Bridging Technological Gulfs for Valuers in Fiscal Cadaster

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ABSTRACT

The impact of computational technology has not been experienced much among valuers in property valuation and land use charge amounting to gulfs in technological advancement in fiscal cadaster. In response, most property information systems have been faced with neglect and usability challenges. This paper presents a framework for property valuation and land use charge systems. It explored the potentials of web technologies and developed a web solution that bridges technological gaps in fiscal cadastre and enhances their productivities in revenue generation, respectively. The resultant solution was subject to usability evaluation with valuation experts. It employed a standard post system usability level evaluation tool – System Usability Scale (SUS) Score for evaluation. Results indicated excellent perceived system usability with an average SUS score of 82.2% at the 90th percentile range. Thus, the acceptable system usability level unburdens property valuers from the rigorous manual land use charge processes highly prone to inaccurate taxation and poor valuation.

(Keywords: property valuation, land use charge, system usability, fiscal cadaster, web solution, GIS).

INTRODUCTION

In recent times, almost all sectors have welcomed the technological shift from the manual mode of operations in business processes across the globe. Information Technology (IT) is reforming how we interact with other entities around us and the impact has greatly affected our ways of lives and business processes. The effect is impossible to ignore as most companies are adapting and embracing their capabilities in executing complex business processes. One such sector needing computational solutions is estate and property agencies. To be particular, the government agency for land and property development. The use of IT solutions in this domain is a major challenge for the staff as their readiness is underrated, but with the fast-growing development of lands and property within communities in recent times, there have been variations in property taxes and valuation. Geographic or spatial data containing landed property information captured by Geographic Information System (GIS) exist at several designated agencies as files queued up for valuation due to the manual system of valuation and land use charge.

Valuation helps to value a property which in turn generates revenues for the state government. Property valuation is vital to valuers and government ministries for the purpose of tax ratings and geographic information management. Its vitality ensures accurate taxation of landed properties for the economic and geographical development of a country. Mantey and Tagoe (2012), emphasized that “property tax has remained an important source of state government revenue which is also a central part of government fiscal adjustment”. A study in 2015 exposed that “the profession has suffered poor quality valuation due to lack of proper tools to manage the process (Gatheru and Nyika, 2015). Owing to this, an efficient property valuation and taxation system will increase staff productivity in revenue generation.

This paper focuses on the automation of land use charge and property valuation processes. The main goal is to extend the impact of web technologies to property valuers to increase their productivities in accurate valuation and revenue generation. It finally subjects the resultant system to a usability evaluation. The remaining sections discuss the milestones in realizing this.

BACKGROUND INFORMATION

Automating Valuation Processes for Property Valuers

With emerging trends in information technologies, land and property valuers can no longer rely on the manual system of valuation and taxation. For a country such as Nigeria, different states have their valuation criteria and the automation of property information systems is still at the infancy stage as a result of property and land laws that govern each state.

Zebong, et al. (2017) stressed "the exploration of potential of automated valuation tools to facilitate more effective and transparent valuation to crosscheck the accuracy of existing valuations". In addition to this, Glumac and Des Rosier (2018) exposed that land and property valuation has received interest in automation to facilitate valuation.

In a recent study, Amannah (2017) opined that Nigerians neglect technology in their property management and developed "an information system for property management" with strong support for client purchasing of property. Akeh (2018), developed a "property information system for effective management of housing estates" providing support for query and a geo-database for estate and property information to aid decision making.

A major concern in GIS or geo-based property information systems is evident in the fact that they don't valuate properties but give geo-information. Most are saddled with ambiguous and overlapping boundaries for landed properties that are not suitable for accurate valuation and taxation. Thus, most of these systems are difficult to use, and most times relegated to the background with usability problems.

Efforts have been highly steered towards GIS while valuers suffer a great deal of setbacks for land taxation and property valuation. It is assumed that most property information systems developed were focused on geographic information and less effort was focused on valuation (Mantey and Tagoe, 2012; Amannah, 2017). Hence, the need for the development of an information system for proper valuation of properties and land use charges. The next section focuses on the concept of property valuation and land use charge as it applies to a given/certain region.

Property Valuation and Land Use Charge

Property valuation and land taxation are fiscal cadasters maintained by an agency of government in a country (Ventura, 2000). Property valuation differs in terms of location and region. There is no unified property valuation system that can cater for all regions.

In Africa, fiscal cadaster valuation differs across countries which are usually governed by land and property laws local within a country. Zebong, et al. (2017) observed that in Cameroon, "their property's presumptive value is obtained by multiplying the surface area by clear reference prices provided for in regulation (classified according to municipality, zones therein and attributes of the property)".

Similarly, Nigeria follows the same property value-based system but with variations in the calculation. Her taxation model is based on the concept where valuers estimate the selling or buying price of landed property or the potential rent rate of the landed property. Also, each state in Nigeria has an agency responsible for valuation, and Edo state was observed as the object of study in this paper. One major problem here is that each state has a separate database and does not share information, thus complicating valuation efforts.

Observed in the object study are the attributes for property and land valuation: *Property Tax, Tenement Tax* and *Ground Rent.* These three attributes are viable in the computation of the total land use charge for each property. Figure 3 depicts input parameters required for valuation. Ground Rent is calculated by multiplying the *Land Size* by the location of *Land Zone Rate*; Tenement Tax is deduced as percentage fraction of the property tax; Property Tax is the land use charge rate multiplied by a percentage fraction of the effective capital value of land and building. Thus, the property is valued as the summation of Ground Tax, Tenement Tax, and Property Tax; which is the total land use charge of a given property. These computations were implemented later in this paper.

This valuation is peculiar to the object study and may vary for other states. On this note, valuation fluctuates with different computations which are consequent on the property owners or occupants. In some cases, two properties of the same parameters are valued at different prices. Manual

valuation is prone to human error and this further reaffirms the pressing need for adopting and embracing IT tools for property valuation across the states. The author later describes the development of a web solution for property valuation and land taxation.

MATERIALS AND METHODS

Design Considerations

A valuation system should consist of certain design principles as Wang and Han (2016) stressed that "to make the system have a good performance and usability, the system design should follow some certain rules:

- Firstly, the property management system should consider a three-layer web structure in the system design.
- Usability. This involves the ability of the property users to easily use the system via good interfaces and less background IT knowledge and supervision.
- Expansibility. The system must be subjected to modifications to accommodate updates with changing user requirements and provide more services. others are E-Business and Security".

This paper concerns itself with the first two design principles. Firstly, the manual concept of valuation and land use charge was conceptualized into a framework giving a systematic representation of the system in Figure 1. The key components of the framework are users, the valuation processes, and the deliverables.

The User component represents the entities that can feed data into the system, perform an operation and query property records. They are usually data entry staff and Valuers. With the right input data, the user can submit the data and initiate an operation that will be handled by the system. With the appropriate valuation preferences and configurations, the system processes and generates the deliverables as depicted in Figure 1. With its fluid design nature, an operation can be revisited in the case of erroneous entry of parameters.

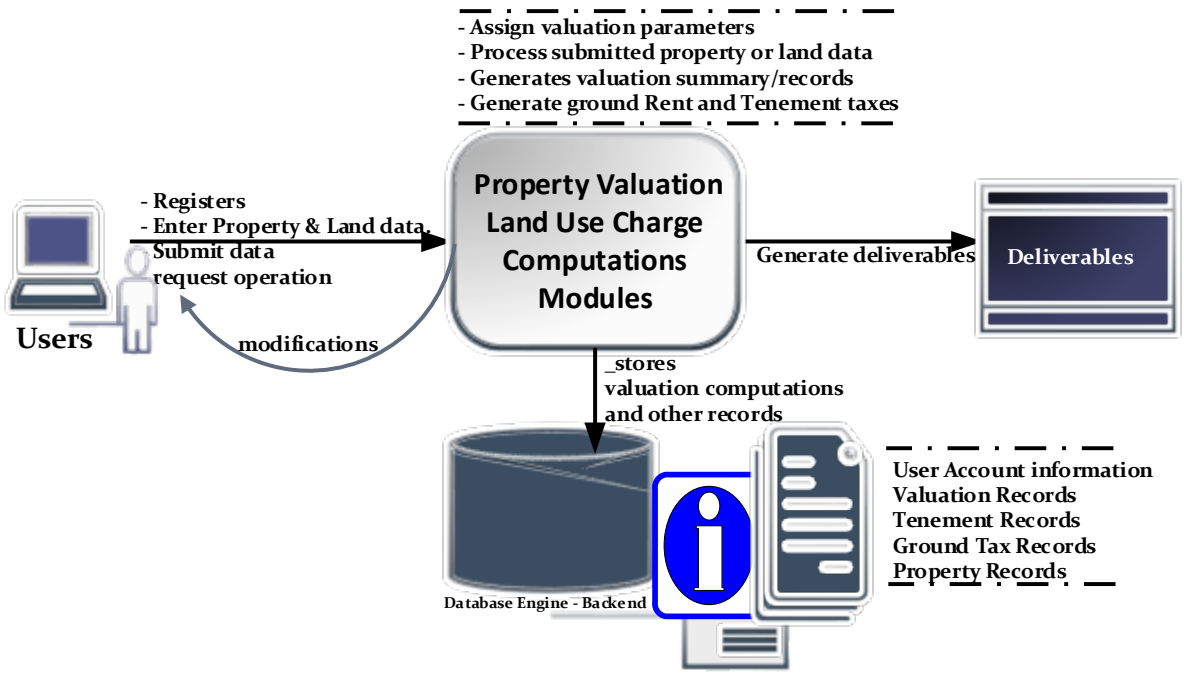

Figure 1: A Framework for Property Valuation and Land Use Charge.

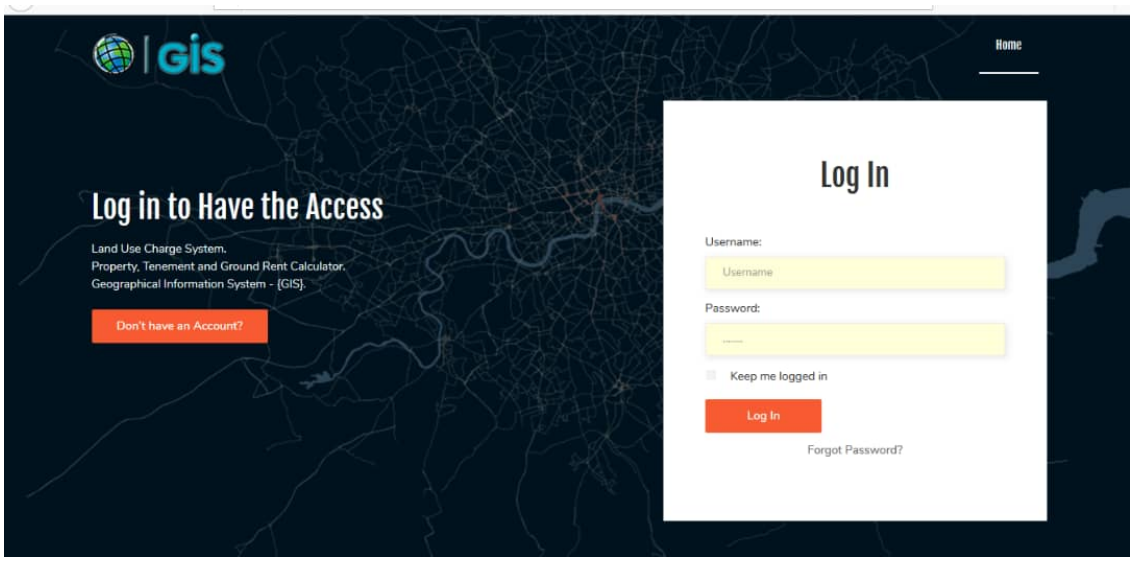

Figure 2: Home Screen.

Implementation, Deployment and Testing

Yielding to Wang and Han's (2016) design principles, the framework was implemented on a three-tier web architecture. The client-tier provided interfaces that support interactivity between the users and the system. The middle-tier and the backend-tier provided services of the Application Server and Database. Software development tools were employed for implementation: Editor – Notepad++; Languages - PHP, JavaScript, HTML; Application Server – Apache; Database – MySQL; other supporting technologies – Bootstrap and AJAX. The resultant system was deployed using XAMPP – a cross-platform server technology providing services of a local server for the system. A home interface of the web solution is captured in Figure 2.

Testing and Evaluation

Upon deployment, the system was tested for compliance and functionalities. Experts in the state were sought after for professional use of the system to ascertain its conformance to valuation. Errors were flagged and debugged accordingly. With experts' opinions, the system observed several software implementation refinements until it met valuation objectives. It was then used by these experts to test different property cases that could pose complexities in valuation. It met all valuation criteria. Figure 3 captures an input module with valuation input parameters while Figure 4 is an interface with property information for valuation and land use charge.

Usability Evaluation

A limitation of our study related to the small population of available valuation experts. This relates to the fact that there are numerous fiscal cadaster differences in valuation across individual states and each is governed by laws peculiar to them. For usability experiments, 8 participants were employed – 5 expert valuers and 3 data entry staff who were also knowledgeable in the profession. The goal was to examine the system's usability and the number of evaluators (participants) was quite adequate in range with regards to software usability evaluation (Macfield, 2009; Six and Macfield, 2016). Participants were subjected to a post system usability test and a survey-based usability tool was employed to measure their perceived system usability levels. The System Usability Score (SUS) was adopted for evaluation.

SUS, a standard post-task level measurement metric scaling from 1 – 5 representing "Strongly Disagree" to "Strongly Agree" with 10 usability questions presented in Table 1 in which after using the system, participants expressed their perceived usefulness of the system via the SUS questionnaire.

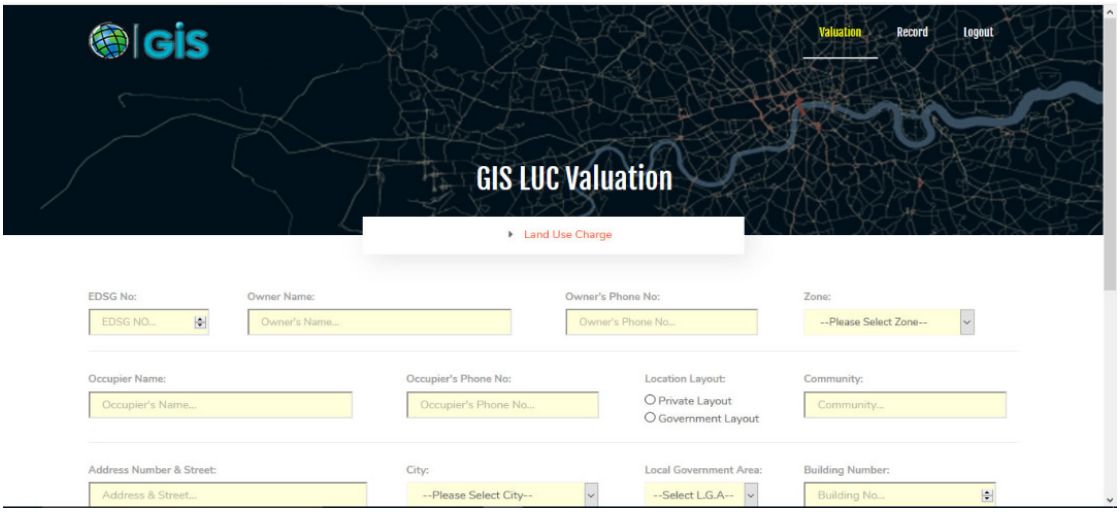

Figure 3: Input Parameters.

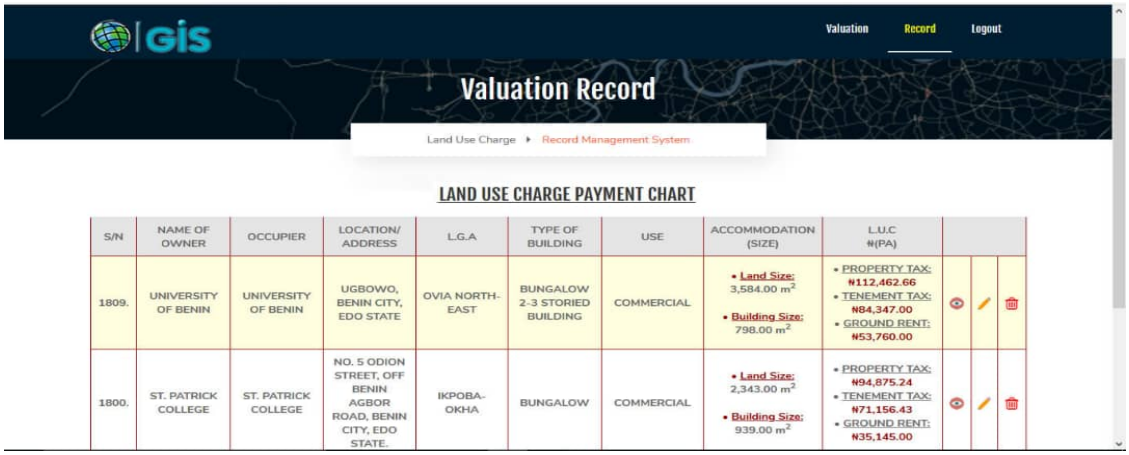

Figure 4: Property Information and Valuation Records.

Table 1: SUS Questionnaire.

c	SUS Questions	Strongly Disagree				Strongly Agree
1	I think that I would like to use this system frequently.	☐	☐	☐	☐	☐
2	I found the system unnecessarily complex.	☐	☐	☐	☐	☐
3	I thought the system was easy to use.	☐	☐	☐	☐	☐
4	I think that I would need the support of a technical person to be able to use the developed system	☐	☐	☐	☐	☐
5	I found the various modules in this system to be well integrated.	☐	☐	☐	☐	☐
6	I thought there was too much inconsistency in this system.	☐	☐	☐	☐	☐
7	I would imagine that most people would learn to use this system very quickly.	☐	☐	☐	☐	☐
8	I found the system very cumbersome to use.	☐	☐	☐	☐	☐
9	I felt very confident using the system.	☐	☐	☐	☐	☐
10	I needed to learn a lot of things before I could get going with this system.	☐	☐	☐	☐	☐

Table 2: System Usability Scale Scores.

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Odd Scores	Even Score	SUS Scores
P1	5	1	5	2	4	1	4	1	4	2	17	18	87.5
P2	5	1	5	1	4	4	5	2	5	1	19	16	87.5
P3	5	2	5	2	5	2	4	1	4	1	18	17	87.5
P4	5	1	5	2	4	3	4	2	5	1	18	16	85.0
P5	5	1	5	1	3	2	5	1	5	1	18	19	92.5
P6	5	3	3	2	4	2	5	2	4	3	16	13	72.5
P7	4	1	4	2	3	2	5	2	4	4	15	14	72.5
P8	5	2	4	3	2	3	5	1	4	2	15	14	72.5
Average SUS													**82.2**

RESULTS AND DISCUSSIONS

Results

The results of the evaluation are presented in Table 2. Values from each participant's (P1 – P8) responses were captured for all 10 questions (Q1 – Q10) and computed with SUS scores via the grading in Table 3. The table presents information on the percentile range in which the level of acceptability is ascertained as ok, good, or best imagined.

Table 3: SUS and Grade Ranking (Suaro, 2018).

Grade	SUS	Percentile Range	Adjective	Acceptable
A+	84.1 – 100	96 – 100	Best Imagined	Acceptable
A	80.8 – 84.0	90 – 95	Excellent	Acceptable
A-	78.9 – 80.7	85 – 89		Acceptable
B+	77.2 – 78.8	80 – 84		Acceptable
B	74.1 – 77.1	70 – 79		Acceptable
B-	72.6 – 74.0	65 – 69		Acceptable
C+	71.1 – 72.5	60 – 64	Good	Acceptable
C	65.0 – 71.0	41 – 59		Marginal
C-	62.7 – 64.9	35 – 40		Marginal
D	51.7 – 62.6	15 – 34	OK	Marginal
F	25.1 – 51.6	2 – 14	Poor	Not Acceptable

Discussions

The evaluation took about two weeks. This was to allow the participants to get acquainted with the system and to properly explore the system to expose its defects in some functionality features. Participants were expert valuers in the dominant field. Results revealed their perceived usability level with the system in Table 2 for the 8 evaluators on the 10 usability items. Using the post system evaluation approach, an acceptable system with good usability interfaces is benchmarked from 68 SUS score and this range according to Suaro (2018), is at the 50th percentile. On average, the perceived SUS score was evaluated as 82.3% at the 90th percentile range which is categorized in grade A ranking in Table 3.

This indicated excellent perceived system learnability and usability. An implication that the developed system is very useful, usable, and can be used to properly valuate properties and consequently speed up the revenue generation for state government through the ministry responsible for land use charge. The automation has satisfactorily unburdened property valuers within the object study from the rigorous manual land use charge processes highly prone to inaccurate taxation and poor valuation. It highly supports file retrieval of property records and valuation records with easy access to the entire agency.

CONCLUSION

This study examined the poor valuation system impacting property values in generating timely and accurate taxation records for state government. In response to this challenge, we developed an information system for property valuation and land use charge. Key emphases are the technological bridging and swift automation of the property valuation processes and charges computation for land use by valuers. An excellent perceived system usability was observed with the strong implication that the developed system is very useful, usable and can highly be used to maintain fiscal cadaster and enhance revenue generation.

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