

1 **Rethinking the Application of Computer Assisted Mass**
2 **Appraisal for Property Valuation in Johannesburg**
3 **Municipality.**

4 Ngwanatladi Marcia RAMMALA¹, Solomon Pelumi AKINBOGUN¹, and Clinton
5 AIGBAVBOA¹

6 ¹Department of Construction Management and Quantity Surveying; Faculty of
7 Engineering and the Built Environment Doornfontein Campus Gauteng, South Africa
8 sakinbogun@uj.ac.za,

9 **Abstract.** In the last decade, mass valuation system is applied in City of
10 Johannesburg in addition to individual valuation system for rates and taxes.
11 Property valuation in Johannesburg for rating purposes are governed by the
12 Municipal Property Rates Act No.6 of 2004, as amended, the Act provides that
13 all real property shall be valued at marketplace value, which is the price that a
14 property would have sold for in open market between willing parties on the
15 valuation date. Following years of manual rating procedure, South Africa finally
16 adopted the Computer Assisted Mass Appraisal (CAMA) over 2 decades ago. It
17 employs a technology named Value Assists; however, the potential deliverables
18 of the innovative approach are not realized. The rate of objections to property tax
19 is alarming and continually growing after each general valuation roll. This paper
20 presents a review of the application of CAMA and the present challenges in
21 Johannesburg municipality with a view to charting the way forward to the
22 adoption of the best practice.

23 **Keywords:** Mass appraisal, Taxation, Value Assist, CAMA

24 **1 Introduction**

25 Taxation remains one of the vital sources of revenue to the government. The economy
26 of Britain, USA and many other developed countries is to a large extent founded on the
27 proceed of tax. For optimum revenue, a good tax is hinged on the principles of
28 economy, convenience and fairness. There are many types of tax, however, property
29 tax is the most viable, stable, predictable, progressive and reliable source of revenue
30 for a local council. However, the assessment, collection and administration are huge
31 challenge in the global south. According to [1], the real estate sector is huge and one of
32 the last to embrace information and communication technology that tech can bring.
33 Many innovative moves backed by billions of dollars often expert investment are on
34 currently to change the way real estate is appraised, traded, used and operated. This is
35 expected to lead to a significant change in the real estate profession [1]. While the
36 adoption of computer aided mass appraiser is quite encouraging in the developed world,
37 the case of Africa is different. Following [2] expression of concern on the poor state of

38 rating valuation in South Africa, [3] provides the first evidence of CAMA publication
39 in south Africa. The study observed that the use of CAMA seen as a controversial and
40 not embraced by practitioners. The study was conducted to determine whether the
41 commercial property sector in South Africa is ready to accept and adopt or reject AVMS
42 and to investigate the possibility of AVMS replacing professional valuation services for
43 commercial property valuations. The study shows that as no AVM system exists for
44 commercial property in South Africa, no factual opinion or experience was obtained.
45 The general attitudes towards AVMS were negative and a small percentage of
46 respondents indicated that there may be future potential. [3] carried out a pilot study to
47 describe the application of CAMA for the improvement property tax revenue in South
48 Africa. Using Cape town, Bloemfontein, Rustenburg as an example, the study focused
49 on possibility of improved valuation performance, cost effectiveness and the most
50 efficient use of limited property information. The study found that a reliable CAMA
51 could be developed with a limited data. [4] noted the high volume of court cases
52 challenging the integrity of valuers' opinion in Northern Ireland in late 20th century
53 which put pressures on professional practice. The study described how to develop an
54 interactive system, which employs CAMA model within an integrated geographic
55 information system (GIS) to assess residential property value. The study found that the
56 integrated system would enhance efficiency, reliability, fairness, transparency, and the
57 ease of revaluation. Despite this finding, [5] found that, inappropriate method of
58 assessment among others is an element of the tax system that is misguided and
59 surrounded with much misgiving; hence the need for a rethink of the property tax
60 process. Using South Africa as an example, this study provides a review of the property
61 mass appraisal process and attempt to answer a question on whether the CAMA system
62 has been able to meet its expectation or not. It provides a review of the Property rating
63 issues affecting mass appraisal in Johannesburg Municipality

64 **2 Property Rating in Africa**

65 Property taxing in most cases is municipal based, whereby municipality collect tax from
66 sales of properties and every activity around them. Internationally, states such USA
67 are amongst states which are doing very well in their process of collecting tax,
68 specifically property tax from people. They are different strategies used by different
69 Municipalities within the US that ensure that property tax is collected effectively.
70 United State of America, Britain, China and other superpower invented methods which
71 by now are used by most states in the world on how to ensure that mass appraisal is
72 effective and tax is optimally collected. This view has influenced states such as South
73 Africa, Senegal, and other developing countries [4]. This whole process influences
74 South Africa to change their own taxation process and mass appraisals process. Property
75 taxation become South Africa's effective initiatives, which was included in the National
76 Development Plan, but it is rooted from the late Nelson Mandela's strategies, which
77 were brought up to bring unity to the country. The Mandela's administration brought
78 two strategies which were based on land redistribution, which were Reconstruction and
79 development programme (RDP) and Growth Employment and Redistribution (GEAR),

80 these strategies were coined to address issues of property and land taxation, which
81 failed and there were modernize within the National Development Plan [4]. However,
82 the City of Johannesburg introduced new strategies of property taxation under the new
83 management of Mayor Mashaba, one of the mechanisms used by this system is Mass
84 appraisals and CAMA. This strategy are modern approaches which are influenced by
85 4th industrial revolution models, which speaks about the usage of technology and
86 modern statistics approaches to collect data and money [4]. South Africa currently has
87 adopted the view or approach of 4thIndustrial revolution, this approach means the
88 ending of man slavery and bring the usage of technology. Technology plays a vital role
89 in making life much simple and making more profit. Post 1994, South Africa property
90 valuation has raised from simple empirical judgements to a valuation model, whereby
91 their application moved from a single property system to mass valuation system [6].
92 This whole process has become problematic to assess current status of property values
93 accurately. Evaluators and assessments are recognized to be able to predict values of
94 properties through their accrued knowledge. However, the difficulties are (i) the
95 correctness and consistency of these assessments that denotes to the weights that
96 assessors gives to specify the excellence of the evaluated standards, and (ii) the rapidity
97 of which the assessing process can occur precise and up- to-date valuation of property
98 standards is not fundamental to landlords of the buildings and real estate agencies but
99 also to the local administrations whom must define the taxes to be imposed on the
100 properties based on their values. It is important to note that there must be a regular
101 monitoring of properties value for precision, fairness and dedication to payment with
102 minimal objections [6]. Given the sizes of mass appraisal valuations to be completed,
103 such straightforwardness is crucial. Modern geographic data systems and overlaps
104 gradually sophisticated desktop assisted valuation methods have, in fact, operated to
105 help with standardization and consistency in recent era. The difficulties on property
106 taxation predominantly in emerging countries is an up-and-coming matter that needs
107 attention from the régime as well as all parties involved in the property tax imposition
108 [7].

109 **3 Property Tech and the basis of CAMA Valuation Model.**

110 Market value for assessment purposes is generally determined through the application
111 of mass appraisal techniques. According to [8] mass appraisal is the process of valuing
112 a group of properties as of a given date and using common data, standardized methods,
113 and statistical testing. The Value estimate is based on valuation equations, tables, and
114 schedules developed through mathematical analysis of market data. For reliable
115 estimates the valuers are expected to input property data that are correct, complete, and
116 up to date into the model. CAMA is a general word which describe any software
117 application used by management agencies to help in building valuation [4]. This system
118 requires the modifying of an assessment model for the entire area and not just limited
119 to a particular area incorporating micro economic theory that are relevant [9]. The
120 purpose of edifice the valuation model is to be able to analyse and value a number of
121 properties efficiently taking into consideration of demand and supply a market factor.

122 Some of its functions are for valuing property, maintaining property data, ensuring tax
123 equity through uniform tax base valuations and many more. [10]. Properly
124 administered, the development, construction, and use of a CAMA system results in a
125 valuation system characterized by accuracy, uniformity, equity, reliability, and low unit
126 costs [12]. Based on the reliability of the data, the system of Mass appraisal could
127 improve valuation accuracy because it is formula driven. Mass appraisal stands in
128 contrast to single property appraisal in which a qualified valuer forms an opinion of
129 value for a subject property by assembling and considering relevant market evidence.
130 Mass appraisal methods are employed for assessment and taxation purposes because
131 single appraisal is expensive and time consuming. In addition, because it employs
132 standard table and algorithms, mass appraisal emphasizes equity and uniformity in
133 valuation, so that like properties will have like values. Mass appraisal and single-
134 property appraisal employ the same three basic approaches to value: sales comparison,
135 income and cost [7]. Mass appraisal is suitable for a precise type of building in an area
136 where these large number of properties are similar in their design appearance. The mass
137 appraisal is the most cost-effective method for municipalities to determine the valuation
138 of the property. The disadvantage was urged that the designed features of a property
139 could cause uncertainty in the property valuation, especially if there were insufficient
140 data available at the time of the valuation assessment. In the case of unique properties,
141 uncertainties are likely to arise in some instances [13]. It is of importance to note that
142 the benefit of this system is that it does not depend on inputs from the property landlord.

143 **4 4.0 The Relevance of CAMA System in Property Taxation in** 144 **Real Property Valuation**

145 **4.1 Low Administrative Cost**

146 The system called CAMA is higher than the manual method of valuations but once it is
147 entirely in operation the future expenses valuation is decreased. In this regards this
148 system brings more cost effective measures since the data is already in the system. This
149 whole process can be computerised and it can hold larger number of valuation in short
150 period of time [7].

151 **4.2 Accuracy and Consistency**

152 Through the usage of CAMA system one can achieve consistence which is one of the
153 challenges faced by a single valuation. There is cost effective in this whole process and
154 this is because of this system, this whole process is called accurate revision with less
155 cost. Through CAMA one can get meaning end [7]. CAMA brings about a reduction of
156 substantial reliance on valuation appraisals judgement and activities which might lead
157 to systematic errors.

158 **4.3 Less Manpower and Time Consumption**

159 The usage of CAMA bring about the assessing of large numbers of buildings, this also
160 will bring about the total number of professional appraisals that must be covered, in
161 this regards it reduce cost and transportation issues.

162 **4.4 Large Data Handling (Good Database System)**

163 The main advantage of this system is that is able to store massive data within its
164 database. [11] state that they are numerous of unique areas where property data and
165 transaction can be stored. This whole process shows that the CAMA can handle the
166 matter efficiently.

167 **4.5 Improvement in equity and Fairness**

168 These two elements which consistence and accuracy in valuation can be driven to a
169 more effective levy system, the strength to handle large amount of data works on its
170 advantage, which can manage to achieve equality and fair sales value principles. Mass
171 appraisal uses a massive number of buildings as comparable data, and this can be used
172 to harvest an outcome that would reflect to market place [7].

173 **5 Property Tax System and Issues in the City of Johannesburg.**

174 The city of Johannesburg property tax is imposed on ratable property within the
175 municipality. The revenue collected is used to deliver service to the people. The
176 taxation basis are outlined by the value of the property, and the biggest role of the
177 municipality is to administer the process of tax collection within the city The process
178 of rate and taxes imposition on all properties requires all municipalities to prepare a
179 valuation roll of all properties located within the jurisdiction area. This task is
180 tremendous, and difficulties are faced in completing it. At the moment, the shortage of
181 manpower at the municipality compelled outsourcing the assessment of properties for
182 rating purpose. This is often the case in many countries, as noted by [14]. Property
183 valuation in Johannesburg for rating purposes are governed by the Municipal Property
184 Rates Act No.6 of 2004, as amended, the Act provides that all real property shall be
185 valued at market value, which is the price that a property would have sold for in open
186 market between willing parties on the valuation date. The valuation date cannot precede
187 the effective taxation date by more than one year. Under the legislation, general
188 revaluations must be conducted at least every four years, although a one-year extension
189 can be granted if requested by the City and approved by the province. Supplementary
190 valuations maybe conducted between general revaluations to pick up omission,
191 subdivision, new buildings and additions to existing buildings, etc.[12].

192 The GV2018 revaluation was completed by Evaluations, a private sector firm which
193 was contracted through an open tender process to deliver the valuation roll for the City
194 of Johannesburg. Evaluations utilized computer assisted mass appraisal (CAMA)

195 techniques consistent with industry standards, statistical sales-based model utilizing
 196 multiple regression analysis (MRA) were used to value properties. Residential sectional
 197 title property was valued based on a unit rate developed for the scheme. Most non-
 198 residential property was valued using CAMA applications of the income approach to
 199 value. Other non-residential properties were valued based on cost approach. The most
 200 complex properties were valued using single property approaches to value [12]. The
 201 cost approach was used for properties that rarely rent. Schools, churches and other
 202 properties that rarely on rent were valued by the cost method. Evaluations estimated
 203 land values for properties appraised using the cost approach. Depreciation tables are
 204 derived internally as well. [12]. The management of data for GV2018 was built entirely
 205 by the revaluation vendor, the city's CAMA system in Value Assist and is a product
 206 that the contractor has used previously. The CAMA system includes a variety of
 207 variables, reports and valuation engines [12]. The current method for assessing
 208 properties in the City of Johannesburg, leads to some issues.

209 The valuation doesn't normally take highest and best use of the property into
 210 considerations as valuer's value what they see. The issues are discussed further in the
 211 next section.

212 **6 Value Assist system:**

213 The municipal has Value Assist software for the valuation exercise, however, the
 214 collection of data for valuation and revaluation process is largely unclear. At the
 215 moment, Value Assist does not contain the tools to perform regression modelling. The
 216 valuation is completed outside the system with the values then being imported back
 217 into Value Assist system. The CAMA system is merely used for storage of record.
 218 CAMA issuing incorrect values resulting with inconsistency values. Hence the
 219 assessment procedure is fraught with errors, of undervaluation, overvaluation,
 220 omission and error in type of use of properties. The resulting effect on the municipality
 221 is a large scale of objections and loss of revenue to court cases.

- 222 • **Objection:** When it comes to Objections lodge, we had a comparison
 223 of the total number of objection files for the previous two General
 224 Valuation roll which were implemented in 2008, 2013 and the current
 225 2018. Objections filed for 2008 were a total of 45371 including
 226 supplementary queries, 2013 was 91263 including supplementary queries
 227 and these an increase of objections due to the value been high for the
 228 current General Valuation 2018. Approximately 50555 objections were
 229 filed, and this does not include supplementary. The number of objections
 230 filed by ratepayers in the current GV indicates that accuracy is an issue.
- 231 • **Data Accuracy:** Commercial data and sales are not as abundant as
 232 one would like. Continuous process improvements are known but hard to
 233 act upon. There is no consistency in the market information applied by
 234 appraisers when appraising. For all other property types, there was not
 235 enough volume of transactions to estimate the time adjustments in the
 236 same manner.

237 7 Conclusion and Recommendation

238 CAMA applications typically result in valuation equation, tables and schedules
 239 developed from analysis of market data. These elements require accurate descriptions
 240 of land and building characteristics for all properties being valued. Since valuation
 241 models are built on data, accurate and consistent data are the single most important
 242 component of a valuation system. Data must be collected, cleaned, captured and
 243 maintained. Good data facilitates good values, if data are of poor quality, valuation
 244 results and the equity of the taxation process will suffer and there will be inaccuracy of
 245 property value. The present system used for mass appraisal in the Johannesburg
 246 municipality is not fully automated. With the massive objections to property tax, it is
 247 arguable to say that the automated valuation model is based on the principles of
 248 transparency, public trust, providing confidence for the stakeholders, broad
 249 applicability. Similarly, the application of statistically sufficient information,
 250 certification and quality assurance in the system of mass appraisal model is in doubt.
 251 This is a challenge to Valuers in the fourth industrial revolution where professionals
 252 are called to add value in service delivery through the use of technology. This study
 253 argues for a need to rethink the current model and recourse to best practice from other
 254 countries where CAMA is effective. The model should adhere to the best practices for
 255 data verification, data and market analysis. the study recommends that future General
 256 Valuation Roll and valuation method. In addition, City Valuation department should be
 257 able to derive capitalization rates from the market for comparison to income and
 258 expense data. Time adjusted sales should be used in all final models. Modelling team
 259 should prepare a summary report for each model. The CAMA system should integrate
 260 a GIS to enhance desktop data collection Method. The City should look for better ways
 261 to capture the multiple uses that occur within non-residential property.

262 Reference

- 263 1. Baum, A. Real estate is a very large - the largest - asset type and one of the last to
 264 adopt technological change and the innovation that tech can bring.
 265 <https://www.sbs.ox.ac.uk/sites/default/files/2018-07/PropTech3.0.pdf> (2017).
- 266 2. De-Sylva, P.G.R, The View from South Africa, South African Valuer fourth Quarter
 267 2001.
- 268 3. Ward R.D, (2001): Demonstration of CAMA in South Africa, Assessment Journal
- 269 4. McCluskey, W. Deddis W, Mannis, A. McBurney, D. and Borst, R.(1997) "Interactive
 270 application of computer assisted mass appraisal and geographic information systems",
 271 Journal of Property Valuation and Investment, Vol. 15 Issue: 5, pp.448-465,
- 272 5. Babawale, G.K, "Designing appropriate valuation model for sustainable property tax
 273 system in developing countries", International Journal of Law and Management, Vol.
 274 55(3), pp.226-246, (2013)
- 275 6. Lapp, K. A history of taxation. Simon & Schuster. New York Africa. (2003)
- 276 7. Deddis, W. Development of a geographic information systems for mass appraisal of
 277 residential property, University of Ulster November (2002).
- 278 8. Pawi, S., Juanil, D.M, Wan Yusof, W.Z and Shafie. F. Property tax performance of local
 279 authorities in Malaysia. Presentation at International Conference on Management and
 280 Artificial Intelligence, Bali, Indonesia. IACSIT Press 6:42-46.

- 281 9. IAAO, Standard on Mass appraisal of real property, International association of assessment
282 officer (2013), Kansas city USA
- 283 10. Daud, D. Z., N. Kamarudin, R. C. D. Franzsen, and W. J. McCluskey. 2013. "Property tax
284 in Malaysia and South Africa: A Question of Assessment Capacity and Quality Assurance."
285 Journal of Property Tax Assessment and Administration 10(4): 5–18.
- 286 11. Mallinson, M. and N. French. 2000. Uncertainty in property valuation. The nature and
287 relevance of uncertainty and how it might be measured and reported. Journal of Property
288 Investment & Finance. 18. 13-32, (2000).
- 289 12. McCluskey. W.J, & Franzsen. R.C.D. Issues around the Value-Based Property Tax in
290 Africa, Journal of property tax assessment and administration Vol.15 (2), (2018).
- 291 13. McCluskey, W.J, McCord, M, Davis P.T, Haran, M and McIlhatton, D. Prediction accuracy
292 in mass appraisal: a comparison of modern approaches, Journal of Property Research,
293 Vol. 30:4, 239-265, (2013).
- 294 14. Franzsen, R. C. D. 1999. "Property taxation in South Africa." In Property Tax: An
295 International Comparative Review, ed. W. J. McCluskey, 337–357. (1999).