e-ISSN: 2229-8568

ICT Adoption among Real Estate Agents in Malaysia

Murni Mohamad [1], Ainoriza Mohd Aini [1,2*], Anuar Alias [3]

[1]Department of Real Estate, Faculty of Built Environment, Universiti Malaya
[2]Centre for Sustainable Urban Planning & Real Estate (SUPRE), Faculty of Built Environment, Universiti Malaya
[3]Department of Building and Property Management, Universiti Tunku Abdul Rahman

*Email: *ainoriza@um.edu.my*

Abstract

The success of real estate agents relies on the ability to provide better services to their clients efficiently and seamlessly. The use of Information and Communication Technology (ICT) is benefiting real estate agents by making it more convenient for real estate agents to find clients, advertise the property, and facilitate the property transaction process, which is indubitable. Therefore, the main objective of this study is to assess the level of ICT usage by real estate agents in valuation and agency firms in Klang Valley, Malaysia. Data were gathered through a survey conducted with these firms, and 400 responses were collected using a quantitative study and analysed using descriptive statistics and the Relative Importance Index (RII) ranking. The study revealed that most respondents adopt ICT in their practices, with the most frequently used tools being Mobile Instant Messaging, Social Media, and Real Estate Agent Websites. However, technologies such as Virtual Reality, Augmented Reality, Robotic Process Automation, and Metaverse Real Estate are rarely utilised. The study concluded that the widespread application of ICT in real estate is evident. However, inadequate training, higher cost of acquisition, and shortage of skilled people are the barriers that limit its full potential within the sector. This study recommends that the top management of valuation and agency firms provide training programs and ongoing support that cater to the specific needs of real estate agents.

Keywords: ICT Adoption, Real Estate Agent, Technology.

1. INTRODUCTION

Real estate agents play an important role in facilitating the buying and selling of properties. They are the middlemen who lead buyers and sellers through all the complexities of transactions (Markoc & Cizmeci, 2021). Estate agents are appointed to sell a house and are tasked with promoting properties for potential buyers. This, in many cases, involves a multi-faceted marketing strategy, as well as traditional and modern methods (Allen et al., 2015 & Goodwin et al., 2018). The development of Information and Communication Technology (ICT) has had some effects on the real estate industry. Importantly, technology is now a tool for connecting technology is now a tool to connect with people. It is easier for real estate agents to disseminate information and physically reach large prospective customers as a marketing-wise (Ayodele et al., 2015). Social media tools have not only transformed the way agents contact potential buyers but also allowed instant communication and information exchange (Dunning et al., 2018).

The National Association of Realtors (NAR) reported in 2023 that 89 per cent of buyers use real estate services to buy a property rather than buy directly through the owner, and most of the buyers used the internet to search for property and real estate agent contact information (NAR, 2023). Eventually, a

real estate agent plays the role of a qualified advisor who guides the buyers through the complexities of purchasing real estate to ensure a smooth and successful transaction (McAllister, 2020).

Existing research has also investigated the technological issues in the real estate industry, such as 'Big9' technologies (Ullah et al., 2018), virtual reality (Adegoke & Oladokun, 2020), internet strategies (Masis et al., 2017), drones for property marketing (Ugljea Stankov et al., 2019), and the role of Facebook in real estate sales (Shi et al., 2020). While informative, these studies provide only a partial view of the full scope of ICT tools used by real estate agents in practical terms. This knowledge gap hinders a full evaluation of ICT adoption in the construction industry.

This paper aims to identify the level of ICT adoption among a sample of real estate agents in Klang Valley, Malaysia. The scope of this study covered the area of Klang Valley, a bustling metropolitan area situated at the heart of Malaysia, which encompasses the federal territories of Kuala Lumpur and Putrajaya, along with adjacent cities and towns in the state of Selangor (Rashid, 2014). The selection of Klang Valley as the study site is justified by its significance as a major transportation, manufacturing, financial, commercial, and educational centre in Malaysia (Rashid et al., 2014; Mun et al., 2022), making it a suitable representation of the country's real estate landscape for identify the level ICT adoption among real estate agents. The study focuses on the practice of ICT tools. The ICT in this study context refers to a wide range of practical ICT applications, tools, services, devices, and platforms used by real estate agents. Before conducting the field survey, a comprehensive analysis of the available literature review was undertaken to establish the ICT tools being employed by real estate agents in their professional practice.

2. LITERATURE REVIEW

The COVID-19 pandemic brought significant changes to the real estate industry. It has transformed real estate agents from traditional practices to adopting ICT tools to market, share, and sell properties to potential buyers (Saiz, 2020; Gu & Zhu, 2021). The following subsection will explain the ICT tools used by real estate agents in their practice.

2.1 Drones

The drone is a generic word for any crewless aerial vehicle that can be flown in an autonomous way and resembles small airplanes with wings (Vergouw et al., 2016). They can be controlled by mobile apps running on smartphones or tablets, wristbands, and consoles acting as ground stations. Additionally, drones may be equipped with cameras, sensors, and other electronics that enable them to live stream or record video (Uglješa et al., 2019). Besides, these drones have been used to live stream and crowd monitor various activities, making dramatic footage work for television or film (Sakiyama et al., 2017). In the real estate industry, drones are typically used to capture highly detailed aerial photographs and videos of residential, commercial, and construction-related activity and land parcels. This makes it possible for a real estate agent to give a broader perspective toward properties towards either tenants or buyers.

2.2 Virtual Reality

Virtual Reality (VR) is a computer-generated environment that aims to replicate a real-life situation. The technology used to support and detect the user's movement control ensures an enjoyable, immersive experience. (Anna et al., 2018; Alcañiz et al., 2019) defined VR as a simulation of a stimulating three-dimensional environment where users can be engaged and interact with their surroundings. VR can be utilized by marketers or salespersons to encourage marketing and enhance customer experience through the ability of VR to imitate real-life scenarios and the physical world. The real estate industry has been leveraging VR to provide potential buyers with tours of properties in an immersive experience without actually having to be physically present. This can be achieved by creating 360-degree images or videos

of a property and VR headsets to create total immersion in the property (Hamad & Jia, 2022). A recent study from the National Association of Realtors found that 72% of real estate agents believe VR will be an important tool in buying and selling real estate. They found that simply not being able to see the property held back 62% of those potential homebuyers from buying a home (Ambika et al., 2023).

2.3 Real Estate Online Platform

Real estate online platforms make finding and comparing property listings simple for buyers. It offers a centralised location where individuals can look for properties, see images as well as video clips, and find out about each residential property's special or relevant attributes. This also allows people to compare properties with each other, which can aid them in making a more well-informed decision when it comes to their home purchases. Besides facilitating property search and comparison, online real estate platforms also make it easier for buyers to connect with real estate agents (Karayaneva, 2023 & Boeing et al., 2020). According to a survey by the National Association of Realtors, in 2020, 97% of buyers will utilise the Internet to search for a home to buy rather than visiting sales agents by appointment, shortening the selling process. iProperty.com, PropertyGuru, and Propwall are the most prominent real estate third-party internet platforms in Malaysia (Najieha et al., 2017), which estate agents employ to reach a larger audience.

2.4 Clouds

The cloud was working on servers and software connected to the web. It is a system that allows users to access the system where the Internet is available. The emails, videos, and or files worked on were not stored on the personal computer. Nonetheless, it could be accessed easily, quickly, and cheaply with the existence of cloud computing technology (Davis & Watts, 2021). Cloud computing has grown to be a popular service providing cost-effective, safe storage and sharing under one roof (Evgeniy, 2021). A Geographic Information System (GIS) is an application that allows to capture, store, manipulate, analyse, manage, and present all spatial or geographical data types (Arshad et al., 2018). This data could be used to identify investment opportunities and highlight the areas that will likely become more expensive due to various factors. These relevant data include location, physical attributes, and legal as well as economic considerations.

2.5 Mobile Instant Messaging (MIM)

MIM is a communication technology that allows users to send and receive text, images, videos, geographic locations, and real-time messages through their smartphones. MIM platforms like WhatsApp, Line, and WeChat are popular among users worldwide (Safieddine & Nakhoul, 2021). In Spain, WhatsApp is the most popular MIM, with 78% of the population using it to send messages to individual users or exchange messages in groups (Gascón et al., 2019). Meanwhile, in China, WeChat is the most widely used instant messaging platform. Furthermore, it provides text and audio message generation features similar to WhatsApp and is available for download, installation, and use on all smartphone platforms (Sandel et al., 2019).

2.6 Social Media

The word "social" implies interaction with others, and "media" refers to advertising through a communication instrument, such as the Internet or traditional media like TV, radio, newspapers, and magazines. Thus, social media can be considered as web-based communication technologies that allow people to communicate and interact with each other by sharing and consuming information (Tsakiridou & Karanikolas, 2019; Flew & Iosifidis, 2019; Tian et al., 2019). Facebook, Twitter, YouTube, LinkedIn, as well as Instagram are among the popular social media applications (Kapoor et al., 2018; Oliverio, 2018). Kaye (2021) also agreed that social media is a way of promoting products and services, such as how advertising can be used, as well as through social media marketing and influencer marketing. So, advertising on social media allows them to make their message heard by larger audiences. They can run

their ads to people in specific locations, demographics, and interests. On the other hand, social media marketing is more effective than advertisement campaigns when promoting products and services. A Facebook business page can create a sense of community, bring in potential buyers, promote the product's brand name, and gather client feedback. When the "Like" button below a post is clicked, the number of Facebook likes grows. It is a way of showing people like it without commenting. Strangely enough, many buyers decide to purchase a product based on Facebook likes (Mazzucchelli et al., 2018). In other words, if a real estate firm has more Facebook likes, it is more likely to sell the property.

2.7 Robotic Process Automation (RPA)

Robotic Process Automation (RPA) is a software technology that automates routine tasks executed by humans. RPA enables rule-based operations to be performed faster and more efficiently due to how robots execute human activities on a computer (Hofmann et al., 2019). RPA is office automation technology that imitates human operation activities on a computer to execute digitalised tasks manually, and this includes the opening and closing of applications, document reading, data entering, and sending emails (Axmann & Harmoko, 2022). Moreover, RPA helps real estate agents automate repetitive and time-consuming tasks like data entry, document processing, and sending out emails for marketing. This allows real estate agents to focus on strategic work like connecting with clients and closing deals. In addition to addressing speed, RPA may reduce errors by automating tasks that are prone to human error, including preparing contracts and calculating costs (Gallino, 2020; Gharbia et al., 2020).

2.8 Metaverse Real Estate

A metaverse is an accessible shared space that allows users to access and employ various types of virtual spaces, content, or services in three-dimensional spaces. Metaverse is more about entering it, using VR and other tech such as Augmented Reality (AR) glasses, personal computers, and smartphones. More noteworthy, the virtual user is able to join different experiences in the metaverse as a virtual avatar that resides in the virtual space (Parcu et al., 2022). Today, the whole world is becoming digital, which affects real estate, whether it is a made-up world (metaverse) or an existing, real one. This occurs in the same way that traditional real estate properties are bought, sold, or developed in metaverse real estate. At the same time, the owners can rent their properties to other people without having to physically travel and search for a property here or there, waste time doing transactional paperwork, and have an agent act as an intermediary. In addition to that, it is flexible for buyers or investors, who can buy land in the virtual world and build anything from a gaming experience, virtual shop, digital art gallery, event centre, and school (Rahaman, 2022). In addition, the metaverse creates a new opportunity for real estate agents to work together with other professionals (Finn, 2022).

2.9 Augmented Reality (AR)

AR technology adds digital information to real-world objects or locations to improve the user experience (Evans & Baker, 2013; Chylinski et al., 2020). AR can be experienced through a smartphone or tablet or by wearing special headsets that project images in front of the user's eyes (Schmalstieg & Hollerer, 2016). Moreover, AR tech has the potential to offer a virtual try-on experience for consumers. It enables consumers to see what the product might look like without physically trying it. In the real estate industry, AR creates interactive experiences that allow potential buyers to see how furniture, appliances, and other items would look in a property. Moreover, it is helpful for buyers trying to decide what kind of furniture they want to buy for their new home as it helps potential buyers visualise how furniture would look in a property (Rauschnabel et al., 2022). However, AR can be used to create visual experiences so that agents can show potential buyers how things like furniture, house appliances, and items would look in a property (Wedel et al., 2020). Accordingly, it is helpful for buyers trying to decide what kind of furniture they want to buy for their new home as it helps potential buyers visualise how furniture would look in a property.

e-ISSN: 2229-8568

3. RESEARCH METHODOLOGY

This study employed a quantitative approach, using a questionnaire that was distributed to real estate agencies in Klang Valley using a random sampling procedure. The target respondents were individuals actively practising within the agencies, including registered estate agents, registered valuers, probationary estate agents, probationary valuers, and real estate negotiators. This research focuses on these individuals because, in Malaysia, the Valuers, Appraisers, Estate Agents, and Property Managers Act 1981 recognises real estate surveyors and valuers as the only professionals qualified to handle all matters related to land and buildings. They operate under the Board of Valuers, Appraisers, Estate Agents, and Property Managers (BOVAEP) Malaysia.

The researcher personally distributed the questionnaires by visiting the valuation and real estate agent organisations registered with BOVAEP. According to the Board's official website, there were 233 registered valuation and estate agent firms active in Klang Valley. A total of 156 firms (representing 67% of practising firms) were randomly selected for the sample. The data collection process took place over four months, from September 1 to December 31, 2022. From the 429 collected surveys, 400 were used for this research after a screening process. The data was analysed using descriptive techniques which include frequency tables and percentages. Additionally, the Relative Importance Index (RII) ranking model was employed to analyse responses on the Likert scale ranging from "Never" to "Every Time." The RII was calculated for each indicator, allowing indicators to be ranked in ascending order of importance.

4. RESULTS

The subsequent sections provide the results of the survey conducted among estate agency and valuation practitioners in Klang Valley, Malaysia. The survey sought to assess the level of adoption of ICT tools by real estate agencies in Klang Valley, Malaysia.

4.1 Respondents Profile

Table 1 below depicts that males comprised 57.25% of the 400 respondents, while females comprised 42.75%. The 28-42 age group was the most well-represented (43%), followed by 18-27 (33.5%), 43-57 (21.25%), and 58-76 (2.25%). In terms of professional qualifications, 62.25% of respondents were Real Estate Negotiators, 20% were Probationary Estate Agents, 8% were Registered Estate Agents, 5.25% were Probationary Valuers, and 4.5% were Registered Valuers.

Table 1: Profile of the respondents

Demographic characteristic	Scale	Frequency	Percentage
Gender	Male	229	57.25
	Female	171	42.75
Age	18- 27 years old	134	33.40
	28-42 years old	172	43
	43-57 years old	85	21.25
	59-76 years old	9	2.25
Professional Qualification	Registered Valuer	18	4.5
	Registered Estate Agent	32	8
	Probationary Valuer	21	5.25
	Probationary Estate Agent	80	20
	Real Estate Negotiator	249	62.25

e-ISSN: 2229-8568

Years of practices	Less than 5 years	235	58.75
	Between 5-10 years	100	25
	More than 10 years	65	16.25

Source: Field Survey, 2022

Table 1 also indicated that 58.75% (235 respondents) had less than five years of experience. Additionally, 25% had five to ten years of experience, and 16.25% had over ten years of working experience.

4.2 The ICT Tools in Sustaining a Career in Real Estate Agency Practice

Table 2 reveals that all respondents agreed that using ICT tools is essential for sustaining a career in real estate agency and valuation practice. This finding helped the researcher assess the level of ICT usage among respondents.

Table 2: ICT Tools in Sustaining Career in Real Estate Agency Practice

Response	Frequency	Percentage
Yes	400	100
No	-	-
Total	400	100

Source: Field Survey, 2022

4.3 Contribution of ICT Tools towards the Development and Growth of Real Estate Agency Practice

Table 3 indicates that all respondents agree on the contribution of ICT tools to the development and growth of real estate agency practices. This evidence indicates that ICT has significantly contributed to the development and growth of estate agency practice.

Table 3: Contribution of ICT Tools towards the Development and Growth of Real Estate Agency Practice

Response	Frequency	Percentage
Yes	400	100
No	-	-
Total	400	100

Source: Field Survey, 2022

4.4 The use of ICT tools in Real Estate Agency Practice

The findings on the use of ICT tools that are applicable in the real estate agency practice are provided in the following tables. The responses are ranked in accordance to the following levels: NV: Never, RA: Rarely in less than 30% of the chances when I could have, OC: Occasionally, in about 50% of the chances when I could have, FR: Frequently, in about 70% of the chances when I could have and, ET: Every time.

e-ISSN: 2229-8568

Table 4: The Use of ICT Tools by Registered Estate Agents

Determinants	NV (1)	RA (2)	OC (3)	FR (4)	ET (5)	Total	Total Number (N)	A*N	RII	Ranking
Social Media	0	0	9	24	115	148	32	160	0.925	1st
Mobile Instant Messaging	0	4	3	16	125	148	32	160	0.925	1st
Real Estate Agent's Website	0	4	6	32	100	142	32	160	0.888	2nd
Clouds	0	4	9	52	70	135	32	160	0.844	3rd
Third-party Website	1	4	27	24	70	126	32	160	0.788	4th
Drones	7	8	36	36	0	87	32	160	0.544	5th
Augmented Reality	24	6	3	16	0	49	32	160	0.306	6th
Robotic Process Automation	27	0	6	8	5	46	32	160	0.288	7th
Virtual Reality	24	10	6	0	5	45	32	160	0.281	8th
Metaverse Real Estate	28	2	0	4	10	44	32	160	0.275	9th

Source: Field Survey, 2022

Table 4 summarises responses with regard to the practice use of ICT tools by registered estate agents. The results indicate that social media and MIM are the most commonly used ICT tools among registered estate agents, achieving the highest RII score of 0.925. Real estate agent websites follow closely at the second rank with an RII score of 0.888. These high rankings suggest that registered estate agents consider these tools crucial. Cloud storage (RII: 0.844), third-party websites (RII: 0.788), and drones (RII: 0.544) occupy the third, fourth, and fifth positions, respectively. AR (RII: 0.306), RPA (RII: 0.288), VR (RII: 0.281), and metaverse real estate (RII: 0.275) were ranked 6th, 7th, 8th, and 9th at the bottom of the RII ranking, respectively.

Table 5: The Use of ICT Tools by Registered Valuers

Determinants	NV (1)	RA (2)	OC (3)	FR (4)	ET (5)	Total	Total Number (N)	A*N	RII	Ranking
Mobile Instant Messaging	0	0	0	4	85	89	18	90	0.989	1st
Social Media	0	0	3	8	75	86	18	90	0.956	2nd
Real Estate Agent's Website	0	0	0	24	60	84	18	90	0.933	3rd
Clouds	0	0	3	24	55	82	18	90	0.911	4th
Third-party Website	0	0	6	28	45	78	18	90	0.878	5th
Drones	7	12	12	4	0	35	18	90	0.389	6th
Virtual Reality	18	0	0	0	0	18	18	90	0.20	7th
Augmented Reality	18	0	0	0	0	18	18	90	0.20	7th
Robotic Process Automation	18	0	0	0	0	18	18	90	0.20	7th
Metaverse Real Estate	18	0	0	0	0	18	18	90	0.20	7th

Source: Field Survey, 2022

Table 5 summarises responses regarding the practice use of ICT tools by registered valuers in practice. Some of the major ICT tools listed were ranked, and the findings suggest that MIM was ranked first with an RII of 0.989, along with social media, which ranked 2nd with an RII of 0.956. However, real estate agent's websites, clouds, third-party websites, and drones were ranked the 3rd, 4th, 5th, and 6th levels of use with RII 0.933, 0.911, 0.878, and 0.389, respectively. On the other hand, VR, AR, RPA, and metaverse real estate are in the same 7th position at the bottom of the ranking table with RII of 2.0,

e-ISSN: 2229-8568

2.0, 2.0, and 2.0, respectively. The result above showed the utilisation level of the various ICT tools from every time used to never used.

Table 6: The Use of ICT Tools by Probationary Estate Agents

Determinants	NV (1)	RA (2)	OC (3)	FR (4)	ET (5)	Total	Total Number (N)	A*N	RII	Ranking
Mobile Instant Messaging	2	0	3	40	335	380	80	400	0.950	1st
Real Estate Agent's Website	2	2	6	40	324	374	80	400	0.935	2nd
Social Media	2	2	6	112	235	357	80	400	0.893	3rd
Clouds	1	2	6	172	165	346	80	400	0.865	4th
Third-party Website	0	8	63	132	110	313	80	400	0.783	5th
Drones	9	40	108	44	20	221	80	400	0.553	6th
Virtual Reality	72	6	6	4	10	98	80	400	0.245	7th
Augmented Reality	76	0	6	4	5	91	80	400	0.228	8th
Metaverse Real Estate	77	2	6	0	0	85	80	400	0.213	9th
Robotic Process Automation	80	0	0	0	0	80	80	400	0.200	10th

Source: Field Survey, 2022

Table 6 provides responses regarding the use of ICT tools by probationary estate agents in practice. Some of the major ICT tools listed were ranked, and the findings indicate that MIM was ranked first with an RII of 0.950, along with the real estate agent's website, which ranked 2nd with an RII of 0.935. These tools likely play a central role in communication with clients and potential clients. However, social media, clouds, third-party websites, and drones were ranked the 3rd, 4th, 5th, and 6th levels of use with RII 0.893, 0.865, 0.783, and 0.553, respectively. On the other hand, VR, AR, metaverse real estate, and RPA tiered the 7th, 8th, 9th, and 10th positions at the bottom of the ranking table with RII of 0.245, 0.228, 0.213, and 0.200, respectively. From this result, we can observe that the most used ICT tools are the least used in the section.

Table 7: The Use of ICT Tools by Probationary Valuers

Determinants	NV (1)	RA (2)	OC (3)	FR (4)	ET (5)	Total	Total Number (N)	A*N	RII	Ranking
Mobile Instant Messaging	0	0	0	0	105	105	21	105	1.000	1st
Clouds	1	0	0	12	85	98	21	105	0.933	2nd
Real Estate Agent's Website	0	0	6	16	75	97	21	105	0.924	3rd
Social Media	0	2	6	12	75	95	21	105	0.905	4th
Third-party Website	0	4	3	20	65	92	21	105	0.876	5th
Drones	7	10	21	4	5	47	21	105	0.448	6th
Virtual Reality	18	6	0	0	0	24	21	105	0.229	7th
Robotic Process Automation	20	2	0	0	0	22	21	105	0.210	8th
Augmented Reality	21	0	0	0	0	21	21	105	0.200	9th
Metaverse Real Estate	21	0	0	0	0	21	21	105	0.200	10th

Source: Final Survey, 2022

Table 7 summarises responses regarding the use of ICT tools by probationary valuers in practice. Some of the major ICT tools listed were ranked, and the findings suggest that MIM was ranked first with an RII of 0.100, along with clouds, which ranked 2nd with an RII of 0.935. However, real estate agent's websites, social media, third-party websites, and drones were ranked the 3rd, 4th, 5th, and 6th levels of use with RII 0.924, 0.905, 0.876, and 0.448, respectively. On the other hand, VR, RPA, AR, and metaverse real estate tiered the 7th, 8th, 9th, and 9th positions at the bottom of the ranking table with RII

of 0.229, 0.210, 0.200, and 0.200, respectively. From this result, we can observe that the most used ICT tools are the least used in the section.

Table 8: The Use of ICT Tools by Real Estate Negotiators

Determinants	NV (1)	RA (2)	OC (3)	FR (4)	ET (5)	Total	Total Number (N)	A*N	RII	Ranking
Mobile Instant Messaging	1	12	87	272	720	1092	249	1245	0.877	1st
Social Media	3	26	132	252	630	1043	249	1245	0.838	2nd
Real Estate Agent's Website	6	36	126	324	510	1002	249	1245	0.805	3rd
Third-party Website	7	38	168	316	440	969	249	1245	0.778	4th
Clouds	10	40	162	424	295	931	249	1245	0.748	5th
Drones	58	68	174	216	80	596	249	1245	0.549	6th
Virtual Reality	116	70	138	156	65	545	249	1245	0.438	7th
Augmented Reality	127	60	129	144	65	525	249	1245	0.422	8th
Robotic Process Automation	148	24	117	152	60	501	249	1245	0.402	9th
Metaverse Real Estate	149	17	132	144	55	497	249	1245	0.399	10th

Source: Final Survey, 2022

Table 8 summarises responses regarding the use of ICT tools by real estate negotiators in practice. Some of the major ICT tools listed were ranked, and the findings indicate that MIM was ranked first with an RII of 0.877, along with social media, which ranked 2nd with an RII of 0.838. However, real estate agent's websites, third-party websites, clouds, and drones were ranked the 3rd, 4th, 5th, and 6th levels of use with RII 0.805, 0.778, 0.748, and 0.569, respectively. On the other hand, VR, AR, RPA, augmented, and metaverse real estate tiered the 7th, 8th, 9th, and 10th positions at the bottom of the ranking table with RII of 0.438, 0.422, 0.402, and 0.399, respectively. This result shows that the most used ICT tools are the least used in the section.

Table 9: Reason for not using ICT Tools by Real Estate Agencies in Practice

Barrier	Mean	Rank
Inadequate Training	3.53	1st
Higher Cost of Acquisition	3.39	2nd
Shortage of Skilled People	3.30	3rd
Fear of Virus Attack	3.24	4th
Difficult to use	3.04	5th
Leaking of personal information	2.96	6th
Time-Consuming	2.91	7th
Not Interested	2.87	8th
Rapid Changes in ICT	2.30	9th
Not Aware	1.76	10th

Source: Field Survey, 2022

Table 9 depicts the most significant reason for not using ICT tools by real estate agencies in practice. It was discovered that inadequate training towards the usage of ICT and higher cost of acquisition were ranked at 1st and 2nd place with a mean of 3.53 and 3.39, respectively. On the other hand, shortage of skilled people, fear of virus attack, difficulty to use, leaking of personal information, and time-consuming were ranked at 3rd, 4th, 5th, 6th, and 7th place with a mean score of 3.30, 3.24, 3.04, 2.96, and 2.91. Conversely, the results indicate that most respondents disagreed with reasons such as lack of interest, rapid changes in ICT, and lack of awareness, which received mean scores of 2.87, 2.30, and 1.76, respectively.

e-ISSN: 2229-8568

5. DISCUSSION

From the findings from the descriptive analysis and RII of the use of ICT tools by real estate agents in practice, the following discussion can be made. All respondents agreed that ICT has been generally accepted and contributes to the performance of real estate practice. However, the results suggested that most respondents use social media and MIM in practice. The utilisation of other ICT tools, such as VR, AR, RPA, and Metaverse Real Estate, remains limited. It revealed that the level of ICT usage is still low among real estate agents. The primary reasons hindering the adoption of these advanced ICT tools, as reported by most respondents, are inadequate training opportunities and higher acquisition costs. These limitations prevent real estate agents from developing proficiency in these technologies. Furthermore, more time-consuming training on new technologies is perceived as a barrier, particularly among senior agents. Older real estate agents (above 50 years old) also mention the amount of time it takes to learn new technologies as a major reason why they do not use them. Even if they might be interested in these new tools, they feel they do not have enough extra time to learn them, often favouring traditional methods.

6. CONCLUSION AND RECOMMENDATIONS

The findings of this study suggest that organisations should design their training programs to cater to the specific needs of agents by providing methods to train people based on different learning styles. Most importantly, real estate firms must provide ongoing learning resources such as online tutorials, a knowledge base, and easy-to-access help desks for troubleshooting issues are helpful to ensure the growth of real estate agents.

The government, too, could assist by way of financial incentives such as grants or vouchers to real estate firms to equip themselves with new technologies. This suggestion is intended to go some way towards enabling real estate agencies to grasp hold of ICT more easily by reducing the initial costs. It is, however, suggested that real estate surveyor organizations that are involved in curriculum design and delivery of core courses should integrate ICT infrastructure into their curriculums to prepare future real estate professionals.

By embracing ICT through real estate agent training, government support for agencies, and integrating ICT into academic curriculums, the industry can overcome existing barriers and unlock the full potential of ICT for the benefit of real estate professionals.

ACKNOWLEDGMENT

The authors are very grateful to the professionals in valuation and agency firms who generously volunteered their time and insights to participate in this study. This manuscript would not have been possible without their willingness to participate in the study.

FUNDING

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

DECLARATION OF INTEREST STATEMENT

The authors declare no conflicts of interest.

REFERENCES

1. Adegoke, A. S., Oladokun, T. T., Ayodele, T. O., Agbato, S. E., Jinadu, A. D., & Olaleye, S. O. (2021). Analysing the criteria for measuring the determinants of virtual reality technology adoption in real estate agency practice in Lagos: a DEMATEL method. *Property Management*, 40(3). https://doi.org/10.1108/pm-05-2021-0035

2. Alcañiz, M., Bigné, E., & Guixeres, J. (2019). Virtual Reality in Marketing: A Framework, Review, and Research Agenda. *Frontiers in Psychology*, *10*. https://doi.org/10.3389/fpsyg.2019.01530

3. Allen, M. T., Cadena, A., Rutherford, J., & Rutherford, R. C. (2015). Effects of Real Estate Brokers' Marketing Strategies: Public Open Houses, Broker Open Houses, MLS Virtual Tours, and MLS Photographs. *Journal of Real Estate Research*, *37*(3), 343–369. https://doi.org/10.1080/10835547.2015.12091422

4. Ambika, A., Shin, H., & Jain, V. (2023). Immersive technologies and consumer behavior: A systematic review of two decades of research. *Australian Journal of Management*. https://doi.org/10.1177/03128962231181429

5. Anna, B., Borawski, M., & Łatuszyńska, M. (2018). The Concept of Virtual Reality System to Study the Media Message Effectiveness of Social Campaigns. *Procedia Computer Science*, *126*, 1616–1626. https://doi.org/10.1016/j.procs.2018.08.135

6. Arshad, Y. bin, bin Mohd Sani, M. S., & binti Syed Ibrahim, S. N. (2018). Geographical Information System (GIS) as an Innovative Adoption to Ease Customers in Locating SME Business Premises in Malacca. *MATEC Web of Conferences*, *150*, 05045. https://doi.org/10.1051/matecconf/201815005045

7. Axmann, B., & Harmoko, H. (2022). Process & Software Selection for Robotic Process Automation (RPA). *Tehnički Glasnik*, *16*(3), 412–419. https://doi.org/10.31803/tg-20220417182552

8. Ayodele, O. M., Babajide, O., & Oluwatofunmi, A. D. (2015). Assessment of Use of Social Media in Real Estate Transactions in Lagos Property Market. *American Journal of Economics, Finance and Management*, *1*(2), 63–68.

9. Boeing, G., Wegmann, J., & Jiao, J. (2020). Rental Housing Spot Markets: How Online Information Exchanges Can Supplement Transacted-Rents Data. *Journal of Planning Education and Research*, 0739456X2090443. https://doi.org/10.1177/0739456x20904435

10. Chylinski, M., Heller, J., Hilken, T., Keeling, D. I., Mahr, D., & de Ruyter, K. (2020). Augmented reality marketing: A technology-enabled approach to situated customer experience. *Australasian Marketing Journal (AMJ)*, *28*(4).

11. Davis, L., & Watts, R. (2021, September 2). *What Is Cloud Computing? Everything You Need To Know*. Forbes Advisor. https://www.forbes.com/advisor/business/what-is-cloud-computing/

12. Dunning, R., Levy, D., Watkins, C., & Young, G. (2018). Technological change and estate agents' practices in the changing nature of housing transactions. *Housing Studies*, *34*(5), 849–867. https://doi.org/10.1080/02673037.2018.1487041

13. Evans, W., & Baker, D. (2013). *Trends, Discovery, and People in the Digital Age*. Elsevier.

14. Evgeniy, A. (2021, March). *Council Post: Why Migrate To The Cloud: The Basics, Benefits And Real-Life Examples*. Forbes. https://www.forbes.com/sites/forbestechcouncil/2021/03/12/why-migrate-to-the-cloud-the-basics-benefits-and-real-life-examples/?sh=6ad32fa45e27

15. Finn, S. (2022, June). Council Post: The Metaverse: Exploring The Wave Of Virtual Real Estate. *Forbes*. https://www.forbes.com/sites/forbesbusinesscouncil/2022/06/10/the-metaverse-exploring-the-wave-of-virtual-real-estate/?sh=7d28c74a5f10.

16. Flew, T., & Iosifidis, P. (2019). Populism, Globalisation and Social Media. *International Communication Gazette*, *82*(1). https://doi.org/10.1177/1748048519880721

17. Gallino, J. (2020, September). *Council Post: Why AI And Robotic Process Automation Are The Perfect Match*. Forbes. https://www.forbes.com/sites/forbestechcouncil/2020/09/18/why-ai-and-robotic-process-automation-are-the-perfect-match/?sh=6558deec5fbf.

18. Gascón, J., Pascual, J. A., Mir-Bernal, P., & Polo-López, M. (2019). Uses of WhatsApp in the Spanish university student. Pros and cons. *Revista Latina de Comunicación Social, 74*. https://doi.org/10.4185/rlcs-2019-1332en

19. Gharbia, M., Chang-Richards, A., Lu, Y., Zhong, R. Y., & Li, H. (2020). Robotic technologies for on-site building construction: A systematic review. *Journal of Building Engineering*, *32*, 101584. https://doi.org/10.1016/j.jobe.2020.101584

20. Gu, G., & Zhu, F. (2020). Trust and Disintermediation: Evidence from an Online Freelance Marketplace. *Management Science*, 67(2), 794–807. https://doi.org/10.1287/mnsc.2020.3583

21. Hamad, A., & Jia, B. (2022). How Virtual Reality Technology Has Changed Our Lives: An Overview of the Current and Potential Applications and Limitations. *International Journal of Environmental Research and Public Health*, *19*(18). https://doi.org/10.3390/ijerph191811278

22. Hofmann, P., Samp, C., & Urbach, N. (2019). Robotic process automation. *Electronic Markets*, *30*(1). https://doi.org/10.1007/s12525-019-00365-8

23. Kapoor, K. K., Tamilmani, K., Rana, N. P., Patil, P., Dwivedi, Y. K., & Nerur, S. (2018). Advances in Social Media Research: Past, Present and Future. *Information Systems Frontiers*, *20*(3), 531–558. Springer.

24. Karayaneva, N. (2023, February). *Top 5 Tech Trends Transforming Real Estate In 2023*. Forbes. https://www.forbes.com/sites/nataliakarayaneva/2023/02/23/top-5-tech-trends-transforming-real-estate-in-2023

25. Kaye, L. K. (2021). Exploring the "socialness" of social media. *Computers in Human Behavior Reports*, *3*, 100083. https://doi.org/10.1016/j.chbr.2021.100083

26. Markoc, I., & Cizmeci, F. (2021). Ethics in real estate: agency practices in Istanbul. *International Journal of Housing Markets and Analysis*, *14*(5), 1145–1165. https://doi.org/10.1108/ijhma-10-2020-0119

27. Masis, N. N. S., Maimun, N. H. A., Noor, N. A. M., Yusof, N. S. M., & Rahman, M. S. A. (2017). E-COMMERCE IN THE MALAYSIAN REAL ESTATE AGENCY INDUSTRY. *International Journal of Real Estate Studies*, 11(5).

28. Mazzucchelli, A., Chierici, R., Ceruti, F., Chiacchierini, C., Godey, B., & Pederzoli, D. (2018). Affecting brand loyalty intention: The effects of UGC and shopping searches via Facebook. *Journal of Global Fashion Marketing*, *9*(3), 270–286. https://doi.org/10.1080/20932685.2018.1461022

29. McAllister, P. (2020). Can brokers rig the real estate market? An exploratory study of the commercial real estate sector. *Journal of Property Research*, 1–35. https://doi.org/10.1080/09599916.2020.1794935

30. Mun, H. W., Hua, N. C., Lin, Y., & Sern, F. J. (2022). Determinants of Internal Migration for Tertiary Students: Structural Equation Modelling Study in Klang Valley, Malaysia. *Asian Development Policy Review*, 10(2), 133–145. https://doi.org/10.55493/5008.v10i2.4513

31. Najieha, N., Masis, S., Hana, N., Maimun, A., Aizuddin, N., Noor, M., Syakima, N., Yusoff, M., Shahril, M., & Rahman, A. (2017). E-COMMERCE IN THE MALAYSIAN REAL ESTATE AGENCY INDUSTRY. *International Journal of Real Estate Studies*, *11*(5). https://core.ac.uk/download/pdf/200251543.pdf

32. National Association of REALTORS. (2020). *2020 Profile of Home Buyers and Sellers*. https://www.gaar.com/images/uploads/2020_NAR_Consumer_Profile.pdf

33. National Association of REALTORS. (2023). *2023 Profile of Home Buyers and Sellers*. https://www.nar.realtor/sites/default/files/documents/2023-profile-of-home-buyers-and-sellers-highlights-11-13-2023.pdf

34. Oliverio, J. (2018). A Survey of Social Media, Big Data, Data Mining, and Analytics. *Journal of Industrial Integration and Management*, *03*(03), 1850003. https://doi.org/10.1142/s2424862218500033

35. Parcu, P. L., Rossi, M. A., Innocenti, N., & Carrozza, C. (2023). How real will the metaverse be? Exploring the spatial impact of virtual worlds. *European Planning Studies*, *31*(7), 1466–1488. https://doi.org/10.1080/09654313.2023.2221323

36. Rahaman, T. (2022). Into the Metaverse – Perspectives on a New Reality. *Medical Reference Services Quarterly*, *41*(3), 330–337. https://doi.org/10.1080/02763869.2022.2096341

37. Rashid, M. F. A., Ab Ghani, I., Ngah, I., & Yasin, S. M. (2014). Evaluation of migration decision-selectivity factors in metropolitan area: a case of Klang Valley region, *Journal of Social Sciences and Humanities*, 9(1), 034-044.

38. Rauschnabel, P. A., Babin, B. J., tom Dieck, M. C., Krey, N., & Jung, T. (2022). What is augmented reality marketing? Its definition, complexity, and future. *Journal of Business Research*, *142*(1), 1140–1150. https://doi.org/10.1016/j.jbusres.2021.12.084

39. Safieddine, F., & Nakhoul, I. (2021). Mobile Instant Messaging (M.I.M.) in Improving S.M.E. in Manufacturing: Case Study. *Wireless Personal Communications*. https://doi.org/10.1007/s11277-021-08307-4

40. Saiz, A. (2020). Bricks, mortar, and proptech. *Journal of Property Investment & Finance*, 38(4), 327–347. https://doi.org/10.1108/jpif-10-2019-0139

41. Sakiyama, M., Miethe, T. D., Lieberman, J. D., Heen, M. S. J., & Tuttle, O. (2017). Big hover or big brother? Public attitudes about drone usage in domestic policing activities. *Security Journal*, *30*(4), 1027–1044. https://doi.org/10.1057/sj.2016.3

42. Sandel, T. L., Ou, C., Wangchuk, D., Ju, B., & Duque, M. (2019). Unpacking and describing interaction on Chinese WeChat: A methodological approach. *Journal of Pragmatics*, *143*, 228–241. https://doi.org/10.1016/j.pragma.2018.08.011

43. Schmalstieg, D., & Hollerer, T. (2016). *Augmented Reality: Principles and Practice* (1st ed.). Pearson Education.

44. Shi, H., Ma, Z., Chong, D., & He, W. (2020). The impact of Facebook on real estate sales. *Journal of Management Analytics*, 8(1), 101–112. https://doi.org/10.1080/23270012.2020.1858985

45. Tian, X., He, W., Tang, C., Li, L., Xu, H., & Selover, D. (2019). A new approach of social media analytics to predict service quality: evidence from the airline industry. *Journal of Enterprise Information Management*, *33*(1), 51–70. https://doi.org/10.1108/jeim-03-2019-0086

46. Tsakiridou, E., & Karanikolas, N. (2019). Real estate in the web and social media era, the Greek reality. *RELAND: International Journal of Real Estate & Land Planning*, *2*(0), 28–43. https://ejournals.lib.auth.gr/reland/article/view/6751/6490

47. Uglješa, S., Kennell, J., Morrison, A. M., & Vujičić, M. D. (2019). The view from above: the relevance of shared aerial drone videos for destination marketing. *Journal of Travel & Tourism Marketing*, *36*(7), 808–822. https://doi.org/10.1080/10548408.2019.1575787

48. Ullah, F., Sepasgozar, S., & Wang, C. (2018). A Systematic Review of Smart Real Estate Technology: Drivers of, and Barriers to, the Use of Digital Disruptive Technologies and Online Platforms. Sustainability, 10(9), 3142.

49. Vergouw, B., Nagel, H., Bondt, G., & Custers, B. (2016). Drone Technology: Types, Payloads, Applications, Frequency Spectrum Issues and Future Developments. *Information Technology and Law Series*, 21–45. https://doi.org/10.1007/978-94-6265-132-6_2

50. Wedel, M., Bigné, E., & Zhang, J. (2020). Virtual and augmented reality: Advancing research in consumer marketing. *International Journal of Research in Marketing*, *37*(3), 443–465. sciencedirect. https://www.sciencedirect.com/science/article/pii/S0167811620300380