INVESTIGATING THE PERCEPTION OF THE USE OF AUTOMATED VALUATION MODELS TO APPRAISE RESIDENTIAL PROPERTIES IN PRETORIA, SOUTH AFRICA

by

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ABSTRACT

Purpose of this paper:

The study aimed to examine the awareness, knowledge, and perception of the property valuers practicing in Pretoria regarding using the AVMs as a tool to appraise residential properties.

Design/methodology/approach-

This research used a quantitative approach method to assess the level of awareness and knowledge about the appraisal of residential properties using the automated valuation models (AVMs). The research aimed to determine if AVMs outperform traditional valuation methods and assess the implications of their fully automated nature on the valuation profession. A semi-structured online survey was used to collect data from property valuers in Pretoria. The survey was distributed through the South African Council for the Property Valuers Profession (SACPVP) and the South African Institute of Valuers (SAIV), with the survey link sent directly to the targeted participants.

Findings

According to this research, AVMs have been shown to be more reliable, faster, efficient, and cost-effective than traditional valuations. Conversely, some valuers have reservations about using AVMs for residential properties due to limitations such as the inability to physically inspect properties and the risk of insufficient and unverified data. Furthermore, there are concerns about the potential impact of AVMs on the valuers' profession, as they may become obsolete in the future. Despite these concerns, most valuers who participated in the study believe that AVMs are still a preferred method for evaluating residential properties.

Research limitations

The study was limited by the POPI Act, resulting in fewer participants than anticipated. The Act establishes specific restrictions for sharing personal information without the owner's consent, preventing direct access to participants. The researcher distributed questionnaires through SACPVP and SAIV services using an online survey. These institutions own the database of all registered valuers in South Africa, making it crucial to work through them to comply with the POPI Act and ethical considerations.

Value of paper

This study aimed to assess the awareness and knowledge of property valuers in Pretoria regarding the use of AVMs in residential property valuation. Additionally, the study sought to determine the extent of AVM usage and its effects on traditional property valuation methods. The paper provides valuable insights by gathering the opinions and perceptions of valuers on the hypothesis surrounding AVMs.

Conclusions

The results of this study confirm that most of the participating valuers in Pretoria believed that AVMs are the best approach for valuing residential properties due to their efficiency, expediency, and cost-effectiveness, despite some notable concerns raised by the few participating valuers. Although, the conclusion remains that AVMs are the preferred method of valuing residential properties.

Keywords: Automated Valuation Models, Fast, Reliable, Accurate, Cost-effective. property inspection

DEDICATION

In loving memory of my mother

Puseletso Gladys Thebe

1956-2003

I want to express my gratitude for everything you have done for me throughout my life, from my earliest days until you departed for heaven. Your sacrifices and devotion have shaped me into the person I am today.

Thank you, Mom.

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I am grateful to God for granting me the wisdom and strength to finish this research despite challenging circumstances. I further want to express my gratitude to my wife for all the support she has given me throughout this journey. Despite sacrificing her valuable time, she persistently stood by my side and helped me in every possible way. Without her, I would not have been able to complete this journey. Thank you so much for your unwavering support.

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ABBREVIATIONS

4IR:	Fourth Industrial Revolution
AI:	Artificial Intelligence
ANN:	Artificial Neural Networks
AVMs:	Automated Valuation Models
CAMA:	Computer-Assisted Mass Appraisal
GIS:	Geographical Information Systems
MRA:	Multiple Regression Analysis
POPI Act	Protection of Personal Information Act, 4 of 2013
SACPVP:	South African Council for Property Valuers Profession
SAIV:	South African Institute of Valuers
SAPVP:	South African Property Valuations Profession
VR:	Virtual Reality

1. INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

The research aims to determine the perceptions of the valuers whether AVMs could outperform traditional valuation methods and assess the implications of 4IR technology on the valuation profession. Therefore, the focus is on how the fourth industrial revolution (4IR) will impact the built environment profession, especially valuers. The 4IR introduces changes in how we live and work (Schwab, 2020). As such, 4IR can potentially increase workplace productivity because it is efficient, effective, and competitive. According to the International Association of Assessing Officers (2018), AVMs are computer programmes that use real estate information, such as comparable sales, property characteristics, and price trends, to estimate the current market value for a specific property. These programmes are empirically based and can be extremely helpful in determining the value of a property.

Valuing a property is a crucial process that requires a significant amount of time and effort. It is not just about determining the value of the property but also the impact that the valuation outcome will have on things such as the taxes, insurance, financing options, and more (Kok, 2020). The value of a property is usually based on the present value of long-term benefits, such as cash flows or rents, that it can provide to the owner. To determine this value, various data points are considered, such as the quality of local schools, the availability of amenities such as supermarkets and public transport, and macroeconomic data such as current interest rates.

According to Scheurwater (2017), Kok (2020) and Valier (2020), valuers utilise three distinct approaches to determine the value of a property, namely Market Approach, Income Approach and Cost Approach. Within these approaches, four valuation methods employed are Comparable Transaction, Discounted Cash Flows (DCF), Replacement Cost and Reproduction Cost, which are fully explained as follows. The first method is the comparable transaction, which looks at the sales price of same or similar properties. This method embraces the idea that open property value may be determined by simply comparing it to the market price for comparable or identical assets. It is preferably used in the valuation of commercial, residential, agricultural properties.

The second method is the replacement cost, which is used to determine the value of properties that do not frequently sell on the open market and no comparable sales in the area. Further, the method is used to value the recently constructed properties in other transaction. The method is predicted on two factors, land value and the depreciated cost of construction material.

The third method is the reproduction cost, usually used to determine the value of properties that generate income for the investor. They are referred to as commercial properties. This method uses the investment income technique and profit method, which are the applicable ways to do valuation.

The fourth method is the discounted cash flow (DCF), which also applies to commercial properties. This approach models ten years of income and expenses for a property, "discounting" those future cash flows back to the present using a discount rate. These methods require the expertise and judgment of a valuer and involve analysing large amounts of data.

Automated valuation models (AVMs) have become a crucial component of the property valuation process in modern global economies. This is highlighted by various studies conducted by (Glumac and Des Rosiers, 2018; Nguyen, 2019b; Glumac and Des Rosiers, 2021). AVMs are becoming widely recognised as a modern approach for conducting property valuations. Valuers worldwide are increasingly using AVMs as a preferred method of evaluating residential properties (Babtan, 2020). In contrast, AVMs have received considerable criticism worldwide, including in Africa (Boshoff and De Kock, 2013). Most of the valuers in South Africa were not knowledgeable about using AVMs as a tool to appraise commercial properties, hence, lack of supporting their usage thereof (Boshoff and De Kock, 2013). According to Mooya (2016), valuers in South Africa are increasingly adopting AVMs for both commercial and residential properties.

Consequently, it will help developing countries to achieve the 2030 Agenda for Sustainable Development Goals (Siniak *et al.*, 2019). In other words, beyond 2030,

the world will evolve around digitalisation in all value chains. Currently, there is less reliance on using paper or physical contact to perform tasks. Instead, people depend on automatic machines and modern technology to get things faster and cheaper (Schwab, 2020).

Furthermore, the use of modern technology such as the Internet of Things (IoT), artificial intelligence (AI), building information modelling (BIM), Geographical information systems (GIS), Block-Chain, Big Data, and automated valuation models (AVM), among others, has led to innovation in the real estate industry (Siniak *et al.*, 2019). Equally so, such developments have caused concerns about anxieties among professionals worldwide regarding the implication of not utilising modern technology in undertaking day to day activities including the built environment (Moghayedi *et al.*, 2020). Although most industries still lack technology development and facilities, real estate has been touted as a possible lead in digital expansion (Siniak *et al.*, 2019). Many argued that very little has been done to bring innovation to the real estate industry (Moghayedi *et al.*, 2020). The IoT, AI, BIM, GIS, Blockchain, Big Data, and AVMs are crucial in improving how valuation is undertaken today. Their use and capability have advantages and disadvantages (Scheurwater, 2017).

The above-mentioned technological concept will improve the way the valuation is undertaken and the reliability, hence, there is a concern with the advent of such technological advancement, particularly AVMs. The valuation profession may partially be obsolete and/or redundant (Scheurwater, 2017), because valuation has slowly become dependent on technology, professionals have gradually embraced modern technology in valuation (Wilkinson, 2018b). Therefore, the advent of 4IR has resulted in more valuation professionals adopting technology based on cost and efficiency.

Consequently, education plays a vital role in adapting to change. Therefore, the relationship between government, universities, professional bodies, and other relevant institutions is critical to achieving the goals of the 21st century (Wilkinson, 2018a). In so doing, universities must introduce a world-class teaching methodology. Students must be taught in a contemporary way to learn theory and practical skills concurrently with the invention of modernisation technology. The universities are still reluctant to

change the curriculum to align with the best international practice, which requires modern software technology to embrace the skills needed in the market (Moghayedi *et al.*, 2020).

According to Mooya (2015), *"There is evidence to suggest that the valuation profession in South Africa regards the current state of affairs as unsatisfactory. These concerns, have arguably led the South African Council for the Property Valuers Profession (SACPVP) to raise the educational requirements for professional registration."* Therefore, from 2013, no person is allowed to register as a professional valuer without attaining at least a university degree, as compared to the past, where a university degree was not a prerequisite requirement (Mooya,2015). In countries such as Australia and the United States of America (USA), qualification, extensive practical experience, and a board exam are requirements to attain professional status. In France, no formal qualification or board examination is required to achieve a professional level. They deem work experience attained as sufficient (Mooya, 2015). Even in SA, one must follow stringent process, which includes writing a board exam to achieve professional status over and above the above-mentioned requirements (*ibid*).

In light of the above, universities must produce qualified students with extensive knowledge and skills to undertake practically reasonable valuation once they complete theoretical studies (Mooya, 2015). In other words, universities have a significant responsibility to produce professionals that are in line with the current demand for the skills required in the market. Highlighting the shortcomings of the current curriculum (Wilkinson, 2018a; 2018b) argues that the valuer's profession must adapt to change and be savvy enough to use technology appropriately. As such, the knowledge they gain from university can enhance their ability to become competitive in the industry. Mooya (2015) concurs with the above view by alluding to the fact that several employers are not entirely satisfied with the current professional valuers in SA. Most alluded to the lack of credible skills to conduct market research and apply the discount cash flow (DCF) valuation method (ibid.). Wilkinson (2018b) suggests that educational institutions such as the university should incorporate desired capabilities such as data management and sustainability in disciplines of the built environment. As a result,

universities worldwide face challenges adapting to the current trend required by the built environment industry (Moghayedi *et al.*, 2020).

1.2 BACKGROUND

AVMs were established in the early 1960s and have been widely used worldwide (Downie, 2008; Boshoff and De Kock, 2013). In South Africa, the use has been limited to municipal valuations for all types of properties and selectively on residential properties (Boshoff and De Kock, 2013; Matysiak, 2017). Moreover, Matysiak (2017:3) states: *"AVMs have been developed and advanced for several reasons: they are convenient, fast, and low-cost alternatives to a full valuation. They are computer-based applications, using a variety of statistical and algorithmic approaches in analyzing the relationship between price/value of a residential property and the property`s underlying characteristics"*.

AVMs were first discovered in Europe in the 1960s, as stated above (Boshoff and De Kock, 2013). AVMs stems from the low interest rate at the time and the increase in the demand for mortgages during the 1960s. As such, lenders had to devise a solution to expedite application process. Therefore, AVMs have become influential in the property valuation profession (PVP), especially in Europe (ibid.). Since then, Asian countries and the United Kingdom have adopted AVMs to evaluate their properties (Boshoff and De Kock, 2013; Scheurwater, 2017). As AVMs become popular globally, technological advancements are changing the real estate landscape and professionals in the sector must adapt to keep up with changes as technology evolves (Scheurwater, 2017; Wilkinson, 2018b). In countries such as Canada, the USA and the UK, Australia and some Asian countries, the use of AVMs is a standard practise in the valuation of residential properties (Bellotti, 2017).

Moreover, AVMs are regarded as superior to traditional valuations because of the absence of interaction with the human being (Matysiak,2017; Kok, 2020). As such, it is assumed to be less risky and less exposed to human error (Kok, 2020). In other words, this can be done without undertaking a physical inspection as the norm for traditional valuation. In contrast, traditional property valuation with human contact, where market research and data are collated using a different approach to AVMs.

Traditional valuation relies more on physical contact with assets/ property to be evaluated, while AVMs rely solely on automated data without seeing the property (Scheurwater, 2017). There is a view that artificial intelligence (AI) and automated valuation models (AVMs) can be synchronised to transfer data through algorithms to ensure that the results are accurate, reliable, and fit for the purpose.

In light of the above, AI is bringing about fundamental changes in the traditional way of carrying valuation and plays a vital role in real estate valuation (Valier, 2020). In the past, the model used regression analysis, whereas now they are using algorithms to improve the accuracy of the valuation (ibid.). This transformation has improved the accuracy of AVMs. AVMs are gradually replacing traditional valuation work. In other words, traditional valuation will become obsolete (Wilkinson, 2018a; b; Moghayedi *et al.*, 2020; Namangale and Chimalizeni, 2021).

1.3 PROBLEM STATEMENT

The problem statement to be explored in this study is stated as follows:

In European countries, Australia, and the United States, the use of AVMs for residential properties has been the norm for years. In contrast, the South African valuation profession is resisting the inevitable adoption of AVMs as the preferred method to appraise residential properties and views it as a threat to their work.

1.4 RESEARCH QUESTION

The main research question is posed as follows:

How are the South African Property Valuers perceiving the disruption caused to its traditional practices and skills by the 4IR in the form of the adoption of the AVMs as a preferred tool to appraise residential properties?

1.5 RESEARCH AIM

Assumption of the study:

The property valuers practicing in Pretoria, are knowledgeable about AVMs and perceive them as a threat to their profession.

Aim of the study:

The study aims to examine the awareness, knowledge and perception of the property valuers practicing in Pretoria regarding using AVMs as a tool to appraise residential properties.

1.6 RESEARCH PROPOSITION

The proposition to be tested in this study is:

The SAPVPs are gradually adapting to the 4IR by adopting the AVMs as an alternative tool to appraise properties.

1.7 RESEARCH OBJECTIVES

The research objectives to be achieved in this study are to:

- Establish what 4IR disruptions apply to the SAPVPs.
- Identify the traditional valuation skills and processes under threat of 4IR-driven changes.
- Determine to what extent valuers in South Africa are aware of and use it as a tool to appraise residential properties.
- Establish what reservations or trust SA property valuers have regarding using AVMs.
- Investigate to what degree the profession is adapting to AVMs and other advanced technologies brought about by 4IR.

1.8 RESEARCH METHOD

To meet the desired research objectives, a review of the literature would be undertaken to review the available data on the use of AVMs as an alternative to traditional valuation. Additionally, primary data will be collected using an online survey questionnaire (explorative method).

An anonymous semi-structured self-administered questionnaire through the survey monkey link will be distributed to the valuers practicing in Pretoria with the use of the SACPVP and SAIV portals, respectively, to reach as many as possible valuers.

1.9 LIMITATIONS

The study is subject to the following primary limitations:

- The survey does not perpetuate the narrative that AVMs are deemed cheap, effective, and reliable, as alluded to in most of the literature reviewed herein.
- The study is carried out without prejudice against anyone participating; therefore, the questionnaire is the same for all participants.
- Two issues that are going to be experienced with the study are the limited response from respondents, as some of the respondents may not have time to evaluate the questionnaire, and second, the reluctance to respond as they have no interest in taking participation.

1.10 REPORT STRUCTURE

The research report is structured into five chapters as briefly described below.

Chapter 1: The brief overview of what the study intends to assess by providing context to the study, including the problem statement, aims, objectives, and hypothesis.

Chapter 2: Herein, the critical review of the existing literature globally and locally is presented to identify similarities, gaps, and possible solutions to the subject matter in discussion.

Chapter 3: This is a chapter wherein the research methodology is applied by undertaking the following essential tasks: acquiring ethics clearance, valuers and sampling, data collection, and data analysis.

Chapter 4: This chapter presents the data collected, the analysis, the interpretation, the findings of the surveys, and the discussion.

Chapter 5: This is where the research design is underpinned to formulate the conclusions and recommendations for the study undertaken and the limitations thereof.

2. LITERATURE REVIEW

2.1 INTRODUCTION

This chapter intends to interrogate the current theory that is available on the same topic of AVMs, amongst other things, to provide a perspective of the theories and their findings thereof. The findings and perspectives of previous researchers are discussed, including their views on the reliability, efficiency and cost effectiveness of AVMs compared to traditional valuation methods (Downie and Robson, 2008; Mooya, 2015; Scheurwater, 2017). In so doing, the following topics will be discussed in this chapter:

- International adoption of automated valuation models as part of the fourth industrial revolution.
- The application of automated valuation models.
- The advantages of using automated valuation models.
- The disadvantage of using automated valuation models.
- The implications for the future of the valuation profession.

2.2 INTERNATIONAL ADOPTION OF AVMs AS PART OF 4IR

AVMs have been used for decades in many countries around the world, including South Africa. The use is limited to specific purposes (Boshoff and De Kock, 2013; Bidanset, 2014; Nguyen, 2019b; Namangale and Chimalizeni, 2021). The advent of the covid-19 pandemic has forced many industries and professionals to embrace modern technology to advance their business interests and meet the demands of customers. Valuers are not excluded, so using the AVMs has shaken some valuers to rethink the traditional valuation method (Scheurwater, 2017).

The fourth industrial revolution (4IR) has been touted as a global game changer, affecting many industries, including real estate (Moghayedi *et al.*, 2020). Therefore, industry experts and higher education institutions must respond to digitalisation and automation to remain relevant. In real estate, particularly in the valuation profession, many countries have adopted the use of automated valuation models (AVMs) to appraise all types of properties, except here in South Africa, where the use of AVMs is limited to municipal valuation (all type of properties) and few financial institutions (Boshoff and De Kock, 2013).

The main argument around the adoption of AVMs in the 4IR has been non-physical inspection of the subject property, which has resulted in some professionals doubting the accuracy and reliability of AVMS (Boshoff and De Kock, 2013; Namangale and Chimalizeni, 2021). Similarly, in the UK, USA, Asia and Australia, the use of AVMs has been a norm for decades and is trusted because it is deemed reliable, cost-effective and time-bound (Bellotti, 2017; Glumac and Des Rosiers, 2021).

2.3 THE APPLICATION OF AUTOMATED VALUATION MODELS

According to Downie and Robson (2008), many countries, including well-developed and developing countries, have widely used AVMs for different purposes. They are categorised into at least five types: hedonic models, econometric forecasts, intelligent systems, house price index models, and tax-assessed value models. It is worth noting that this valuable tool has been utilised for a considerable amount of time, with various countries adopting it as early as 1960 for noble purposes (Boshoff and De Kock, 2013; Matysiak, 2017). According to Scheurwater (2017), AVMs are widely used in European countries and are regarded as a preferential method for valuing residential properties. In order for AVMs to be considered reliable and accurate, a reasonably high number of comparable transactions is required in terms of the size of the property and the number of bedrooms (Ibid.). In other words, sufficient data of similar and the same attributes in the proximity of the neighbourhood shall be enough to confirm the accuracy of AVMs without a doubt (Boshoff and De Kock, 2013; Namangale and Chimalizeni, 2021).

Boshoff and De Kock, 2013; Mooya (2015); Scheurwater (2017); Namangale and Chimalizeni, 2021 argues that the AVMs will replace valuers, whereas (Eplsey,2017) argue that the AVMs will never replace valuers. It can only improve the valuer's skills. Those who think that AVMs will diminish valuers argue that they are efficient, reliable, and reasonably cheaper, but accuracy is not accurate, but acceptable (Mooya, 2011; Wilkinson, 2018a; b; Moghayedi *et al.*, 2020; Namangale and Chimalizeni, 2021). While the opposing view is that valuers' skills learned through years and knowledge cannot be replaced by automation and that AVMs are unable to perform a physical inspection of the property, the outcome is the likelihood to be untested, unreliable, and inaccurate thereof (Boshoff and De Kock, 2013). Accuracy and credibility are based

on the skills of the AVM operator because the model is based on computer estimates that omit critical parts of the valuation process that determine the estimates, such as property inspection (Epley, 2017).

AVMs have been used to evaluate different types of properties worldwide (Downie and Robson, 2008; Demetriou, 2016; IAAO, 2018). Lenders and banks found that AVMs are valuable for their respective use due to their benefits, such as being cheaper, faster, and more reliable than traditional valuation (Downie and Robson, 2008; Boshoff and De Kock, 2013; Matysiak, 2017; Scheurwater, 2017; Kok, 2020). The European AVMs Alliance (2016) and Krause *et al*. (2020) believe that AVMs have shortened the process of approving mortgages due to the availability of the valuation report within a short period of time compared to traditional valuation. This follows several authors' arguments that, even though it shortened the period of delivery, the risk remains for the inability of the model to inspect the property, and the accuracy and reliability of the valuation remain questionable (Boshoff and De Kock, 2013; Glumac and Des Rosiers, 2021). The validity of the valuation report relies on the assumption that the subject property's condition is still intact, and therefore the data available on the market make an untested prediction (Glumac and Des Rosiers, 2021). In order to verify and validate the outcome of the models, the reliability and accuracy of AVM must be scientifically proven.

Moreover, limitations such as data quality, inability to inspect the property, financial regulations of the lending process, and risk acceptance, amongst other things, play a vital role in supporting AVMs (Downie and Robson, 2008; Kok, 2020). AVMs have proven to be a successful model for valuing residential property, as most European countries have used it for decades, and countries such as South Africa (SA) have slowly adopted their use, although it is limited to a specific type of properties (Downie and Robson, 2008; Boshoff and De Kock, 2013; Namangale and Chimalizeni, 2021). Many researchers have highlighted the usefulness of automated valuation models (AVM) in the financial sector throughout the European Union (EU) since the early 1970s (Downie and Robson, 2008; IAAO, 2018; Glumac and Des Rosiers, 2021). Further, it has been noted that the use of this technology has been limited to loan origination, mortgages, re-mortgages, property portfolios, and related taxes (ibid).

According to studies undertaken by researchers (Downie and Robson, 2008; Mooya, 2011; Namangale and Chimalizeni, 2021), professionals differ in opinion from those who believe that AVMs can be used to supplement to traditional property valuation. By contrast, others believe the model can be helpful in valuing properties as an alternative tool. Another school of thought believes that AVMs can replace traditional valuation (ibid.). Nguyen (2019) reported that 26 countries on five continents have implemented AVMs for property valuation. Table 1, provided below, displays the list of countries utilizing AVMs across the world.

TABLE 1: COUNTRIES APPLYING AVMs (Nguyen, 2019a:9)

Nr.	Continent	Country	Number of Appllication cases	% of total number of identified Application cases
1	Europe	Austria	2	2,6%
2		Czech Rep.	2	2,6%
3		Denmark	17	22,4%
4		Germany	15	19,7%
5		Great Britain	36	47,4%
6		Greece	3	3,9%
7		Ireland	4	5,3%
8		Italy	11	14,5%
9		Montenegro	3	3,9%
10		Netherlands	29	38,2%
11		Norway	16	21,1%
12		Poland	1	1,3%
13		Portugal	2	2,6%
14		Romania	4	5,3%
15		Spain	7	9,2%
16		Sweden	16	21,1%
17		Switzerland	20	26,3%
18	North	USA	43	56,6%
19	America and	Canada	7	9,2%
20	Oceania	New Zealand	10	13,2%
21		Australia	24	31,6%
22	Asia	China	2	2,6%
23		Japan	4	5,3%
24		Singapore	3	3,9%
25		Taiwan	4	5,3%
26	Africa	South Africa	8	10,5%

From Table 1 above, it is evident that Africa is still behind in using AVMs. Only South Africa in the entire African continent is using AVMs. Although, its use is not at total capacity (Downie and Robson, 2008). Most European, Asian, and American countries

use AVMs for different purposes, and residential properties have since been fully automated.

According to Namangale and Chimalizeni (2021), using AVMs in Africa, particularly in SA and Malawi, received a mixed reaction from the valuers practicing in these countries. In Malawi, for instance, other valuers are inclined to adopt the AVMs if the comply with the country prevailing prescripts. The other group does not support the use of AVMs, fears competition, and possibility of losing their jobs. On the other hand, SA has a mixed view of valuers practising. One group has suggested that AVMs diminish the valuation profession (Boshoff and De Kock, 2013; Namangale and Chimalizeni, 2021). In contrast, others are not sure whether the model will work. At the time, few valuers knew AVMs because, at the time, most valuers registered in SA were senior and still believed in the traditional valuation thereof (Boshoff and De Kock, 2013). Although there is a difference in the timing of the two studies, it is important to note that Malawi and South Africa valuers express similar views. They see AVMs as a threat that could diminish their profession and make it obsolete. (Boshoff and De Kock, 2013; Namangale and Chimalizeni, 2021).

The common denominating factor from the studies conducted in Malawi and SA is that both acknowledge that AVMs are cost effective, efficient, and time bound (Boshoff and De Kock, 2013; Namangale and Chimalizeni, 2021). Conversely, some valuers question the accuracy and reliability of AVMs compared to traditional valuation methods. These reservations may stem from manufactured data, a significant problem in Africa's extensive data landscape (ibid). Despite these concerns, many valuers still consider AVMs a valuable tool (ibid.).

AVMs are regarded as cost-effective, reliable and faster than the traditional valuation method (Boshoff and De Kock, 2013; Neal *et al.*, 2020; Namangale and Chimalizeni, 2021). The debate around the benefit of AVMs versus traditional valuation is still ongoing (ibid.). The disadvantage of AVMs is that they do not provide for physical inspection of the property and their valuation cannot be trusted (Mooya, 2011; Boshoff and De Kock, 2013; Namangale and Chimalizeni, 2021). When used alone, AVMs assume that the property condition is good. As such, they misrepresent the fact, unlike

when used in conjunction with human interaction, that misgiving could be eliminated by substantial evidence collected during physical property inspection (Boshoff and De Kock, 2013; Namangale and Chimalizeni, 2021).

Considering that AVMs rely heavily on the accuracy of the data available in the market, it is argued that the use of AVMs in real estate will not completely replace valuers due to the amount of data used (Boshoff and De Kock, 2013; Namangale and Chimalizeni, 2021). On the other hand, some argue that the valuer's profession will be deemed redundant with time due to the introduction of improved technology (Mooya, 2011; Scheurwater, 2017). Therefore, the fact that the AVMs rely on the availability and accuracy of data seems to be a long way before this automation can replace the valuer's profession (Boshoff and De Kock, 2013; Neal *et al.*, 2020).

According to Namangale and Chimalizeni (2021), in Malawi, the use of AVMs is not supported for the following reasons: first, it is perceived to be a threat to professional valuers, and second, it is not trusted due to its reliance on automated data without human interaction. Therefore, the argument remains that the AVMs cannot replace the skills and knowledge of the valuer estimate of the market value due, among other things, to limitations such as physical inspection and lack of sufficient data (ibid.). Similarly, most SA valuers argued that AVMS is unreliable, so they remain loyal to traditional valuation (Boshoff and De Kock, 2013). In spite of this, (Mooya, 2011) argued that the valuer trusts traditional valuation because of fear that AVMs will replace them and make them redundant, as it is evident that AVMs give valuers a good run for their money.

In Malawi, valuers are divided on the adoption of AVMS in the valuation profession, and others argue that it would have been effective if it was incorporated into traditional valuation as a tool to enhance valuation, not as a standalone tool to determine the values (Namangale and Chimalizeni, 2021). By contrast, some argue that AVMs do not comply with the valuation standards and should not be considered for adoption (Downie and Robson, 2008) echoed same sentiment. Finally, it was concluded that AVMs could be considered for adoption in Malawi only as a complementary tool to improve the valuer’s ability to accurately value properties. The view is that regulating

AVMs will allow everyone to use AVMS without the knowledge and skills to be a valuer, jeopardising the valuation profession (Namangale and Chimalizeni, 2021). As such, use of AVMs for valuations must be regulated by the government to protect the valuations profession in Malawi. The same views were echoed by the valuers practicing SA even though it is regarded as valid if it is supplemented by traditional valuation by others (Boshoff and De Kock, 2013).

According to Mooya (2011), many valuers see AVMs as a threat to the profession. Despite this, evidence shows that traditional valuations are expensive and time-consumed expressly with a valuation for a mortgage, in contrast to AVMs. Furthermore, it is argued that the AVMs cannot be used to determine market value as they are not trusted due to non-physical inspection of the subject property. In summary, Mooya (2011) believes that no evidence suggests that AVMs cannot entirely substitute the valuers. In other words, no concrete evidence exists to dispute that AVMs may diminish the traditional valuation with time (Mooya, 2011). Therefore, leave space for further investigation of the impact of AVMs on the valuer's profession.

2.4 THE ADVANTAGE AND DISADVANTAGES OF USING AVMs

This section further discusses the philosophical debate and the hypothetical conspiracy around using the AVMs to appraise residential properties and why valuers think this is a game changer. On the other hand, some valuers argue that this model is just dull because without human interaction, it will not produce accurate and reliable valuation that can be attested (Mooya, 2011; Boshoff and De Kock, 2013; Scheurwater, 2017; Neal *et al.*, 2020; Doumpos *et al.*, 2021). This prompts the researcher to investigate the actual benefits and drawbacks of using AVMs compared to traditional valuation methods, Moreover, the researcher examined the real advantages and disadvantages of using AVMs to appraise residential properties in the context of the South African market, in contrast to what other developed countries have achieved by adopting the same model.

2.4.1 ADVANTAGES OF AVMs

As mentioned above, AVMs have been widely used for decades in Europe, Asia, and the United States, but rarely in Africa. According to Downie and Robson (2008); Mooya (2011); Boshoff and De Kock (2013); Bidanset (2014); Belloti (2017); Matysiak (2017); Nhuyen (2019); Gumac and Des Rosiers 2021); and Namangale and Chimalizeni (2021), many professionals believe that automated valuation models (AVMs) can revolutionise the valuation industry and enhance the quality of service compared to traditional methods. Proponents of AVMs assert that they are more economical, dependable, efficient, and user-friendly than traditional valuation techniques. AVMs are less prone to human errors and partiality since the entire process is automated, reducing the possibility of manipulation through human intervention(ibid.).

The lenders and banks prefer AVM to traditional valuations for valuing residential properties because they are considered an efficient and cheaper way to quickly complete valuations (Matysiak, 2017; Neal *et al.*, 2020). As a result, AVMs are touted as alternative tools for valuation due to technological advancements and the pressure from lenders to conclude mortgage application expeditiously (Fortelny and Reed, 2005). In spite of this, there are concerns regarding the reliability and accuracy of the valuation performed using AVMS (Bidanset, 2014; Neal *et al.*, 2020; Valier, 2020). This creates an opportunity for further studies to establish this claim.

It is essential to note that while AVMs may provide a faster valuation than traditional valuation methods, their reliability and accuracy have yet to be fully proven (Fortelny and Reed, 2005; Neal *et al.*, 2020). In contrast, AVMS has seen a significant rise in usage compared with traditional valuation methods, particularly during the Covid-19 pandemic. This is due to its flexibility and capability to provide instant results. The demand for AVMS has increased tremendously (Neal *et al.*, 2020). It has come to light that lenders prefer AVMs to traditional valuation methods. AVMs involve limited interaction with humans and are free of biases or prejudices associated with human contact, as suggested (ibid.).

According to Babtan (2020), the AVMs' results on residential properties are more reliable and accurate, giving AVMs the benefit of doubt for residential properties in

small areas. The same confession was made by Neal *et al* (2020), who stated that AVMs can achieve accurate results in a unique situation. Therefore, AVMs are the most suitable valuation method for residential properties, such as 1- or 2-bedroom apartments (Babtan, 2020).

Therefore, AVMs can be used, among other things, to make informed decisions by buyers and sellers without undue influence. The financial institution can also benefit from using the model to estimate collateral on residential property mortgage loans (Lim and Bellotti, 2021). The fact that AVMs reports are driven by technology, including algorithms, means financial institutions can instantly obtain results. This makes it superior to traditional valuation (Matysiak, 2017). According to Knight (2021:7), 'In *general terms, AVMs work best with widely traded homogeneous assets, and their performance degrades with increasingly heterogeneous assets, or that are thinly traded*" In summary, Knight (2021) states that to avoid unpredictable results, AVMs require high quality data. Nevertheless, it is still widely acknowledged that AVMs are considered reliable (ibid).

Although several risks have been identified when opting for AVMs, the model is highly regarded as optimal, mainly for the valuation of residential properties (Knight, 2022). Furthermore, according to Downie and Robson (2008:15), *"AVMs' share of valuations is growing as is that of drive-bys, at the expense of the traditional full inspection services"*. AVMs offer high objectivity, consistency, and speed in their results. AVMs remain more reliable than traditional valuations (Mooya, 2016). On the contrary, AVMs are superior to traditional valuations because of the consistency, speed, and objectivity. Additionally, to perform the pricing function well, there must be enough information on the market regarding the properties being considered and the competitive prices paid (Mooya, 2016). The fact that AVMs process large amounts of data more quickly than human nature is sufficiently evident that the model is superior to traditional valuation (ibid). The development of values that are as neoclassical economic theory-conforming as possible is ensured by applying these three principles to AVMs. These guiding principles provide AVMs superior benefits over traditional valuations (Mooya, 2016).

Further benefits of the model are associated with its ability to make reputable property tax assessments for property-related transaction (Bidanset, 2014; Glumac and Des Rosiers, 2018). According to Glumac and Rosiers (2018) and Lim and Belloti (2021), the use of AVMs for residential properties is supported due to its competitive results backed by reliable data and the fact that the results are accurate is advantageous. The fact that the model uses the dominant method called the 'hedonic price method', which assumes an integrated approach and calculates the value of a property as a function of specific characteristics. It is highly valued in regression formation and assists the model in accurately predicting the market value (Bellotti, 2017: 2; Glumac and Des Rosiers, 2018). Moreover, Glumac and Des Rosiers (2018:2) believe that the *"Credibility of an AVM depends on the data used and the skills of the modeler producing the AVM".* In other words, without an expert modeler, the model alone will not produce exceptional results.

Moreover, the use of AVM models for several transactions, such as insurance risk assessment, lending risk assessment, portfolio of property assessment, and local government taxes estimates, among others, has been welcomed by considerable scholars because of its efficiency and accuracy with a particular type of transaction, and has been used widely in most European countries (Glumac and Des Rosiers, 2018; 2021). This has been adopted as the preferred valuation method for the above-mentioned transactions. Moreover, it suggests that the model can be used for any property if there are sufficient reliable data. The availability of big data makes a huge difference in the use of AVMs because it can accurately define an asset's actual market value (Kok *et al.*, 2017). According to Kok et al. (2017:204), the benefit of using AVMs is the fact that the model includes a "s*earch engine that compares attributes of the subject property with comparable properties using a radius search pattern or other logical search parameters over a predetermined period",* which is similar to what traditional valuation is especially with residential and commercial where data are available.

2.4.2 DISADVANTAGES OF USING AVMs

The disadvantage of using AVMs is that they do not consider the condition of the property because of the inability of a qualified valuer to perform property inspection

(Neal *et al.*, 2020; Glumac and Des Rosiers, 2021).The other factor is that the model relies too much on externalities without checks and balances. Therefore, its accuracy remains questionable (Glumac and Des Rosiers, 2021). This is why Glumac and Des Rosiers (2021) are adamant that AVMs cannot replace the valuers due to, among other things, the limitations associated with the model, such as property inspection and limited reliable data sources, in particular with a single property.

Moreover, Glumac and Des Rosiers (2021) argue that AVMs cannot produce valuation reports that meet the minimum standards set by the European Valuation Standards (EVS) due to the above constraints. Although the model had some helpful features, it primarily assists the valuer in conducting and verifying valuations. Furthermore, it emphasises that the model would improve over time as data quality improves, and the amount of data available for use in the market (Tajani *et al.*, 2018; Glumac and Des Rosiers, 2021).

According to Downie and Robson (2008) and Babtan (2020) the disadvantage of using AVMs than traditional valuation is the inability of the models to evaluate the comparable sale transactions and the fact that local market knowledge is fundamental. Hence traditional valuation is still applicable even though some might argue that it is time-consuming, although, its accuracy has been tested. The fact that the model's credibility depended on the data used and the skill of the so-called modeller remains questionable (Babtan, 2020). Although AVMs are designed to generate estimates of property values at a specific point in time, using human interaction is crucial (Mooya, 2011). Thus, the difference between AVMs and traditional valuation is that the former produces the values through mathematical modelling. On the contrary, the latter produces valuation values through data analysis and the calculation of raw data supported by externalities such as observation and market analysis (Mooya, 2011; Babtan, 2020).

Furthermore, to estimate the current or future value of a property, AVMs frequently use advanced analytics, such as machine learning models, to analyse various distinct date points for a given property (Belloti, 2017; Matysiak, 2017; Demirci, 2021). Although AVMs are helpful for comparisons, they become problematic when comparable data are unavailable. This makes it challenging to use AVMs accurately

for newly constructed properties *(ibid.* In the main, the following is the widely stated list of challenges identified in using AVMs.

- Insufficient supervision by the valuation profession.
- Many developed where data are insufficient and that may create problems with skew results.
- There may be a potential conflict of interest where the modeler plays a dual role due to under-resources.
- The issue of bias is due to a general risk inherited from algorithms and AI approaches.
- Due to a lack of awareness from the consumer on how the model works, this may result in prejudice to them.
- There is growing concern from the insurance industry regarding the increasing use of AVMs globally in underwriting liability and assurance.
- Property and valuation sector professionals are concerned that they are not involved in the design, development, operations, and governance of the model.

According to Downie and Robson (2008), the model's success is hindered by the lack of available transaction and descriptive property data. As a result, several countries have not yet adopted AVMs. Uncertainties about how the model will deal with the adjustment of values (either up or down) and correction due to limited transactional data available in the market remain a huge concern. In addition, there are concerns about how the model will adjust values, whether they increase or decrease, and correcting for limited transactional data in the market. These uncertainties are a significant cause for concern (Knight, 2022). Again, Downie and Robson (2008) argue that where AVMs have to be privately obtained, they are far more difficult and costly to develop because of the monopoly created by the large financial institutions, which owns the database. Therefore, the accuracy and reliability of the output are questionable due to the lack of reliable data. The inherent risk due to selection bias is due to the model being driven by a partial view of the market and based on the available data. is based on a limited view of the market and the available data, is among the risks associated with the use of data using AVMs (Knight, 2022). The real estate market is considered inefficient for several reasons, such as the diverse nature of properties, the lack of a centralised trading system, and the relatively low number

of transactions (Mooya, 2016). Furthermore, the main disadvantage of the model is that it produces a singular predictive formula that remains unchanged across all variables (ibid.).

2.5 IMPLICATIONS FOR THE FUTURE OF THE VALUATION PROFESSION

According to Schwab (2016:2), "*the First Industrial Revolution used water and steam power to mechanize production. Second, they have used electric power to create mass production. The Third used electronics and information technology to automate production. Now the Fourth Industrial Revolution is building on the Third; the digital revolution has occurred since the middle of the last century."* The future of the built environment (BE) is based on technology and artificial intelligence. For current and future generations to compete in the world of technology, they need to be technology-savvy (Moghayedi *et al.*, 2020). The BE industry has been criticised for its reluctance to implement the required change in the world of technology proactively. Although higher education institutions have been acknowledged for providing innovative, well-trained graduates in the BE industry, it is still regarded as insufficient and well-trained, posing a considerable risk (ibid.).

The 4IR is touted as a game changer in the BE industry to improve its efficiency. It is also noted that 4IR is slowly getting traction in BE education by introducing digital platforms in tertiary institutions to allow students to gain valuable knowledge. The effects of 4IR on education are incredibly high due to the increase in the use of technology. In most developed countries, classrooms have been redefined to align with the current trend in teaching techniques of the twenty-first century (the 21st century) (Moghayedi *et al.*, 2020).

Moreover, it is alluded to the fact that beyond the 21st century, employers want to hire people who are technology savvy. Therefore, the education system should be aligned with the demand for the workforce. Additionally, Wilkinson (2018a;2018b) and Babtan (2020) argued that essential critical skills needed for 4IR are difficult to teach and believe digitalisation tools such as virtual reality (VR) are the way to go. It is further suggested that the invention of virtual reality will play a vital role in addressing the challenges faced by the BE industry.

The valuers practicing in Australia face challenges with the vast majority of the lenders, particularly the banks preferring AVMs over traditional valuation to undertake valuation for residential mortgages (Wilkinson, 2018a). Recently, desktop valuation became a norm for undertaking such valuations. The fear is that should the banks own intellectual property, the valuers will deem surplus to the requirements in valuing residential properties for a mortgage since banks will have their database and derive their valuation report (ibid.). On the contrary, the notion that the data will no longer be an obstacle in valuation per se, valuers see this as an opportunity to increase the use of AVMs as part of their valuation undertaking (Wilkinson, 2018a).

Globally, the future of the valuation profession is under severe pressure in the 21st century due to, among others, the increase in the use of automation by lenders and banks, particularly with residential mortgages (Mooya, 2011; Wilkinson, 2018b; 2018a). Furthermore, Mooya (2011); Wilkinson(2018b); and Wilkinson (2018a) argued that the profession is receiving the recognition it deserves globally. As such, there has been a decline in the number of new valuers joining the profession (Boshoff and De Kock, 2013; Wilkinson, 2018b; 2018a). The reasons for this are client interference, the rapid growth of AVMs, banks dictating conditions, and low fees charged. Consequently, the quality and accuracy of the valuation are compromised (Wilkinson, 2018a).

According to Mooya (2011), valuers will not be replaced by AVMs because neither hypothetical nor sensible evidence suggests that AVMs cannot replace valuers. In other words, in the future, the valuers will deem surplus to the requirements (Mooya, 2011). Even though, the AVMs seem to be favoured by most lenders, as alluded to (Knight, 2022). As much as the valuers practicing in South Africa are concerned about using AVMs, it seems like a threat to their profession (Mooya, 2011; Boshoff and De Kock, 2013). On the other hand, some say that using AVMs is good if it complements the traditional valuation. In other words, AVMs are considered appropriate if used as a supplementary tool to traditional valuation (Downie and Robson, 2008; EAA, 2016; Matysiak, 2017; IAAO, 2018). The argument is that as much as AVMs are regarded as reliable, cheap, and fast. Limitation to physical inspection of a subject property remains unresolved (Matysiak, 2017), which is critical in valuation. The property may

be overstated or understated on the basis of the unconfirmed data. The AVMs remain unreliable and accurate unless such time technology is used to take interior pictures and has all the information to the data.

As suggested in the literature, the future of valuation is not looking bad, as may be suggested in other literature. According to (Knight, 2022), AVMs have increased significantly and can be used interchangeably with and without human interaction. The purpose of the valuation may determine whether AVMs can be used without the valuers or can be used alone. AVMs are a preferred way of valuing property to estimate compensation payments, cost-benefit analyses, and lending purposes (Downie and Robson, 2008; Knight, 2022). Although the disadvantage of using the AVMs is that it relies heavily on the reliability and accuracy of the existing data (Downie and Robson, 2008). The limitation to inspecting the subject's property is also a concern due to the inability to collect crucial information about the attributes of the property (Matysiak, 2017).

Additionally, insufficient quantifiable, comparable, accurate and reliable data can render AVMs questionable (Downie and Robson, 2008; Boshoff and De Kock, 2013; Scheurwater, 2017). On the contrary, the advantage of AVMs is that they can help valuers identify pitfalls that cannot be found under normal circumstances (Scheurwater, 2017; IAAO, 2018). The ability to link with technology such as the Internet and handle big data, which is cheap, fast, and more reliable than traditional valuation, makes the model effective (Downie and Robson, 2008; Mooya, 2011; Pornchokchai, 2022b). The model can be used for different types of valuation, and many countries worldwide already use it for ages (Downie and Robson, 2008; IAAO, 2018). AVMs reduce the dependency on human interaction. As a result, they eliminate inaccuracy caused by human error (Matysiak, 2017). In the study conducted by the president of the FIABC (Pornchokchai, 2022a) on the topic of the future of the valuation profession in the world. The following 33 countries participated in the studies; the outcome-related discussion is provided in Table 2:

Table 2: Source: Webinar-The Future of Valuation Profession (1 August 2022)

COUNTRIES	
Australia	
Austria	Netherlands
Azerbaijan	New Zealand
Bangladesh	Nigeria
Botswana	Philippines
Bulgaria	Romania
Cambodia	Singapore
Canda	South Africa
China	Sri Lanka
Germany	Taiwan
Ghana	Tanzania
Hong Kong	Thailand
India	Uganda
Indonesia	Ukraine
Italy	USA
Japan	Vietnam

Of the 33 countries that participated, only 150 respondents received the survey. Among the countries listed, six African nations participated, including South Africa, Botswana, Uganda, Tanzania, Ghana, and Nigeria. According to Pornchokchai (2022a), there are currently five factors that affect the valuation profession: technology, data and research, methodologies, internal factors within the profession and external factors. Valuers feel threatened by the advent of modern technology such as AI and AVMs, which poses a significant challenge to them (Pornchokchai, 2022a). As a result, embracing technology in the future is crucial, enhancing the client's experience, ensuring independence and objectivity, being aware of liability, reducing turnaround times, and updating skill sets. According to Pornchokchai (2022a; 2022b), technology will take over the valuation process in the next 10 years.

In other words, technology will take over writing valuation reports and drafting leases and contracts. The professional needs to adapt to modern technology to survive in the current competitive market changed by the growing use of technology to advance the valuation profession (Pornchokchai, 2022b). Some valuers still feel threatened by the use of AVMs and do not believe in it (Boshoff and De Kock, 2013). Notwithstanding,

the opportunity presented using AVMs, which is used wisely, can complement the value, especially in modern days, where technology is preferred. Therefore, the valuer will have a valid verified valuation report (Bidanset, 2014; Krause *et al.*, 2020).

According to Doumpos *et al.* (2021), AVMs are used widely to provide property price estimates. The following are identified as drivers of using AVMs: speed, cost, scale, and consistency. The AVMs are not 100% automated as may be suggested and are hybrid with a mixture of human interaction and using reliable data. In some cases, it is used to support the valuation or a second opinion on valuation per se. Most importantly, the issue of scale and speed are the drivers of AVMs, most clients want instant results, and AVMs can provide that.

2.6 SUMMARY

Automated valuation models (AVMs) have long been used for limited purposes in various countries, including South Africa. The Covid-19 pandemic has forced many valuers to adopt AVMs and reconsider traditional valuation methods. The Fourth Industrial Revolution has had a global impact on real estate and the valuation profession, but the use of AVM in South Africa remains limited. Although there are concerns about accuracy due to the inability to inspect properties physically, AVMs are commonly used and trusted in the UK, US, Asia, and Australia as a cost-effective and time-efficient option.

AVMs are becoming increasingly popular in Europe, Asia, and America. They are faster and cheaper than traditional methods and less influenced by human error or bias. Although, there are concerns about their reliability and precision. AVMs are helpful for making informed decisions by buyers and sellers, and financial institutions can use them to estimate collateral on residential property mortgage loans. AVMs require high-quality data and work best with widely traded homogeneous assets. Despite the risks, AVMs are considered an excellent choice for assessing the value of residential properties. In view of the above literature reviewed, the future of the valuers remains safe so far due to the above expressed limitation, which confirms that the AVMs without human interaction will not be subjective.

3. RESEARCH METHODOLOGY

3.1 INTRODUCTION

Research findings rely significantly on the methodology employed, which reinforces credibility to the results (Melissa, 2002). Purposeful activity towards a specified end is necessary for successful research. The suggested method for efficient planning is interpretive, acknowledging that the question asked ultimately shapes the answer. This approach allows for adaptability within a defined working structure (Melissa, 2002).

This chapter presents a comprehensive overview of the research plan. This includes a detailed description of philosophy, strategy, method, and approach. The methods used for data collection, sample selection, and the research process are described below. Furthermore, the author provides valuable information on the type of data analysis used, ethical considerations, and any limitations of the research project.

Essentially It outlines how the research was conducted. In doing so, the research onion was adopted, as depicted in the Figure1 below:

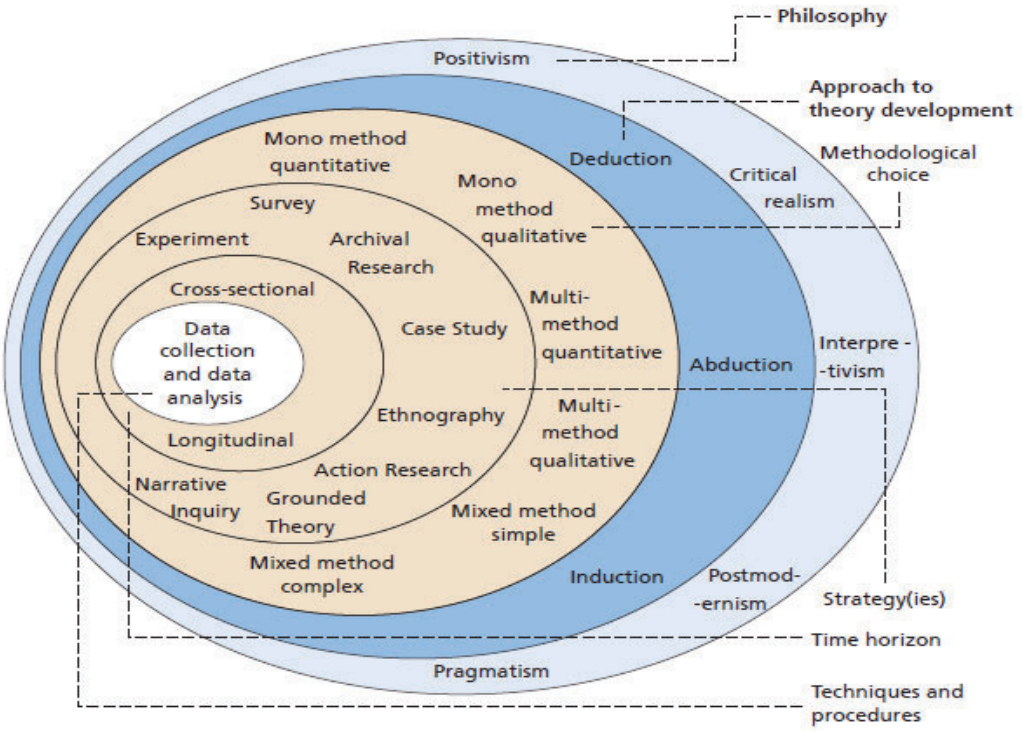

Figure 1: Research Onion (Saunders, 2019:108)

3.2 RESEARCH PURPOSE

The primary objective of this study was to establish the perception and knowledge of valuers about the use of AVMs as a preferred method of evaluating residential properties. Moreover, it demonstrates how valuers adapt to the evolving changes brought about by technology and the disruption caused to their traditional practices by the inception of 4IR in the form of AVMs.

3.3 RESEARCH PHILOSOPHY

The foundation of any study lies in its philosophy, which is essentially a set of beliefs that underpins the research. Research philosophy can be viewed from two perspectives, namely ontology and epistemology (Rugg and Petre, 2007; Creswell, 2013; Creswell and Creswell, 2017; Saunders, 2019). Ontology concerns the nature of reality and what we can know and understand about it. Epistemology, on the other hand, is concerned with the process of obtaining knowledge and understanding (ibid.). Although there are several research philosophies, we focus on positivism, realism, interpretivism, and pragmatism. These philosophies operate on different ontological and epistemological assumptions and provide a good starting point for understanding the spectrum of philosophies (Rugg and Petre, 2007; Creswell, 2013; Creswell and Creswell, 2017; Saunders, 2019).

The research philosophy is a set of beliefs and principles that guide a researcher's actions and interpretation of findings (Greener, 2008). Moreover, Creswell (2013) suggests that philosophical presumptions have an impact on the selection of hypotheses that steer the direction of the study. Philosophy is commonly associated with an individual's worldview and the exploration of fundamental inquiries regarding the significance of existence (Greener, 2008; Saunders and Lewis, *2012*). Moreover, Seale et al. (2003), Saunders and Lewis (2012) and Cresswell (2013) believes that the main threads of research philosophy are positivism, realism, interpretivism, and pragmatism, as they are presumed to be influential.

The philosophy mentioned above is described below as follows:

Positivism: is similar to physical and natural sciences and uses structured methods for replication and law-like generalisation (Saunders,2012). Seale et al. (2003) posits that the natural sciences accumulate facts about the world.

Realism is a philosophy that emphasises the existence of objects independent of our knowledge (Saunders, 2012; Creswell, 2003).

Interpretivism: is a research philosophy that highlights the importance of understanding the differences between individuals as social actors (Saunders, 2012; Seale et al., 2003).

Pragmatism: argues that the research questions and objectives determine the research philosophy adopted (Saunders, 2012). Creswell (2013) argues that a pragmatist perspective allows researchers to select the most appropriate technique for their inquiry, without being limited to a single philosophy or reality.

In this study, the research philosophy adopted is positivism due to, among other things, its relevance, since the primary research question is how SAPVPs adapt to the disruption caused to their traditional practices and skills by the 4IR in the form of AVMs. Moreover, the philosophy is to explore the views of the professionals practicing as valuers as to what extent they think the AVMs will positively or negatively impact their profession. Its relevance is due to a scientific approach used to identify the cause and effect of the variable to address the research question and the objectives to explore enough to establish the actual problem in this study.

Therefore, to ensure the reliability and validity of the research, researchers need to be truthful about their hypotheses from the outset because of the hermeneutic spiral. Although some researchers may view hypotheses as a logical positivist component and, therefore, avoid them, they remain a crucial aspect of the research process (Creswell and Creswell, 2017).

This study adopts an exploratory approach from a philosophical perspective. The objective was to evaluate the awareness and knowledge of the use of AVMs to appraise residential properties among South African property valuers based in Pretoria and determine how their traditional practices may be affected. The explorative approach assumes that people create and connect their unique perceptions as they engage with their surroundings, allowing for more comprehensive data collection (Leavy, 2022).

3.4 RESEARCH APPROACH/ METHOD

The approach to a research project depends on theoretical approach (Östlund et al., 2011; Saunders, 2012). The two established research approaches are deduction and induction.

This study adopts the deductive method, which has five sequential steps. You begin with the theory you want to assess and follow the steps or stages below to confirm or modify your view. A deductive approach is generally associated with positivistic philosophy and the quantitative research method (Saunders and Lewis, 2012: 108). These steps/stages entail:

a) "*defining research questions from the general theory that exists."*

b) "operationalizing these questions (i.e., specifying how the questions may be answered)."

c) "seeking answers to the questions defined in stage 1".

d) "analysing the inquiry results to determine whether it supports the theory or suggests the need for its modification."

e) "confirming or modifying the initial general theory considering the findings."

In summary, the research approach used in this study was inductive. According to this approach, researchers begin with specific observations, which produce generalised theories and conclusions drawn from research. The inductive approach was chosen because it considers the context in which the research effort was active (Saunders and Lewis, *2012;* Saunders *et al.*, 2019). Furthermore, according to Saunders and Lewis (2012), Creswell (2017), and Leavy (2017), the common research design effectively used is the quantitative, qualitative, and mixed method, which are fully described below.

The quantitative research method focuses on statistics, data collection, and generalisation. It aims to provide for objective and precise measurements to support or refute theories and hypotheses.

Qualitative research methods prioritise personal experiences and conduct in-depth analysis. They explored the meanings that individuals attach to their lives, generating significant and descriptive data through inductive designs. Although they are often

used for exploratory or descriptive research, qualitative approaches can serve other research goals.

The mixed research method combines quantitative and qualitative data to provide a holistic understanding of a subject. It employs deductive and inductive designs to generate and integrate data sets. This method helps to study complex problems and evaluate issues.

The most commonly used research approaches are (a) qualitative, (b) quantitative, and (c) mixed methods (Creswell, 2012; Creswell and Creswell, 2017; Ishtiaq, 2019). Therefore, the study used a quantitative approach by preparing a semi-structured questionnaire and distributing it to the valuers. The SACPVP and SAIV facilitated the dissemination of the survey by providing a link to their members for participation. The objective of this method was to gauge valuers' perspectives on using AVMs as a viable alternative for valuing residential property and to assess their understanding of the advantages and disadvantages of AVMs in today's modern valuation practices in South Africa. It is worth noting that the scope of this study was limited to the Pretoria area.

3.5 RESEARCH POPULATION AND SAMPLING STRATEGY

3.5.1 RESEARCH POPULATION

Population refers to the total count of individuals, objects, events, or organisations from which data are gathered (Parahoo, 2014). According to Creswell (2013), the population can be used to identify trends in the attitude, opinions, behaviour, or characteristics of large groups.

Moreover, according to Saunders (2012) and Creswell and Creswell (2017), the online survey is a popular choice for data collection due to its flexibility in connecting with participants. As the chosen participants had hectic schedules, the online method was the most suitable method for collecting data. Therefore, the methodology was meticulously structured to guarantee reliability and reproducibility (Creswell and Creswell, 2017).

When conducting the study, the researcher considered a number of options before deciding to choose the most appropriate tools to collect valuable data based on the

nature of the targeted participants. The study relied on the level of response of the valuers. As indicated, the research methodology adopted in this study was exploratory. The chosen research approach, quantitative research, was important in the particular survey because it involves studying a population sample to derive a quantitative or numerical description of their trends, attitudes, or opinions.

3.5.2 RESEARCH SAMPLING

3.5.2.1 Sampling Method

When working with quantitative data, it is crucial to understand that random sampling is frequently used to guarantee that everyone has an equal opportunity to be selected. This guarantees that the sample accurately represents the larger population. On the contrary, purposeful sampling is used when collecting qualitative data, where individuals are selected based on their connection to the central phenomenon. Moreover, having well-defined and comprehensive sampling procedures is strongly recommended by (Saunders and Lewis,2012; Creswell and Creswell,2017), regardless of whether gathering quantitative or qualitative data.

An extensive review of the academic literature was conducted to establish the common theme worldwide regarding AVMs, in contrast to traditional valuation. As a result, it was evident that the ideal method to adopt will be an online survey questionnaire to enable one to reach out to the targeted participant to reach out easily, as they are always on the road and having a focus group is not possible to attract enough numbers, primarily if you are not affiliated to the SACPVP and SAIV.

This was done through cross-sectional and longitudinal studies, which use questionnaires or structured interviews to collect data. The ultimate goal was to generalise the findings of the sample population to a larger population (Creswell, 2013).

3.5.2.2 Sampling Procedure

In this study, the random sampling method was adopted due to the fact that the study is quantitative and exploratory in nature. The participants were chosen specifically because of their knowledge of the subject and their expertise in the valuation profession, as the sole subject matter expert. The valuers practicing in private,

government, and financial institutions, including academics, were selected as target participants for this study, as they can provide valuable input to the study due to their knowledge and expertise in property valuation. In so doing, the researcher obtained access to these prestigious participants through the SACPVP and SAIV agreeing to distribute the survey questionnaire links to their members to enable them to respond as the only influential association in SA, which valuers are affiliated with and have a database of the professionals practicing in the country.

3.5.2.3 Sampling Size

When carrying out this study, the population size of the established targeted participants was 2178 in the nine provinces, as depicted in Table 1 below. The Gauteng Province where the study area was situated had a total of 941 sample size. While the area of study had a sample size of 110 registered valuers. Although the survey managed to elicit 22 responses, six (6) surveys were incomplete, making the viable sample size 16. Thus, the response rate was 14%. Thus the conclusion derived from the study cannot be regarded as representative of the entire sample.

Table 3: Targeted participants' statistics (SACPVP, 2023)

	Professional Valuers	Professional Associate Valuers	Candidates Valuers	Others (CSRPA)	Total per Province
Gauteng	353	294	288	6	**941**
Limpopo	29	20	30	0	**79**
Mpumalanga	33	30	27	0	**90**
Free State	29	29	29	1	**88**
North-West	14	16	22	1	**53**
Kwazulu-Natal	131	87	86	0	**304**
Eastern Cape	64	47	52	3	**166**
Western Cape	171	146	98	5	**430**
Northern Cape	11	5	11	0	**27**
TOTAL (RSA)	**835**	**674**	**643**	**16**	**2178**

Table 3a: Participants from Pretoria Statistics: Source (https://www.sacpvp.co.za, 4 November 2023)

	Professional Valuers	Professional Associate Valuers	Candidates Valuers	Others (CSRPA)	Total per Province
Pretoria_	46	31	28	5	**110**
TOTAL (RSA)	**46**	**31**	**28**	**5**	**110**

3.6 DATA COLLECTION STRATEGY

When executing the research strategy to collect data, it is essential to consider the question(s) that the study answers and ensure that it meets the research objective (Saunders, 2012). The following are the commonly used research strategies: experiments, surveys, case studies, action research, grounded theory, ethnography, archival research, and combination-combining methods. Because the quantitative approach followed, only a survey was conducted to obtain the opinions of the valuers. The benefit of this approach is that it provides objectivity and accuracy of the collected data, as there are fewer variables involved in quantitative research (Greener, 2008). The scale is more appropriate for quantitative research in which the survey is conducted online (Greener, 2008.).

The study used a survey to collect data aligned with the applied quantitative research methodology. The researcher conducted a semi structured online survey questionnaire, which was sent to valuers via SACPV and SAIV for dissemination to the practicing valuers. In addition, the study was conducted to determine the opinion and sentiments of the participants about adopting AVMs as a preferred tool to value residential properties. The questionnaire was structured to allow the participants to contribute meaningfully by adding views and selecting preferred answers. A five-point Likert scale was used to analyse the data.

In addition to the comprehensive literature review, this research was informed by previous studies conducted by esteemed scholars who delved into similar topics. These studies offered secondary data to substantiate the perspectives and insights regarding the widespread use of AVMs, further bolstering the findings of the literature review. As such, an online survey questionnaire was used to collect data to reach the ideal sample size of participants. This method was chosen due to its flexibility, cost-effectiveness, and convenience for valuers (Zikmund, 2003). Valuers can participate at their own pace and whenever they have time, without needing to be in a specific place at a specific time to participate.

3.6.1 RESEARCH INSTRUMENT

A survey was used as a research instrument in this study. The survey was conducted using a Monkey survey, in which a semi-structured questionnaire survey link was distributed to the targeted participants (valuers) through the SACPVP and SAIV communication channels, as they have a valid database of the valuers. The annex to this study is the online survey questionnaire marked **Appendix A**, which is divided into two sections, namely **Section A and Section B**.

Section A: Demographics

The purpose of this section was to establish the synopsis of the demographics of the targeted valuers, including, amongst other things, the professional status of the valuers.

Section B: Open-ended and closed questions

This section was intended to collect sufficient information regarding the hypothesis and primary objectives of the study. In so doing, the valuers were provided with a list of mixed questions incorporating open-ended and closed questions to seek their opinion on the knowledge and perception about the use of AVMs as a tool to appraise residential properties in Pretoria.

The study aimed to achieve four goals: (1) to pinpoint traditional valuation skills and processes that are at risk of being impacted by changes driven by the fourth industrial revolution (4IR), (2) to assess the level of awareness and usage of automated valuation models (AVMs) among South African property valuers for appraising residential properties, (3) to determine the degree of trust and reservations that South African property valuers have towards the use of AVMs, and (4) to investigate the extent to which the profession adapts to AVMs and other advanced technologies brought by the 4IR.

To pinpoint the traditional valuation skills and processes that are at risk of being impacted by the 4IR driven changes, the following research questions were asked: 'In *your opinion, do you think AVMs is a game changer in the valuation profession, particularly with a residential appraisal?', 'Do you think automation is the most effective way to assess residential property in modern times?' and 'What impact does the fourth industrial revolution have on the valuation profession?'.* These questions were asked

to establish the views regarding the impact of 4IR on the valuation skills possess by the current crop of valuers

To gain a better understanding of the current usage of AVMs, the researcher formulated, among other things, the following research questions in response to the objective no. 2 described above. *"As a valuer, are you ready to use the AVMs to appraise residential properties? and "What is your prior knowledge or experience about the AVMs?"* These questions were designed to assess the level of knowledge regarding the use of AVMs in contemporary times. Therefore, it was crucial that they be formulated in such a way that the participants can respond fully.

To determine the reservations and trust of the valuer in using the model to evaluate residential property, the following questions were asked. 'What *is your view on the reliability and precision of AVMs' and 'How do you perceive the use of AVMs compared to the old traditional way of evaluation?'* The literature suggests that valuers may not trust the accuracy and reliability of models used in property valuation due to factors such as an inability to physically inspect the property and insufficient data to verify information (Mooya, 2011; Boshoff and De Kock, 2013; Bellotti, 2017). The purpose of the designed questions was to test this hypothesis and gain insight into the current perspectives of the valuers regarding the results provided by automated valuation models (AVMs).

When considering the fourth objective of investigating how the profession is adapting to advanced technologies brought about by the Fourth Industrial Revolution, several questions were raised. One of these questions is whether or not the use of automated valuation models (AVMs) is impacting the valuers' profession. Additionally, it was examined whether valuers are embracing AVMs as an alternative tool for appraising residential properties and to what extent this adoption has improved their competencies. The objective of this investigation is to determine whether valuers recognise the importance of being technology-savvy in modern times, particularly when clients require instant results and financial institutions want to quickly conclude deals involving residential properties.

3.7 RESEARCH INSTRUMENT VALIDATION

In the field of research methodology, one will frequently come across the term's "validity" and "reliability". These two phrases are typically associated with measurement. The precision and consistency of measuring instruments will determine how much one can discover about the subject research, the likelihood of obtaining statistical significance in data analysis, and how much meaningful insight can be derived from the data (Leedy and Ormrod, 2010). Further, specific steps must be undertaken for the study to be reliable and accurate. A critical step was to validate the data used in the study. According to Leedy and Ormrod (2010) and Saunders and Lewis (2012), there are two crucial theories to consider when designing a research strategy: the validity and reliability of the data. These terms refer to the credibility of the research design, findings, and conclusions, respectively. To conduct credible research, it is essential to meticulously consider both validity and reliability. Validity is concerned with the precision of data collection methods in measuring their intended target. Reliability, on the other hand, guarantees consistent findings through meticulous data collection and analysis procedures (Leedy and Ormrod, 2010; Saunders and Lewis, *2012*). Therefore, it is imperative to take both factors into account to ensure precise research findings (Leedy and Ormrod, 1980; Saunders and Lewis, *2012*).

To ensure the accuracy of the study, the researcher conducted a pilot study with a select group of valuers practicing in Pretoria. The purpose of this study was to gain valuable information and confirm that the questionnaire produced answers to the research questions and met the desired objective. The valuers were specifically chosen due to their frequent collaboration with banks in the study area, allowing the researcher to determine whether the questionnaire could successfully gather the necessary information from these individuals. Through their collaboration, the questionnaire was improved by removing ambiguous questions and ensuring that the targeted participants easily understood it. This contribution increased the researcher's confidence in the outcome of the study, as the pilot successfully tested the hypothesis for validity and reliability.

3.8 DATA ANALYSIS TECHNIQUE

According to Leedy and Ormrod (2010), and Saunders and Lewis (2012), there are two types of data analysis, namely quantitative and qualitative. Quantitative analysis involves measured numerical values, while qualitative analysis does not rely on numerical values and has not been measured. Quantitative data can be further categorised into categorical data (descriptive and ranked) and numerical data (discrete and continuous). Qualitative data, on the other hand, can be divided into text data and non-text data (audio, video, and image).

For this study, the researcher used the inferential statistics analysis approach to analyse quantitative data. This technique was chosen due to its relevance to the study. As stated by Byjus (2023), statistical analysis effectively collects and examines information from a large group of participants. The researcher collected data through an online survey questionnaire using SurveyMonkey and analysed them using spreadsheet software. Graphs and tables were also used to establish the participants' views on the study, as explained by Byjus (2023). This approach was chosen because the research was quantitative and descriptive. Tables, bar graphs, pie charts, and histograms were essential tools for analysing specific data, as highlighted by (Creswell and Creswell, 2017).

3.9 RESEARCH LIMITATION

According to Dudovskiy (2022) it is normal for the research to have some limitations because it is critically important for the researcher to strive to minimise the range of scope of limitations throughout the research process. Moreover, the researcher needs to provide the acknowledgement of research limitations in the conclusions chapter honestly. Therefore, due to practical constraints, the study was unable to reach as many participants as intended, primarily due to limitations imposed by the Protection of Personal Information Act (POPI Act). The POPI Act sets specific parameters regarding the sharing or distribution of personal information to third parties without the owner's consent. As a result, the researcher was unable to have direct access to the participants. The limitation necessitated the researcher to opt for an online survey, which was found to be the best option for the targeted participants. The researcher had to rely on the services of SACPVP and SAIV to distribute the questionnaire amongst the targeted participants. These two institutions own the database of registered valuers practicing in South Africa. Therefore, it was essential to work

through them to access the targeted valuers in accordance with the POPI Act and ethical considerations.

One of the disadvantages of the study was the researcher's inability to directly write a reminder to the targeted participants from time to time to participate in the study, due to a limitation posed by the POPI Act. Additionally, this was compounded by the fact that the participants are frequently on the move, performing physical property inspections for residential and commercial valuations. As a result, their daily routine takes them out of the office, leaving them with limited time to check emails and attend to non-essential tasks. This made it difficult to get their input, mainly if they were not interested in participating voluntarily.

3.10 ETHICAL CONSIDERATION

Ethical consideration contributes meaningfully to selecting the research topic and design, attaining institutional access, collecting data, processing and storing data, analysing data, and finally writing the research findings (Saunders and Lewis, *2012*). Moreover, essential aspects of the research must be considered at the data collection stage, which are crucial to the study success, confidentiality, causing harm, data collection honesty, and compliance with data collection legislation (ibid.). the cover letter marked **Appendix B.**

Considering the above, the researcher protected the identity, privacy, confidentiality, and anonymity of all the participants in the study. Before the survey questionnaire was distributed for participation, the application for ethics clearance was made to the University of Cape Town, Ethics Committee of the Faculty of Engineering and Built Environment, for approval. As a result, approval was granted, allowing the researcher to approach the participant to participate in the study, subject to the participant's consent (**refer to Appendix C**).

Subsequently, data collection was started with the link to a survey questionnaire distributed to SACPVP and SAIV to distribute to valuers. A research instrument letter was attached to both the former and the latter. Furthermore, the valuers were required to provide consent before participating in the study, which was a more conservative approach with limited errors.

3.11 SUMMARY

This section provides an overview of the process adopted to examine the research problem. The method used in this study was quantitative and was obtained by collecting data using a semi-structured online survey. Moreover, it highlights the steps taken to validate the research and its compliance with institutional ethical conduct. As such, the following research methodology was adopted, positivism, quantitative method, online semi structure survey questionnaire and descriptive data statistics.

4. RESULTS AND DISCUSSION

4.1 INTRODUCTION

The chapter aims to provide an overview of the respondents, discuss the findings, and proved insights based on the analysis of the data collected.

4.2 PARTICIPANT DEMOGRAPHICS FINDINGS

The objective of this study was to examine the use of AVMs in valuing residential properties, focusing specifically on valuers as the target participants. Therefore, it was crucial to analyse the demographic data of the participants to establish a clear understanding of their views expressed to ensure the reliability and credibility of the collected data.

The summary of the demographics of the participants is presented in Table 4. Based on the results, the following observations are made. The majority of participants (50%) were registered as professional valuers. The age group 36-54 represents the largest group of participants (50%). The study found that most of the valuers who participated in the study work in private firms (69%) and hold an honours degree (31%). Furthermore, the majority of participants (81%) have more than 10 years of experience. In conclusion, the study confirmed that participants were highly educated, experienced professionals from private sector and dominant by middle age group.

Table 4: Participants' demographics

Moderating Factors	Demographics		
Age	Items	No	Percentage
	18-35	4	25%
	36-54	8	50%
	55-64	3	19%
	65 and above	1	6%
Level of Qualification	Matric/N6	1	6%
	National Diploma	4	25%
	Bachelor's degree / Advanced diploma	3	19%
	Honours degree/ Post Graduate Diploma	5	31%
	Master's degree	2	13%
	PHD	1	6%
Registration Category	Candidate Valuer	1	6%
	Professional Associates Valuer	7	44%
	Professional valuer	8	50%
Work Experience	0- 5 years	3	19%
	5-10 years	0	0%
	>10 years	13	81%
Employment Category	Banks& Mortgage Institutions	2	13%
	Private Firm	11	69%
	Municipality	3	19%

4.3 MAIN RESEARCH FINDINGS AND DISCUSSION

The collected data was analysed through Microsoft Excel in accordance with the following categories: (1) 4IR impact on valuation, (2) prior knowledge of using AVMs, (3) valuers' general perception about the use of the AVMs, (4) the use of AVMs as a preferred tool to appraise residential properties AVMs, and (5) the future of valuation profession.

4.3.1 FOURTH INDUSTRIAL REVOLUTION IMPACT ON VALUATION

The data presented in Table 5 demonstrate that the majority of participants agree that Cloud Computing: Internet of Things best describe the 4IR. The majority of participants who share this view were in the age group of 36-54. Both candidate valuers and professional associate valuers agree on this selection. Also, valuers with more than 10 years of experience share the same view, and the majority of the participants are employed in the private sector. Interestingly, participants with matriculation level education agree with those holding a PhD on their selection.

Table 5: The concept that best describe the fourth industrial revolution (4IR)

		According to your understanding, rank which concept best describes what you think 4IR means?					
Variables		Cloud Computing: Internet of Things	Modelling and visualization: Virtuality reality	Analysis: Machine Learning& Artificial Intelligence	Robotics: Automation	Outputs: 3D Printert & Additive manufacturing	Materials: Nano Technology
Age bands							
18-35	Mode	3	1	4	2	5	6
36-54	Mode	1	3	2	4	6	5
55-64	Mode	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
65+	Mode	4	3	2	1	5	6
Registration Status							
Candidate Valuer	Mode	1	2	3	4	N/A	5
Prof Assoc Valuer	Mode	1	3	4	4	5	6
Professional Valuer	Mode	3	3	2	1	#N/A	6
Work experience as Valuer							
0-5 years	Mode	3	1	4	2	5	6
6-9 years	Mode	no data	no data	no data	no data	no data	no data
More than 10 years	Mode	1	3	2	4	5	6
Employment Category							
Banks and Mortgage	Mode	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Municipality	Mode	3	1	4	2	5	6
Private Firm	Mode	1	3	2	4	5	6
Highest Qualification							
Matric	Mode	1	2	3	4	N/A	5
Nat Dip/ Dip	Mode	#N/A	#N/A	2	#N/A	#N/A	#N/A
Bach Degree/ Adv Dip	Mode	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Hnrs Degree/ PG Dip	Mode	3	3	#N/A	4	5	6
Masters	Mode	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
PhD	Mode	1	2	N/A	N/A	N/A	5
Total	Mode	1	3	2	4	5	6

Note: N/A means that the respondents did not have a common response (rank)

Table 6 indicates that most participants agree that the impact of the 4IR will not be severe, with a 50% chance of impact (dominated by participants with National Diploma and Batchelor Degree). In contrast, 31% of respondents believe that the impact of 4IR will be severe, ranging from 90% to 100%. It is worth noting that the majority of these respondents hold an Honours degree.

Table 6: Impact 41R have on the valuation profession based on Qualification

		What impact does the fourth industrial revolution have on the valuation profession?													
Highest Qualification		50%	%	60%	%	70%	%	80%	%	90%	%	100%	%	Total	%
Matric	n	0	0,0%	0	0,0%	1	100,0%	0	0,0%	0	0,0%	0	0,0%	1	100,0%
	%	0,0%		0,0%		33,3%		#DIV/0!		0,0%		0,0%		6,3%	
Nat Dip/ Dip	n	3	75,0%	0	0,0%	1	25,0%	0	0,0%	0	0,0%	0	0,0%	4	100,0%
	%	50,0%		0,0%		33,3%		#DIV/0!		0,0%		0,0%		25,0%	
Bachelor Degree/ Adv Dip	n	2	66,7%	1	33,3%	0	0,0%	0	0,0%	0	0,0%	0	0,0%	3	100,0%
	%	33,3%		50,0%		0,0%		#DIV/0!		0,0%		0,0%		18,8%	
Honours Degree/ PG Dip	n	1	20,0%	0	0,0%	0	0,0%	0	0,0%	2	40,0%	2	40,0%	5	100,0%
	%	16,7%		0,0%		0,0%		#DIV/0!		100,0%		66,7%		31,3%	
Masters	n	0	0,0%	1	50,0%	0	0,0%	0	0,0%	0	0,0%	1	50,0%	2	100,0%
	%	0,0%		50,0%		0,0%		#DIV/0!		0,0%		33,3%		12,5%	
PhD	n	0	0,0%	0	0,0%	1	100,0%	0	0,0%	0	0,0%	0	0,0%	1	100,0%
	%	0,0%		0,0%		33,3%		#DIV/0!		0,0%		0,0%		6,3%	
Total	n	6	37,5%	2	12,5%	3	18,8%	0	0,0%	2	12,5%	3	18,8%	16	100,0%
	%	100,0%		100,0%		100,0%		#DIV/0!		100,0%		100,0%		100,0%	

Table 7, indicates that a majority of participants in the age group of 36-54 believe that the impact of the 4IR on the valuation profession will be moderate, with a percentage of 50%. Moreover, the survey results revealed that the younger generation is more optimistic, with majority of them believing that the impact will be severe at 100%, compared to their older counterparts.

Table 7: Impact 41R have on the valuation profession based on Age group

		What impact does the fourth industrial revolution have on the valuation profession?													
Age bands		50%	%	60%	%	70%	%	80%	%	90%	%	100%	%	Total	%
18-35	n	1	25,0%	0	0,0%	0	0,0%	0	0,0%	0	0,0%	3	75,0%	4	100,0%
	%	16,7%		0,0%		0,0%		#DIV/0!		0,0%		100,0%		25,0%	
36-54	n	4	50,0%	1	12,5%	1	12,5%	0	0,0%	2	25,0%	0	0,0%	8	100,0%
	%	66,7%		50,0%		33,3%		#DIV/0!		100,0%		0,0%		50,0%	
55-64	n	1	33,3%	1	33,3%	1	33,3%	0	0,0%	0	0,0%	0	0,0%	3	100,0%
	%	16,7%		50,0%		33,3%		#DIV/0!		0,0%		0,0%		18,8%	
65+	n	0	0,0%	0	0,0%	1	100,0%	0	0,0%	0	0,0%	0	0,0%	1	100,0%
	%	0,0%		0,0%		33,3%		#DIV/0!		0,0%		0,0%		6,3%	
Total	n	6	37,5%	2	12,5%	3	18,8%	0	0,0%	2	12,5%	3	18,8%	16	100,0%
	%	100,0%		100,0%		100,0%		#DIV/0!		100,0%		100,0%		100,0%	

Based on Table 8, it was found that a majority of participants from the private sector think that the 4IR will have a minor impact (50%) on the valuation profession. On the other hand, fewer participants from the municipality sector are convinced. although, across all employment categories, fewer participants believe that the impact will be severe (100%).

Table 8: Impact 41R have on the valuation profession based on Employment

		What impact does the fourth industrial revolution have on the valuation profession?													
Employment Category		50%	%	60%	%	70%	%	80%	%	90%	%	100%	%	Total	%
Banks and Mortgage Instiutions	n	0	0,0%	0	0,0%	1	50,0%	0	0,0%	0	0,0%	1	50,0%	2	100,0%
	%	0,0%		0,0%		33,3%		#DIV/0!		0,0%		33,3%		12,5%	
Municipality	n	2	66,7%	0	0,0%	0	0,0%	0	0,0%	0	0,0%	1	33,3%	3	100,0%
	%	33,3%		0,0%		0,0%		#DIV/0!		0,0%		33,3%		18,8%	
Private Firm	n	4	36,4%	2	18,2%	2	18,2%	0	0,0%	2	18,2%	1	9,1%	11	100,0%
	%	66,7%		100,0%		66,7%		#DIV/0!		100,0%		33,3%		68,8%	
Total	n	6	37,5%	2	12,5%	3	18,8%	0	0,0%	2	12,5%	3	18,8%	16	100,0%
	%	100,0%		100,0%		100,0%		#DIV/0!		100,0%		100,0%		100,0%	

Based on Table 9, it can be inferred that a significant proportion of professional valuers and professional associate valuers anticipate that the 4IR will have a moderate impact on the valuation profession, with 37% of the respondents sharing this view. Although, a small minority of professional valuers believe that the impact will be severe, placing it at 100%. Conversely, across the registration status, the opinion is that the impact will be moderate to high, estimated at 70%.

Table 9: Impact 41R have on the valuation profession based on Registration

		What impact does the fourth industrial revolution have on the valuation profession?													
Registration Status		50%	%	60%	%	70%	%	80%	%	90%	%	100%	%	Total	%
Candidate Valuer	n	0	0,0%	0	0,0%	1	100,0%	0	0,0%	0	0,0%	0	0,0%	1	100,0%
	%	0,0%		0,0%		33,3%		#DIV/0!		0,0%		0,0%		6,3%	
Professional Associate Valuer	n	3	42,9%	1	14,3%	1	14,3%	0	0,0%	1	14,3%	1	14,3%	7	100,0%
	%	50,0%		50,0%		33,3%		#DIV/0!		50,0%		33,3%		43,8%	
Professional Valuer	n	3	37,5%	1	12,5%	1	12,5%	0	0,0%	1	12,5%	2	25,0%	8	100,0%
	%	50,0%		50,0%		33,3%		#DIV/0!		50,0%		66,7%		50,0%	
Total	n	6	37,5%	2	12,5%	3	18,8%	0	0,0%	2	12,5%	3	18,8%	16	100,0%
	%	100,0%		100,0%		100,0%		#DIV/0!		100,0%		100,0%		100,0%	

DISCUSSIONS

From analysis of this study, the majority of the participants concur that the 4IR will have an impact on the valuation profession. although the impact is regarded as not severe. The following reasons were provided for their expressed views: first, the lack of competition and innovative initiatives in AVMs means that traditional valuation still plays a crucial role, although proper assessment should be considered. Second, the profession has not kept up with technological advancements; the same sentiments were echoed by (Wilkinson, 2018a; Wilkinson,2018b; Moghayedi *et al.*, 2020), leading to a lack of interest from younger valuers and contrast with other industries. Third, the human aspect is essential in valuation, including physical inspection; the same views were expressed by (Mooya, 2011; Boshoff and De Kock, 2013; Nguyen, 2019b). Although AVMs are useful for residential and bulk valuations, such as municipal valuation rolls, human interaction is still necessary for data validation and verification through physical property inspections (ibid.). Although modernisation is not necessarily necessary, human factors cannot be overlooked.

The above expressed results are consistent with the opinions expressed in the literature by (Mooya, 2011; Boshoff and De Kock ,2013; Nguyen,2019a). It is worth noting that the older generation's hesitation towards adopting AVMs stems from their desire to maintain their existing skills and expertise. Nevertheless, with proper training and guidance, it is possible to ease their transition into the realm of automation.

4.3.2 PRIOR KNOWLEDGE OF USING AVMs

Based on the information provided in Table 10, it can be inferred that 50% of the participants possess a commendable understanding of AVMs. It is noteworthy that most of the individuals who have knowledge of using AVMs hold an Honours Degree ah have a work experience of less than five years. Surprisingly, 31% of the respondents who have an experience of over 10 years also possess prior knowledge of using AVMs dominated by participants with Bachelor Degree.

Table 10: Participants knowledge/experience about AVMs based on Qualification

		What is your prior knowledge or experience about AVMs?							
Highest Qualification		Less than 5 years	%	5-10 years	%	More than 10 years	%	Total	%
Matric	n	1	100,0%	0	0,0%	0	0,0%	1	100,0%
	%	12,5%		0,0%		0,0%		6,3%	
Nat Dip/ Dip	n	1	25,0%	2	50,0%	1	25,0%	4	100,0%
	%	12,5%		66,7%		20,0%		25,0%	
Bachelor Degree/ Adv Dip	n	1	33,3%	0	0,0%	2	66,7%	3	100,0%
	%	12,5%		0,0%		40,0%		18,8%	
Honours Degree/ PG Dip	n	4	80,0%	0	0,0%	1	20,0%	5	100,0%
	%	50,0%		0,0%		20,0%		31,3%	
Masters	n	1	50,0%	0	0,0%	1	50,0%	2	100,0%
	%	12,5%		0,0%		20,0%		12,5%	
PhD	n	0	0,0%	1	100,0%	0	0,0%	1	100,0%
	%	0,0%		33,3%		0,0%		6,3%	
Total	n	8	50,0%	3	18,8%	5	31,3%	16	100,0%
	%	100,0%		100,0%		100,0%		100,0%	

Table 11 provides information on the participants' comprehension and familiarity with AVMS. It appears that the majority of participants in the age group of 36-54 have a good understanding of AVMs, particularly those with less than 5 years of experience, followed by those with more than 10 years of experience. It is interesting to note that both older participants (55-64) and younger ones (18-35) have some knowledge about AVMs.

Table 11: Participants knowledge/experience about AVMs based on Age group

		What is your prior knowledge or experience about AVMs?							
Age bands		Less than 5 years	%	5-10 years	%	More than 10 years	%	Total	%
18-35	n	3	75,0%	0	0,0%	1	25,0%	4	100,0%
	%	37,5%		0,0%		20,0%		25,0%	
36-54	n	4	50,0%	1	12,5%	3	37,5%	8	100,0%
	%	50,0%		33,3%		60,0%		50,0%	
55-64	n	1	33,3%	1	33,3%	1	33,3%	3	100,0%
	%	12,5%		33,3%		20,0%		18,8%	
65+	n	0	0,0%	1	100,0%	0	0,0%	1	100,0%
	%	0,0%		33,3%		0,0%		6,3%	
Total	n	8	50,0%	3	18,8%	5	31,3%	16	100,0%
	%	100,0%		100,0%		100,0%		100,0%	

Based on the information presented in Table 12, it can be inferred that individuals with less than five years of experience and those with more than 10 years of experience in the private sector have a superior comprehension of AVMs as compared to those who work in municipalities and financial institutions.

Table 12: Participants knowledge/experience about AVMs based on Employment

		What is your prior knowledge or experience about AVMs?							
Employment Category		Less than 5 years	%	5-10 years	%	More than 10 years	%	Total	%
Banks and Mortgage Instiutions	n	1	50,0%	1	50,0%	0	0,0%	2	100,0%
	%	12,5%		25,0%		0,0%		12,5%	
Municipality	n	2	66,7%	0	0,0%	1	33,3%	3	100,0%
	%	25,0%		0,0%		25,0%		18,8%	
Private Firm	n	5	45,5%	3	27,3%	3	27,3%	11	100,0%
	%	62,5%		75,0%		75,0%		68,8%	
Total	n	8	50,0%	4	25,0%	4	25,0%	16	100,0%
	%	100,0%		100,0%		100,0%		100,0%	

The data presented in Table 13 shows that most participants with prior knowledge of using the model have less than five years of experience and more than ten years of experience. The majority being the professional associates' valuers, followed by the professional valuers. It is interesting to note that some participants with 5-10 years of experience also have prior knowledge, especially professional valuers.

Table 13: Participants knowledge/experience about AVMs based on Registration

		What is your prior knowledge or experience about AVMs?							
Registration Status		Less than 5 years	%	5-10 years	%	More than 10 years	%	Total	%
Candidate Valuer	n	1	100,0%	0	0,0%	0	0,0%	1	100,0%
	%	12,5%		0,0%		0,0%		6,3%	
Professional Associate Valuer	n	4	57,1%	1	14,3%	2	28,6%	7	100,0%
	%	50,0%		33,3%		40,0%		43,8%	
Professional Valuer	n	3	37,5%	2	25,0%	3	37,5%	8	100,0%
	%	37,5%		66,7%		60,0%		50,0%	
Total	n	8	50,0%	3	18,8%	5	31,3%	16	100,0%
	%	100,0%		100,0%		100,0%		100,0%	

Table 14 displays data shows that participants across all the qualification except those with matric certificate are knowledgeable about AVMs. Moreover, 12% of the participants extremely knowledgeable about the model, in particular those who have Batchelors Degree and Masters Degree. On the other hand, 37% of the participants are somewhat knowledgeable, particularly those who holds Honours Degree and National Diploma.

Table 14: Participants knowledgeable about AVMs based on Qualification

		How knowledgeable are you about AVMs?							
Highest Qualification		Somewhat Knowledgeable	%	Knowledgeable	%	Extremely Knowledgeable	%	Total	%
Matric	n	1	100,0%	0	0,0%	0	0,0%	1	100,0%
	%	16,7%		0,0%		0,0%		6,3%	
Nat Dip/ Dip	n	2	50,0%	2	50,0%	0	0,0%	4	100,0%
	%	33,3%		25,0%		0,0%		25,0%	
Bachelor Degree/ Adv Dip	n	0	0,0%	2	66,7%	1	33,3%	3	100,0%
	%	0,0%		25,0%		50,0%		18,8%	
Honours Degree/ PG Dip	n	3	60,0%	2	40,0%	0	0,0%	5	100,0%
	%	50,0%		25,0%		0,0%		31,3%	
Masters	n	0	0,0%	1	50,0%	1	50,0%	2	100,0%
	%	0,0%		12,5%		50,0%		12,5%	
PhD	n	0	0,0%	1	100,0%	0	0,0%	1	100,0%
	%	0,0%		12,5%		0,0%		6,3%	
Total	n	6	37,5%	8	50,0%	2	12,5%	16	100,0%
	%	100,0%		100,0%		100,0%		100,0%	

Based on the data provided in Table 15, it appears that a significant percentage (62%) of those who are knowledgeable about AVMs are between the ages of 18-35 and 36-54. In contrast, 31% of participants have only some knowledge, with the majority falling within the 36-54 age range. This was an intriguing finding. Moreover, it is important to note that both younger and middle-aged individuals demonstrate familiarity with this model.

Table15: Participants knowledgeable about AVMs based on Age group

		How knowledgeable are you about AVMs?							
Age bands		Somewhat Knowledgeable	%	Knowledgeable	%	Extremely Knowledgeable	%	Total	%
18-35	n	0	0,0%	4	100,0%	0	0,0%	4	100,0%
	%	0,0%		40,0%		0,0%		25,0%	
36-54	n	4	50,0%	4	50,0%	0	0,0%	8	100,0%
	%	80,0%		40,0%		0,0%		50,0%	
55-64	n	1	33,3%	1	33,3%	1	33,3%	3	100,0%
	%	20,0%		10,0%		100,0%		18,8%	
65+	n	0	0,0%	1	100,0%	0	0,0%	1	100,0%
	%	0,0%		10,0%		0,0%		6,3%	
Total	n	5	31,3%	10	62,5%	1	6,3%	16	100,0%
	%	100,0%		100,0%		100,0%		100,0%	

According to Table 16, 56% of the participants have knowledge about AVMs and 6% are extremely knowledgeable. This means that the majority of the participants are familiar with the model, especially those who work in the private sector and municipality. It is worth noting that there is also a considerable number of participants who are somewhat knowledgeable, particularly from the private sector.

Table 16: Participants knowledgeable about AVMs based on Employment

		How knowledgeable are you about AVMs?							
Employment Category		Somewhat Knowledgeable	%	Knowledgeable	%	Extremely Knowledgeable	%	Total	%
Banks and Mortgage Instiutions	n	1	50,0%	1	50,0%	0	0,0%	2	100,0%
	%	16,7%		11,1%		0,0%		12,5%	
Municipality	n	0	0,0%	3	100,0%	0	0,0%	3	100,0%
	%	0,0%		33,3%		0,0%		18,8%	
Private Firm	n	5	45,5%	5	45,5%	1	9,1%	11	100,0%
	%	83,3%		55,6%		100,0%		68,8%	
Total	n	6	37,5%	9	56,3%	1	6,3%	16	100,0%
	%	100,0%		100,0%		100,0%		100,0%	

Table 17 below demonstrate that proportional number of the participants are knowledgeable about the AVMs (56%). It is quite interesting to note that the majority of participants are dominated by the professional valuers, closely followed by professional associate valuers (who deem themselves more knowledgeable than professional valuers 5 out of 7 versus 4 out of 8).

Table 17: Participants Knowledgeable about AVMs based on Registration

		How knowledgeable are you about AVMs?							
Registration Status		Somewhat Knowledgeable	%	Knowledgeable	%	Extremely Knowledgeable	%	Total	%
Candidate Valuer	n	1	100,0%	0	0,0%	0	0,0%	1	100,0%
	%	16,7%		0,0%		0,0%		6,3%	
Professional Associate Valuer	n	2	28,6%	5	71,4%	0	0,0%	7	100,0%
	%	33,3%		55,6%		0,0%		43,8%	
Professional Valuer	n	3	37,5%	4	50,0%	1	12,5%	8	100,0%
	%	50,0%		44,4%		100,0%		50,0%	
Total	n	6	37,5%	9	56,3%	1	6,3%	16	100,0%
	%	100,0%		100,0%		100,0%		100,0%	

DISCUSSIONS

The following questions were asked to establish amongst other the prior knowledge oof using the AVMs and the to what extent the knowledge is exposed with AVMs

1. *"What is your prior knowledge/experience using the AVMs":*
2. *"How knowledgeable are you about AVMs"*

Based on the tables presented above, it is evident that a majority of the participants have prior experience in using AVMS. The data confirms that most participants are knowledgeable about the use of AVMS. Interestingly, the majority of experienced and knowledgeable participants are from the private sector, and predominantly professional valuers, belonging to the age group of 36-54. It is also noteworthy that participants with Honours Degrees, have expressed familiarity with the use of the model.

The above analysis indicates that the use of AVMs is gradually gaining popularity in the valuation profession. The study further revealed that participants with higher levels

of education were better represented in the study, as compared to a similar study conducted by (Boshoff and De Kock, 2013), which had a majority of lesser-educated participants.

4.3.3 VALUERS`GENERAL PERCEPTION ON THE USE OF AVMs

According to Table 18, 31% of participants believe that automation is the most effective method for appraising residential properties in today's world. On the other hand, 25% of participants are unsure, while another 25% disagree. It is worth noting that most participants with a Bachelor's Degree support the implementation of automation, while the majority of those holding a National Diploma disagree. Additionally, a significant number of participants across the board remain neutral, except for those with a National Diploma and PhD.

Table 18: Automation of residential properties valuation based on Qualification

		Do you think automation is the most effective way of appraising residential property in modern times?											
Highest Qualification		Strongly Disagree	%	Disagree	%	Neutral	%	Agree	%	Strongly Agree	%	Total	%
Matric	n	0	0,0%	0	0,0%	1	100,0%	0	0,0%	0	0,0%	1	100,0%
	%	0,0%		0,0%		25,0%		0,0%		0,0%		6,3%	
Nat Dip/ Dip	n	1	25,0%	2	50,0%	0	0,0%	1	25,0%	0	0,0%	4	100,0%
	%	50,0%		50,0%		0,0%		20,0%		0,0%		25,0%	
Bachelor Degree/ Adv Dip	n	0	0,0%	0	0,0%	1	33,3%	2	66,7%	0	0,0%	3	100,0%
	%	0,0%		0,0%		25,0%		40,0%		0,0%		18,8%	
Honours Degree/ PG Dip	n	1	20,0%	1	20,0%	1	20,0%	1	20,0%	1	20,0%	5	100,0%
	%	50,0%		25,0%		25,0%		20,0%		100,0%		31,3%	
Masters	n	0	0,0%	0	0,0%	1	50,0%	1	50,0%	0	0,0%	2	100,0%
	%	0,0%		0,0%		25,0%		20,0%		0,0%		12,5%	
PhD	n	0	0,0%	1	100,0%	0	0,0%	0	0,0%	0	0,0%	1	100,0%
	%	0,0%		25,0%		0,0%		0,0%		0,0%		6,3%	
Total	n	2	12,5%	4	25,0%	4	25,0%	5	31,3%	1	6,3%	16	100,0%
	%	100,0%		100,0%		100,0%		100,0%		100,0%		100,0%	

According to the data presented in Table 19, it can be observed that the majority of the participants who believe that automation is the most cost-effective method of appraising residential properties fall in the age group of 18-35. Conversely, half of the participants belonging to the age group of 36-54 remain neutral on this issue. Furthermore, 25% of the participants across all age groups disagree with this notion.

Table 19: Automation of residential properties valuation based on Age group

		Do you think automation is the most effective way of appraising residential property in modern times?											
Age bands		Strongly Disagree	%	Disagree	%	Neutral	%	Agree	%	Strongly Agree	%	Total	%
18-35	n	0	0,0%	1	25,0%	0	0,0%	2	50,0%	1	25,0%	4	100,0%
	%	0,0%		25,0%		0,0%		40,0%		100,0%		25,0%	
36-54	n	1	12,5%	1	12,5%	4	50,0%	2	25,0%	0	0,0%	8	100,0%
	%	50,0%		25,0%		100,0%		40,0%		0,0%		50,0%	
55-64	n	1	33,3%	1	33,3%	0	0,0%	1	33,3%	0	0,0%	3	100,0%
	%	50,0%		25,0%		0,0%		20,0%		0,0%		18,8%	
65+	n	0	0,0%	1	100,0%	0	0,0%	0	0,0%	0	0,0%	1	100,0%
	%	0,0%		25,0%		0,0%		0,0%		0,0%		6,3%	
Total	n	2	12,5%	4	25,0%	4	25,0%	5	31,3%	1	6,3%	16	100,0%
	%	100,0%		100,0%		100,0%		100,0%		100,0%		100,0%	

Table 20 illustrates that most participants who agree with the idea that automation is the most effective way of appraising residential properties in modern times are from private firms. In contrast, it is worth noting that the majority of participants from private firms actually disagree with the idea. Thus, across all employment categories, participants generally tend to agree with the notion.

Table 20: Automation of residential properties valuation based on Employment

		Do you think automation is the most effective way of appraising residential property in modern times?											
Employment Category		Strongly Disagree	%	Disagree	%	Neutral	%	Agree	%	Strongly Agree	%	Total	%
Banks and Mortgage Instiutions	n	0	0,0%	0	0,0%	1	50,0%	1	50,0%	0	0,0%	2	100,0%
	%	0,0%		0,0%		25,0%		20,0%		0,0%		12,5%	
Municipality	n	0	0,0%	0	0,0%	1	33,3%	1	33,3%	1	33,3%	3	100,0%
	%	0,0%		0,0%		25,0%		20,0%		100,0%		18,8%	
Private Firm	n	2	18,2%	4	36,4%	2	18,2%	3	27,3%	0	0,0%	11	100,0%
	%	100,0%		100,0%		50,0%		60,0%		0,0%		68,8%	
Total	n	2	12,5%	4	25,0%	4	25,0%	5	31,3%	1	6,3%	16	100,0%
	%	100,0%		100,0%		100,0%		100,0%		100,0%		100,0%	

The data presented in Table 21 demonstrates that most of the participants who believe that automation is the most effective way of appraising residential properties are professional valuers. Interestingly, the majority of those who disagree with this notion are also professional valuers. The analysis confirms that the majority agrees with the notion, while fewer disagree, and an equal number remain neutral.

Table 21: Automation of residential properties valuation based on Registration

		Do you think automation is the most effective way of appraising residential property in modern times?											
Registration Status		Strongly Disagree	%	Disagree	%	Neutral	%	Agree	%	Strongly Agree	%	Total	%
Candidate Valuer	n	0	0,0%	0	0,0%	1	100,0%	0	0,0%	0	0,0%	1	100,0%
	%	0,0%		0,0%		25,0%		0,0%		0,0%		6,3%	
Professional Associate Valuer	n	2	28,6%	1	14,3%	2	28,6%	1	14,3%	1	14,3%	7	100,0%
	%	100,0%		25,0%		50,0%		20,0%		100,0%		43,8%	
Professional Valuer	n	0	0,0%	3	37,5%	1	12,5%	4	50,0%	0	0,0%	8	100,0%
	%	0,0%		75,0%		25,0%		80,0%		0,0%		50,0%	
Total	n	2	12,5%	4	25,0%	4	25,0%	5	31,3%	1	6,3%	16	100,0%
	%	100,0%		100,0%		100,0%		100,0%		100,0%		100,0%	

Table 22 below indicate that majority of the participants believe that the AVMs is somewhat reliable and accurate (69%), whereas 19% said it is reliable and accurate thereof. Interesting, the majority of those who lean toward the somewhat reliable and accurate are holding Honours Degree and National Diploma.

Table 22: AVMs reliability and accuracy based on Qualification

		What is your view regarding the reliability and accuracy of AVMs?							
Highest Qualification		Unreliable and inaccurate	%	Somewhat reliable and accurate	%	Reliable and accurate	%	Total	%
Matric	n	0	0,0%	1	100,0%	0	0,0%	1	100,0%
	%	0,0%		9,1%		0,0%		6,3%	
Nat Dip/ Dip	n	1	25,0%	3	75,0%	0	0,0%	4	100,0%
	%	50,0%		27,3%		0,0%		25,0%	
Bachelor Degree/ Adv Dip	n	0	0,0%	1	33,3%	2	66,7%	3	100,0%
	%	0,0%		9,1%		66,7%		18,8%	
Honours Degree/ PG Dip	n	1	20,0%	3	60,0%	1	20,0%	5	100,0%
	%	50,0%		27,3%		33,3%		31,3%	
Masters	n	0	0,0%	2	100,0%	0	0,0%	2	100,0%
	%	0,0%		18,2%		0,0%		12,5%	
PhD	n	0	0,0%	1	100,0%	0	0,0%	1	100,0%
	%	0,0%		9,1%		0,0%		6,3%	
Total	n	2	12,5%	11	68,8%	3	18,8%	16	100,0%
	%	100,0%		100,0%		100,0%		100,0%	

Table 23 shows that most people aged 36-54 find AVMs somewhat reliable and accurate. Younger participants (18-35) make up only 19% of those who deem AVMs unreliable. Meanwhile, 12% of participants aged 36-54 and above 65 find AVMs unreliable. Despite this, most participants still believe in the model.

Table 23: AVMs reliability and accuracy based on Age group

		What is your view regarding the reliability and accuracy of AVMs?							
Age bands		Unreliable and inaccurate	%	Somewhat reliable and accurate	%	Reliable and accurate	%	Total	%
18-35	n	0	0,0%	2	50,0%	2	50,0%	4	100,0%
	%	0,0%		18,2%		66,7%		25,0%	
36-54	n	1	12,5%	7	87,5%	0	0,0%	8	100,0%
	%	50,0%		63,6%		0,0%		50,0%	
55-64	n	0	0,0%	2	66,7%	1	33,3%	3	100,0%
	%	0,0%		18,2%		33,3%		18,8%	
65+	n	1	100,0%	0	0,0%	0	0,0%	1	100,0%
	%	50,0%		0,0%		0,0%		6,3%	
Total	n	2	12,5%	11	68,8%	3	18,8%	16	100,0%
	%	100,0%		100,0%		100,0%		100,0%	

According to Table 24, 68% of the participants believe that AVMs are somewhat reliable and accurate. A significant number of these participants are from private firms. Interestingly, a sizable number of participants from financial institutions and municipalities also agree with the views expressed by the private firm participants.

Table 24: AVMs reliability and accuracy based on Employment

		What is your view regarding the reliability and accuracy of AVMs?							
Employment Category		Unreliable and inaccurate	%	Somewhat reliable and accurate	%	Reliable and accurate	%	Total	%
Banks and Mortgage Instiutions	n	0	0,0%	2	100,0%	0	0,0%	2	100,0%
	%	0,0%		18,2%		0,0%		12,5%	
Municipality	n	0	0,0%	2	66,7%	1	33,3%	3	100,0%
	%	0,0%		18,2%		33,3%		18,8%	
Private Firm	n	2	18,2%	7	63,6%	2	18,2%	11	100,0%
	%	100,0%		63,6%		66,7%		68,8%	
Total	n	2	12,5%	11	68,8%	3	18,8%	16	100,0%
	%	100,0%		100,0%		100,0%		100,0%	

After analysing the data presented in Table 25, it can be inferred that the majority of the participants deem AVMs to be somewhat reliable and accurate. This viewpoint is shared by professional valuers and professional associates. On the other hand, a minority of the participants, mostly consisting of professional associates' valuers, consider AVMs to be reliable and accurate.

Table 25: AVMs reliability and accuracy based on Registration

		What is your view regarding the reliability and accuracy of AVMs?							
Registration Status		Unreliable and inaccurate	%	Somewhat reliable and accurate	%	Reliable and accurate	%	Total	%
Candidate Valuer	n	0	0,0%	1	100,0%	0	0,0%	1	100,0%
	%	0,0%		9,1%		0,0%		6,3%	
Professional Associate Valuer	n	1	14,3%	5	71,4%	1	14,3%	7	100,0%
	%	50,0%		45,5%		33,3%		43,8%	
Professional Valuer	n	1	12,5%	5	62,5%	2	25,0%	8	100,0%
	%	50,0%		45,5%		66,7%		50,0%	
Total	n	2	12,5%	11	68,8%	3	18,8%	16	100,0%
	%	100,0%		100,0%		100,0%		100,0%	

DISCUSSIONS

These findings demonstrate that AVMs may be useful tool in determining appraisals. The valuers have shared their perspectives on the general perception on the use of AVMs. They firmly believe that AVMs can help determine mortgage lending values and speed up the valuation process. Furthermore, the valuers expressed the importance of collecting accurate, reliable, and sufficient data to maintain high-quality reports. They stressed that using AVMs can reduce the workload and costs of valuation. For that reason, it may also decrease the number of specialists in the field. In other words, it can take away valuers' jobs and make the profession redundant to use. Notwithstanding that, AVMs lead to fewer errors because there is less human input, which can increase the margin of error. It is important to note that AVMs should only be used for homogeneous properties to minimise risks. Previous scholars also support this viewpoint (Mooya, 2016; Doumpos *et al.*, 2021; Knight, 2022).

Further discussions on the reliability and accuracy of the AVMs, the participating valuers who believe that the model is somewhat accurate and reliable provided the following notable views:

1. *"Any AVMS is about data. General data and tailored data. If the data and the data reader is not designed to generate information and result from the information populated, the accuracy will be in dispute."*
2. *"The technical inspection of properties remains an important part that AVM does not address, and given the age profile of most bonded properties in SA, AVMs will take time to gain traction"*
3. *"A good analyst may provide single point estimate closer to opinion of value"*
4. *"Condition of a building cannot be accurately assessed without a proper inspection"*
5. *"AVM omit the human factor in condition and use of properties which can in the long-run expose risks that could have been prevented."*
6. *"It's depends on the data collected, if data is correct the end product will be accurate"*

4.3.4 USE OF AVMs AS A PREFERRED TOOL TO APPRAISE RESIDENTIAL PROPERTIES

The data presented in Table 26 shows that most of the participants agreeing that AVMs will have prospect of succeeding in the South African (SA) property market. The majority of these participants have a National Diploma, followed by those with an Honours Degree. Overall, most participants are optimistic about the model's success.

Table 26: Adoption of the AVMs for residential properties valuation by-Qualification

		Do you think the adoption of AVMs as a preferred method of appraising residential properties has a prospect to succeed in the South African property market?											
Highest Qualification		Strongly Disagree	%	Disagree	%	Neutral	%	Agree	%	Strongly Agree	%	Total	%
Matric	n	0	0,0%	0	0,0%	1	100,0%	0	0,0%	0	0,0%	1	100,0%
	%	0,0%		#DIV/0!		20,0%		0,0%		0,0%		6,3%	
Nat Dip/ Dip	n	1	25,0%	0	0,0%	0	0,0%	3	75,0%	0	0,0%	4	100,0%
	%	50,0%		#DIV/0!		0,0%		50,0%		0,0%		25,0%	
Bachelor Degree/ Adv Dip	n	0	0,0%	0	0,0%	2	66,7%	0	0,0%	1	33,3%	3	100,0%
	%	0,0%		#DIV/0!		40,0%		0,0%		33,3%		18,8%	
Honours Degree/ PG Dip	n	1	20,0%	0	0,0%	0	0,0%	2	40,0%	2	40,0%	5	100,0%
	%	50,0%		#DIV/0!		0,0%		33,3%		66,7%		31,3%	
Masters	n	0	0,0%	0	0,0%	1	50,0%	1	50,0%	0	0,0%	2	100,0%
	%	0,0%		#DIV/0!		20,0%		16,7%		0,0%		12,5%	
PhD	n	0	0,0%	0	0,0%	1	100,0%	0	0,0%	0	0,0%	1	100,0%
	%	0,0%		#DIV/0!		20,0%		0,0%		0,0%		6,3%	
Total	n	2	12,5%	0	0,0%	5	31,3%	6	37,5%	3	18,8%	16	100,0%
	%	100,0%		#DIV/0!		100,0%		100,0%		100,0%		100,0%	

Table 27 shows that most of the participants who agree that AVMs have the potential to succeed in the South African property market are in the age group of 36-54. Amongst the younger generation (18-35), the majority are equally divided between strongly agreeing and being neutral. It's interesting to note that only a few from the older generation agree with the majority.

Table 27: Adoption of the AVMs for residential properties valuation by Age group

		Do you think the adoption of AVMs as a preferred method of appraising residential properties has a prospect to succeed in the South African property market?											
Age bands		Strongly Disagree	%	Disagree	%	Neutral	%	Agree	%	Strongly Agree	%	Total	%
18-35	n	0	0,0%	0	0,0%	2	50,0%	0	0,0%	2	50,0%	4	100,0%
	%	0,0%		#DIV/0!		40,0%		0,0%		66,7%		25,0%	
36-54	n	1	12,5%	0	0,0%	2	25,0%	5	62,5%	0	0,0%	8	100,0%
	%	50,0%		#DIV/0!		40,0%		83,3%		0,0%		50,0%	
55-64	n	1	33,3%	0	0,0%	1	33,3%	0	0,0%	1	33,3%	3	100,0%
	%	50,0%		#DIV/0!		20,0%		0,0%		33,3%		18,8%	
65+	n	0	0,0%	0	0,0%	0	0,0%	1	100,0%	0	0,0%	1	100,0%
	%	0,0%		#DIV/0!		0,0%		16,7%		0,0%		6,3%	
Total	n	2	12,5%	0	0,0%	5	31,3%	6	37,5%	3	18,8%	16	100,0%
	%	100,0%		#DIV/0!		100,0%		100,0%		100,0%		100,0%	

Based on the data presented in Table 28 most participants agree that the AVMs has a prospect to succeed in the SA property market. The majority of those are from the private sector. Conversely, it is notable that the majority of participants from the municipality and financial institutions have remained neutral.

Table 28: Adoption of the AVMs for residential properties valuation by Employment

		Do you think the adoption of AVMs as a preferred method of appraising residential properties has a prospect to succeed in the South African property market?											
Employment Category		Strongly Disagree	%	Disagree	%	Neutral	%	Agree	%	Strongly Agree	%	Total	%
Banks and Mortgage Instiutions	n	0	0,0%	0	0,0%	2	100,0%	0	0,0%	0	0,0%	2	100,0%
	%	0,0%		#DIV/0!		40,0%		0,0%		0,0%		12,5%	
Municipality	n	0	0,0%	0	0,0%	2	66,7%	0	0,0%	1	33,3%	3	100,0%
	%	0,0%		#DIV/0!		40,0%		0,0%		33,3%		18,8%	
Private Firm	n	2	18,2%	0	0,0%	1	9,1%	6	54,5%	2	18,2%	11	100,0%
	%	100,0%		#DIV/0!		20,0%		100,0%		66,7%		68,8%	
Total	n	2	12,5%	0	0,0%	5	31,3%	6	37,5%	3	18,8%	16	100,0%
	%	100,0%		#DIV/0!		100,0%		100,0%		100,0%		100,0%	

Table 29 data shows that professional valuers believe that AVMs have a good chance of succeeding in the South African property market. While there is a general consensus among professional valuers, their level of agreement varies. On the other hand, professional associates are less likely to agree with this opinion. This difference in opinion is mainly due to the registration status. Associates have limitations on the types of properties they can value in transactions, while professionals have no such limitations.

Table 29: Adoption of the AVMs for residential properties valuation by Registration

		Do you think the adoption of AVMs as a preferred method of appraising residential properties has a prospect to succeed in the South African property market?											
Registration Status		Strongly Disagree	%	Disagree	%	Neutral	%	Agree	%	Strongly Agree	%	Total	%
Candidate Valuer	n	0	0,0%	0	0,0%	1	100,0%	0	0,0%	0	0,0%	1	100,0%
	%	0,0%		#DIV/0!		20,0%		0,0%		0,0%		6,3%	
Professional Associate Valuer	n	2	28,6%	0	0,0%	3	42,9%	1	14,3%	1	14,3%	7	100,0%
	%	100,0%		#DIV/0!		60,0%		16,7%		33,3%		43,8%	
Professional Valuer	n	0	0,0%	0	0,0%	1	12,5%	5	62,5%	2	25,0%	8	100,0%
	%	0,0%		#DIV/0!		20,0%		83,3%		66,7%		50,0%	
Total	n	2	12,5%	0	0,0%	5	31,3%	6	37,5%	3	18,8%	16	100,0%
	%	100,0%		#DIV/0!		100,0%		100,0%		100,0%		100,0%	

According to Table 30, the majority of the participants (75%) voted against the complete move to the AVMs, while 25% voted in favour of it. Interestingly, all participants across different levels of education were against the notion. Among those who opposed the idea, the majority held a National Diploma, followed by an Honours Degree. Conversely, those who supported the idea were mostly participants with a Bachelor's and Honours Degree.

Table 30: Complete move to use AVMs based on Qualification

		If you have an option to move completely to the use of AVMs to appraise residential properties, would you do so?							
Highest Qualification		No Answer	%	No	%	Yes	%	Total	%
Matric	n	0	0,0%	1	100,0%	0	0,0%	1	100,0%
	%	#DIV/0!		8,3%		0,0%		6,3%	
Nat Dip/ Dip	n	0	0,0%	4	100,0%	0	0,0%	4	100,0%
	%	#DIV/0!		33,3%		0,0%		25,0%	
Bachelor Degree/ Adv Dip	n	0	0,0%	1	33,3%	2	66,7%	3	100,0%
	%	#DIV/0!		8,3%		50,0%		18,8%	
Honours Degree/ PG Dip	n	0	0,0%	3	60,0%	2	40,0%	5	100,0%
	%	#DIV/0!		25,0%		50,0%		31,3%	
Masters	n	0	0,0%	2	100,0%	0	0,0%	2	100,0%
	%	#DIV/0!		16,7%		0,0%		12,5%	
PhD	n	0	0,0%	1	100,0%	0	0,0%	1	100,0%
	%	#DIV/0!		8,3%		0,0%		6,3%	
Total	n	0	0,0%	12	75,0%	4	25,0%	16	100,0%
	%	#DIV/0!		100,0%		100,0%		100,0%	

According to the data presented in Table 31, a majority of the participants, particularly those in the age group of 36-54, are not in favour of relying solely on AVMs to appraise residential properties. In fact, participants from all age groups are against this idea, even though, there is insignificant number of participants who support the complete shift to AVMs.

Table 31: Complete move to use AVMs based on Age group

		If you have an option to move completely to the use of AVMs to appraise residential properties, would you do so?							
Age bands		No Answer	%	No	%	Yes	%	Total	%
18-35	n	0	0,0%	2	50,0%	2	50,0%	4	100,0%
	%	#DIV/0!		16,7%		50,0%		25,0%	
36-54	n	0	0,0%	7	87,5%	1	12,5%	8	100,0%
	%	#DIV/0!		58,3%		25,0%		50,0%	
55-64	n	0	0,0%	2	66,7%	1	33,3%	3	100,0%
	%	#DIV/0!		16,7%		25,0%		18,8%	
65+	n	0	0,0%	1	100,0%	0	0,0%	1	100,0%
	%	#DIV/0!		8,3%		0,0%		6,3%	
Total	n	0	0,0%	12	75,0%	4	25,0%	16	100,0%
	%	#DIV/0!		100,0%		100,0%		100,0%	

Based on the data presented in Table 32, it appears that the majority of participants who are against the complete switch to AVMs to appraise residential properties are from the private sector. Additionally, participants from all employment categories are not in support of this idea. Interestingly, a small proportion of participants from the private sector and municipality do support the complete switch to using AVMs.

Table 32: Complete move to use AVMs based on Employment

		If you have an option to move completely to the use of AVMs to appraise residential properties, would you do so?							
Employment Category		No Answer	%	No	%	Yes	%	Total	%
Banks and Mortgage Instiutions	n	0	0,0%	2	100,0%	0	0,0%	2	100,0%
	%	#DIV/0!		16,7%		0,0%		12,5%	
Municipality	n	0	0,0%	1	33,3%	2	66,7%	3	100,0%
	%	#DIV/0!		8,3%		50,0%		18,8%	
Private Firm	n	0	0,0%	9	81,8%	2	18,2%	11	100,0%
	%	#DIV/0!		75,0%		50,0%		68,8%	
Total	n	0	0,0%	12	75,0%	4	25,0%	16	100,0%
	%	#DIV/0!		100,0%		100,0%		100,0%	

As shown in Table 33 It is worth noting that the majority of participants who oppose the complete transition to AVMs for assessing residential properties are professional associate valuers and professional valuers. Interestingly, a significant number of participants who support the complete shift to AVMs belong to the same profession.

Table 33: Complete move to use AVMs based on Registration

		If you have an option to move completely to the use of AVMs to appraise residential properties, would you do so?							
Registration Status		No Answer	%	No	%	Yes	%	Total	%
Candidate Valuer	n	0	0,0%	1	100,0%	0	0,0%	1	100,0%
	%	#DIV/0!		8,3%		0,0%		6,3%	
Professional Associate Valuer	n	0	0,0%	5	71,4%	2	28,6%	7	100,0%
	%	#DIV/0!		41,7%		50,0%		43,8%	
Professional Valuer	n	0	0,0%	6	75,0%	2	25,0%	8	100,0%
	%	#DIV/0!		50,0%		50,0%		50,0%	
Total	n	0	0,0%	12	75,0%	4	25,0%	16	100,0%
	%	#DIV/0!		100,0%		100,0%		100,0%	

Discussions

Based on the above results, it can be concluded that a majority of the participants are highly educated, having attained an honours degree. They are registered as professional valuers and possess considerable experience. Moreover, they are middle-aged. Those participants who agree that AVMs can become the preferred method of valuing residential property in the South African (SA) property market have provided the following feedback:

1. *"Due to accuracy score conducted vs psychical valuations"*
2. *"Because we have to comply with the valuation standards and feasibility on the reports"*
3. *"The process is faster and accurate Can easily spot mistakes"*

In reference to the participants who voted against using AVMS completely for appraising residential properties cited amongst others, the following notable reasons:

1. *"AVMS could be extremely valuable for certain requirements and purpose. But any tool needs to be able to be override, in order allowing for traditional approaches when required."*
2. *"There is always the unknown factor not contained in any knowledge data basee"*
3. *"it cannot be used accurately in all areas and could create a risk in terms of mortgage lending and for clients."*
4. *"Technical inspection will remain an essential need for older properties that must be bonded for mortgage financing"*
5. *"Property is a complex good I think we need a combination a hybrid process using both AVM and property inspection"*

Moreover, it is interesting to note that most participants believe that AVMs have the potential to succeed in SA property market. E, they are against the complete adoption of the model for residential valuation. Valuers who disagree with the impact of AVMs on their profession argue that the model is risky for homogenous properties and may not succeed in producing accurate results in the market, leading to incorrect property values. This position is supported by scholars. (Babtan, 2020; Glumac and Des Rosiers, 2021). Furthermore, they believe that the model cannot conduct proper investigations, including physical property inspections, as confirmed by (Babtan, 2020) and will replace valuers, leading to a significant reduction in the number of specialists and income loss.

Based on the responses of the participants, it is evident that although they believe there is potential for the model to succeed, they have certain reservations about a complete transition. These reservations stem from several factors, including the inability to inspect properties and obtain accurate data, which hinders the reliability and accuracy of AVMs. Therefore, the opinions expressed here are consistent with those of scholars (Matysiak, 2017; Babtan, 2020; Neal *et al.*, 2020; Glumac and Des Rosiers, 2021).

4.3.5 FUTURE OF THE VALUATION PROFESSION

Based on these findings presented in Figure 2, it can be concluded that most participants agree that the AVMs is the most cost effective to appraise residential properties.

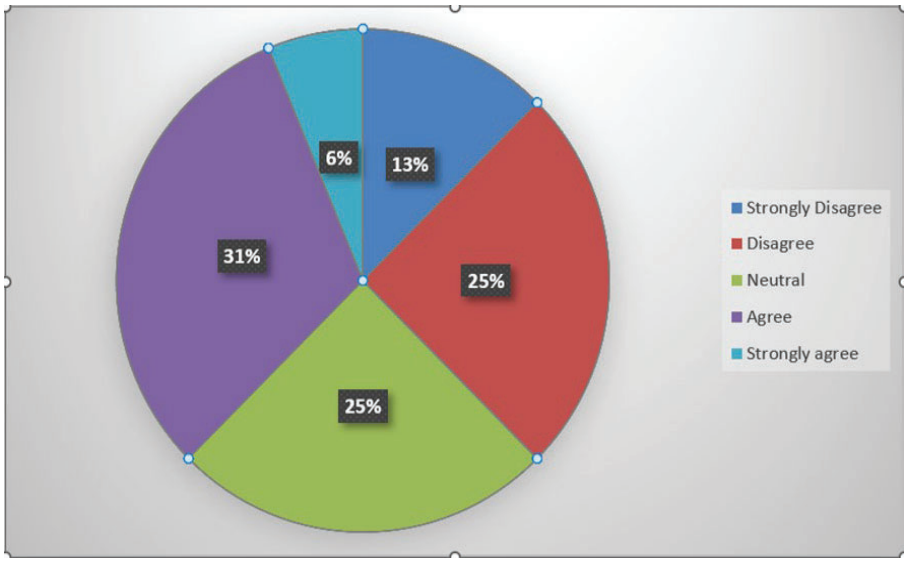

Figure 2: AVMs are the most cost-effective way to appraise residential property

Based on Table 34, 81% of the participants agree that AVMs will have an impact on the valuer's profession, while only 12% believe that it will not affect the profession. An interesting observation is that the majority of those who believe that AVMs will impact the profession hold an Honours Degree. It is noteworthy that participants across all qualification levels share this opinion. On the other hand, the participants who do not think that AVMs will impact the profession are those with a National Diploma and Bachelor's Degree.

Table 34: AVMs-Impact on valuers' profession based on Qualification I

		Do you think AVMs have impact on valuers' profession?							
Highest Qualification		No Answer	%	No	%	Yes	%	Total	%
Matric	n	0	0,0%	0	0,0%	1	100,0%	1	100,0%
	%	0,0%		0,0%		7,7%		6,3%	
Nat Dip/ Dip	n	1	25,0%	1	25,0%	2	50,0%	4	100,0%
	%	100,0%		50,0%		15,4%		25,0%	
Bachelor Degree/ Adv Dip	n	0	0,0%	1	33,3%	2	66,7%	3	100,0%
	%	0,0%		50,0%		15,4%		18,8%	
Honours Degree/ PG Dip	n	0	0,0%	0	0,0%	5	100,0%	5	100,0%
	%	0,0%		0,0%		38,5%		31,3%	
Masters	n	0	0,0%	0	0,0%	2	100,0%	2	100,0%
	%	0,0%		0,0%		15,4%		12,5%	
PhD	n	0	0,0%	0	0,0%	1	100,0%	1	100,0%
	%	0,0%		0,0%		7,7%		6,3%	
Total	n	1	6,3%	2	12,5%	13	81,3%	16	100,0%
	%	100,0%		100,0%		100,0%		100,0%	

Based on the data presented in Table 35, it can be inferred that the majority of participants who believe that AVMs will impact the valuation professions belong to the age category of 36-54 years, followed by those in the age group of 18-35. On the other hand, participants who do not believe that AVMs will impact the profession are mostly in the age group of 55-64. These results suggest that the younger and middle-aged generations are in agreement with each other regarding the impact of AVMs, while the older generation holds a different opinion.

Table 35: AVMs-Impact on valuers' profession based on Age group

		Do you think AVMs have impact on valuers' profession?							
Age bands		No Answer	%	No	%	Yes	%	Total	%
18-35	n	0	0,0%	0	0,0%	4	100,0%	4	100,0%
	%	0,0%		0,0%		30,8%		25,0%	
36-54	n	0	0,0%	0	0,0%	8	100,0%	8	100,0%
	%	0,0%		0,0%		61,5%		50,0%	
55-64	n	0	0,0%	2	66,7%	1	33,3%	3	100,0%
	%	0,0%		100,0%		7,7%		18,8%	
65+	n	1	100,0%	0	0,0%	0	0,0%	1	100,0%
	%	100,0%		0,0%		0,0%		6,3%	
Total	n	1	6,3%	2	12,5%	13	81,3%	16	100,0%
	%	100,0%		100,0%		100,0%		100,0%	

According to Table 36, the majority of participants who believe that AVMs will have an impact on the valuers' profession work in the private sector. It is interesting to note that across all employment categories, participants believe that AVMs will have an impact on the valuers' profession. On the other hand, participants who do not believe that the model will impact the valuers' profession are mainly from private firms.

Table 36: AVMs-Impact on valuers' profession based on Employment

		Do you think AVMs have impact on valuers' profession?							
Employment Category		No Answer	%	No	%	Yes	%	Total	%
Banks and Mortgage Instiutions	n	0	0,0%	0	0,0%	2	100,0%	2	100,0%
	%	0,0%		0,0%		15,4%		12,5%	
Municipality	n	0	0,0%	0	0,0%	3	100,0%	3	100,0%
	%	0,0%		0,0%		23,1%		18,8%	
Private Firm	n	1	9,1%	2	18,2%	8	72,7%	11	100,0%
	%	100,0%		100,0%		61,5%		68,8%	
Total	n	1	6,3%	2	12,5%	13	81,3%	16	100,0%
	%	100,0%		100,0%		100,0%		100,0%	

Table 37 below illustrate the view expressed by most participants concurring that the AVMs will have impact on the valuers' profession. Notably the professional associate valuers concur with professional valuers, which is not surprisingly considering their registration category distinction.

Table 37: AVMs-Impact on valuers` profession based on Registration

		Do you think AVMs have impact on valuers' profession?							
Registration Status		No Answer	%	No	%	Yes	%	Total	%
Candidate Valuer	n	0	0,0%	0	0,0%	1	100,0%	1	100,0%
	%	0,0%		0,0%		7,7%		6,3%	
Professional Associate Valuer	n	0	0,0%	1	14,3%	6	85,7%	7	100,0%
	%	0,0%		50,0%		46,2%		43,8%	
Professional Valuer	n	1	12,5%	1	12,5%	6	75,0%	8	100,0%
	%	100,0%		50,0%		46,2%		50,0%	
Total	n	1	6,3%	2	12,5%	13	81,3%	16	100,0%
	%	100,0%		100,0%		100,0%		100,0%	

Based on the data presented in Table 38, it can be observed that 43% of the participants who hold Honours Degrees are confident that AVMs will significantly impact the industry. Moreover, the majority of those who agreed that AVMs will be a game-changer hold an Honours Degree. Conversely, those who believe it is too early to determine the impact of AVMs are mostly Bachelor's Degree holders.

Table 38: AVMs a game changer in the valuation profession- Qualification

		In your view, do you think AVMs is a game-changer in the valuation profession, particularly with a residential appraisal?									
Highest Qualification		It is unlikely to happen	%	It is too early to tell	%	It will take a while to be adopted	%	It is definitely a game changer	%	Total	%
Matric	n	0	0,0%	1	100,0%	0	0,0%	0	0,0%	1	100,0%
	%	0,0%		20,0%		0,0%		0,0%		6,3%	
Nat Dip/ Dip	n	1	25,0%	0	0,0%	1	25,0%	2	50,0%	4	100,0%
	%	50,0%		0,0%		50,0%		28,6%		25,0%	
Bachelor Degree/ Adv Dip	n	0	0,0%	2	66,7%	0	0,0%	1	33,3%	3	100,0%
	%	0,0%		40,0%		0,0%		14,3%		18,8%	
Honours Degree/ PG Dip	n	1	20,0%	1	20,0%	0	0,0%	3	60,0%	5	100,0%
	%	50,0%		20,0%		0,0%		42,9%		31,3%	
Masters	n	0	0,0%	1	50,0%	0	0,0%	1	50,0%	2	100,0%
	%	0,0%		20,0%		0,0%		14,3%		12,5%	
PhD	n	0	0,0%	0	0,0%	1	100,0%	0	0,0%	1	100,0%
	%	0,0%		0,0%		50,0%		0,0%		6,3%	
Total	n	2	12,5%	5	31,3%	2	12,5%	7	43,8%	16	100,0%
	%	100,0%		100,0%		100,0%		100,0%		100,0%	

Based on Table 39, the largest percentage of participants (37%) believe that it will take some time before AVMs are widely adopted. This is mostly prevalent in the age group of 36-54. Meanwhile, 31% of the participants believe that it is still too early to determine whether AVMs will be a game-changer in the valuation profession. This is mainly the view of the younger generation (18-35) and the older generation (55-64). It is noteworthy that both the younger and older generations share this view.

Table 39: AVMs a game changer in the valuation profession- Age group

		In your view, do you think AVMs is a game-changer in the valuation profession, particularly with a residential appraisal?									
Age bands		It is unlikely to happen	%	It is too early to tell	%	It will take a while to be adopted	%	It is definitely a game changer	%	Total	%
18-35	n	0	0,0%	2	50,0%	0	0,0%	2	50,0%	4	100,0%
	%	0,0%		40,0%		0,0%		66,7%		25,0%	
36-54	n	1	16,7%	0	0,0%	5	83,3%	0	0,0%	6	100,0%
	%	50,0%		0,0%		83,3%		0,0%		37,5%	
55-64	n	1	20,0%	3	60,0%	0	0,0%	1	20,0%	5	100,0%
	%	50,0%		60,0%		0,0%		33,3%		31,3%	
65+	n	0	0,0%	0	0,0%	1	100,0%	0	0,0%	1	100,0%
	%	0,0%		0,0%		16,7%		0,0%		6,3%	
Total	n	2	12,5%	5	31,3%	6	37,5%	3	18,8%	16	100,0%
	%	100,0%		100,0%		100,0%		100,0%		100,0%	

The data presented in Table 40 shows that most participants who concur that the AVMs are indeed game changer are in the private sector. On the other hand, those who believe is too early to tell are predominately the participants from the financial institutions and municipality, although there is sizeable number from the private sector.

Table 40: AVMs a game changer in the valuation profession- Employment

		In your view, do you think AVMs is a game-changer in the valuation profession, particularly with a residential appraisal?									
Employment Category		It is unlikely to happen	%	It is too early to tell	%	It will take a while to be adopted	%	It is definitely a game changer	%	Total	%
Banks and Mortgage Instiutions	n	0	0,0%	2	100,0%	0	0,0%	0	0,0%	2	100,0%
	%	0,0%		40,0%		0,0%		0,0%		12,5%	
Municipality	n	0	0,0%	2	66,7%	0	0,0%	1	33,3%	3	100,0%
	%	0,0%		40,0%		0,0%		14,3%		18,8%	
Private Firm	n	2	18,2%	1	9,1%	2	18,2%	6	54,5%	11	100,0%
	%	100,0%		20,0%		100,0%		85,7%		68,8%	
Total	n	2	12,5%	5	31,3%	2	12,5%	7	43,8%	16	100,0%
	%	100,0%		100,0%		100,0%		100,0%		100,0%	

Table 41 shows that most participants agree that AVMS are the game changer. The professional valuers concur with the professional associate valuers in this view, which is quite interesting to note but not surprised due to the professional category status. The professional valuers have no limitation of work to undertake, unlike the associate valuers who have limitations.

Table 41: AVMs a game changer in the valuation profession-Registration

		In your view, do you think AVMs is a game-changer in the valuation profession, particularly with a residential appraisal?									
Registration Status		It is unlikely to happen	%	It is too early to tell	%	It will take a while to be adopted	%	It is definitely a game changer	%	Total	%
Candidate Valuer	n	0	0,0%	1	100,0%	0	0,0%	0	0,0%	1	100,0%
	%	0,0%		20,0%		0,0%		0,0%		6,3%	
Professional Associate Valuer	n	2	28,6%	2	28,6%	1	14,3%	2	28,6%	7	100,0%
	%	100,0%		40,0%		50,0%		28,6%		43,8%	
Professional Valuer	n	0	0,0%	2	25,0%	1	12,5%	5	62,5%	8	100,0%
	%	0,0%		40,0%		50,0%		71,4%		50,0%	
Total	n	2	12,5%	5	31,3%	2	12,5%	7	43,8%	16	100,0%
	%	100,0%		100,0%		100,0%		100,0%		100,0%	

DISCUSSIONS

Valuers presented their reasons for disagreeing that AVMs are the future of residential valuations. They believe that traditional valuation will always be relevant and that physical property inspections are crucial, particularly for older buildings. AVMs pose a risk to mortgage lenders if they produce inaccurate results, and human interaction is necessary in the valuation process. Furthermore, AVMs can overlook important characteristics of the value of the property that are noticeable through dynamic market analysis (Mooya, 2011; Babtan, 2020).

Some valuers who support adopting changes in appraising residential properties have provided the following reasons: AVMs can work well, particularly in housing estates where body corporates prescribe the size and attributes of the houses. AVMs can also benefit the housing market in rural areas. For that reason, the implementation of AVMs should be accompanied by a tool to override and create specific requirements and purposes.

Even though the valuers are defending their profession, with the other part arguing that the inability of the model to inspect the property is crucial, the fact is that most

banks and lenders are slowly leaning towards automation as deemed cheaper and reliable. It is clear that most participants believe that AVMs will negatively impact the valuers' profession. This is due to factors such as the perception that AVMs are cheaper, more convenient, and faster than traditional valuation methods, as noted by scholars, including (Mooya 2011; Boshoff and De Kock 2013). Nevertheless, they concur that the AVMs will have impact on the profession but still maintain that it will be limited to the above mentioned constrain.

Furthermore, the participants who believe AVMS will be a game changer they feel that AVMs will save time, reduce errors and be less expensive than traditional valuations, the same view confirmed by scholars (Glumac and Des Rosiers, 2018; 2021; Namangale and Chimalizeni, 2021).

4.4 SUMMARY

The valuation profession is expected to change due to the competition and innovation brought about by AVMs, as a result of the 4IR. Although traditional valuation remains essential, it is crucial to ensure proper evaluation. The profession has not been able to keep up with technological advancements, leading to a lack of interest from younger valuers and a contrast with other industries. Human interaction is still required for data validation and verification through physical property inspections. AVMs can assist in determining mortgage loan lending values and speeding up the valuation process, but accurate and sufficient data collection is necessary. Most valuers support using AVMs for appraising residential properties, but their concern about the level of accuracy in contrast to traditional valuation methods. The older generation is not in favour using AVMs due to resistance to change and fear of their profession becoming obsolete. On the contrary, most valuers have a strong understanding of the model, and most support using AVMs more than traditional valuation for appraising residential properties. For the reason that, AVMs should only be used for homogeneous properties to mitigate risks.

5. RESEARCH CONCLUSION AND RECOMMENDATION

5.1 INTRODUCTION

In this chapter, the study examines the use of automated valuation models (AVMs) as a preferred method to appraise residential properties. The conclusions are based on research questions, purposes, and findings. The study also explains the implications of these findings and the subsequent recommendations based on the decision and purpose of the study.

In the beginning the research objective were derived to explore the valuer's perception about the use of the AVMs as a preferred tool to appraise residential property. In the study it was established that indeed the valuers have expressed their concern regarding the use of the AVMs as preferred tool to appraise residential properties, amongst other things, mentioned thereto, are the inability to inspect the properties, inaccurate reliable data source, the impact on the valuation profession, with possibility of making the profession redundant. On the other hand, the majority of the participants still believe that AVMs will add value to the profession as it begins to establish itself in residential property market. For the reason that, they emphasise that the model cannot succeed on its own without human interaction due to the above stated risk.

Moreover, the chapter discusses the findings and recommendations for future research. It aims to gather property valuers' opinions on AVMs and their impact on the profession. The study also explores the influence of the 4IR on property valuations in the 21st century

5.2 SUMMARY OF THE FINDINGS

When the study was conducted, the following research objectives were defined:

- Establish what 4IR disruptions apply to the SAPVPs.
- Identify the traditional valuation skills and processes under threat of 4IR-driven changes.
- Determine to what extent valuers in South Africa are aware of and use it as a tool to appraise residential properties.
- Establish what reservations or trust SA property valuers have regarding using AVMs.

- Investigate to what degree the profession is adapting to AVMs and other advanced technologies brought about by 4IR.

In order to gain a comprehensive understanding of the topic, the study followed a thorough process that included conducting a pilot study and an online survey. This was done to determine the participants' holistic views on the objectives of the study.

As a result, the following findings where established during data collection as fully discussed herein:

The valuation profession was impacted by the 4IR, although traditional valuation methods remain important, because integration with technology is necessary. Physical property inspections are vital for data validation. AVMs are gaining popularity among middle-aged valuation professionals. They believe that AVMs expedite the mortgage lending process and lower valuation costs; but the AVMs should only be used for homogeneous properties to minimise the risks associated with using them without property inspection. Residential property appraisals are preferred to traditional methods by most valuers using AVM. Notwithstanding that, AVMs have limitations and may not be as reliable in markets with limited sales data. Although they are precise in active markets, they are only 80% accurate compared to traditional valuation methods. Some appraisers oppose the narrative due to potential errors, biased results, and inaccurate quantification of income without physical inspection.

The findings presented above validate the notion that suggests that the future of valuation is under threat due to the introduction of AVMs.

5.3 CONCLUSIONS

The study aimed to test whether SAPVP is gradually considering adopting AVMs as a preferred method to appraise residential properties, considering the impact of 4IR on the valuation profession through artificial intelligence.

After conducting the study and analysing its findings, several conclusions were established regarding the potential use of AVMs as a preferred method to appraise residential properties. The study examines how valuers are adapting to the disruption caused by the adoption of AVMs to appraise residential properties as part of the 4IR.

In the end, the study concluded that AVMs are somewhat reliable and accurate, but faster, and cost-effective than traditional valuation methods. Although, some participants expressed reservations due to their inability to amongst others, inspect properties and the accuracy and validity of the data available on the market. In addition, the study concluded that although AVMs are the preferred method to assess residential properties, some areas need to be considered and improved. The 4IR will greatly impact the valuation profession due to the modern technology used in the valuation, the cost implications, and the speedy processes offered by the participants expressed concern regarding the complete move to AVMS, citing that it poses a risk of inaccurate valuation and making the profession obsolete.

5.4 RECOMMENDATIONS

Based on the findings and conclusions of this study, the following recommendations were made:

a) The South African Council for Property Valuers Profession (SACPVP) and the South African Institute of Valuers (SAIV) should create a centralised dataset to confirm the accuracy of AVMs.

b) Automated valuation models (AVMs) for residential properties should be supported, with the condition that external property amenities are inspected using tools such as Google Map and drone.

c) Only property valuers registered with SACPVP should be allowed to produce valuations using the AVMs to protect the integrity of the profession.

d) The use of the drone for inspection of residential property during valuation be made compulsory to support the AVMs.

e) The higher education institutions must align its curriculum with current technological trends to produce technologically savvy graduates who can adapt to the 4IR.

f) The SACPVP should make it mandatory for valuers to learn about artificial intelligence during their board exams. This will increase knowledge in the use of technology as the world evolves.

5.5 RECOMMENDATIONS FOR FUTURE RESEARCH

Based on the findings of the research, it is recommended that the following future research be explored:

a) Further research is needed on this topic with a larger sample of participants in South Africa to gain a broader perspective on the perceptions of the valuers professionals.

b) Further research is needed to explore how valuers can ensure that the profession does not become obsolete due to the adoption of AVMs as a preferred method of valuation.

c) Further research is needed to determine how nonphysical property inspections affect property values.

d) Further research is needed on the same topic, but the focus should be on the valuation of farms using AVMs for the purpose of acquiring land and servitude rights for linear infrastructure projects (electricity, rail, road, water, and gas pipelines).

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APPENDIX A: PARTICIPANTS CONSENT FORM

The Knowledge and perception of the valuers regarding the use of automated valuation models (AVMs) to appraise residential properties in Pretoria.

CONSENT TO PARTICIPATE IN A RESEARCH PROJECT

Dear potential participant

You are being invited in a research study conducted by Andries Thebe, a MSc Property Studies student at the University of Cape Town. The research is supervised by Mrs Karen Le Jeune of the University of Cape Town and the results of the study will be presented to the Department of Construction Economics and Management in fulfilment of the requirements for the degree of MSc Property Studies in Construction Economics and Management.

If you have any question or concern about the research, please feel free to contact me at mldmol001@myuct.ac.za. The research supervisor, Mrs Karen Le Jeune may also be contacted at karen.lejeune@uct.ac.za.

Purpose of the study: The primary aim of the study is to assess the level of awareness and knowledge about the use of AVMs as a tool to appraise residential properties and determine the extent of use and perception of South African property valuers and how this may impact their traditional practices.

Procedures: Your participation in this study is voluntary. If you volunteer to participate in the study, we would you to set aside roughly 20 minutes of your time to complete the survey.

Potential benefits to participants: At your request, the anonymized research findings will be shared to you.

Confidentiality: Every effort will be made to ensure confidentiality of all information gathered will be maintained. Each survey shall be assigned a four-character code, consisting of two letters and two numbers e.g., IN08. These codes shall be randomly assigned and have no relation to your personal information or the company that you work for. The information gathered through the survey process will be used solely for

this research purpose. The raw data of the survey will only be known to the student/researcher.

Participation and Withdrawal: You may choose to withdraw from this study at any time of your wish. You may also refuse to answer any question that you do not want to answer.

Rights of research participants: You may withdraw your consent at any time and discontinue participation without any penalty. This study has been reviewed and received ethics clearance from the University of Cape Town.

*** Please indicate your choice:**

☐ I have read the information provided for the research as described above. My questions have been answered to my satisfactions, and I agree to participate in this study.

☐ I decline to participate in this study.

APPENDIX B: COVER LETTER

Department of Construction Economics and Management Fifth
Snape Building, Engineering Mall Upper, Upper Campus
Telephone: 021 650 34443
Email: Con-cem@uct.ac.za

The knowledge and perception of the property valuers regarding the use of automated valuation models (AVMs) as a tool to appraise residential properties in Pretoria, South Africa.

Dear Sir/ Madam,

The study is focused on assessing the level of knowledge and perception regarding the use of AVMs as a tool to appraise residential properties. The use of AVMs for residential properties remains a challenge.

Your participation in this research project is greatly appreciated. Therefore, your contribution will enable me to make objective conclusion based on evidence from the expert professional. The questionnaire will take approximately 10 minutes of your time to complete.

The participants will be anonymous should they wish to do so as no sensitive personal details such as name and address will be collected from this study. Therefore, if you wish to receive a copy of the results of the research, you are welcome to do so by requesting the same from the researcher. The data will be accessed by the researchers and the University of Cape Town authorised employees.

Kind regards,

Andries Thebe (Researcher)
Email : mldml001@uct.ac.za

APPENDIX C: RESEARCH INSTRUMENT

RESEARCH QUESTIONNAIRE

- Thank you for agreeing to participate in this questionnaire.
- The purpose of this research is to establish the knowledge and perception of the valuers regarding the use of automated valuation models (AVMs) to appraise residential properties.
- Please note that you will remain completely anonymous, and your response will be kept strictly confidential.
- If further use of this data is required, subsequent consent to this effect will be requested. If further clarification is required, please feel free to contact me via email.
- Also, you are free to withdraw from the process at any time.

SECTION A: DEMOGRAPHICS

1. **In what age group are you falling?**
   - 18-35
   - 36-54
   - 55 and above
2. **What is your current registration category?**
   - Professional Valuer
   - Professional Associates Valuer
   - Candidate Valuer
   - Single Residential Property Assessor
   - Candidate Single Residential Property Assessor
3. **How many years of experience practicing as a valuer?**
   - 0-5 years
   - 6-10 years
   - Above 10 years
4. **What is your highest qualification?**
   - Matric/N6
   - National Diploma/ Diploma
   - Bachelor's Degree/Advanced Diploma

- Honour`s Degree/ Post Graduate Diploma
- Master's Degree
- PHD

SECTION B: OPEN-ENDED AND CLOSED QUESTION

1. **What impact does the fourth industrial revolution have on the valuation profession?**
    - None
    - Insignificant
    - Substantial
    - Substantial Enormous
2. **How does the fourth industrial revolution affect the way valuers undertaking valuations?**

3. **Do you think the adoption of AVMs as a preferred method of appraising residential properties has a prospect to succeed in the South African property market?**
    - I think so
    - I do not think so
    - I do not Know
4. **Do you or your company currently use AVMs for valuations and, if so, was this for residential or commercial properties? (Boshoff and De Kock, 2013)**
    - Residential
    - Commercial
    - Other
    - None
5. **In your view, do you think AVMs is a game-changer in the valuation profession, particularly with a residential appraisal?**
    - I think so
    - I don't think so
    - Too early to tell

- I don't Know

6. **As a valuer are you ready to use the AVMs to appraise residential properties?**
   - I think so
   - I don't think so
   - Too early to tell
   - I don't Know
7. **What is your prior knowledge or experience about the AVMs?**
   - Less than 5 years
   - 5 -10 years
   - More than 10yrs
   - None
8. **What is your view regarding the reliability and accuracy of AVMs?**
   - Very reliable and accurate
   - Somewhat reliable and accurate
   - Not reliable and accurate at all
   - I don't know
9. **If you have an option to move completely to use AVMs to appraise residential properties, would you do so?**
   - I will move to AVMs
   - I will not move to AVMs
   - I will somewhat move to AVMs
   - I don't know
10. **In support of your answer above, please give reason(s) as to why do you go for that option?**
11. **What effect does the use of AVMS have on the valuers?**
    - Increase efficiency
    - Reduce valuers to dispensable
    - None
12. **What is the most effective way of appraising residential property?**
    - Traditional
    - Automation
    - The mixture of traditional and Automation

13. **How is the use of the AVMS is perceived concerning the traditional way of valuation (please choose 1)?**
    - Cost-effective
    - Inaccurate& unreliable
    - Accurate &reliable
    - Expensive
    - Don't know
14. **Are you generally inclined or opposed to the use of the AVMs? (Boshoff and De Kock, 2013)**
    - I don't know
    - I believe the AVMS can work
    - I don't believe in AVMs
    - I somewhat believe in AVMs
15. **Do you believe that these applications can be successfully employed in the South African residential property market? (Boshoff and De Kock, 2013)**
    - To some extent
    - Definitely
    - Not at all
    - I don't know