Interval Estimate in Plant and Machinery Valuation: A Guide against Variance for Capacity Development amongst Estate Valuers

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Abstract -Valuation variance, one of the valuation errors, has been explored by researchers all over the world in relation to valuation of land and buildings; however, there is dearth of this research on plant and machinery. This research is in a bid to harmonizing values of these assets amongst estate valuers particularly at this propitious time when the Financial Reporting Act of 2011 has paved way for more enforceable statutory valuations in Nigeria. This study as against most arbitrary placed margin of errors is in furtherance to an earlier pedagogic work that entailed the review of related literatures from where an allowable range of ±5% error was permisible and an interval estimate of an appropriate depreciated value at a 95% confidence level was adopted from basic statistics to give a reasonable ±9.8% margin of error. The researchers hereby opine that adherence to thie result in practice will help in capacity development of Estate Valuers who have the statutory preserve to undertake valuations of all assets.

Keywords: Interval Estimate, Plant and Machinery, Variance, Valuation errors, Estate Valuers, Capacity Development

I. INTRODUCTION

Valuation variance and valuation accuracy are the known "valuation errors" in contemporary property valuation parlance. While the former deals with the disparities in values gotten from property valuation of two or more independent estate valuers, the latter deals with the inability of property valuation to represent outcomes in the property market. These errors might be attributed to differences in valuation methods adopted; the efficiency of the property market; the availability of transaction data and due to valuers' behaviour and bias. Unlike in other forms of investment such as stocks and bonds which are frequently traded and have readily data available, the property market is characterized with its heterogeneous goods, illiquidity, high transaction costs, incomplete information and a lack of a central market [1]. Hence, the role of a professional to divulge activities in the market cannot be down played. However, while carrying out this assignment, the appraiser or valuer, (nomenclatures which means the same thing depending on country of affiliation) charged with the sole responsibility by statute of placing professional estimates on assets does not only make recourse to the market but is guided by personal hunches. This explains why valuation has been regarded as not just a 'science' but also an 'art'. Hence, [2] have argued that errors in valuation cannot be avoided. Just as it exists in the physical sciences, the authors went ahead to classify the errors in two folds: random and systematic. According to the authors while the former cannot be avoided due to instances such as unpredicabilityof the market, the latter which needs pain taking approach by the valuer to avoid is as a result of 'gut feelings' usually gotten from experience. In recent times towards the end of the twentieth century researches in these valuation errors have sprawled real estate literature particularly in the UK, US, Australia, and Nigeria. However, these researches are predominantly on land and buildings with trifling contributions in plant and machinery, a valuable asset requiring the professional expertise of the valuer. At this time and age when the Financial Reporting Act of 2011 has paved way for regulated valuations most especially in the public sector and a crave for meeting intenational standards in practice (Sec 29) is sought, no asset should be left behind while curbing deficiencies in practice 29[C]. The foregoing has sparked off the focus of this present study

II. ACCURACY IN PROPERTY VALUATION

Research in "valuation error", valuation accuracy to be precise started from the UK property market in the mid-eighties [3] where valuation was discovered to be inaccurate. There after series of research has been conducted on the subject matter. Findings from these various researches diverge from any expected consensus. To some, valuation is inaccurate [4], to others valuation is a good proxy of property prices [5], [6], [7], [8], [9], [10], [11], [12], [13]. While some did not interpret the result specifically, it was more of presenting ranges of inconsistency [14], [15], [16], advocating optimum period for valuation before actual sales to reduce inaccuracy [17], use of Automated and Artificial Intelligent system to guard against valuation inaccuracy [18]. Although majority of the work has been conducted in UK with some in the US and Australia, Nigeria is not left out in the quest for valuation accuracy even though research is still sparse in this area. [19] having a

pioneering feat discovered that Estate Valuers had a poor grasp of investment valuation resulting to "misvaluations' and "guesstimations". [20], [21], [22] discovered that valuations were not good proxy for market prices; [23] findings were contrary as mortgage valuations were seen to represent outcomes in the property market. Much later, [24] discovered inaccuracy in mortgage valuation and the ensuing quality control measures embarked upon by mortgagees to protect mortgage loans. [25] revealed Nigerian valuers as being in the second stage of sophistication in investors' requirements in compacting inaccuracy in valuation as against their UK counterpart that have gone 7-stage sequence. [26] examined continuing problems of valuation inaccuracy with the intent of drawing out solutions from theory and practice for implementation by three stakeholders: the academia, practitioners and the regulatory institutions. The authors advocated the unanimous use of investment method of valuation amongst practitioners, standardization in the manner of determining values of valuation inputs, the upgrading of the outdated Guidance Notes on Property Valuation [27], and a shift over of valuers from conventional to discounted cash flow methods. These are suggestions according to the authors that will invariably ensure valuation that is more accurate. Other notable studies in Nigeria, which turned out inaccurate include [28]; [29]; [30]; [31]; [32]; [33] and [34]. Valuation accuracy is an ongoing debate that is yet to be resolved. Even the [35] geared towards addressing this issue is yet to hush this intellectual tiff. Perhaps that explains why [36] and [37] advocated that valuation and sales prices do have mutual influences and as such comparison of both would be ludicrous.

III. VARIANCE IN PROPERTY VALUATION

The first research on valuation variance, which is not as much studied compared to its accuracy counterpart, was also conducted in the UK over the period of 1975 to 1980 [38]. In his work both accuracy and variance were studied. The author compared capital valuations with selling prices (accuracy) and similarly compared capital values with the capital values produced by other firms (variance). The use of regression analysis and the coefficient of determination resulting to the closeness of the regression equation intercept to zero and the closeness of the slope to one, confirms that valuations are a good proxy of price and likewise a good proxy for valuations of other firms (R^2 =0.99 in both cases). Hence, valuation variance was ruled-off in the UK property market. [39] conducted a research into variance in property valuation involving a survey of major national and local firms in the UK. The authors discovered a 9.53% overall variation in the mean valuation of each property, contrary to findings of [38]. This represents differences in the variance of valuation between national and local valuation firms of 8.63% and 11.86% respectively. The reason for the variance was attributed principally to the organizational support, especially in terms of availability of transactional information available particularly in national firms. Also in the UK, [40] can be credited as the first to ever study variance in property valuation from the stance of cognitive psychology which involved a multi-strand analysis of the valuation process. The work entailed usage of analytical tools from cognitive psychology such as verbal protocol and semantic differential and Keirsay-Bates temperament sorter used in education research in identifying causes of such variance. Result from 19 estate valuers who responded to the research revealed that personality traits, learning styles, salient characteristics of subject property, selection and analysis of comparable evidence, mechanical construction of valuation and the methods used at arriving at property valuation were principally responsible for variance in valuation.

[41] was also not principally concerned with the existence of variance, as it seems more of a norm, but rather investigated the possible causes of variance as well as the acceptable margin of error in investment valuations for commercial lending. 220 questionnaires were distributed to a range of stakeholders: lenders, finance brokers, valuers and investors. The study revealed that the main cause of variance was individual valuer's 'behavioural influences'. These behaviourial influences manifest in external pressure from clients'; adoption of complex methodology; inability to influence the provisions of accurate and relevant evidence and lastly the experience of the valuer. The 'margin of error' principle - the legal manifestation of valuation variance - was widely accepted by parties to a valuation instruction as a test of negligence, with the majority (40%), advocating for ±10% as the most appropriate margin of error. This crave against variance in property valuation has resulted in the criticism against the market value as a benchmark in determining the adequacy of compensation in compulsory acquisition. This was the highlight in Finland where different valuers had divergent values in a research where market value cannot be said to be rightly determined in such circumstances. The study however advocated the use of the cadastral survey method as it extirpates opinion shopping [42].

IV. VALUATIONS IN PLANT AND MACHINERY

The aforementioned researches have been centred on land and buildings to a reasonable neglect on Plant and machinery which is still in its infancy**.** Research in this area should not be taken with triviality considering the professional scuffles on who best to handle this task. The engineers have tried to estimate the realizable value of the plant and machinery of Paterson Zochonis [PZ] Nigeria based on replacement value concept [43]. Agricultural machinery has been sought after for valuation even by agricultural engineers and agricultural economists [44]. The accountants on their own part envisage professionalism in handling this specialised aspect of valuation that will result to little or no error particularly when discoveries have been made that the choice of depreciation techniques used has an overall outcome on assets' final value [45]. In order to curb the

occurrence of divergent values amongst estate valuers, [46] advocated the use, amongst others with varying probability level, the age-long method of declining balance. Out of the laid-down process in handling this specialized aspect of valuation: identification and categorization of plant and machinery; the compilation of inventory, the actual valuation; recording; updating; accounting; and finally its presentation [47], [46] was of the view that it is at the stage of carrying out actual valuation that disparities of values are likely to be experienced. An occurrence of this inaccuracy is already being experienced in Nigeria [48]. Hence, there is need for a call for caution at this stage which differs in handling based on any of the three major purposes of valuation: financial; open market and insurance [49]. If "valuation errors" are being evident then there need to be conscious effort in seeing to its abatement. In this era when there has been declaration of the mandatory valuation of public plant and machinery to be carried out by valuers, based on the Financial Reporting Council Act of June 2011, the efforts put in by researchers with respect to "valuation errors" particularly variance so as to enhance capacity development amongst estate valuers is not encouraging. That forms the crux of this present research

V. VALUATION AND THE "MARGIN OF ERROR" CONCEPT

Debates in accuracy/variance literature have led to the concept of *"Margin of Error Principle"*. This debate (which has raged in courts and academic papers), has to do with the maximum permissible percentage of error amongst valuations and between valuations and realized prices. The premise suggests that these errors are inevitable between/among contemporaneous valuations considering that valuation is not just a science but an art and as such an element of human judgment will certainly play out. There is however no consensus yet on what should actually be the degree of acceptable margin of error. The various opinions expressed in courts and subsequently opinions expressed in academic papers on appropriate margins of valuation error are hereby presented.

VI. COURTS' POSITION ON THE "MARGIN OF ERROR"

Most of the decided cases on the margin of error concept were decided in the UK and Australia courts. These cases were decided to determine whether a valuer exercised reasonable care and skill in carrying out a valuation. The concept is used to determine the extent to which a valuation departs from the "true value" of the property. In negligence cases, a court is usually required to decide on two issues: the "true value" of the subject property on the date of the defendant's valuation; and the "bracket" around that value within which any competent valuation could be expected to fall. The first of such cases is *Singer & Friedlander Ltd v John D Wood & Co (*1977) 2 EGLR 84, a UK court used the concept of "margin of error" for the first time in a professional negligence action brought against a property valuer where the court held a permisible range of between ±10% and ±15%. In *Trade Credits Limited V Baillien Knight Frank (NSW) Ltd (1985)* the judge held that a "permissible margin of error of between ±10% and ± 15% is acceptable. In another case (*Private Bank and Trust Co. Ltd vs. S (UK) Ltd, (1983),* the trial judge accepted a permissible margin of error of "15%. In *Banque Bruxelles Lambert SAV. Eagle Star Insurance Co. Lt and others (1994)* the difference of between ±39% and ±74%, gotten from valuation of three office properties were unacceptable by the trial judge. In *Corisand v Druce & Co* (1978) 2 EGLR 86, the plaintiff was ready to accept ±15% margin of error for the valuation of a hotel. In *Interchase Corporation Ltd v CAN 010087573 Pty Ltd and Others (*2000) QSC 013, it was agreed that a margin of error as low as ±7% was appropriate.

The courts showed readiness to applying margins of more than ±10% in cases involving development valuations. The Court of Appeal in *Nykredit Mortgage Bank Plc v Edward Erdman Group Ltd (*1996) 1 EGLR 119 noted that when two valuations before the court were compared, they showed a difference in gross development value of ±17%, which, with almost identical costs and profits, led to a difference in residual land value of ±11.4%. The judge considered this as absurd. *Nykredit Mortgage Bank Plc v Edward Erdman Group Ltd (*1993, unreported) allowed a margin of ±15%. In *Mount Banking Corporation Ltd v Cooper & Co (*1992) 2 EGLR 142, the plaintiff accepted ±17.5% on a residual valuation. In *Private Bank & Trust Co Ltd v S (UK) Ltd (*1993) 1 EGLR 144, the parties agreed that the valuer was permitted to a bracket of ±15% around a residual valuation. In *Nyckeln Finance Co Ltd v Stumpbrook Continuation Ltd (*1994) 2 EGLR 143 the expert witnesses agreed that the appropriate bracket was a mere ±10%.

In cases involving residential property, both judges and expert witnesses suggest margins of error of less than ±10%. For example, Staughton LJ in *Beaumont v Humberts (*1990) 2 EGLR 166 opined that ±10% seems a high standard to impose. In *BNP Mortgages Ltd v Barton Cook & Sams (*1996) 1 EGLR 239, the expert witnesses agreed that on a standard estate house, the acceptable margin should not exceed ±5%. A margin of ±5% was also applied by the judge in *Axa Equity & Law Home Loans Ltd v Goldsack & Freeman (*19941 EGLR 175 notwithstanding the valuer's access to any true comparables. In the case of *Legal & General Mortgage Services Ltd v HPC Professional Services (*20 February 1997, unreported), the expert witness was ready to accept a ±20% margin where the defendant had valued an unusual house at £400,000.

VII. POSITION OF ACADEMIC PAPERS ON THE "MARGIN OF ERROR"

Ever since the first paper on valuation accuracy in the UK, [3] was published it has provoked much of the later

works on the valuation accuracy/variance. These authors considered an acceptable margin of ±5% but from a small sample survey where ten surveyors were invited to value two properties, deviation of sale prices to valuations of ±10.6%, and ±18.5% was discovered. In Nigeria, [20] and [21] adopted the 5% margin set by Hager and Lord in the UK and found that valuations exceeded the standard. 5% was considered unnecessarily stringent by later researchers. This prompted [22] in Nigeria to increase this margin to ±10% following the comments in [50] suggesting a margin of between ±10% and 15%. [51] later increased the margin within a range of between (±11.1% and ±13.16) to accommodate instability in market conditions so as to meet various stakeholders' needs. In the UK, after [3] ±5% margin, other researchers have placed between ±8% and ±20% as more appropriate margins.

[15] discovered that 30% of valuations were within ±10% of the selling price, 55% of valuations were within a ±15% margin while 70% of valuations were within ±20% of the selling price. [39] whose work was in valuation variance discovered a 9.53% overall variation in the mean valuation of each property and found differences in the variance of valuation of 8.63% and 11.86% respectively for national and local firms

[52] advocated the application with caution of ±10% - ±15% which must justify emperical valuations on accuracy and variance while [41] recommended an appropriate margin of ±10%. In the US, [53], found an appraisal error of between 6% and 13%. [54] covering the US, UK and Netherlands using data from the NCREIF index (US), ROZ/IPD index (Netherlands) and IPD index (UK), discovered that the average deviations of valuations from sale prices were – 0.1% (SD = 5.1%), 7.9% (SD = 4.9%), and 5.7% (SD = 5.9%) for the US, Netherlands and UK respectively. In Australia, [12] among major valuation consumers in his country established an acceptable margin of ±5% to ±10% with a mode of 5% and arithmetic mean of 6.04%.

VIII. THE RESEARCH CONCEPT AND INTERVAL ESTIMATE FOR CAPACITY DEVELOPMENT

The foregoing suggests a lack of worldwide consensus obtained within the courts and academic community as to maximum margins of error and also margins of error were fixed arbitrary without being based on any empirical mode of determination. Margins of error suggested above range from ±5% to as much as ±20%. [55] observed the likelihood of "errors" in every valuation, notwithstanding the expertise of the professional undertaking the task. On this basis, he argued against point estimate valuations stating that values are better expressed as a range of values with probability estimates attached to each point on the range. Such probability estimates would demonstrate the true, unobservable and unknown market values. [56] also recommended amongst others the use of probability-based "Crystal Ball" model that results in ranges of values as against point estimates in values obtained amongst others in other to handle likely errors in valuation. The authors are of the opinion that such recommendation would aid the valuation user's in understanding outcomes of valuation.

Considering a range of between ±5% and ±20% considered amongst various authors and decided cases. This study in a bid to reducing "valuation errors" to the bearest minimum is adopting the lowest permissible error of within ±5% for this specialized form of valuation (Plant and Machinery) that requires a huge financial outlay to get these assets and keep them in operation.

[46] advocating the use of certain depreciation techniques while handling plant and machinery valuation in a pedagogic paper had limitations in the lack of quantitative application. This work intends to eliminate such limitations by recommending an appropriate range amongst valuations, which will be a product of a confidence level of probability and acceptable "error". A 5% acceptable error has been adopted as stated above. From the most common confidence level known i.e. between 68% and 99%, a 95% confidence level is adopted as higher confidence level will increase chances of making Type 1 error with more grievous effect by equating two disparate valuations. When lesser confidence levels are adopted it appears placing a more difficult benchmark. From the Z test (critical value) a value of 1.96 represents the 95% confidence level multiplied by an acceptable "error" of 5 gives a value of ±9.8% (this figures is likened to the sampling error in standard statistics, which the authors recommend as the "permissible margin of error" in plant and machinery valuation).

This research has been able to determine a more reasonable margin of error to guide against disparities in valuers' valuation while the profession awaits a groundbreaking research in point estimate. The margin of error determined might not be too far from what has been advocated by some earlier studies or decided cases (±10%) for land and buildings, however the figure gotten (±9.8%) is more emperically determined and not just placed arbitrarily. Although the limitations of this research are that inputs of stakeholders such as Estate Valuers and clients' that make use of valuation reports are not evident, it is a pioneering work in valuation variance for plant and machinery. The Nigerian Institution of Estate Surveyors and Valuers and The Estate Surveyors and Valuers Registration Board of Nigeria are encouraged to sponsor the regular Mandatory Continuous Professional Development Seminar in line with this theme so as to sensitize all members in a bid for capacity development while handling her statutorily task in an ever increasing sophisticated market.

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