frequency. The severity and frequency indices express the frequency of occurrence and magnitude of the variables respectively and computed as;

$$S.I. (\%) = \sum \left(\frac{a_i n_i}{5N} \right) * 100 \dots \dots \dots \text{eqn 2}$$

$$F.I. (\%) = \sum \left(\frac{a_i n_i}{5N} \right) * 100 \dots \dots \dots \text{eqn 3}$$

where

a_i is the constant expressing the weights assigned to each of the factors by the respondents of the i^{th} rank

n_i is the frequency of the responses of the i^{th} rank

N is the total number of responses

According to Doloi [30] while the RII doesn't represent the statistically significant measurement of any instance, the score provides a good indication on the relative merit of an attribute based on the frequency of occurrence within the independent collected sample and it is expressed as ;

$$RII. (\%) = \frac{S.I. (\%) * F.I. (\%)}{100} \dots \dots \dots \text{eqn 4}$$

3.2.3 Test of Agreement between Respondents

Several methods exist in testing the strength of agreement or disagreement between pairs of variables such as Pearson, Spearman rho and Kendall's tau coefficient. However, according to (Hauke & Kossowski [47] even though both the Spearman rho and Kendall's tau coefficients are proffered for rank correlations and invariable lead to the same conclusions, the latter is rarely applied because of the

awarding contracts even before budget is approved by government, variations and additional work as a result of changes in site conditions and lack of enforcement of contract provisions by parties are the most important factors that cause cost overruns.

Interestingly all the three respondents agreed on *delays and uncertainties surrounding payment of work done* and *lack of enforcement of contract provisions by parties* as the most important factors causing cost overruns in public projects.

Table 1: Summary of RII and ranks for the factors that engender cost overruns in public projects in Ghana

ID	Cost Overrun Factors	Client		Consultants		Contractors		All Respondents	
		RII	Rank	RII	Rank	RII	Rank	RII	Rank
1	Lack of frequent and effective supervision by consultants	48.57	11	36.00	16	50.42	10	43.19	13
2	Errors and discrepancies in contract document such as architectural and structural designs, bills of quantities and specification	37.09	16	36.83	15	54.38	7	40.53	15
3	Lack of coordination and communication during the design stage between the consultants and the beneficiary institutions	39.52	15	66.29	5	41.58	16	51.06	11
4	Lack of enforcement of contract provisions by parties	69.57	1	71.23	2	56.50	5	67.31	2
5	Excessive material and labour price fluctuations	64.71	5	57.49	7	53.92	8	59.06	5
6	Delays and uncertainties surrounding payment of work done	66.55	4	85.70	1	71.94	1	75.99	1
7	Poor budget estimation of project cost sent to Ministry of Finance by implementing agencies	60.77	7	64.17	6	37.95	18	56.79	7
8	Variations and additional work as a result of changes in site conditions	59.33	8	70.49	3	58.06	4	63.88	3
9	Poor caliber of contractors	68.27	3	57.02	8	43.76	14	57.73	6
10	Implementing agencies awarding contracts even before budget is approved by government	51.89	9	45.45	11	60.71	3	51.07	10
11	Arbitrariness in the selection of a margin for price and physical contingency	28.69	19	39.57	13	49.94	11	37.85	16
12	Excessive use of prime cost and provisional sums in the Bills of Quantities	51.58	10	51.94	10	65.09	2	54.60	8
13	Harsh weather conditions which slows down productivity and causes delays	17.83	21	18.68	20	32.75	20	21.17	21
14	Frequent shortages in materials such as cement and chippings	13.79	22	22.17	18	29.68	22	20.69	22
15	Lapses and challenges within the public procurement law (PPL)	68.77	2	68.37	4	39.62	17	61.55	4
16	Excessive bribery and cronyism regarding payment for work done	48.36	12	55.43	9	53.44	9	52.57	9
17	Inexperience and mismanagement on the part of consultants who handle government projects	26.37	20	15.02	22	36.00	19	22.76	20
18	Deliberate underestimation of initial project cost to ensure projects are implemented by clients	31.77	17	18.18	21	54.41	6	29.54	19
19	Collusion between consultants/public officials and contractors	44.63	13	20.87	19	44.29	13	32.95	18
20	Delays in awarding contract after tendering	30.73	18	35.98	17	48.03	12	36.64	17
21	Variations and additional works borne out of political expediency	43.13	14	41.38	12	42.91	15	42.36	14
22	Funding requirements of donors that has the tendency to delay project	61.83	6	37.66	14	30.21	21	43.29	12

From the views of all the respondents, the five most important causes of cost overruns are discussed in detail.

4.2.1 Delay and uncertainty surrounding payment for work done

Delay and uncertainty surrounding payment for work done (RII=75.99) was ranked the most important factor engendering cost overruns. Even though individually the clients ranked it 4th, the 1st position is shared by both consultants and contractors and corroborates earlier studies by [13] in ground

water projects where contractors and consultants equally viewed monthly payment difficulties as being the major cause of cost overruns. The phenomenon of payment delays is pervasive in almost all developing countries albeit the severity differ [13, 23, 31, 32, 35]. Several causes leading to payment delays have been identified: clients poor financial management, over elaborated payment process, withholding payment for non-compliance by contractor, results of “pay-when-paid” clause, errors in contractors claim, disagreement over valuation of works, delayed certification of valuation by consultants and the general attitude and culture of the people. Funding arrangements for most government projects in Ghana are rarely completed before commencement of works compelling contractors to suspend works midstream for several months whiles government mobilises funds to honour outstanding certificates. The fundamental cause is due to the rather huge shortfalls between the anticipated and actual budget revenues *vis-a-vis* the typical financial administration practice which suggest that recurrent expenditure such as personal emoluments and administrative expenses are given priority over capital spending such as investment and development activities. Meanwhile, even when the funds have been finally allocated, the institutional bureaucracies from valuation of works to receipt of cheque can take several months. There are instances contractors’ payment cheques have been returned by the central bank for lack of funds. This phenomenon of delays distorts the contractor’s cash flow, creates financial hardships for contractors and impacts severely on the contractual payment chain cascading into late payments to subcontractors and suppliers, adversarial relationship between the client and contractors, progress delays, bankruptcy or liquidation, extension of time and eventual abandonment of works. In an uncertain environment characterised by double digit inflation and interest rates, payment delays according to [36] never bring justice to contractors who are highly dependent on interim payments to discharge debts accrued.

4.2.2 Lack of enforcement of contract provisions by parties

Lack of enforcement of contract provisions by parties (RII=67.31) was ranked the 2nd most important factor. Individually it is ranked 1st, 2nd and 5th by clients, consultants and contractors respectively. This finding corroborates the observations made by [35, 37-39] that there is very little respect for construction contracts entered into by parties in Ghana with neither of them expecting it to be binding. A construction contract according to Mohamad & Madon [40] is supposed to express the intent of the parties and memorialise their principal risk allocations. An effective understanding and interpretation of the contractual obligations of each party is reliant on the clarity of the contract document in translating the requirements implied in the signed agreement. The habit of several consultants lifting contract conditions and specifications from past contracts to new ones without any modification to suit the requirements of the new contract is not uncommon. Lack of proper understanding and enforcement of the contract provisions manifest predominantly in late handover of site, delayed payments, refusal to pay interest on delayed payments, consultant’s reluctance to apply LAD clause, contractors reluctance to submit and review works programme, frequent suspension of works without proper notification etc. Fugar & Agyakwah-Baah [41] in their view reveal that most of the parties to a contract have weak understanding of the conditions of contract and are unable to appreciate the consequences of actions taken. Lack of enforcement of the contract conditions have the tendency to cause disputes which if not properly managed can undermine team spirit, cause delays and cost overruns.

4.2.3 Variations and additional works resulting from changes in site conditions

Variations and additional works resulting from changes in site condition (RII=63.88) was ranked 3rd by all the respondents. This factor which was similarly ranked 8th, 3rd and 4th by clients, consultants and contractors respectively reveals the effects of absence of site feasibility studies and accurate geological data. This problem according to Mansfield et al. [11] is a function of hasty commencement of project and political expediency overriding the detailed preparation of designs. Site feasibility studies to ascertain ground conditions are rare unless for few large construction projects whiles existing geological information about most part of the country is either archaic or non-existent. The phenomenon of

producing a single design scheme (*mainly social infrastructure like educational and health buildings*) and replicating it across the country also leads to change orders often resulting from change in site conditions. Lacking knowledge of site conditions can cause design changes prompting project delays. Site investigation to assess conditions before design should be thorough and complete before project commencement. Several past researchers have identified variations and additional works amongst the major causes of cost overruns [11, 32, 42]. Apart from the extra cost that is directly incurred when site conditions tend to differ from what was anticipated, extension of time claims to cover loss and expense such as overheads and material and labour price fluctuations can significantly increase the initial budget.

4.2.4 Lapses and challenges within PPL

Lapses and challenges within the PPL (RII=61.55) was ranked the 4th most important cause of cost overrun. The client and consultants share this view (*ranked 2nd and 4th respectively*) while contractors think otherwise (*ranked 17th*). Shortcomings within the PPL with potential effects on project cost have been studied and well documented [42-45]. Deficient staff strength and quality, deliberate attempt by most procurement entities to split contracts into smaller lots to meet the requirements of a preferred contractor, undue political influence and corruption, attempts by several procurement entities to minimise competition and conscious effort by some procurement entities to frustrate interested bidders and shroud procurement process in secrecy are amongst the myriad challenges confronting the procurement process in Ghana. Dividing contracts into smaller lots in order to meet the threshold of a preferred contractor contravenes section 21(5) of the PPL and creates opportunities for contractors with less financial and technical capabilities to win projects beyond their capacity. Deliberately reducing the scope of works to meet the financial threshold of a particular bidder only leads to additional works which ends up increasing the variance between the initial and final contract sum. The risk of delays are also imminent as most of the contractors involved in such schemes lack capacity in terms of experience, personnel, equipments and finance to carry out such projects. Section 59 of the PPL (Act 663) requires selection of the contractor with lowest evaluated tender price which according to [46] conforms to the requirements by multilateral development banks. Price has often been preferred as the major criteria over other requirements because it is perceived to reduce the exercise of subjectivity, nepotism and corruption. Desperate contractors often offer unrealistically low prices to win contracts (*suicide tendering*) with the aim of compromising on quality of works, influencing consultants to change specifications of some materials so they can submit new quotations or raising unjustifiable claims and becoming aggressive with clients.

4.2.5 Excessive material and labour price fluctuations

Excessive material and labour price fluctuation (RII=59.06) was ranked 5th most important cause of cost overruns by the respondents. The clients, consultants and contractors individually ranked it 5th, 7th and 8th important factor respectively. This corroborates the observation by [31, 23, 13] who found excessive fluctuation in material cost as a significant cause of cost overruns in Uganda and Tanzania respectively. Ghana's construction industry is highly dependent on imports importing almost about 80% of its inputs. Further to this are the weak fundamentals of the economy which are extremely vulnerable to both internal and external shocks such as fluctuating world crude oil prices, exchange rate pressures and unpredictable inflation. Unstable rates of inflation has been one of the intractable challenges Ghana has faced after independence; 7.9% between 1960 and 1970; 38.8% between 1970 and 1979, 48.3% between 1980 and 1989; 27.5% between 1990 and 1999, 18.4% between 2000 and 2009 and 13.77% between 2010 and 2012 [26, 47]. The effects are that both local and imported construction material prices are highly elastic to a shift in these dynamics which inhibit the accurate projection of construction cost. Hence, a project delay of just two months in Ghana is capable of having a lot of financial implications on initial project cost.

4.3 Importance Rank Correlation

Table 2 displays the results of the Spearman's rank correlation coefficient between any two groups of respondents to the questionnaire which explain the degree of consensus on the factors causing cost overruns. All the correlation coefficients are highly significant at $\alpha=0.05$. The results show that there is a relatively high agreement between the clients and consultants ($\rho=0.7820$). On the other hand clients and contractors ($\rho=0.4429$) and consultants and contractors ($\rho=0.3891$) do not seem to agree very much. Meanwhile, according to Chan & Kumaraswamy [27] this is not surprising considering the many allegations and counter-allegations regarding each other's contribution towards cost overruns. A fair degree of objectivity and validity can be credited to the results especially considering the educational background and average level of experience of the respondents.

Table 2: Spearman's rank correlation of the rankings

Group	Client & Consultant		Client & Contractor		Consultant & Contractor	
	ρ	<i>P-value</i>	ρ	<i>P-value</i>	ρ	<i>P-value</i>
Test for agreement	0.7820	0.000	0.4429	0.000	0.3891	0.000

Note: *Spearman correlation is significant at 0.05 level of significance

5.0 Conclusion and Recommendation

The research has identified and discussed the factors that engender cost overruns in public building construction projects in Ghana. A multiple research approach based on the principle of expand-focus technique helped to identify 22 factors in the context of the Ghanaian construction industry. About 90% of the respondents revealed they had been involved in projects that experienced cost overruns. 45% of the respondents indicated an average cost overrun of between 5 and 20%. Based on the severity, frequency and importance indices, the five most important causes of cost overruns from the view of clients, consultants and contractors have been highlighted. The research has thoroughly discussed the five most important factors based on the aggregated views of all respondents which are *delay and uncertainty surrounding payment for work done, lack of enforcement of contract provisions by parties, variations and additional works resulting from changes in site conditions, lapses and challenges within PPL and excessive material and labour price fluctuations*. Apparent biases within the response of the participants cannot repudiate the views proffered considering the average level of experience and stance of allegations and counter-allegations regarding each other's contribution towards cost overruns.

It is recommended that government ensures removing all bottlenecks hindering the timely payment of works done and enforce all contractual clauses pertaining to late payments. There is also the need for professional bodies to study the contract conditions and amend existing standard forms to ensure a balanced allocation of risk. All provisions within a contract should be binding on all without fear or favour. Architects should endeavour to design with site conditions in mind. As a requirement, institutions responsible for approving structural designs should demand a soil test. The public procurement authority should consider reviewing the PPL after ten years of its enactment to reflect the current situation in Ghana. Whiles government works to stabilise the economy and attempt to redirect it from a consuming to a producing economy, factors that easily engender project delays should be curtailed to prevent excessive payment of material and labour fluctuations.

The findings are expected to help practitioners understand the core factors that engender construction cost overruns of public buildings. It is expected that by assessing these potential factors in their current and future projects, practitioners can assuage the impact of cost overruns. Even though the

findings of this research are cast in the context of Ghana, it could be adopted in other developing countries that have similar features like the construction industry in Ghana.

6.0 References

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