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Project environment factors contributing to time overruns of projects delivery in Lagos and Abuja, Nigeria.

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Abstract- The contribution of project environment factors to construction delay and time overrun were frequently observed during construction projects delivery, the actual frequency and magnitude of these factors are not known which had proved to be a serious and very expensive problem to the construction industry. This paper examines the role of project environment factors and its contributions to time overruns in building project delivery. A survey was conducted in Abuja and Lagos and systematic sampling technique was used to select respondents from a list of registered members from each of the respective professional institution office in Abuja and Lagos. One hundred and fifty (150) questionnaires were administered to respondents and sixty-three (63%) were returned. Data collected were analyzed using Relative Importance Weight (RIW) to determine the relative importance of the various factors that contributed to time overrun of project delivery. The Kendall coefficient of concordance (W) was applied to investigate agreement between differing groups and Chi-square test was used to investigate (W) for significance to ensure that the agreement among the five rankings were not as a result of pure chance. It was found that unexpected price rise of building materials; weather; access to capital; late delivery of building materials and equipment as well as planning regulation are the main factors contributing to time overruns of project delivery. It was concluded that time overruns on construction may be inevitable, adequate planning and control can bring about reductions. Therefore, the paper calls for careful exploration of each of the factor identified, so as to be able to curtail their effect on project delivery.

***Keywords: Environment, relative importance weight, project delivery, time overrun*.**

1. Introduction

The construction industry is a complex environment and full of uncertainty as a result, projects are influenced by a multitude of factors which could come from different sources. Among the sources include environmental factors (Mahamid & Dimaidi, 2013). Project environment is the surrounding in which a project is undertaken; therefore, it includes air, water, land, natural resources, pollutions, human and their interaction (i.e. social, political, economic, legal and physical). It includes virtually everything outside the project. The contribution of project environment factors to construction time overrun (delay) were frequently observed during projects delivery, the actual frequency and magnitude of these factors are not known which had proved to be a serious and very expensive problem to the construction industry. However, project participants rarely took account of the environmental factors upon the project (Obalola, 2008). As a result, projects are managed and controlled according to outdated ideas of organization structure based upon institutionalized roles (Walker & Vanes, 2000). In addition, many contractors have insufficient knowledge of these environmental factors and do not have the experience to manage them effectively. This result in conflicts, poor quality, late completion, poor performance in terms of time overrun, which is common in the construction industry.

Construction time overrun is defined as the time either beyond completion date specified in a contract, or beyond the date that parties agrees upon for delivery of a project (Assaf & Hejji, 2006). While, Aibinu and

Jagboro (2002) see time overrun as a situation when the contractor and the project owner jointly or severally contribute to the non-completion of a project within the original or the stipulated or agreed contract period. The time overrun in construction projects has become one of the most common problems in the industry that cause multitude of negative effects on the projects and its stakeholders. In general, most of the construction projects (if not all), according to Parviz and Nabil (2004) experience time overrun during their implementation phase. Thus, time overrun has been constantly investigated by the researchers across the world with a great enthusiasm (Aibinu and Jagboro, 2002; Frimpong, Oluwole, and Crawford, 2003; Assaf and Al-Hejji, 2006; Ameh and Osegbo, 2011; Dolage and Rathnamali, 2013; Kadiri and Shittu, 2015).

Frimpong, et al. (2003) studied groundwater project in Ghana and illustrated that owners, contractors and consultants ranked poor contract management, monthly payment difficulties from agencies, material procurement, poor technical performance and escalation of material prices as major factors that can cause time overrun. Similarly, Ameh and Osegbo (2011) studied the relationship between time overrun and productivity on construction site in Nigeria. The study established that inadequate funding of projects, inadequate planning before take-off and inadequate tools and equipment and delay in delivery of materials to site, in that descending order, were the major cause of project delay in Nigeria.

The findings of the above studies have all pointed out many factors that can cause time overrun in construction project. These range from factors inherent in the technology and its management, to those resulting from the physical, social and financial but failed to explore in depth contribution of environmental factors to time overrun. Akintoye and Macleod (1997) opined that project environment in construction has been the object of attention because of time and cost overrun associated with construction projects It is on this note that the present study set out to examine the role of project environment factors and its contributions to time overrun of building project execution in Lagos and Abuja

2. The Project environment factors

Construction projects are influence by a multitude of factors which can be external or internal to the organization responsible for its management and execution (Datta and Mukherjee, 2001; Albert, 2007).

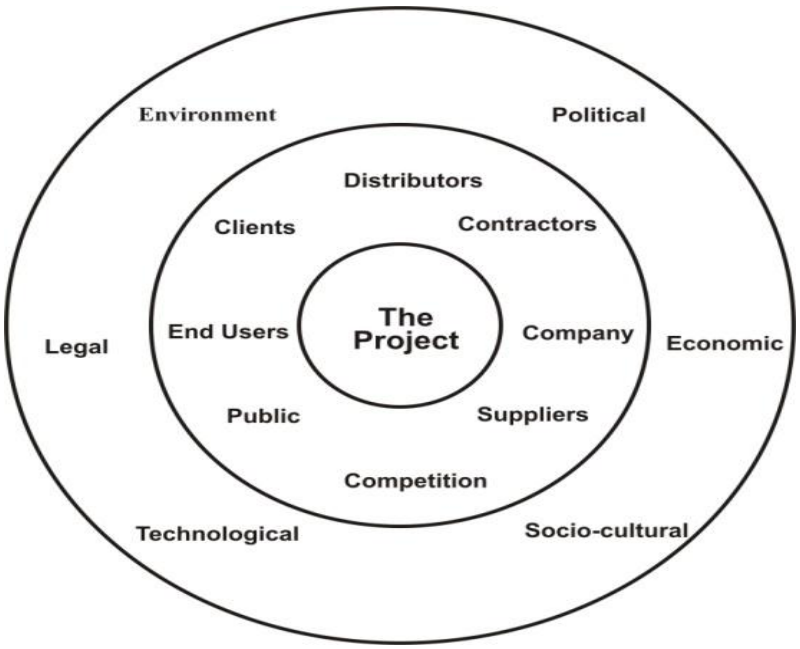

Fig.1: The Project Environment. Source: Datta and Mukherjee (2001).

Schwartz (2014) explained factors as any circumstance, fact, or influence which contributes to a result. Project environment factors are set of circumstances, facts or influences which contribute to the project outcomes. These are the influential forces which either facilitate or impede project success. A schematic diagram presented in figure 1 illustrates the project surrounded by its external environment. The project takes place inside the organization's boundary and is surrounded by the immediate environment such as contractor, clients, distributor, suppliers, end users, public and competition that constitute an organizations immediate environment. Chan, Scott and Chan, (2004) enumerated external environment factors that can affect project success as economic, social, political, industrial relations and technology advanced. All these factors according to Albert (2007) are neatly encapsulated by the acronym PESTLE, which stands for political; economic; social; technical; legal and environmental.

Political

This is concerned with policy and the effect of political decisions upon the project (Oladapo, 2000). It also covers sometimes large influence that strong individuals can have over project. Political stability, national unity and good political leadership are crucial to national development. Changes in government often accompany changes in policy. Political factors affect construction process and consisted of instability in government; political agitation; policy instability; legislation; election (Walker, 1985).

Economic

There are two levels of economy: internal and external (Albert, 2007). The internal economy relates to the viability of the project. It is vital during the construction phase to ensure the economic viability of the project. The external economy is related to the political climate that can have a serious influence on the project. Higher interest rates or exchange rates, and additional taxes on labour, materials or end product, can seriously affect the viability of the project. Economic factors consisted of: inflation rate; inadequate working capital; foreign exchange rate; unexpected price rise for labours; unexpected price rise for materials and equipment; access to capital (Walker, 1985).

Social

Social is concerned with the social environment within which the project is operating and society's acceptance or tolerance of certain modes of behaviours (Hughes, 1989). The nature of the society and culture of the people affect the management of projects. Many projects and indeed most construction projects inevitably affect the community in whose area they are carried out. (Oladapo, 2000). It contained five variables namely: civil conflicts or disturbance; believes; hidden obstruction; access to med-care; literacy level.

Technical

Technical factors relate to the technology which is available to do the work, both in terms of the design work and the construction work. If the project is not technically sound, it will end in failure (Albert, 2007). The mechanisms by which these technical requirements are implemented can seriously affect the projects. Technical factors consisted of five variables which include: shortage of labour; shortage of plant/equipment spare parts; importation of materials and equipment; strike by the labour force; and late delivery of materials and equipment.

Legal

Legislation according to Oladapo (2000) influences the contractual relationships within a project. One of the fundamental requirements of a contract is that it is legal. In other words, if it is illegal in a certain country to build a brewery, little protection can be expected from the law. In this way, legislation can have a serious influence on the project. Legal factors consisted of planning regulation; types of contract; attitude of judiciary to dispute.

Environmental

According to Albert (2007) environmental impact assessments are highly desirable where they are not already mandatory. The location of the project clearly has an enormous influence on the cost and completion time. The same type of project can be constructed in the UK, China or even Nigeria, but the problems of costs and construction times can be very different due to factors such Temperature (daytime and night) at different seasons, rainy seasons, ground conditions and earthquake, access by road, rail, water or air etc. Environmental factors have serious influence on the project and consisted of weather; unfavourable site conditions; unexpected geological condition; acts of God (e.g. storm, fire, land slide and earthquake); flood and erosion.

2.2 Understanding the concept of time overrun

Time Overrun is one of the most significant issues being faced by the construction industry today. There are various factors responsible for the time overrun which require serious attention to understand and address in order to achieve successful completion of projects on time. According to Parviz and Nabil (2004) time is a very frequent phenomenon and is almost associated with all projects of construction industry. Kaming's diary (as cited in Danso and Antwi, 2012) defined time overruns as the extension of time beyond completion dates traceable to contractors. Oko, Aliu and Koleola, (2010) also defined time overrun as the time difference between the actual and the initially planned dates of completion. It can also be defined as the duration between the date of approval of the project and its expected date of completion

3. Research methodology

Twenty-nine (29) project environment factors were adapted from studies by Walker (1985) and Hughes (1989) grouped into six major factors by Albert (2007) viz: political, economic, social, technical, legal and environmental. A questionnaire was then drawn up and was divided into two sections. Section A sought to know the personal data of the respondents, section B contained project environment factors contributing to time overrun of projects. The 29 factors were placed on a six – point scales to assess the contribution of each factors to time overruns of project delivery, where '1' represents not sure level of contribution, "2" represents no contribution, "3" represents very low contribution, "4" represents low contribution, "5" represents high contribution and "6" represents extremely high level of contribution.

The respondents were asked to identify and rank individual project environment factors (based on one specific project completed by their firms between 2012 and 2017) observed that had contributed to project time overrun, according to their own judgments and working experience in construction industry. Copies of the questionnaires were sent to five groups of respondents' viz. clients, construction professionals (architects, quantity surveyors, engineers) and contractors. These groups of respondents were chosen because they are the principal interest in the construction industry. Systematic sampling technique was adopted in the selection. This according to Leedy's diary (as cited in Aibinu and Jagboro, 2002) minimizes bias. Construction professionals were selected from a list of registered members collected from each of the respective professional institution office in Abuja and Lagos. Abuja and Lagos was chosen because a lot of construction activities are taken place in those two states. Contractors were selected from list of contractors (indigenous, contracting within Lagos and Abuja) from the federation of construction industry while, clients (those that were involved in building operations) were selected from federal and state government agencies and parastatals. A total of one hundred and fifty (150) questionnaires were distributed and ninety-five (95) were returned representing a response rate of 63%. (Table 1). This was considered adequate for the analysis based on the assertion by Moser and Kalton's diary (as cited in Aibinu and Jagboro, 2002) that a result of a survey could be considered as bias and of little value if the return rate was lower than 30-40%.

Table 1: A record of response to the questionnaires

Respondents	Questionnaire distributed	Number of respondents	Percentage (%) of responses
Clients	30	15	16
Architects	30	22	23
Quantity surveyors	30	21	22
Engineers	30	21	22
Contractors	30	16	17
Totals	150	95	100

Table 2: A record of response to the questionnaire in Abuja and Lagos States of Nigeria

Location	Number of Respondents	Percentage of Respondents
Abuja	50	53
Lagos	45	47
Total	95	100

The procedure used in analyzing the results was aimed at establishing the relative importance of the various factors contributed to project time overrun. Relative Importance Weight' method was used to analyze the data collected from the questionnaire survey. The analysis was carried out for each group of respondents (clients, architects, quantity surveyors, engineers and contractors). The six-point scale mentioned earlier was transformed to relative importance weight for each of the twenty-nine project environment factors. Hence, all the numerical scores of each of the identified factors were transformed to relative importance weight. The weight is then used to determine the rank, of each item. These rankings made it possible to cross-compare the relative importance of the factors as perceived by the five groups of respondents. The relative importance weight (RIW) was evaluated using the following expression:

$$\mathbf{RIW} = \frac{\sum a_i . n_i}{\sum Xj} \times 100 \qquad (1)$$

Where: i = response category index = 1, 2, 3, 4, 5, and 6 for not sure contribution to extremely high contribution; xj = the sum of the jth factors; j = the factors 1, 2, 3…N; N = total Number of factors (29); $\mathbf{a_i}$ = constant expressing the weight given to the ith response: i = 1, 2, 3, 4, 5, 6; $\mathbf{n_i}$ = the variable expressing the frequency of the ith response.

For a response of 'not sure contribution'	a_1	=	1
For a response of 'no contribution'	a_2	=	2
For a response of 'very low contribution'	a_3	=	3
For a response of 'low contribution'	a_4	=	4
For a response of 'high contribution'	a_5	=	5
For a response of 'extremely contribution'	a_6	=	6
The frequency of not sure contribution' response	n_1		
The frequency of 'no contribution' response	n_2		
The frequency of 'very contribution' response	n_3		
The frequency of 'low contribution' response	n_4		
The frequency of 'high contribution' response	n_5		
The frequency of 'extremely contribution' response	n_6		

Equation 1 was used to calculate the relative importance weight (RIW) for all project environment factors. Kendall's coefficient of concordance test was applied to investigate, in holistic terms the agreement between differing groups within the survey. Kendall's coefficient of concordance *W* was computed using the formula as shown in equation 2, to know whether five groups of respondents agree or do not agree on the ranking of the importance of factors contributing to time overrun.

$$W = \frac{12 \sum R^2 - 3K^2N(N+1)^2}{K^2 N (N^2-1) - K\sum T} \quad (2)$$

Where $\sum R^2$ = the sum of the square sums of ranks for each of the factors influencing time overrun being ranked; K is the number of sets of ranking (that is the number of group and is equal to 5); N is the number of factors being ranked and is equal to twenty nine (29); and T is the correction factor required for the set of ranks. Value of *W* must also be investigated for significance, to ensure that the agreement among the five rankings were not as a result of pure chance. Significant testing is based on the Chi-square distribution with (N-1) degree of freedom. For this the chi-squared test was used in determining the probability of occurrence of a relationship between the five set of rankings. The chi-square (X^2) statistic is computed as

$$X^2 = K (N-1) W \quad (3)$$

Where K is the number of respondent groups five (5) in this case; N is the number of factors being ranked and *W* is the Kendall's Coefficient of Concordance. In other to determine whether there is an agreement or disagreement among the groups of respondent with respect to how they rank factors contributing to time overrun, a test of hypothesis was formulated as follows: -

H_0: Construction professionals', contractors' and clients' perceptive of the factors contributing to time overrun are not the same.

H_1: Construction professionals', contractors' and clients' perceptive of the factors contributing to time overrun are the same.

To determine the significance of the result, null hypothesis (H_0) is to be rejected if computed value X^2 is greater than critical table value X^2, otherwise accept alternative hypothesis (H_1) if computed value not greater than critical table value X^2.

Identification of project environment factors contributing to time overrun of project delivery.

In order to evaluate project environment factors that contributed to time overrun of project delivery, data collected were analyzed and results were presented as shown in Table 3 and 4.

Table 3: Project environment factors category as assessed by the five groups of respondents with their weighted averages.

Factors category	Clients		Architects		Quantity Surveyors		Engineers		Contractors		Weighted All average	
	RIW%	R	RIW%	R	RIW%	R	RIW%	R	RIW%	R	RIW%	R
Economic	1.18	1	1.30	1	1.69	1	1.69	1	1.02	1	1.38	1
Technical	0.93	4	0.89	5.5	1.10	3	1.21	3	0.77	4.5	0.98	4
Political	0.83	5	0.94	4	1.01	5	1.31	2	0.77	4.5	0.97	5
Legal	1.07	2	1.13	2	1.01	4	1.08	5	0.93	2	1.04	3
Social	0.78	6	0.89	5.5	0.79	6	0.95	6	0.63	6	0.81	6
Environmental.	1.05	3	1.06	3	1.17	2	1.12	4	0.89	3	1.06	2

Source: Field survey (2017)

Economic factors

Economic factors were ranked first by all the parties with relative importance weight (RIW) of 1.38 as shown in Table 3. The highest ranked factor among economic factors is unexpected price rise for materials with relative important weight of 1.68 (Table 4). High ranking of the factor could be attributed to high and unstable inflation trend in Nigeria and developing countries in general. The market situations

associated with construction resources in Nigeria are unpredictably influence inflation trend in such a way that, the time at which projects are actually completed exceed their initial project duration.

Environmental factors

As shown in Table 3, environmental factors have relative importance weight of 1.06 and were ranked second by all the parties. Among the environmental factors, weather was ranked second with relative importance weight of 1.45 as indicated in Table 4. Ranking weather high is an indication of the fact that it is the most difficult and unknown factor because it cannot be controlled.

Table 4: Project environment factors as assessed by the five groups of respondents with their weighted averages.

PROJECT ENVIRONMENT FACTORS	Clients		Architects		Quantity Surveyors		Engineers		Contractors		Weighted All average	
	RIW%	R	RIW%	R	RIW%	R	RIW%	R	RIW%	R	RIW%	R
ECONOMIC FACTORS												
Inflation rate	1.03	9	0.34	29	1.55	8	1.83	2	1.00	9.	1.15	9
Inadequate working capital	1.00	11	1.03	10	1.62	4	1.55	5	1.03	7	1.25	7
Foreign exchange rate	1.03	9.5	0.76	21.5	1.31	10	1.44	9	0.79	15	1.07	12
Unexpected price rise for labours	0.97	13.5	1.24	6	1.62	4.5	1.62	4	0.87	12	1.26	6
Unexpected price rise for materials	1.28	2	1.31	5	2.34	1	2.21	1	1.27	1	1.68	1
Access to capital	1.21	3	1.17	8	1.72	2	1.48	7.5	1.14	3	1.34	3.5
TECHNICAL FACTORS												
shortage of labour	0.66	25	0.83	16.5	0.83	22.5	1.03	21.5	0.59	24.5	0.79	24
Shortage of plant/equipment spare parts	0.72	22.5	1.21	7	0.86	21	1.38	10	0.66	22.5	0.97	14
Importation of materials and equipment	1.14	5.5	0.90	14.5	1.24	11.5	1.28	15	1.07	6	1.13	11
Strike by the labour force	0.69	24	0.76	21.5	0.93	19	0.90	25	0.55	27	0.77	25
Late delivery of materials and equipment	1.10	7	1.51	2	1.62	4.5	1.48	7.5	1.00	9.5	1.34	3.5
POLITICAL FACTORS												
Instability in Government	0.76	21	0.66	26	1.07	15	1.24	16	0.76	16	0.90	18
Political agitation	0.79	17.5	0.68	25	0.89	20	1.34	11.5	0.72	17.5	0.88	19.5
Policy instability	0.97	13.5	0.97	12	1.41	9	1.79	3	0.97	11	1.22	8
Legislation	0.79	17.5	0.83	16.5	1.00	16.5	1.10	18.5	0.69	20.5	0.88	19.5
election	0.86	16	0.83	16.5	0.69	25.5	1.06	20	0.69	20.5	0.83	22
LEGAL FACTORS												
Planning regulation	1.41	1	1.38	3	1.21	13.5	1.34	11.5	1.13	4	1.29	5
Type of contract	0.79	17.5	1.03	10.5	1.00	16.5	1.10	18.5	0.83	13.5	0.95	15
Attitude of judiciary to dispute	1.00	11.5	0.59	27	0.83	22.5	0.79	28	0.83	13.5	0.81	23
SOCIAL FACTORS												
Civil conflicts or disturbance	0.97	13.5	0.76	21.5	1.24	11.5	1.03	21.5	0.72	17.5	0.94	16
Believes	0.62	27.5	0.79	20	0.34	29	1.03	21.5	0.48	29	0.65	28
Hidden obstruction	0.72	22.5	1.14	9	1.00	16.5	1.14	17	0.66	22.5	0.93	17
Access to med-care	0.67	26	0.83	16.5	0.69	25.5	0.76	29	0.59	24.5	0.71	27
Literacy level	0.79	17.5	0.72	24	0.66	29	1.31	14	0.72	17.5	0.84	21
ENVIRONMENTAL												
Weather	1.17	4	1.69	1	1.66	3	1.52	5	1.21	2	1.45	2
Unfavorable site conditions	1.14	5.5	1.34	4	1.58	7	1.34	11.5	1.10	5	1.14	10
Unexpected geological condition	1.07	8	0.93	13	1.21	13.5	1.00	24	1.03	7.5	1.05	13
Act of God e. g. storm, fire, land slide	0.52	29	0.39	28	0.59	28	0.86	26.5	0.52	28	0.58	29
Flood and Erosion	0.62	27.5	0.90	14.5	0.79	24	0.86	26.5	0.59	24.5	0.75	26

Source: Field work (2017)

Of course, the moderate weather in Abuja coupled with Lagos being below sea level contributes to the high ranking. In Abuja and Lagos, the effects of weather are very significant. Abuja and Lagos are located in a tropical zone with only two climates: wet and dry. In Lagos rain would definitely stop construction activities because it is below sea level. In Abuja during the dry season, the average temperature varies between 30 and 38 degrees Celsius. While the humidity ranges from 25 to 80%. If temperature and humidity rise above average it affects the productivity of workers (Okpala, 1986) and may contribute to delay in project as a result, the time at which projects are actually completed exceed initial project duration.

Legal factors

Legal factors were ranked third by all the parties with relative importance weight of 1.04 as shown in Table 3. Planning regulation archived the highest relative importance weight of 1.29 among the factors (Table 4). Planning regulations was considered very important by all the parties especially clients, that ranked the factor first as indicated in Table 4. Ranking of planning regulation by the groups aforementioned is an indication of the fact that planning law affects the client's activities and also influences the contractual relationships within a project. Low ranking of planning law by engineers and quantity surveyors may be as a result of bad contract administration.

Technical factors

Result showed that construction technology and resources was ranked fourth with relative importance weight of 0.98 (Table 3). The highest ranked among technical factors is late delivery of materials and equipment and was ranked third with relative importance weight of 1.34 as shown in Table 4. Ranking the factor high may be as a result of the fact that imported material and equipment take a considerable time to procure and deliver resulting in delay of projects which could give rise to project being overrun.

Political factors

Political factors were ranked fifth by all the parties as factor contributing to time overrun of project delivery with relative importance weight of 0.97. Policy instability was ranked highest among political factors with relative importance weight of 1.22 (Table 4). The high ranking of policy instability indicates dynamic, complex, diverse and hostile nature of construction project. Projects take place in a dynamic and uncertain environment and are influence by a multitude of factors. Unstable government gives rise to policy instability and unpredictable shifts in the economy. Unstable government result in project being delayed or sometimes abandon completely as a result the time that projects are actually completed exceed their initial project duration.

Social factors

Social factors were ranked sixth with relative importance weight of 0.81. Civil conflicts/disturbances wer e the most important factor among the social factors with relative importance weight of 0.94 as shown in Table 4. Ranking civil conflicts/disturbance high shows that selected respondents are aware of the extent to which the factor contributed to time overrun of project delivery. The nature of the society and culture of the people affect the management of projects. Sometimes, the community leaders or miscreants deman d huge compensation or claim before allowing projects to commence. This act contributes to the risk in co nstruction and as a result project could be delayed and as well contribute to project being overrun.

Investigating agreement: Kendall's concordance test and the chi-squared test

To ensure that the ranking of the project environment factors obtained in Table 4 was as a result of a consensus agreement between differing factions of the respondents, and also to check how significant this agreement is, two types of statistical test were carried out: Kendall's coefficient of concordance test and the chi-squared test. The result in Table 5 showed that Kendall's coefficient of concordance *W* obtained is 0.6671. A coefficient of 0.6671 is considered a high degree of concordance among the groups (Vijay, 1988). Nevertheless, the value of *W* must also be investigated for significance, to ensure that the agreement among the five groups were not as a result of pure chance.

Table 5: Test for agreement of ranking of project environment factors influencing time overruns

Cases	*W*	DF	Chi-square statistic	Computed value X^2	Critical table X^2 at 0.05	Inference
All Groups	0.6671	28	5(28)0.6671	93	41.33	Significant.

The result of the hypothesis set up is shown in Table 5. The calculated value X^2 was significant and larger than the critical value of 41.33 hence, the null hypothesis was rejected and alternative hypothesis is hereby upheld. This implies that there is a significant degree of concordance among the five groups of respondent with respect to how they rank the factors and there was a high correlation in the perception of factors contributing to time overrun.

4. Findings

After a thorough review of factors that contributed to time overruns and in-depth analysis of the concept o f time overrun of project delivery in Abuja and Lagos, the research revealed that unexpected price rise for materials and access to capital; weather; late delivery of materials and equipment and planning regulation s are the main factors contributing to time overruns of project delivery in Abuja and Lagos States of Niger ia. Despite some difference in viewpoint held by the five groups surveyed, the study revealed that there is a significant degree of agreement among the five groups with respect to how they rank the factors and tha t there was a high correlation in the perception of factors contributing to time overrun.

5. Conclusions

The study concludes that the economic factors, legal factors and environmental factors are the most significant contributors to time overrun in Abuja and Lagos. Numerous studies referred to in literature support them as factors affecting the project success. Careful exploration of each of the factor is important, so as to be able to curtail their effect on project delivery. The paper recommended that positive measures should be put in place by the stakeholders, to address those factors identified, so as to bring improvement to the overall success of project delivery and also guide efforts to improve the performance of construction industry.

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