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A Stakeholder-Centric Hybrid Framework for Enhancing Property Valuation Quality and Decision-Making in New Zealand

A thesis submitted in partial fulfilment of the requirements for the degree of

Doctor of Philosophy

In

Construction

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ABSTRACT

Property valuation is fundamental to mortgage lending, investment decisions, taxations, and housing policy. Recent advances in automated valuation models (AVMs), machine learning, and large property data sets have improved valuation accuracy by approximately 5-20%. However, existing approaches still face important challenges, including limited transparency, over-reliance on historical data, insufficient considerations of contextual and behavioural factors, and weak integration of stakeholder perspectives. As a result, property valuation quality (PVQ) continues to be assessed credibility. These limitations highlight the need for a more integrated socio-technical frameworks for residential property valuation (RPV). In New Zealand, RPV is becoming more complex due to changing market conditions, new technologies, and increasing stakeholder expectations. While AI and AVMs improve efficiency, concerns remain about transparency, valuation judgement (VJ), and trust. This study develops and evaluates a stakeholder-centric hybrid PVQ framework to support more transparent and informed valuation decisions in the residential property market.

A sequential mixed-methods design was adopted, beginning with a conceptual review of valuation theory, stakeholder decision-making, and PVQ, followed by two systematic literature reviews (SLRs). The first SLR synthesised 41 peer-reviewed studies examining digital transformation and smart real estate (SRE) technologies, identifying increasing reliance on AVMs, data-driven decision systems, and platform-based valuation environments. The second SLR reviewed 44 peer-reviewed studies AI applications in property valuation, analysing the performance of models such as random forest, support vector machines, decision trees, and gradient boosting. Both reviews highlighted limited stakeholder perspectives, weak VJ integration, and inadequate treatment of PVQ.

Building on these theoretical insights, semi-structured interviews were conducted with key residential property stakeholders, including property valuers (PVs), real estate agents (RAs), residential property investors (RPIs), and home buyers (HBs) (n= 34). The qualitative findings revealed that VJ is highly interpretive and context-dependent, shaped by professional experience, market uncertainty, behavioural considerations, and varying stakeholder priorities. Participants consistently emphasised that "*clients do not just want a number, but an explanation of how that number was reached*" highlighting transparency and communicative clarity as foundational to trust. These findings informed the identification of

strategic principles (SP's) (SP1 – Trust), which reframes PVQ as a legitimacy-based outcome grounded in professional transparency and stakeholder confidence rather than accuracy alone. Stakeholders emphasised that AVMs should support, not replace, professional VJ, particularly in context-specific cases. This informed SP3 (Hybridisation) and operational principles (OP's) (OP1 – Contextualisation), reinforcing the integration of technology with local expertise. Regulatory accountability and structured human oversight further shaped SP2 (Governance) and OP2-OP3 (Orchestration and Adaptation), defining the socio-technical structure underpinning perceived PVQ.

The qualitative results informed the development of a nationwide survey (n =112), which was analysed using exploratory factor analysis (EFA), cluster analysis, and partial least squares structural equation modelling (PLS-SEM). The structural model demonstrated moderate explanatory power, with the highest variance explained for VJ (R^2 = 56.9%), followed by Trust (R^2 = 35.4%) and PVQ (R^2 = 11.7%), providing empirical support for the proposed relationships. The findings revealed that RPV is inherently iterative and interpretive, shaped by the interaction of data, professional judgement, market context, and stakeholder expectations. PVQ is not determined solely by model accuracy and methodological compliance, but emerges from how valuation information is generated, interpreted, communicated, and trusted. While digital tools and AVMs enhance efficiency and consistency, they are most effective when used as supportive inputs within a hybrid decision-making process that retains human expertise and contextual awareness. Drawing on these insights, the thesis proposes a stakeholder-centric modular hybrid framework that enhances PVQ as a system level outcome. Framework evaluation findings confirm that the framework reflects contemporary valuation practice and offers practical value for improving transparency, communication, training, and quality assurance.

This research makes theoretical, methodological, and practical contributions. Theoretically, it redefines PVQ as more than just pricing accuracy by showing that it also depends on trust, stakeholder needs, professional judgement, and technology. Methodologically, it develops and tests a stakeholder-centred framework using structural modelling. Practically, it provides guidance on how AI and AVMs can be integrated into professional valuation in a transparent, accountable, and trustworthy way. Although the study is based on New Zealand's residential

property market and uses cross-sectional data, the framework can be adapted to other countries that are adopting digital technologies in property valuation.

DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citations duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Massey University or any other institution.

Wajhat Ali

Student's Signature

Full Name: Wajhat Ali

Student ID:

Date: 30th August 2026

Acknowledgement

Completing this PhD has been one of the most meaningful experiences of my life. It has helped me grow both personally and professionally. I sincerely thank everyone who supported, encouraged, and believed in me throughout this journey.

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Thank you to everyone who has been part of this journey. I will always remain grateful for your kindness, encouragement, and belief in me.

Dedication

This thesis is dedicated to my beloved father and my brother, whose dreams, sacrifices, and unwavering belief in me became my greatest source of motivation. Every lesson you taught me, every sacrifice you made, and every prayer you offered gave me the strength to reach this milestone. Becoming the first PhD in our family is a reflection of your vision, your values, and your constant encouragement to pursue education and excellence. Thank you, Abu and Bhai Jan, for always believing in me, standing by me through every challenge, and inspiring me to never give up. This achievement belongs to both of you as much as it belongs to me.

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LIST OF PUBLICATIONS RELATED TO MY PhD:

Journal Articles

1. **Ali, W.,** Samarasinghe, D. A. S., Feng, Z., Wilkinson, S., & Rotimi, J. O. B. (2026). A systematic literature review on digital transformation in real estate: Challenges and opportunities. *Smart and Sustainable Built Environment, 15*(2), 831–856.
   (Published)
   DOI: https://doi.org/10.1108/SASBE-04-2024-0111

2. **Ali, W.,** Samarasinghe, D. A. S., Feng, Z., & Rotimi, J.O.B (2025). Stakeholder trust in artificial intelligence (AI) for property valuation: Insights from a systematic literature review. *Urbanisation, Sustainability and Society*.
   (Published)
   DOI: https://doi.org/10.1108/USS-12-2025-0060

3. **Ali, W.,** Samarasinghe, D. A. S., Feng, Z., & Rotimi, J.O.B (2026). Operationalisation of property valuation quality: A practical hybrid socio-technical framework. *Housing and Society – Taylor and Francis*.
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4. **Ali, W.,** Samarasinghe, D. A. S., Feng, Z., & Rotimi, J.O.B (2026). Developing and testing a multi-stage framework for property valuation quality using PLS-SEM. *Pacific Rim Property Research Journal – Taylor and Francis*.
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Conference Papers

5. **Ali, W**., Samarasinghe, D.A.S., Feng, Z., & Wilkinson, S. (2025). Exploring real estate digital: The impact of innovative technologies. In Proceedings of the 46th Australasian Universities Building Education Association **(AUBEA)** Auckland, New Zealand.
   DOI: https://doi.org/10.1007/978-981-96-
   (Published)

6. **Ali, W.,** Samarasinghe, D. A. S., Feng, Z., & Rotimi, J.O.B. (2024). *Key factors influencing real estate property valuation: A pilot study on client priorities in buying and selling houses*. In *Proceedings of the 47th Australasian Universities Building Education Association (AUBEA)*, Melbourne, Australia.
   (Presented)

7. **Ali, W.,** Samarasinghe, D. A. S., Feng, Z., & Rotimi, J.O.B. (2025). *The transformative influence of artificial intelligence (AI) on the real estate sector: A systematic literature review*. In *Proceedings of the World Building Congress*, USA.
   (Published)
   DOI: https://doi.org/10.7771/3067-4883.1790

Note: The conference outputs associated with this research have been further developed into extended journal publications. Therefore, they are not included in chapters to avoid repetition and overlapping information.

ABBREVIATION AND ACRONYMS

REM Real estate management

RA Real Estate Agent

SRE Smart Real Estate

AI Artificial Intelligence

VR Virtual Reality

ML Machine Learning

IoT Internet of Things

SaaS Software as a Service

VJ Valuation Judgement

PV Property Valuer

RV Registered Valuer

AVM Automated Valuation Model

RPI Residential Property Investor

HB Home Buyer

RPV Residential Property Valuation

PVQ Property Valuation Quality

BNZ Bank of New Zealand

LVR Loan to Value Ratio

DTI Debt to Income Ratio

IVSC International Valuation Standards Council

PVIF Property Valuation Influencing Factors

PINZ Property Institute of New Zealand

RICS Royal Institution of Chartered Surveyors

KMO Kaiser–Meyer–Olkin Measure of Sampling Adequacy

HTMT Heterotrait–Monotrait Ratio

AR Augmented Reality

SLR Systematic Literature Review

PEST Political, Economic, Social, and Technological

RMSE Root Mean Square Error

PESTLE Political, Economic, Social, Technological, Legal, and Environmental

ANN	Artificial Neural Network
AVM	Automated Valuation Model
CNN	Convolutional Neural Network
DL	Deep Learning
DT	Decision Tree
GBM	Gradient Boosting Machine
GIS	Geographic Information System
GDP	Gross Domestic Product
IP	Intellectual Property
IQ	Information Quality
LIME	Local Interpretable Model-Agnostic Explanations
LSTM	Long Short-Term Memory
ML	Machine Learning
RF	Random Forest
RM	Regression Model
ROI	Return on Investment
SHAP	Shapley Additive Explanations
SVM	Support Vector Machine

PART ONE

BACKGROUND OF THE STUDY

AND

STUDY APPROACH

PROLOGUE – PART ONE

This thesis is situated at the intersection of digital transformation, professional VJ practice, and property valuation in traditional residential real estate markets. It responds to a growing recognition across both academic and professional domains that, while artificial intelligence (AI), automated valuation models (AVMs), and data-driven decision-support systems are increasingly embedded in valuation processes, their implications for valuation quality, stakeholder trust, and professional reasoning remain incompletely understood. The first three chapters of this thesis establish the conceptual, theoretical, and methodological foundations necessary to examine how property valuation quality (PVQ) emerges within hybrid human-technology environments.

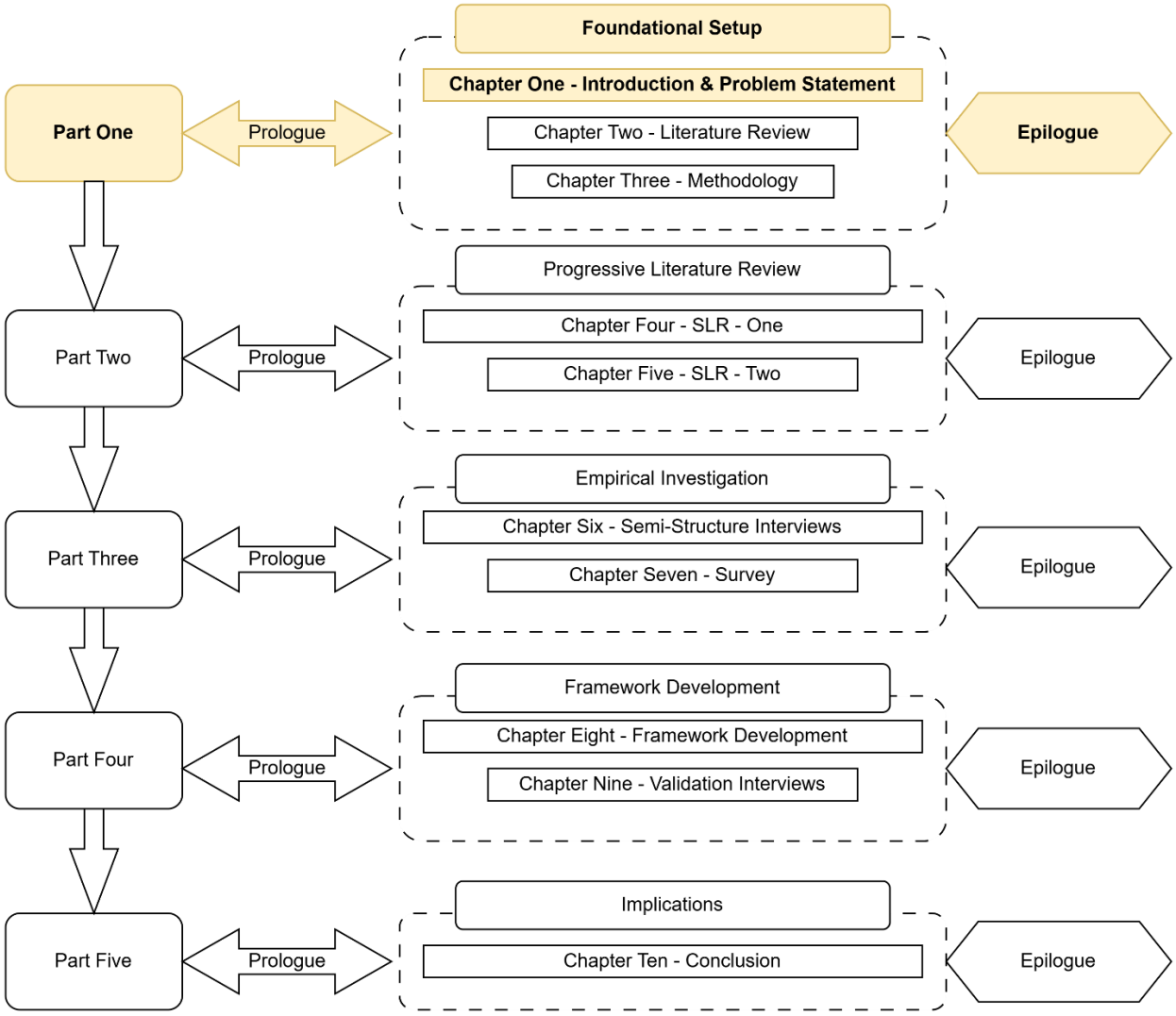
CHAPTER 1 introduces the research problem and contextualises the study within the broader transformation of the real estate sector. It outlines how advances in AI, big data, and digital platforms have reshaped the availability, speed, and volume of valuation-relevant information, while simultaneously intensifying challenges related to information quality, interpretive uncertainty, and institutional trust. The chapter positions residential property valuation (RPV) as a critical decision domain where financial, legal, and social consequences converge, and where the limitations of purely technical and automated approaches become most visible. Building on this context, the chapter articulates the problem statement, research aim, objectives, research questions (RQs), and sub-research questions (SRQs) that guide the thesis.

CHAPTER 2 provides a focused a synthesis of the theoretical and conceptual foundation of the study by integrating on real estate valuation, decision-making theory, socio-technical systems, and institutional trust. It examines the role of AVMs and digital decision-support tools alongside professional VJ, and introduces key concepts such as PVIFs, information quality, and stakeholder trust. The chapter culminates in a conceptual framework that positions PVQ as an emergent outcome of interaction between human reasoning and technological support rather than a purely technical result.

CHAPTER 3 outlines the methodological design of this thesis and explains how the conceptual framework is operationalised through mixed-methods approach. It justifies the use of systematic literature review (SLR), a pilot survey, semi-structured interviews, and a full-scale

multi-stakeholder survey analysed using partial least square – structure equation modelling (PLS-SEM). The chapter details the sampling, instrument development, and analytical procedures adopted to ensure reliability, validity, and coherence across the empirical phases.

Together, CHAPTER 1, CHAPTER 2, and CHAPTER 3 provide the intellectual and methodological platforms for the progressive review and empirical analysis that follow. The frame the thesis as an investigation and foundational layer into how PVQ is constructed within digitally, mediated, professionally regulated, and socially evaluated environments. This foundation enables the subsequent chapters to move systematically from mapping the digital transformation landscape in real estate, through valuation-centred theoretical synthesis to stakeholder-informed qualitative exploration and full-scale quantitative validation of a hybrid property valuation quality framework.


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CHAPTER 1

1. INTRODUCTION

1.1 Research Background

Real estate encompasses land, buildings, and structures, covering residential, commercial, office, and industrial properties (Ullah, Sepasgozar, Shirowzhan, & Davis, 2021b). Real estate management (REM) involves overseeing and administering these properties on behalf of owners. The sector plays a significant role in global economic growth and supports property valuation, transaction, and development across different sectors (Ullah, Sepasgozar, Thaheem, & Al-Turjman, 2021a; F. Ullah et al., 2018c). Consequently, the real estate industry contributes substantially to both urban and rural development worldwide.

Broadly, this sector is categorised into commercial and residential property (Ali et al., 2025a). Therefore, the global scale and economic importance of commercial real estate were highlighted in 2017 statistics when the total value of transactions reached 873 billion USD, and this confounding figure emphasizes the important role played by this industry in the global economy as specifically highlighted by Ullah, Al-Turjman, et al. (2021b). In the year 2019, a notable shift extended within this sector characterized by the rise in the value of commercial properties which increased to an impressive $30 trillion (Kempeneer et al., 2021a). Simultaneously, the residential properties exceeded this figure, boasting an even more substantial worth of $160 trillion (Naeem et al., 2023b). The momentum observed in previous years carried over into 2020, resulting in an extraordinary increase in both sectors, the international commercial property market experienced a real rise, reaching a significant value of USD 32.6 trillion (Naeem et al., 2023b), which served as a testament to the sector's resilience. Concurrently, the residential property sector demonstrated a significant growth of 13% culminating in an impressive total value of USD 258.5 trillion (Tostevin, 2021). This data emphasizes the extensive expansion witnessed in global real estate transactions, while the substantial growth in the sectors highlights the widespread impact and significance of these developments on a global scale, therefore, the global economic importance of real estate is evident. In the United States, it accounts for 11% of the total output, where as in China, it represents 6% of the GDP as mentioned by Naeem et al. (2023b). According to Wang (2023b) Australian capital cities depend extensively on this industry, accounting for 12% of their GDP,

and in Malaysia, real estate and property market contributes 4% to the overall GDP and provides employment opportunities as mentioned by Low et al. (2020b). During the same year, Malaysian statistics show a significant rise in internet users, increasing from 2.9 million to 5 million between 2004 to 2016 and this rapid expansion of internet access made it easier for people to search property information online, compare prices, communicate with real estate agents (RAs) and engage in digital property transaction (Low et al., 2020b). These swift expansions accompanied by a growing preference for technology and internet utilisation have prompted various industries to integrate technologies and hybrid approaches as a fundamental element of their services (Aydinoglu & Bovkir, 2020b). Therefore, the above statistical figures and statements highlight the important impact of real estate including sale, purchase and property valuation on the world economy and they highlight how advancement in technologies with hybrid approaches are not only shaping but also enhancing the industry, emphasizing its evolving role for the economic growth.

The real estate industry continues to grow globally but still relies on traditional practices such as inspections, paper-based records, and experience valuation methods Kania and Kmieć (2022a). To address this limitation, the concept of smart real estate (SRE) was introduced by Fahim F. Ullah et al. (2018b) to integrate innovative technologies into REM and improve conventional processes. SRE aims to reduce challenges in property transactions, and valuation, particularly the regret often experienced by buyers, and sellers due to limited information and the complexity of property purchasing (Munawar et al., 2020a). However, despite its economic importance, the real estate sector has been slow to adopt new technologies due to resistance to change, limited technological infrastructure, and lack of proper guidance and training (Azizi & Rudnytskyi, 2022).

Furthermore, SRE encompasses a range of technologies, including Artificial Intelligence (AI) (Naz et al., 2022b), Virtual Reality (VR) (Azmi et al., 2022a), Big Data (Munawar et al., 2020a), Blockchain (Kasim et al., 2025c), Machine Learning (ML) (Hapuarachchi et al., 2022a), Software as a Service (SaaS) (F. Ullah et al., 2018b), Internet of Things (IoT), Websites and various online platforms (Klamer, 2021). The applications of SRE encompass a wide collection of processes related to the purchase, sales and property valuation of various property types, (Aydinoglu & Bovkir, 2020b). Within this technological ecosystem, property valuation has emerged as a critical application area, where SRE tools are increasingly used to improve data

integration, analytical capability, and decision support. In particular, AI-driven and data-enabled valuation systems have been developed to enhance efficiency, consistency, and predictive performance in property valuation processes (Abatecola et al., 2013b). However, rather than replacing traditional appraisal practices, recent research shows that technology is not intended to replace property valuers (PVs) (Rotimi Boluwatife Abidoye et al., 2019). Instead, it is used to assist their work through what is known as a hybrid property valuation approach, which means that both a computer systems and a PVs are involved in the property valuation process (Kasim et al., 2025c). The computer, often called an automated valuation models (AVMs), analyses large amount of sales data and produces an estimated property value, and PVs then reviews this estimate and decides whether it is reasonable for the specific property (Donovan, 2015). While valuation judgement (VJ) refers to the PVs professional decision-making process, it includes using experience and local market knowledge to consider factors that a computer may not fully capture, and therefore final valuation is based on both data analysis and human judgement (Klamer, 2021). Such hybrid configurations enabled valuation systems to utilize the strengths of technology speed, scalability, and data processing while retaining the interpretive, ethical, and contextual reasoning capabilities of PVs (AlZaidan et al., 2025). Hence, the exponential growth of the evolving real estate industry from last few years after COVID-19 is intimately connected to the expanded adoption and utilization of “innovative technologies” or “SRE” in the realm of REM (Ullah & Al-Turjman, 2023b). These are the main spots where we anticipate witnessing the next major wave of real estate growth and profit opportunities, and therefore previous research by Azizi and Rudnytskyi (2022) suggests that technological advancements and hybrid approaches are the primary catalyst for disruption in the real estate and property sector.

Unlike many other industries, the real estate sector has been slow to adopt technological transformation due to its reliance on traditional professional practices (Cajias & Wins, 2022a). However, recent developments particularly during the COVID-19 pandemic have accelerated the adoption of digital technologies in the sector (Low et al., 2020b). The emergence of SRE enables more efficient data analysis, improving transparency, accessibility, and decision-making in property markets (Abatecola et al., 2013b). With the advancement of the fourth industrial revolution, technology is reshaping the real estate industry by enhancing efficiency,

creating new opportunities for growth, and encouraging professionals to adopt hybrid technological approaches to remain competitive (Aydinoglu & Bovkir, 2020b).

Despite the evident advantages offered by these innovations, their integration faces various challenges which are listed by Ullah, Sepasgozar, Thaheem and Al-Turjman (2021a). The primary challenge faced by the industry lies in the inadequate technological infrastructure, introducing complications in seamlessly integrating advanced tools into existing systems (Abatecola et al., 2013b). This deficiency in a solid foundation becomes evident obstacle, hindering the effective deployment of technological solutions aimed at enhancing the decision-making process (Aydinoglu & Bovkir, 2020b). Furthermore, a significant aggravating factor for these challenges is the scarcity of practical work and research, especially in the domain of technologies like AI specifically concerning property valuation. The current reliance on manual work for property valuation further increases the difficulties associated with leading in cutting-edge technologies into the real estate market (Kempeneer et al., 2021a). Practical barriers also encompass industry resistance to change, concerns related to data security, and the need for extensive training to adapt to new technologies, all contributing to the gradual adoption of innovative solutions (Kempeneer et al., 2021a).

AI holds immense promise for revolutionizing real estate offering solutions that can significantly enhance efficiency, accuracy, and decision-making processes (Cajias & Wins, 2022a). Chaphalkar and Sandbhor (2013) mentioned that one notable application is AVM where AI algorithms analyse vast datasets to provide more accurate and timely property valuations, supporting hybrid approach and reducing reliance on manual appraisal methods. AI-driven predictive analytics empowers real estate professionals to forecast market trends, pinpoint investment opportunities, and make well smart decisions using previous data (Xu & Gade, 2017b). AI also contributes to an enhanced customer experience through chatbots and virtual assistants that facilitate rapid responses to customer inquiries while delivering property recommendations based on individual preferences (Hapuarachchi et al., 2022a), and this not only streamlines communication but also improves overall customer satisfaction. Additionally, AI plays a pivotal role in risk assessment by analysing various factors such as economic indicators and market conditions, helping residential property investors (RPIs), PVs, home buyers (HBs), and developers use the information to make smart decisions and reduce risks linked with real estate investments (Manko, 2022). While the potential benefits of AI in

real estate are vast, overcoming challenges related to technology adoption, data privacy, and industry resistance is crucial for widespread implementation (Cellmer et al., 2024). Continued research, practical applications, and collaborative efforts are essential to fully harness the transformative power of AI in real estate.

While technological innovation and SRE initiatives are transforming the broader real estate sector, the effectiveness of these advancements ultimately depends on how core real estate functions are performed in practice (Al-haimi et al., 2025). Among these functions, property valuation plays a pivotal role, as it directly influences transaction decisions, lending assessments, investment strategies and regulatory processes (Amidu, 2011). The accuracy and reliability of valuation outcomes are therefore fundamental to market stability, transparency, and stakeholder confidence within real estate systems (Amidu, Levy, Bolomope, & Liman, 2024). Despite rapid advances in AI and data driven technology, property valuation remains heavily reliant on professional VJ and traditional appraisal methods, which can limit the extent to which technological benefits are realised in practice as explored by Kasim et al. (2025a). Consequently, the transformative potential of AI in real estate can only be fully achieved when such technologies are effectively integrated into the valuation process in ways that enhance accuracy, transparency, and decision-making quality while maintaining professional standards and trust (Klamer et al., 2017). Within the broader property valuation landscape, residential property valuation (RPV) warrants particular attention due to its scale, high frequency of transactions, and direct social and economic implications for HBs, RPIs, lenders, and policymakers (Liman et al., 2025). RPV outcomes influence everyday financial decisions such as home purchases, mortgage lending, and investment choices, making them highly visible and impactful at both individual and societal levels (Johnson et al., 2024). Unlike commercial valuation, RPV is often shaped by behavioural influences, neighbourhood context, and market sentiment, which increases sensitivity to uncertainty and places greater emphasis on property valuation quality PVQ and transparency as firstly described by Amidu, Levy, Bolomope and Liman (2024). As RPV outcomes increasingly affect financial stability and household decision-making, attention has shifted beyond accuracy alone toward broader notions of PVQ (French & Gabrielli, 2018). PVQ reflects not only the technical correctness of a valuation but also its fairness, transparency, interpretability, and credibility among stakeholders (Wolodko, 2024). From this perspective PVQ emerges as a socio-technical

outcome theory aligned with Appelbaum (1997), shaped by the interaction between data, analytical methods, professional VJ, and stakeholder interpretation, rather than a purely technical calculation.

In response to persistent challenges associated with traditional valuation practices, such as subjectivity (Vaz, 2015), data fragmentation (Hazeem & AlBurshaid, 2024), and limited responsiveness to dynamic market conditions, AI has emerged as a promising tool for supporting RPV through AVMs and data-driven decision support as mentioned by Topraklı (2025). While existing studies demonstrate the potential of AI to improve valuation accuracy and efficiency, much of the literature remains narrowly focused on technical performance (El Jaouhari et al., 2024b). Consequently, limited attention has been given to how AI systems interact with professional VJ, contextual understanding, and stakeholder trust in real world valuation settings. This gap highlights the need for a hybrid valuation framework that integrates technological capability with human expertise to enhance PVQ. Such an approach recognises that AI should function as decision support rather than replacement, complementing professional VJ and contextual insight to deliver valuation outcomes that are not only accurate but also transparent, interpretable, and trusted by stakeholders. Therefore, ongoing shift from traditional real estate to SRE and traditional property valuation to AVMs is expected to bring about various improvements in decision-making and tackle challenges in adopting new technologies and hybrid approaches.

1.2 Problem Statement

The real estate sector is one of the most influential components of the global economy, shaping patterns of investment, household wealth accumulation, urban development, and financial stability as explored by Al-haimi et al. (2025). Despite its scale and economic importance, real estate markets remain inherently complex, information-intensive, and uncertain (El Jaouhari et al., 2024b). HBs, RPIs, PVs, RAs, and policymakers routinely make high stakes decisions under conditions of incomplete information, market volatility, and regulatory complexity as also mentioned by Ali et al. (2025a). These challenges have intensified in recent years due to rapid urbanization, increased market dynamism, and

growing expectations for transparency and efficiency in real estate transactions (Fahim Ullah et al., 2018).

In response, the industry has increasingly embraced digital transformation and SRE initiatives. Technologies such as data analytics, digital platforms, and AI-enabled tools are promoted to improve access to information, streamline transactions, and support more informed decision-making as by Ali et al. (2025a). Although these innovations have enhanced property search, and transaction efficiency, they have not fundamentally resolved the deeper decision-making challenges that underpin real estate outcomes (Kempeneer et al., 2021a).

At the core of real estate decision-making lies property valuation, which serves as the primary benchmark for determining transaction prices, mortgage lending limits, investment feasibility, taxation, and regulatory compliance (Patel, 2024). Valuation outcomes influence how risk are assessed, how capital is allocated and how value is perceived across property markets (AlZaidan et al., 2025). As a result, the credibility of real estate systems depend heavily on the quality and reliability of valuation decisions (Warren-Myers, 2012). When valuation outcomes are trusted and well-founded, markets function more efficiently; when they are inconsistent, uncertainty and risk are amplified throughout the system (Topraklı, 2025).

Despite this central role, traditional property valuation practices faces persistent challenges. Property valuation remains largely dependent on professional expertise referring to VJ (Kasim et al., 2024), and local market knowledge (Kasim et al., 2025a). While professional expertise is essential, reliance on human judgement can introduce subjectivity and variation across PVs, locations, and time periods (Amidu et al., 2021b). These challenges are further compounded by fragmented data sources, time constraints, and the need to interpret complex market signals (Liman et al., 2025). These limitations are particularly evident in RPV, where valuation outcomes directly affect borrowing capacity, housing affordability, and household financial security. As a result, even minor inconsistencies in valuation outcomes can undermine stakeholder trust and decision confidence (Kasim et al., 2024).

The above limitations highlight the importance of a hybrid approach to property valuation, in which technological tools are used to support, rather than replace, professional VJ. A hybrid perspective recognizes valuation as a socio-technical process (Appelbaum, 1997), shaped by

the interaction between data, analytical tools, professional expertise, contextual understanding, and stakeholder trust (Kasim et al., 2025a). However, despite increasing attention to technology-enabled valuation tools, research still lacks a comprehensive framework explaining how technological support and professional judgement interact to influence PVQ particularly in residential markets (Amidu, Levy, et al., 2024b).

These global challenges are particularly acute in New Zealand, where RPV occupies a central position in household wealth formation, financial stability, and national economic performance (Amidu, Levy, et al., 2024b). Valuation outcomes affect mortgage approvals, loan to value ratio, and investment decisions, making them highly consequential for stakeholders such as HBs, RPIs, Ras, and policymakers (Armstrong et al., 2019). Although digital property platforms and AVMs have increased access to market information access, professional valuation practice in New Zealand remains largely judgement-driven (Wilkinson, 2025). Consequently, there remains limited empirical understanding of how technological tools, professional practice, and stakeholder interpretation interact to shape valuation outcomes. Addressing this gap is essential for improving PVQ and supporting more reliable and transparent decision-making within dynamic residential property markets.

1.3 Research Aim and Objectives

This research aims to develop and empirically validate stakeholder-centric modular hybrid property valuation quality framework for residential property valuation in New Zealand.

The framework focuses on the interaction between digital valuation technologies and professional valuation judgement . The study adopts a stakeholder-centric perspective, recognising the roles of HBs, PVs, RAs, RPIs, and policymakers in the valuation process. It examines how these stakeholders interpret and valuation information when making property-related decisions. Furthermore, the research explores how technological tools and professional expertise interact to influence the quality, transparency, and reliability of valuation outcomes. Through this approach, the study aims to provide a structured framework to support more informed and consistent property valuation practices.

Consistent with the research background and the problem statement, this research embarks on the following the research objectives:

1. To develop a conceptual framework that synthesises how digital technologies can support property valuation decision-making in real estate.
2. To formulate a hybrid property valuation quality (PVQ) framework by integrating technological valuation support with professional valuation judgement and contextual factors.
3. To empirically develop and validate the practical application of the stakeholder-Centric modular hybrid property valuation quality framework.

Table 1.1 presents an overview of the research aim, objectives, research questions (RQs), and the corresponding data collection methods and analytical techniques adopted in this study to develop and validate stakeholder-Centric modular hybrid property valuation quality framework.

Table 1.1: Overview of Research Objectives

Research Aim	Research Objectives	Research Questions	Data Collection method/s	Analytical Techniques
This research aims to develop and empirically validate stakeholder-centric modular hybrid property valuation quality framework for residential property valuation in New Zealand.	1. To develop a conceptual framework that synthesises how digital technologies can support property valuation decision-making in real estate.	**RQ1**. What are the current scientific trends in the real estate sector? **RQ2**. What are the primary innovative technologies employed in SRE? **RQ3**. What challenges exist to implementing innovative technologies in SRE? **RQ4.** How do innovative technologies facilitate data-driven decision-making in real estate. **RQ5.** What are the diverse needs of stakeholders in AI-driven property valuation models in the real estate industry? **RQ6.** What factors influence stakeholders trust in AI-driven property valuation models?	Systematic Literature Review (SLR)	PRISMA-based systematic review; thematic synthesis
	2. To formulate a hybrid property valuation quality (PVQ) framework by integrating technological valuation support with professional valuation judgement and contextual factors	**RQ1.** How do key stakeholders perceive property valuation quality and the limitations of existing valuation approaches? **RQ2**. How do stakeholders perceive the role of AI-enabled and automated valuation tools in influencing valuation accuracy, transparency, and trust in residential property valuation? **RQ3**. What key dimensions define property valuation quality in residential real estate from a multi-stakeholder perspective? **RQ4.** How can a hybrid property valuation quality framework be constructed?	Semi-structured interviews with property valuers, real estate agents, home buyers, and residential property investors	Thematic analysis; causal loop analysis; framework synthesis
	3. To empirically test, develop and evaluate the practical application of the stakeholder-Centric modular hybrid property valuation quality framework.	**RQ1.** What key factors are used when valuing residential properties in practice? **RQ2.** Do different stakeholder groups place different levels of importance on these valuation factors? **RQ3.** How do valuation judgement, professional practice, and hybrid valuation support shape trust and perceived PVQ? To operationalise RQ3, three sequential sub-research questions (SRQs) are examined: ▪ *SRQ1: How do valuation influencing factors shape valuation judgement? (Phase 01)* ▪ *SRQ2: How does valuation judgement relate to professionalism and hybrid valuation support? (Phase 02)* ▪ *SRQ3: How do professionalism and hybrid valuation support influence trust in PVQ? (Phase 03)* **RQ4.** How do experts evaluate clarity, relevance, and practical applicability of the proposed hybrid property valuation quality framework?	Survey (Questionnaire); Expert Evaluation	Exploratory factor analysis; Cluster Analysis, Partial Least Square – Structural Equation Modelling (SmartPLS4)

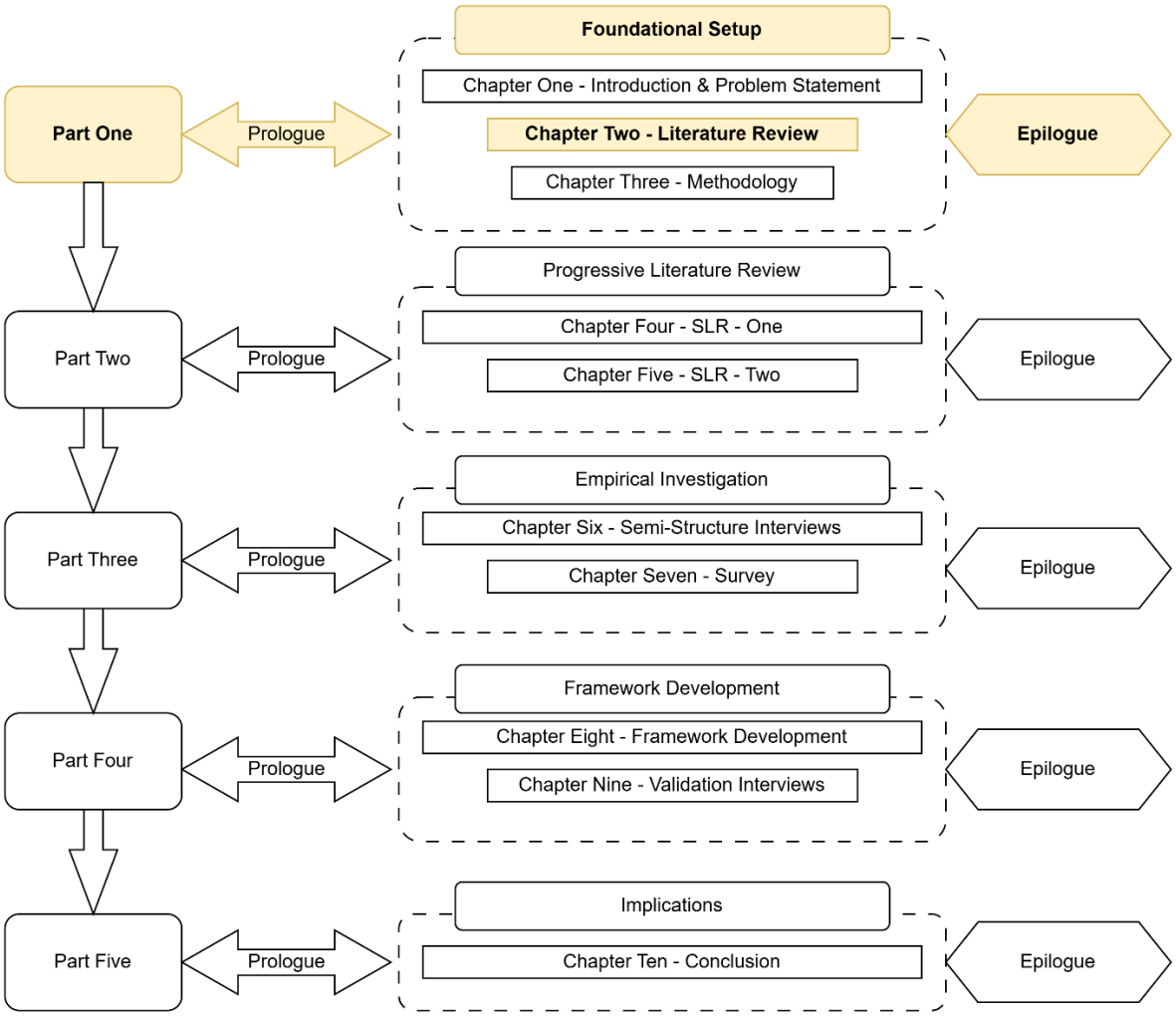
1.4 Scope of the Study

This study focuses on PVQ within the context of residential real estate New Zealand, with particular attention to how valuation decisions are formed through the interaction of technological valuation support, professional VJ, and contextual influences. The scope of the research is intentionally defined to ensure depth, coherence, and methodological rigour while addressing a clearly identified gap in valuation literature and practice. Therefore, from a thematic perspective, the study concentrates on PVQ rather than valuation accuracy alone. While accuracy is recognised as an important technical component of valuation, prior research highlights that valuation outcomes are also shaped by transparency, interpretability, contextual sensitivity, ethical judgement, and stakeholder trust. Accordingly, this research demonstrates PVQ as a socio-technical decision-making outcome, emerging from the combined influence of data, analytical tools, human expertise, and institutional context. Within this broader framing, the study specifically examines the role of technological valuation support, including AVMs, digital property platforms, and AI-enabled decision-support tools, as they are used and interpreted in practice. Rather than assessing the technical performance of these technologies, the study focuses on how such tools influence professional VJ, stakeholder trust, and valuation transparency. This focus reflects increasing academic, and professional attention to explainability and contextual alignment in technology assisted valuation processes.

To investigate these interactions systematically, the scope of the research is structured across three interconnected methodological stages. First, a SLRs establishes a conceptual foundation by synthesising research on technology use and valuation decision-making. Second qualitative stakeholder interviews with PVs, RAs, RPIs, and HBs, capture real world valuation practices, perceptions, and challenges. These insights are analysed using reflexive thematic analysis and causal loop diagramming to construct the hybrid PVQ framework. Third, the framework is empirically tested and validated using survey data analysed through exploratory factor analysis (EFA), cluster analysis, and PLS-SEM, ensuring that the proposed relationships are robust and contextually relevant. This quantitative validation is complemented by expert interviews, which are used to refine and confirm the framework by assessing its clarity, relevance, and practical applicability across professional and institutional contexts. Together, these stages ensure that the framework is not only empirically grounded but also informed

by expert judgement and practice-based insight. Although the empirical data are drawn from stakeholders in New Zealand's residential property market, the findings and concepts may be transferable to , or informative for, other jurisdictions undergoing similar digital transformation and regulatory developments. While the study is grounded in the New Zealand context, the proposed framework provides adaptable insights that may support future research and practice in comparable property valuation systems. This design enables the framework to offer value across different residential property markets where similar valuation challenges related to technology integration, judgement, and trust are present.

Recognising that PVQ is co-produced rather than determined by a single actor, the study adopts a multi-stakeholder perspective, incorporating insights from PVs, RAs, RPIs, and expert HBs. This inclusive approach reflects evidence that valuation outcomes emerge through interaction between professionals, end users, technologies, and institutional settings. Finally, the scope of the study is defined by international boundaries. The research focuses exclusively on RPV, does not develop specific AI algorithms, and does not propose and implement a digital valuation platform. Instead, its contribution lies in developing, empirically validating, and implementing actionable insights in a hybrid decision-oriented framework that explains how PVQ can be enhanced through structured integration of technological support, professional VJ, and contextual understanding. These boundaries ensure analytical focus while allowing the study to make a meaningful theoretical and practical contribution to global valuation research and practice.


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CHAPTER 2

2. LITERATURE REVIEW

RPV sits at the centre of housing market decision-making because it shapes transaction feasibility, mortgage lending approvals, households borrowing capacity, and perceptions of whether a purchase and investment is fair and defensible (van der Molen & Nijskens, 2019). According to recent report of BNZ (2025), In New Zealand, this role is especially consequential because bank lending settings such as loan to value limits and debt to income restriction directly condition who can assess mortgage finance and on what terms, thereby elevating the practical importance of valuation evidence in a volatile housing environment. However, as per Kurlat and Stroebel (2015) work and RICS (2021) report that PVQ is difficult to sustain consistently because housing markets are heterogeneous and fast moving, and PVs must reconcile imperfect and fragmented information with local market external signals and stakeholder expectations. At the same time, property valuation practice is being reshaped by increasing digitisation and decision-support tools, creating a hybrid environment in which professional VJ remains necessary but must be exercised transparently and communicated convincingly (Kasim et al., 2025a). This aligns with international valuation standards council (IVSC) linking public trust in valuation to consistent, objective, and transparent VJ that is clearly reported by RICS (2025). In New Zealand context, recent sector work has similarly framed PVQ as a multi-dimensional construct informed by PVs and clients expectations, highlighting the practical need to understand how “quality” is assessed beyond technical correctness alone as first time highlighted by Amidu et al. (2021b).

Therefore, this chapter synthesises prior research to develop a coherent theoretical foundation explaining how property valuation influencing factors (PVIFs), are interpreted through professional VJ, how this VJ shapes perceptions of professionalism and the use of hybrid valuation support, and how these pathways ultimately contribute to trust and PVQ, thereby setting up the conceptual framework and hypotheses tested in the final quantitative stage.

2.1 The globalised real estate landscape

The real estate sector operates within an increasingly globalised economic environment in which capital flows, investment behaviour, regulatory oversight, and market expectations are shaped by international financial conditions and coordinated policy responses as reported by Naeem et al. (2023b). Residential real estate represents the largest proportion of global property assets and plays a pivotal role in household wealth formation, financial system stability, and macroeconomic performance (Fahim Ullah et al., 2018). As housing markets have become more interconnected, shifts in interest rates, credit availability, and RPIs sentiment have transmitted more rapidly across authorities, increasing volatility at the local market level and intensifying reliance on credible valuation information to support informed decision-making by HBs, RPIs, RAs, PVs, and policymakers as reported by Ali et al. (2025a). In this context, RPV functions not merely as a technical price estimation exercise but as a key informational mechanism that translates complex and dynamic external market signals into evidence used for high stakes housing and financial decisions (Teikari et al., 2025). Globalisation has also increased the pace and complexity of residential property markets (Clerc, 2019), making valuation practice more challenging reported by Ismail et al. (2025). International capital movements, regulatory reforms, and shifting housing demand patterns have contributed to shorter market cycles and heightened price volatility, particularly in residential sectors where supply constraints, behavioural influences and neighbourhood effects play a significant role as explored by Badarinza and Ramadorai (2025). These conditions place substantial pressure on PVs to interpret market dynamics accurately while accounting for localised contextual factors such as HBs preferences, neighbourhood characteristics, and regulatory settings (Fernandez, 2019). Consistent with this view, prior research conceptualises valuation as professional decision-making process in which market is filtered through professional VJ, contextual interpretation, and reasonableness assessment (Liman et al., 2025). Figure 2.1 synthesises this literature by illustrating how property valuation outcomes emerge from the interaction between PVIFs, VJ, qualitative assessment, and decisions support tools, rather than from mechanical application of historical sales data alone as this work done by Liman et al. (2025).

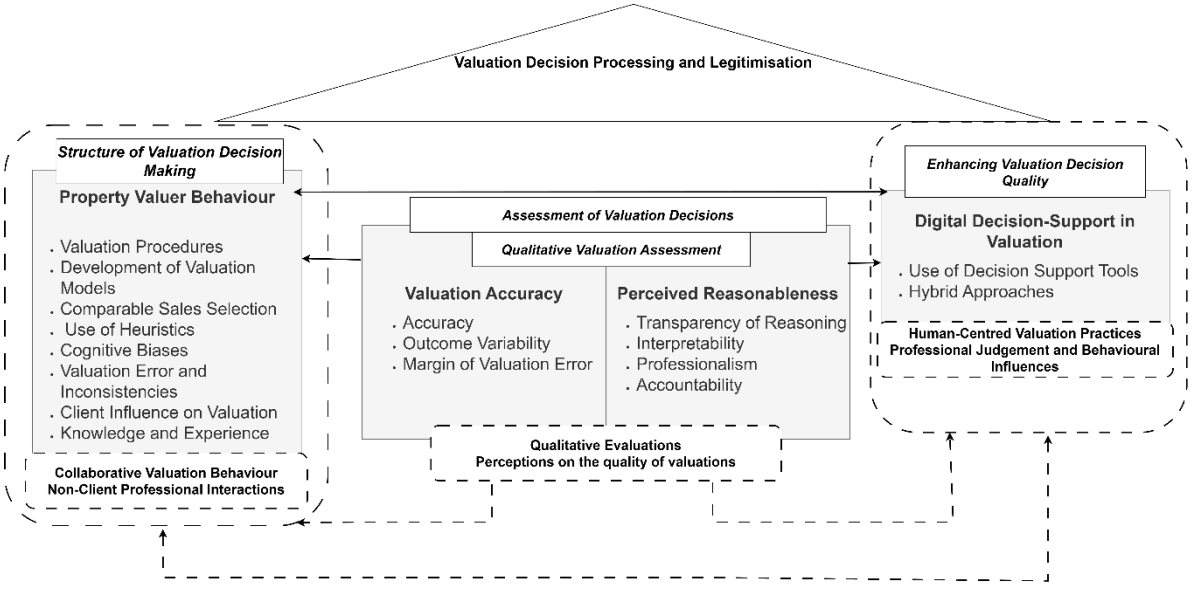


Figure 2.1: Conceptual synthesis derived from the literature

Source: (Liman et al., 2025)

Furthermore, recent global disruptions, most notably the COVID-19 pandemic, exposed vulnerabilities in traditional real estate practices and intensified dependence on valuation outputs during periods of uncertainty (Logan, 2016). As recent work by He et al. (2025) shows that lockdowns, mobility restrictions and economic instability disrupted transaction activity, delayed construction, and reduced cross-border investment flows across many housing markets. At the same time, rapid shifts in housing demand, such as increased preferences for suburban and lower density living and changing expectations around home-based work, altered price formation processes in ways that were difficult to capture traditional valuation approaches reliant on lagged transaction data (Gamber et al., 2023; Liu & Su, 2021).These developments highlighted the limitations of traditional valuation practices and reinforced the need for contextual interpretation and professional VJ when forming valuation conclusions in rapidly changing market environments. Furthermore, the pandemic period also accelerated the adoption of digital platform and technology-enabled practices across the real estate sector, including online listings, virtual inspections, and automated market analytics (Ullah, 2021).

As illustrated in Figure 2.2, global capital investment and deal activity in smart and technology-enabled real estate increased substantially in the years preceding the pandemic, followed by a sharp contraction in 2020 as market uncertainty intensified (FinTech, 2020).

While these digital developments improved access to information and operational efficiency, they did not reduce the complexity of valuation decision-making (Ullah, 2021). Instead, they reshaped how valuation evidence is generated, interpreted and communicated, raising critical questions about how professional VJ is exercised in industry, how valuation reasoning is legitimised, and how stakeholders form trust in valuation outcomes within increasingly hybrid valuation environments (Kasim et al., 2024). Accordingly, the globalised and post-pandemic real estate landscape provides an essential backdrop for examining RPV as a socio-technical decisions-making process in which PVQ emerges from the interaction between market context, valuation inputs, professional VJ, technological support, and stakeholder interpretation.

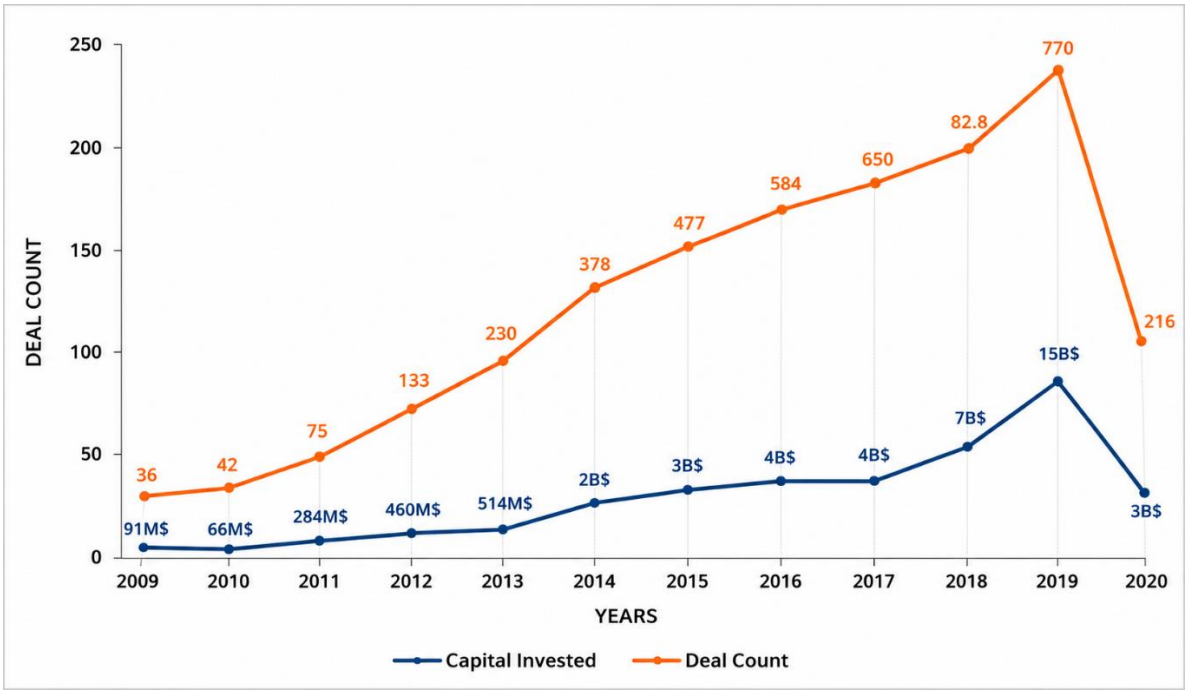


Figure 2.2: Global SRE investment trends, 2009–2020.

Source: Michaeli (2020b)

2.2 Residential Property Valuation as a Decision Process

Within the globalised, volatile, and increasingly digitised housing environment described in the preceding section, RPV emerges as a professional decision-making process rather than a purely technical task. In practice, PVs do not estimate prices through fixed rules and historical averages alone; valuation is a judgement-based process that requires the interpretation, weighting, and reconciliation of market evidence under prevailing conditions as claim is supported by IVSC (2024). Instead, they are required to form judgement-based conclusions

by integrating multiple sources of information, often under conditions of uncertainty, time pressure, and incomplete market evidence as per IVSC (Aronsohn, 2017). Each valuation decision and report involves assessing what information is relevant, determining how different valuation input relate to one another, deciding how market signals should be interpreted at a specific point in time as mentioned by Brown (1998) that "*The idea that valuation is an art, not a science, is hardly mentioned these days".* Therefore, residential property markets amplify this decision-making challenge because properties are inherently heterogenous (Marsh & Gibb, 2011). As per Baum et al. (2013) differences in location, neighbourhood quality, physical condition, layout, orientation, and surrounding amenities mean that no two residential properties are directly comparable therefore requires interpretation and adjustment rather than direct comparison as also supported by Marsh and Gibb (2011). Even where recent transaction data are available, PVs must judge the degree to which those transactions reflect current market conditions and whether they are appropriate benchmarks for the subject property (Liman et al., 2025). This interpretive process requires PVs to move beyond mechanical comparison and apply professional reasoning informed by local market knowledge and experience (Plante et al., 2022b).

Decision-making theory proposed by Turpin and Marais (2004) helps explain why professional VJ remains unavoidable in property valuation. By comparing different theoretical models of decision-making, their work demonstrates that complex decisions cannot be fully resolved through analytical models alone and require human judgement to interpret information quality and manage uncertainty (Johnson & Busemeyer, 2010). Furthermore, the concept of bounded rationality by Simon (1955) here suggests that decisions-makers operate within limits imposed by imperfect information, cognitive constraints, and time pressures, rather than making fully optimised chooses based on complete data. Similarly, RPV closely reflects these conditions, where market data may be outdated, incomplete, or inconsistent, while economic and behavioural factors can shift rapidly (Marsh & Gibb, 2011). PVs use professional VJ to interpret market evidence, apply, and reconcile different valuation approaches (market, income, and cost), manage uncertainty, and arrive at valuation conclusions that are reasonable, defensible, and consistent with prevailing market conditions as also mentioned by property institute of New Zealand (PINZ) (Hoyt Richard et al., 2002). Therefore, the decision-oriented nature of RPV becomes especially evident when market

conditions are unstable and changing rapidly as per recent report of Guide (2025a). For example, economic shocks, particularly affecting housing demand, can weaken the reliability of historical sales evidence and increase uncertainty in price formation, such shocks often disrupt market stability, leading to changes in house prices, transaction volumes, and investor sentiment, which in turn reduce the accuracy and consistency of past sales data used in valuation (BNZ, 2025). In such situations, PVs must assess emerging trends, anticipate market responses, and exercise forward-looking judgement, even when quantitative evidence is limited (Badarinza & Ramadorai, 2025). Rather than eliminating VJ, these conditions increase its importance, as valuation conclusions must account for context and risk alongside observable data (Plante et al., 2022b).

Importantly, RPV decisions are not made in isolations, PVs operate within professional, institutional, and regulatory environments that shape how decisions are formed and justified (Klamer et al., 2021b). RPV outcomes must be communicated clearly and defended to multiple stakeholders, including HBs, RPIs, lenders, and regulators (Joslin, 2005). This requirement places emphasis on transparency, consistency, and credibility in valuation reasoning (Cheung, 2024). Professional VJ therefore involves not only selecting and weighting valuation inputs, but also articulating how these VJ have been reached in ways that can be understood and accepted by others (Klamer, 2021), therefore, RPV can be understood as a structured yet judgement dependent process. PVQ emerges through the interaction between valuation inputs, professional reasoning, contextual understanding, and institutional expectations, rather than from valuation methods alone (Amidu et al., 2021b). This understanding provides a critical foundation for examining the specific factors that inform valuation decisions.

2.3 Property Valuation Influencing Factors

Building on the view of RPV as a professional decision process, the literature further asks a practical question: what information do PVs rely on when they form a valuation opinion? The answer is not a single dataset or a fixed formula (Amidu et al., 2021b). Instead, valuation decisions emerge from how PVs engage with multiple forms of evidence some measurables, some contextual, and some behavioural, and how they judge what matters most at a particular moment in time (Liman et al., 2025). Across property valuation research, these inputs are commonly described as PVIFs (Kasim et al., 2025c). Importantly, PVIFs are rarely

treat as automatic “drivers” of value (Kasim et al., 2025a). Rather, they are understood as value-relevant signals that must be identified, interpreted, and combined through professional reasoning especially when market evidence is incomplete (Rotimi Boluwatife Abidoye et al., 2019). A key insight from the body of this research is that PVIFs are not universal across contexts. What constitutes relevant evidence, and the degree to which it influences value, varies according to market cycles, local norms, regulatory environments, and the specific purpose of the valuation assignment (Lorenzo-Seva & Ferrando, 2024). This perspective aligns closely with the decision-oriented view of valuation, which emphasises that the central challenge is often not the availability of information but the meaning attributed to that information under conditions of uncertainty (Khemka, 2021). From this standpoint, drivers can be seen as the raw materials of property valuation reasoning, inputs that do not speak for themselves until a PVs construct a defensible valuation argument through professional interpretation and justification.

2.3.1 Value Signals

According to Dimopoulos (2023) property valuation research repeatedly stresses a distinction between data and value. Even though prices, property details, and market data are factual, they do not automatically show a property’s true value, where PVs must interpret this information to decide (Gatzlaff & Holmes, 2013). These PVIFs are more like signals, clues about how a particular buyer and seller agreed on a price under specific conditions (Knight et al., 1994). According to Information economics the signalling theory by Connelly et al. (2011) helps explain why signals are necessary in the first place: housing markets contain imperfect and asymmetric information, meaning different actors hold different knowledge about quality, risks, and true market conditions both what is visible and what is hidden as also explored by Kurlat and Stroebel (2015). Transaction evidence, for example is shaped by timing, finance approvals, urgency, negotiation dynamics, marketing strategies, and expectations about future prices (Marshall, 2024). Two property sales that appear similar in data can reflect very different underlying circumstances, which means that valuation is an interpretive process, where PVs must assess whether each sale is truly comparable to property being valued (Santo, 2015). Therefore this literature increasingly frames valuation as a signal filtering process: PVs sifts through available evidence, assess reliability, and decide

what deserves weight and what should be treated cautiously particularly in markets where turnover is uneven and sentiments shifts quickly (Gonzales et al., 2023).

2.3.2 Comparability

Therefore, if value signals are the starting point, comparability is often the main bridge between signals and conclusions in RPV (Lorenz & Lützkendorf, 2008). Research shows that comparability does not happen automatically, instead PVs use their professional VJ to decide whether a sale can be treated as comparable (Kasim et al., 2025c). RPV markets are heterogenous by nature differences in design, maintenance, functionality, and lived experience mean properties cannot be matched perfectly, even within a small area (Watkins, 1999). This indicates that a comparable sale is not merely identified but is established and justified through the PVs professional reasoning (Crosby, 2000). As per characteristics theory by Ekelund Jr and Hebert (1991) suggests that people do not value a product as a whole, but rather value it based on the individual features it offers, and hedonic pricing theory formalises the idea that the market implicitly prices bundles of attributes through transactions (Kivimäki, 2024). Therefore, empirical housing research built on this tradition shows that the value of attributes changes across space and over time: the same feature can be rewarded differently depending on housing cycles, policy changes, infrastructure investment, or shifting household preferences (Preece et al., 2020). As a result, comparability is always conditional: PVs must decide which differences are meaningful in this market, at this time, and how strongly adjustments should reflect those differences (Salvo & Tavano, 2024). Therefore, comparability is about matching and more about professional reasoning, while selecting evidence that can credibly stand as a benchmark and explaining why that evidence supports the valuation conclusion.

2.3.3 Market Context

Once comparable are identified, the literature argues that they cannot be interpreted without market context (Gabrielli & French, 2021). Residential markets respond to changes in interest rates, credit access, labour market conditions, and expectations about price trajectories (Ortalo-Magne & Rady, 2006). These forces shape not only sale prices but also the usefulness of sale price as valuation evidence (Kuchler et al., 2023). Under stable conditions, recent transactions may provide a reasonable picture of what HBs are willing to pay (Davis & Haltiwanger, 2024). During periods of market disruption, historical sales evidence may fail to

capture current HBs sentiment and emerging market trends (Case & Shiller, 1988). According to decision-making theory Turpin and Marais (2004) PVs often work with limited and imperfect information, rather than relying on complete models they use the best available cues and adjust their VJ as market conditions change. In practice, PVs consider whether the market is shifting, whether past sales are still useful, and whether new market signals should matter more than older data (Crosby, 2000). The literature therefore treats markets context as a valuation influence in two ways: it affects prices directly, and it shapes how confidently different forms of evidence can be relied on at the valuation date.

2.3.4 Behaviour

A growing body of research also highlights that market evidence is created within a system shaped by human behaviour (Kasim et al., 2025a). Housing decisions are high-stakes and emotionally loaded, especially for owner-occupiers, and they are often made under time pressure and uncertainty (Cole, 2020). According to behavioural economics by Earl (1990) shows that in such settings people rely on heuristics, narratives, and expectations rather than purely rational calculations (Liman et al., 2025). In housing markets, these behavioural factors can be seen in competitive bidding, a sense of urgency among HBs, and fears of missing out all of which can strengthen and speed up market ups and downs (Landry, 2014). Furthermore, empirical work demonstrates that sentiment and beliefs about future price growth can influence transaction activity and price formation, especially in boom bust dynamics (Duca et al., 2021). For valuation, the implication is not that prices are wrong, but that prices can sometime reflect short-lived psychology as much as underlying fundamentals (Rotimi Boluwatife Abidoye et al., 2019). This strengthens the argument that PVIFs must be interpreted with awareness of prevailing market narratives: what buyers believe, what sellers expect, and what lenders or investors assume about risk and future conditions.

2.3.5 Risk

Risk and uncertainty have become more prominent in valuation literature as residential markets face environmental, financial, and regulatory pressures (Ahiadu et al., 2025). Studies show that values can be sensitive to perceived risks such as hazard exposure, insurance costs, affordability constraints, but the impact of risk is not uniform (McCluskey & Rausser, 2001). It depends on whether risk is known, disclosed, and believed by market participants (Mallinson & French, 2000). Risk also introduced a forward-looking element into valuation,

even when the valuation is grounded in current evidence, risk evaluation often involves anticipating how future costs, restrictions, and perceptions may influence demand and price resilience (Lind & Nordlund, 2021), this why risk-related PVIFs are difficult to treat as stable numeric adjustments. This literature generally treats them as interpretive influences that require PVs to judge salience, credibility, and likely market reaction again reinforcing valuation as a decision process, not an automated calculation.

2.3.6 Institutions

Finally, property valuation does not occur in a blankness, and it is embedded in institutional settings, planning rules, taxation regimes, professional standards, lending policies, and regulatory expectations (Dagan, 2011). Institutional theory by Ayyagari et al. (2008) emphasises that economic behaviour is structured by rules and norms, and that legitimacy is shaped by compliance with accepted frameworks (Earl, 1990). In RPV, this matters because valuations are often used for mortgage decisions and risk management, meaning conclusions must be not only plausible but institutionally defensible (Davidson & Levin, 2014). The literature shows that institutional framing influences what evidence is accepted, which assumptions are permitted, and how valuation reasoning must be documented and communicated particularly in regulated lending and professional practice contexts (Amidu, Levy, et al., 2025). Therefore, PVIFs are not just market influences; they are also legitimacy influences, shaping whether stakeholders trust a valuation conclusion enough to act on it.

Across these strands, the literature delivers a consistent message: PVIFs are best understood as signals rather than fixed determinants. They matter because they provide evidence about value, but they do not deliver value automatically. RPV therefore involves selecting, prioritising, and reconciling diverse information under uncertainty, and then converting that information into coherent, defendable narrative. Technological advances and richer datasets may expand the information available to PVs, but they do not remove the need for VJ. Instead, they often increase interpretive demands by multiplying signal and creating new questions about reliability, relevance, and communication (Kasim et al., 2024). This framing provides a direct bridge from the decision-process view of valuation to the next section on professional VJ. If PVIFs are the signals, then VJ is the reasoning mechanism that explains how signals are weighed, how uncertainty is managed, and how valuation conclusions are legitimised within professional and institutional practice. This perspective links the decision-making view of RPV

to the role of professional VJ. If PVIFs provide the signals, then VJ explains how PVs interpret and weigh these signals, manage uncertainty, and justify their final valuation decisions within professional and institutional settings. Therefore, the next section reviews of professional VJ, focussing on how it is exercised, structured, and justified in RPV.

2.4 Valuation Judgement in Residential Markets

As RPV is increasingly understood as a decision-making process shaped by complex and uncertain market conditions, the literature consistently identifies professional VJ as the core mechanism through which valuation decisions are formed by interpreting PVIFs (Klamer et al., 2017). Rather than viewing RPV as a mechanical application of methods to data, previous research emphasise that valuation outcomes emerge from how PVs interpret, reconcile and justify multiple and often competing sources of information (Chmielewska et al., 2025). This perspective reflects a broader shift in valuation research away from purely technical accuracy toward understanding valuation as a professional reasoning activity embedded within real market contexts (Amidu et al., 2019a). Therefore, professional VJ refers to the evaluative process and role of knowledge of PVs through which determine what information is relevant, how much weight should be assigned to different forms of evidence, and how uncertainty should be addressed in arriving at a final value opinion (Wilkinson et al., 2017). Therefore the previous studies stresses that VJ is not an optional element of valuation practice, but an unavoidable and necessary feature, particularly in residential markets characterised by heterogeneity (Klamer et al., 2017), behavioural influences (Amidu et al., 2019a), and rapidly changing conditions (Kasim et al., 2024). Even where formal valuation approaches provide analytical structure, they do not remove the need for VJ; instead, they rely on judgement to function effectively in practice because these decision are made with uncertainty as mentioned with a simple theory of complex valuation by Casey and Simon-Kerr (2014).

2.4.1 Uncertainty

Uncertainty is repeatedly identified as a defining condition of RPV, where housing markets rarely provide complete, timely, and perfectly comparable data (Thorne, 2021), and valuation decisions must often be made despite gaps, inconsistencies and lag in transaction evidence (Mallinson & French, 2000). As Decision-making theory by Turpin and Marais (2004) and also recent work by Liman et al. (2025) offers a useful framework for understanding how PVs operate under such conditions. Furthermore, RPV closely reflects these conditions, where PVs

must decide whether recent sales reflect stable market behaviour and temporary distortions, assess whether emerging trend should influence current values, and judge how uncertainty should be reflected in valuation conclusions (Mohammad et al., 2018).Therefore, a study by Stasiak and Jarecki (2024) shows during periods of market volatility, such as sudden shifts in housing demand, uncertainty in valuation increases because data become less complete, timely, and comparable. Under such condition, important studies by Mohammad et al. (2018) and Ahiadu et al. (2024) emphasise that PVs must rely more heavily on professional VJ to imperfect market evidence with the role of knowledge mentioned by Amidu et al. (2019a) and also managing uncertainty rather than depending on solely on historical approaches as highlighted in Liman et al. (2025) work. In these contexts, VJ functions as a mean of integrating incomplete evidence with contextual understanding and role of knowledge to produce defensible outcomes.

2.4.2 Experience

A substantial research highlights that PVs experience and professional knowledge significantly influence the quality of VJ (Amidu et al., 2021b), since PVs must interpret data and apply market insights rather than rely solely on formulas (Pagourtzi et al., 2003; PYE, 2018). Experienced PVs develop understood knowledge about market behaviour, HBs responses, and local conditions as explored by Amidu et al. (2019a) that cannot be fully captured in formal datasets. This aligns with broader theories of professional expertise by Eraut (2001), which suggest that experts rely on accumulated experience and pattern recognition when making complex judgements under uncertainty as also aligned with Klamer et al. (2017) work. In RPV, experience enables PVs to recognise when transaction prices are influenced by exceptional circumstances (Levy & Schuck, 2005; Mohammad et al., 2018), identify subtle differences between seemingly similar properties, and anticipate how market participants may respond to changing conditions (Kasim et al., 2024). Therefore, the literature suggests that this experiential dimension of VJ contributes to both consistency and credibility in valuation practice, particularly in market where behavioural and contextual factors play a strong role. Importantly, experience and role of knowledge do not eliminate uncertainty, but it improves the PVs ability to manage and explain it with reasoning.

2.4.3 Heuristics and structured reasoning

While professional experience strengthens VJ, where Liman et al. (2025) also recognises that PVs routinely rely on heuristics and cognitive shortcuts, to manage the complexity and uncertainty inherent in RPV (Coskun, 2022). Therefore, RPV requires the processing of large volumes of information (Amidu et al., 2021b), transaction data (Mohammad et al., 2018), property attributes (Kasim et al., 2024), market trends, and contextual signals often within limited timeframes and under commercial and regulatory pressures as highlighted with data challenges by (Oladokun & Mooya, 2023). Under such conditions, heuristics serve as practical tools that enable PVs to simplify decision tasks and focus attention on information perceived as most relevant (Ali et al., 2020). Common heuristics identified in valuation research include anchoring to recent comparable sales, using familiar neighbourhood narratives as reference points, and drawing on prior valuation outcomes to frame current VJ (Oyeyoade, 2012). From a decision-theory perspective by Turpin and Marais (2004), heuristics use in valuation reflects bounded rationality (Bar-Gill & Perisco, 2018), as practitioners operate under cognitive and informational constraints that encourage reliance on simplified, experienced-based reasoning rather than fully optimised analytical procedures (Amidu et al., 2021b). In residential markets, where transactions evidence may imperfect, and delayed, heuristics allow PVs to form timely and workable VJ without exhaustively analysing every possible input (Coskun, 2022). The literature emphasises that such heuristics reasoning is not sign of poor practice, but a rational response to be realities of valuation work in complex and dynamic housing markets (Pathak et al., 2023).

Importantly, valuation research does not portray heuristics as inherently problematic (Coskun, 2022). Instead, they argue that PVQ of VJ depends on how heuristics are embedded within professional and institutional structures (Liman et al., 2025). When heuristics reasoning operates within clearly defined valuation frameworks, professional standards, and reflective practice, it can enhance consistency and efficiency while maintaining credibility (Ali et al., 2020; Klamer et al., 2021b). Professional valuation standards, methodological guidance, peer review processes, and regulatory oversight act as safeguards that discipline intuitive reasoning, helping to prevent over-reliance on any single reference point (Amar & Armitage, 2026). This perspective positions VJ as a structured hybrid process, rather than a choice between insight and calculation. Cognitive strategies such heuristic interact with formal

valuation methods, professional norms, and institutional expectations to shape valuation outcomes (Amidu, 2011). As a result, VJ in RPV is neither purely subjective nor purely mechanical; it emerges from the continuous interaction between human reasoning, professional discipline, and contextual market understanding (French & Gabrielli, 2018). This hybrid nature of VJ becomes increasingly important in contemporary valuation environments, where expanding data availability and analytical tools amplify, rather than replace, the need for informed and accountable professional reasoning.

2.4.4 Judgement legitimacy and Communication

Professional VJ does not end with formation of an internal value opinion; it also involves the ability to communicate, justify, and defend that opinion to others as highlighted by USPAP (1990). RPV are used by a wider range of stakeholders including HBs, mortgage lenders, RPIs, insurers and regulatory authorities, each of whom relies on valuation outputs for different decisions and evaluates valuation credibility through different lenses (Achu, 2013). As a result, the literature emphasises that PVQ is not determined solely by the numerical outcome, but by how clearly the reasoning behind that outcome is explained and made intelligible to others which is further explained by Amidu et al. (2021b). Communications also play a critical role in translating complex VJ based reasoning into a form that can be understood, scrutinised, and relied upon by non-PVs emphasised by Kasim et al. (2024). RPV reports must therefore do more than present comparable sales and calculations; they must explain why certain evidence was selected as highlighted in comparable research by RICS (Santo, 2015), how differences were interpreted where writing effective narrative story is important explained by Amidu, Levy, Liman and Gray (2024), and how uncertainty was addressed (Thorne, 2021). Therefore, previous studies show that when valuation reasoning is poorly articulated, stakeholders may question the credibility of the valuation even if the numerical estimate appears reasonable (Gunawardhana, 2024). This highlights that transparency in reasoning is a central mechanism through which valuation conclusions gain acceptance (Ali et al., 2025a). From an institutional theory perspective by Fedyunina and Oganesyan (2019), where property valuation legitimacy arises when professional VJ is exercised and communicated in ways that align with established rules, norms, and expectations governing valuation practice (Amidu et al., 2021b; Kasim et al., 2025a). Professional standards, regulatory frameworks, and lender requirements shape not only how valuations are produced, but also how they are evaluated

and trusted as highlighted by IVSC (2019). PVs must therefore ensure that their VJ is framed within recognised methodological conventions and that departures from standard approaches are clearly justified (Crosby, 2000). In this sense, legitimacy is not inherent in the valuation figure itself but is constructed through conformity with institutional expectations and professional accountability.

The literature further suggests that valuation communication serves as stabilising function in housing markets characterised by uncertainty and heterogeneity (Özçiftçi et al., 2025). By providing structured explanations and consistent narratives, valuation reports help stakeholders reconcile differing interpretation of market signals and reduce ambiguity around value conclusions as further highlighted by Amidu, Levy, Liman and Gray (2024) and where it supports communication of information can reduce volatility ad uncertainty in real estate markets (Özçiftçi et al., 2025). This reinforces the view of valuation as a socio-professional practice, where credibility depends on coherence, consistency, and trust, rather than on technical accuracy alone (Plante et al., 2022a). Therefore, these insights underline that professional VJ is inseparable from its communicative role and PVQ emerges not only from how VJ are formed, but from how convincingly they are articulated and legitimised within professionalism and institutional settings (Amidu, Levy, Liman, & Gray, 2024; Kasim et al., 2025a; Plante et al., 2022a). This understanding provides a critical foundation for examining how trust in valuation outcomes is formed, sustained, and challenged in contemporary residential markets, an issue that becomes particularly salient in hybrid valuation environments where human judgement increasingly interacts with automated and data-driven valuation tools.

2.4.5 Judgement in evolving valuation environments

A Recent work by Hindagoda (2025) in Sri Lanka highlights that the role of VJ has become more complex with the increasing use of digital tools, AVMs, and model driven-decision support systems and also supported by Teikari et al. (2025) work. While these technologies expand access to information and analytical capability, they do not remove uncertainty and interpretive demands (Ali et al., 2025a). Instead, they introduce new forms of VJ related to data quality, model assumptions, and the appropriate use of automated outputs as released by IVSC in 2025 and highlighted by Karanikolas et al. (2025). Prior research increasingly describes contemporary valuation practice as operating within hybrid valuation

environments, where human and technological support coexist (Jiang & Ma, 2025). In such contexts, VJ is required to decide when to rely on automated insights, when to override them, and how to integrate them into professional reasoning as supported by Teikari et al. (2025). Therefore, literature suggests that PVQ in these environments depends less on technological sophistication alone and more on how effectively professional VJ mediates between data, models, and real-world context.

2.5 Hybrid Valuation Support

As also mentioned above professional VJ remains central to RPV, the literature increasingly recognises that valuation decisions are no longer made in purely manual and purely automated environments (Ali et al., 2025a). Instead, existing valuation practice operates within hybrid valuation settings, where digital tools, data analytics, and automated systems support but do not replace human VJ as emphasised by Topraklı (2025). This shift reflects broader changes across professional services, where technology is used to enhance decision-making capacity while preserving expert oversight and accountability (Kasim et al., 2025a). Hybrid valuation support refers to the use of technology-enabled tools, such as AVMs, data analytics platforms, and digital market intelligence to assist PVs in collecting, analysing, and interpreting valuation relevant information (Kasim et al., 2025c; Sisman et al., 2023). Therefore AI-augmented valuation framework proposed by Teikari et al. (2025) and emphasise that these tools are designed to support VJ rather than replace human. In residential markets, where uncertainty, heterogeneity, and behavioural influences remain strong, valuation decisions still require human interpretation, contextual understanding, and professional responsibility (Ahiadu et al., 2025; Amidu, Levy, Bolomope, & Liman, 2024; Kasim et al., 2024; Teikari et al., 2025).

2.5.1 Automation to decision support

Early research on valuation technology was largely driven by the promise of automation, speed, and consistency (Ali et al., 2025a). AVMs were promoted as tools capable of producing rapid and objective value estimates by processing large volumes of transaction data through statistical and econometric techniques (Amar & Armitage, 2026). In markets characterised by frequent transactions, standardised housing stock, and relatively stable conditions, these systems demonstrated strong predictive performance and offered clear efficiency gains for lender and institutional users (Amidu, Levy, et al., 2025). As a result, a study by Kasim et al.

(2024) often framed valuation technology as a potential replacement for time intensive professional processes, particularly for low risk and high-volume valuation tasks (Liman et al., 2025). However, as AVMs were applied more widely, researchers began to document important limitations (Liu et al., 2025). Empirical studies showed that model performance deteriorated in volatile market conditions, during turning points in the housing cycle, and in location with inconsistent transaction data (RICS, 2022). Similarly, properties with a typical characteristics, unique layouts, and strong locational influences were often poorly captured by automated models (Teikari et al., 2025). These findings highlighted a fundamental challenge, while AVMs could detect patterns in historical data, they struggled to interpret contextual factors, emerging trends, and qualitative information that shape residential values in practice (D'Amato & Kauko, 2017). Rather than eliminating uncertainty, automation sometimes obscured it by producing precise-looking outputs that masked underlying data weaknesses (Amidu, Levy, & Kasim, 2025a).

In response, the researchers gradually shifted away from viewing valuation technology as a substitute for professional expertise and toward understanding it as a decision-support mechanism (Cellmer et al., 2024). Decision-support theory by Turpin and Marais (2004) argues that complex professional decisions are most effective when technology enhances information processing while leaving interpretation and final VJ with human experts (Liman et al., 2025). This perspective recognises that technology can assist by organising market evidence, identifying anomalies, and providing analytical insight, but cannot determine how evidence should be explained within a specific market context (Ali et al., 2025a; Amidu et al., 2019a). Therefore, Ali et al. (2020) emphasise the evolving role of PVs as evaluators and interpreters of technology-generated outputs, responsible for assessing relevance, reliability, and risk before forming defensible valuation conclusions. As a result, this section is framing PVQ as an outcome of human-technology interaction, rather than as a purely automated result.

2.5.2 Information and interpretive demand

Building on the view of valuation technology as a decision-support mechanism rather than a substitute for professional expertise, the literature highlights that hybrid valuation environments fundamentally reshape the informational landscape in which PVs operate (D'Amato & Kauko, 2017). Digital platforms provide access to large volumes of transaction

data, spatial analytics, historical trends, and predictive indicators that were previously difficult to assemble (Ullah, Sepasgozar, Thaheem, & Al-Turjman, 2021a; F. Ullah et al., 2018c). While this improves informational richness, the literature notes that it also increases interpretive complexity rather than reducing it (Xiong et al., 2022a). Information systems research highlights that more data does not automatically lead to better decisions; instead, it can increase cognitive load and ambiguity if not properly interpreted (Naeem et al., 2023b). In practice, PVs must judge which data sources are relevant, and how to reconcile conflicting signals, and when automated outputs should be trusted and questioned (Hazeem & AlBurshaid, 2024). Hybrid environments therefore intensify the need for professional VJ by increasing both the quantity and diversity of valuation inputs (Jiang & Ma, 2025).

2.5.3 Transparency and explainability

Furthermore, a key concern in the literature relates to transparency and explainability in technology-supported valuation (Ali et al., 2025a), while automated tools can produce numerical outputs efficiently (Chmielewska et al., 2025), stakeholders often seek explanations for how values are derived (El Jaouhari et al., 2024b), particularly in high-stakes residential decisions involving lending, affordability, and risk (French & Gabrielli, 2018). Black box models that lack interpretability may undermine confidence, even if they perform well statistically (Ali et al., 2025a). Therefore Renigier-Biłozor et al. (2020) emphasises the importance of hybrid approaches where PVs can interrogate, contextualise, and explain technology-assisted insights also explored by Velez (2024). Explainability aligns with professional valuation standards, which prioritise clarity, justification, and accountability in valuation reporting (Oladokun & Mooya, 2023). In this sense, technology does not replace professional reasoning but become part of the narrative through which valuation conclusions legitimised (Mohammad et al., 2018).

2.5.4 Professional control and responsibility

Another recurring theme in the literature is the importance of maintaining professional control over valuation decisions in hybrid environments (Marshall, 2024). Institutional and professional theories emphasise that responsibility and accountability cannot be delegated to algorithms, particularly in regulated domains such as property valuation (Liman et al., 2025). PVs remain legally and ethically responsible for valuation outcomes, regardless of the tools used in the process (Klamer et al., 2017). A study by Karanikolas et al. (2025) that when

technology is framed as support rather than authority, PVs are more likely to engage critically with automated outputs, apply professional scepticism, and integrate contextual knowledge into final decisions (Amidu et al., 2019a). Conversely, over-reliance on automated systems without sufficient oversight can reduce transparency and weaken professional legitimacy (Ali et al., 2025a). This reinforces the view that hybrid valuation support must be embedded within professional VJ rather than positioned above it.

2.5.5 Hybrid valuation and evolving practice

Furthermore a recent work by El Jaouhari et al. (2024b) indicates that hybrid valuation support is reshaping residential valuation practice by changing how PVs work with information, rather than simply improving computational accuracy (Fernandez, 2019). PVs now operate in environments where AVMs, data analytics, and digital platforms generate large volumes of market evidence that must be interpreted and contextualised (Goode et al., 2025). As a result, valuation practice has shifted away from manual data assembly toward judgement-based evaluation which is highlighted by Hindagoda (2025), and where professionals assess the relevance, reliability, and implications of technology generated outputs (Jiang & Ma, 2025). In this setting PVs increasingly act as interpreters and mediators between technology and market understanding (Kasim et al., 2024). While analytical systems can identify patterns and trends, they do not explain why these patterns exists and how they should be weighted under specific market conditions (Karanikolas et al., 2025). Therefore, reducing uncertainty, hybrid systems often make judgement more visible by requiring PVs to justify how data-driven outputs align with local context and prevailing market dynamics (Jiang & Ma, 2025).

This shift is well explained in terms of socio-technical systems theory (Ropohl, 1999), which views professional outcomes as emerging from the interaction between human expertise, technological tools, and institutional structures (Liman et al., 2025). Applied to valuation, this perspective suggests that PVQ depends not on technology and VJ alone (Mohammad et al., 2018), but on how effectively they are integrated in practice (Amidu et al., 2019a). Hybrid valuation systems perform best when technology supports insight and efficiency, while PVs retain responsibility for interpretation, explanation, and final decision-making (Amidu, Levy, Liman, & Gray, 2024). A study by El Jaouhari et al. (2024b) further cautions that when automated outputs are treated as authoritative without sufficient professional scrutiny,

valuation reasoning can become hard, reducing transparency and stakeholder confidence (Enever et al., 2014). Conversely, when professional VJ remains explicit and well-articulated, technology can enhance credibility by strengthening evidence and supporting clearer communication of valuation reasoning (Gamage et al., 2025; Goode et al., 2025). Overall, hybrid valuation support is best understood as an evolving professional practice rather than a fixed technical solution (El Jaouhari et al., 2024b). PVQ emerges through the ongoing alignment of VJ, technology, and institutional expectations, reinforcing the need to examine how stakeholders interpret and trust valuation outcomes in hybrid valuation environments (Hindagoda, 2025).

2.6 Professionalism

As RPV increasingly operates within uncertain, data-intensive, and technology-supported environments with hybrid approach, the importance of professionalism becomes more visible and more consequential (Kasim et al., 2024). While previous sections have shown that valuation outcomes depend on VJ, valuation inputs, and hybrid decision support, the literature emphasises that VJ alone is not sufficient to ensure credible valuation outcomes as also highlighted by (Amidu et al., 2021b) with role of knowledge. Instead, valuation decisions must also be embedded within professional norms (Ali et al., 2025a). Ethical standards, and institutional frameworks that provide legitimacy, accountability, and public confidence in valuation practice (Ali et al., 2020; USPAP, 1990). Professionalism in valuation refers to more than technical competence (Klamer et al., 2017). It encompasses ethical conduct, independence, consistency, responsibility, and adherence to recognised standards and codes of practice (Amidu et al., 2019a). Institutional theory by Fedyunina and Oganesyan (2019) explains that professional activities gain legitimacy when they conform to shared rules, norms, and expectations that recognised by stakeholders and governing bodies (Amidu et al., 2021b). In residential property markets, valuation outcomes influence lending decisions, household borrowing capacity, and regulatory assessments (Armstrong et al., 2019). As a result, the profession is expected to demonstrate not only analytical capability, but also integrity and transparency in how valuation conclusions are formed and communicated (Amidu, Levy, et al., 2025). Furthermore, studies consistently highlights that independence and objectivity as core dimensions of professionalism (Amidu, Levy, et al., 2025). PVs are required to operate at arm's length from market participants, resisting pressure from clients,

lenders, and other stakeholders who may have financial interests in specific outcomes (Amidu, Levy, et al., 2024b). Empirical studies show that perceived conflicts of interest and inconsistent application of standards can undermine confidence in valuation outputs, even when technical methods are sound as highlighted by Cellmer et al. (2024). Professionalism therefore functions as a stabilising force, ensuring that VJ are grounded in defensible reasoning rather than external influence (Kasim et al., 2024).

Ethical responsibility is another central component of professional valuation practice (Kasim et al., 2025c). Codes of conduct and professional standards such as those issued by valuation institutes and international bodies, aim to guide behaviour in situations where market evidence is ambiguous (Kasim et al., 2024, 2025a). Furthermore, Amidu et al. (2021b) emphasises that ethical frameworks do not eliminate VJ, but shape how VJ is exercised, documented, and defended (Amidu et al., 2019a). In RPV, where outcomes can significantly affect households and communities, ethical professionalism helps ensure that uncertainty is acknowledged rather than concealed and that assumptions are communicated clearly (Chmielewska et al., 2025). Therefore, professionalism also plays critical role in communication and accountability by Klamer et al. (2017), where valuation reports are not purely technical documents, they are communicative artefacts that explain reasoning to diverse audiences, including HBs, lenders, RPIs, and regulators (Kasim et al., 2025c; Klamer, 2021). Research by Amidu et al. (2021b) posit that stakeholders evaluate PVQ not only on numerical outputs but on clarity, coherence, and the extent to which valuation reasoning can be followed and understood (Lorenz & Lützkendorf, 2008). Professionalism therefore requires PVs to articulate how VJ were reached, how risk was considered, and how valuation inputs were interpreted within prevailing market conditions (Klamer, 2021).

The rise of hybrid valuation environments further amplifies the importance of professionalism in the above section. As AVMs and analytical systems become embedded in valuation workflows, concerns, and around accountability, explainability, and responsibility intensify (D'Amato & Kauko, 2017). A study by J. A. Numan and I. M. Yusoff (2024) cautions that while technology can support efficiency, it does not carry ethical responsibility and professional liability (Mohammad et al., 2018). PVs remain accountable for valuation conclusions, regardless of whether outputs are generated manually or with technology assistance (Marsh & Gibb, 2011). Professionalism thus provides the institutional anchor that ensures technology

is used as a support tool rather than as a substitute for responsible decision-making (Liu et al., 2025). Importantly, professionalism and ethical practice play a key role in trust formation within valuation systems, as stakeholders are more likely on valuations when they believe PVs are independent, transparent, and accountable (Amidu et al., 2021b). Institutional theory by Fedyunina and Oganesyan (2019) suggests that confidence in expert outputs depends on the perceived competence, integrity, and fairness of the profession, rather than on individual decisions alone (Amidu, Levy, & Kasim, 2025a). In residential property markets, repeated exposures to inconsistent valuation practices can erode trust among borrowers, HBs. RPIs, RAs, lenders, and policymakers (Amidu, Levy, et al., 2025). Conversely, strong professional norms and consistent standards help sustain confidence in valuation outcomes, even under conditions of market volatility and uncertainty (Cheung, 2024). Therefore, a study by Kasim et al. (2024) positions professionalism as a foundational layer that supports VJ, hybrid decision support, and PVQ. It shapes how VJ is exercised, how uncertainty is handled, and how valuation conclusions are legitimised within institutional settings (Jiang & Ma, 2025). Professionalism does not remove subjectivity from valuation, but its constraints and guides it within ethical and institutional boundaries (Klamer et al., 2017). This understanding provides a critical bridge to the next section, which examines how these elements collectively influence PVQ and stakeholder trust in residential property valuation outcomes.

2.7 Property Valuation Quality and Stakeholder Trust

As RPV has evolved into a judgement-based, technology-supported, and institutionally embedded practice, attention has increasingly shifted toward the concept of PVQ. While early research often associated quality with methodological accuracy, recent literature adopts a broader perspective, recognising that PVQ is also shaped by interpretation, transparency, and stakeholder confidence (Liman et al., 2025; Lind & Nordlund, 2021). A first study by Amidu et al. (2021b) increasingly defines PVQ as a multi-dimensional construct that reflects not only the correctness of valuation outputs, but also the reasoning processes through which those outputs are produced and communicated (Amidu & Boyd, 2018). Research by Adair and Hutchison (2005) and Amar and Armitage (2026) show that valuation users rarely have access to full technical details underpinning a valuation. Instead, they assess quality based on whether valuation conclusions appear reasonable, well-justified, and consistent with their understanding of market conditions (Klamer, 2021). This perspective highlights that PVQ is

partly perceptual, shaped by how valuation evidence and judgement are explained rather than by numerical accuracy alone (Klamer et al., 2017). Stakeholder trust plays a central role in this process, where Duijf (2021) suggests that confidence in expert outputs depends on perceptions of competence, integrity, and reliability, particularly in contexts characterised by information asymmetry and uncertainty. HBs, lenders, RPIs, Ras, and policymakers rely on valuation outcomes without being able to independently verify all underlying assumptions and data (Dagan, 2011). As a result, trust becomes the mechanism through which valuation outputs gain legitimacy and are accepted as a basis for decision-making.

Furthermore, research by Adilieme et al. (2023) shows that trust in valuation outcomes is shaped by several interrelated factors. Transparency in valuation reasoning allows stakeholders to understand how conclusions were reached and how uncertainty was handled (Ahiadu et al., 2024). Consistency across valuations reinforces perceptions of fairness and reliability, particularly in lending and regulatory contexts (Al-haimi et al., 2025). Clear communication of assumptions and limitations helps manage expectations and reduces the risk of misinterpretation (Ali et al., 2025a). When these elements are present, PVs are more likely to perceived valuation outcomes as credible, even in volatile and uncertain markets (AlZaidan et al., 2025). Therefore, hybrid environments further complicate the relationship between PVQ and trust (Amidu et al., 2021b). While automated systems and analytical tools can enhance efficiency and consistency, they can also introduce new sources of complexity if their outputs are not adequately explained (Amar & Armitage, 2026). Furthermore, research by Klamer et al. (2017) cautions that stakeholders may questions valuation credibility when technology-generated values appear disconnected from observable market conditions and professional reasoning (Amidu et al., 2019a). Conversely, when VJ is used to contextualise and explain technological outputs, hybrid systems can strengthen trust by combining analytical rigour with interpretive clarity (Coussement et al., 2024). Therefore, PVQ is not assessed uniformly across stakeholders, because PVs may prioritise risk consistency and regulatory compliance (Al-haimi et al., 2025), while HBs focus on perceived fairness and alignment with market expectations (Ali et al., 2020). RPIs may evaluate PVQ in terms of decision, usefulness and strategic insight (Amidu, 2011; Amidu et al., 2019a). This variation reinforces the idea that PVQ is not a single objective standard, but an outcome shaped by stakeholder interpretation within specific decision contexts (Amidu et al., 2021b; Amidu, Levy, Liman, &

Gray, 2024). Therefore, the above literature positions PVQ as an emergent outcome arising from the interaction between valuation inputs, VJ, technological support, professionalism, and stakeholder interpretation. PVQ is therefore not produced solely by better data and advanced models, but by how valuation decisions are reasoned, explained, and trusted within institutional settings. This understanding provides a critical foundation for the development of the study's conceptual framework and hypotheses, which seeks to explain how these elements interact to shape PVQ in contemporary residential property markets.

2.8 Conceptual framework and hypothesis development

The preceding literature shows that RPV cannot be explained as a simple technical exercise in which data are processed to produce a single correct price. Instead, property valuation emerges as a staged and judgement-driven decision process in which information is interpreted, justified, and evaluated within professional and institutional contexts where role of knowledge is required (Amidu, Levy, Liman, & Gray, 2024). Across property valuation theory by Scarrett and Osborn (2014), behavioural decision-making research by Khemka (2021), and socio-technical studies shows a consistent message emerges that PVQ is not determined by valuation inputs alone, but by how those inputs are filtered through professional VJ supported by technology and trusted by stakeholders (Pathak et al., 2023). Building on this understanding, this section integrates the reviewed literature into a multi-phase conceptual framework that explains how PVQ is constructed in residential real estate markets. The framework is structured as a process model, moving from inputs, through interpretive and professional mechanisms, to outcomes, and is translated into a set of testable hypotheses in Figure 2.3.

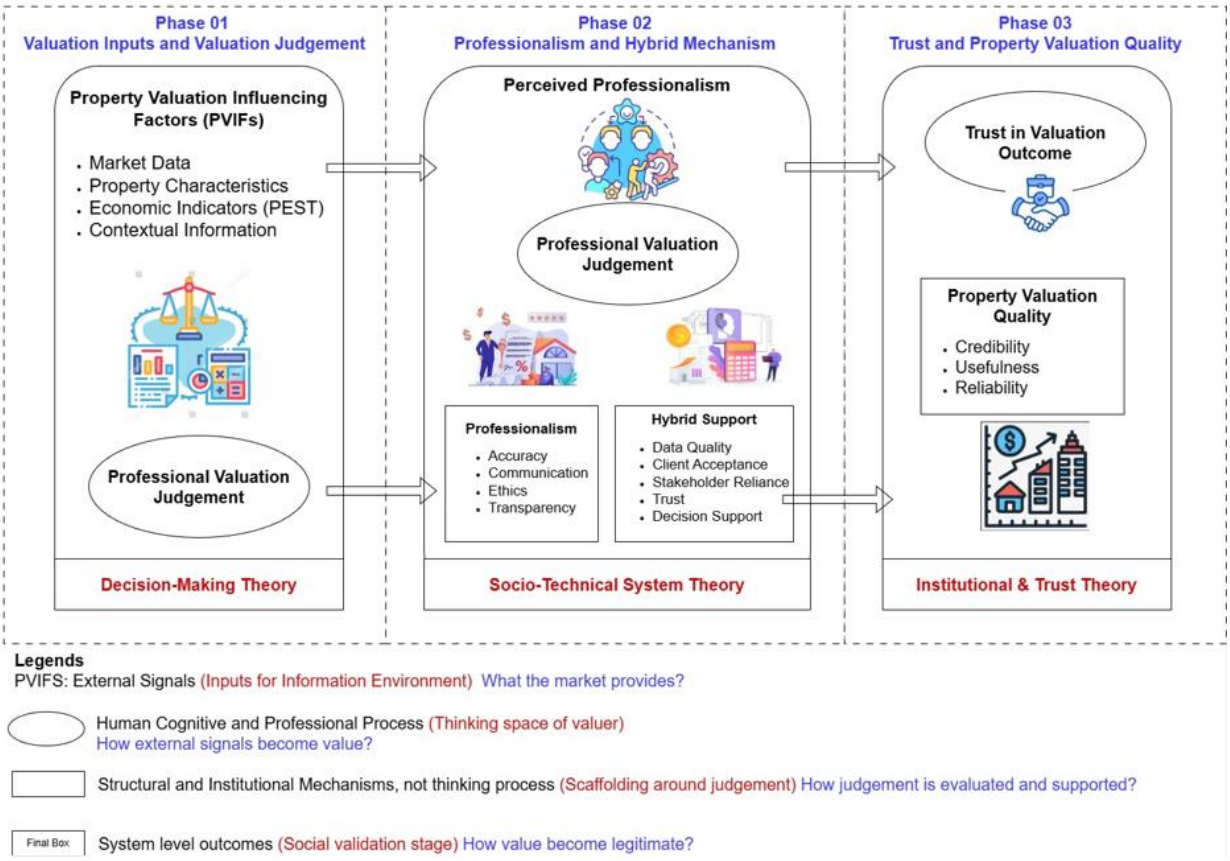


Figure 2.3 Conceptual Framework

Figure 2.3 illustrates a multi-phase socio-technical conceptual framework explaining how PVQ emerges in residential markets. The framework begins in phase 01, where PVIFs enter the valuation process as value-relevant external signals for information environment as raw materials rather than direct determinants of value (Kasim et al., 2025c). Consistent with decision-making theory, these signals require interpretation under condition of uncertainty, making professional VJ central to transforming information into valuation reasoning where role of knowledge and thinking space is required for PVs (Amidu et al., 2019a). In phase 02, VJ is operationalised through professional practice and hybrid valuation mechanisms as a structural and institutional mechanisms, not thinking process (Amidu et al., 2021b). Drawing on socio-technical systems theory, this phase highlights how professionalism and technology jointly shape valuation practice, with PVs acting as interpreters who integrate analytical outputs with local market understanding, ethical standards, and transparent communication (Amidu, Levy, Liman, & Gray, 2024). Rather than replacing VJ, hybrid valuation support increases the need for professional interpretation and explanation. Finally, phase 3 shows how professionalism and hybrid practices influence trust in valuation outcomes, which

ultimately determines perceived PVQ (Appelbaum, 1997). Institutional and trust theory suggest that PVQ is judged not only by technical accuracy, but by credibility, usefulness, and reliability as perceived by stakeholders where social validation is required (Amidu, Levy, et al., 2025). Overall, the framework presents PVQ as an emergent outcome of interacting informational, professional, technological, and institutional processes, rather than a purely technical output of valuation methods.

2.8.1 Conceptual logic and theoretical foundation

The conceptual framework is grounded in three complementary theoretical perspectives that together explain why PVQ emerges as a process rather than a direct outcome. First, decision-making theory and bounded rationality explain why VJ is unavoidable in residential valuation (Khemka, 2021). PVs routinely operate under conditions of incomplete information, market volatility, time pressure, and uncertainty with raw material in external information environment (Klamer et al., 2017). Under such conditions, decisions cannot be optimised mechanically; instead, professionals rely on VJ to reconcile competing signals and form defensible conclusions (Klamer, 2021). Second, socio-technical systems theory explains why valuation outcomes depend on the interaction between human expertise and technological tools (Plante et al., 2022a). Valuation practice increasingly involves analytical systems, AVMs, and digital platforms, yet these tools do not operate independently of professional interpretation (Renigier-Biłozor et al., 2020). Outcomes emerge from how humans and technologies work together, not from either element in isolation. Third, institutional and trust theory highlights that valuation outcomes gain legitimacy only when professional conduct, transparency, and accountability support stakeholder confidence (Amidu et al., 2021b). Valuation matter because they are relied upon by PVs, HBs, RPIs, RAs, and regulators, and their acceptance depends on trust in both the process and the professional delivering it. Therefore conceptually, these theories suggest a staged logic where valuation inputs influence VJ, and VJ shapes professional practice and the use of technology, and these mechanisms jointly influence trust in valuation outcomes; and trust ultimately determines PVQ.

2.8.2 Phase 1: External Information Environment

The first phase of the framework focuses on inputs, which is external signals from the market in information environment conceptualised as PVIFs. The literature consistently

demonstrates that these factors do not determine value directly (Amidu, Levy, et al., 2024b). Instead, they function as informational signals that require interpretation, prioritisation, and synthesis by PVs (Amidu et al., 2019a). Residential markets are characterised by property heterogeneity, shifting market conditions, and imperfect information (Black & Babin, 2019). As a result, the same valuation inputs may carry different meanings depending on timing, contexts, and market sentiments (Case & Shiller, 1988). PVs must therefore decide which inputs are relevant, how much weight they deserve, and how they should be reconciled when signals conflict (G. W. Cheung et al., 2024). Therefore, VJ act as interpretive mechanism in this phase. Rather than applying inputs mechanically, PVs assess relevance, comparability, risk, and uncertainty to construct valuation reasoning that is defensible under prevailing market conditions. This role of VJ as a filter between information and conclusions is a central insight of behavioural valuation research.

***H1**: PVIF's positively influence professional VJ.*

2.8.3 Phase 2: Professional and hybrid mechanisms

The second phase of the framework in Figure 2.3 focuses on how VJ operates in practice, shaping both professional conduct and the use of technology. First, the VJ informs professionalism, where the literature shows that stakeholders do not assess professionalism based solely on technical methods, but on the clarity, consistency, and transparency of valuation reasoning (Cheung, 2024). The ability to explain decisions, justify assumptions, and demonstrate independence is central to how professionalism is inferred in valuation practice (Chmielewska et al., 2025). VJ therefore underpins how professionalism is authorized and perceived (Coskun, 2022). Second, VJ governs the effective use of hybrid valuation support, as AVMs and analytical systems become more prominent, PVs increasingly work in hybrid environments where technology generates large volumes of evidence (Hindagoda, 2025). However, these outputs do not speak for themselves, therefore Cheung (2024) emphasises that hybrid systems add value only when VJ is used to interpret, contextualise, and explain technological insights. In this sense, VJ mediates the relationship between technology and valuation conclusions.

***H2**: VJ positively influences perceived professionalism*

***H3**: VJ positively influences hybrid valuation support.*

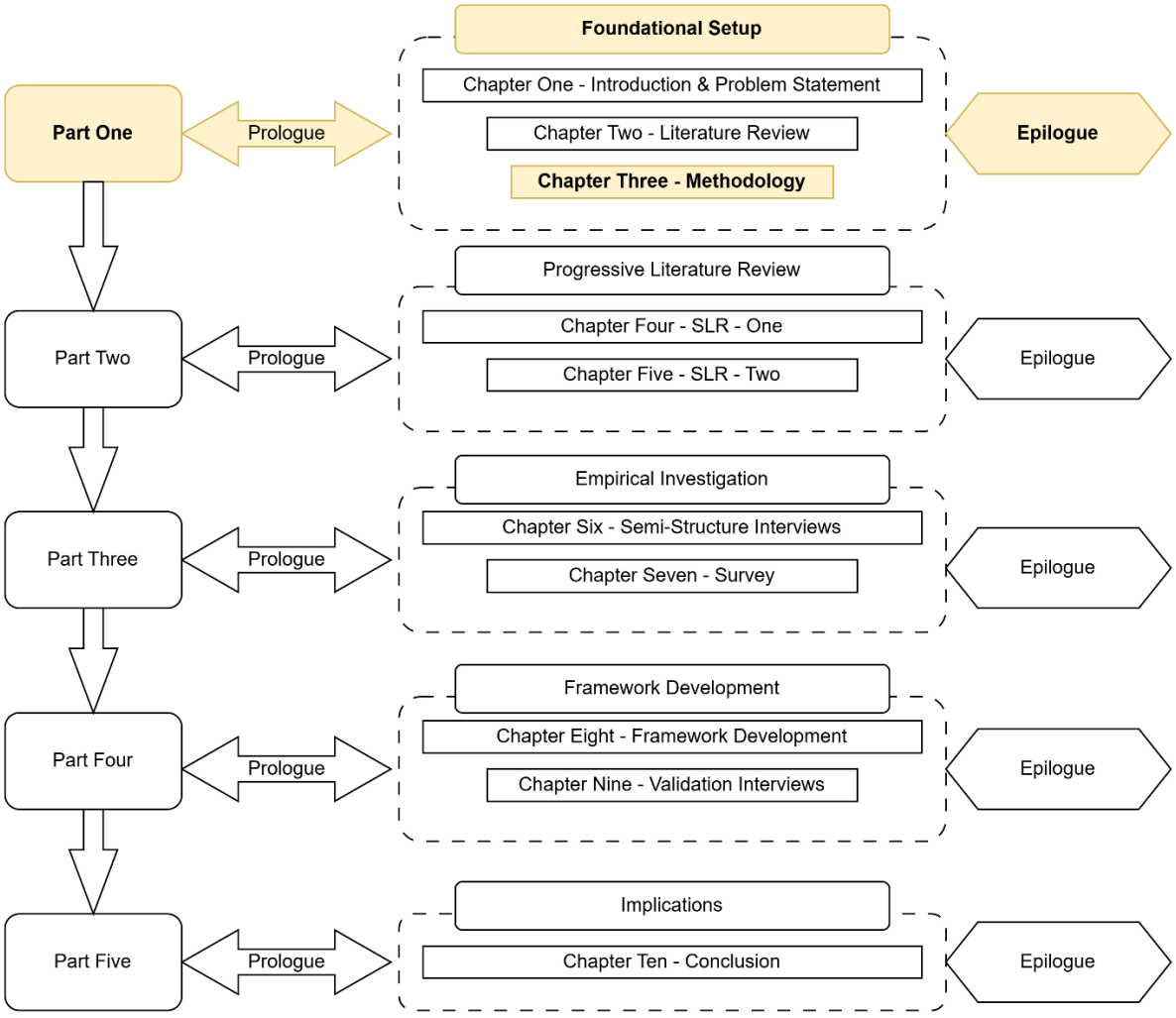
2.8.4 Phase 3: Trust as the pathway to valuation quality

The third phase of the framework centres on trust, which the literature increasingly identifies as the critical link between valuation practice and PVQ (Plante et al., 2022a). Trust reflects confidence not only in numerical accuracy, but in the integrity of the valuation process, the competence of the PVs, and the transparent use of technology (Salvo & Tavano, 2024). Professionalism contributes to trust by signalling ethical conduct, independence, and consistency (Mohammad et al., 2018). At the same time, hybrid valuation support influences trust when technological tools are used responsibly and explained clearly, rather than treated as unclear and unquestionable authorities (Amidu, Levy, et al., 2024b). Trust therefore emerges from the combined effect of professional behaviour and the transparent integration of technology (Amidu, Levy, Liman, & Gray, 2024). Once established, trust plays a decisive role in shaping perceived PVQ, where literature increasingly defines PVQ in terms of credibility, usefulness, and acceptance by stakeholders, rather than accuracy alone (Cheung, 2024). Valuations that are trusted are more likely to support confident decision-making, lending approval and investment commitment (Chmielewska et al., 2025).

***H4**: Perceived professionalism positively influences trust in the valuation outcome.*

***H5**: Hybrid valuation support positively influences trust in the valuation outcome.*

***H6**: Trust positively influences perceived PVQ*


Foundational Setup
Part One
Prologue
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Chapter Three - Methodology
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Progressive Literature Review
Part Two
Prologue
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CHAPTER 3

3. METHODOLOGY

3.1 Introduction

This chapter explains how the research was designed and conducted to investigate how PVQ is formed in residential real estate markets. While earlier chapters established the research problem, theoretical foundation, and conceptual framework, this chapter focuses on how evidence was generated to answer the RQs and meet the research objectives. RPV is not a purely technical activity, it involves VJ, interaction with technology, and interpretation by multiple stakeholders (Amidu et al., 2021b). Because of this complexity, no single method is sufficient to fully explain how PVQ develops in practice (Amidu, Levy, et al., 2024b). Instead, this study adopts a mixed-methods research design by Creswell (1999), combining qualitative and quantitative approaches to capture both depth of understanding and empirical generalisation. The chapter begins by explaining the philosophical foundations explains by Shan (2022) that guide the study and justify the choice of methods. It then outlines the qualitative phase (Creswell, 1999), which uses semi-structured interviews to explore how VJ, professionalism, hybrid support and trust are experiences in practice. This is followed by the quantitative phase (Schutt, 2019), which uses survey data and statistical analysis to test the relationships identified in the literature and refined through qualitative findings. The chapter concludes with a summary explaining how the methodological approach aligns with the conceptual framework and supports the study's overall contribution.

3.2 Philosophical Justification

Every research study is guided by a set of underlying philosophical assumptions about reality, knowledge, and how that knowledge can be generated. Shan (2022) describe these assumptions as knowledge claims, which explain what the researcher believes can be known and how learning about the research problem should occur (Crossan, 2003). These knowledge claims influence all stages of a study, including the formulation of RQs, the choice of methods, and the interpretation of findings. In this study, clarifying the research philosophy is particularly important because RPV is not purely technical activity as mentioned earlier. While market data such as sales prices and lending ratios exist, valuation outcomes are shaped by professional VJ, the use of technology, and the way stakeholders interpret and trust valuation

results. Therefore, a research philosophy is required that can account for both observable market and realities and the interpretive nature of valuation practice (Leitch et al., 2010a). This study adopts a critical realist research philosophy informed by Elder-Vass (2022), supported by a pragmatic orientation in Figure 3.1. Critical realism assumes that a real world exists independently of human perception, but that our understanding of this world is always partial and shaped by social, professional, and institutional processes (Crossan, 2003). In the context of RPV, this means that market prices housing transactions, and regulatory structures exist as real phenomena (Ali et al., 2025a). However, PVQ does not emerge directly from these factors alone. Instead, it is formed through professional VJ, institutional norms, and the interpretation of valuation information by different stakeholders. This philosophical position is well suited to the present study because RPV operates at the intersection of objective market conditions and subjective professional reasoning. PVs interpret valuation influencing information, apply judgement under uncertainty, and justify their conclusions within professional and regulatory frameworks (Klamer et al., 2017). A critical realist stance by pragmatism allows the study to recognise both the existence of market realities and the role of VJ and interpretation in shaping valuation outcomes (Heeks et al., 2025). The study adopts a pragmatic orientation to guide methodological choices (Elder-Vass, 2022). Pragmatism focuses on selecting research methods based on their usefulness in answering RQs, rather than strict adherence to a single methodological tradition (Shan, 2022). This orientation is appropriate because the research aims to explain how PVQ is formed in practice and how to improve with framework, which requires both qualitative insights and quantitative evidence.

Therefore, the adoption of critical realism reflects the nature of the research problem. RPV involves real market structures, such as transaction prices and lending constraints, but also involves hidden mechanisms such as professional VJ, institutional expectations, and stakeholder trust. Critical realism by Jenssen (2024) explicitly acknowledges the existence of these underlying mechanisms and supports investigations beyond surface level observations to propose framework for PVQ (Leitch et al., 2010a). At the same time, the pragmatism supports by Zhao (2022) the use of semi-structured interviews to explore how PVs and stakeholder interpret valuation information and exercise VJ, while quantitative analysis are used to examine relationships between valuation constructs across stakeholder groups.

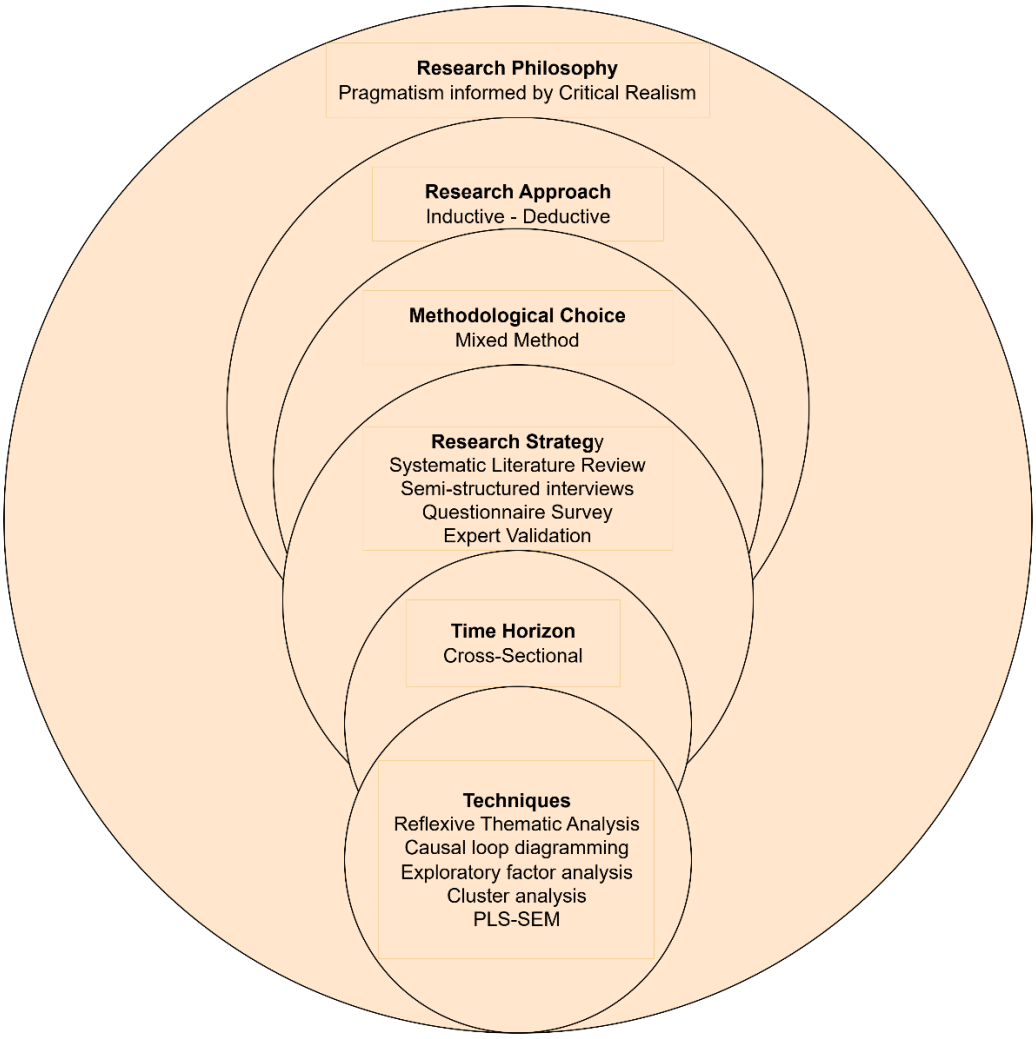


Figure 3.1: Customised research onion for the hybrid property valuation framework study

Note: The research onion has been customised to reflect the methodological design of this study, integrating a SLR, interviews, a questionnaire survey, and expert evaluation to develop and evaluate the hybrid property valuation quality framework.

Following Hoots (1974), this study explains its philosophical position through five interconnected components as mentioned in Figure 3.2. Ontology, epistemology, axiology, rhetoric, and methodology. Together, these components clarify how reality is understood, how knowledge is generated, what values guide the research, how findings are communicated, and how the study is conducted. Rather than treating these elements as abstract philosophy, this study uses them to explain why particular research choices are appropriate for investigating RPV practice and PVQ.

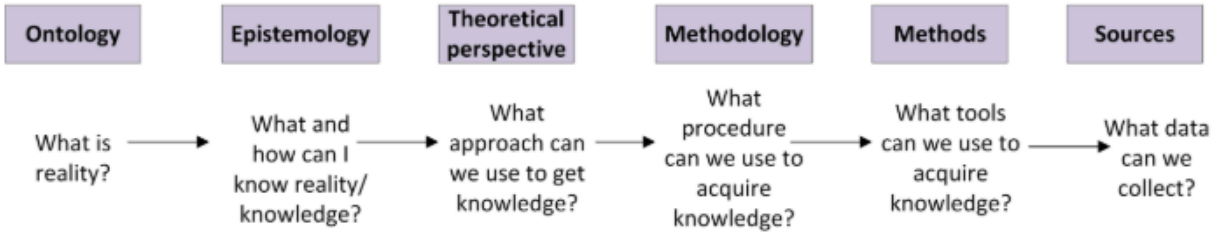


Figure 3.2: Research Philosophy and methodological alignment

3.2.1 Ontology

Ontology concerns assumptions about what reality is and what can be said to exist (Smith, 2004). In this study, reality is understood as partly objective and partly socially constructed (Berger & Luckmann, 2016). Residential property markets, transaction prices, regulations, and valuation outputs exist as real phenomena independent of the researcher (Amidu, Levy, & Kasim, 2025a). These elements can be observed, measured, and analysed using empirical data (Amidu, Levy, Liman, & Gray, 2024). However, the study also recognises that PVQ is not purely objective (Anna & Jason, 2005). This view aligns with critical realism (Smith, 2004), which accepts the existence of an objective world, while recognising that our understanding of it is mediated through social processes and professional practice. Accordingly, this study adopts an ontological position (Berger & Luckmann, 2016, that reality exist but is interpreted, making it particularly suitable for examining valuation as a judgement-based and socio-technical process rather than a purely mechanical exercise.

3.2.2 Epistemology

Epistemology addresses how knowledge can be known and what counts as valid knowledge (Audi, 2010). In this study, knowledge about RPV is generated through both empirical evidence and interpretive understanding. Quantitative data help identify patterns, relationships, and structural associations among valuation constructs (Ädel, 2014), while qualitative insights explain how and why valuation decisions are made in practice (Amidu, 2011). This epistemology stance explains by Hothersall (2019) reflects pragmatism, which argue that no single method or form of knowledge is sufficient for understanding complex professional problems. Valuation practice involves measurable elements, such as market data and valuation inputs, but also interpretive elements, such as professional VJ, experience, and contextual reasoning (Cheung, 2024). Understanding PVQ therefore requires combining objective analysis with subjective interpretation (Vaz, 2015). By integrating survey data with

stakeholder interviews, the study treats knowledge as provisional, contextual, and problem-driven, rather than absolute. This approach aligns with Creswell (1999), who argues that pragmatic epistemology is particularly appropriate for mixed-methods research addressing applied and professional decision-making contexts.

3.2.3 Axiology

As per study of Pretorius (2024) axiology concerns the role of values, ethics, and researcher positioning in a study. This research explicitly acknowledges that values are inseparable from property valuation practice (Amidu, 2011). Professional values such as independence, transparency, accountability, and ethical responsibility are fundamental to valuation credibility and trust, particularly in residential markets where valuation outcomes affect lending decisions, investment risk, and household welfare (Amidu & Boyd, 2018). Rather than attempting to eliminate values, the study recognises them as central analytical constructs as following MacKenzie et al. (2011). Professionalism and trust are not treated as biases to be controlled, but as key mechanisms through which PVQ is formed (Amidu, Levy, et al., 2024b). This aligns with institutional theory by Fedyunina and Oganesyan (2019), which emphasises that professional practice is guided by shared norms, ethical standards, and expectations of legitimacy (Kasim et al., 2025a). At the research level, the study maintains reflexivity by acknowledging the researcher role in interpreting qualitative data and structuring quantitative models. Ethical approvals, informed consent, confidentiality, and transparent reporting are used following Laothavorn et al. (2019) to ensure that the research process itself reflects the professional values under investigation.

3.2.4 Rhetoric

Rhetoric refers to how research findings are communicated and the style of language used as explained by Pretorius (2024). This study adopts a clear, accessible, and professional writing style, deliberately avoiding unnecessary technical jargon where simpler explanations can convey meaning more effectively (O'Connell & Kowal, 2008). This rhetorical choice reflects the applied nature of the research and its relevance to both academic and professional audiences as guided by Condit and Bates (2009). Because PVQ is closely linked to transparency and explanation, the way findings are communicated is not merely stylistic but conceptually important (Amidu et al., 2019a). The study therefore presents results in a way that mirrors professional valuation reasoning: structured, evidence-based, and clearly justified. This

approach supports knowledge transfer to practitioners, regulators, and policymakers, consistent with pragmatic research principles (Creswell, 1999).

3.2.5 Methodological Justification

The methodological approach of this study explains how knowledge about RPV practice and PVQ is systematically generated, examined, and validated. Methodology concerns not only the techniques used for data collection and analysis, but also the logical processes through which evidence is interpreted, and conclusions are drawn within a specific disciplinary context as per in Figure 3.1 and 3.2. Given the complex, judgement-based, and socio-technical nature of RPV, this study adopts a structured methodological approach that integrates theory, empirical evidence, and analytical reasoning (Evans et al., 2017). This research is guided primarily by deductive reasoning in Figure 3.1 and guided by Shan (2022), which supported by exploratory qualitative insight. Deductive reasoning is appropriate when research is grounded in existing theory and seeks to test theoretically derived relationships using empirical data (Gilgun, 2019). In this study, an extensive review of valuation literature, behavioural decision-making theory by Khemka (2021), socio-technical systems theory by Appelbaum (1997) and institutional trust theory by Fedyunina and Oganesyan (2019) informed the development of conceptual framework in Figure 2.3. This framework specifies expected relationships among PVIFs, professional VJ, professionalism, hybrid valuation support, trust and PVQ. Consistent with deductive logic (Gilgun, 2019), the study began with clearly articulated RQs and a theory driven conceptual framework. From this framework, testable hypotheses were formulated to examine the proposed relationships empirically. Quantitative data were then collected through a structured survey and analysed using statistical techniques to assess whether the observed evidence supported the hypothesised relationships (Nardi, 2018). This process reflects the core deductive sequence of theory development, hypothesis testing, and statistical validation (Gilgun, 2019). The clarity and maturity of theory at the outset of the study influenced the choice of a deductive research strategy (Shan, 2022). As noted by Saunders and Tosey (2012), when prior theory is sufficiently developed, deductive approaches are particularly effective for examining causal relationships and validating conceptual models. In the context of this research, existing valuation and decision-making literature provided a robust theoretical foundation for specifying constructs and expected pathways making deduction a logical and appropriate

methodological choice (Gilgun, 2019). Although, this study adopts a predominantly deductive orientation (Shan, 2022), it also recognises the interpretive complexity of valuation practice (Gunawardhana, 2024). To ensure that the conceptual framework accurately reflected real-world valuation processes, qualitative semi-structured interviews were conducted with key valuation stakeholders during the earlier phase of the research. These interviews informed the refinement of constructs and enhanced contextual understanding but did not replace the deductive logic of hypothesis testing. Instead, qualitative insights were used to strengthen theoretical grounding before empirical testing, aligning with recommendations for rigorous mixed-methods research (Shan, 2022).

Overall, the methodological approach of this study follows clear and structured logic as following Dissanayake (2023). Theory informed the development of a conceptual framework; hypothesis was derived from this framework; data were collected to test these hypotheses; and analytical techniques were applied to evaluate the strength and significance of the proposed relationships and evaluation of framework interviews were conducted with experts for operationalisation. This approach ensures methodological consistency, theoretical coherence, and empirical rigour in examining how RPV quality is formed in contemporary valuation environments.

3.3 Mixed Method Research

The methodological design of this study is guided by the nature of research problem and the type of understanding required to explain PVQ in residential markets. As demonstrated in the preceding literature, RPV is not purely technical exercise, nor can PVQ be understood solely through numerical accuracy (Amidu et al., 2021b). Instead, PVQ emerges through professional VJ, stakeholder interpretation, institutional expectations, and the interaction between human expertise and technological support (Cheung, 2024). Capturing this complexity requires a research design that can both explore professional meaning and empirically test structured relationships. For this reason, the study adopts a mixed-methods research design, incorporating qualitative and quantitative approaches within a single coherent framework (Shan, 2022). Mixed-methods research is particularly appropriate when a study seeks to understand both processes and outcomes (Curry et al., 2009). In this research, qualitative inquiry is required to explore how PVs and stakeholders interpret valuation formation, exercise judgment, and perceived professionalism and trust in practice (El Jaouhari et al.,

2024b). At the same time, quantitative analysis is necessary to test how these concepts related to one another across broader population and to validate the proposed conceptual framework statistically (Creswell, 1999). Using either method in isolation would provide an incomplete explanation of PVQ in complex and dynamic housing markets (Jenssen, 2024). From a philosophical standpoint, the study is informed by a pragmatic and critical realist orientation (Elder-Vass, 2022). Pragmatism emphasises problem-centred inquiry and supports the use of multiple methods when they provide more meaningful answers than a single methodological approach (Heeks et al., 2025). This stance allows the researcher to select qualitative and quantitative methods based on their usefulness at different stages of the study, rather than adherence to a single philosophical tradition (Creswell, 1999). This is particularly suitable for valuation research, where professional decision-making involves both measurable outcomes and interpretive reasoning.

Accordingly, the study adopts a sequential mixed-methods design with expert evaluation interviews following methodological triangulation as following Subedi (2016), where the first phase consists of qualitative semi-structured interviews with key valuation stakeholders. This phase is exploratory and aims to develop a contextual understanding of valuation decisions are formed, how VJ is exercised, and how trust and professionalism are constructed in practice. Semi-structured interviews allow participants to articulate their experiences in their own words while maintaining sufficient structure to align findings with the study's conceptual focus (Heeks et al., 2025). Therefore, insights from this phase inform construct development, framework refinement and survey design. The second phase employs a quantitative cross-sectional survey design with expert evaluation interviews for operationalising the framework (Creswell, 1999). Cross-sectional research involves collecting data at a single point in time to examine relationships among variables within a defined population (Elder-Vass, 2022). This approach is appropriate for this study because the objective is not to measure change over time, but to test theoretical relationships among PVIFs, VJ, professionalism, hybrid valuation support, trust, and PVQ as they currently operate within the residential valuation system. Cross-sectional surveys are widely used in behavioural and professional decision-making research to test conceptual models and structural relationships (Connelly, 2016).

The quantitative phase follows a deductive reasoning approach (Gilgun, 2019), where hypotheses derived from existing theory, prior literature, and qualitative insights are tested

empirically. Survey data are analysed using PLS-SEM, which is well suited to predictive, theory building research involving latent constructs and complex relational models (Connelly, 2016). This method allows the study to assess both direct and mediated relationships within the proposed conceptual framework. Therefore, the integration of qualitative and quantitative phases strengthens the study in several ways. First, it enhances the conceptual robustness, as survey constructs are grounded in real valuation practice rather than imposed solely from theory. Second, it improves explanatory depth, allowing the study to explain not only whether relationships exist, but how and why the operate. Third, it supports methodological triangulation following Bekhet and Zauszniewski (2012), increasing confidence in the findings through the convergence of multiple forms of evidence. Therefore, the adoption of a mixed-methods, cross-sectional research design is both methodologically and theoretically justified. It reflects the socio-technical and judgement-driven nature of RPV and aligns with the study's aims to explain how PVQ is formed in practice. By integrating qualitative exploration with quantitative cross-sectional design, the study provides a comprehensive and credible foundation for analysing valuation decision-making and PVQ.

3.4 Research Process

Research is a systematic and structured process undertaken to generate reliable and meaningful knowledge that addresses a clearly defined research problem as noted by Tranfield et al. (2003). In the context of this study, the research process was designed to progressively develop, examine, and validate an integrated understanding of PVQ by combining theoretical insights, empirical evidence, and stakeholder perspectives.

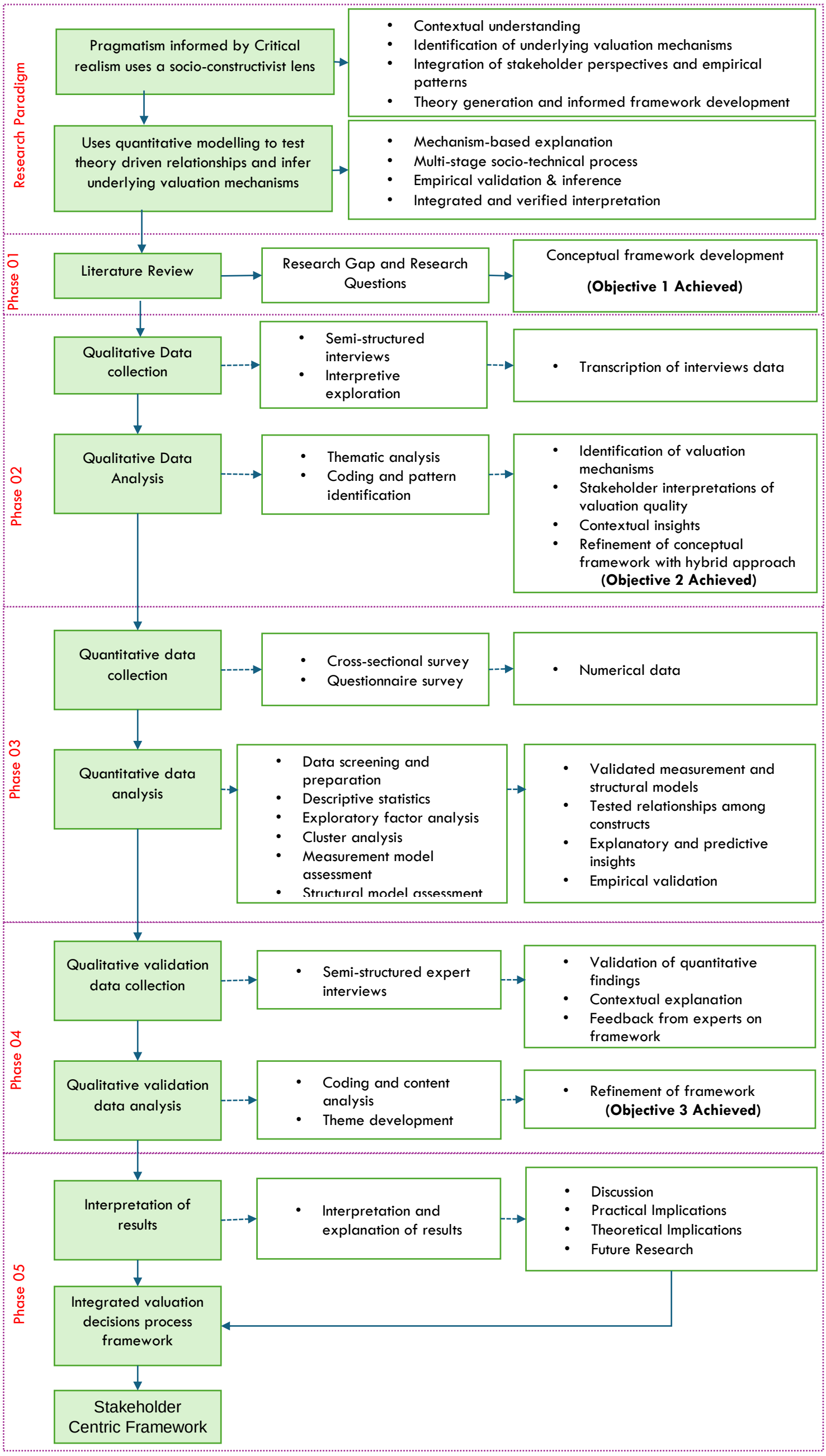


Figure 3.3: Research Process Flowchart

3.5 Research Design

Research design refers to the structured plan that links the research aim, conceptual framework, data collection strategies, and analytical procedures into a coherent and transparent study architecture as guided by Jabareen (2009). In this research, the design operationalises the proposed hybrid PVQ framework by specifying how empirical evidence is generated, refined, and validated across successive phases. The study follows a sequential mixed methods structure comprising two interconnected phases (Subedi, 2016). The first phase consists of qualitative, semi-structured interviews with key residential valuation stakeholders, including PVs, RAs, RPIs, and HBs. This phase is designed to elicit practice-based insights into how valuation information is interpreted, how professional VJ is exercised, and how trust and professionalism are constructed in real decision contexts. The findings from this phase are used to refine conceptual definitions, identify context-specific valuation inputs, and inform the operationalisation of constructs for the survey instrument.

The second phase employs a quantitative, cross-sectional survey to empirically test the relationships specified in the refined conceptual framework. Survey measures are developed directly from the qualitative findings and established literature, ensuring construct validity and contextual relevance. Data from this phase are analysed using PLS-SEM, which appropriate for assessing latent constructs and complex relational models in predictive and theory building research (Ädel, 2014). From a temporal perspective, data for both phases are collected within a defined time window, enabling the study to capture stakeholder perceptions and professional practices as they operate within the current residential valuation context. This design support the systematic movement from conceptual exploration to statistical validation, ensuring that the proposed PVQ framework is both grounded in professional practice and statistically robust (Connelly, 2016).

3.6 Research Approach

This study adopts a mixed-methods research approach, combining qualitative and quantitative techniques to develop and validate a stakeholder centric modular hybrid PVQ framework for New Zealand's residential property market. Mixed methods are appropriate for investigating complex, judgement-based phenomena, as they allow exploratory insights from qualitative data to be systematically tested through quantitative analysis (Curry et al., 2009). Semi-structured interviews are to capture stakeholder perspectives on valuation

practice and VJ, while cross-sectional survey enables empirical testing of relationships within the proposed framework using PLS-SEM as it is particularly suitable for prediction-oriented, exploratory, and theory building research involving complex models and latent constructs. PLS-SEM works well with small to medium samples and does not require strict normality assumptions (Gamage et al., 2025; Gilgun, 2019) as also following research onion in Figure 2.1. This approach aligns with a pragmatic and critical realist stance, recognising both the existence of underlying valuation mechanisms and the socially constructed nature of VJ.

3.7 Measurement Development

The development of the quantitative survey instrument followed a structured and theory driven-driven measurement development process, consistent with the four-phase approach proposed by Smith (1999). This approach was selected to ensure that the constructs examined in this study were conceptually sound, empirically measurable, and suitable for statistically analysis as noted by Ahire and Devaraj (2001). Given that this research, investigates PVQ as an outcome of VJ, hybrid valuation support, and trust, careful attentions was given to aligning measurement items with conceptual framework developed in CHAPTER 2. The measurement development process involved four key stages following Smith (1999). First, construct domains were clearly defined based on valuation theory, behavioural decision-making theory by Turpin and Marais (2004), socio-technical systems theory by Appelbaum (1997), and institutional perspectives by Ayyagari et al. (2008). Second, measurement items were identified and adapted from validated instruments used in prior valuation, decisions-making, professionalism, trust, and technology supported decision-research (McRae, 2019). Third, the survey instrument was refined through expert feedback and pilot testing ensure clarity, contextual relevance, and face validity within the New Zealand RPV context as following Olson (2010) guidelines. Finally, the reliability and validity of the measurement model were evaluated during the quantitative analysis stage to confirm the robustness of the instrument (Chin et al., 2003). This systematic process ensured that each construct in the research framework was operationalised in a manner that faithfully reflected its theoretical meaning while remaining suitable for empirical testing.

3.7.1 Operational Definitions of Constructs

Operational definitions were developed to translate the study's theoretical constructs into measurable variables. Table 3.1 presents the specification of construct domains, conceptual

definitions, and measurement sources used in this research. Following established guidelines by Polites et al. (2012) for scale development, each construct was measured using multiple indicators to capture its multidimensional nature. The selection and refinement of measurement scale were guided by three key criteria. First, all items were required to demonstrate strong conceptual alignment with the construct identified in the literature review and conceptual framework. Second, preferences were given to scales that had been empirically validated in prior peer-reviewed research. Third, items were assessed for their suitability in capturing perception-based responses from multiple valuation stakeholders, including PVs, RAs, RPIs, and HBs. Where necessary, wording was carefully adapted to reflect the RPV context in New Zealand, while maintaining the theoretical integrity of the original instruments. This approach ensured both contextual relevance and comparability with existing studies.

Table 3.1: Constructs, Definitions, and Measurement Sources Used in the Study

Construct	**Conceptual Definition**	**Indicative Measurement Sources**
PVIFs	Information signals and contextual factors that inform residential valuation decisions and require professional interpretation	(Amidu & Boyd, 2018; Kasim et al., 2025c)
VJ	The professional reasoning process through which valuation information is interpreted, weighted, and synthesised	(Klamer, 2021; Klamer et al., 2017)
Professionalism	Ethical conduct, transparency, independence, and accountability demonstrated in valuation practice	(Kasim et al., 2024, 2025a; Polites et al., 2012; Fahim Ullah et al., 2018)
Hybrid Valuation Support	The use of AVMs, analytics, and digital tools to support valuation reasoning without replacing professional judgement	(El Jaouhari et al., 2024b; Jabareen, 2009; Jiang & Ma, 2025; Karanikolas et al., 2025)
Trust in Valuation Outcomes	Stakeholder confidence in the valuation process, reasoning, and reported outcomes	(Amidu, Levy, Liman, & Gray, 2024; Amidu, Levy,

		et al., 2025; Dimopoulos, 2023; Duca et al., 2021)
PVQ	Perceived credibility, usefulness, and reliability of valuation outcomes	(Amidu et al., 2021b; Amidu, Levy, et al., 2024b)

3.7.2 Research Instruments Design

In line with the mixed-methods design adopted in this study (Subedi, 2016), two complementary data collection instruments were developed: a semi-structured interview guide for the qualitative phase and a self-administered online questionnaire via Qualtrics for the quantitative phase. Together, these instruments were designed to capture both measurable patterns and deeper interpretive insights into how PVQ is formed through professional VJ, technological support, and stakeholder experience.

To complement the quantitative survey, semi-structured interview guide was developed. The design, alignment with the conceptual framework, interview procedures and analytical integration are described in detail in CHAPTER 06.

3.7.2.1 Quantitative Questionnaire Design

The quantitative phase employed a self-administered online survey as the primary instrument for data collection. Online questionnaires are widely recognised as effective tools for gathering structured data from diverse participants groups while ensuring consistency, anonymity, and efficiency (Curry et al., 2009). This approach was particularly suitable for the present study, which sought responses from residential property stakeholders across New Zealand, including PVs, RAs, RPIs, and HBs. The questionnaire was designed to be clear, logically sequenced, and easy to complete (Shan, 2022). A well-structured questionnaire was enhanced respondent comprehension and reduces error, thereby improving data quality and responses rates (Connelly, 2016). Following established guidance questionnaire sequencing, the survey began with a short information and consent section, followed by background questions capturing respondents' roles, experiences and engagement with the residential property market (Nardi, 2018). The main body of the questionnaire then progressed through the key conceptual domains of the study in a natural evaluative order. Respondents were first asked to assess PVIFs relevant to residential properties such as location, physical conditions, environmental context, and neighbourhood characteristics. These questions reflect how

stakeholders typically begin valuation and purchase assessments, thereby aligning the instrument with real-world valuation reasoning. Subsequent sections examined higher-level constructs central to the conceptual framework, including professional VJ, professionalism and the use of hybrid support. These sections explored how respondents perceive VJ quality, transparency, ethical practice, and the role of AVMs in supporting valuation decisions. The questionnaire concluded with items relating to perceived PVQ, followed by optional demographic and contextual questions.

Consistent with best practice in quantitative research (Curry et al., 2009), the questionnaire employed Likert-type rating scales to measure perceptions and evaluative judgements (Ädel, 2014). Likert scales following Joshi et al. (2015) are widely used to capture degrees of importance and agreement and allow for reliable statistical analysis of latent constructs. Scale anchors and wording were selected to ensure clarity and consistency across constructs. To minimise potential response bias and common method variance, several procedural safeguards were embedded in the questionnaire design (Yao & Xu, 2024). These included neutral wording, avoidance of double-barrelled questions, consistent scale orientation, and assurance of anonymity and confidentiality. Participants were informed that their responses would be used solely for academic purposes and that no identifying information would be collected, encouraging honest and unbiased responses.

Procedural safeguards, including neutral wording, consistent scale orientation, and assurance of anonymity, were embedded to minimise response bias and enhance data quality. A detailed description of questionnaire development, measurement validation, and statistical procedures is provided in CHAPTER 07.

3.7.2.2 Pre-test and Instrument Refinement

Prior to full deployment, both the questionnaire and interview guide underwent a pre-testing process to assess clarity, relevance, and content validity following (Pulling et al., 2023). Content validity refers to the extent to which an instrument adequately represents the conceptual domain it is intended to measure. Establishing content validity is particularly important in mixed methods (Curry et al., 2009), where instruments must align closely with both theory and practice. The pre-test involved an expert from academic and industry with familiarity in research design and the residential property domain. Reviewer were asked to assess the clarity of wording, appropriateness of terminology, logical flow of questions, and

alignment with the study's conceptual framework. Attention was paid to identifying ambiguous phrasing, overlapping questions, or terminology that might be interpreted across stakeholder groups. Feedback from the pre-test informed minor refinements to both instruments, including improved wording, enhanced consistency of terms, and clearer alignment between questions underlying constructs with indicators (Pulling et al., 2023). For the interview guide, pre-testing also helped refine prompts to ensure they encouraged reflection without leading participants toward predetermined responses. Following these refinements, the instruments were considered suitable for pilot testing and subsequent implementation in the main qualitative and quantitative phases of the study. This systematic and iterative approach to instrument development enhanced the credibility, reliability, and methodological rigour of the research design.

3.7.3 Pilot Study

A pilot study was conducted to assess the feasibility, clarity, and reliability of the research instruments prior to the main data collection (Nardi, 2018). Pilot studies are recommended as a critical step in refining research design, testing measurement instruments, and identifying potential procedural issues before full-scale implementation (Polites et al., 2012). In mixed-methods research (Schutt, 2019), the pilot phase also supports alignment between qualitative insights and quantitative measurement structures. For the quantitative component (Shan, 2022), the pilot study evaluated the clarity of questionnaire items, response format, completion time, and preliminary measurement properties. Experts were to be asked to comment on item wording, sequencing, and overall comprehensibility to ensure content validity and face validity (Pulling et al., 2023). Preliminary reliability and convergent validity were assessed to confirm that the measurement scales functioned as intended, consistent with recommendations for exploratory research. In addition, pilot testing informed minor refinements to the semi-structured interview guide used in the qualitative phase. Feedback from pilot interviews helped improve question phrasing, flow, and probing strategies, ensuring that interview questions effectively captured stakeholder perspectives on valuation practice, VJ, and technology use. A post hoc power analysis was also undertaken to confirm the adequacy of the pilot sample size. The analysis demonstrates the acceptable statistical power can be achieved with relatively small samples when effect sizes are large, which is appropriate for pilot and feasibility studies. Overall, the pilot study provided confidence in

the suitability of the research instruments and procedures, supporting their application in the main study.

3.8 Population and Sample

Population refers to the entire set of individuals, organisations, or cases that share common characteristics relevant to a research inquiry, while a sample represents a subset of the population selected for empirical investigation and generalisation (Barreiro & Albandoz, 2001). Clearly defining the population and sampling strategy is essential to ensure the credibility, relevance, and transferability of research findings. In this study, the unit of analysis is the individual professional involved in RPV and related decision-making processes in New Zealand. Accordingly, the target population comprises key stakeholders engaged in valuation practice and property decision-making, including PVs, RAs, RPIs, and HBs, whose professional roles directly influence VJ and PVQ outcomes. This population was selected because the research seeks to explain how PVQ emerges through the interaction of professional judgement, information quality, and technological support within New Zealand's residential property market (Amidu, 2011; Amidu et al., 2021b; Amidu, Levy, et al., 2024b). Given the mixed-methods research design (Creswell, 1999), different sampling strategies were adopted for the qualitative and quantitative phases, consistent with methodological guidance for sequential and integrative designs (Subedi, 2016).

For the qualitative phase, purposive sample was employed to identify participants with substantial experience and insight into RPV and decision-making (Kasim et al., 2025a). Purposive sampling is appropriate when the objective is obtained to rich, context-specific understanding rather than statistical representatives (Kasim et al., 2024). Participants were selected based on their professional involvement, years of experience, and familiarity with valuation practice, market dynamics, and emerging technological tools. The qualitative sample size was guided by the principle of theoretical saturation, whereby data continued until no new conceptual insights emerged (Curry et al., 2009). For the quantitative phase, a non-probability voluntary sampling strategy was adopted (Schutt, 2019). Voluntary sampling is commonly used in professional and organisational research where access to a complete sample frame is limited, and participants self-select based on relevance and interest in the research topic (Saunders, 2012). This approach is appropriate for exploratory and theory testing studies in applied professional contexts such as property valuation. The minimum

sample size for this study was assessed using the 10 times-rule for PLS-SEM, which recommends that the sample should be at least ten times the maximum number of structural paths directed at any endogenous construct or ten times the largest number of indicators used to measure a single construct, whichever is greater. In this study, the PVIFs were empirically identified through EFA prior to the specification of the PLS-SEM model. Accordingly, the application of the 10 times rules was based on the final measurement and structural model derived from the EFA results, rather than the initial conceptual framework. In the resulting PLS model, the most complex endogenous construct receives six incoming structural paths, and the largest measurement block consists of six reflective indicators. Based on the larger scale of these two values, the minimum required sample size was calculated as 60. The achieved sample size of 112 respondents therefore exceeds this threshold, indicating that the dataset is sufficient to support stable parameter estimation and structural model assessment within the empirically specified PLS-SEM framework. Furthermore, to determine an adequate sample size for the quantitative analysis, a power analysis was conducted using G* Power 3.1. Power analysis assists in identifying the minimum sample size required to detect statistically meaningful effects with acceptable confidence, thereby reducing the risks of Type I and Type II errors. Following established conventions, the analysis assumed a medium effect size ($f^2 = 0.15$), a significance level of 0.05, and a statistical power of 0.95, which is considered robust for behavioural and management research.

Based on these parameters and the number of predictors in the proposed structural model, the power analysis is indicated that a minimum sample size is more than 100 respondents was sufficient for subsequent PLS-SEM analysis (Henseler et al., 2009). This sample size also satisfies recommended guidelines for multivariate modelling, which suggest that the sample should be at least ten times the maximum number of structural paths pointing to at construct in the model (Hair, 2014). Overall, the adopted population and sampling strategy ensured that the study captured both depth and breadth of stakeholder perspectives, supporting the development, evaluation, and empirical testing of the proposed hybrid PVQ framework.

3.9 Data Collection Methods

Consistent with the mixed-methods research design, this study employed a sequential and complementary data collection strategy, integrating qualitative and quantitative methods to address the research comprehensively (Subedi, 2016). The use of multiple data sources

enabled triangulation and strengthened the robustness of the findings by capturing both stakeholder perspectives and empirically testable relationships (Bekhet & Zauszniewski, 2012).

In alignment with this design, the qualitative phase involved semi-structured interviews with key stakeholders to explore in-depth perceptions, contextual factors, and experiential insights related to PVQ. The procedures, sampling strategy, interview protocol, and thematic analysis approach adopted for this qualitative component are presented in detail in CHAPTER 06. Building upon the qualitative findings, the quantitative phase utilised a structured survey instrument to empirically examine the relationships among the identified constructs and to test the proposed framework. The survey design, measurement development, data collection process, and statistical analysis procedures are comprehensively described in CHAPTER 07. Together, these chapters provide a systematic account of the methodological implementation underpinning the study's mixed-methods framework.

3.10 Data Preparation

Data preparation in this study was conducted separately for qualitative and quantitative datasets, while maintaining consistency with the overall analytical framework. Preparing both datasets systematically ensured methodological rigour, analytical transparency, and the reliability subsequent interpretations. For the qualitative component, data preparation involved verbatim transcription of semi-structured interviews, anonymisation of participants identities, verification of transcript accuracy, and systematic organisation of data within qualitative analysis software (NVivo 14) to facilitate coding and thematic development. The detailed procedures for qualitative data preparation and analysis are presented in CHAPTER 06.

For the quantitative component, data preparation, included survey data screening, coding of variables, handling of missing values, assessment of normality, and verification of measurement reliability and validity prior to statistical modelling. The comprehensive steps undertaken for quantitative data preparation and subsequent analysis are outlined in CHAPTER 07. Together, these chapters provide a clear and structured account of how both datasets were prepared and analysed in alignment with the study's mixed-methods framework.

Furthermore the data were examined for distributional characteristics, including skewness and kurtosis, to identify extreme departures that could influence interpretation as mentioned in Figure 3.4 (Tenenhaus et al., 2005). Descriptive statistics were reviewed to confirm that values remained within acceptable ranges (Hair Jr et al., 2021). Finally, the potential presence pf common method of bias was assessed, as multiple constructs were measured using single survey instrument. Following PLS-SEM guidelines, full collinearity variance inflation factors (VIFs) were examined for all latent constructs to evaluate whether any construct exceeded the conservative threshold of 3.3, which would indicate potential method bias.

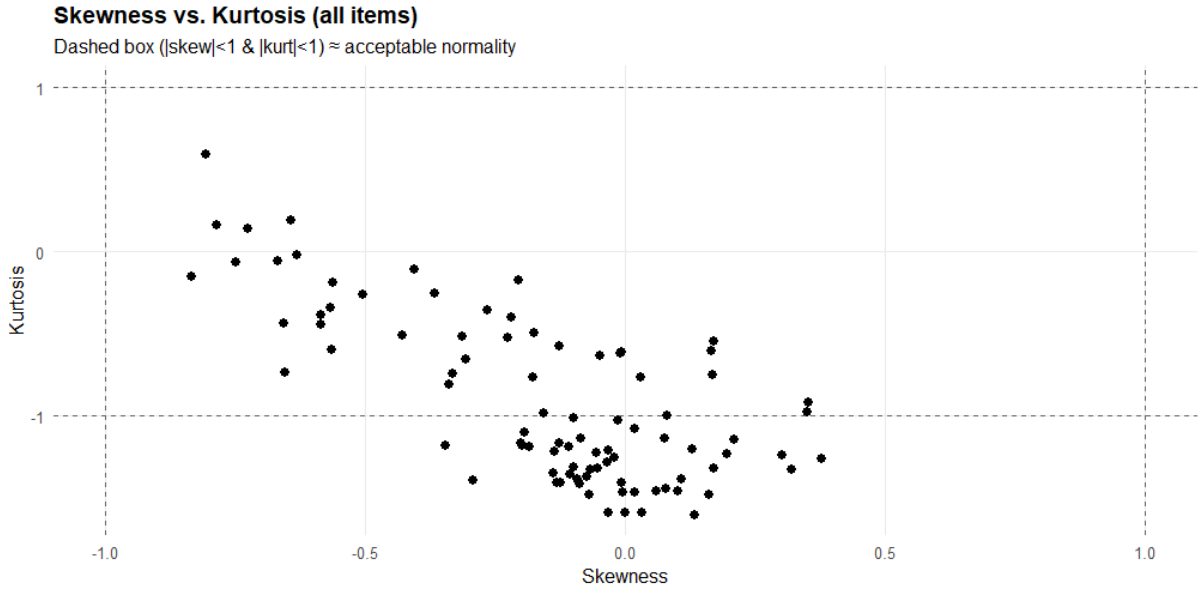


Figure 3.4: Skewness–kurtosis plot for questionnaire survey

All VIF values were below this threshold, suggesting that common method bias was unlikely to be a serious concern (Henseler et al., 2009).

3.11 Data Analysis Methods

In alignment with the mixed-methods research design adopted in this study (Subedi, 2016), data analysis was conducted through a sequential and integrative analytical strategy, combining qualitative thematic analysis with multiple quantitative techniques (Curry et al., 2009). This approach reflects a pragmatic and critical realist stance (Elder-Vass, 2022), recognising that PVQ emerges from both measurable patterns and underlying professional reasoning processes. The qualitative phase informed construct development and framework refinement, while the quantitative phase followed a three-stage analytical process comprising

EFA, cluster analysis, and PLS-SEM (Guenther et al., 2023). This multi-stage strategy ensured both conceptual robustness and empirical validation of the proposed hybrid PVQ framework.

Qualitative data were analysed using thematic analysis within NVivo (Ali et al., 2025a), following the systematic procedure outlined by Braun and Clarke (2006). An inductive-deductive coding strategy was adopted to integrate theory-informed constructs with emergent stakeholder insights relevant to residential property valuation practice. The detailed coding process, quotation analysis, theme development, and integration with the conceptual framework are presented comprehensively in CHAPTER 06.

Quantitative data analysis followed a structured, multi-stage approach progressing from construction validation to segmentation and theory testing, consistent with mixed-methods research principles following Subedi (2016). EFA was first conducted to validate the measurement structure, followed by cluster analysis and subsequent structural modelling (PLS-SEM) to examine relationships among constructs. The full statistical procedures, diagnostic tests, and model evaluation criteria are described in detail in CHAPTER 07.

Prior to model estimation, descriptive statistics were also examined to provide an initial understanding of the data distribution and to assess data quality (Hair et al., 2022). Descriptive analysis included measures of central tendency (mean and median) and dispersion (standard deviation), enabling evaluation of response patterns across constructs as mentioned in Table 3.2 (Tenenhaus et al., 2005).

Additionally, initial hierarchical clustering procedure was employed to determine the appropriate number of clusters, followed by k-means clustering to refine cluster membership in Figure 3.5 and 3.6 (Kovács et al., 2021). The validity of the cluster solutions was assessed using measures such as Hopkin statistics and interpretability of cluster profiles (He, 2025).

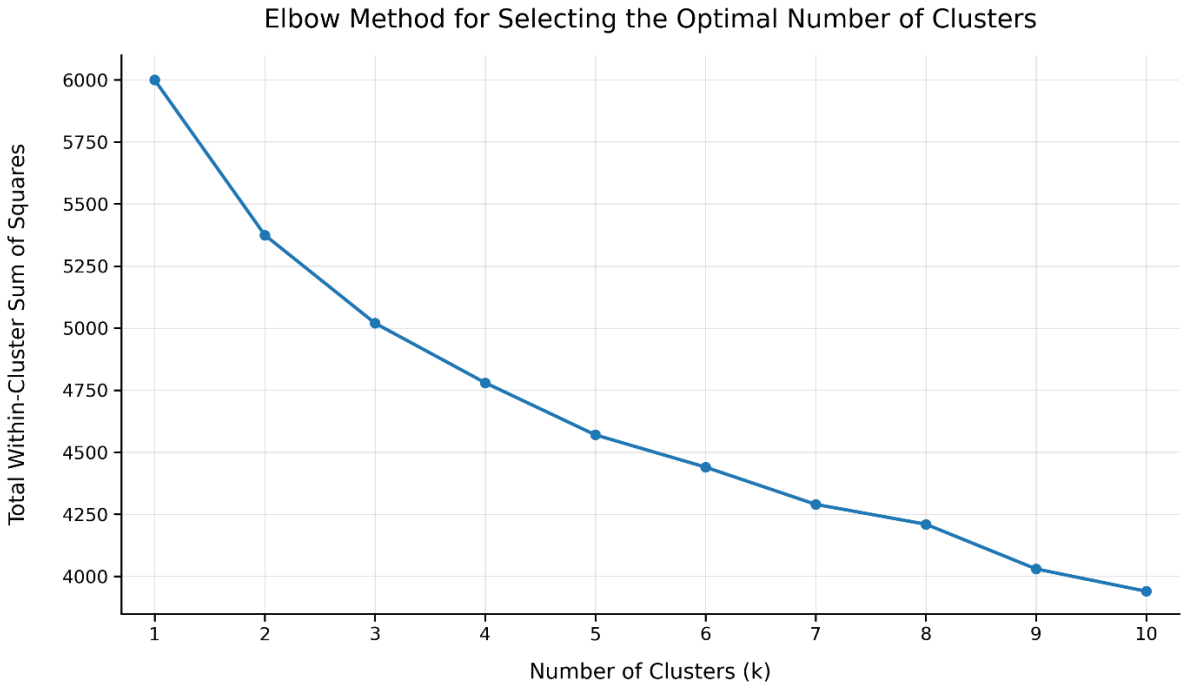


Figure 3.5: Elbow method for selecting the optimal number of clusters (k)

This analysis provided insight into how different stakeholder groups prioritise PVIFs and engage wit technological tools differently. These cluster were later used to inform comparative interpretation and strengthen the explanatory power of the final framework.

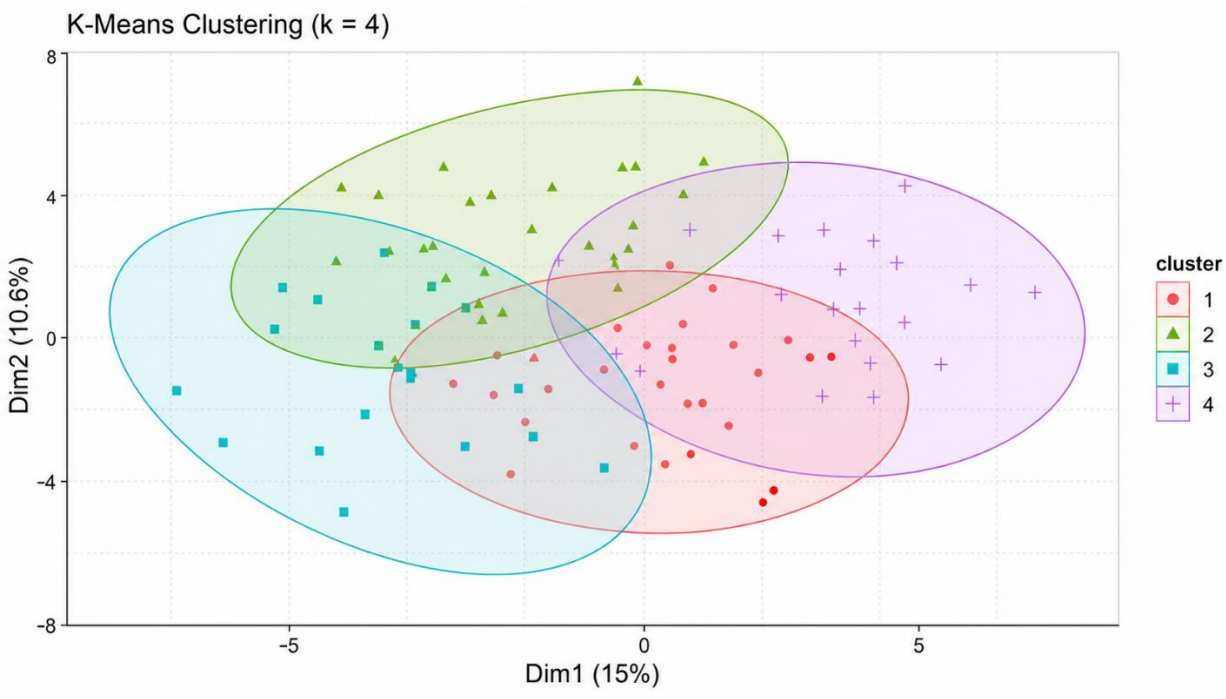


Figure 3.6: K-means clustering (k = 4) displayed on the first two principal dimensions

Table 3.2: Summary of Descriptive Statistics for Survey Constructs Used in the Analysis

Construct	Scale	Min	Max	Mean	Std. Deviation	Kurtosis	Skewness
PVIF1	Interval (1 to 5)	1	5	2.979	0.828	-1.272	0.067
PVIF2	Interval (1 to 5)	1	5	3.023	0.823	-1.309	-0.013
PVIF3	Interval (1 to 5)	1	5	3.390	0.904	-0.770	-0.022
PVIF4	Interval (1 to 5)	1	5	3.765	0.834	-0.338	-0.437
PVIF5	Interval (1 to 5)	1	5	3.730	0.900	-0.254	-0.442
PVIF6	Interval (1 to 5)	1	5	3.675	0.872	-0.246	-0.407
VJ	Interval (1 to 5)	1	5	3.821	0.865	-0.644	-0.431
Professionalism	Interval (1 to 5)	1	5	3.844	0.859	-0.313	-0.472
Hybrid Valuation Support	Interval (1 to 5)	1	5	3.387	0.913	-0.351	-0.240
TRUST	Interval (1 to 5)	1	5	3.862	0.854	-0.185	-0.517
PVQ	Interval (1 to 5)	1	5	3.040	1.415	-1.285	-0.073

Note: Following the EFA, composite mean scores were computed for each retained construct and used for descriptive and subsequent analyses.

This step is important in survey-based valuation research, as it allows the research to identify extreme values, potential response bias, and overall variability in stakeholder perceptions before proceeding to latent variable modelling. Furthermore, to ensures transparency and methodological rigour, the validity and reliability of the reflective measurement model were evaluated using established criteria recommended in the PLS-SEM literature above. Table 3.2 summarises the key validity principles, evaluation criteria, and threshold guidelines applied in this study. These criteria collectively assess internal consistency reliability, indicator reliability, convergent validity, and discriminant validity, and are widely accepted as best practice for evaluating reflective measurement models in exploratory and predictive research.

Table 3.3 Measurement Model Validity Criteria and Evaluation Guidelines for PLS-SEM

No.	Validity Type	Criterion	Guidelines
1	Internal Consistency	Composite Reliability (CR)	CR > 0.70 (exploratory research); CR > 0.80 (advanced research); CR < 0.60 indicates lack of reliability

2	Indicator Reliability	Indicator Loadings	Item loadings ≥ 0.70 and statistically significant; loadings ≥ 0.50 acceptable in exploratory studies
3	Convergent Validity	Average Variance Extracted (AVE)	AVE ≥ 0.50
4	Discriminant Validity	Fornell–Larcker Criterion and HTMT	Each indicator loads highest on its intended construct; square root of AVE exceeds inter-construct correlations; HTMT below threshold

Based on these criteria, the measurement model in this study was considered acceptable when:

1. Composite reliability values exceeded the recommended threshold of 0.70.
2. Indicator loadings were above 0.50 and conceptually meaningful.
3. AVE values for each construct were greater than 0.50, indicating adequate convergent validity; and
4. Discriminant validity was confirmed through both the Fornell-Larcker criterion and the HTMT ratio, ensuring that each construct was empirically distinct.

Once the measurement model was validated as per above criteria, the structural model was assessed to examine the hypothesised relationships between latent constructs as per Figure 2.3. This step focuses on theoretical testing and predictive capability rather than measurement quality. Before interpreting path relationships, collinearity among predictor constructs was assessed using Variance Inflation Factor (VIF) values (Yusoff et al., 2020). VIF values below 3.3 indicate that multicollinearity does not threaten the stability of path estimates (Tenenhaus et al., 2005). The path coefficient represents the strength and direction of relationships between constructs. These coefficients were evaluated using a bootstrapping procedure with many resamples to assess statistical significance (Guenther et al., 2023). Significant path coefficients provide empirical support for the proposed hypotheses (Izah et al., 2023). The coefficient of determination (R^2) was examined to assess the explanatory power of the model as noted by Hair (2014). R^2 values indicate the proportion of variance in endogenous constructs explained by their predictors (Haji-Othman & Yusuff, 2022). According to Hair (2014), values of 0.25, 0.50, and 0.75 can be described as weak, moderate, and

substantial, respectively. The detailed procedures, statistical criteria, and results of the structural model analysis are presented comprehensively in CHAPTER 07.

3.12 Ethical Considerations

Ethical considerations are central to all stages of the research process, particularly when a study involves human participants and the collection of both qualitative and quantitative data as noted by (Nii Laryeafio & Ogbewe, 2023). Research ethics refers to the principles and standards that guide researchers to conduct their work responsibility, transparently, and with respect for participants rights and wellbeing (Khan, 2024). These considerations extend across the formulation of the research design, access to participants, data collection, analysis, storage, interpretation, and reporting of findings (Alhabsi, 2024). Given the mixed-methods nature of this study, ethical safeguards were applied consistently across both the qualitative and quantitative phases. Prior to data collection, ethical approval was obtained from the Massey University Human Ethics Committee (Human Ethics Notification – 4000028413). The study was assessed as low risk, and approval was granted. This approval ensured that the research design, recruitment strategy, and data handling procedures complied with institutional and international ethical standards for research involving human participants. Informed and voluntary consent was a key ethical requirement in this study followed by Marshall et al. (2006) where all participants were provided with a detailed participant information sheet outlining the purpose of the research, the nature of their involvement, the voluntary nature of participation, and their right to withdraw at any stage without consequence (Nii Laryeafio & Ogbewe, 2023). Consent was obtained explicitly before participation, with survey respondents providing electronic consent prior to accessing the questionnaire, and interview participants providing written consent before commencement of semi-structured interviews.

Confidentiality and anonymity were given particular attention due to the professional context of the study and the involvement of valuation experts and industry stakeholders. No identifying personal and organisation information was collected in the survey, and interview transcripts were anonymised using codes to protect participant identities. Any references that could indirectly reveal individuals or organisations. Any references that could indirectly reveal individuals or organisations were removed during transcription and analysis. All data were stored securely and accessible only to the researcher and supervisors, in accordance

with Massey University's data management policies. Given the qualitative interview component, there was a possibility that participants might unintentionally disclose sensitive professional information. To mitigate this risk, interview questions were carefully designed to focus on general practices, perceptions, and experiences rather than confidential case-specific details. Participants were also reminded during interviews not to shared proprietary information. Finally, the study-maintained transparency and integrity in data analysis and reporting. Findings were analysed and presented honestly, without fabrication, misrepresentation, or selective reporting. The mixed methods design further supported ethical rigor by enabling triangulation thereby enhancing credibility and reducing the risk of biased interpretation. Overall, ethical principles of respect, beneficence, confidentiality, and accountability were upheld throughout the research process, ensuring that the study was conducted responsibly and in line with accepted academic and professional standards.

EPILOGUE: PART ONE

This thesis begins by recognising that RPV in New Zealand is no longer a purely technical exercise. Property valuation outcomes increasingly depend on how information is interpreted, how professional VJ is applied, and how technological tools are used and trusted. CHAPTER 1 sets this foundation by clearly defining the research problem surrounding PVQ and explaining why traditional valuation approaches alone are no longer sufficient. The chapter outlines the research aim, objectives, and questions, positioning PVQ as an emergent outcome shaped by human judgement, data quality, and stakeholder confidence. It also clarifies the scope of the study and highlights the intended contributions to both property valuation theory and professional practice.

Building on this foundation, CHAPTER 2 moves into the literature to understand how PVQ has been discussed, measured, and challenged in previous research. Rather than treating valuation as a simple output of methods or models, the chapter shows that property valuation is a judgement-driven and context-dependent process. Insights from valuation theory, behavioural decision-making, socio-technical systems, and institutional trust literature are brought together to explain how PVs interpret valuation inputs in real market conditions where the structure guide is missing. The review highlights the growing role of automated and hybrid valuation tools and the tensions they create for professional VJ and credibility. This chapter culminates in the development of a multi-phase conceptual framework that explains PVQ as a process beginning with valuation inputs, moving through professionalism and hybrid support mechanisms and ultimately leading to trust and PVQ. In doing so, the chapter address key gaps in existing research by shifting attention away from isolation valuation methods toward the broader valuation decision-making system.

With the conceptual framework established, CHAPTER 3 explains how the study was designed to investigate these ideas empirically. The chapter adopts a pragmatic research philosophy informed by critical realism, recognising that valuation outcomes are shaped by both observable patterns and deeper underlying mechanisms. To capture this complexity, a mixed-methods research design is employed. Qualitative semi-structured interviews are used to explore how valuation stakeholders understand VJ, technology and trust in practice. These insights inform the development of a quantitative survey, which is then used to test and refine the conceptual framework across larger sample. The chapter details the research design, data

collection procedures, measurement model development, pilot testing, and ethical considerations. Advanced analytical techniques, including EFA, cluster analysis, and PLS-SEM, are used to ensure both methodological rigor and analytical depth.

Together, the first three chapters form a coherent and integrated foundation for the thesis. They establish why PVQ is an important and timely issue, explain how it can be understood through theory, and justify the methodological choices used to examine it. This integrated foundation provides a clear pathway into the empirical analysis that follows, where qualitative and quantitative findings are presented, interpreted, and brought together to explain how PVQ is formed in contemporary residential property markets.

PART TWO

PROGRESSIVE LITERATURE REVIEW

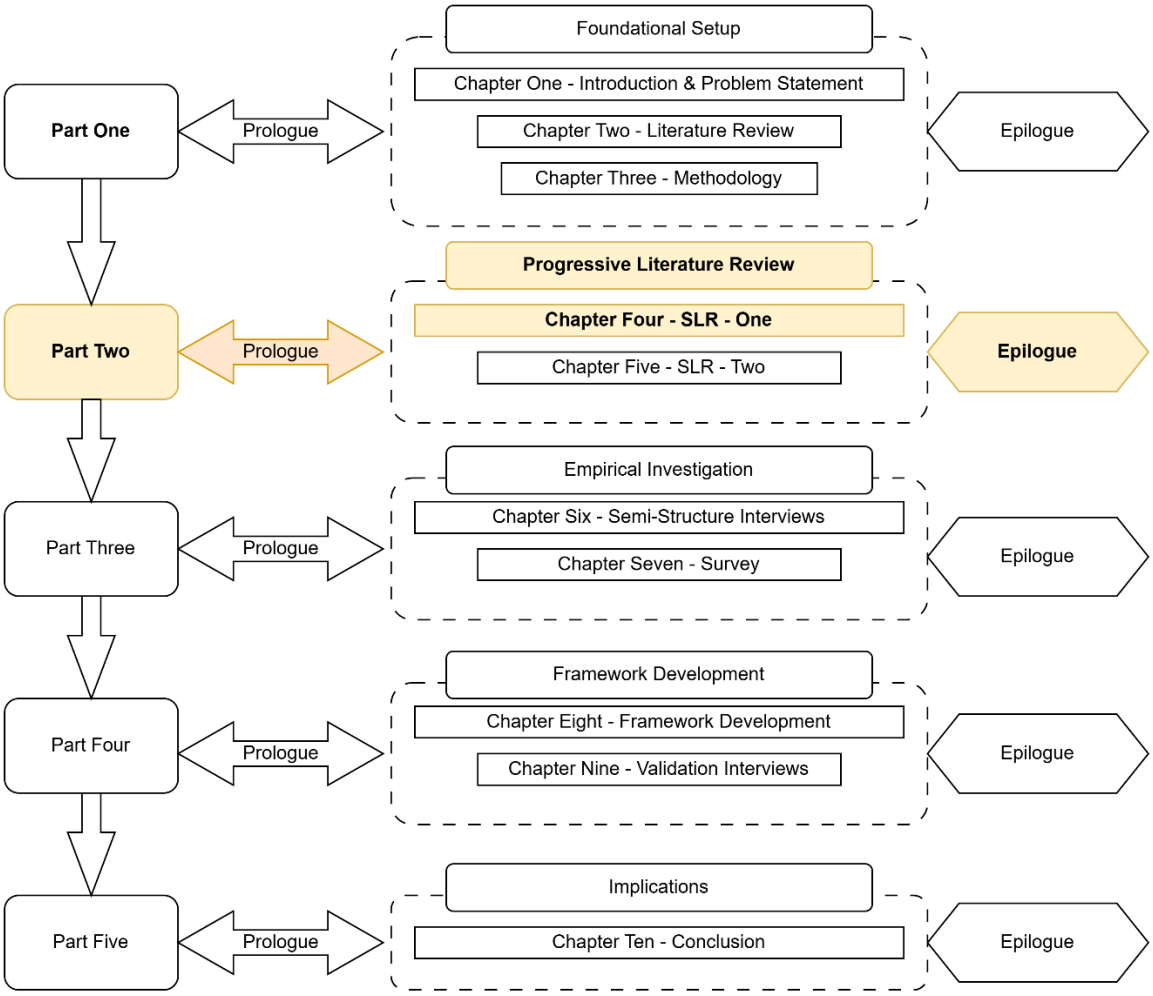
PROLOGUE – PART TWO

This part of the thesis marks the transition from methodological design to a structured analytical examination of how digital transformation influences decision-making processes within the real estate and property valuation domain and explore answers to RQ1 to RQ5 in order to achieve objective 1 (mentioned in CHAPTER 1). Having established the overall research architecture in CHAPTER 3, the study proceeds with a progressive literature review designed to trace the evolution from sector level digital transformation to the specific institutional and behavioural conditions under which valuation outcomes are interpreted, legitimised, and acted upon in practice.

CHAPTER 04 initiates this analytical progression by situating property valuation within the broader digital transformation of the SRE sector. Drawing on a systematic review of international literature, the chapter map the political, economic, social, and technological (PEST) drivers influencing technology adoption in real estate systems. The findings indicate that while AI, predictive analytics, blockchain-enabled transactions systems, and data-driven platforms offer enhanced efficiency, information symmetry, and decision accuracy, their adoption is moderated by regulatory uncertainty, professional standard ambiguity, implementation costs, organisational capability constraints, and stakeholder resistance to automation. By applying the PEST analytical framework, CHAPTER 04 establishes the institutional, regulatory, and organisational conditions that shape the environment within which valuation practice operates.

CHAPTER 05 narrows that analytical focus from sector-wide to digital transformation to the specific integration of AI and AVMs within property valuation processes. Building on the prior institutional mapping, this chapter synthesises literature on model performance, explainability, stakeholder trust, and governance mechanisms AI-assisted valuation. Although empirical studies report improvements in predictive accuracy and computational efficiency, the literature consistently identifies persistent concerns relating to algorithmic opacity, bias, legal accountability, and compliance with professional standards. These findings demonstrates that technical performance alone is insufficient to secure stakeholder acceptance of AI-supported valuation outcomes. Instead, valuation legitimacy depends on interpretability, governance alignment, and professional accountability within hybrid decisions environments.

CHAPTER 04 and CHAPTER 05 collectively establish a layered SLR progression. CHAPTER 04 contextualises valuation practice within the macro-level digital and institutional transformation of the real estate sector, while CHAPTER 05 examines the micro-level interaction between professional VJ and AI enabled valuation systems. This structured review strategy provides the conceptual bridge linking sector-level digitalisation with valuation-specific governance challenges. It thereby establishes the theoretical foundation for the development of the stakeholder centric hybrid modular PVQ framework, integrating professional VJ, technological decision-support mechanisms, and stakeholder trust within a coherent socio-technical architecture.


Part One
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Part Two
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GRADUATE RESEARCH SCHOOL

STATEMENT OF CONTRIBUTION DOCTORATE WITH PUBLICATIONS/MANUSCRIPTS

We, the student and the student's main supervisor, certify that all co-authors have consented to their work being included in the thesis and they have accepted the student's contribution as indicated below in the Statement of Originality.

Student name:	Wajhat Ali
Name and title of main supervisor:	Dr. Don Amila Sajeevan Samarasinghe - Senior Lecturer
In which chapter is the manuscript/published work?	Chapter 4

Describe the contribution that the student and members of the supervisory team have made to the manuscript/published work:[1]

Student: Conducting the literature review, data collection, data analysis, and drafting the manuscript.

Supervisory Team: Providing overall supervision of the PhD project; contributing to the conceptualisation and research design; offering methodological guidance; reviewing and providing feedback on manuscript drafts; supporting revisions; and providing ongoing academic mentorship throughout the research process.

Please select one of the following three options:

- (●) **The manuscript/published work is published or in press**

  Please provide the full reference of the research output:
  Ali, W., Samarasinghe, D. A. S., Feng, Z., Wilkinson, S., & Rotimi, J. O. B. (2026). A systematic literature review on digital transformation in real estate: Challenges and opportunities. Smart and Sustainable Built Environment, 15(2), 831–856. https://doi.org/10.1108/SASBE-04-2024-0111

- ( ) **The manuscript is currently under review for publication**

  Please provide the name of the journal:

- ( ) **It is intended that the manuscript will be published, but it has not yet been submitted to a journal**

Student's signature:	Wajhat Ali — Digitally signed by Wajhat Ali Date: 2026.03.07 16:55:39 +13'00'	Main supervisor's signature:	Don Samarasinghe — Digitally signed by Don Samarasinghe DN: cn=Don Samarasinghe, o=Massey University, ou=School of Built Environment, College of Sciences, email=D.Samarasinghe@massey.ac.nz Reason: I am the author of this document Location: Auckland, New Zealand Date: 2026.03.05 15:31:32 +13'00'

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CHAPTER 04

4. A SYSTEMATIC LITERATURE REVIEW ON DIGITAL TRANSFORMATION IN REAL ESTATE: CHALLENGES AND OPPORTUNITIES

This chapter is based on the following published/publishable journal paper:
Ali, W., Samarasinghe, D. A. S., Feng, Z., Wilkinson, S., & Rotimi, J. O. B. (2026). A systematic literature review on digital transformation in real estate: Challenges and opportunities. *Smart and Sustainable Built Environment, 15*(2), 831–856. ***(Published)***

DOI: https://doi.org/10.1108/SASBE-04-2024-0111

Abstract

Purpose – This study identifies key barriers to adopting smart real estate (SRE) technologies and offers insights and recommendations to enhance decision-making for stakeholders, including buyers and property investors.

Design/methodology/approach – To achieve the aim of the study, a rigorous research approach was employed, conducting an in-depth analysis of 41 academic papers utilising PRISMA guidelines and checklists. The chosen methodology also applies a PEST (Political, Economic, Social and Technological) framework to identify factors influencing technology adoption in the real estate sector.

Findings – The study uncovers critical barriers to adopting smart real estate technologies, such as regulatory ambiguity, high implementation costs, and societal resistance. PEST analysis reveals that unclear standards and guidelines, coupled with the high financial burden of technology implementation, are significant obstacles. Socially, resistance to change and difficulties in integrating new technologies are prevalent. The study also underscores the potential of artificial intelligence (AI) for predictive analytics and blockchain for secure transactions and records, though their adoption is currently hindered by inadequate infrastructure and regulatory challenges. These findings underscore the need for strategic interventions to address these barriers and facilitate the effective integration of advanced technologies in the real estate sector, thereby enhancing industry innovation and competitiveness.

Practical implications – The study offers insights for real estate stakeholders to embrace technology effectively, with a conceptual framework contributing guidance for industry

advancements.

Originality/value – The study's key contribution is offering real estate stakeholders execution tactics and recommendations to navigate barriers and utilise technology, thereby driving industry innovation and enhancing competitiveness.

4.1 Introduction

As the largest sector of business in the world, real estate continuously manages construction and significantly boosts the global economy (Ngoc et al., 2022). In 2017, the global market for commercial real estate transactions amounted to a staggering $873 billion (Doug Morrison, 2018). This sector witnessed a significant change in 2019, with commercial properties reaching a value of $30 trillion, while residential properties surpassed that with an even more substantial worth of $160 trillion (Ullah, Sepasgozar, Thaheem, & Al-Turjman, 2021b). This momentum continued into 2020, marking a remarkable uptick in both sectors. International commercial real estate soared to a substantial $32.6 trillion, while residential real estate experienced a notable 13% growth, culminating in a total value of $258.5 trillion (Fields & Rogers, 2021). This data highlights the substantial and widespread growth observed in commercial and residential real estate transactions globally (Hapuarachchi et al., 2022b). Therefore, the real estate industry holds significant economic importance globally, contributing 11.3% to the gross output in the United States, 5.98% of China's GDP, 11.4% of the GDP of Australian capital cities and 4.2% of Malaysia's GDP (Naeem et al., 2023a; Shahid et al., 2017; Zhang et al., 2018). In the following period, Malaysian statistics revealed a noteworthy surge in internet users, escalating from 2.9 million to 5 million between 2004 and 2016 (Najieha et al., 2017). This rapid expansion, coupled with a rising inclination toward technology and internet usage, has led numerous industries to incorporate technology as an essential component of their services (Naeem et al., 2023a). These statistical figures highlight the real estate industry's substantial role in the wealth and GDP of nations worldwide (Jang et al., 2020).

The real estate industry's ongoing development has significantly contributed to overall economic prosperity globally (Arndt et al., 2017). The scope of the real estate sector extends beyond conventional property transactions and encompasses various properties, including residential houses, commercial shopping centres, office spaces and industrial facilities (De Paola, 2024; Xiong et al., 2022b). This sector's landscape is undergoing constant global

changes, marked by an intricate network of interrelated components (Allameh et al., 2012a; Kania & Kmieć, 2022b). Therefore, “Smart Real Estate” (SRE) (F. Ullah et al., 2018a) has been introduced to improve the adoption of technologies to move from traditional real estate. SRE incorporates a spectrum of technologies, such as Artificial Intelligence (AI) (Naz et al., 2022a), Virtual Reality (VR) (Kholim et al., 2023; Naz et al., 2022a), big data (Munawar et al., 2020b), blockchain (Saari et al., 2022), Software as a Service (SaaS) (Loukis et al., 2019), Internet of Things (IoT), websites and various online platforms (Akindele et al., 2021; Conole, 2016). The SRE applications cover multiple processes involved in purchasing or selling various properties (Siniak et al., 2020b).

Introducing SRE has propelled global innovation and reshaped the real estate industry (Guttentag, 2015; Low et al., 2020a). These technologies offer numerous beneficial features, leading to improved convenience and efficiency, remain a necessity to establishing optimal practices, standards and policies, and provide new opportunities for investment and growth, accompanied by novel risks and challenges (Azmi et al., 2022b). However, the real estate world has been slow to use or adopt technology, a response that may continue (Siniak et al., 2020b). Innovating in real estate is challenging because there are established ways of doing things that are hard to change (Kassner et al., 2023b). These technologies shake up traditional methods, forcing organisations adapt to this changing environment (Siniak et al., 2020b). The world is currently experiencing a transformative period fueled by technology integration to transform traditional methods due to manual work processes, resistance to change and a lack of predictive analytical tools for industry (Aydinoglu & Bovkir, 2020a). Therefore, the ongoing change from traditional real estate to SRE is anticipated to have a multifaceted impact on the future, improving the decision-making process for real estate professionals, including flipping investors, and buyers, and overcoming adoption barriers for technologies. Consequently, this research endeavours to systematically address the overarching challenges of comprehending and surmounting barriers to technology adoption in real estate, specifically about SRE initiatives.

This study aims to systematically review the literature on innovative technologies in real estate using the PEST framework. The objective is to identify and analyse key barriers to adoption of technology, provide a comprehensive understanding of the factors influencing

this process, and offer insights and recommendations based on current research to support informed decision-making.

4.2 Research Methodology

This study employed a systematic literature review (SLR) using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) guidelines and checklists to select targeted academic publications (Rasheed *et al*., 2022). This study applied the PEST framework to analyse internal and external factors impacting organisations, including barriers from the targeted publications (Chutiphongdech & Vongsaroj, 2021). The methodology recommended by (Rojas-Sánchez et al., 2023) uses integrated bibliometric analysis with R software to comprehensively examine selected papers. This systematic approach aids in mapping the current state of knowledge and identifying potential research gaps within a specific area (Singh & Walia, 2022). The research methodology begins with step 1 SLR (Ansah *et al*., 2023), which includes question formulation (Lamé, 2019), locating studies (using keywords) and selecting the articles. Subsequently, it encompasses the identification and screening of relevant articles. Additionally, the methodology involves conducting step 2 of bibliometric analysis (Aria & Cuccurullo, 2017) to assess the existing themes and trends of the literature by using R software. In step 3, PEST analysis is a structured way to assess the factors influencing the real estate industry. The PEST framework in NVivo was selected for analysing the articles to explore barriers associated with technologies in the real estate industry (Chutiphongdech & Vongsaroj, 2021). Therefore, this framework thoroughly examines the critical considerations that can impact the real estate sector, helping us to identify and categorise critical factors within these dimensions.

4.2.1 Literature retrieval and selection

4.2.1.1 Formulation of Questions and Search Strategy

By bridging traditional practices with SRE, this study formulated four research questions (RQ 1 to RQ 4) to provide valuable insights into the trends, barriers and impact of technologies within SRE. This study seeks to address the following questions concerning SRE:

RQ1: What are the current scientific trends in the real estate sector?

RQ2: What are the primary innovative technologies employed in SRE?

RQ3: What barriers exist to implementing innovative technologies in SRE?

RQ4: How do innovative technologies facilitate data-driven decision-making in real estate management?

A search strategy was developed to explore these questions comprehensively using a database search, Scopus. The Scopus database was selected for its extensive coverage and credibility (Ansah et al., 2023; Zhu & Liu, 2020). Scopus is recognised as a reputable academic resource and is widely utilised by researchers (Carrera-Rivera et al., 2022b) and was chosen here due to its comprehensive coverage of peer-reviewed literature, including 20,346 journals from more than 4,000 publishers, as well as conference proceedings and book series (Mongeon & Paul-Hus, 2016). Moreover, backwards and forward snowballing was utilised to cover the relevant articles comprehensively (Naderifar *et al.*, 2017). Keywords related to the RQs were formulated to ensure the inclusion of all relevant studies. These served as guiding principles during the search process, minimising the risk of overlooking significant literature (Fedorowicz et al., 2014a).

Keywords were categorised into two separate fields, with Field 1 being linked to real estate and Field 2 being associated with technologies, as follows:

Field 1 comprises keywords to “Real estat*”, “Propert*” and “Land*”.

Field 2 encompasses keywords such as “Smart Real Estate”, “Real Estate Technology” and “Digitisation”.

The selected keywords encompass various topics in SRE, reflecting diverse studies and perspectives. This approach supported an interdisciplinary view, highlighting the importance of integrating PEST framework dimensions for a comprehensive understanding. This structured approach to keyword selection enhanced the comprehensiveness of our search and ensured that we captured all relevant research studies in the field. This initial search yielded a total of 1,839 research articles. The selected keywords directly related to the core RQs, ensuring that the review remained focused and relevant and that the keywords covered a broad spectrum of topics within SRE, including a wide range of studies and perspectives.

4.2.1.2 Selection of Studies

To ensure the inclusion of research articles initially, the study established the following inclusion criteria (IC) after a search within Scopus (Figure 4.1, below):

IC1: Research in the real estate field and technologies were considered.

IC2: The present study incorporated research papers written in English.

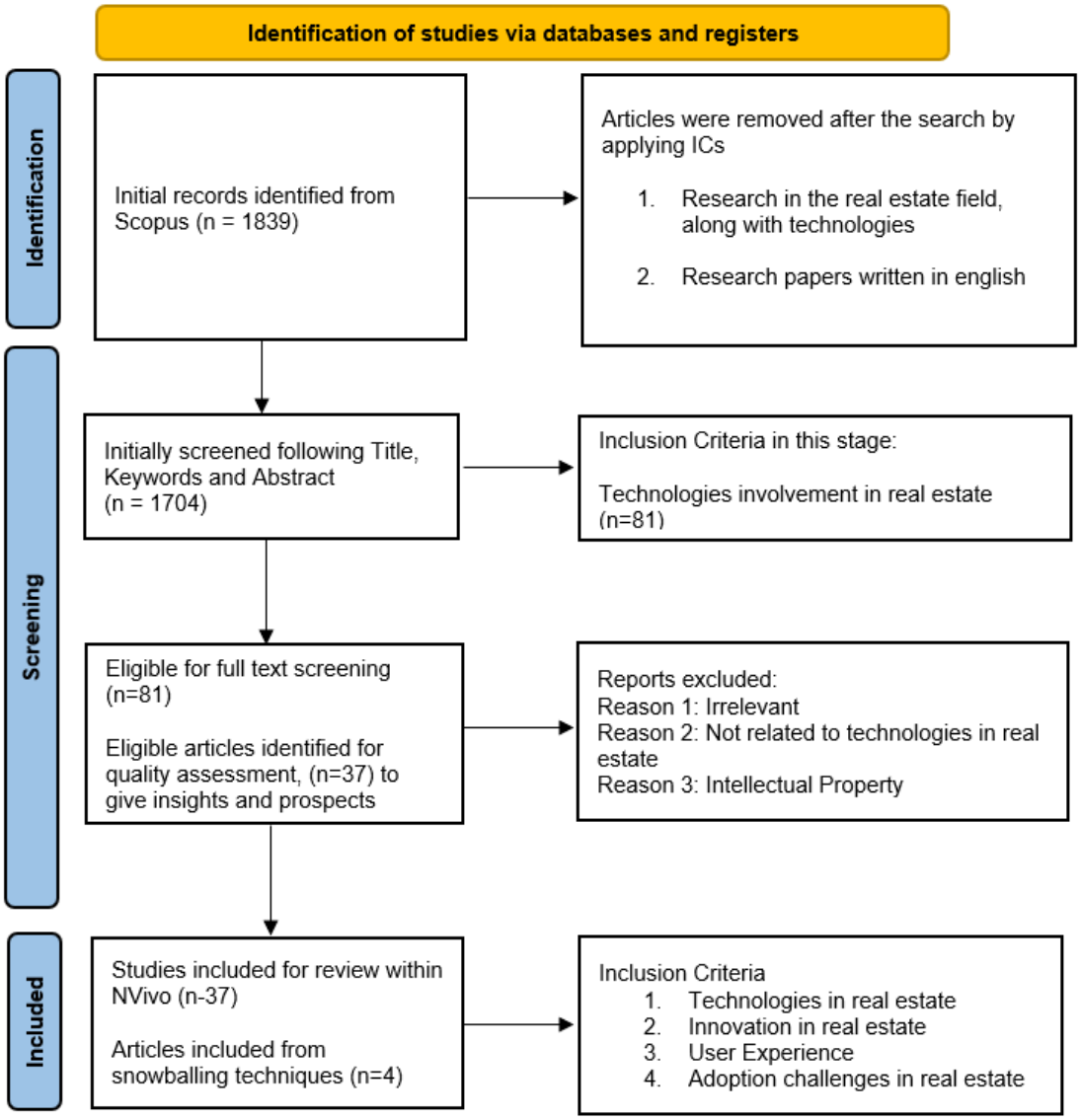


Figure 4.1: Paper selection approach and PRISMA workflow. Source: Construct, 2023

In the identification steps after applying these IC to 1,839 articles after the search (shown in Figure 4.1), the authors found 1,704 results for initial screening using the Rayaan tool. Furthermore, the study employed two-step screening to identify relevant studies. The first step involved an initial screening in which the titles, keywords and abstracts of the documents were reviewed using the Rayyan tool (Fedorowicz et al., 2014a), which facilitates decision-making regarding their suitability for the present study (inclusion criteria in this stage was "technologies involvement in real estate"). In the second step, the documents that passed the initial screening were included in the final dataset for full-text screening. In the initial screening of 1,704 records examined, 81 papers passed the initial screening, then the

researcher thoroughly reviewed 81 articles by full-text screening to identify eligible papers for quality assessment within NVivo, following the exclusion criteria (EC) shown in Figure 4.1.

EC_1: The research article is irrelevant to the research area.

EC_2: No technologies are involved in real estate in the article.

EC_3: Articles related to Intellectual Property.

Finally, 37 studies successfully passed the full-text screening by following the IC: 1. Technologies in real estate; 2. Innovation in real estate; 3. User experience; and 4. Adoption challenges in real estate, which were consequently included in the final assessment. To ensure the incorporation of all significant articles, the study also applied forward and backwards referencing approaches, identifying four additional research studies (Naderifar *et al*., 2017). Ultimately, the study involved 41 research studies spanning from 2002 to 2023 for literature and bibliometric analysis (Rojas-Sánchez *et al*., 2023).

4.2.2 Data Analysis

The data analysis involved bibliometric and PEST framework analyses. Bibliometric analysis includes various evaluative and relational techniques to identify publication trends, keywords, thematic maps and research studies within a specific field, focusing on RQ1 (de Carvalho et al., 2020; Donthu et al., 2021). It also provides insights into the intellectual and social structure of that field. Several open–source software tools are available for bibliometric analysis, including Bibexcel (Bankar, 2019), bibliometrics (Aria & Cuccurullo, 2017), CitesSpace (Hongqiang *et al*., 2020) and Histcite (Wu & Tsai, 2022). For the preliminary bibliometric analysis, the present study utilised R programming (Aria & Cuccurullo, 2017), and NVivo helped identify which technologies are more commonly used within the industry for answering RQ1 and RQ2.

The PEST framework analysis is a valuable tool for evaluating the characteristics and changes related to barriers in the research environment that can impact various factors in the present and future, addressing RQ3 (Chutiphongdech & Vongsaroj, 2021). NVivo was employed to code eligible papers to identify answers to each research question, then the researchers determined the impacts of technologies in the decision-making process through coding in NVivo for RQ4. Therefore, all tools, including the PEST framework, R software and NVivo, were crucial and played a vital role in the analysis to find information about technologies, barriers and the impact of technologies on the decision-making process in real estate (Peng & Nunes,

2007). These findings contribute to formulating strategies or frameworks for addressing these issues in the future.

4.3 Results

4.3.1 Scientific Production

Scientific production refers to the number of research papers published in a specific area over a certain period. This paper examined publication trends from 2002 to 2023 in a particular research area, as shown in Table 4.1. The researcher gathered data from Scopus, which included 31 sources such as journals and conferences, totalling 41 documents for analysis using the R software. The study found that in R software from the selected set of papers, the annual growth rate was approximately 10.41%. The analysis revealed the contribution of 107 authors, encompassing instances where four authors were associated with single documents. Table I, generated using R software, illustrates international co-authorship with 29.27%, and the dataset incorporates 197 authors' keywords, referencing a total of 2,496 numbers across all selected documents with an average document age of 3.85 at the time of analysis, and lower age suggest more recent publications were analysed, Notably, each document gathered an average of 19.39 citations. The above details are presented in Table 4.1.

Table 4.1: Main data information. Source: Construct, 2023

Description	Score
Timespan	2002 – 2003
Sources	31
Documents	41
Annual growth rate	10.41%
Authors	109
Authors of single-authored documents	4
International co-authorship	29.27%
Co-authors per document	3.15
Authors’ keywords	197
References	2496
Document average age	3.85
Average citations per document	19.39

4.3.1.1 Publication Trends

The publication rates or trends show how the number of research papers in a specific area change over time. Since 2020, there has been a significant increase in publication numbers (shown in Figure 4.2) in the selected dataset, with the last four years contributing to around 70% of the total papers: from 2002 to 2019, 8 papers in total with technology involvement in real estate were published, while from 2020 to 2023 33 publications were identified from eligible papers. This growth highlights the growing interest of scholars in the convergence of real estate and technology. Figure 2 indicates a strong relationship between the number of publications and the published years and illustrates the annual production trend of selected research articles on real estate technology using R software.

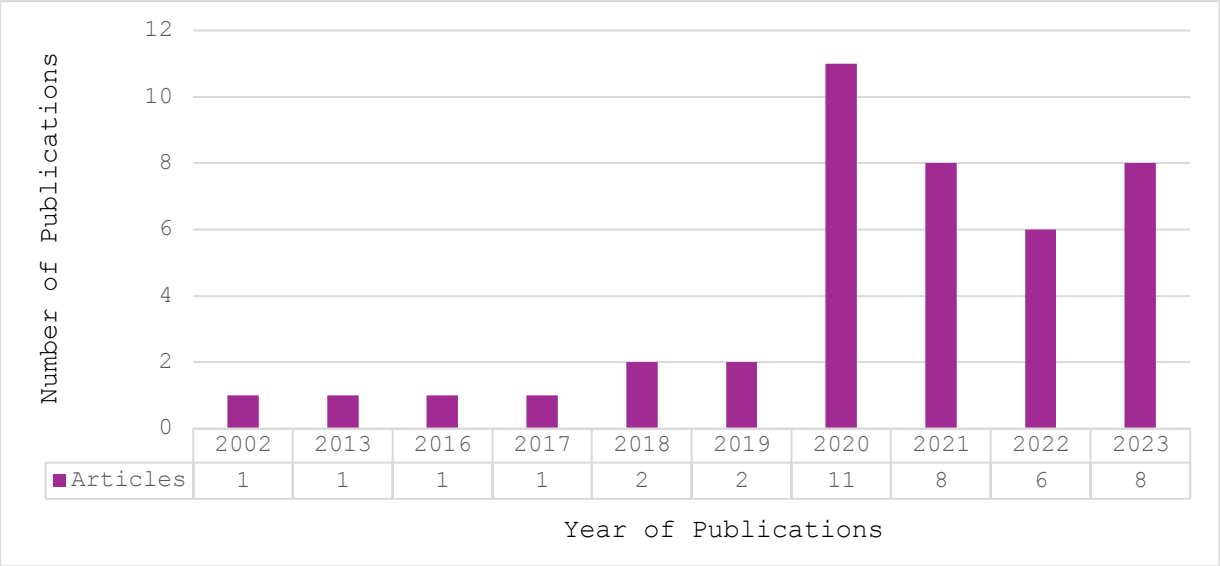


Figure 4.2: Scientific publications trends. Source: Construct, 2023

4.3.1.2 Thematic Analysis

In this section, we present a thematic map (Figure 4.3) of the innovative learning environment field, divided into four quadrants (labelled Q_1 to Q_4) and development degree, which refers to the extent to which a particular theme or topic has evolved or developed over time. At the same time, the relevance degree measures the significance or frequency of the theme within the context of the research area.

- The upper right quadrant (Q_1) represents motor themes, which are more dominant or driving themes, indicating high relevance and high development.
- The upper left quadrant (Q_2) represents niche themes with low relevance and development.

- The lower left quadrant (Q_3) includes emerging themes, indicating low relevance and low development.
- The lower right quadrant (Q_4) comprises basic themes that are fundamental, indicating high relevance within the study but low development.
- The central themes balance centrality, indicating balance relevance and development.

Figure 4.3 highlights that “smart real estate” and “technology adoption in real estate industries positioned between Q_1 and Q_4" were well-established and influential themes within the research area. This indicated that adopting innovative real estate and technology within real estate continues to be a leading topic. Additionally, Q_4 themes such as basic themes, including “virtual reality”, “real estate” and architectural design”, are foundational and essential for the field’s advancements. Themes in Q_2 developed internal connections in the field of real estate research, as niche themes encompass “digital technology” which explores the impact of technologies in real estate. Housing and online platforms including “real estate investment” focused on housing challenges and examined the influence of platforms on real estate. The theme in Q_3 (emerging themes) included “real estate management”, which investigated innovative property management strategies and sustainable practices. “User experience”, “built environment” and “artificial intelligence” explored how digital interfaces and innovative technologies enhance the overall experience of property owners, renters and real estate professionals. Additionally, the Q_1 motor themes (core themes) included “digitisation” and “internet”, examining how digital technologies and online platforms are reshaping the traditional “property market”, including deep learning algorithms, neural networks and machine learning information management. These themes explored the profound influence of the digital age on real estate transactions, marketing and consumer behaviour. Figure 4.3 was generated using R from eligible papers.

The research themes analysis was created using R and incorporated a word cloud that complemented the emerging themes analysis (presented in Figure 4.3 & 4.4). Both figures revealed consistent themes, emphasising information management, machine learning, digitisation, VR and technology adoption and innovation. These highlighted themes show persistent focus and ongoing research efforts.

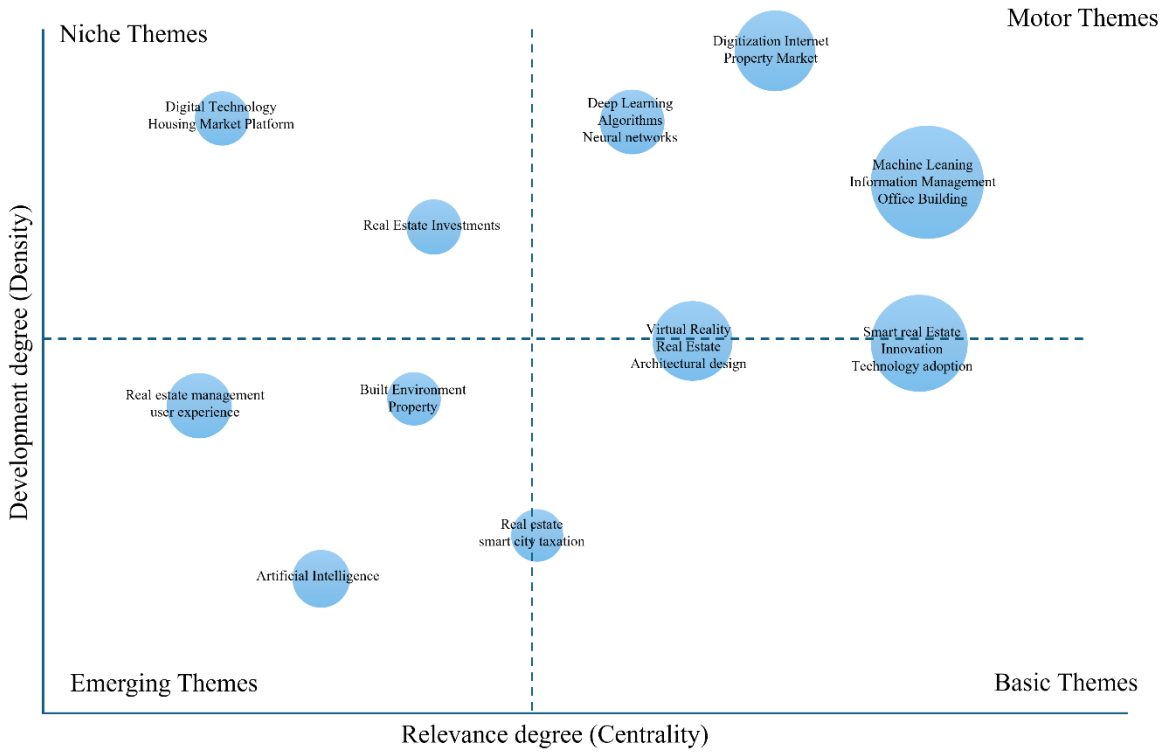


Figure 4.3. Emerging themes Analysis. Source: Construct, 2023



Figure 4.4. Themes analysis of word cloud. Source: Construct, 2023

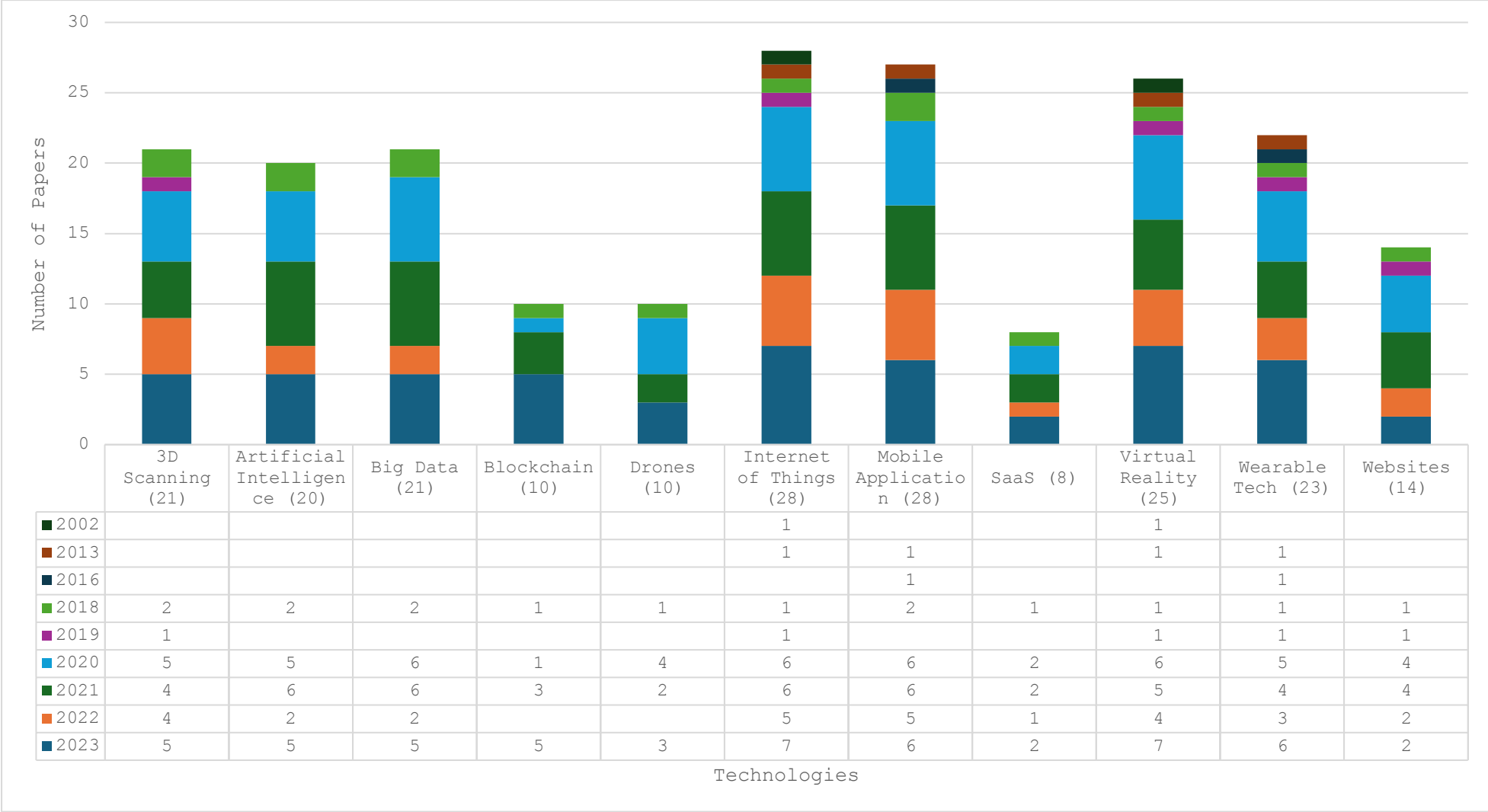
4.3.2 Existing Innovative Technologies

The real estate industry is experiencing significant transformations due to innovative technologies. Our review identified several key areas where these technologies are impacting traditional practices: Artificial Intelligence (AI), discussed in 20 papers, is enhancing predictive analytics, personalised recommendations, and property valuation based on market trends (Miljkovic et al., 2023; Naz et al., 2022a). Virtual reality (VR), covered in 25 articles, is

revolutionizing property showcasing by enabling immersive virtual tours, a concept first introduced by Redfin and Southby (Azmi et al., 2022b). Blockchain technology has also made substantial inroads in the real estate domain; its application in property transactions and contracts ensures transparency, security and reliability (AbdulKader & Kumar, 2023). Smart contracts powered by blockchain simplify processes such as property transfers, lease agreements and financial transactions, reducing the need for intermediaries and streamlining operations, as discussed in 10 articles (shown in Figure 4.5) (Argelich Comelles, 2022).

The Internet of Things (IoT) has introduced the concept of "smart" buildings, where interconnected devices optimise energy usage, enhance security and offer convenient amenities for tenants (Ullah, Sepasgozar, Thaheem, & Al-Turjman, 2021b), as discussed in 28 papers (Figure 4.5). These IoT-enabled systems contribute to improved operational efficiency and enhanced living or working experience within real estate properties (Su & Li, 2019). Additionally, big data analytics is crucial in empowering real estate professionals with comprehensive insights and recommendations (M. Yang et al., 2023), as discussed in 21 articles out of 41. By employing vast amounts of data, industry experts gain a deeper understanding of market trends, buyer and tenant behavior analysis, predictive maintenance and investment opportunities for quickly flipping investors, selling and buying properties (Low et al., 2020a; Naz et al., 2022a). This data-driven approach enhances decision-making processes and provides more technologically informed strategic planning (Rabiei-Dastjerdi *et al*., 2021). Furthermore, using drones, mobile applications and websites in real estate for stakeholders such as sellers and buyers has transformed property surveys and inspections (Kania & Kmieć, 2022b). Nevertheless, 95% of online home searches mainly occur through websites, with mobile apps contributing to 72% of this digital exploration (Ullah, Sepasgozar, Shirowzhan, & Davis, 2021a). This highlights the transformative role played by websites and mobile applications in reshaping the landscape of real estate (Cajias & Wins, 2022b). As these changes unfold, challenges emerge, particularly in the context of global searches, where 51% of buyers express regret over their decisions, attributing it to the prevalence of information asymmetry and the absence of predictive tools (F. Ullah et al., 2018a). These all-technological advancements, including Software as a Service (SaaS), 3D scanning and wearable tech collectively reshape the real estate landscape, offering efficiency, transparency, convenience and sustainability in various aspects of the industry (Naz et al., 2022a). The ongoing

integration of these technologies continues to redefine traditional practices, shaping a more dynamic and responsive real estate ecosystem. Figure 4.5 shows the number of papers discussing the above technologies from 41 papers in different years and most importantly, the 11 technologies identified within the real estate sector.



	3D Scanning (21)	Artificial Intelligence (20)	Big Data (21)	Blockchain (10)	Drones (10)	Internet of Things (28)	Mobile Application (28)	SaaS (8)	Virtual Reality (25)	Wearable Tech (23)	Websites (14)
2002						1			1		
2013						1	1		1	1	
2016							1			1	
2018	2	2	2	1	1	1	2	1	1	1	1
2019	1					1			1	1	1
2020	5	5	6	1	4	6	6	2	6	5	4
2021	4	6	6	3	2	6	6	2	5	4	4
2022	4	2	2			5	5	1	4	3	2
2023	5	5	5	5	3	7	6	2	7	6	2

Figure 4.5. Technology usage and occurrences. Source: Construct, 2023

4.3.3 Barriers to Adoption

We employed PEST analysis to systematically assess the political, economic, social and technological factors influencing the adoption of innovative technologies in the real estate sector. Using NVivo, we identified and analysed these factors within the context of SRE. This analysis reveals how these factors shape technology adoption and highlight real estate industry trends. We explored and presented below how these factors have influenced technology adoption in the real estate industry.

4.3.3.1 Political Factors

Political forces have considerable influence on the adoption of technology in SRE (Abatecola et al., 2013a). Government policies, particularly those championing green technologies and innovative city initiatives, play a pivotal role in fostering innovation within this sector (Kassner et al., 2023b). However, navigating the political landscape reveals regulatory challenges, including slow-moving regulations and a lack of proper rules for real estate with technological adoption (Samonte et al., 2022) and legal challenges (Allameh et al., 2012a). A significant issue is the absence of clear, consistent standards, absence of guidelines and restricted policies governing smart technology implementation; these issues need to be addressed in political aspects (Cajias & Wins, 2022b). This ambiguity can create uncertainty, and standardisation poses further obstacles that hinder the seamless integration of new technologies. In the subsequent analysis, we researched into the impacts of these political factors on the adoption of innovative technologies in SRE.

4.3.3.2 Economic Considerations

Economic considerations are pivotal in evaluating the feasibility of technology adoption in SRE (Azmi et al., 2022b). The findings revealed the crucial factors, such as the absence of initial investment costs (Benjamin et al., 2002), overlooking fundamental housing needs aligned with consumer preferences (M. Yang et al., 2023), reluctance to embrace change due to perceived complexity, high costs and associated (Cajias & Wins, 2022b), insufficient resources and potential savings (Cajias & Wins, 2022b) and challenges related to return on investment (Brown, 2017), significantly impact the decisions of real estate developers and investors (Kempeneer et al., 2021b). According to Kassner et al. (2023b), the long-term economic benefits, such as reduced operational costs and increased property value for developing

predictive tools, far outweigh these initial expenses. Consequently, technology adoption emerges as a financially prudent choice for stakeholders (Su & Li, 2019).

Furthermore, an economic challenge that surfaces is information asymmetry (Samonte et al., 2022), which means that buyers may encounter difficulties accessing all the information from one platform. This shows the need for technological adoption within the industry to overcome information asymmetry (F. Ullah et al., 2018a), because buyers may encounter difficulties accessing all the information needed for an informed decision-making process (Rabiei-Dastjerdi *et al*., 2021), which potentially affects real estate market efficiency and fairness (Aydinoglu & Bovkir, 2020a). In the ensuing analysis, we investigated these economic dynamics and their implications for technology adoption within SRE.

4.3.3.3 Social Dynamics

Social factors encompass user preferences and societal attitudes toward technology's role in SRE (M. Yang et al., 2023). The willingness of tenants and homeowners to embrace technology-driven features and services plays a pivotal role in determining adoption rates (Fields & Rogers, 2021). Lecomte (2020) highlight that younger generations exhibit a more open disposition toward technology-driven real estate experiences, such as smart home features, virtual property tours and predictive analytics by AI for property valuations. Consequently, SRE companies targeting this demographic report significantly higher adoption rates (Ibrahim et al., 2023a). Moreover, the social factor analysis highlights the imperative of enhancing consumer satisfaction and well-being through smart real estate technologies (Aydinoglu & Bovkir, 2020a). It also highlights the challenge of cultivating user acceptance and satisfaction, and the lack of long-term effectiveness with user preferences due to complexities and accuracy of technologies (M. Yang et al., 2023). This increases the slow adoption of technologies in existing structures and shows the lack of effective leadership to promote technology benefits for buying and selling purposes with predictive analytics (Ullah, Sepasgozar, Thaheem, & Al-Turjman, 2021b). Traditional services are more expensive and time-consuming, including lack of accessibility and affordability to all stakeholders within the industry (Xu & Gade, 2017a) and lack of willingness to share data with all customers manually (Wang, 2023a). However, the findings reveal that clients trust digital technologies, which is integral to the industry's success (Samonte et al., 2022). Furthermore, the analysis identified a demand for more efficient decision-making tools modified to user preferences, i.e. predictive analytical tools, which is currently missing (Shaw, 2020). This shows that

technological advancements are required for industry to provide benefits to customers and improve client satisfaction for future buying and selling processes.

4.3.3.4 Technological Dimensions

The technological dimension is at the core of SRE; key innovative technologies driving this transformation include the IoT for property automation (Ullah & Sepasgozar, 2020a), and AI for enhancing predictive analytics by accurately forecasting market trends, property values, investment opportunities and enabling predictive maintenance to optimise building performance and reduce costs (Xu & Gade, 2017a), Blockchain is used for transparent transaction processes (Sankar *et al.*, 2023) and VR and Augmented Reality (AR) are used for immersive property experiences (Ibrahim et al., 2023a). One of the central challenges within this technological landscape is the relatively slow adoption of these technologies, with high percentages and the persistent need for more advanced and innovative solutions (Low et al., 2020a; Munawar et al., 2020b). To remain competitive and relevant, the real estate industry must keep pace with evolving technological trends (Wang, 2023a). Additionally, the main barrier is a lack of infrastructure and collaboration with companies for smooth digital implementation (Ibrahim et al., 2023a; Naz et al., 2022a). This emerged as a critical task that needs to be addressed for developing and implementing new technologies in industry. Overcoming this hurdle is vital for realising the full potential of technology-driven advancements in SRE.

After our comprehensive analysis of each PEST factor, we investigated the technology challenges within the real estate industry. Table 4.2 highlights the key barriers across these factors. Internally, challenges include limited budgets, resistance to change and reliance on outdated systems. Externally, government policies, market trends, user preferences and rapid technological changes pose hurdles. These factors underscore the complexities of adopting technology in real estate (shown in Table 4.2 below).

Table 4.2: Summary of internal and external challenges of PEST factors

PEST	Internal barriers	External barriers
Political	• Lack of company influence efforts for real estate industry (Samonte et al., 2022; Ullah & Al-Turjman, 2023a). • Lack of assessment of property taxes (Xu & Gade, 2017a). • Conflict within organisations (AbdulKader & Kumar, 2023; Ibrahim et al., 2023a). • Lack regulatory framework (Sankar *et al*., 2023), • Lack of new policies, guidelines, standards for transparency (Rabiei-Dastjerdi *et al*., 2021). • Lack of flexibility and willingness to experiment with new technologies within local property development organisations.	• Regulatory and legal challenges and potential conflicts between local and national regulations (Azmi et al., 2022b). • Lack of understanding of political economy of housing within digital platform (Fields & Rogers, 2021). • Regulatory barriers and government policies that may hinder the growth and adoption of proptech solutions (Kassner et al., 2023b). • Lack of government support and policies for proptech adoption (Starr *et al*., 2021). • Lack of regulatory framework to accommodate disruptive technologies (Azmi et al., 2022b).
Economical	• High-quality and efficient housing service (M. Yang et al., 2023). • Resistance to change and adoption due to complexity, cost and risk (Starr *et al*., 2021). • High cost of software and hardware (Kassner et al., 2023b). • Market disruptions and lack of investment for infrastructure (Naz et al., 2022a). • Limited accessibility and affordability (Azmi et al., 2022b). • Lack of enough budget for infrastructure (Miljkovic *et al*., 2023).	• Lack of basic housing needs (M. Yang et al., 2023). • High transaction costs and information asymmetry (Ullah & Al-Turjman, 2023a). • Economic uncertainties, such as job loss and financial instability (Ibrahim et al., 2023a). • Lack of market studies and financial feasibility studies in real estate (Low et al., 2020a). • Lack of investment for training and infrastructure (Ullah, Al-Turjman, et al., 2021a).

	• Limited resources and capabilities with high initial investment (Kassner et al., 2023b).	
Social	• Resistance to change from traditional methods and lack of long term effectiveness with user preferences (M. Yang et al., 2023). • Fear of job displacement (Ansah *et al*., 2023). • There is a slow response to customer feedback (Starr *et al*., 2021). • An internal culture that does not prioritise customer needs when adopting technology (Siniak et al., 2020b). • Lack of collaboration between AI and human decision-making competence (Miljkovic *et al*., 2023).	• Traditional services are expensive (Xu & Gade, 2017a). • Lack of accessibility to all stakeholders (Wang, 2023a). • Lack of acceptance, satisfaction and trust in technologies (Ullah, Sepasgozar, Shirowzhan, & Davis, 2021a). • Lack of crime rates analysis and access to amenities (Starr et al., 2021). • Lack of improving location, neighbourhood and proximities in determining property values, which can influence social aspects (Hapuarachchi et al., 2022b). • Lack of skill development and education with technological advancements (Siniak et al., 2020b).
Technological	• Lack of digital technology requirements and basic housing needs in technology (M. Yang et al., 2023). • Lack of access to market data required for integrating the selected technology with existing infrastructure and lack of technology infrastructure (Wang, 2023a). • Lack of standardisation and coordination among stakeholders (Ullah & Sepasgozar, 2020a). • Lack of algorithms and automation which impact real estate practices (Fields & Rogers, 2021). • Lack of use of novel techniques (Hapuarachchi et al., 2022b).	• Due to fast technological changes professionals are confused about adoption (Fields & Rogers, 2021; Low et al., 2020a). • Limited understanding of technology (Su & Li, 2019). • Lack of updated, reliable and accessible information (Naz et al., 2022a). • Lack of research and understanding of technologies (Shaw, 2020).

	• Lack of data analytics, artificial intelligence, virtual reality and blockchain implementation framework (Siniak et al., 2020b).	• Lack of collaboration with suppliers and partners to navigate the traditional real estate methods (Ekman et al., 2016). • Integration and compatibility issues, technical complexities and challenges while developing and implementing technologies (Kassner et al., 2023b).

4.3.4 Impact on Decision-making Process

Using NVivo, we examined 41 articles to see how technology affects decision-making in real estate, as seen in Figure 4.6. We found that AI plays a significant role in many areas of real estate, particularly in expediting and cost-effectively streamlining property valuation processes. This is achieved through the implementation of advanced automated valuation models (AVMs), which utilise a range of machine learning algorithms such as Artificial Neural Networks (ANNs), Support Vector Machines (SVMs), Random Forest and Gradient Boosting Machines (GBMs) (Cajias & Wins, 2022b). These algorithms analyse property data and market trends swiftly and accurately, effectively replacing labour-intensive and time-consuming manual valuation methods (Starr *et al*., 2021). AI enhances intra-stakeholder communication in real estate, facilitating deeper insights into property features and the surrounding environment; this improvement in communication is particularly beneficial in tasks such as real-time property monitoring (Ansah *et al*., 2023), interactive property showcasing and remote property management, which streamline the decision-making process and enhance operational efficiency in SRE (Fields & Rogers, 2021). AI's ability to swiftly analyse vast datasets and present findings in easy-to-understand visual formats such as charts and graphs significantly enhances decision-making in SRE management (Miljkovic *et al*., 2023). This involves techniques like Natural Language Processing (NLP), machine learning and data mining. For instance, AI can predict maintenance needs, assess investment risks using models like Random Forest and forecast market trends using techniques like Time Series Analysis (Munawar et al., 2020b). Moreover, AI's advanced algorithms improve information management and task organisation efficiency. AI optimises property portfolio management using algorithms like K-means clustering for market segmentation (Su & Li, 2019). AI significantly enhances real estate marketing through advanced behavioural analysis, enabling precise audience targeting based on individual interests and actions (Ullah, Al-Turjman, et al., 2021a). It also enhances security measures by implementing encryption and authentication protocols to protect sensitive data and property assets (Rabiei-Dastjerdi *et al*., 2021). Figure 4.6 shows that AI has many benefits in real estate decision-making and can help handle the challenges of the industry effectively (Miljkovic *et al*., 2023). In real estate, big data techniques are extensively employed for various tasks, particularly in automating property valuation. Advanced machine learning models such as Random Forest, Gradient Boosting and Deep Neural Networks analyse extensive datasets encompassing historical sales data, market

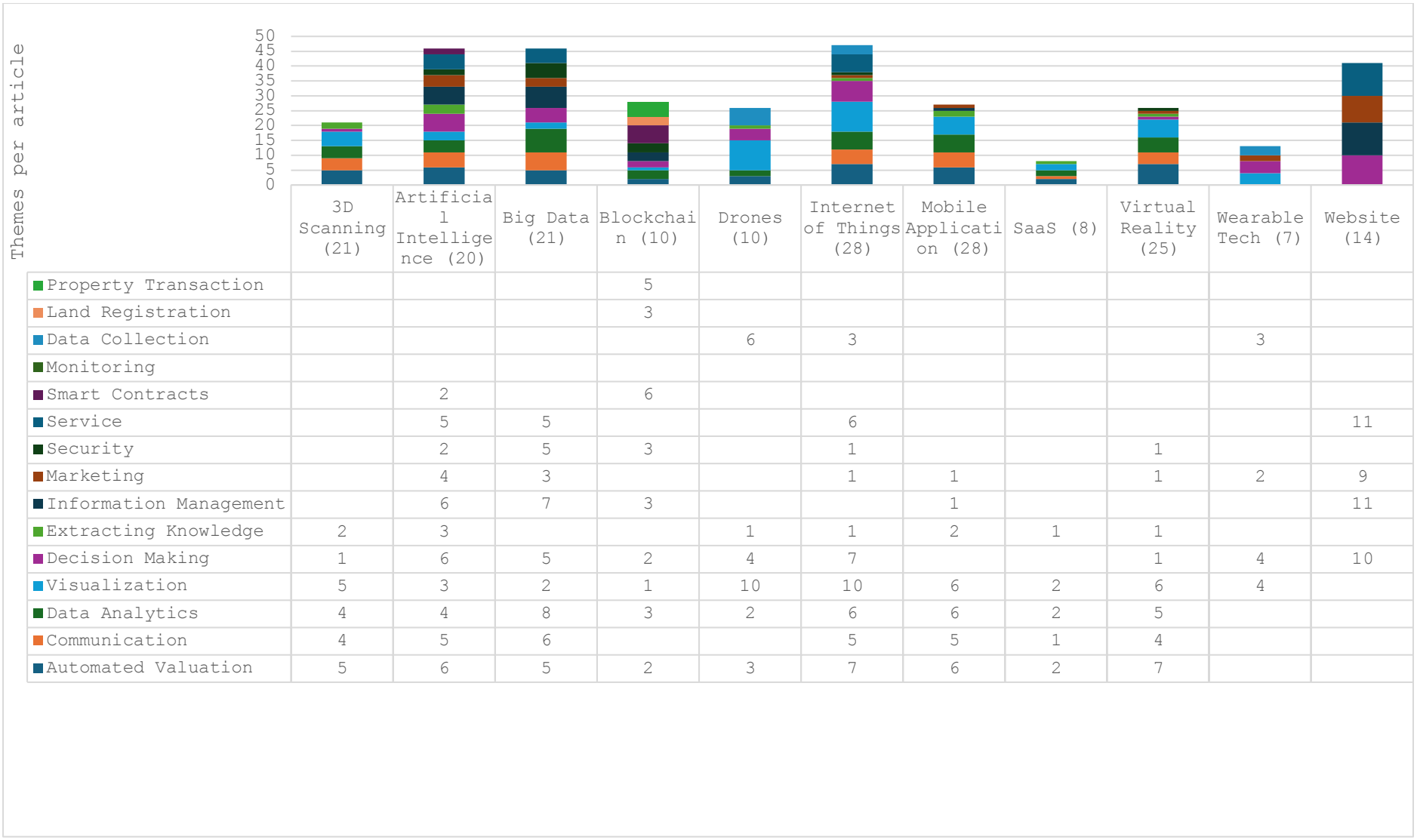
trends and property characteristics to provide rapid and accurate property value assessments (Su & Li, 2019). These models enhance the location, size and condition of properties to enhance the precision of valuations (M. Yang et al., 2023). These methods also analyse market data using techniques like clustering algorithms, aiding in the understanding of market trends (Wang, 2023a). Moreover, they support decision-making processes by providing valuable insights through predictive analytics and data mining (Brown, 2017). Additionally, big data enhances information management by organising and making data easily accessible for stakeholders using advanced database management systems (Kania & Kmieć, 2022b). Furthermore, they refine marketing strategies through targeted approaches, enhancing customer segmentation and sentiment analysis (Ullah & Al-Turjman, 2023a). They also improve service provision by better understanding clients' needs through customer behaviour analysis and recommendation systems (Fields & Rogers, 2021). Lastly, big data visualises insights, using data visualisation tools to make complex data easier to interpret, thereby significantly improving efficiency and effectiveness in real estate operations (Miljkovic et al., 2023).

Blockchain technology is extensively utilised in real estate for various applications, as described in Figure 4.6. It automates property valuation by enhancing decentralised ledgers, ensuring secure and transparent data access for decision-making and protecting sensitive information through cryptographic techniques (Starr et al., 2021). Additionally, it registers land ownership and authenticates property transactions using immutable records, which enhances security measures against fraud and tampering (Ullah & Al-Turjman, 2023a). Furthermore, blockchain facilitates the deployment of smart contracts, which automate contract enforcement and optimise processes such as lease agreements, property sales and title transfers through self-executing code (Ansah *et al.*, 2023). These smart contracts use predefined conditions and cryptographic signatures to ensure tamper-proof and transparent transactions (Ansah et al., 2023).

Drones are another impactful technology in real estate that help gather data to support decision-making and offer visualisation for viewing properties (Ullah & Sepasgozar, 2020a). Mobile applications such as Zillow and Redfin are key for decision-making, adjusting information, better marketing and service enhancements in real estate, as illustrated in Figure 4.6 (Kempeneer et al., 2021b). VR was first introduced in real estate by Southby and Redfin

during Covid-19, aiding collaboration, communication, information management, marketing activity monitoring, service improvement and visualisation in real estate. Wearable tech assists in data collection of properties and surroundings to improve the decision-making process and marketing of properties (Ibrahim et al., 2023a; Miljkovic et al., 2023). SaaS supports decision-making by information management, marketing and service enhancement in real estate (Samonte et al., 2022). Websites also help in the decision-making process, providing information management (Low et al., 2020a), marketing and service provision in real estate activities.

Throughout these technology applications, several recurring themes were observed, including decision-making support (Rabiei-Dastjerdi *et al.*, 2021), effective information management (Ansah et al., 2023), marketing optimisation, service enhancement and visualisation capabilities (Munawar et al., 2020b). The most suggestive themes consistently emerge across various technologies and highlight their fundamental role in driving innovation and efficiency within the real estate industry (as shown in Figure 4.6) and impacting the decision-making process.



	3D Scanning (21)	Artificial Intelligence (20)	Big Data (21)	Blockchain (10)	Drones (10)	Internet of Things (28)	Mobile Application (28)	SaaS (8)	Virtual Reality (25)	Wearable Tech (7)	Website (14)
Property Transaction				5							
Land Registration				3							
Data Collection					6	3				3	
Monitoring											
Smart Contracts		2		6							
Service		5	5			6					11
Security		2	5	3		1			1		
Marketing		4	3			1	1		1	2	9
Information Management		6	7	3			1				11
Extracting Knowledge	2	3			1	1	2	1	1		
Decision Making	1	6	5	2	4	7			1	4	10
Visualization	5	3	2	1	10	10	6	2	6	4	
Data Analytics	4	4	8	3	2	6	6	2	5		
Communication	4	5	6			5	5	1	4		
Automated Valuation	5	6	5	2	3	7	6	2	7		

Figure 4.6. Emerging themes with technologies. Source: Construct, 2023

4.4 Discussion

This study highlights the real estate industry's complex challenges in integrating and adopting innovative technologies across the PEST framework by investigating the implications arising from the identified challenges. In the political domain, we identified the lack of government policies designed for the industry as a notable obstacle, along with political instability, lack of assessment of property taxes (Xu & Gade, 2017a) and conflicts within organisations as major issues to be addressed (Arndt *et al*., 2017). Lack of policy and regulation frameworks for protecting the individual rights (Naz et al., 2022a), lack of new policies, guidelines, standards for transparency (Rabiei-Dastjerdi *et al*., 2021) and insufficient government funding (Benjamin et al., 2002; Pomaza-Ponomarenko et al., 2023) were also identified as problems. To address these issues and challenges, industry stakeholders must engage with policymakers in government to advocate for tailored policies and advance a stable political environment conducive to technological advancements to implement strategies.

Economically, the findings reveal that technological structure is missing within the industry due to the sector grappling with limited budgets (Sankar *et al*., 2023), lack of financial expertise in the industry (Rabiei-Dastjerdi *et al*., 2021), lack of investments (Naz et al., 2022a; Newell, 2022), lack of housing quality and efficient housing services (M. Yang et al., 2023) and, most importantly, an industry-wide unwillingness to embrace new infrastructure in the real estate sector (Xu & Gade, 2017a). These constraints impede the adoption of innovative technologies that could otherwise lead to operational cost reduction and improved decision-making processes with technology adoption (Aydinoglu & Bovkir, 2020a; Azmi et al., 2022b; Fields & Rogers, 2021). This highlights the potential of innovative financing models and investment incentives to overcome these challenges to enhance decision-making process in real estate.

About social dynamics, the researcher analysed the barrier more deeply. The real estate industry faces barriers to resistance to change from traditional methods (Azmi et al., 2022b), lack of long-term effectiveness with user experience and preferences for the development of the model (M. Yang et al., 2023), privacy violation for data (Al-Rimawi & Nadler, 2023) and a slow response to customer feedback (Naz et al., 2022a; Puķīte & Geipele, 2017; Rabiei-Dastjerdi et al., 2021). Some of these challenges are evident in that the industry must prioritise change management programs, including social people preferences, while designing

the model or preferences and investing in comprehensive market research to gain a deeper understanding of customer preferences. Addressing these social challenges is essential to design strategies for barriers achieving user acceptance and to better align with evolving customer needs to enhance the decision-making process in the industry (Galster & Lee, 2020).

This study also investigated the impacts and challenges of adopting technologies concerning technological dimensions, such as AI, big data analytics, VR and blockchain (all of which were identified as the most suggestive technologies in the real estate industry). While these technologies offer significant potential, our analysis revealed several challenges hindering their widespread adoption (Xu & Gade, 2017a; M. Yang et al., 2023); Professionals often resist transitioning from traditional systems and inadequate technological infrastructure and studies present significant barriers (Arndt et al., 2017; Renigier-Biłozor et al., 2022). Overcoming these hurdles requires investment in comprehensive training programs and the development of robust organisational and technological capabilities (Ho et al., 2015). Despite these impediments, AI is revolutionising real estate operations, enhancing communication and enabling stakeholders to gain insights into property dynamics (Miljkovic *et al*., 2023). As noted by Jim *et al*. (2024), NLP and machine learning algorithms analyse vast, unstructured data sources, such as social media and customer feedback, facilitating informed decision-making and techniques like sentiment analysis and topic modelling to identify patterns and trends, while machine learning algorithms classify and predict outcomes. As Bharadiya (2023) suggests, this process helps stakeholders make informed decisions by providing recommendations on public opinion, emerging trends and market conditions. Techniques like Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs) create detailed visualisations and predictive models, aiding in property evaluation and market trend analysis. CNNs analyse images, such as photos and floor plans, to assist in property valuation, while RNNs handle time-series data, enabling predictive models for market trends and future property values for investors (Alzubaidi *et al*., 2021). AI techniques GBMs boost predictive accuracy by combining multiple prediction models, while Random Forests aggregate predictions from numerous decision trees to improve accuracy and reduce overfitting (Bentéjac *et al*., 2021), This comprehensive analysis allows AVMs to provide more precise and efficient property valuations compared to traditional methods. Additionally, AI-driven marketing strategies utilise algorithms like k-means clustering and collaborative filtering for

targeted advertising based on consumer behaviour analysis, enhancing client engagement (Hemalatha, 2023; Ikotun et al., 2023).

Predictive analytics, Similarly, big data analytics revolutionises real estate by automating property valuation and market trend analysis. The technology is aiding strategic decision-making techniques like cluster Analysis, which groups similar data points together, and sentiment analysis, which evaluates attitudes and emotions in text data and organises vast data sets. This improves stakeholder engagement and understanding market sentiment (Singh *et al.*, 2020) employing models such as Autoregressive Integrated Moving Average (ARIMA), used to forecast property prices, rental trends or maintenance needs based on past data, helps to optimise operational efficiency and reduce costs by enabling predictive maintenance strategies (Punia & Shankar, 2022). Risk management in real estate involves using big data analytics to assess and mitigate risks associated with property investments (Jacob & Asha, 2023) and therefore, this analysis helps real estate stakeholders provide insights into factors that may affect investment returns. Conversely, Blockchain technology, utilising cryptographic techniques such as hashing and consensus algorithms, revolutionises real estate by enhancing transparency and security. It ensures secure data access in AVMs and authenticating transactions (Argelich Comelles, 2022). Smart contracts, a key blockchain component, automate contract enforcement, reducing administrative overheads (Al-Rimawi & Nadler, 2023). These contracts are powered by Ethereum, a blockchain platform that supports smart contracts, enabling automated and trust less transactions (Oliva *et al.*, 2020). Additionally, blockchain enables the registration of land ownership and authentication of property transactions and improves overall security measures (Sankar *et al.*, 2023). This technological advancement reflects broader themes in the real estate industry, as shown in Figure 4.6 and Figure 4.7, including the integration of the IoT for real-time monitoring and maintenance, AI-driven chatbots for customer service and VR for immersive property experiences (Naz et al., 2022a). Predictive analytics for market trends, forecasting and optimisation of investment strategies, along with smart building technologies incorporating IoT sensors and automation systems, are also key areas of development. As for further exploration, incorporating Building Information Modelling (BIM) – Geographic Information System (GIS) – SRE applications links into real estate practices represent a significant advancement, offering novel processes that can revolutionise decision-making and planning,

these links enable BIM-GIS-SRE integration, providing real-time visualisation and analysis of property data (Elsheikh *et al*., 2021). This integration also enhances urban planning and development projects by offering detailed insights into property dynamics and environmental impacts, aligning with the industry's increasing focus on sustainability and efficiency (Wang *et al*., 2019). This combined technology aids urban planners in simulating development impacts on traffic and environmental quality, helps developers assess project feasibility by considering costs and regulations and enables property managers to optimise building performance and resource efficiency, ensuring sustainable and comfortable environments for tenants (Elsheikh *et al*., 2021). Therefore, clear recommendations should address infrastructure, social preferences, data access, and training to improve decision-making based on PEST dimensions.

For decades, the real estate industry was complex and traditional, but the 2008 crisis drove startups to innovate with technology (Shengguo Li et al., 2021; Michaeli, 2020a). This led to a steady increase in technology investment for digital transformation (what we call "Smart Real Estate"), which reached a peak of $15B in 2019 (as shown in Table 4.3, where capital invested depicts annual investment figures in technologies correlating with the deal count (Michaeli, 2020a). However, in 2020, there was a decline in capital invested due to the global disruption by COVID-19 impacting real estate sales worldwide (Balemi et al., 2021). This decline highlights the increasing necessity for digital transformation in investments to stimulate global economic growth, as shown in Table 4.3. The positive impact of COVID-19 in the adoption of SRE has been a key factor in facilitating the digital transformation of the real estate industry.

Table 4.3: Investment per year for Smart Real Estate. Source: *(Michaeli, 2020a)*

Year	Capital invested	Deal count
2009	91M$	36
2010	66M$	42
2011	284M$	75
2012	460M$	133
2013	514M$	230
2014	2B$	378
2015	3B$	477
2016	4B$	584
2017	4B$	650
2018	7B$	82.8
2019	15B$	770
2020	3B$	216

In Figure 4.7, the decision-making process followed by (Hassan et al., 2021), is divided into three phases: Initiation, Service Process and Final Stage (Qazzafi, 2019), each phase represents critical steps where stakeholders, investors, buyers, and service providers engage with one another, contributing to the overall outcome of the transaction (Grybauskas et al., 2021; Rane et al., 2023), In the initiation phase, the focus begins with requirement identification, where investors/buyers determine whether to buy, sell, or build properties (Trinh, 2022), At this stage, buyers form their purchase intentions and conduct option analysis, narrowing down potential properties (Mang et al., 2020; Nguyen et al., 2021). A barrier that frequently arises here is incomplete property information, which can delay decision-making, investors and buyers are also overwhelmed by the excessive number of property options and face difficulties in assessing real-time market data. These challenges hinder the ability to make accurate, timely decisions. The service process phase then involves engaging with service providers, such as real estate agents, financial institutions, and managers, who facilitate transactions, financing, managing, valuing and reporting (Haleem et al., 2022). Barriers emerge due to the manual nature of contracts, leading to errors, and there is resistance to automation, particularly among service providers who are accustomed to traditional processes. Another barrier is the inconsistent data quality for valuation, which affects accurate property appraisals and service delivery (P. Sharma et al., 2023). In the final stage, the decision on whether to proceed with a transaction culminates in the buyers final purchase decision (Pleyers & Poncin, 2020). Should the transaction move forward, the post-purchase phase involves maintaining buyer engagement, ensuring a smooth transaction, and

managing the post-purchase behaviour (Zhang et al., 2024). Barriers arise when there is low buyer engagement post-sale, especially when buyers do not receive adequate follow-up or support (Naeem et al., 2023a). Additionally, there is resistance to using smart contracts for property maintenance, and predictive maintenance systems may not always deliver reliable results, leading to potential issues in property upkeep (Seagraves, 2024).

To overcome these barriers, novel solutions and execution tactics plays a vital role in each phase. For the initiation phase, AI-powered recommendations and predictive analytics provide more accurate property recommendations on base of existing literature. Thus improving the speed and precision of option analysis (Liu, 2022). Additionally, blockchain technology could ensure the transparency and security of property records, mitigating the issue of incomplete information (Kabaivanov & Markovska, 2021). Execution tactics such as integrating AI into existing real estate platforms and adopting VR tools for virtual property visits make it easier for buyers to assess property options efficiently (P. Sharma et al., 2023). Following service process in phase – 2, smart contracts and AI-powered valuation tools reduce the likelihood of errors in contracts and improve the accuracy of property appraisals, tackling the problem of inconsistent data quality (Javaid et al., 2022; Saleh et al., 2021). These tools also streamline operational workflows for service providers and execution tactics like promoting smart contracts and training for automation adoption encourage service providers to embrace these processes minimising resistance. (Hamledari & Fischer, 2020). Proceeding to the final stage, AI-based post-purchase analysis and predictive maintenance systems ensure that properties are well maintained and that buyers remain engaged with the property ecosystem (Adewusi et al., 2024; Theissler et al., 2021). Execution tactics such as enhancing buyer engagement tools and improving predictive maintenance foster long-term buyer satisfaction and proactive property management (Tidwell & Gallimore, 2014; Ucar et al., 2024). The overall framework with combination of insights and recommendations from existing literature of novel processes and solutions and execution tactics transforms each phase of the real estate decision-making process into a more efficient, data-driven system. These recommendations address the barriers at each stage, enabling smoother transition, more accurate decision-making, and enhance outcomes for stakeholders.

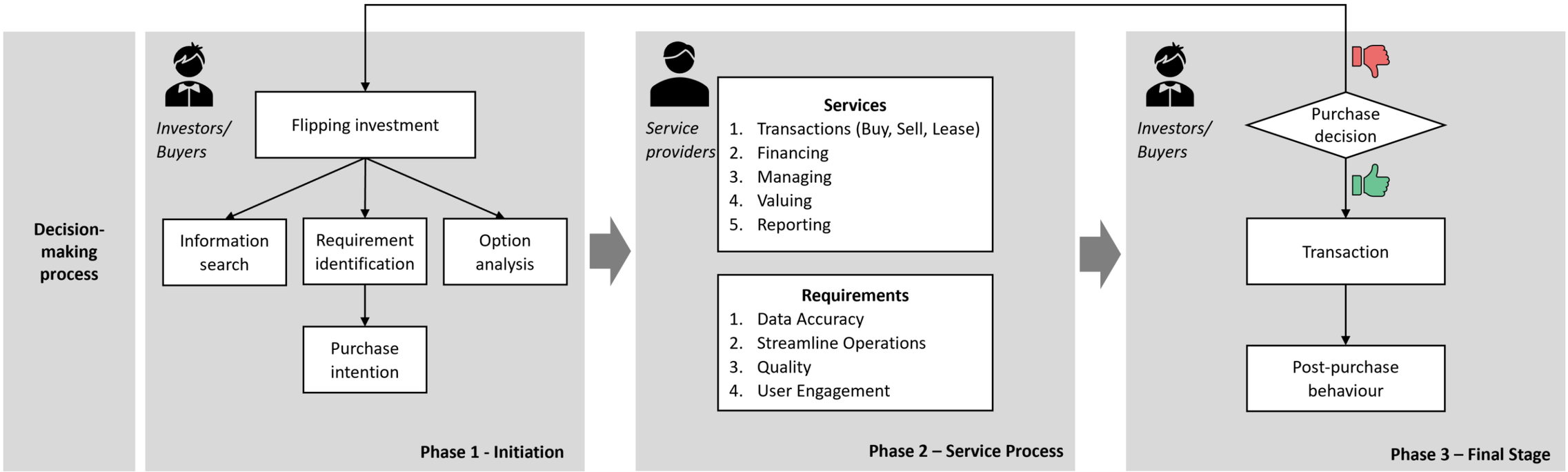
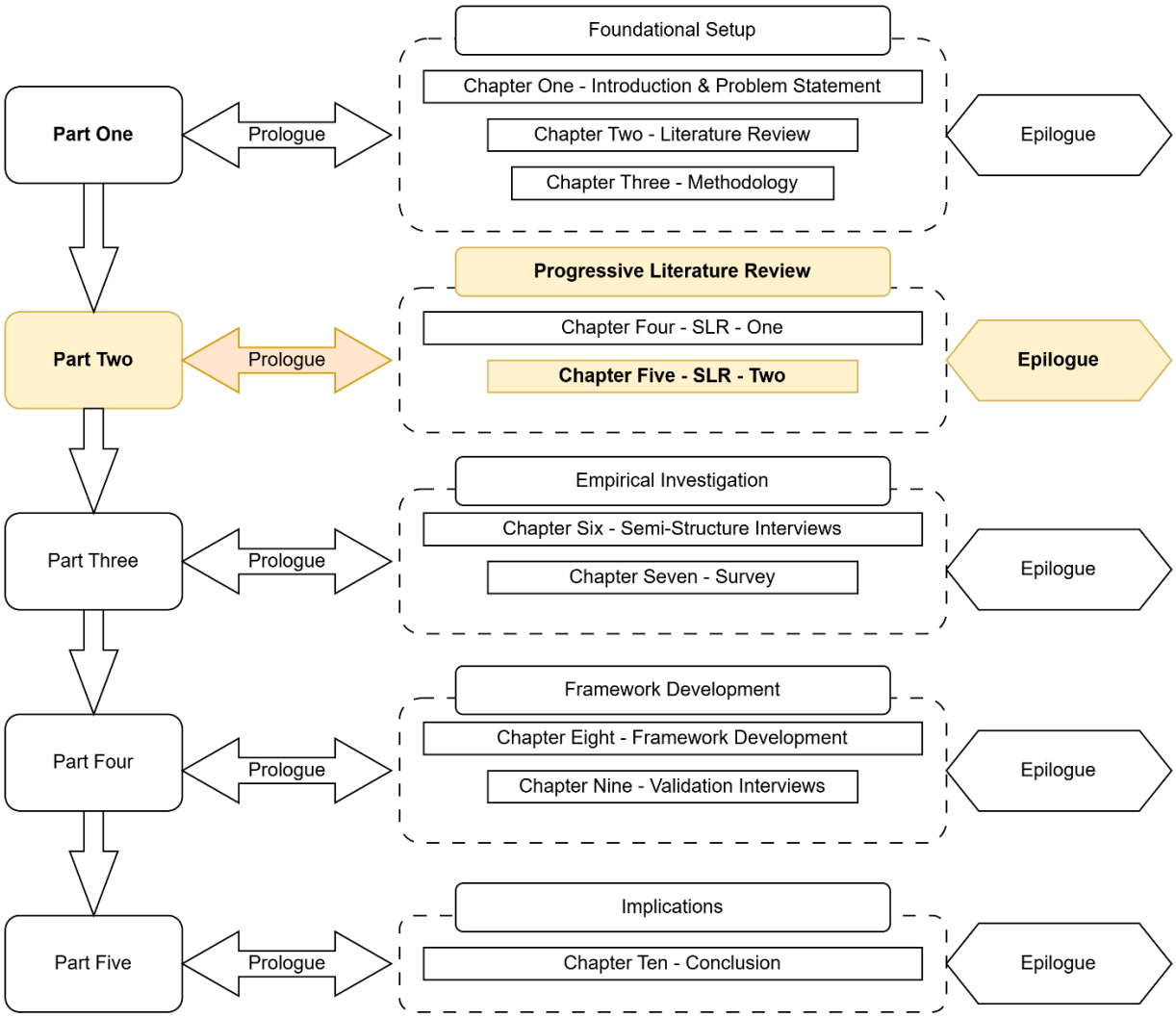


Figure 4.7. A conceptual framework for technologies in real estate. Source: Construct, 2023

4.5 Conclusion

This study offers a systematic review of the barriers and opportunities surrounding the adoption of SRE technologies, utilising the PEST framework to provide a comprehensive analysis across political, economic, social, and technological dimensions. The research highlights key barriers such as regulatory ambiguity, high costs, and societal resistance that hinder the integration of advanced technologies in the real estate sector. The study employed a rigorous literature review of 41 academic papers, following PRISMA guidelines along with bibliometric and PEST analysis. This multi-layered approach allowed for a thorough exploration of technology adoption challenges within the industry. The analysis revealed several critical barriers including unclear regulatory standards, high costs of implementation, and the societal resistance to change. Technologies like AI, blockchain, and IoT promise to improve decision-making and transaction processes but remain under utilised due to infrastructure and regulatory limitations. This study's primary contribution lies in identifying specific barriers to technology adoption and offering recommendations for stakeholders to overcome them. The proposed conceptual framework provides a structured approach for integrating smart technologies, improving decision-making, and fostering industry innovation. These findings have practical implications for stakeholders such as buyers, and investors, offering insights to enhance the decision-making process with technology adoption. The study encourages strategic collaboration between policymakers and industry leaders to mitigate barriers and promote the benefits of technology-driven solutions.

Further studies should focus on quantifying the long-term economic benefits of SRE technologies and exploring the broader implications of AI-driven predictive analytics in real estate. Additionally, future research could address ethical considerations and data privacy concerns associated with advanced technological tools.


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STATEMENT OF CONTRIBUTION DOCTORATE WITH PUBLICATIONS/MANUSCRIPTS

We, the student and the student's main supervisor, certify that all co-authors have consented to their work being included in the thesis and they have accepted the student's contribution as indicated below in the Statement of Originality.

Student name:	Wajhat Ali
Name and title of main supervisor:	Dr Don Amila Sajeevan Samarasinghe - Senior Lecturer
In which chapter is the manuscript/published work?	Chapter 5

Describe the contribution that the student and members of the supervisory team have made to the manuscript/published work:[1]

Student: Conducting the literature review, data collection, data analysis, and drafting the manuscript.

Supervisory Team: Providing overall supervision of the PhD project; contributing to the conceptualisation and research design; offering methodological guidance; reviewing and providing feedback on manuscript drafts; supporting revisions; and providing ongoing academic mentorship throughout the research process.

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CHAPTER 05

5. STAKEHOLDER TRUST IN ARTIFICIAL INTELLIGENCE (AI) FOR PROPERTY VALUATION: INSIGHTS FROM A SYSTEMATIC LITERATURE REVIEW

This chapter is based on the following published/publishable journal paper:
Ali, W., Samarasinghe, D. A. S., Feng, Z., & Rotimi, J.O.B (2025). Stakeholder trust in artificial intelligence (AI) for property valuation: Insights from a systematic literature review. *Urbanisation, Sustainability and Society*. (Accepted)

Abstract

Purpose: This study aims to address the growing concerns surrounding the use of artificial intelligence (AI) in property valuation, particularly issues of transparency, trust and accuracy. It focuses on aligning AI models with expectations to foster responsible adoption in real estate decision-making.

Design: A systematic literature review (SLR) of 44 peer-reviewed studies published between 2018 and 2025 was conducted. NVivo software was used for qualitative coding, and the PESTLE framework guided the analysis of external factors influencing AI adoption. The study examined both technical model performance and stakeholder concerns.

Findings: Random forest and support vector machines were most frequently applied in structured valuation tasks, while artificial neural networks were reported in contexts involving non-linear modelling and complex data patterns. Despite demonstrated predictive capabilities, policymakers and professional stakeholders placed greater emphasis on transparency, explainability, and legal accountability. Identified trust-related challenges included algorithmic bias, limited model interpretability, regulatory ambiguity, and insufficient integration of contextual factors. These findings informed the development of a hybrid AI valuation framework that integrates technological performance with governance mechanisms, contextual calibration, and professional judgement to strengthen property valuation quality.

Originality: This study synthesises technical and stakeholder dimensions of AI in property valuation using a structured qualitative approach via SLR. It proposes a novel hybrid framework that integrates stakeholder trust factors with model precision to enhance both reliability and acceptance of AI tools.

Research limitations: This study is limited by the absence of primary data from stakeholder interviews. The findings are based solely on published literature, which may not fully capture real time industry perspectives or emerging on ground challenges.

Practical implications: The proposed framework offers a transparent, data-driven solution for valuers, investors and regulators, supporting better-informed decisions and encouraging ethical AI adoption in real estate.

5.1 Introduction

Property valuation is key in real estate, affecting investments, mortgage approvals, taxes and urban planning (Abdul-Rahman et al., 2021). Traditionally, valuation methods such as the sales comparison approach, cost approach and income capitalisation approach have been widely used (Gude, 2024). However, these methods depend on historical data and expert judgement, which can cause inconsistencies, especially in changing markets (Ali et al., 2025). As real estate markets grow more complex and technology advances, there is a rising demand for valuation techniques that are accurate, efficient and meet the needs of various stakeholders, including buyers, investors, professionals, policymakers, developers and valuers (Deppner & Cajias, 2024).

Automated Valuation Models (AVMs), driven by artificial intelligence (AI) and machine learning (ML), have become increasingly prevalent across the real estate sector (Hoxha, 2024). They are widely used by mortgage banks, integrated into property listings platforms such as Zillow and Zoopla, and employed by government agencies for taxation and regulatory purposes (Gnat, 2024). These data-driven models utilise property attributes, market trends and economic indicators to generate timely and objective valuations, often outperforming traditional methods in predictive accuracy (Hoxha, 2024). Existing AI-based valuation research can broadly be grouped into three streams. The first stream focuses on predictive performance, comparing algorithms such as regression models (RM), random forest (RF), gradient boosting, and neural networks to enhance valuation accuracy (Chiasson et al., 2023; Sun & Peng, 2022). The second stream integrates economic, spatial and socio-demographic variables to improve risk modelling and market responsiveness. The third, more recent stream addresses issue of transparency, explainability and stakeholder trust in AI-driven systems (Chandu & Bharatha Devi, 2023). While these streams advance technical and methodological development, they are often examined independently rather than through

structured synthesis that connect model capabilities with stakeholder-oriented valuation needs. Conceptually, this study is grounded in socio-technical systems theory, which views technological innovation as embedded within institutional, regulatory and stakeholder contexts. It also draws on stakeholder theory and trust-based adoption perspectives to explain how valuation technologies are interpreted, legitimised, and accepted across different actor groups.

However, despite their technical potential, many stakeholders remain cautious and concerns have been raised over the transparency, explainability and fairness of AI-generated valuation, which undermines trust, particularly when black-box models make it difficult to interpret how values are derived (Deppner & Cajias, 2024; Schnitzer & Tiruwuha, 2024). Real estate professionals, investors and policymakers seek not only accurate outputs, but also clarity and accountability in the valuation process (Gnat, 2024). While existing literature often emphasises improving model performance, there is limited focus on aligning these tools with stakeholder expectations and trust in AI adoption (Forys, 2022). This highlights a critical gap in the absence of a structured framework that accounts for both the technical strengths of AI and the contextual needs of users. Addressing this gap, this study explores how AI-enhanced valuation systems can be better designed to foster stakeholder trust, ensure interpretability and support more inclusive adoption within the property valuation ecosystem.

This study contributes to the growing body of the research on AI in property valuation by moving beyond a purely technical focus on model accuracy to incorporate stakeholder trust, regulatory alignment and multidimensional adoption considerations. By integrating model performance insights with stakeholder needs and political, economic, social, technological, legal and environmental (PESTLE) based trust dimensions, the research conceptualises AI-driven valuation as a socio-technical system rather than merely a predictive mechanism. The proposed hybrid framework therefore advances both theoretical understanding and practical implementation by aligning technical robustness with transparency, explainability, and governance requirements. The remainder of this property is structured as follows. Section 2 outlines the research methodology, including (Structured, Prudent, Adaptable and Rigorous for Systematic Literature Review) protocol and analytical approach. Section 3 presents the results, examining stakeholder needs and trust dimensions in AI-driven valuation. Section 4 discusses the findings and introduces the proposed conceptual framework. Finally, Section 5

concludes the study by summarising key contributions and highlighting implications for practice and future research.

5.2 Research Methodology

This study employed a systematic literature review (SLR) following the SPAR-4-SLR (Structured, Prudent, Adaptable and Rigorous for Systematic Literature Review) protocol to select relevant academic publications mentioned in Figure 5.1 and explored by (Paul, Lim, O'Cass, et al., 2021; Rotimi et al., 2024). The political, economic, social, technological, legal and environmental (PESTLE) framework was then applied to analyse the stakeholders in terms of each direction within the PESTLE framework (Alanzi, 2018). The research methodology begins with the SLR process, which includes formulating research questions, locating studies through keywords and selecting relevant articles (Carrera-Rivera et al., 2022a). This is the assembling stage (Identification and Acquisition), which identifies articles through acquisition (Paul et al., 2024). The next step is organising and refining papers to identify stakeholder themes using NVivo (Reiff & Schlegel, 2022). PESTLE analysis is conducted to assess the trust of stakeholders for AI-property valuation models (Buye, 2021).

5.2.1 Literature retrieval and selection

5.2.1.1 Formulation of questions

This study integrates "stakeholders' need" and "stakeholders' trust" with AI-driven property valuation, posing two research questions to explore the impact of AI applications in valuation:

RQ5. What are the diverse needs of stakeholders in AI-driven property valuation models in the real estate industry?

RQ6. What factors influence stakeholders' trust in AI-driven property valuation models?

5.2.1.2 Search Strategy and Selection of Studies

Figure 5.1 outlines the SLR process for AI in property valuation, starting with stage 1: Identification, where research questions and sources were recently defined by Wang et al. (2025). Acquisition (Stage 2) acquires relevant studies using AI keywords. Stage 3 categorises stakeholder needs, AI techniques and trust. Stage 4 filters out irrelevant papers (Paul, Lim, et al., 2021b). Evaluation (Stage 5) applies thematic analysis using Rayyan and NVivo, leading to a final selection of 44 studies. Lastly, Reporting (Stage 6) provides findings with graphs, tables

and a framework, noting limitations like language and database coverage (N. Sharma et al., 2023).

5.2.1.3 Assembling Phase

Following the SPAR-4-SLR protocol by Wang et al. (2025), the research methodology begins with the Assembling phase, initiating at Stage 1: Identification, where the review domain is precisely defined as AI in property valuation. The scope of review was guided by two primary research questions: stakeholders' needs from AI-based valuation models and what factors influence their trust in these systems (Lee, 2022).

A systematic strategy was developed using carefully selected keywords (See Figure 5.1). In Stage 2: Acquisition, relevant literature was retrieved primarily from the Scopus database, which provides extensive coverage of peer-reviewed journals and conference proceedings. To enhance coverage a snowballing technique was also applied by reviewing references and citations of selected studies (Lee, 2022). The research process initially identified 1,118 articles. After applying preliminary filters, 743 articles were retained for the subsequent screening and refinement stages.

5.2.1.4 Inclusion and Exclusion Criteria

The inclusion criteria required that studies focus specifically on AI or ML applications in property valuation and be published as peer-reviewed journal articles or conference papers to ensure academic credibility and methodological rigour (Baig, 2018; Loo, 2020). A systematic keyword-based search strategy was implemented, and relevant studies were retrieved primarily from the Scopus database, selected due to its extensive coverage of high-quality peer-reviewed literature across multidisciplinary domains (Bramer et al., 2018). Scopus is widely recognised for its comprehensive collection of peer-reviewed literature (Lee, 2022), including journals, conference proceedings and books from over 4,000 publishers, making it a reliable source for academic research (Bramer et al., 2018). To enhance comprehensiveness, a snowballing technique was also applied by examining references and citations of initially identified articles (Lee, 2022). Studies were limited to those published in English between 2018 and 2025 to capture recent developments in AI-driven property valuation while ensuring consistency and accessibility in analysis (Bramer et al., 2018). Studies were excluded if they did not directly address AI applications in property valuation, were not peer-reviewed, were published outside the specified timeframe or were written in languages

other than English. While the selection of a single primary database and English-language restriction enhanced methodological consistency and feasibility, these criteria may introduce potential database and language bias, which were considered when the interpreting the findings.

5.2.1.5 Arranging Phase

The review progresses to Stage 3: Organisation, where the 743 articles are coded and aligned with research focus (Fedorowicz et al., 2014b). Each article is categorised into three codes: stakeholder categories, AI techniques and trust factors (mentioned in Figure 5.1 and process captured from Paul, Lim, et al. (2021a). This organisation stage allows efficient relevance filtering and thematic alignment for the analysis stages (Polanin et al., 2019). This ensures only studies focusing on stakeholders, AI techniques and trust factors proceed to further review stages (Fedorowicz et al., 2014b). In Stage 4: Purification, the 743 articles undergo rigorous screening to retain only the most relevant and highest quality studies for detailed analysis (Rožanc & Mernik, 2021). Articles are first screened by title and abstract to remove those that are unrelated to specific AI application in property valuation or that focus on irrelevant areas such as intellectual property and not linked with AI in property valuation (Wohlin et al., 2022). Through this two-step screening, the initial relevance check was followed by a full-text review and a significant number of articles are excluded (Rožanc & Mernik, 2021). Specifically, 560 articles are removed after initial screening based on title and abstract, and another 144 articles are excluded after careful full-text review due to lack of direct relevance (Haefner et al., 2021). This process results in 39 articles, with five additional studies found through snowballing, bringing the total to 44 for in-depth evaluation (Collins et al., 2021). The purification stage ensures studies are focused and aligned for in-depth analysis.

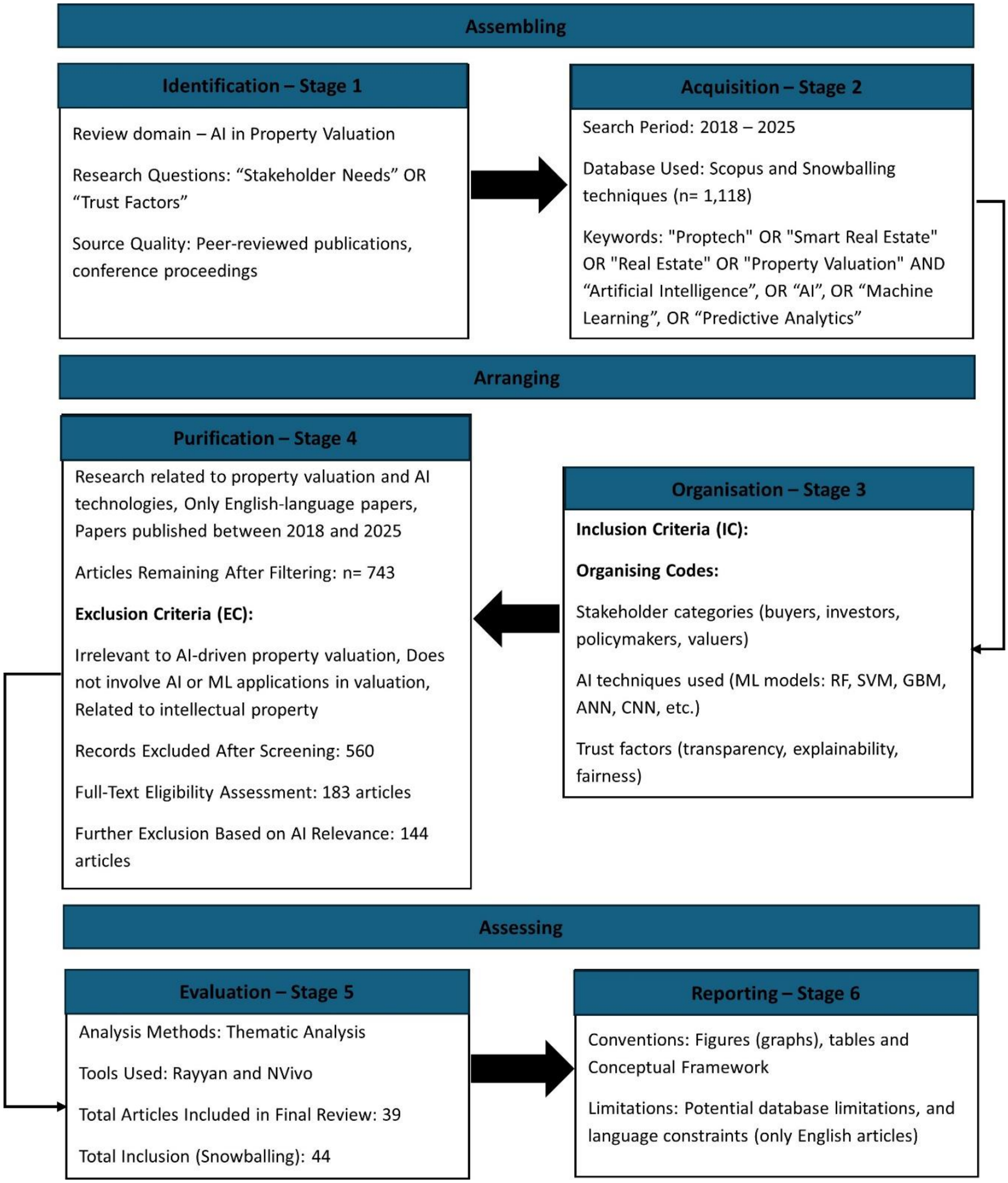


Figure 5.1: SPAR -SLR review protocol stages

5.2.1.6 Assessing Phase

The review enters the Evaluation phase (Stage 5), with Rayyan software supporting the review process. Rayyan enables efficient screening and selection of relevant studies using inclusion and exclusion criteria (Fedorowicz et al., 2014b). A thematic analysis was used to code and categorise the 44 articles based on emerging themes aligned with research questions (Buye, 2021; Fedorowicz et al., 2014b). NVivo software was used to organise themes related to stakeholder needs and trust, aiding deeper qualitative analysis (Rožanc & Mernik, 2021). This

systematic use of thematic analysis and digital tools ensued a robust and replicable evaluation process (Polanin et al., 2019). In Stage 6: Reporting, findings were synthesised into graphs, tables and a conceptual framework to present thematic relationships (Polanin et al., 2019). The reporting stage addressed study limitations, including the focus on English language publications, ensuring transparency, consistency and academic rigor.

5.2.2 Data Analysis

The data analysis in this study focused on two key aspects: the diverse needs of stakeholders in AI-drive property valuation (RQ1) and the factors influencing their trust in these models (RQ2). To address RQ1, the study analyses factors shaping stakeholder expectations, such as accuracy, affordability, efficiency, market analysis and customisation of AI-based valuation tools (Buye, 2021; Fedorowicz et al., 2014b). Using NVivo, the study systematically coded relevant literature to identify recurring themes that highlight how different users, including buyers, investors, policymakers and property valuers engage with AI valuation systems, and what they require from these technologies (Almusallam, 2021).

For RQ2, the study explored the factors affecting stakeholder trust in AI-driven property valuation using the PESTLE framework. Key themes were analysed in terms of real estate professionals to understand concerns regarding AI's decision-making processes (Cajias, 2024). The PESTLE framework was followed to understand these categories and to identify how trust can be strengthened among different stakeholder groups (Alanzi, 2018). By examining both needs and trust-related concerns, this study provides a structured understanding of how AI valuation models can be improved to enhance their adoption and credibility in the real estate sector.

5.3 Results

5.3.1 Diverse Stakeholder Needs in AI-Driven Property Valuation

The SLR identifies AI techniques applied in property valuation and reports their predictive accuracy in relation to reliability and trust-related dimensions discussed in the reviewed studies. As reported by Lee et al. (2024), diverse use of AI models is applied in property valuation, including ensemble methods such as (RF) and gradient boosting machine (GBM). The reviewed studies frequently evaluate these models based on predictive accuracy and interpretability (Numan & Yusoff, 2024; Phan, 2019). Artificial neural network (ANN) is reported to be applied to unstructured data and non-linear modelling tasks (Tran et al., 2025;

Vargas-Calderón & Camargo, 2022). The reviewed studies evaluate ANN based on predictive accuracy and their application in complex valuation contexts.

To answer RQ5, Table 5.1 summarises the distribution of AI techniques across six real estate domains: property development, investment strategies, property management, pricing strategies, property transactions and real estate business.

RF is reported in property development for site selection and risk assessment (Forys, 2022), in investment strategies for portfolio optimisation and investment risk analysis (Gnat, 2024). Furthermore, in property management for automated land valuation (Habbab et al., 2025), in pricing strategies for rental price prediction (Ho et al., 2021), in property transaction for transaction price prediction, and in real estate business for market trend forecasting (Hoxha, 2024). Support vector machines (SVM) are used for profitability modelling, and undervalued asset detection (Chandu & Bharatha Devi, 2023). They also appear in land-use classification (Hong et al., 2020), rental trend prediction , transaction price estimation, and demand forecasting (Borodulin et al., 2024; Tran et al., 2025). Furthermore, Table 5.1 shows that GBM is reported for project valuation (Singh et al., 2025), risk-adjusted investment strategies, and land parcel classification (Alshammari, 2023). They are also applied for dynamic rental pricing, real-time price prediction, and business valuation (Abdul-Rahman et al., 2021).

Furthermore, within the reviewed studies, decision tree (DT) is applied across several valuation activities. DT is used in feasibility analysis, and investment decision support (Abidoye et al., 2019; Danona et al., 2023). Their application also extends to land registration assessment (Jáuregui-Velarde et al., 2023), rental property classification, transaction modelling for quick assessments, and business valuation models (Kmen et al., 2024; Lahmiri et al., 2023). Extreme gradient boosting (XGBoost) appears frequently in risk-related and forecasting tasks (Hanuma Reddy & Sriramya, 2022). It is reported in risk modelling, and portfolio risk management (Hjort et al., 2022). The model is also applied in large-scale automated valuation systems, rental yield prediction, rapid price estimation in transactions, and broader real estate business analytics (Abut et al., 2023; Borodulin et al., 2024; Genc et al., 2025). RM analysis used across valuation functions, it appears in cost estimation, and return-on-investment analysis (Przekop, 2022). Additional applications include land valuation for taxation purposes (Li et al., 2021), rental price forecasting, transaction price estimation

based on historical sales, and financial forecasting in real estate business contexts (Singh et al., 2022).

ANN are reported in development-related pattern identification, and investment prediction models (Chandu & Bharatha Devi, 2023). Their use also extends to smart urban planning systems, non-linear rental price forecasting, high-precision transaction prediction, and demand segmentation analysis (Borodulin et al., 2024). Convolutional Neural Network (CNN) are primarily associated with image-based applications (Yakub et al., 2021). Studies report their use in image feasibility analysis, and visual property valuation (Zulkifley et al., 2020). They are also applied to land boundary detection, property condition assessment, image-based transaction risk assessment, and market intelligence identification (Przekop, 2022).

Each model is evaluated against critical factors (mentioned in Figure 5.2). The numbers inside each cell represent the article numbers with which a given AI model was associated with a specific factor across the reviewed studies. As shown in Figure 5.2, ANN were linked 19 times to risk assessment (Przekop, 2022). The numbers in parentheses next to each factor label (e.g. Risk Assessment (23)) indicate the total number of studies mentioning that factor across all models. Overall, RMs and ANN were the most frequently cited across multiple factors, reflecting their strong reliability and widespread adoption in property valuation tasks. In contrast, although CNNs are increasingly being explored for real estate applications, their frequency of mention across factors is relatively low compared to traditional models (Chandu & Bharatha Devi, 2023). It is also important to note that while the factor “Affordability” has a total of 15 mentions or other factors (as shown in parentheses), which is lower compared to other factors such as “Market Dynamics” (31) and “Real Estate Features” (29), its inclusion remains significant (Gude, 2024).. This is because affordability is a critical emerging concern in property valuation (Borodulin et al., 2024), especially in the context of changing housing markets (Chandu & Bharatha Devi, 2023). The lower number does not diminish its importance; rather, it indicates that affordability is a relatively new area of integration into AI models for valuation purposes.

Beyond affordability, key factors in terms of real estate features include ownership types (Lee et al., 2024), surveillance, elevator availability, number of rooms and construction year, as variables included in valuation models as explored by Yang et al. (2023). Furthermore, the reviewed studies include historical price trends (Hoxha, 2024), demand-supply dynamics

(Rodriguez-Serrano, 2025), and inflation as variables incorporated into valuation models . Several studies also report the use of predictive analytics and time-series forecasting approaches in this context Hoxha (2024). AVMs using techniques like RF, SVM, DT and GBM are reported to achieve accuracy by analysing large datasets (Sun & Peng, 2022).These models incorporate variables such as property size or number of rooms (Hong et al. (2020), location (proximity to amenities, schools, and transport links) (Almaslukh, 2020), property age (Chiasson et al., 2023), condition (roof and interior state) (Gampala et al., 2022) and economic factors (Abidoye et al., 2019). AI models such as ANN and CNN further enhance precision by processing unstructured data, including images, to assess structural integrity and renovations (Abidoye et al. (2019). Advanced algorithms like XGBoost and GBM enhance predictive accuracy, adjusting for geographical boundary issues and market anomalies (Abdul-Rahman et al., 2021).

Economic indicators, such as interest rates, GDP and demographic shifts, are reported as variables included in valuation models (Chiasson et al., 2023). AI techniques, including RF, SVM and ANN, help stakeholders by forecasting price movements, identifying emerging submarkets and analysing local demand-supply dynamics (Cekic et al., 2022; Gnat, 2024; Ho et al., 2021). The reviewed studies document the application of AI models in real-time market analysis, including the use of time-series forecasting methods such as XGBoost for price trend modelling based on historical data (Hoxha, 2024; Lahmiri et al., 2023). Social and environmental factors (Chou et al., 2022), such as population shifts and local market trends, are reported as variables incorporated into valuation models (Chiasson et al., 2023; Lee et al., 2024). The reviewed studies also discuss model customisation in relation to different stakeholder groups, including buyers, investors, lenders, and agents (Borodulin et al., 2024; Gnat, 2024). Customisation features reported in the literature include user preference, investment goals, risk tolerance, and property attributes (Lahmiri et al., 2023; Phan, 2019). The reviewed studies report the used of AI algorithms, including recommendation systems, that incorporate local market dynamics and criteria such as location and affordability (Lee et al., 2024; Numan & Yusoff, 2024). These application are described in relation to property suggestion and risk assessment functions (Verma et al., 2023). Social trends and consumer behaviour are also reported in relation to property demand modelling (Tran et al., 2025). Technological developments in AI are described in the literature in connection with regional

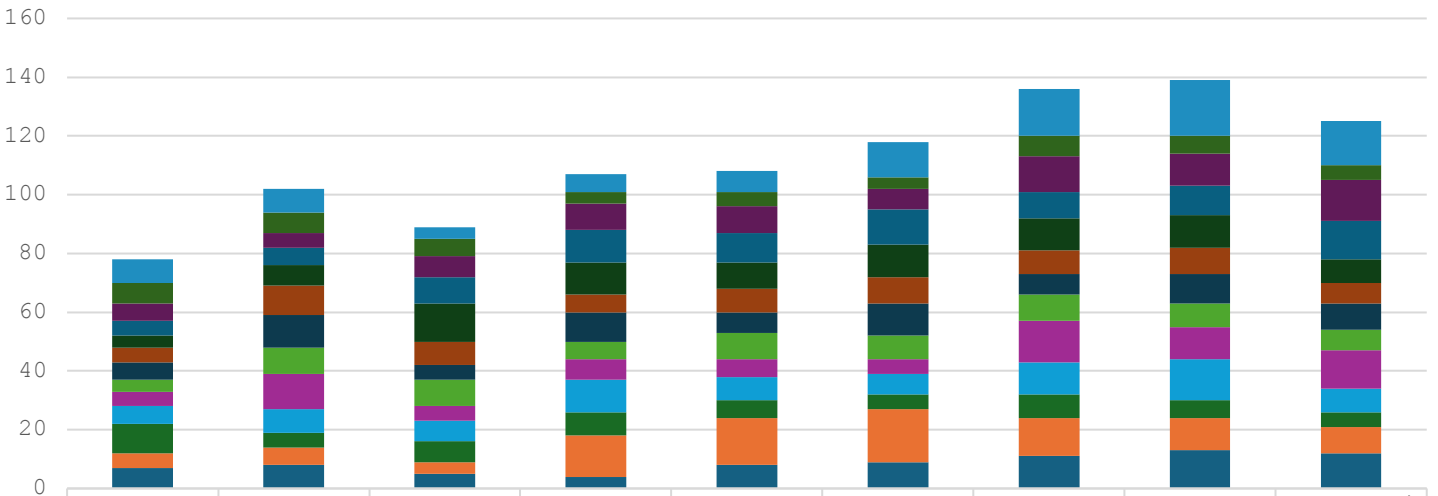
Table 5.1: Applications of AI techniques in the 6 key real estate domains

AI Techniques	**Property Development**	**Investment Strategies**	**Property Management**	**Pricing Strategies**	**Property Transactions**	Real estate business
Random Forest (RF)	Site selection and risk assessment (Abdul-Rahman et al., 2021)	Portfolio optimisation and investment risks (Hjort et al., 2022)	Automated land valuation (S. Li et al., 2021)	Rental price prediction (Abdul-Rahman et al., 2021)	Transaction price prediction (Chiasson et al., 2023)	Market trend forecasting (Verma et al., 2023)
Support Vector Machines (SVM)	Profitability modelling (Singh et al., 2025)	Undervalued asset detection (Hong et al., 2020)	Land use classification (Lee et al., 2024)	Rental market trend prediction (Alshammari, 2023)	Estimating transaction prices in varying market conditions (Borodulin et al., 2024)	Demand forecasting (Sun & Peng, 2022)
Gradient Boosting (GBM)	Project valuation (Hanuma Reddy & Sriramya, 2022)	Risk adjusted investment strategies (Hong & Kim, 2022)	Land parcel classification (Lahmiri et al., 2023)	Dynamic rental pricing (Phan, 2019)	Real time price prediction (Rodriguez-Serrano, 2025)	Advance business valuation (Gampala et al., 2022)
Decision Tree (DT)	Feasibility analysis (Ho et al., 2021)	Investment decision support (Jáuregui-Velarde et al., 2023)	Land registration assessment (Kmen et al., 2024)	Rental property classification (Chiasson et al., 2023)	Property transaction decision trees for quick assessments (Matey et al., 2022)	Business valuation models (Przekop, 2022)
XGBoost	Risk modelling and forecasting (Matey et al., 2022)	Portfolio risk management (Tran et al., 2025)	AI-driven large-scale valuation (Vargas-Calderón & Camargo, 2022)	Rental yield prediction (J. A. A. Numan & I. M. Yusoff, 2024)	Rapid and dynamic estimation (Chiasson et al., 2023)	Business analytics (Chou et al., 2022)
Regression Analysis	Cost estimation and revenue forecasting (Przekop, 2022)	Market trends and ROI analysis (Singh et al., 2025)	Land valuation for taxation (Verma et al., 2023)	Rental price forecasting (Zulkifley et al., 2020)	Transaction price estimation based on past sales (Danona et al., 2023)	Business financial forecasting (Yakub et al., 2021)
Artificial Neural Networks (ANN)	Pattern identification in development (Tanamal et al., 2023)	Deep learning-based investment predictions (Rodriguez-Serrano, 2025)	Smart urban planning (Y. Yang et al., 2023)	Non-linear rental price forecasting (Vestly et al., 2024)	High precision property transaction predictions (Abut et al., 2023)	Demand segmentation and forecasting (Hjort et al., 2022)
Convolutional Neural Networks (CNN)	Image-based feasibility analysis (Singh et al., 2022)	Visual property valuations (Sun & Peng, 2022)	Land boundary detection (Hoxha, 2024)	Property condition assessment (Yakub et al., 2021)	Transaction risk assessment using image-based property features (R. B. Abidoye et al., 2019)	Market intelligence identification (Singh et al., 2025)

data adaptation approaches (Zulkifley et al., 2020). AI systems including SVM, RF, and ANN are additionally reported in applications involving interactive interfaces and chatbot-based systems (Przekop, 2022).

The reviewed studies report the inclusion of socio-demographic variables in AI-driven property valuation models (Borodulin et al., 2024). These variables include income levels, education (Borodulin et al., 2024); (Almaslukh, 2020), and proximity to local amenities such as schools, parks, and public transport (Abdul-Rahman et al., 2021). Valuation accuracy is discussed in relation to dataset quality (Cekic et al., 2022), number of variables, model selection, and feature importance (Hjort et al., 2022), as identified in 12 studies. The application of RF and ANN is reported in relation to predictive modelling tasks (Zulkifley et al., 2020). Interpretability is discussed of diverse datasets, including images and geospatial data, is also documented (Sun & Peng, 2022). CNN applications are reported in relation to unstructured data, processing (Phan, 2019). AI techniques are further documented in contexts involving risks modelling, return on investment, and portfolio optimisation (Abut et al., 2023).

The reviewed studies further report that AI applications in relation to efficiency, transparency, and risk assessment dimensions (Borodulin et al., 2024; Chandu & Bharatha Devi, 2023; Chou et al., 2022). Techniques such as XGBoost and GIS-integrated models are documented in contexts involving location-specific price estimation (Danona et al., 2023). Several studies discuss trust in AI valuations in relation to the transparency of data inputs, valuation methods, and model performance metrics (Almaslukh, 2020). Risk assessment applications are reported in 23 studies, including the use of RF and DT for modelling crime rates, environmental hazards, and market volatility (Abut et al., 2023). GIS-integrated models also documented for assessing location-specific risks such as flood zones and earthquake exposures (Singh et al., 2022; Tanamal et al., 2023). Predictive analytics approaches are described in relation to economic fluctuations modelling (Verma et al., 2023). Overall, the findings indicate that AI techniques in property valuation are applied across multiple real estate domains and are associated with diverse stakeholder-related dimensions. Different models are documented in relation to specific valuation tasks, data types, and contextual variables, including economic, social environmental, technological and regulatory factors.



	XGBoost	CatBoost	Random Forest	Support Vector Machines	Gradient Boosting	Decision Tree	Regression Model	Artificial Neural Network	Convolutional Neural Networks
Risk Assessment (23	8	8	4	6	7	12	16	19	15
Trust (17)	7	7	6	4	5	4	7	6	5
Efficiency (16)	6	5	7	9	9	7	12	11	14
Decision-Making (16)	5	6	9	11	10	12	9	10	13
Variable Integration (14)	4	7	13	11	9	11	11	11	8
Interpretability (10)	5	10	8	6	8	9	8	9	7
Accuracy of Valuation (12)	6	11	5	10	7	11	7	10	9
Socio-Demographic Factors (13)	4	9	9	6	9	8	9	8	7
Customization (33)	5	12	5	7	6	5	14	11	13
Predictive Analytics (16)	6	8	7	11	8	7	11	14	8
Market Dynamics (31)	10	5	7	8	6	5	8	6	5
Real Estate Features (29)	5	6	4	14	16	18	13	11	9
Affordability (15)	7	8	5	4	8	9	11	13	12

Figure 5.2. Thematic distribution with stakeholders' needs of AI techniques in real estate from SLR dataset

5.3.2 Multidimensional Trust Factors in AI Property Valuation

To answer RQ6, Figure 5.3 present the frequency with which different PESTLE dimensions were discussed across stakeholder groups in the reviewed studies. Economic factors were most frequently associated with investors (28 studies), followed by homebuyers (15 studies). Social factors were most frequently associated with homebuyers (20 studies) and real estate agents (13 studies) (Hjort et al., 2022; Jáuregui-Velarde et al., 2023). Real estate features were also frequently linked to environmental factors (12 studies) (Abut et al., 2023; Phan, 2019). Political factors were discussed in relation to investors (11 studies) and policymakers (10 studies) (Zulkifley et al., 2020). In comparison, property developers were associated with political factors in 4 studies (Chiasson et al., 2023). The numbers shown in Figure 5.3 represent the frequency of discussion within the reviewed literature rather than direct measures of stakeholder concern.

Economic factors, including cost efficiency, market stability, and valuation accuracy, were most frequently associated with investors (28 studies) and homebuyers (15 studies) (Abut et al., 2023; Phan, 2019). In comparison economic factors were less frequently associated with policymakers (7 studies) and property developers (5 studies) (Abdul-Rahman et al., 2021). Social factors, including fairness, transparency, and public acceptance (Chiasson et al., 2023), were most frequently associated with homebuyers (20 studies) and real estate agents (13 studies) (Vestly et al., 2024). Policymakers (4 studies) and property developers (3 studies) were less frequently associated with social factors (Chiasson et al., 2023). Technological factors, including model accuracy, reliability, and interpretability, were frequently discussed in relation to homebuyers (11 studies), investors (9 studies), and real estate agents (9 studies) (Vargas-Calderón & Camargo, 2022). Policymakers (5 studies) and property developers (5 studies) were less frequently associated with technological dimensions (Hoxha, 2024; Przekop, 2022).

Legal factors, such as liability, data protection and compliance, were discussed across stakeholder groups in the reviewed studies (Abut et al., 2023; Numan & Yusoff, 2024). Real estate agents (7) were most frequently associated with legal factors (Abidoye et al., 2019). Several studies discuss legal compliance and accountability frameworks in relation to AI driven valuation models (Singh et al., 2022). Homebuyers (3) and policymakers (4) were less frequently associated with legal factors (Singh et al., 2025; Sun & Peng, 2022). Vargas-

Table 5.2: Challenges and opportunities of AI adoption in real estate: a PESTLE analysis

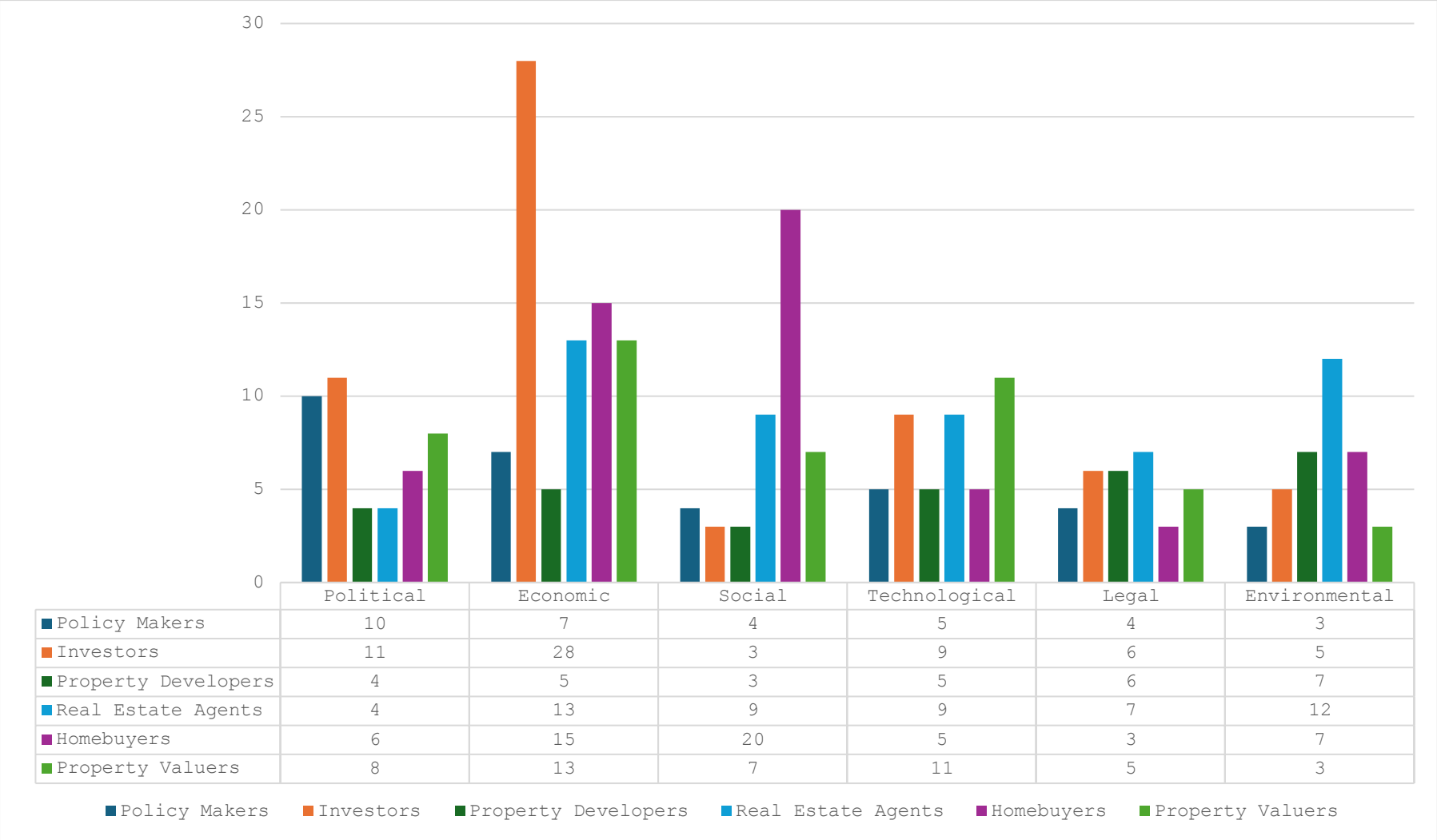
PESTLE Factor	Challenges	Impact on stakeholders and opportunities
Political	Inconsistent regulations across regions (Abdul-Rahman et al., 2021) Ambiguity around AI accountability (Zulkifley et al., 2020) Policy resistance to AI-driven decision-making (R. B. Abidoye et al., 2019) Data privacy and protection (Y. Yang et al., 2023)	Government bodies can standardise AI regulation to ensure fairness (Abut et al., 2023) Valuers and property firms can push for clear legal guidelines to reduce liability risks (Almaslukh, 2020). Industry leaders can advocate for policy framework supporting AI adoption (Chandu & Bharatha Devi, 2023). Technology developers can design privacy centric AI models to meet compliance standards (Borodulin et al., 2024).
Economic	High implementation and maintenance costs (Forys, 2022). Uncertainty in AVMs long term ROI (Genc et al., 2025). AVMs inability to full capture market dynamics (Gude, 2024). Impact of economic downturns on AI innovation (Habbab et al., 2025).	Property firms can invest in AI to enhance cost efficiency and valuation accuracy (Hanuma Reddy & Sriramya, 2022). Investors can mitigate risks by piloting AI projects before full scale adoption, testing models like SVM and DT for reliable turns in property investments (Cekic et al., 2022; Chou et al., 2022). Analyst can combine AI insights with traditional valuation methods, using models like Regressions and RF to enhance their understanding of market behaviour (Gnat, 2024). Financial institutions can use AI to identify emerging real estate opportunities during downturns, utilising SVM and ANN (Habbab et al., 2025).
Social	Public distrust in AVMs (Hong et al., 2020). Fear of job displacement in valuation roles (Sun & Peng, 2022). Perceived bias in AI algorithms (Tran et al., 2025). Limited public understanding of AI processes (Y. Yang et al., 2023).	Real estate agencies can build trust by promoting AI transparency and fairness, especially with explainable AI models like DT and Regression (Tran et al., 2025). Valuers can utilise AI for routine tasks while focusing on complex appraisals, using AI models like ANN and CNN to assist in AVM processes (Vargas-Calderón & Camargo, 2022). Educational bodies can offer training programs on AI's role in real estate valuation, helping agents understand how models like regressions and RF work in practice (Lee et al., 2024; S. Li et al., 2021).

Technological	Limited interpretability of complex AI models (Phan, 2019). Data quality and integration issues (Vestly et al., 2024). Rapid technological changes outpacing policy (Yakub et al., 2021). Difficulty adapting AI to local market (Vargas-Calderón & Camargo, 2022).	Developers can prioritise explainable AI to ensure stakeholder trust and transparency (Przekop, 2022), focusing on models like DT and Regression for better clarity (Rodriguez-Serrano, 2025). Data providers can enhance data sharing frameworks to improve AI model performance, enabling better integration of models like RF and SVM with real estate data (Sun & Peng, 2022). Policymakers can work closely with AI experts to stay ahead of emerging technologies, ensuring that models like ANN and CNN are continuously adapted to the real estate sector (Yakub et al., 2021).

Calderón and Camargo (2022) reports issues related to legal accountability in cases of valuation discrepancies (Chandu & Bharatha Devi, 2023). Few studies in the selected dataset explored environmental factors like sustainability and climate-related risks, which are particularly important to real estate agents (12) (Gampala et al., 2022; Genc et al., 2025). Homebuyers (7) and investors (5) were also linked to environmental dimensions. Environmental data integration into AI-driven valuation is documented in the reviewed literature (Tran et al., 2025). However, policymakers (3) and property valuers (3) assign lower importance to environmental factors, which may reflect a gap in recognising how climate risks impact property values (Habbab et al., 2025). Neglecting environmental variables in AI models can undermine trust, particularly as environmental factors gain increasing attention (Borodulin et al., 2024). Abidoye et al. (2019) found that failing to incorporate flood risks or climate change projections in property valuation models may lead to inaccurate assessments (Matey et al., 2022), reducing investor confidence (Danona et al., 2023). As environmental sustainability becomes a critical concern, the absence of such variables raises doubts about a model's reliability (Habbab et al., 2025).

As mentioned by many studies, investors and homebuyers are more frequently associated with economic and technological accuracy, while real estate agents are reported across social, legal and environmental dimensions (Chou et al., 2022; Hoxha, 2024). Similarly, policymakers and property developers show lower engagement with social and technological concerns (Genc et al., 2025; Habbab et al., 2025), which indicates a need for more comprehensive policy frameworks to address emerging AI property valuation challenges (Ho et al., 2021). According to Tran et al. (2025), enhancing trust in AI requires transparency (Hong & Kim, 2022), legal frameworks and applied accuracy, aligning AI with stakeholder expectations to boost confidence and adoption in real estate (Phan, 2019).

As mentioned by many studies, investors and homebuyers are more frequently associated with economic and technological accuracy, while real estate agents are reported across social, legal and environmental dimensions (Chou et al., 2022; Hoxha, 2024). Similarly, policymakers and property developers show lower engagement with social and technological concerns (Genc et al., 2025; Habbab et al., 2025), which indicates a need for more comprehensive policy frameworks to address emerging AI property valuation challenges (Ho et al., 2021).



	Political	Economic	Social	Technological	Legal	Environmental
Policy Makers	10	7	4	5	4	3
Investors	11	28	3	9	6	5
Property Developers	4	5	3	5	6	7
Real Estate Agents	4	13	9	9	7	12
Homebuyers	6	15	20	5	3	7
Property Valuers	8	13	7	11	5	3

Figure 5.3. PESTLE dimensions across stakeholder groups

According to Tran et al. (2025), enhancing trust in AI requires transparency (Hong & Kim, 2022), legal frameworks and applied accuracy, aligning AI with stakeholder expectations to boost confidence and adoption in real estate (Phan, 2019).

Table 5.2 highlights various challenges such as inconsistent regulations data privacy issues (Singh et al., 2022), high implementation costs (Jáuregui-Velarde et al., 2023) and AI's limited ability to fully capture market dynamics (Lee et al., 2024). These create opportunities for stakeholders to standardise regulations, advocate for clear legal guidelines and pilot AI models to reported valuation accuracy (Gampala et al., 2022). Table 5.2 also addresses the social and technological challenges of AI adoption, such as public distrust in AI techniques and perceived bias in algorithms (Cekic et al., 2022; Gnat, 2024). It emphasises how stakeholders can promote transparency through explainable AI models like a DT and RM Singh et al. (2022), which can foster trust (Danona et al., 2023). Valuers are encouraged to utilise AI for routine tasks, allowing them to focus on more complex appraisals (Gampala et al., 2022). Educational bodies can help by providing training on AI models, while developers and policymakers can ensure that emerging technologies are continuously aligned with the real estate industry's needs (Gampala et al., 2022). Furthermore, the environmental challenges are addressed by pushing for AI models that account for climate risks and support sustainability initiatives (Matey et al., 2022), with stakeholders like environmental agencies and sustainability advocates driving the integration of these factors into AI-driven property valuations (Lee et al., 2024).

Overall, the findings indicate that stakeholder's trust in AI-driven property valuation models is associated with multiple PESTLE dimensions, with varying levels of emphasis across stakeholder groups. Economic and technological factors were most frequently linked to investors and homebuyers, while social and environmental dimensions were more commonly associated with real estate agents. Political and legal dimensions were documented across investors and policymakers, whereas property developers were less frequently linked to these trust-related factors. The distribution presented in Figure 5.3 demonstrates that stakeholder trust in valuation models is multidimensional and varies according to stakeholder role and contextual emphasis within the reviewed literature.

5.4 Discussion

The findings demonstrate that stakeholder trust in AI-driven property valuation is shaped not only by predictive accuracy but also by transparency, regulatory clarity, and contextual adaptability (Cekic et al., 2022; Vestly et al., 2024). While ML and deep learning (DL) models such as RF, XGBoost, ANN, and CNN show strong technical performance across valuation tasks, their acceptance varies depending on stakeholder priorities (Hanuma Reddy & Sriramya, 2022). Investors and homebuyers prioritise economic accuracy and affordability outcomes, whereas policymakers emphasise regulatory compliance and explainability (Przekop, 2022; Tran et al., 2025). These differences indicate that AI valuation systems cannot rely solely on model performance; instead, they must integrate governance mechanisms, bias mitigation strategies, and explainable AI techniques to ensure broader adoption (Jáuregui-Velarde et al., 2023; Sun & Peng, 2022). The results therefore suggest that AI-driven valuation operates as a socio-technical system, where technical robustness and institutional trust factors must be aligned (Sun & Peng, 2022).

AI has significantly transformed property valuation by enhancing accuracy, efficiency and data-driven decision-making (Lee et al., 2024). However, its adoption raises important considerations regarding stakeholder needs, trust in AI models and regulatory requirements, as argued by Phan (2019).. This study examines these aspects systematically to provide a clear understanding of AI's role in property valuation (Hoxha, 2024). AI techniques have demonstrated strong predictive capabilities further demonstrated by Phan (2019). These models analyse historical price trends, market conditions and socio-economic factors to assist stakeholders in making informed decisions (Phan, 2019). Despite these advancements, certain challenges persist, as cross-countered by Phanhan et al. (2023), including AI models struggling to fully adapt to local market variations (Habbab et al., 2025), which can result in inconsistencies in property valuation (Hoxha, 2024). Additionally, biases in training datasets can affect fairness, leading to concerns about trust and credibility (Iwai & Hamagami, 2022). Addressing these issues is critical to ensuring AI models deliver reliable and equitable valuations (Phan, 2019).

The findings indicate that key stakeholders have unique priorities (Singh et al., 2022). While buyers and investors seek affordability and accuracy, policymakers emphasise regulatory compliance and transparency (Habbab et al., 2025). However, conflicting priorities already

exist among these stakeholders: investors and buyers advocate for AI models that emphasise affordability, investment analysis and precision, ensuring accurate price estimates and fair property valuations (Singh et al., 2022). ML models such as XGBoost and CatBoost help refine property pricing predictions with greater accuracy (Habbab et al., 2025). In contrast, policymakers focus on transparency and regulatory compliance, often requiring AI systems to justify their predictions (Abidoye et al., 2021). Techniques like explainable AI and SHAP (Shapley Additive Explanations) are critical for increasing trust in AI-driven modes by revealing the decision-making process (Brimos et al., 2023). One of the main concerns identified is stakeholder trust in these models, including algorithmic biases, lack of explainability and data privacy concerns (Singh et al., 2022). Plakandaras et al. (2024) argue that AI can eliminate human biases in traditional valuation methods, improving fairness and objectivity (Ali et al., 2025). However, critics counter that AI-driven models can inherit biases from historical datasets, reinforcing existing inequalities in property valuation (Brimos et al., 2023). To mitigate these issues, there is a strong need for standardised frameworks, where model interpretability and enhanced regulatory oversight to ensure transparency and accountability (Saeed et al., 2023). Advocates of AI-driven valuation emphasise the need for open-source valuation models and explainable AI techniques, allowing stakeholders to understand and challenge valuation decisions (Singh et al., 2022). On the other hand (Brimos et al., 2023), argue that complete transparency may not always be feasible (Saeed et al., 2023), as some AI models rely on proprietary algorithms and complex ML techniques that can be difficult for experts to interpret (Lee et al., 2024).

Balancing views is key, as fair AI guidelines should build trust without limiting innovation (Saeed et al., 2023). Furthermore, AI-driven valuation models enhance efficiency by automating property assessments and reducing human bias, making valuations more objective and accessible, e.g. by using DT, GBM, and SVM to analyse structured real estate data and predict pricing trends with high accuracy (Abidoye et al., 2024). Meanwhile, models like CNN contribute to valuation accuracy by assessing visual data, such as property images and neighbourhood infrastructure (Abidoye et al., 2024). Similarly, financial institutions and investors benefit from AI applications in risk assessment, market predictions and portfolio management (Lee et al., 2024). Long short-term memory (LSTM) networks, a subset of DL models, excel in analysing time series data, enabling real-time price forecasting and trend

analysis (Gude, 2024). Investors can use these insights to make informed decisions about property acquisition and investment strategies, mitigating financial risks (Habbab et al., 2025). For policymakers, these insights offer valuable tools for urban planning, housing regulations and affordable housing policies (Yang et al., 2023). AI models can predict future housing demand, assess the impact of economic fluctuations and help formulate evidence-based housing policies (Danona et al., 2023). Without well-defined governance, inconsistencies in AI-generated predictions may undermine stakeholder trust and hinder adoption. Additionally, transparency and accountability must be integrated into AI-driven property valuation (Verma et al., 2023). Explainable AI techniques, such as SHAP and LIME (Local Interpretable Model Agnostic Explanations), can enhance trust by providing insights into how valuation decisions are made (Danona et al., 2023). Ensuring that AI models comply with ethical standards and regulatory guidelines will be key to their successful implementations in real estate (Danona et al., 2023). However, its adoption requires a structured approach that integrates stakeholder needs, model development and trust factors (Verma et al., 2023). In Figure 5.4, a framework is proposed that ensures AI-driven valuation models align with market demands while maintaining transparency and regulatory compliance. The process begins with identifying key stakeholders' needs in the proposed framework, which encompasses investment optimisations, affordability analysis, market trend assessment and regulatory adherence. As Habbab et al. (2025) state, stakeholders, including buyers, investors, policymakers and real estate professionals have distinct priorities. Addressing these diverse needs ensures AI valuation models align with both economic and ethical expectations. To meet these requirements, AI approaches for valuation utilise advanced ML and DL techniques (Kim et al., 2020). DT, RF, GBM, XGBoost and CatBoost improve structured data analysis, refining price predictions based on historical sales trends and economic conditions (Lee et al., 2024). DL models, such as ANN and CNN, enhance valuation accuracy by analysing unstructured data like property images and neighbourhood characteristics (Jafary et al., 2024). The selection of an appropriate AI approach is crucial, as it influences the precision and reliability of property valuations (Hoxha, 2024). AI model development involves gathering property, market and environmental data to create robust predictive models (Danona et al., 2023). Additionally, environmental analysis identifies climate risks and sustainability factors, providing a holistic perspective on property valuation.

Model effectiveness and trust factors are essential for ensuring AI adoption in property valuation (Abidoye et al., 2021) , as shown in Figure 5.4. Accuracy and reliability are fundamental, requiring models to deliver precise and unbiased results (Abidoye et al., 2024). Trust and usability depend on interpretability, explainability and bias reduction (Borodulin et al., 2024). Efficiency and performance factors such as model processing time and real-time adaptability (Abidoye & Chan, 2017) further enhance the applicability of AI-driven valuation. Evaluating these factors helps ensure AI valuations are accurate and trusted. Therefore, combining ML and DL in a hybrid approach is often the most effective. This approach identifies accuracy, data utilisation and predictive capabilities by utilising the strengths of both methodologies (Gude, 2024). The implementation of AI-driven valuation models follows a validation cycle, where models are assessed for their trustworthiness and effectiveness before full-scale deployment. If models meet the required standard, including the needs of stakeholders and enhancement of trust, they proceed to the implementation stage; otherwise, they undergo refinement and reassessment in a continuous improvement loop (Abidoye et al., 2021). Trust and decision integration are critical aspects of AI model acceptance, as AVMs satisfaction relies on transparency and interpretability, ensuring that AI-generated valuations are explainable (Abidoye et al., 2024). User satisfaction is equally important, as confidence in AI-based valuation insights determines adoption rates (Lee et al., 2024). Regulatory bodies and real estate professionals play a vital role in refining AI valuation models to balance accuracy, transparency and compliance (Lee et al., 2024). This framework contributes to AI-driven valuation research with a focus on technical performance, along with stakeholder-centric concerns. Previous studies primarily emphasised model accuracy, whereas this approach integrates transparency, explainability and regulatory alignment (Lee et al., 2024). Ali et al. (2025) proposed solutions such AI-powered property recommendations, automated valuations and predictive analytics. Figure 5.4 illustrates how AI techniques are integrated within the PESTLE framework to address these solutions.

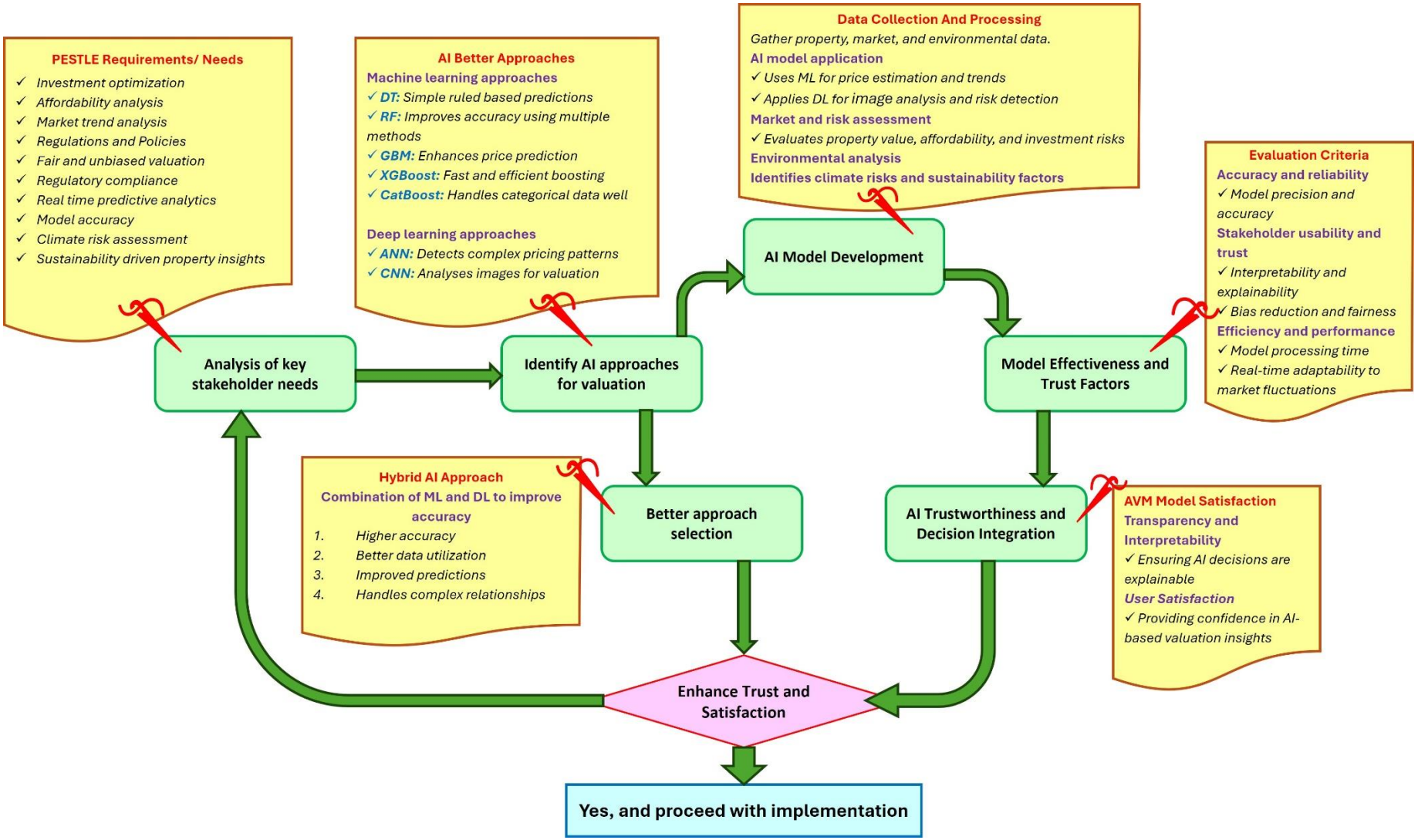


Figure 5.4. AI-driven model development conceptual framework for property valuation to enhance stakeholders' trust

5.4.1 Theoretical Contributions

This study advances AI-driven property valuation research by moving beyond a purely performance-based evaluation of models toward a socio-technical perspective that integrates predictive techniques with stakeholder trust and governance dimensions. By systematically mapping AI models across real estate domains and aligning them with PESTLE-based trust factors, the study bridges fragmented streams of literature on technical modelling, stakeholder adoption, and regulatory considerations. The proposed hybrid framework positions trust, transparency, and interpretability as central mechanisms in AI adoption, thereby extending stakeholder theory and trust-based perspectives into the automated valuation context.

5.4.2 Practical Implications

For practitioners, the findings suggest that AI model selection should be aligned with task-specific valuation objectives rather than on a single universal approach. Ensemble models are widely applied in structured valuation tasks, while DL models are documented in complex and unstructured data contexts, indicating the value of hybrid modelling strategies. The study also highlights the importance of embedding explainability tools, ensuring transparency of inputs and outputs, and strengthening professional training to support responsible and informed use of AI-driven valuation systems.

5.4.3 Policy and Governance Implications

The study also highlights the need for clearer regulatory frameworks governing AI-based property valuation. Policymakers should:

1. Establish accountability standards for automated valuations
2. Clarify liability in cases of valuation discrepancies
3. Encourage data governance protocols to protect privacy
4. Integrate environmental risk variables into valuation guidelines

Given the increasing role of AI in mortgage approvals, taxation, and urban planning, regulatory alignment is essential to ensure fairness, transparency, and systematic stability. Furthermore, public-private collaboration is recommended to develop standardised benchmarks for AI valuation performance and explainability. This can promote responsible innovation while safeguarding stakeholder trust.

5.5 Conclusion

In conclusion, this study highlights the crucial connection between AI-driven property valuation models and stakeholders' needs and trust concerns. By analysing the various ML and DL techniques, the research reveals that models like RF, SVM and ANN are among the

most accurate and reliable for property valuation. However, the study highlights the need for tailored AI models that cater to the diverse priorities of stakeholders. Buyers and investors focus on affordability and predictive accuracy, while policymakers emphasise transparency and legal compliance. The research also emphasises that while ML models like RF and SVM are effective for structured datasets due to their interpretability, DL models such as ANN and CNN are better at capturing non-linear patterns in unstructured data. A hybrid approach, combining both ML and DL techniques, holds the greatest promise for improving property valuation accuracy. Furthermore, regulatory and ethical issues such as AI accountability, data privacy and legal liability pose significant challenges to gaining stakeholder trust. To overcome these barriers, the adoption of explainable AI methods, like SHAP and LIME, is essential to enhance transparency and ensure compliance with legal standards. Based on these findings, it is recommended that real estate stakeholders develop AI models that incorporate explainability from the outset. Practical steps such as integrating local property features, ensuring regulatory alignment and conducting stakeholder training on AI tools can further support effective implementation and trust in AI-driven valuation systems. The study proposed a hybrid AI conceptual framework that integrates socio-economic, technological and legal factors, all vital for fostering trust and accelerating AI adoption in property valuation. This study aligns AI models with stakeholder concerns, laying the foundation for future research and policy. While limited to a literature review, future work will validate findings through surveys, interviews and pilots, refining the AI framework for regional residential markets.

EPILOGUE: PART TWO

Part two of this thesis concludes by consolidating the literature-driven insights into a coherent foundation for empirical investigation and achieved objective 1 by answering RQ1 to RQ5. The CHAPTER 04 and CHAPTER 05 have clarified that the value of digital and AI-enabled valuation systems lies not only in their technical performance, but in how they are embedded within professional routines, institutional expectations, and stakeholder interpretation. This recognition shifts the analytical focus away from isolated models and toward the decision pathways through which valuation outcomes gain meaning, credibility, and practical relevance.

The synthesis achieved in this part establishes the core assumptions where conceptual frameworks are proposed that guide the empirical phases of the thesis: that valuation inputs must be interpreted through professional VJ, that technological support functions as a governance and sense-making mechanism rather than an autonomous decision-maker, and that rust operates as a critical mediator between valuation logic and real-world action. These propositions define the conceptual boundaries within the subsequent analyses are conducted.

Accordingly, the following chapters move from theoretical consolidation to practical examination following conceptual frameworks proposed in previous Chapters. Through stakeholder engagement and quantitative modelling, the study investigates how these mechanisms operate in applied valuation settings, how they vary across professional and user groups, and how their interaction shapes the formation and evaluation of PVQ in contemporary real estate practice.

PART THREE

EMPIRICAL INVESTIGATION

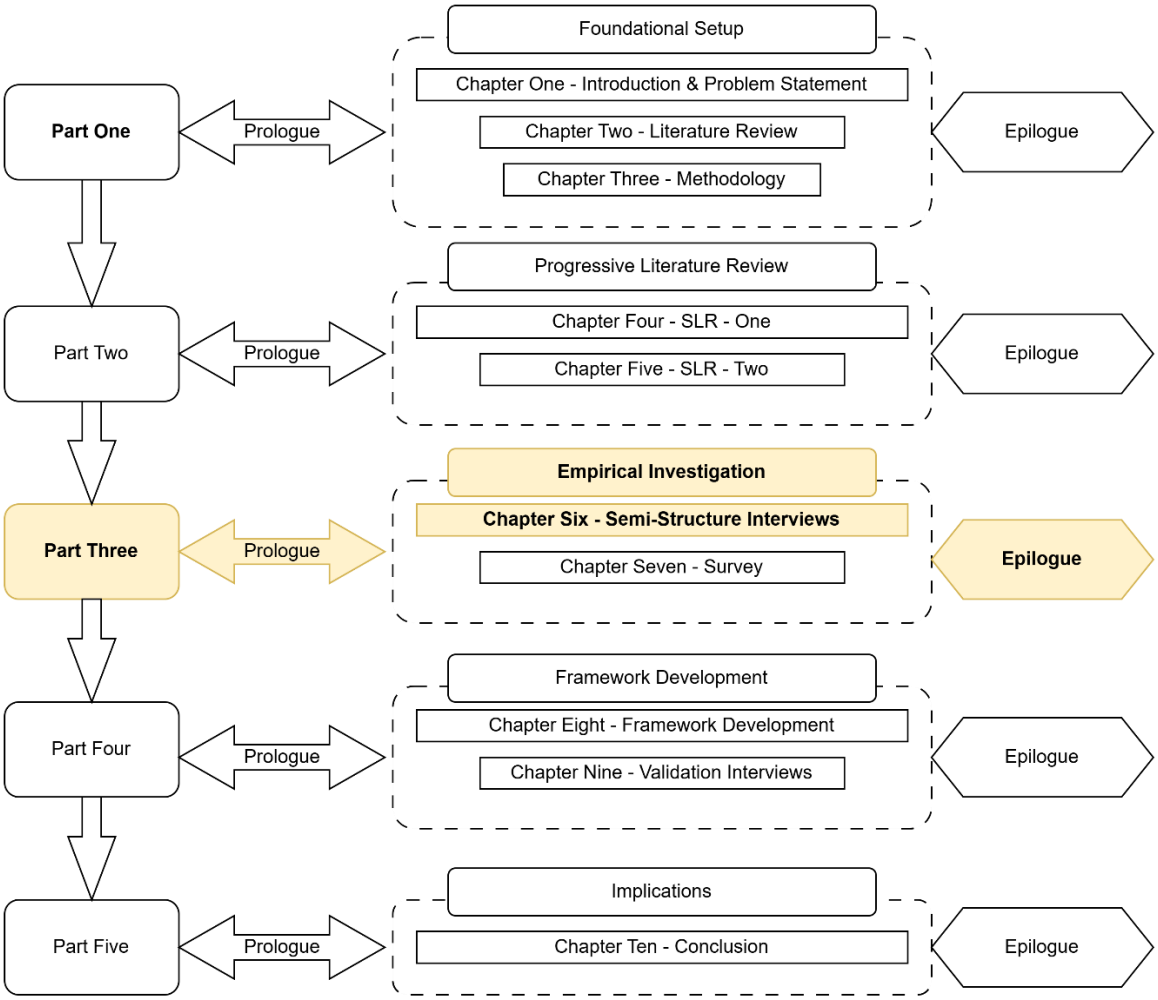
PROLOGUE – PART THREE

This part of the thesis marks the transition from theoretical synthesis to empirical examination of the proposed stakeholder-centric hybrid modular PVQ framework and explore objective 2 (RQ1 to RQ5) and objective 3 (RQ1 to RQ3) as mentioned in CHAPTER 1. Following the progressive literature reviews, the study advances from conceptual development to applied investigation, examining how professional VJ, technological decision-support systems, and stakeholder interpretation interact within operational valuation environments.

CHAPTER 06 initiates the empirical phase through semi-structured interviews with industry stakeholders. This qualitative inquiry shifts the analytical focus from normative assumptions derived from the literature to observed valuation practices within real-world contexts. By engaging PVs, RAs, RPIs, and HBs, the chapter captures multi-perspective insights into how valuation reasoning is formed, how digital tools are interpreted and utilised, and how trust is negotiated across professional and user groups. The analysis identifies interpretive, contextual, and institutional dimensions of valuation processes that are often underrepresented in model-centric and compliance-oriented studies.

Building on these qualitative findings, CHAPTER 07 advances the investigation through a structured, multi-stakeholder survey and quantitative structural modelling. Using PLS-SEM, the chapter empirically tests the relationships proposed within the conceptual framework. Specifically, the analysis examines how PVIFs shape professional VJ, how hybrid valuation support and professionalism function as mediating mechanisms, and how stakeholder trust influences perceived PVQ across distinct stakeholder segments. The modelling approach enables examination of complex, multi-stage relationships within a socio-technical valuation system.

Together, CHAPTER 06 and CHAPTER 07 establish a coherent empirical progression that integrates qualitative stakeholder evidence with quantitative validation. This sequential design ensures that the proposed framework is not only theoretically grounded but also empirically substantiated, providing a comprehensive and analytically rigorous account of how PVQ emerges within hybrid human-technology valuation environments.


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CHAPTER 06

6. OPERATIONALISATION OF PROPERTY VALUATION QUALITY: A PRACTICAL HYBRID SOCIO-TECHNICAL FRAMEWORK

This chapter is based on the following published/publishable journal paper:
Ali, W., Samarasinghe, D. A. S., Feng, Z., & Rotimi, J.O.B (2026). Operationalisation of property valuation quality: A practical hybrid socio-technical framework. *Property Management*. (Under Review)

Abstract

Purpose

Property valuation quality (PVQ) in New Zealand continues to rely on valuer-centric frameworks, while automated valuation models (AVMs) struggle with transparency, contextual sensitivity and stakeholder trust. This study proposed a hybrid, implementation-oriented approach that integrates stakeholder perspectives, contextual factors, explainable AI and policy alignment to enhance transparency and trust, supporting SDG 11: Sustainable Cities and Communities.

Methodology

Data was collected in New Zealand through semi-structured interviews with 34 stakeholders including property valuers (PVs), real estate agents (RAs), residential property investors (RPIs) and home buyers (HBs) using purposive sampling. Transcripts were coded and analysed using reflexive thematic analysis in NVivo 14 and resulting themes were synthesised through causal loop diagramming (CLD) in Miro to illustrate system-level influences on PVQ. Literature triangulation and cross-stakeholder comparisons were conducted to strengthen the contextual validity of the framework proposed

Findings

The findings indicates that PVQ arises from dynamic interactions between AVMs, professional judgement, stakeholder expectations, and contextual forces. While 76% of participants emphasises AVM accuracy and 85% supported improving AVM performance, 47% highlighted risks of over-reliance and transparency limitations. Contextual constraints were strongly

identified, including environmental risks (88%), economic trends (73%), and affordability pressures (58%). Communication and trust (70%) and valuation clarity (73%) were also emphasised as central to quality outcomes. Synthesising interview evidence and CLD analysis, PVQ is conceptualises as a social-technical process and translated into six strategic and operational principles, trust, governance, hybridisation, contextualisation, orchestration, and adaptation, to support transparent, accountable, and policy-responsive valuation practice.

Originality

This study operationalises the PVQ by integrating technological and stakeholder contexts to support trustworthy, AI-assisted valuation practice.

Research limitations

The study is based on qualitative insights, requiring further validation through quantitative testing.

Practical implications

The framework application can enhance valuation reliability, foster stakeholder collaboration and promote ethical, accountable integration of AI across the property sector with six strategic and operational principles.

6.1 Introduction

Property valuation underpins key financial and planning decisions (Crosby *et al*., 2018). Rapid urbanisation and market shifts in New Zealand complicate valuation accuracy and transparency (Amidu et al., 2024b, Greenaway-McGrevy et al., 2021). While traditional valuation methods such as comparable sales, cost-based and income capitalisation approaches remain standard practice (Deppner *et al*., 2023), they often overlook broader socio-economic, environmental and stakeholder-specific factors (Warren-Myers, 2022). Considering these factors, property valuation quality (PVQ), understood as the credibility, transparency and contextual appropriateness of valuation outcomes, is increasingly examined due to technological disruptions, climate risks and growing demands for transparency (Wu *et al*., 2024). Existing frameworks, such as PVQ (Amidu et al. (2025), provide a strong foundation by emphasising professional competence and ethics. However, these frameworks mainly reflect property valuers' (PVs) views, while AVMs are reshaping PVQ with integrated data insights (El Jaouhari *et al*., 2024). Technological adoption however comes with its own set of challenges, as outlined in Ali *et al*. (2025) work. A key issue lies in the mismatch

between AI-generated valuations and the real-world experiences of on-ground stakeholders. This highlights the need for more contextual, explainable AI uses in valuations (El Jaouhari *et al*., 2024). To address this, Ali *et al*. (2025) state that framework starts by analysing stakeholder needs to guide the foundation for implementing the most suitable PVQ.

Despite its vital role in financial, legal and planning decisions, valuation in New Zealand faces challenges of PVQ and stakeholder relevance (Amidu et al., 2024b). Traditional methods often rely heavily on professional judgement and overlook social, environmental and technological complexities (Renigier-Biłozor *et al*., 2022), as well as the perspectives of real estate agents (RAs), residential property investors (RPIs) and home buyers (HBs) (Adilieme *et al*., 2024). Although a recent PVQ framework developed by Amidu *et al*. (2025) improves professional standards, while it provides a strong foundation for PVQ, it remains largely normative and principle-driven. This study builds on the foundation by demonstrating how such principles can be operationalised through stakeholder-informed mechanisms, explainable AI integration, and system-level feedback loops.(Hopkins, 2023). Contextual factors, such as neighbourhood and environmental conditions, capture real-world influences that traditional methods and AVMs often overlook (Chai *et al*., 2021). The growing reliance on AVMs highlights the need for explainable AI, enabling transparent and interpretable valuation reasoning rather than opaque outputs (Linna Zhu, 2025). Finally, policy alignment ensures valuation practice remains consistent with regulatory requirements and sustainability objectives (Ali et al. (2025). Addressing these gaps, this study proposed a hybrid, implementation-oriented approach that integrates stakeholder perspectives, contextual factors, explainable AI and policy alignment to enhance transparency and trust, supporting SDG 11: Sustainable Cities and Communities.

6.2 Literature Review

6.2.1 Traditional Valuation Approaches

Traditional valuation approaches rely on three main approaches: sales comparison, cost and income capitalisation (Deppner *et al*., 2023). The sales comparison approach lies on recent sales and struggles in dynamic markets affected by zoning, infrastructure and policy changes (Greenaway-McGrevy, 2025). The cost approach bases value on replacement costs minus depreciation, but often overlooks market-driven influences and environmental risks (Krajewska *et al*., 2021). The income approach estimates value from net operating income,

but is less reliable where rental yields and investment returns fluctuate rapidly (Deppner *et al*., 2023). Although widely used, these approaches are increasingly criticised for their data-centric focus and failure to address social, environmental and spatial factors shaping modern property markets (Goddar & Moser, 2011). For example, properties with similar physical features can differ greatly in value due to school zones, flood risks or urban intensification overlays, which are often excluded from standard appraisals (Amidu et al. (2021a). All three approaches share a key limitation – their data-centric focus – often overlooking spatial planning, social contexts and environmental risks that shape property value (Warren-Myers, 2022). Previous studies call for valuation practices that are technically robust, socially informed and context-sensitive, aligning with sustainability and governance goals (El Jaouhari et al., 2024a). To address this gap, this study develops a PVQ framework integrating stakeholder perspectives and contextual insights from the New Zealand property market.

6.2.2 Regional Policy in Valuation Practice

Traditional valuation approaches struggle to account for the growing impact of local policies and urban planning on property values (Krajewska *et al*., 2021). In New Zealand, policies like the Auckland Unitary Plan (AUP), flood zone overlays and special housing areas have reshaped property markets by redefining land use and development properties (Council, 2013). These changes influence perceptions of potential, liveability and investment risk, and are often overlooked in standard valuation models (Amidu et al. (2021a). Location-based policy tools shape land value and investor decisions, but AVMs and manual valuations frequently ignore these influences, weakening transparency and confidence (Murphy, 2011). Furthermore, key socio-political factors like RA influence, RI risk and HB motivations are often overlooked, though they shape valuation behaviour (Deppner *et al*., 2023). Studies from New Zealand show that valuation outcomes are influenced by how HB perceive local risks (such as earthquakes in Christchurch) and how these perceptions shift over time (Mendoza *et al*., 2024). Environmental and social factors such as flooding, transport access and school zoning shape market perceptions and align with SDG11 focus on equitable and resilient urban housing (Deppner *et al*., 2023). However, inconsistency in how these variables are operationalised raises concerns over PVQ reliability (Amidu et al. (2021a).

6.2.3 Automated Valuation Models

AVM's rely on algorithms using historical sales and property data (Teikari et al. (2025). Globally, AVMs are used by institutional clients to enhance efficiency and scalability (Kasim et al., 2025b). In New Zealand, platforms like CoreLogic, Homes.co.nz and OneRoof provide AVM-powered estimates to support lending, investment and risk assessment decisions (Murphy, 2011). Banks often use by CoreLogic AVM estimates as the default property value for lending Bidanset and Rakow (2022). AVMs enable rapid, low-cost property assessments for mortgages and portfolio management (El Jaouhari et al., 2024a). Rising concerns about transparency and consistency have shifted research toward frameworks enhancing PVQ (Renigier-Biłozor *et al*., 2022). One of the most notable and recent contributions in this area is the valuation quality framework (VQF) proposed by Amidu et al. (2021a), which seeks to improve the professional integrity and trustworthiness of valuation practices. This VQF identifies six core dimensions of valuation quality: professional competence, stakeholder communication, governance structures, ethical conduct, technological integration and institutional support (Amidu et al., 2021a). While this framework offers valuable insights, its scope is primarily confined to the valuer-client relationship, overlooking the influence of other key stakeholders in the property market (Klamer et al. (2021a); RA, RPI and HB, each of whom play a critical role in shaping market dynamics, are notably absent from the framework's stakeholders lens (Tallam, 2025). This omission weakens the framework relevance in participatory valuation, where diverse experiences shape value.

AVMs depend on historical and structural data, often overlooking condition, renovations, neighbourhood context and regulatory or environmental factors like flood zones and planning overlays by Toprakli (2024). Despite many tools, the valuation process remains fragmented, lacking a unified data integration framework (Berlato *et al*., 2025). Qualitative judgements, such as neighbourhood reputation, HB sentiment and environmental risk, are inconsistently applied across PV (Walia *et al*., 2025) and stakeholder insights are rarely integrated, limiting the social and contextual relevance valuation outcomes (Tallam, 2025). These limitations highlight the need for a PVQ approach that explicitly integrates stakeholder perspectives, contextual sensitivity, explainable AI and policy alignment to enhance transparency and relevance in valuation practice.

6.2.4 PESTL-informed critical synthesis

Existing PVQ research has expanded across professional standards, market accuracy, stakeholder communication and technological adoption. However, much of this literature remains fragmented, with political, economic, social, technological, and legal (PESTL) influences examined in isolation and treated as contextual background conditions as mentioned in Table 6.1. Dominant frameworks such as the VQF provide a robust normative foundation but offer limited guidance on how PVQ is shaped by dynamic policy shifts, behavioural responses, technological mediation and governance arrangements (Amidu et al., 2021b; Amidu, Levy, Bolomope, & Liman, 2024). To address this limitation, a PESTL-informed synthesis is employed to critically examine how these interacting dimensions are conceptualised and where significant theoretical and operational gap persist as mentioned in Table 6.1.

The PESTL-based synthesis in Table 6.1 demonstrates that limitations in valuation quality research are not isolated but structurally interconnected. Across political and economic dimensions, valuation frameworks continue to externalise policy dynamics and macroeconomic pressures, implicitly assuming market stability and regulatory continuity (McLeod & Babb, 2025). Social and behavioural considerations remain largely valuer-centric, with stakeholder perceptions, trust formation and behavioural responses weakly theorised and insufficiently operationalised (Adilieme et al., 2023). At the same time, technological advances particularly AVMs are framed instrumentally as efficiency tools, while issues of explainability, algorithmic bias and decision accountability remain marginal (Glumac & Des Rosiers, 2021). Governance mechanisms further reinforce this fragmentation by prioritising professional compliance over system-wide accountability, especially in AI-assisted valuation contexts (Taruvinga, 2025). Collectively, these patterns reveal a structural gap in existing frameworks, which lack the theoretical capacity to conceptualise valuation quality as an emergent, system level outcome shaped by interacting policy, economic, behavioural, technological and governance factors. In response, this study reframes PVQ as a socio-technical and stakeholder-mediated process, developing an implementation-oriented hybrid framework that translates these interacting forces into actionable guidance.

Table 6.1: PESTL-based synthesis of valuation quality literature and identified structural limitations

Dimension	Existing Literature	Critical Limitations
Political	• Existing frameworks focus on professional compliance, rather than policy as an active valuation driver (Amidu et al., 2021b; Amidu, Levy, Bolomope, & Liman, 2024). • Urban policies are acknowledged but rarely theorised (K. S. Cheung et al., 2024; Phibbs & Gurran, 2021). • Stakeholder expectations are not integrated as dynamic valuation drivers (Amidu et al., 2021b; Amidu, Levy, Bolomope, & Liman, 2024).	• Policy is treated as static and external to valuation processes (McLeod & Babb, 2025). • Frequent zoning reforms are not well captured in valuation frameworks (Greenaway-McGrevy, 2025). • Housing strategies are rarely linked to valuation logic and uncertainty (Coleman, 2023). • Sustainability agents are not integrated as dynamic valuation drivers (Lorenz & Lützkendorf, 2011).
Economic	• Valuation accuracy relies heavily on market evidence and comparables (Amidu et al., 2021b; Amidu, Levy, Bolomope, & Liman, 2024). • Mortgage conditions and investment performance dominate valuation logic (Greenaway-McGrevy, 2025). • Valuation quality frameworks prioritise technical accuracy and professional judgement (Lorenz & Lützkendorf, 2011). • Affordability is framed as an outcome, not a structural valuation constraint (Coleman, 2023).	• Over-reliance on market evidence assumes stable markets (Dilshan & Kaluthanthri, 2025). • Valuation logic is dominated by lending and investment metrics (Magni, 2020). • Quality frameworks remain conceptual, and valuer centric and accuracy focused (Cheung, 2025). • Affordability is treated as a result, not a constraint (Bramley, 2012).
Social (Behavioural)	• Valuation credibility relies on professional judgement and ethics (Wise, 2005). • Communication is framed mainly through a valuer-client lens (Klamer et al., 2021b). • Other stakeholder's perspectives remain underrepresented in valuation theory (Adilieme et al., 2023). • Stakeholder engagement is acknowledged but not operationalised (Klamer et al., 2021b). • Valuation quality remains valuer-centric rather than stakeholder integrated (Amidu et al., 2021b; Amidu, Levy, Bolomope, & Liman, 2024).	• Valuation quality remains dominated by valuer judgement, limiting inclusivity (Dilshan & Kaluthanthri, 2025). • Ethical standards are profession-focused, not system wide (Magni, 2020). • Communication is one-directional, centred on valuer-client relationships (Adilieme et al., 2023). • Wider stakeholder behaviour and perceptions are not systematically integrated (Greenaway-McGrevy, 2025). • Stakeholder engagement is conceptual rather than operational (Klamer et al., 2021b).

Technological	• AVMs are framed as efficiency-enhancing valuation tools (Greenaway-McGrevy, 2025). • AVMs support consistency and scalability in valuation practice (Glumac & Des Rosiers, 2021). • Technology integration is recognised as a valuation quality dimension (Taruvinga, 2025). • Technological use is treated as supportive rather transformative (Kasim, 2025).	• AVMs are framed mainly as efficiency tools, not decision and supporting system (Taruvinga, 2025). • Consistency and scalability are prioritised over interpretability and trust (Greenaway-McGrevy, 2025). • Technology integration is acknowledged but weakly operationalised (Kasim, 2025). • Governance, explainability, and bias risks remain under-theorised (Amidu et al., 2021b; Amidu, Levy, Bolomope, & Liman, 2024).
Legal (Governance)	• Valuation quality prioritised professional ethics and independence (Pinto & Picoto, 2016). • Compliance with formal valuation standards underpins credibility (Thorne, 2021). • Governance is centred on professional conduct (Taruvinga, 2025). • Institutional oversight is treated as sufficient governance (Magni, 2020).	• Governance is framed as professional compliance, not system accountability (Adilieme et al., 2023). • Ethical standards focus on human conduct, overlooking AI influence (Dilshan & Kaluthanthri, 2025). • Institutional oversight assumes static valuation processes (K. S. Cheung et al., 2024; Phibbs & Gurran, 2021). • Accountability in AI-assisted decisions remains unclear (McLeod & Babb, 2025).

6.3 Methodology

6.3.1 Research Methods

This research follows a qualitative and exploratory design (Stevens & Wrenn, 2013) to understand how different stakeholders – PV, RA, HB and RPI, experience and make sense of the residential property valuation process in New Zealand. A qualitative approach was chosen because it allows for a deep understanding of people's views and interpretations, especially in complex and context dependent areas (Levy, 2006). The study is guided by an interpretivist philosophy, valuing perceptions of "value" and "quality" (Leitch et al., 2010b). The study also draws from social constructionism (Van der Walt, 2020) and uses semi-structured interviews to explore stakeholders' views on PVQ and AVM use.

6.3.2 Participant Selection and Data Collection

The interview protocol was developed based on the literature on PVQ and AVMs and was refined through informal pilot testing to ensure clarity, relevance, and terminology alignment. Interviews were conducted in a semi-structured format, audio recorded with participant consent, and subsequently transcribed verbatim for analysis. All transcripts and notes were imported into NVivo to support systematic coding and ensure analytical transparency and replicability.

To understand how different people view PVQ and the role of AVMs, this study used purposive sampling (Campbell *et al.*, 2020) to select participants who were best suited to the topic and to capture diverse insights from four stakeholder groups: PVs (n=8), RAs (n=10), RPIs (n=6) and HB (n=10). Data saturation was assessed separately for each group using matrix coding theory in NVivo, with no new themes emerging after interview 7 for PVs, 9 for RAs, 5 for RPIs and 8 for HBs. This aligns with guidance indicating saturation is typically reached with 6-12 interviews per group. In total, the study had 34 participants across four stakeholder groups.

Group PV1-PV8 included professionals like valuation directors, consultants and compliance managers with 6 to 25 years of experience. Group RA1-RA10 had roles in sales and property management, bringing between 3 and 11 years of experience. Group HB1-HB10 was diverse, consisting of professionals within banking, engineering, teaching and healthcare who had recently bought a home. Group RPI1-RPI6 was involved in development, flipping and long-

term investment and had 5 to 14 years of experience as mentioned in Table 6.2. Semi-structured interviews were taken by Adeoye-Olatunde and Olenik (2021) which allowed participants to speak freely about their thoughts and experiences. This type of interview is useful in qualitative research because it creates a conversational flow and allows deeper discussion while keeping focus on the main topics. Participants were asked 10 semi-structured questions, such as "*What is your understanding of property valuation?*" and asked following questions about AVMs, valuation accuracy, environmental and policy influences and factors affecting PVQ. Interviews lasted 20-30 minutes and were conducted in person or online with participant consent.

Table 6.2: Summary of Interview Participants (Author Construct)

Participant	Speciality	Role	Experience (years)
PV1	Property Research & Valuation Quality	National Valuation Compliance Manager	12
PV2	Property Valuation	Retired Semi-Consultant	25
PV3	Property Valuation	Director	12
PV4	Property Valuation/Civil Engineering	Valuation and Advisory Services	6
PV5	Property Valuation	Development Manager	8
PV6	Property Development and Valuation Research	Head of Research	10
PV7	Development, Sales and Valuation	Property Coach	8
PV8	Property Valuation	Property Portfolio Manager	7
RA1	Property Development and Management	Developer and Salesperson	5
RA2	Property Sales	Salesperson	4
RA3	Property Sales and Management	Branch Management	10
RA4	Property Sales	Salesperson	6
RA5	Property Sales	Salesperson	11
RA6	Property Management and Sales	Property Manager and Salesperson	7
RA7	Property Sales	Salesperson	4
RA8	Property Sales	Salesperson	5
RA9	Property Sales	Salesperson	3
RA10	Property Sales	Salesperson	2
HB1	Banking	Homeowner	2
HB2	Developers	Homeowner	4

HB3	Civil Engineer	Homeowner	2
HB4	Business Development	Founder (Investment Management) and Homeowner	4
HB5	Residential Development	Homeowner	3
HB6	Academic	Property Lecturer and Homeowner	4
HB7	Civil Engineering	Land Development and Homeowner	3
HB8	Banking	Financial Advisor and Homeowner	5
HB9	Academic	Academic Lecturer and Homeowner	4
HB10	Civil Engineering	Site Engineer and Homeowner	3
RPI1	Investment and Residential Development	Founder and Director of....	7
RPI2	Investment and Development	Financial Advisor and Investor	14
RPI3	Residential Development	Flipping Investor	10
RPI4	Land Development	Flipping Investor and Director	7
RPI5	Residential development	Founder and Civil Engineer	5
RPI6	Investment Consultant	Investment Advisor	6

6.3.3 Data Analysis

This study used reflexive thematic analysis, following the six-step method developed by Braun *et al*. (2019). The process began with reading the interview transcripts several times (Byrne, 2022), then important statements were highlighted and labelled with initial codes within NVivo using matrix coding theory (Braun *et al*., 2019). Codes were then grouped together into broader themes that represented common ideas across participants (Sweeney *et al*., 2013). The themes were refined and aligned with the research aim of developing a PVQ, with NVivo used for systematic data analysis (Limna, 2023). Coding was developed through iterative thematic analysis following the approach of (Byrne, 2022), where themes are treated as conceptual patterns rather than simple descriptive categories. By linking stakeholder input with contextual, environmental, technological and professional factors, this study provides a transparent foundation for understanding the dynamics shaping PVQ and guiding framework development. Consistent with an interpretivist epistemology, the analysis prioritised meaning and contextual interpretation over quantification. Percentage indicators were used only to reflect the relative prominence of themes and do not imply statistical generalisability. Themes

were refined in alignment with the research aim of developing PVQ framework, with NVivo supporting systematic data organisation and transparency

The ten themes from coding informed the construction of the causal loop diagramming (CLD), which visualises how these factors interact dynamically to influence PVQ. The CLD was developed by integrating findings from interviews and relevant literature. It illustrates reinforcing loops that enhance PVQ and balancing loops that limit it. The CLD integrates stakeholder perspectives to show how these factors interact across the housing market.

6.4 Interview Results and Discussion

This section presents the findings from the semi-structured interviews conducted with key stakeholders involved in residential property valuation and AI-supported decision-making. Using thematic analysis guided by the study conceptual framework and Objective 2 in Table 1.1, the findings address RQ1 by examining how stakeholders perceive PVQ and the limitations of existing approaches; RQ2 by analysing perceptions of AVMs and AI-enabled tools in shaping accuracy, transparency, and trust; RQ3 by identifying key multidimensional factors that define PVQ across stakeholder groups; and RQ4 by providing the empirical foundation for constructing a hybrid PVQ framework. Themes were organised to reflect stakeholder-specific priorities, benefits, challenges, and trust-related concerns. Table 6.3 summarises the key themes and sub-themes derived from the qualitative analysis.

6.4.1 Stakeholders' Perspectives

6.4.1.1 Property Valuers

Table 6.3 outlines PVs' perspectives on AVM's influence and the prominence of each theme. At 58%, AVMs emerged as a central theme and was discussed positively by the majority of PVs (63%), acknowledging that AVMs enhance accuracy and transparency in the valuation process. According to PV1, "*AVMs save us time and give us a reliable starting point when assessing a property*". This aligns with findings from (El Jaouhari et al., 2024a), who suggest that automation improves efficiency in PVQ. Several PVs viewed AVMs neutrally, acknowledging their usefulness. According to PV1, "*AVMs give you a number, but they can't feel dampness or noise, those are things we notice on site*." Similarly, PV2 remarked, "*In New Zealand, we are probably still trying to work on healthy homes; smart homes or AI still don't have a major impact, but they will eventually*". These concerns resonate with Krämer, Stang, et al. (2023), who argue AVMs often miss micro-level data, leading to valuation discrepancies.

Only 37% of PVs trusted automation, while 25% warned against over-reliance, with PV4 stating "*If we rely on AVMs alone, we risk overlooking the realities of the local market*". Half stressed integrating local datasets into AVMs for better accuracy, highlighting the key role of contextual influences, aligning with Chai *et al*. (2021). Contextual and external influences (64%) were emphasised, with flood zones dominating discussions (88%), which PVs saw as crucial environmental risks. As PV5 noted, "*If a property is in a flood prone area, its market value immediately drops*", aligning with Moore (2020). As PV4 stated, "*Flooding has become a major attribute after recent events, it can drastically affect value*", while PV3 added, "*Slope drainage, site level details are not captured in models, but they change everything*", highlighting AVM's limited reliability in high risk areas (Glumac and Rosiers (2020). Crime rates (50%) and orientation to sunlight (25%) sparked diverse responses, while 63% of PVs emphasised government policy's strong influence on PVQ, as supported by Teikari *et al*. (2025).

The AUP was highlighted as a key factor shaping land-use permissions and zoning as, according to PV6, "*When the zoning rules change, the property's value can change overnight*". This supports the Toman et al. (2017) argument that regulatory frameworks significantly influence accuracy. Additionally, economic trends and mortgage rates (63%) strongly affect HB and RPI decisions but make valuations less consistent (Časta, 2025). Decision-making (65%) highlighted professionalism and evidence-based practice. PVs preferred evidence-based practices, with 88% relying on verified data. According to PV8, "*Evidence-based valuations make it easier to justify our decisions and maintain transparency*", aligning with Moore (2020). Data-driven decisions build trust, but 63% noted challenges from market volatility and inconsistent data. As PV3 explained "*Clients often expect higher valuations, but the data doesn't always support their expectations*". Professionalism overall (70%) was highlighted by 75% of PVs, linking it to credibility and ethics. "*We are still accountable for the valuation, even if the model gives us a number, we are the ones signing the report*," stated PV5, with PV2 adding, "*You need both theory and field reality otherwise, you are just doing maths*", aligning with Guide (2025b). However, 63% acknowledged that growing concerns around housing affordability are reshaping preferences and investment strategies. As stated by PV5, "*Affordability issues are forcing us to rethink how we assess property values*". Table 6.3 shows PVs explored key themes, revealing how multiple factors collectively shape PVQ.

6.4.1.2 Agent Perspectives

Real estate agents noted that valuation involves more than numbers, drawing on market context, professional judgement and HB motivations. When discussing AVMs, 80% of RAs engaged in mixed discussions, viewing AVMs as helpful for improving accuracy and transparency in valuations (Table 6.3). RAs also use AVMs, but only as a starting point: "*We use AVMs to get a ballpark, but they are not gospel",* explained by RA6*.* Put more directly, RA4 stated, "*If the AVM lags the market, I will back my judgement over the algorithm*". These views align with Bidanset and Rakow (2022), who argue AVMs enhance efficiency but require local expertise for accuracy. Low trust was expressed by 40% of RAs, stressing validation through sales data and professional judgement. "*Comparable sales are our baseline,*" said RA3, "*but every property tells its own story*", with RA7 adding, "*Clients want the number, but they also want the reasoning why this property is worth more than the one down the road*". These reflections support Amidu et al. (2019b), who argue valuation should blend data with professional insight to deliver meaningful outcomes.

Agents highlighted contextual factors, with 90% stressing flood zone impact, As RA6 stated: "*Buyers are now very cautious about flood zones; they directly impact property prices*". Similarly, RA6 gave mixed views on crime (70%) and sunlight (20%), while 70% of RAs stressed government policies, especially AUP rules, with RA5 stating "*Any zoning change affects how we pitch properties and guide clients*". These findings are consistent with Bidanset and Rakow (2022), who argue regulatory frameworks strongly shape property use and valuation. Additionally, 80% noted that economic trends and mortgage rates influence HB behaviour and affordability. "*Interest rates change buyer sentiment overnight*", said RA2, with RA8 noting, "*Buyers don't calculate property tax upfront, but if affects affordability later*". These insights support Ali et al. (2025a), whose study highlights the growing role of macroeconomic conditions in property demand, with 80% of agents favouring evidence-based strategies for valuations and client advice. "*We always validate AVM figures with recent sales data to guide clients confidently*," RA4 explained. This is supported by Kwan *et al*. (2021), who highlight the role of data-driven practices in enhancing valuation credibility. However, 70% of agents discussed challenges such as rapid market fluctuations and increasing client expectations. As RA5 stated, "*Old data skews the numbers*", with RA10 highlighting "*Renovations or defects are not captured, and that changes everything*". These frustrations also align with Michaletz and Artemenkov (2019), who caution that data gaps weaken valuation reliability, while

neighbourhood factors, school zones, amenities, safety and transport strongly shape HB preferences. "*Beach access can add a huge premium*", stated RA3, with RA7 adding, "*School zones are the first thing some families ask about*". These findings align with (O'connor, 2019), who highlights the importance of location-based factors in shaping PVQ.

Finally, RAs recognised significant differences in buyer motivations, noting how valuation strategies vary depending on client type. "*An investor thinks yield and exit*," explained by RA1, "*While a first-home buyer thinks schools and commute*," mentioned RA6. This supports Bidanset and Rakow (2022), who suggest that client motivations strongly influence property pricing and valuation approaches.

6.4.1.3 Home Buyers' Perspectives

Buyers' decisions are influenced by practicality, emotion and trust. Neighbourhood and location features emerged as the strongest drivers influencing HBs' perceptions of value. Flood zones (90%), school zones (80%) and amenities (80%) were among the most frequently discussed, followed by crime and safety (60%) and public transport access (40%). As HB5 stated, "*School zones are non-negotiable for us. We'd rather compromise on house size than location*." *"If it is near to public transport and has a good safety record, we will pay more*", stated HB2. These views align with Moore (2020), who notes that location quality strongly influences housing demand, and with Dehnavi *et al*. (2025), who highlight the role of safety in shaping residential choices.

Property characteristics were another significant influence on buyer decisions. Land size (90%), number of bedrooms and bathrooms (90%), layout, parking availability (80%) and property age (70%) ranked highly. Similarly, HBs placed high importance on property characteristics such as roofing type, cladding, foundation condition and the presence of smart home systems. "*We walked away from a property because of roof issues,*" recalled HB7. "*It's not worth the risk if repairs cost a fortune*." "*Smart home features are a bonus, but the structure has to be sound first,*" added HB1. This reflects that physical conditions and construction quality influence both willingness to pay and post-purchase satisfaction (Bidanset & Rakow, 2022). When it comes to AVMs, HBs had mixed perceptions. While 50% used AVMs as a quick reference point, as HB3 mentioned: "*They give a starting point*". Many expressed mixed sentiments about their reliability and lack of contextual accuracy. "*We have seen AVMs be off by $100,000*," stated HB6, while HB9 stated "*They don't know the*

neighbourhood like we do." This also supports Krvavica and Rubinić (2020), who argue that while AVMs improve efficiency, they often lack contextual judgement required to fully capture property specific nuances.

Decision-making processes were also shaped by professional advice and affordability constraints. A large proportion of HBs (80%) valued evidence-based insights from RAs and PVs but raised concerns about inconsistent communication. "*We trust our agent when they back it up with evidence, but sometimes they just quote a number without a context*," stated HB8. Financial considerations were equally influential, with economic trends and mortgage rates (90%) and affordability factors (60%) heavily impacting decisions. "*The interest rate hike changed our budget overnight*," stated HB4. Similarly, HB2 stated that "*We don't just think about buying; we think about living here for 20 years*." Buyers also identified areas for improvement in terms of PVQ, particularly the need for better integration of data and simplified access to relevant information, as HB1 stated: "*It's exhausting having to piece together data from different places*". These statements align with Michaletz and Artemenkov (2019), who recommend greater valuation transparency and streamlined reporting processes to enhance decision-making.

6.4.1.4 Investors' Perspectives on Property Valuation

Investor perspectives show valuation is anchored in return on investment, tempered by location and risk. Motivational factors dominate investor discussion: capital growth potential (66%), rental yield (83%) and prospective growth (50%). As RPI3 stated, "*For us, it is not just the current value, it is what can be worth in five or ten years*." "*I will take a smaller yield now if the land is in a growth zone,*" stated RPI1. These views align with Chaudary *et al*. (2024), who note RIs often prefer long-term appreciation over near-time income. On AVMs' changing valuations, RIs' views were mixed and precise: accuracy and transparency (66%), trust in automation (50%), over-reliance risks (47%), human vs AI judgement (66%) and integration with data (33%). Acknowledging speed, RPI2 stated, "*They are fine for quick checks*", while RPI3 cautioned, "*An algorithm can't assess renovation potential or zoning changes*," echoing concerns in Tallam (2025) about relying on AVMs without expert oversight. Contextual and external influences are clearly flagged, including flood zones (83%), crime rate (66%), orientation of sunlight (50%), with government policy and regulations (50%) and economic trends and mortgage rates (50%). "*Interest rates can flip an investment from profitable to*

unviable overnight," RPI1 warned, with RPI5 noting, "*Tax changes can alter our entire strategy; we adjust when policy shifts happen*." This mirrors Michaletz and Artemenkov (2019) on macro conditions interacting with local market signals. Investors also weighed social environment factors with granularity: school zones (60%), amenities (60%), public transport (33%) and community engagement (33%). Location was mentioned by RPI4: "*The right location covers a lot of other weaknesses*", with RI6 adding, "*We focus on growth zones where demand drives both rental yield and future capital appreciation*". For property characteristics, RPIs pointed to land size (50%), house size (50%), bed count (60%), parking (60%) and property age (60%) as practical screens shaping price and risk.

Finally, professionalism matters materially to RPIs: valuation transparency (50%), ethical practices (66%) and communication and trust (66%). "*If the valuation is not backed by sound reasoning, we won't use it to make a purchase decision,*" RPI4 stated, with RPI3 adding: "*Clear, honest communication is critical. We base multi-million-dollar decisions on these reports*." These priorities align with Berlato *et al*. (2025) and Michaletz and Artemenkov (2019) regarding methodological rigour. Investors treat AVMs as supportive tools, not substitutes for local expertise, professional standards or context-rich due diligence, with decisions ultimately steered by yield, growth prospects, location quality and policy settings.

Table 6.3: Themes and sub-themes influencing Property Valuation Quality (PVQ) across stakeholders

Main-Themes	***Sub-themes***	***Valuers***	***Agents***	***Buyers***	***Investors***	***% of Total (34)***
Theme 1: AVMs Changing Valuation (58%)	*Accuracy & Transparency*	*63%*	*80%*	*90%*	*66%*	*76%*
	Trust in Automation	*37%*	*40%*	*50%*	*50%*	*44%*
	Over-Reliance Risks	*25%*	*60%*	*50%*	*50%*	*47%*
	Human vs AI Judgment	*50%*	*70%*	*60%*	*66%*	*68%*
	Integration with Local Data	*50%*	*60%*	*70%*	*33%*	*55%*
Theme 2: Contextual & External Influences (Environmental Factors) (64%)	*Flood Zones*	*88%*	*90%*	*90%*	*83%*	*88%*
	Crime Rate	*50%*	*70%*	*60%*	*66%*	*61%*
	Orientation & Sunlight	*25%*	*20%*	*50%*	*50%*	*32%*
	Government Policies & Regulations	*63%*	*70%*	*70%*	*50%*	*64%*
	Economic Trends & Mortgage Rates	*63%*	*80%*	*90%*	*50%*	*73%*
Theme 3: Decision-Making (65%)	*Challenges in Valuation*	*63%*	*70%*	*60%*	*50%*	*61%*
	Evidence-based Decisions	*88%*	*80%*	*80%*	*50%*	*76%*
	Professionalism	*75%*	*70%*	*70%*	*33%*	*64%*
	Affordability	*63%*	*70%*	*60%*	*33%*	*58%*

	Data Standardisation	*63%*	*80%*	*70%*	*50%*	*68%*
	Accuracy of AVMs	*87%*	*90%*	*90%*	*66%*	*85%*
Theme 4: Potential for Improvement (66%)	*Integration of AI tools*	*75%*	*70%*	*80%*	*50%*	*70%*
	Valuers Training and Upskilling	*88%*	*50%*	*30%*	*33%*	*50%*
	Stakeholder Collaboration	*50%*	*70%*	*70%*	*50%*	*61%*
	Transparency in Valuations	*75%*	*60%*	*70%*	*50%*	*64%*
	Policy-Driven Inequality	*37%*	*50%*	*30%*	*33%*	*38%*
	Social Inclusion and Community Balance	*37%*	*40%*	*70%*	*33%*	*47%*
Theme 5: Housing Equity and Inclusions (53%)	*Equity Between Buyers & Investors*	*50%*	*70%*	*80%*	*50%*	*64%*
	Transparency in Pricing and Valuation	*75%*	*70%*	*70%*	*33%*	*64%*
	School Zones	*50%*	*70%*	*80%*	*60%*	*64%*
Theme 6: Neighbourhood & Social Environment (52%)	*Community Engagement*	*25%*	*40%*	*50%*	*33%*	*38%*
	Amenities	*50%*	*70%*	*80%*	*60%*	*64%*
	Public Transport	*37%*	*50%*	*40%*	*33%*	*41%*
	Land Size	*75%*	*70%*	*90%*	*50%*	*73%*
	House Size and Layout	*75%*	*70%*	*80%*	*50%*	*70%*
Theme 7: Property Characteristics (68%)	*Numbers of Bathrooms and Bedrooms*	*63%*	*70%*	*90%*	*60%*	*70%*
	Parking Availability	*63%*	*60%*	*80%*	*60%*	*62%*
	Property Age	*63%*	*70%*	*70%*	*60%*	*64%*
	Capital Growth Potential	*63%*	*60%*	*80%*	*66%*	*70%*
Theme 8: Motivational Factors (70%)	*Rental Yield*	*87%*	*70%*	*60%*	*83%*	*73%*
	Prospective Growth	*63%*	*70%*	*80%*	*50%*	*67%*
Theme 9: Technology & Smart Features (79%)	*Smart Home Systems*	*37%*	*40%*	*60%*	*33%*	*44%*
	Energy Efficiency	*12%*	*30%*	*50%*	*50%*	*35%*
	Ethical Practices	*75%*	*70%*	*70%*	*66%*	*67%*
Theme 10: Professionalism (70%)	*Communication and Trust*	*75%*	*80%*	*90%*	*66%*	*70%*
	Valuation Transparency	*88%*	*80%*	*70%*	*50%*	*73%*

Note: Percentages indicate the proportion of participants within each stakeholder group who referenced a given theme or sub-theme at least once during the interviews. The "% of Total (34)" reflects the proportion of all participants mentioning the theme. Percentages are used to support comparative interpretation rather than to imply statistical generalisation.

The ten themes in Table 6.3 show that property valuation in New Zealand is a multi-layered process shaped by technology and context. High emphasis was placed on potential for improvement (66%), while motivational factors (70%), professionalism (70%) and property characteristics (68%) highlighting the balance between automation, expertise and social considerations.

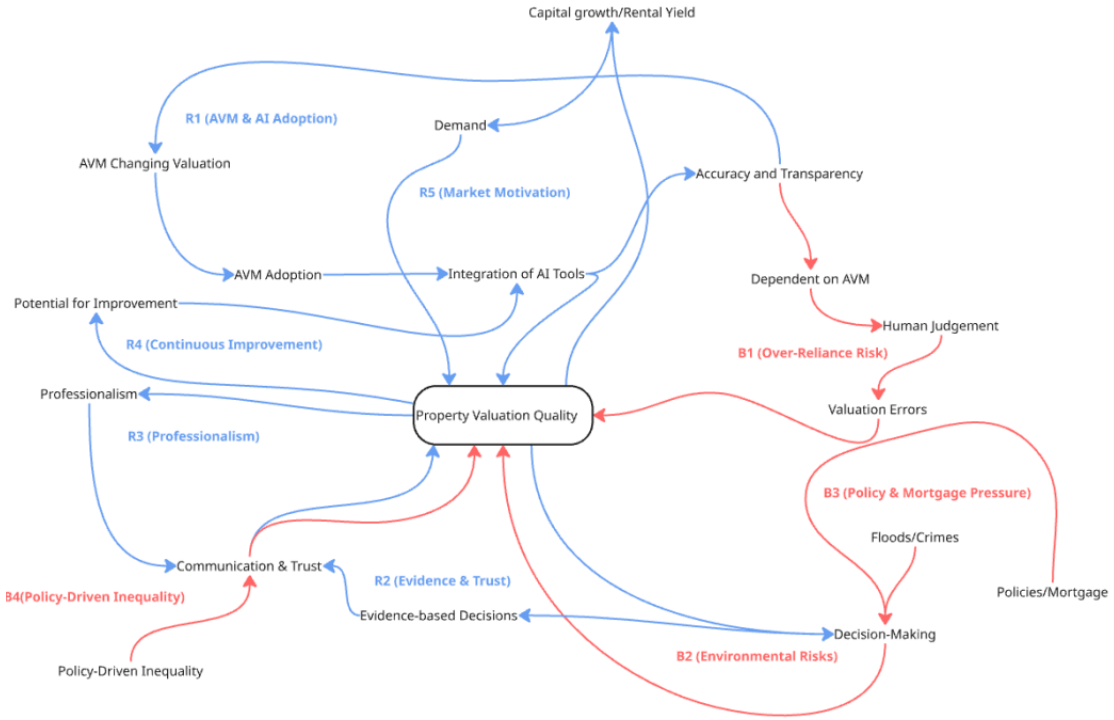
6.5 Integrated Causal Loop Diagram

Figure 6.1 shows the CLD developed from stakeholder interviews and literature (Haraldsson (2004), illustrating factors influencing PVQ in New Zealand. The diagram integrates eight interconnected feedback loops: five reinforcing loops (R1–R5) that drive continuous improvement in PVQ and four balancing loops (B1–B4) that regulate or limit these improvements, with loops defined by Lannon (2012). The CLD was developed through a structured interpretive process grounded in the interview data. Factors were selected from the validated themes and sub-themes in Table 6.3, causal directions were inferred from recurring cause-effect narratives across stakeholder groups and supported by prior valuation literature, and loops were identified using established system dynamics logic to distinguish amplifying and constraining mechanisms influencing PVQ. Therefore, this CLD shows that PVQ is determined by the dynamic interaction of technology adoption, professional practices, market demand, policy settings and social-environmental contexts. The AVM and AI adoption (R1), including AVM changing valuations, highlights the growing role of AVMs and AI-enabled tools in modern valuation practices. When AVMs are combined with high quality data, they improve accuracy and transparency, which builds trust and drives further adoption. This finding aligns with research showing that AI-supported valuations can enhance efficiency and reduce human error when integrated with contextual data (Chai *et al*., 2021). Similarly, the continuous improvement loop (R4) demonstrates how advances in AI integration, data standardisation and process automation create a positive cycle, where better tools improve valuations and refined data further enhances system performance. Respondents confirmed that timely, transparent, data-driven valuations improve confidence and support decision-making. This aligns with systematic reviews showing that AVMs enhance market efficiency and support data-driven decision-making in real estate (El Jaouhari et al., 2024a). Professionalism loop (R3), through PVs' skills, ethics and transparency, enhances PVQ and builds trust. As PV3 stated, "*When reports are defensible and transparent, clients are more confident in the outcome*." This aligns with uniform standards of professional appraisal practice (USPAP) standards by Board and Administration (1990), which emphasise integrity, impartiality, objectivity and independent judgement as essential for producing credible valuation outcomes. The evidence and trust loop (R2) illustrates that evidence-based decision-making and improving communication among stakeholders reduces disputes, builds stronger stakeholder relationships and enhances PVQ. The market motivation loop (R5)

captures how capital growth expectations, rental yields and investor confidence drive property demand and motivate stakeholders to pursue higher valuation accuracy. Investors confirmed that reliable valuations play a key role in investment decisions and long-term planning, reinforcing the need for accurate, transparent and timely information; this is consistent with findings showing that accurate valuation systems significantly enhance investor confidence (Na Ayuthaya & Swierczek, 2014).

Several balancing loops constrain improvements in PVQ. The over-reliance risk loop (B1) reflects concerns that depending too heavily on AVMs without expert oversight reduces accuracy and trust, and highlights industry warnings on AVM reliability (Teikari et al. (2025). The environmental risks loop (B2) demonstrates how flood zones and crime rates negatively influence demand and stability; for instance, a major floor in Vietnam caused a 9% drop in house prices (Bui *et al*., 2024). The policy and mortgage pressure loop (B3) highlights how lending rules, mortgage rates and regulations directly affect affordability, consistent with evidence that mortgage shocks disproportionately impact house prices in debt-heavy regions (Chai *et al*., 2021). Finally, the policy-driven inequality loop (B4) shows how inconsistent policies such as credit limits on buyers erode trust and deepen inequities (Hochstenbach et al., 2025). Synthesising stakeholder evidence for RQ3 (Objective 2), PVQ in residential real estate can be conceptualised as a multidimensional construct comprising five interrelated dimensions: (1) Technology reliability and explainability; (2) Professional competence and ethical practice; (3) Contextual and environmental intelligence; (4) Governance and policy responsiveness; and (5) Market and affordability alignment.

Taken together, the percentage-based findings (Table 6.3) and CLD indicate the PVQ is shaped by interacting tensions rather than agreement around a single valuation criterion. The patterns highlight that PVQ cannot be understood as a static technical outcome, but rather as a socio-technical process emerging from the interaction of trust, professionalism, contextual intelligence, and governance mechanisms. On this basis, in the next section the framework operationalises and translates these empirical and CLD insights into six operational principles which together provide a structured pathway for embedding explainable AI, professional judgement, stakeholder engagement, and policy responsiveness into valuation practice.



Colour	Loop Type	Effect
	Reinforcing Loops (R)	Positive relationship.
	Balancing Loops (B)	Negative relationship.

Loop	Colour	Name	Effect	Impact on PVQ
R1		AVM & AI Adoption	More AVMs need more AI integration and increase accuracy	Increases PVQ
R2		Evidence & Trust	Evidence-based decisions build trust	Increases PVQ
R3		Professionalism	Ethics & transparency improve reliability	Increases PVQ
R4		Continuous Improvement	Ongoing AI integration boosts performance	Increases PVQ
R5		Market Motivation	Rental yield & capital growth drive demand	Increases PVQ
B1		Over-Reliance Risk	Too much dependence on AVMs reduces human judgment	Decreases PVQ
B2		Environmental Risks	Floods & crimes reduce property demand	Decreases PVQ
B3		Policy & Mortgage Pressure	Strict rules & high rates affect decisions	Decreases PVQ
B4		Policy-Driven Inequality	Unfair policies reduce trust & transparency	Decreases PVQ

Figure 6.1. Feedback loops and drivers of valuation quality from multi-stakeholder perspective (Author Construct)

6.6 Practical Operationalisation

The findings of this study demonstrates that PVQ emerges from the dynamic interaction between technological tools, professional judgement, and contextual knowledge, rather than from any single valuation input. While AVMs offer clear advantages in terms of scalability, speed, and consistency, consistent with evidence that algorithmic approaches can standardise outputs and reduce turnaround times (Dehnavi et al., 2025), stakeholders highlighted critical limitations in their ability to capture property condition, micro-location effects, and socio-environmental context. These concerns align with prior studies cautioning against over-reliance on statistical modelling without human interpretation (Rojas & Avitia, 2017). As such, the empirical findings strongly support the need for hybrid valuation approaches, in which AVMs functions as decision-support tools rather than decision substitutes. Across stakeholder groups, there was convergence around the continued centrality of professional expertise. PVs emphasised the irreplaceable role of experiential knowledge, site inspections, and local market interpretation, reinforcing arguments that valuation is not purely data-driven but socially constructed through professional judgement Squires (2021). RAs highlighted the importance of transparency and communication in valuation acceptance, consistent with evidence that perceived competence and openness significantly influence market confidence Amidu, Levy and Kasim (2025b). HBs place greater weight on tangible property features, neighbourhood desirability, and amenity access, supporting behavioural perspectives in housing economics that stress the salience of lived experience in valuation perception (Dehnavi *et al.*, 2025). RPIs, while more receptive to data-driven modelling, similarly acknowledged the importance of redevelopment potential and market cycle dynamics, echoing findings that strategic valuation requires interpretive judgement beyond automated outputs (Squires, 2021).

Figure 6.1 interprets these perspectives, mapping reinforcing loops such as professionalism, trust and acceptance (R1) and AVM training, accuracy and adoption (R3), demonstrating how ethical standards, ongoing training and transparent communication create self-reinforcing improvements in PVQ. Similar findings are reported by Lannon (2012), who stresses that model optimisation is most effective when paired with professional feedback loops. Balancing loops capture counterforces that stabilise the system, such as affordability constraints (B3), environmental risks (B2) and checks on over reliance on AVMs (B1). This reflects work by

Bartke and Schwarze (2021), who emphasise that market sustainability and social equity must temper purely efficiency-driven approaches. This highlights the need for socio-technical frameworks that account for both market variables and community context (Pai & Wang, 2020).

Building on this causal structure, the proposed framework in Figure 6.2 translates findings into a set of strategic principles (SP) and operational principles (OP) that make PVQ actionable in practice. At the strategic level, SP1 (Trust) reframes PVQ as a legitimacy-based outcome shaped by transparency and stakeholder confidence rather than accuracy alone. Structured valuation narratives that explicitly communicate assumptions, uncertainty, and contextual considerations enhance transparency and legitimacy, reducing disputes and perceptions of bias as aligned with Squires (2021). These findings also align with valuation research showing that transparency and communicative clarity are central to valuation credibility and stakeholder acceptance (Rojas & Avitia, 2017). SP1 therefore frames PVQ not solely as technical accuracy, but as a socially constructed outcome.

Building on this orientation, SP2 (Governance) operationalises policy responsiveness by embedding regulatory and housing policy triggers such as zoning reforms, housing strategies, and lending conditions within valuation review processes (Pai & Wang, 2020). This mechanism ensures that valuation logic remains aligned with dynamic policy and equity objectives, addressing critiques that valuation frameworks often treat policy as an external constraint rather than an active driver (Bui *et al.*, 2024). SP2 thus stabilises valuation outcomes under regulatory uncertainty. Within this governed environment SP3 (Hybridisation) defines how technological and professional inputs interact. Mandatory human validation of AVM outputs positions automation as decision support rather than decision authority, preventing automation bias while preserving efficiency and consistency (Hochstenbach et al., 2025). This hybrid logic reflects growing consensus that AVMs improve performance only when complemented by professional judgement and local market interpretation.



Figure 6.2. Hybrid Framework for the practical operationalisation of PVQ

At the operational stage, OP1 (Contextualisation) ensures that environmental risks, neighbourhood attributes, and local market indicators are systematically integrated into valuation inputs (Pai & Wang, 2020). This responds directly to empirical evidence that micro-level factors such as flood exposure and amenity access, materially influence property values and cannot be reliably captures by generic models (Dehnavi *et al*., 2025). OP1 therefore reduces mispricing and enhances interpretive accuracy. OP2 (Orchestration) then specifies how AI outputs and professional judgement are sequenced within decision-making workflows. By clarifying when and how automated estimates are interpreted, adjusted, or overridden, OP2 strengthens accountability and decision credibility (Chai *et al*., 2021). This mechanism aligns with socio-technical systems theory, which emphasises that performance outcomes depend on the coordination between technical tools and human actors rather than their independent optimisation. Finally, OP3 (Adaptation) closes the loop by embedding continuous AI literacy, bias awareness, and ethical training within valuation practice. This principle sustains PVQ under evolving technological, policy, and market conditions, reflecting

evidence that learning-based feedback loops are essential for maintaining professional competence and trust in AI-assisted systems (Pai & Wang, 2020).

Taken together, the principles operate as an integrated flow: SP2 and SP1 define system orientation; OP and SP3 shape informed decision inputs; OP2 structures execution; and OP3 enables continuous refinement. This flow demonstrates how PVQ emerges as a dynamic, socio-technical outcome, directly grounded in stakeholder evidence and responsive to policy, technology, and sustainability imperatives, including SDG11.

6.6.1 Framework Evaluation

To assess the practical legitimacy and structural robustness of the proposed framework, expert evaluation interviews were conducted with the same five industry participants involved in the first phase of the study (three registered PVs and two RAs). These participants were originally interviewed during the semi-structured interview stage and were subsequently invited to evaluate developed framework. The evaluation questions were designed to examine whether the framework reflects contemporary valuation practice, supports stakeholder communication, enhances organisation applicability, and demonstrates conceptual innovation. Rather than treating evaluation as separate empirical study, this phase functioned as a structured robustness check of the framework's strategic and operational components. Table 6.4 summarises how expert reflections aligned with each framework layer. The evaluation findings demonstrate strong convergence between the conceptual architecture of the PVQ framework and contemporary professional practice. SP1 and SP2 were particularly reinforced through expert emphasis on transparency, explainability, and professional accountability. This indicates that PVQ is not merely technical accuracy but is deeply embedded in communicative credibility and institutional responsibility. The SP3 was consistently validated, with experts rejecting the notion of algorithmic substitution and instead framing AI as a decision-support mechanism embedded within human reasoning. This confirms the socio-technical positioning of the framework and strengthens its theoretical grounding. At the operational level, OP1 and OP2 were strongly supported, reflecting the complex balancing of local market data, regulatory pressures, stakeholder expectations in real-world practice. OP3 emerged as a critical requirement, particularly in the context of AI integration and evolving policy landscapes, reinforcing the need for continuous professional learning.

Table 6.4: Industry-Based Evaluation and Practical Legitimacy Assessment of the PVQ Framework

Framework Layer	Component	Question Themes	Description
SP1	Trust	Explaining Decisions	Expert reinforced the centrality of transparency and credibility in valuation decisions. As one P1 noted, "*Clients don't just want a number; they want to understand how that number was reached*."
SP2	Governance	Professional Practice & Novelty	Strong emphasis was placed on AVM explainability and professional accountability. One P2 stated, "*AVM outputs must be explainable, responsibility still lies with the valuer*"
SP3	Hybridisation	Overall Framework	Consensus emerged that AI should support rather than replace professional judgement. As highlighted by P5, "*Models assist, but the final reasoning remains human*."
OP1	Contextualisation	Professional Experience	Experts confirmed the importance of integrating local, environmental, and market specific factors. One P4 remarked, "*Without local context, valuation accuracy becomes superficial*."
OP2	Orchestration	Organisational Application	The need to balance policy logic, market evidence, and professional interpretation was validated. An P3 explained, "*We constantly navigate between market pressures, regulation, and client expectations*."
OP3	Adaptation	Overall Framework	Continuous learning and upskilling were viewed as essential in AI-integrated environments. As one P4 noted, "*Valuers must continuously adapt to understand new tools and risks*."
PVQ Dimensions		Overall Evaluation	The six PVQ dimensions were broadly supported as reflective of contemporary valuation quality. One P3 summarised, "*This framework captures what quality valuation actually means today not just price precision, but judgement, context, and accountability."*

Note: P1–P5 denote anonymised expert participants drawn from the property market, including registered valuers and real estate agents. Participant codes are used to preserve confidentiality

Importantly the six PVQ dimensions were collectively perceived as reflective of contemporary valuation quality, extending beyond price precision to encompass judgement, contextual reasoning, and accountability. Overall, the evaluation phase enhances the framework's practical legitimacy within industry settings. Experts did not challenge the conceptual structure of the model; rather suggested refinements were limited to presentation clarity and usability. This indicates structural robustness and reinforces the framework's applicability across professional, organisational, and regulatory contexts. The findings therefore provide empirical support for the framework's hybrid and stakeholder-centric positioning.

6.6.1.1 Theoretical Contributions

The validated framework contributes theoretically by operationalising PVQ as a measurable socio-technical construct shaped by interactions between AVMs, professional judgement, governance mechanisms, and contextual influences. Rather than treating PVQ solely as predictive accuracy, the framework integrates trust, transparency, regulatory alignment, contextual calibration, and stakeholder coordination as structural dimensions of PVQ. This extends socio-techincal systems theory into the valuation domain by empirically demonstrating how technological performance and institutional factors co-produce valuation outcomes.

6.6.1.2 Practical Contributions

From a practical perspective, the framework provides structured guidance for AI adoption in valuation practice. It can be applied by valuation firms to design hybrid workflows where AVMs support, rather than replace, professional judgement. It offers regulators a basis for developing explainability and accountability standards aligned with governance and trust principles. For real estate agencies and financial institutions, the framework supports risk-sensitive deployment of AI tools by embedding contextualisation (e.g., environmental risks, local data integration) and adaptation mechanisms (e.g., training and upskilling). In policy settings, it can inform guidelines for transparent AI-assisted valuations in taxation, mortgage approvals, and urban planning contexts.

6.6.1.3 Methodological Contributions

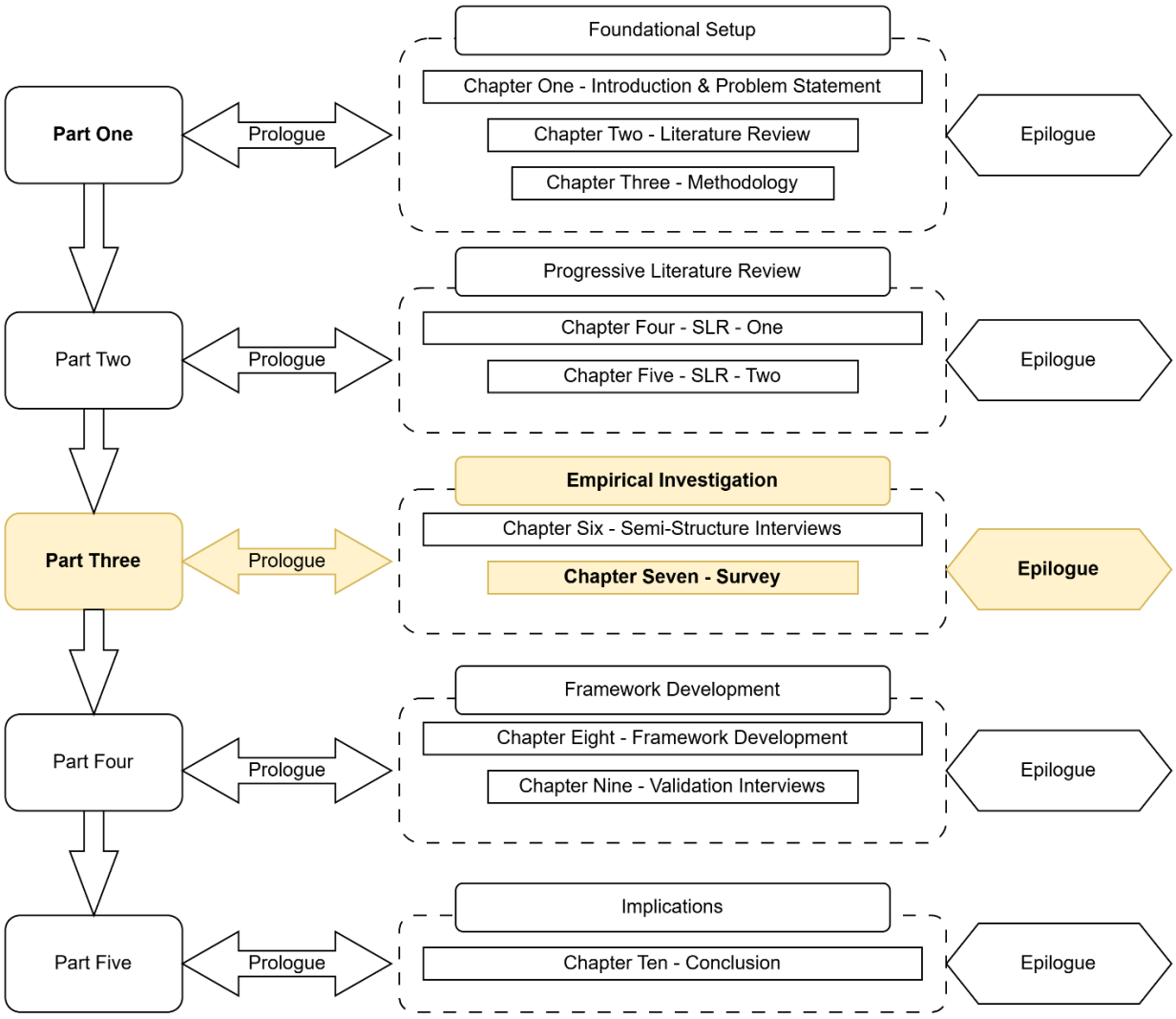
Methodologically, the study advances valuation research by systematically integrating qualitative stakeholder interviews with systems-based CLD modelling to translate thematic findings into structured operational principles. Rather than treating interview insights as

standalone narratives, the approach synthesises stakeholder perspectives into feedback-based system dynamics, enabling the identification of reinforcing and balancing mechanisms influencing PVQ. This integration provides a transparent and replicable analytical pathway for examining AI adoption and governance in complex professional settings, offering a transferable methodological framework of real estate valuation and other AI-decision-making domains.

6.7 Conclusion

The study demonstrates that PVQ cannot be understood as a static or purely technical outcome, but as a socio-technical process shaped by interacting technological, professional, contextual, and governance forces. By synthesising stakeholder interviews with CLD analysis, the study shows how reinforcing dynamics of evidence, professionalism, and trust sustain valuation credibility, while balancing forces, such as over-reliance on automation, affordability pressures, environmental risk, and policy volatility systematically constrain valuation outcomes. This synthesis advances existing valuation quality by reframing PVQ as an emergent system level phenomenon rather than a compliance-driven and accuracy centred construct.

Building on this synthesis, the proposed framework translates empirical insights into actionable guidance for practice and policy. For PVs, the findings highlight the need to operationalise explainable valuation narratives, integrate micro-local and environmental intelligence, and apply structured human oversight to AVM outputs. For policy makers and regulators, the framework underscores the important of treating planning policy, housing strategies, and lending rules as active valuation drivers rather than external constraints, with periodic policy-triggered review checkpoints embedded in valuation workflows. For AVM developers, the result point to the necessity of designing systems that prioritise interpretability, uncertainty signalling, and accountability alongside efficiency and scalability. Collectively, these actions support more transparent, defensible, and socially legitimate valuation practices, aligning valuation systems with broader objectives of housing equity, resilience, and sustainability consistent with SDG11.


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Part Two
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Student name:	Wajhat Ali
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CHAPTER 07

7. DEVELOPING AND TESTING A MULTI-STAGE FRAMEWORK FOR PROPERTY VALUATION QUALITY USING PLS-SEM

This chapter is based on the following published/publishable journal paper:
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Abstract

Property valuation quality (PVQ) has traditionally been assessed through accuracy-focused and model centric approaches, offering limited insight into how valuation decisions are formed, interpreted, and legitimised across diverse stakeholder contexts. This study adopts a process-oriented perspective to examine how PVQ emerges through interaction of valuation inputs, professional valuation judgement VJ, hybrid valuation support, trust formation, and stakeholder interpretation. Drawing on behavioural valuation and socio-technical decision-making literature, the study proposes and empirically tests an integrated valuation decision process framework (IVDPF). Survey data were collected through Qualtrics from property valuers (PVs), real estate agents (RAs), home buyers (HBs), residential property investors (RPIs). Exploratory factor analysis (EFA), and cluster analysis were used in R software to identify property valuation influencing factors (PVIFs), and stakeholder segments, followed by partial least squares structural equation modelling (PLS-SEM) in SmartPLS 4. The findings show that PVIFs affect PVQ indirectly through VJ, while professionalism and hybrid valuation support influence outcomes only through trust. This study frames PVQ as a multi-stage, trust mediated outcome rather than a purely technical metric. Practically, the framework provides a diagnostic and design tool for valuation practice, supporting stakeholder-sensitive communication and the responsible adoption of AI-enabled valuation systems.

7.1 Introduction

Residential property valuation (RPV) is fundamental to housing markets, shaping decisions on transactions, investment, taxation, and financial risk (Shuaibu Liman et al., 2024). These RPV shape prices, borrowing capacity, and long-term financial decisions, making confidence in valuation processes essential for market stability and efficiency (Dobeson, 2025). In urban housing markets, RPV are engaged by diverse stakeholders, including property valuers (PVs),

real estate agents (RAs), residential property investors (RPIs), and home buyers (HBs) for distinct decision-making purposes as mentioned by RICS (2022). Beyond technical assessment, RPV plays a key institutional role in legitimising prices and shaping market trust (Dobeson, 2025). As housing affordability pressures intensify, the quality and credibility of RPV have become growing concerns for both researchers and practitioners (Amidu, Levy, Bolomope, & Liman, 2024). Despite established standard, RPV outcomes often vary across PVs, firms, and transaction contexts, even for comparable properties (Amidu et al., 2021b). Recent study by Amidu, Levy and Kasim (2025a) reports persistent concerns regarding inconsistency, transparency, and judgement variability in RPV. This variability raises questions about how professional valuation judgements (VJ) are formed in practice, which refers to professional reasoning process through which PVs synthesise valuation inputs into a final valuation opinion, as reflected in the clarity, confidence, and consistency of the valuation reasoning presented in the valuation report. VJ does not refer to the numerical valuation outcome alone, but to the quality of interpretive judgement underpinning that valuation conclusion, including how evidence is selected, weighted, justified, and communicated, and how property valuation quality (PVQ) extends beyond technical accuracy (Amidu et al., 2021b). Therefore, these challenges are intensified in housing markets characterised by rapid price movements, complex regulations, and data intensive valuation practices. (Oladokun & Mooya, 2023). Therefore, it is important for PVs to synthesise diverse property, regulatory, and market information under uncertainty.

Despite these concerns, research has largely focused on model performance and methodological comparison as outlined in Liman et al. (2025) work. Although J. A. Numan and I. M. Yusoff (2024) identify appraisal methods that enhance predictive accuracy, and literature offers limited insight into how valuation factors are jointly interpreted in practice. Therefore, PVQ is framed as a methodological outcome, rather than a VJ, and practice-driven process (Amidu et al., 2021b). Similarly, research on automated valuation models (AVMs) has focused on performance gains, with limited attention to how trust, explainability, and professional integration shaped PVQ (El Jaouhari et al., 2024b). Consequently, valuation research lacks an integrated, process-based understanding of how VJ, stakeholder differences, and trust interact to shape perceived PVQ in hybrid human-AI contexts (Liman et al., 2025). In response to these gaps, this study examines how PVQ is shaped by property valuation influencing

factors (PVIFs), VJ, hybrid valuation support, trust, and stakeholder interpretation. Adopting a process-oriented approach guided by Amidu et al. (2021b), the study examines how these elements interact across valuation decisions-making stages. The paper is guided by the following research questions (RQs):

RQ1: What key factors are used when valuing residential properties in practice?

RQ2: Do different stakeholder groups place different levels of importance on these valuation factors?

RQ3: How do valuation judgement, professional practice, and hybrid valuation support shape trust and perceived PVQ?

To operationalise RQ3, three sequential sub-research questions (SRQs) are examined:

- *SRQ1: How do valuation influencing factors shape valuation judgement? (Phase 01)*
- *SRQ2: How does valuation judgement relate to professionalism and hybrid valuation support? (Phase 02)*
- *SRQ3: How do professionalism and hybrid valuation support influence trust in PVQ? (Phase 03)*

Together, these questions examine PVQ as a multi-stage process linking valuation, inputs, VJ, trust, and stakeholder interpretation.

7.2 Literature Review

Early research has consistently shown that physical characteristics of the dwelling, locational attributes, neighbourhood amenities, environmental conditions, regulatory constraints, and broader market dynamics play important role in shaping RPV (Liu et al., 2025). Prior studies collectively demonstrate that property value is not determined by a single dominant attribute but emerges from the interaction of multiple dimensions. Building on this understanding, Crosby (2000) and Liu et al. (2025) have emphasised the inherently multidimensional nature of RPV. Recent studies including Zhou et al. (2025) and Buszta et al. (2025) find that RPV arise from the interaction of market and non-market attributes, motivating the development of structured valuation frameworks and professional standards to systematically integrate diverse influences. Despite this progress, empirical valuation literature has approached valuation complexity by examining individual determinants in prioritising predictive

performance (Maselli & Nesticò, 2025). Recent studies continue to rely on regression-based and hedonic price models to quantify how specific property attributes relate to transaction prices (Nor et al., 2025). Therefore, these methods have become central to empirical valuation research. Similarly, J. A. Numan and I. M. Yusoff (2024) identify appraisal methods to evaluate the robustness of such models, and emphasised statistical metrics, such as regression coefficients, goodness of fit, and prediction errors to assess model performance. These indicators are widely used to compare valuation methods and to demonstrate improvements in predictive performance (Maselli & Nesticò, 2025). As valuation models become increasingly data-intensive and complex, recent studies suggest that gains in predictive accuracy often come at the expense of transparency and interpretability for practitioners and stakeholders (Yiu & Cheung, 2025). While these statistical metrics reveal patterns in data, several few studies argue that they provide limited insight into how VJ are formed in practice (Amidu, Levy, Bolomope, & Liman, 2024). This has raised concerns about the extent to which statistical performance alone can adequately represent PVQ in real world valuation contexts.

Similarly, Amidu et al. (2021b) mentioned that methodological tendencies have important implications for how PVQ is framed in the literature. Studies conceptualises PVQ as a methodological outcome, commonly assessed using accuracy, and error-based indicators (J. A. Numan & I. M. Yusoff, 2024). However, studies argue that outcome-based measures inadequately capture PVQ under market volatility and uncertainty (Kasim et al., 2025c). As Amidu et al. (2021b) also argue that market value is inherently uncertain and unobservable, PVQ cannot be reliably assessed using numerical outcomes alone. In response to these limitations, researchers have shifted attention toward VJ and practice (Kasim et al., 2024). Furthermore, a studies by El Jaouhari et al. (2024b) and Kasim et al. (2025a) shows that valuation outcomes are influenced by PVs professional experience, domain knowledge, how they select and interpret comparable evidence, and the use of heuristics under uncertainty, therefore valuation is a judgement-intensive process in which PVs integrate multiple sources of information, rather than a purely technical task. At the same time, valuation outcomes are interpreted and used by diverse stakeholder groups rather than a single homogeneous audience (Yiu & Cheung, 2025). Behavioural research by Amidu, Levy and Kasim (2025a) indicates that PVs, RAs, RPIs, and HBs, interpret valuation information differently according

to their objectives, but systematic empirical comparisons of stakeholder valuation priorities remain limited (Amidu et al., 2021b). Consequently, expectation gaps and communication challenges persist, particularly in residential markets where valuations shape investment, and affordability decisions (Crosby, 2000). These gaps highlight trust as a key yet underexplored theme of valuation, extending beyond technical accuracy to perceptions of professionalism and transparency (Amidu et al., 2021b). This limitation is amplified in AVM-driven valuation contexts, where research has prioritised predictive performance over explainability, VJ, and trust (Liman et al., 2025).

Literature reveals a persistent gap in RPV research, despite advances in factor identification and model sophistication, there remains limited integrated understanding of how valuation factors are interpreted through VJ, how stakeholders engage with valuation outputs, and how trust shapes perceived PVQ in practice (Amidu et al., 2021b). Addressing this gap requires a process-oriented perspective that treats VJ, stakeholder interpretation, and trust as interrelated components of PVQ. This study responds by empirically examining PVIFs, stakeholder heterogeneity, trust within hybrid human-AI valuation contexts.

7.3 Methodology

Building on the gaps identified in the literature, particularly the lack of empirical evidence on the structural organisation of RPV factors and stakeholder-specific valuation priorities. This study adopted a methodological design followed a structured multi-stage approach in Figure 7.1, consistent with prior valuation research examining stakeholder perceptions and PVQ (Amidu et al., 2021b). Data were collected using a questionnaire administered via Qualtrics. Following data preparation, descriptive analysis and exploratory factor analysis (EFA) were conducted in R to identify PVIFs, and cluster analysis was applied to segment stakeholders based on valuation factor priorities. These results informed subsequent partial least squares structural equation modelling (PLS-SEM) using SmartPLS 4, including measurement and structural model assessment, bootstrapping. This sequential analytical approach supported the development of an integrated valuation decision process framework (IVDPF).

7.3.1 Conceptual Framework and Hypothesis Development

Studies indicate that RPV outcomes are shaped by multiple factors that are interpreted through professional VJ rather than applied mechanically (Liman et al., 2025). Within framework presented in Figure 7.2, VJ is conceptualised as a cognitive and interpretive

mechanisms through which PVIFs are identified, weighted, and synthesised into a defensible valuation reasoning. Rather than operating as direct drivers of value, PVIFs function as external information signals that require professional reasoning to determine their relevance and influence in each market context. Accordingly, H1 addresses SRQ1 by examining the foundational relationship between valuation inputs and human interpretation.

***H1**: PVIF's positively influence professional VJ.*

Following the EFA, this relationship is further specified through sub-hypotheses to reflect the multidimensional structure of the external information environment that shapes professional VJ.

Building on this interpretive role, the framework positions VJ as a central linking construct between technical valuation activity and institutional and technological mechanisms. As shown in phase 2, VJ shapes how professional practice is enacted and communicated, with stakeholders inferring professionalism from the transparency, consistency, and justificatory logic embedded in valuation reasoning. Therefore, professionalism reflects not only loyalty to formal standards, but also external interpretation of ethical conduct, independence, and procedural clarity demonstrated through valuation process. In parallel, VJ guides the effective use of hybrid valuation support, defined as the structured integration of professional expertise with technological systems such as AVMs, digital databases, and decision-support, which require expert interpretation rather than automated application (Johnson et al., 2024). These relationships form the basis of SRQ2 and are reflected in the following hypothesis:

***H2**: VJ positively influences professionalism*

***H3**: VJ positively influences hybrid valuation support.*

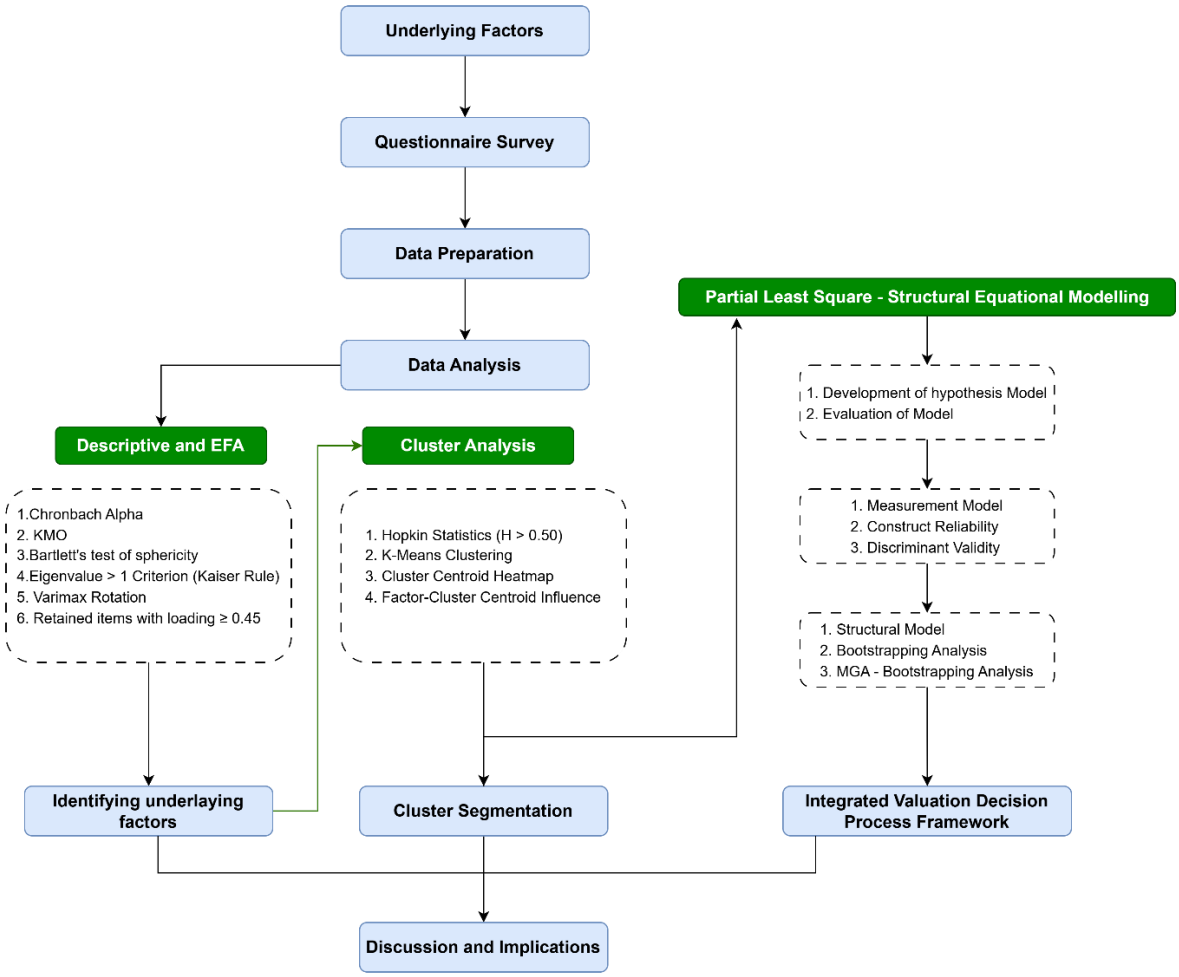


Figure 7.1: Overview of the research design and analytical process

Importantly, this structure clarifies that professionalism and hybrid valuation support are not modelled as PVIFs. While PVIFs represent exogenous construct, market and property derived information signals, professionalism and hybrid valuation support are conceptualised as endogenous governance and mediation mechanisms that emerge from how PVs interpret and operationalise those signals. Their inclusion in Figure 7.2 therefore reflects a process-based distinction between inputs and interpretive mechanisms, rather than a circular relationship.

In Phase 3, the framework conceptualises valuation as a process of legitimisation through stakeholder trust. Trust in the valuation outcome is modelled as a perceptual and relational construct shaped by both the professionalism of the PVs and the transparent, accountable, use of hybrid technological support (El Jaouhari et al., 2024b). This reflects the assumption that stakeholders are more likely to accept valuation outcomes when they observe both strong professional governance and credible technological augmentation. Trust is further positioned as a key antecedent of PVQ, which is treated as an emergent, system-level

outcome extending beyond technical accuracy to include confidence in the valuation process and its institutional credibility, consistent with professional guidance from RICS (2025). Accordingly, the following hypothesis are proposed to address SRQ3:

***H4**: Professionalism positively influences trust in the valuation outcome.*

***H5**: Hybrid valuation support positively influences trust in the valuation outcome.*

***H6**: Trust positively influences perceived PVQ*

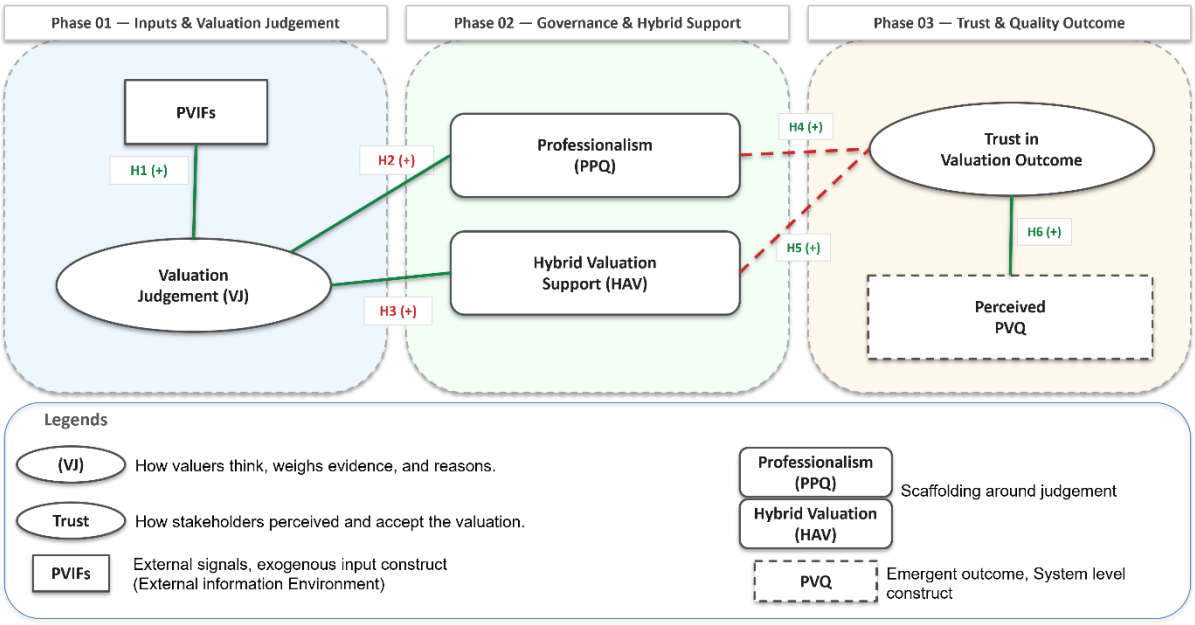


Figure 7.1: Multi-phase conceptual model of valuation decision-making and quality

Figure 7.2 shows that PVQ does not emerge directly from data and model alone. Instead, PVs first interpret market signals and valuation input factors through professional VJ, which shapes how standards are applied and how technology is used to support the valuation. For instance, a PVs reviews recent sales, rental demand, zoning rules, and flood risk to understand the property beyond its listed price. While an AVM may suggest a high value based on recent transactions, the PVs may identify a zoning change the system missed and adjust the figure, clearly explaining why. This explanation helps RAs manage seller and buyer expectations, enables RPIs and HBs to focus on the logic rather than just the number, and allows lenders to accept the valuation because the assumptions and risks are transparent. In this way, trust is formed through explanation and consistency, and PVQ is realised when the outcome is confidently used in real-world decisions.

7.3.2 Questionnaire Design and Data Collection

A questionnaire-based survey was employed following Saunders et al. (2009) to capture stakeholder perceptions related to RPV. The instrument first collected participant characteristics, including stakeholder role, professional experience, and prior residential property experience, to support stakeholder-based analysis. It then measured 91 valuation-related variables and additional constructs capturing VJ, professionalism, hybrid valuation support, trust in valuation outcomes, and perceived PVQ. All items were measured using a five-point Likert scale *(1 = not important to 5 = extremely important)*. The questionnaire was reviewed by academic researchers and industry practitioners to ensure clarity and content validity. Data were collected via the Qualtrics platform within the New Zealand residential property market. Purposive and snowball sampling were used to reach participants actively involved in valuation, purchasing, selling, and investment activities. After data screening, 112 valid responses were retained for analysis.

7.3.3 Sample Characteristics and Adequacy

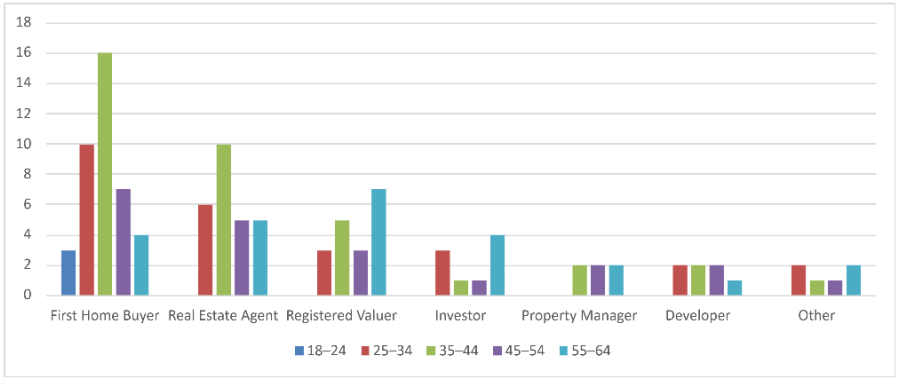
The final sample comprised a diverse range of stakeholder groups involved in residential property markets, including HBs, PVs, RAs, and RPIs. Figure 7.3 summarises respondent characteristics, including age distribution, prior property purchase experience, and years of professional experience. The sample size is appropriate for the empirical techniques employed. Prior methodological research indicates that EFA can be reliably conducted with samples exceeding 100 observations when factor loadings and communalities are adequate (Lorenzo-Seva & Ferrando, 2024). Cluster analysis prioritises heterogeneity and pattern identification rather than large sample sizes alone (Mooi & Sarstedt, 2011). In addition, PLS-SEM is well suited to complex models with moderate sample sizes, as it focuses on variance explanation and imposes minimal distributional assumptions (Hair et al., 2022). Based on established guidelines concerning the maximum number of structural paths directed at endogenous constructs, the sample size exceeds minimum requirements for the proposed analysis (Guenther et al., 2023).

7.3.4 Data Analysis

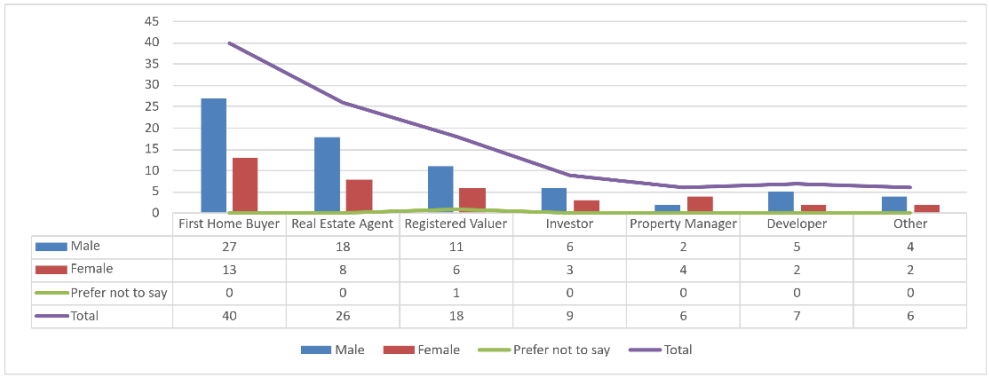
Prior to statistical modelling, the dataset was screened for completeness and suitability for multivariate analysis. Responses with substantial missing data were removed, and remaining items were examined to ensure sufficient variability. Sampling adequacy was assessed using

the Kaiser-Meyer-Olkin (KMO) measure, while Bartlett's Test of Sphericity was employed to confirm the appropriateness of the correlation matrix for EFA. KMO values exceeded the recommended threshold of 0.60 and Bartlett's Test was significant ($p < 0.001$), indicating suitability for EFA (Hair et al., 2022). EFA was conducted as the first analytical step to identify latent dimensions underlying RPV attributes. Principal axis factoring was selected due to its robustness for perception-based survey data that may deviate from normality, and promax rotation was applied to allow factor intercorrelations consistent with theory (Anna & Jason, 2005). Factor retention was guided by eigenvalues greater than one, scree plot inspection, and author considered a minimum loading of threshold of 0.45 items exhibiting substantial cross-loadings and weak conceptual relevance were removed iteratively to achieve a stable and interpretable factor structure.

Following factor extraction, factor scores were used as inputs for cluster analysis to explore heterogeneity in valuation priorities across respondents. A two-stage clustering procedure was adopted, comprising hierarchical clustering using Ward's method to identify natural groupings, followed by K-means clustering to refine cluster membership and enhance within-cluster homogeneity (Black & Babin, 2019). In results section, cluster solutions were evaluated based on centroid separation, internal coherence, and interpretability relative to stakeholder characteristics. The hypothesised relationships among valuation judgement, professional practice, hybrid valuation support, trust, and perceived PVQ were then examined using PLS-SEM in SmartPLS 4. PLS-SEM was selected due to its suitability for complex models, moderate sample sizes, and minimal distributional assumptions (Henseler et al., 2009). Model evaluation followed a two-step procedure assessing the measurement model (reliability and validity) and the structural model using bootstrapping for hypothesis testing (Tenenhaus et al., 2005).

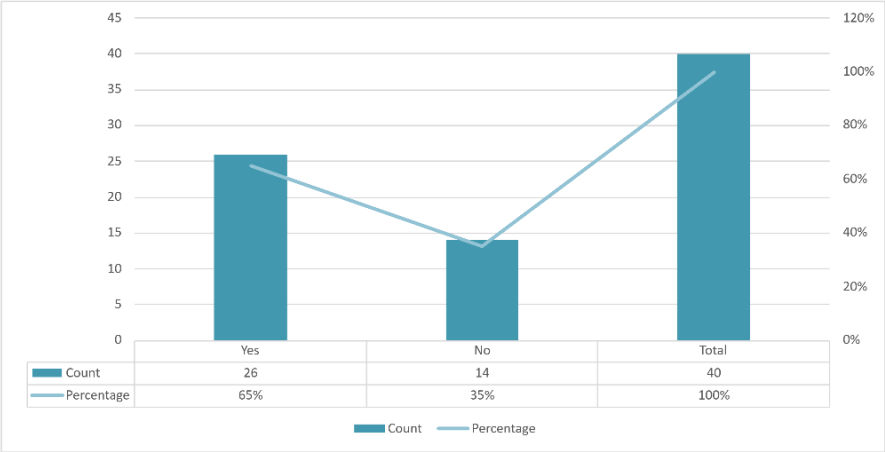


Age Distribution Across Stakeholder Groups (Years)



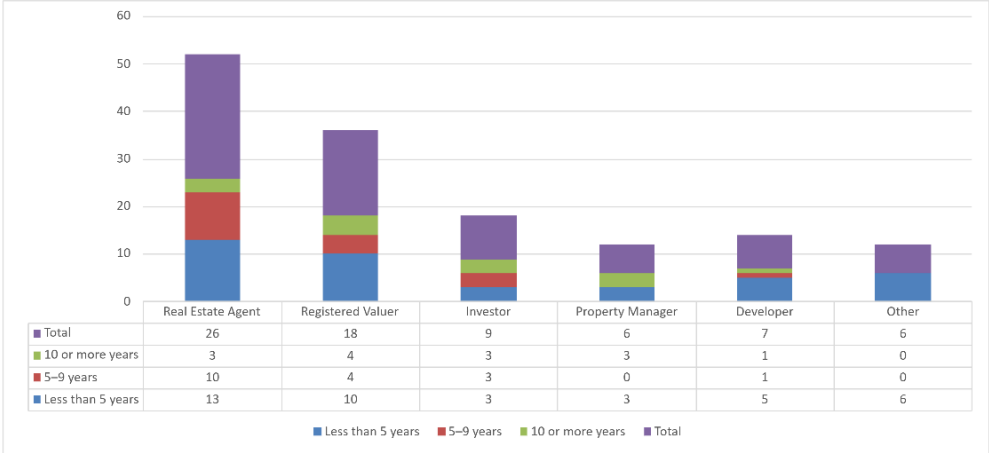
	First Home Buyer	Real Estate Agent	Registered Valuer	Investor	Property Manager	Developer	Other
Male	27	18	11	6	2	5	4
Female	13	8	6	3	4	2	2
Prefer not to say	0	0	1	0	0	0	0
Total	40	26	18	9	6	7	6

Distribution of respondents by stakeholder group and gender.



	Yes	No	Total
Count	26	14	40
Percentage	65%	35%	100%

Respondents with Prior Property Purchase Experience



	Real Estate Agent	Registered Valuer	Investor	Property Manager	Developer	Other
Total	26	18	9	6	7	6
10 or more years	3	4	3	3	1	0
5–9 years	10	4	3	0	1	0
Less than 5 years	13	10	3	3	5	6

Stakeholder Roles by Years of Experience

Figure 7.2. Overview of respondent demographics and stakeholder composition

7.4 Results and Discussion

7.4.1 Valuation Dimensions (RQ1)

This section presents the EFA results in Table 7.1 and discusses their conceptual meaning and implications for RPV practice. Prior to factor extraction, descriptive statistics, reliability and sampling adequacy were assessed to confirm the suitability of the data for EFA (Anna & Jason, 2005). Mean scores across PVIFs ranged from approximately 3.0 to 3.9, with acceptable standard deviations indicating sufficient response variability. Skewness and kurtosis values were within commonly accepted thresholds, suggesting no severe departures from normality. Internal consistency was satisfactory, with Cronbach's alpha exceeding 0.70 (Izah et al., 2023). In addition, the KMO measure met recommended levels and Bartlett's Test of Sphericity was significant ($p < 0.001$), confirming the appropriateness of the correlation matrix for factor extraction. Following data screening and adequacy checks, EFA was applied to the full set of 91 valuation-related variables to identify underlying structure of valuation considerations (Anna & Jason, 2005). Therefore, factors extraction was guided by eigenvalues greater than one, inspection of the scree plot, and interpretability of the resulting factor solution. Based on these criteria, six distinct PVIF's and two operationalisation constructs were retained, collectively explaining 85.7% of the total variance.

7.4.1.1 PVIF1: Locational Attributes

The first extracted PVIF in Table 7.1, location attributes, captures the combined influence of proximity to employment centres, public transport, schools, local services, sunlight exposures, and dwelling size. As the factor explaining the largest share of variance (35.9%; eigenvalue = 6.83), with all items exhibiting strong factor loadings (0.80 – 0.90), indicating a robust and coherent construct. its dominance highlights the central role of location-related considerations in RPV. Consistent with established real estate and urban economics research, this finding confirms that location is not treated as a single spatial characteristics but as a composite construct reflecting accessibility, neighbourhood quality and environmental comfort as also mentioned by Liu et al. (2025). The prominence of this PVIF reinforces long-standing valuation principles that position location as a primary anchor of value judgements and price expectations in RPV as aligned with Cellmer et al. (2024). The findings emphasise transparent communication of locational advantages in urban valuation practice (Gamage et al., 2025).

7.4.1.2 PVIF2: Dwelling Spatial Quality

The second PVIF, Dwelling Spatial Quality, captures functional and aesthetic characteristics of the built form, including layout efficiency, exterior appearance, quality of finishes, and interior design. This PVIF explains a further 10.3% of the variance (eigenvalue = 1.95), with strong loadings for layout and floor plan (0.90), exterior appearance (p.87), and quality of finishes (0.84), indicating a coherent spatial-quality construct. The emergence of this PVIF suggests that RPV extends beyond measurable structural attributes to incorporate perceptions of comfort, usability, and design appeal. This is consistent with behavioural evidence link spatial quality to perceived value (Alonso & Jacoby, 2023). Therefore, the prominence of this PVIF supports the view that RPV is partly shaped by lived spatial experience and social meaning, rather than derived solely from quantifiable physical metrics (Gamage et al., 2025). Practically, the findings suggest that RAs should clearly communicate design quality, while PVs should explain how spatial features influence their VJ.

7.4.1.3 PVIF3: Market and Regulatory Conditions

The third extracted factor, Market and Regulatory Conditions, captures affordability, zoning and planning regulations, mortgage interest rates, property taxation, and legal fees. This PVIF explains a further 8.43% of the variance (eigenvalue = 1.60), with strong loadings for affordability, zoning law, and property taxes (all ≥ 0.90), indicating a robust institutional-economic construct. The composition of this PVIF confirms that RPV is embedded within broader financial and regulatory frameworks, where policy settings and cost burdens shape perceived feasibility and investment risk. Consistent with housing economics research, these results indicate that VJ are not purely market-driven but are actively conditioned by regulatory constraints and financial risk exposure assessed by PVs and market participants (Zhao & Liu, 2023). This shows rising housing affordability pressures, where RPV reports should therefore clearly explain financial and regulatory conditions, particularly when market is unstable.

7.4.1.4 PVIF4: Condition and Functional Utility

The fourth extracted factor, Condition and Functional Utility, captures renovation history, construction quality, structural integrity, ventilation performance, energy efficiency, accessibility features, safety systems, and repair requirements. This PVIF explains a further 7.86% of the variance (eigenvalue = 1.46), with strong loadings for airflow and ventilation (0.92), construction quality (0.84), recent renovations (0.83), and structural integrity (0.81),

indicating a performance-oriented construct. Its composition suggests that VJ extend beyond point in time condition to consider long-term functionality, maintenance burden, and adaptability of the dwelling. This aligns with building science and asset management research, which emphasises lifecycle performance, durability, usability as key determinants of built-asset value as highlighted by recent work of (Wei & Peiser, 2025). The inclusion of accessibility and energy performance further reflects a market shift toward future proofing in ageing and climate-sensitive contexts (Goode et al., 2025).

7.4.1.5 PVIF5: Physical Safety

The fifth extracted factor, Physical Safety, encompasses property age, crime exposure, noise environment, security features, and fire safety systems. This PVIF explains 6.55% of the variance (eigenvalue = 1.25), with strong loadings for property age (0.84), safety (0.77), and crime rate (0.74), indicating a coherent risk-related construct. Consistent with residential choice and housing economics research, these results reflect the significant psychological and financial influence of safety and neighbourhood stability on value perceptions (Kallberg & Shimizu, 2025). This suggests that PVs consider wellbeing and risk, not just physical features. In practice, RPV reports should clearly explain safety and risk factors, especially for HBs and risk averse clients.

7.4.1.6 PVIF6: Sustainability and Environmental Resilience

The sixth extracted factor, Sustainability and Environmental Resilience, captures eco-friendly features, flood risk, stormwater management, passive solar design, climate change exposure, sustainable materials, proximity to green space, and thermal performance. This PVIF explains a further 5.96% of the variance (eigenvalue = 1.13), with strong loadings for solar features (0.89), and flood risk (0.86), indicating a coherent climate-performance construct. Its emergence reflects the growing influence of energy efficiency and climate resilience in RPV, consistent with recent evidence that environmental risks and sustainability attributes are increasingly capitalised into housing values (Goode et al., 2025). The presence of flood and climate-related variables also indicates that stakeholders internalise long-term environmental risk rather than focusing solely on current condition. These findings support recent valuation guidance emphasising sustainability and climate risk in valuation workflows, consistent with international valuation standard council (IVSC) sustainability standards and

professional expectations (IVSC, 2024) and the increasing integration of environmental, social and governance considerations into valuation standards (BRANZ, 2024).

7.4.1.7 PPQ: Professional practice quality

The seventh factor, professional practice quality (PPQ) (eigenvalue – 1.09; variance = 5.72%), comprises ethical standards, transparency, accuracy, and clarity of communication. Its emergence confirms that RPV is not solely technical exercise but also a relational and interpretive practice. These attributes shaped how valuation outcomes are understood, accepted, and trusted by market participants, particularly in contexts such as negotiation, lending, and investment risk assessment. Prior research highlights that a PVs ability to justify analytical choices and communicate uncertainty underpins professional credibility and perceived PVQ. (Amidu et al., 2021b).

Within Figure 7.2, professionalism is specified as a process-level governance mechanism while PPQ represents its empirically derived measurement form. Although both constructs draw on similar indicators, they operate at different levels: PPQ reflects the observable signals of professional behaviour embedded in valuation practice, whereas professionalism captures how these signals are enacted through VJ and translated into stakeholder trust and perceived PVQ.

7.4.1.8 HAV: Hybrid Automated Valuation

The eighth factor, hybrid automation valuation (HAV) (eigenvalue = 1.02; variance = 5.14%), captures the integration of AVMs as decision-support tools through indicators usage frequency, trust, data quality, decisions influence, and stakeholder reliance. The clustering of these indicators suggests that automation is not perceived as a substitute for professional expertise, but rather as an augmentative resource embedded within professional VJ. This reflects a hybrid valuation paradigm in which algorithmic efficiency is balanced with professional interpretation and accountability. Consistent with professional guidance, PVs retain responsibility for the final VJ even when automated tools are employed (BRANZ, 2024; IVSC, 2024). Recent research further indicates that acceptance of AVM-supported valuation depends less on automation itself and more on transparency, data governance, and interpretive oversight exercised by PVs (Liman et al., 2025).

Within Figure 7.2, hybrid valuation support is specified as a process-level, governance mechanism, while HAV represent its empirically derived, measurement level

operationalisation. Although both draw on overlapping indicators, they operate at different analytical levels: HAV captures the observable patterns of technology use and reliance in practice, where hybrid valuation support represents how these technological resources are strategically integrated through VJ to build a stakeholder trust and perceived PVQ.

Together, the six PVIFs show that RPV is a multidimensional process in which market, dwelling, regulatory, experiential, professional, and technological factors are integrated VJ. These results confirm that PVQ is shaped by professional interpretation and stakeholder trust, rather than by technical inputs alone. The EFA results provided empirical support for Figure 7.2 consolidating the initially proposed PVIFs into six empirically coherent dimensions corresponding to the specified sub-hypotheses. In addition, indicators related to professionalism identified as professional valuation governance (PPQ) and hybrid valuation support identified as hybrid automated valuation (HAV), loaded consistently with their theoretically defined constructs, supported their inclusion in subsequent structural analysis.

Table 7.1: EFA-derived factor structure of valuation influencing factors

Factor	Item	Loading
PVIF1 — Locational attributes	Proximity to Work (PW)	0.90
	Proximity to Public Transport (PPT)	0.89
	Sunlight Exposure (SE)	0.87
	Size and Space (SS)	0.86
	Local Services (LS)	0.82
	Proximity to School (PS)	0.80
	Eigenvalue	**6.83**
	Variance (%)	**35.9**
	Cumulative Variance (%)	**35.9**
PVIF2 — Dwelling spatial quality	Layout and Floor Plan (LFP)	0.90
	Exterior Appearance (EA)	0.87
	Quality of Finishes (QF)	0.84
	Interior Design (ID)	0.57
	Eigenvalue	**1.95**
	Variance (%)	**10.3**
	Cumulative (%)	**46.2**
PVIF3 — Market regulatory conditions	Affordability (AF)	0.90
	Zoning Law (ZL)	0.90
	Property Taxes (PT)	0.90
	Mortgage Rates (MR)	0.86
	Legal Fees (LF)	0.76
	Eigenvalue	**1.60**
	Variance (%)	**8.43**
	Cumulative (%)	**54.6**
PVIF4 — Condition and functional utility	Airflow and Ventilation (AV)	0.92
	Construction Quality (CQ)	0.84
	Recent Renovations (RR)	0.83

	Energy Efficiency of Property (EEP)	0.82
	Air Conditioning (AC)	0.81
	Structural Integrity (SI)	0.81
	Accessibility Features (AF)	0.53
	Immediate Need for Repair (INR)	0.46
	Eigenvalue	**1.46**
	Variance (%)	**7.68**
	Cumulative (%)	**62.3**
PVIF5 — Physical safety	Age of Property (AP)	0.84
	Safety (SF)	0.77
	Crime Rate (CR)	0.74
	Noise Level (NL)	0.71
	Security Features (SF)	0.69
	Fire Safety System (FSS)	0.64
	Eigenvalue	**1.25**
	Variance (%)	**6.55**
	Cumulative (%)	**68.9**
PVIF6 — Sustainability and Environment	Eco-Friendly Features (EFF)	0.89
	Flood Risks (FR)	0.86
	Stormwater Management (SM)	0.80
	Passive Solar Design (PSD)	0.75
	Climate Change (CC)	0.69
	Sustainable Materials (SM)	0.65
	Proximity to Green Space (PGS)	0.61
	Thermal Performance (TP)	0.59
	Eigenvalue	**1.13**
	Variance (%)	**5.96**
	Cumulative (%)	**74.8**
PPQ— Professional practice quality	Ethical Standards (ES)	0.69
	Transparency (TRANS)	0.67
	Accuracy (ACC)	0.65
	Communication (COM)	0.62
	Eigenvalue	**1.09**
	Variance (%)	**5.72**
	Cumulative (%)	**80.6**
HAV — Hybrid-automated valuation	Usage Frequency (UF)	0.87
	Trust (TRU)	0.85
	Decision Support (DS)	0.82
	Data Quality (DQ)	0.79
	Stakeholder Reliance (SR)	0.76
	Clients Acceptance (CA)	0.72
	Eigenvalue	**1.02**
	Variance (%)	**5.14**
	Cumulative (%)	**85.7**

7.4.2 Stakeholders Segmentation (RQ2)

Building on the six PVIFs identified through EFA, the model also incorporates PPQ and HAV as the empirical operationalisations of the theoretical constructs of professionalism and hybrid valuation support. This integration ensures that the framework captures not only external valuation inputs, but also the governance and technological mechanisms through which VJ is

enacted in practice. To examine whether respondents interpret and prioritise these valuation inputs in a uniform manner, cluster analysis was employed to address RQ2. Following He (2025) Hopkin statistic (mean H = 0.604) in Figure 7.4 confirmed that the data exhibit a meaningful clustering tendency, indicating the valuation priorities are structured rather than randomly distributed across the sample. Hierarchical clustering using Ward's method, followed by k-means refinement, was therefore applied to identify internally coherent groups based on similarities in PVIF weighting patterns.

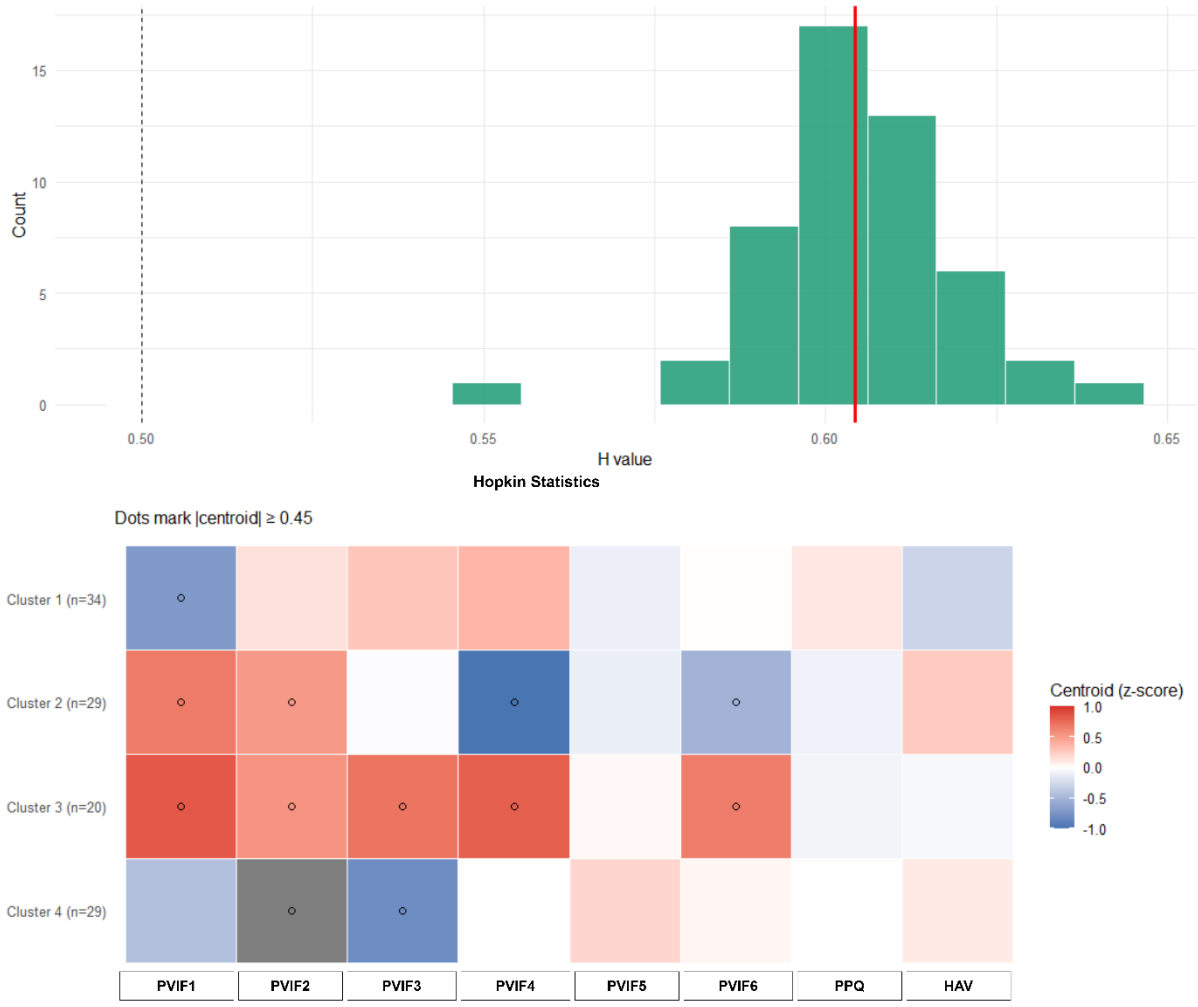


Figure 7.3. Evaluation of cluster tendency and k-means centroid patterns across PVIF dimensions

The resulting centroid in Figure 7.4, and the reinforcing and weakening pathways illustrated in Figure 7.5, demonstrate that valuation inputs do not exert consistent influence across all respondents. Instead, the findings reveal systematic variation in how market signals, professional governance attributes, and hybrid technological support are interpreted and weighted within the valuation process. This provides empirical support for the framework's

central assumption that valuation is not a mechanically applied model, but a judgement-driven process shaped by different priority logics operating across stakeholders. Collectively, these results justify the positioning of VJ as a mediating mechanism between valuation inputs and downstream outcomes and reinforce the role of professionalism (PPQ) and hybrid valuation support (HAV) as contextual forces that structure how valuation reasoning is formed, communicated, and ultimately trusted. This evidence aligns with the process-oriented structure presented in Figure 7.2, in which PVQ emerges as a system-level outcome of interpreted information, governed practice, and augmented professional decision-making rather than direct data application alone.

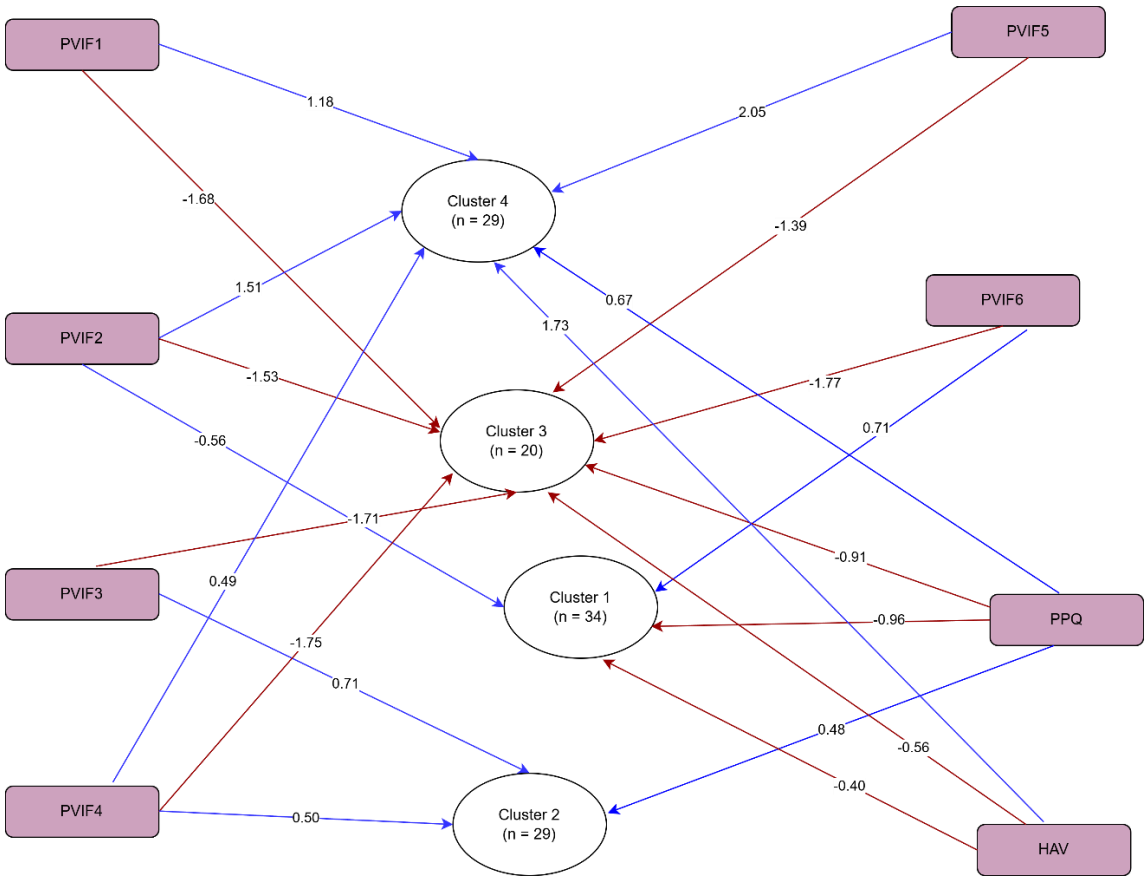


Figure 7.5. Cluster network map illustrating how PVIFs positively and negatively influence each cluster.

7.4.3 Valuation Judgement Formation (RQ3)

Prior to hypothesis testing, the measurement model was evaluated to ensure the reliability and validity of all constructs used across the structural phases. To address SRQ1 (Phase 01), the VJ was operationalised as a reflective construct capturing clarity, confidence, and consistency in valuation reasoning, and six empirically derived PVIFs identified through EFA

were specified as exogenous constructs predicting VJ using PLS-SEM. Across Phase 01 – 03, all retained indicators loaded above the recommended threshold of 0.70, confirming satisfactory indicator reliability, while Cronbach's alpha and composite reliability values exceeded 0.70, indicating strong internal consistency (Hair, 2014; Hair Jr et al., 2021). Convergent validity was supported, with average variance extracted (AVE) values exceeding the 0.50 benchmark for all constructs, with the exception of professionalism as also identified via EFA as named PPQ in Table 7.1, which was retained due to strong theoretical grounding in literature and high indicator loadings, an approach supported in PLS-SEM when theoretical relevance is robust as guided by Hair (2014). Discriminant validity was established using the Fornell-Larcker criterion with square roots of AVE exceeding inter-construct correlations values below the conservative threshold of 0.85 (G. W. Cheung et al., 2024; Fornell & Larcker, 1981). Collectively, these results confirm that the measurement model demonstrates adequate reliability and validity, providing a robust foundation for the phase-specific structural model analysis addressing SRQ1, SRQ2, and SRQ3 (Table 7.2 – 7.7).

7.4.3.1 Effects of PVIFs

Following confirmation of the measurement model (Table 7.2 and 7.3), the structural model was assessed to test H1, and its sub-hypothesis as modified after EFA results (H1a – H1f) examining whether PVIFs positively shape VJ. Hypothesis testing was conducted using bootstrapping with 5,000 resamples in SmartPLS 4, consistent with established PLS-SEM guidelines for two-tailed significance testing (Hair, 2014). As reported in Table 7.4 and illustrated in Figure 7.6, all six PVIFs dimensions exerted positive and statistically significant effects on VJ ($p < 0.01$, two-tailed), providing full support for H1 and its sub hypothesis. PVIF2 exhibited the strongest effect on VJ ($\beta = 0.354$), highlighting the importance of internal layout, design coherence, and functional usability in VJ. PVIF4 also demonstrated a substantial influence ($\beta = 0.349$), indicating that assessments of building performance, maintenance state, and long-term usability are central to valuation reasoning. In addition, PVIF6 showed a strong positive effect ($\beta = 0.333$), confirming the growing integration of climate risk and environmental performance into contemporary valuation practice. PVIF1 ($\beta = 0.280$) and PVIF3 ($\beta = 0.257$) further contributed significantly to VJ, reflecting the continued relevance of accessibility, neighbourhood context, affordability, and regulatory constraints. PVIF5 also exhibited a meaningful, though comparatively smaller, effect ($\beta = 0.231$), indicating the role of risk minimisation and perceived safety in valuation decisions. Overall, these findings

demonstrates that VJ is shaped by a multidimensional configuration of all PVIFs, rather than by any single dominant attribute, providing strong empirical support for H1 and aligning with prior valuation decisions-making research (Levy & Schuck, 2005).

Table 7.2: Measurement Model Evaluation - Phase 1

Construct	Indicator	Factor Loading	Cronbach's Alpha	Composite Reliability	AVE
PVIF1	Local Services	0.867	0.912	0.970	0.868
	Proximity to Public Transport	0.844			
	Proximity to School	0.813			
	Proximity to Work	0.795			
	Size and Space	0.844			
	Sunlight Exposure	0.814			
PVIF2	Exterior Appearance	0.766	0.777	0.879	0.596
	Interior Design	0.757			
	Layout and Floor Plan	0.816			
	Quality of Finishes	0.747			
PVIF3	Affordability	0.792	0.885	0.899	0.588
	Legal Fees	0.738			
	Mortgage Rates	0.845			
	Property Taxes	0.753			
	Zoning Law	0.698			
PVIF4	Accessibility Features	0.778	0.918	0.923	0.574
	Air Conditioning	0.757			
	Airflow & Ventilation	0.713			
	Construction Quality	0.759			
	Energy Efficiency	0.766			
	Fire Safety System	0.772			
	Immediate Repair	0.706			
	Recent Renovations	0.771			
	Structural Integrity	0.783			
PVIF5	Age of Property	0.747	0.884	0.901	0.657
	Crime Rate	0.792			

	Fire Safety System	0.809			
	Noise Level	0.816			
	Safety	0.818			
	Security Features	0.782			
PVIF6	Climate Change Risk	0.772	0.892	0.912	0.565
	Eco-Friendly Features	0.685			
	Flood Risks	0.826			
	Passive Solar Design	0.687			
	Proximity to Green Space	0.814			
	Stormwater Management	0.714			
	Sustainable Materials	0.719			
	Thermal Performance	0.781			
VJ	VJ Clarity	0.775	0.747	0.856	0.664
	VJ Confidence	0.861			
	VJ Consistency	0.807			

Table 7.3: Discriminant validity assessment using the Fornell–Larcker criterion - Phase 1

Constructs	**PVIF1**	**PVIF2**	**PVIF3**	**PVIF4**	**PVIF5**	**PVIF6**	**VJ**
PVIF1	**0.830**						
PVIF2	0.030	**0.772**					
PVIF3	–0.098	–0.052	**0.767**				
PVIF4	–0.017	0.205	–0.054	**0.758**			
PVIF5	0.079	–0.042	–0.096	0.070	**0.794**		
PVIF6	–0.039	0.058	0.120	–0.047	–0.134	**0.752**	
VJ	0.265	0.430	0.210	0.404	0.193	0.326	**0.815**

Table 7.4: Hypothesis testing results for PVIFs and valuation judgement

Hypothetical Path	**Path Coefficient (β)**	**Sample Mean (M)**	**SD**	**t-value**	**p-value**	**Interpretation**
H1a: PVIF1 -> VJ	0.280	0.279	0.063	4.459	0.000	Supported
H1b: PVIF2 ->VJ	0.354	0.345	0.051	6.957	0.000	Supported
H1c: PVIF3 -> VJ	0.257	0.253	0.080	3.200	0.001	Supported
H1d: PVIF4 -> VJ	0.349	0.342	0.051	6.850	0.000	Supported
H1e: PVIF5 -> VJ	0.231	0.225	0.074	3.136	0.002	Supported

H1f: PVIF6 -> VJ	0.333	0.327	0.062	5.383	0.000	Supported

7.4.3.2 Professional and Hybrid Outcomes

Building on the findings of SRQ1, which demonstrated that VJ is shaped by a multidimensional configuration of PVIFs, SRQ2 examines whether this judgement translates into broader professional and technological outcomes within valuation practice which is also identified in RQ1 via EFA results (PPQ and HAV). In the measurement model, professionalism is operationalised through the empirically derived factor PPQ, while hybrid valuation support is operationalised through the factor HAV, both capturing the observable behavioural, communicative, and technological indicators specified in Figure 7.2. Specifically, Phase 02 investigates whether stronger VJ is associated with higher perceived professionalism and greater confidence in hybrid support. This phase addresses a notable gap in valuation research, where the link between judgement quality, professional conduct, and the effective integration of valuation technologies is often assumed rather than empirically tested (RICS, 2025). Before hypothesis testing, the measurement model was assessed to confirm reliability and validity, as shown in Table 7.5 and 7.6. Furthermore, the AVE value for PPQ was 0.308, which is below the recommended threshold of 0.50, indicating limited convergent validity for this construct. While reliability values were within acceptable ranges, the low AVE suggests that the indicators may sufficiently capture the latent variance of PPQ.

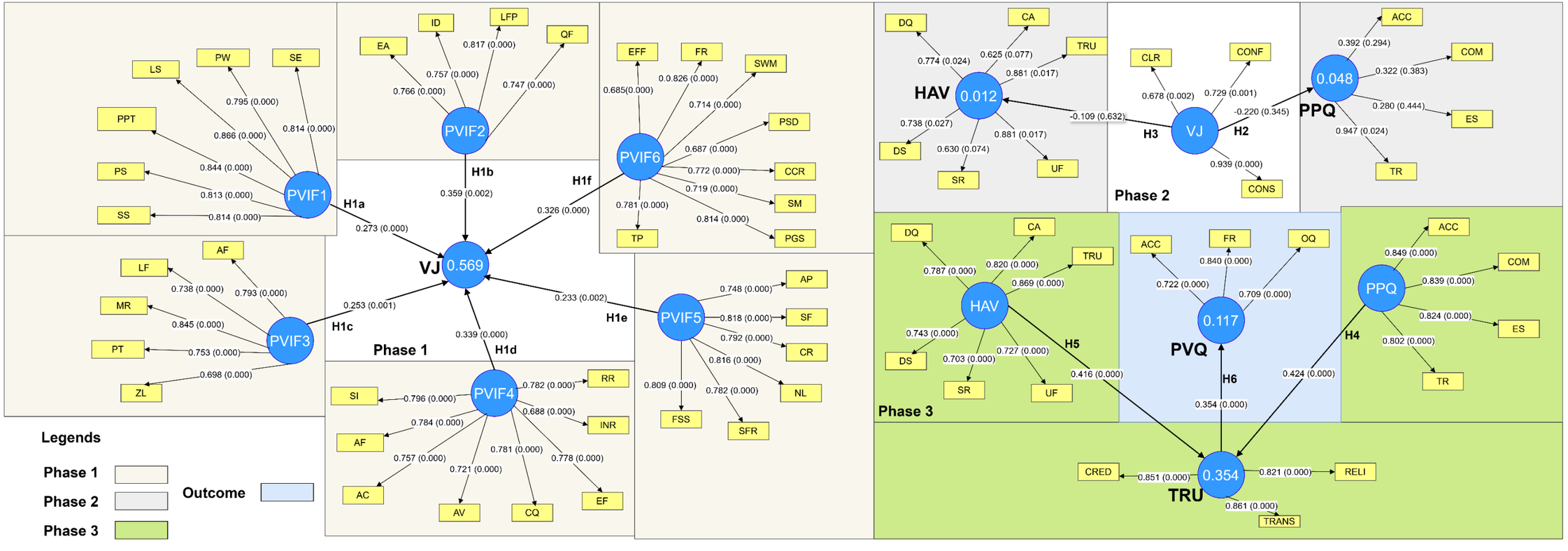


Figure 7.4. PLS-SEM structural relationships among valuation judgement, professionalism, hybrid valuation support, and trust

Table 7.5: Measurement Model Evaluation - Phase 2

Construct	Indicator	Factor Loading	Cronbach's Alpha	Composite Reliability	AVE
PPQ	Accuracy	0.392	0.849	0.576	0.308
	Communication	0.322			
	Ethical Standards	0.280			
	Transparency	0.947			
HAV	Client Acceptance	0.625	0.872	0.862	0.515
	Data Quality	0.774			
	Decision Support	0.738			
	Stakeholder Reliance	0.630			
	Trust	0.617			
	Usage Frequency	0.881			
VJ	VJ Clarity	0.678	0.747	0.830	0.624
	VJ Confidence	0.729			
	VJ Consistency	0.939			

Table 7.6: Discriminant validity assessment using the Fornell–Larcker criterion - Phase 2

Construct	PPQ	HAV	VJ
PPQ	**0.555**		
HAV	-0.058	**0.717**	
VJ	-0.220	-0.109	**0.790**

The structural relationships hypothesised in phase 2 were evaluated using PLS-SEM with bootstrapping (5,000 resamples), with results reported in Figure 7.6 and Table 7.7. Contrary to expectation, VJ did not exhibit a significant effect on either perceived professionalism or hybrid valuation support. The path from VJ to professionalism in Figure 7.2 was negative and statistically non-significant ($\beta = -0.220$, $p = 0.345$), indicating that higher clarity, confidence, and consistency in VJ do not necessarily translate into stronger perceptions of ethical conduct, transparency and communication quality. Similarly, the relationship between VJ and hybrid support was weak and non-significant ($\beta = -0.109$, $p = 0.632$), suggesting that quality of VJ does not meaningfully influence trust in reliance on, or use of valuation technologies. These findings indicate a clear decoupling between VJ and broader professional and technological perceptions. While phase 1 confirms that VJ plays a central role in shaping valuation reasoning

and Phase 2 suggests that professionalism and technology-related trust are not direct cognitive extensions of judgement quality. Instead, these dimensions reflect institutional and system level conditions rather than individual judgement alone. This interpretation aligns with prior research highlighting that professional credibility, rather than purely judgement driven. Taken together, the phase 2 results challenge the implicit assumption within valuation practice that stronger valuation report (VJ) automatically enhances perceived professionalism or confidence in valuation technologies. Instead, they point toward a layered valuation system in which VJ operates primarily at the cognitive level with experience, while professionalism and hybrid system acceptance are governed by broader structural and institutional logics (Liman et al., 2025). This finding provides a critical transition to phase 3, where trust is examined as a distinct construct shaping perceived PVQ and where stakeholder differences are explicitly considered.

Table 7.7: Hypothesis testing results for Phase 02

Hypothetical Path	Path Coefficient (β)	Sample Mean (M)	SD	t-value	p-value	Interpretation
H2: VJ -> PPQ	-0.220	-0.052	0.232	0.945	0.345	Not supported
H3: VJ -> HAV	-0.109	-0.021	0.227	0.480	0.632	Not supported

7.4.3.3 Determinants of Trust in Hybrid Valuation

Building on SRQ1, which established that VJ is shaped by a multidimensional configuration of PVIFs, SRQ2 examined whether this judgement translates into broader professional and technological outcomes within valuation practice. Although, Phase 02 did not provide empirical support for a direct relationship between VJ and either perceived professionalism or hybrid valuation support, this finding does not contradict valuation theory. Rather, it suggests that professionalism and technology-related perceptions may not function as immediate cognitive extensions of VJ, but are instead shaped by more stable institutional, regulatory, and system level conditions (Kasim et al., 2024). From theoretical perspective, this decoupling implies that the influence of professional conduct and hybrid valuation practices on valuation outcomes may operate indirectly, through trust in PVQ is formed within hybrid human-AI valuation environments (RICS, 2022). Therefore, Phase 03 positions trust as a mediating construct through which professional valuation standards and hybrid valuation support shape confidence in valuation outcomes when human expertise and AI-enabled tools re jointly employed. Trust is conceptualised as perceptions of credibility, reliability, and

transparency, consistent with valuation and decisions support literature (Amidu, Levy, Bolomope, & Liman, 2024).

Table 7.8: Measurement Model Evaluation - Phase 3

Construct	Indicator	Factor Loading (Modified)	Cronbach's Alpha	Composite Reliability	AVE
PPQ	Accuracy	0.849	0.849	0.898	0.687
	Communication	0.839			
	Ethical Standards	0.824			
	Transparency	0.802			
HAV	Client Acceptance	0.820	0.872	0.901	0.604
	Data Quality	0.787			
	Decision Support	0.743			
	Stakeholder Reliance	0.703			
	Trust	0.869			
	Usage Frequency	0.727			
PVQ	Accuracy	0.722	0.649	0.682	0.576
	Fairness	0.840			
	Overall Quality	0.709			
TRUST	Trust Credibility	0.858	0.799	0.882	0.713
	Trust Reliability	0.823			
	Trust Transparency	0.853			

Table 7.9: Discriminant Validity – Fornell–Larcker Criterion (Phase 03)

Constructs	PPQ	HAV	PVQ	TRUST
PPQ	**0.829**			
HAV	0.037	**0.777**		
PVQ	0.269	0.170	**0.759**	
TRUST	0.440	0.431	0.354	**0.845**

The phase 3 structural model results presented in Table 7.10 and Figure 7.6 show that both PPQ (professionalism) and HAV (hybrid valuation support) exert strong, positive, and statistically significant effects on trust in valuation outcomes. PPQ demonstrates a substantial influence on trust ($\beta = 0.425$, $t = 6.797$, $p < 0.001$), indicating that ethical conduct, transparency, analytical clarity, and effective communication remain central to the credibility

of valuation practice, consistent with established valuation research and professional guidance.(Crosby, 2000; RICS, 2022). Similarly, HAV exhibits a comparably strong and significant effect on trust (β = 0.415, t = 6.575, p < 0.001), suggesting that stakeholders increasingly anchor their confidence in valuation outcomes on the quality, reliability, and decision-support capabilities of automated and data-driven systems. This finding aligns with recent literature on hybrid human-Ai decision environments, which emphasise that trust is co-produced through the interaction of expert judgement and transparent, explainable technological support rather than through professional expertise alone. (Liman et al., 2025). Finally, trust itself is shown to significantly influence perceived PVQ (β = 0.354, t = 4.447, p < 0.001), confirming its role as a key mediating mechanism linking professional governance and hybrid support to valuation outcomes. Collectively, these results indicate that PVQ emerges downstream of VJ through the joint and reinforcing effects of professional practice and hybrid technological support on stakeholder trust, as summarised in Table 7.10 and Figure 7.6. Collectively, the findings indicate that trust forms downstream of VJ via the joint influence of institutional professionalism and AI-enabled valuation support.

Table 7.10: Hypothesis testing results for Phase 03

Hypothetical Path	Path Coefficient (β)	Sample Mean (M)	SD	t-value	p-value	Interpretation
H4: PPQ -> TRUST	0.425	0.432	0.062	6.797	0.000	Supported
H5: HAV -> TRUST	0.415	0.424	0.063	6.575	0.000	Supported
H6: TRUST -> PVQ	0.354	0.371	0.080	4.447	0.000	Supported

Taken together, the findings for RQ3 indicates that trust in RPV is not generated directly from VJ alone but emerges through broader professional and institutional mechanisms (Amidu et al., 2021b). While SRQ1 confirms that VJ is shaped by a multidimensional configuration of PVIFs, SRQ2 demonstrates that judgement quality does not automatically translate into perceptions of professionalism or confidence in valuation technologies, consistent with literature that views professionalism as institutionally governed rather than individually derived (Amidu, Levy, Bolomope, & Liman, 2024; Gamage et al., 2025). SRQ3 resolves this disconnect by showing that trust is formed downstream of judgement through the combined influence of professional standards and hybrid valuation support, aligning with valuation research that emphasises ethical conduct, transparency, and accountability as central to valuation credibility (Amidu, Levy, & Kasim, 2025a). This significant role of hybrid valuation

support further reflects emerging evidence that trust in valuation outcomes is increasingly shaped by data quality, system, transparency, and explainable decision support rather than by expert judgement in isolation (Cellmer et al., 2024). Across the multi-stage model, the explanatory power of the endogenous constructs is assessed using R^2 values, following established PLS-SEM guidelines. The results indicate moderate to substantial explanatory power across phases, with VJ achieving 0.569, trust in valuation outcomes explaining 0.354 of variance, along with PVQ explaining 0.11 and professionalism and hybrid valuation support showing smaller but meaningful R^2 values. Consistent with Chin et al. (2003) benchmarks where R^2 values of approximately 0.65, 0.33, and 0.19 represent substantial, moderate, and weak exploratory power, these results are appropriate for complex, behaviourally grounded models. The Overall, these findings align with a growing bod of literature that views trust as socially and institutionally embedded through the interaction of professional norms and technology-enabled valuation systems rather than from technical accuracy or individual expertise alone.

7.5 Integrated Valuation Decision Process Framework

This study proposes the IVDPF framework as a process-oriented explanation of how PVQ is formed within hybrid human-AVM systems. As illustrated in Figure 7.7, the framework reconceptualises valuation not as a linear transformation of market data into a price estimate, but as a multi-stage decision and governance process in which valuation outcomes emerge through the interaction of information quality, professional VJ, institutional alignment, and stakeholder trust. In phase 1, the framework positions valuation inputs within a broader information quality environment, where external data, AVM pre-estimates, and local market knowledge are interpreted rather than mechanically applied. This aligns with behavioural valuation research that emphasises valuation as an interpretive practice shaped by cognitive reasoning, professional experience, and contextual awareness rather than the aggregation of objective variables alone. (French & Gabrielli, 2018). The empirical findings support this perspective by demonstrating that PVIFs inform VJ indirectly, operating through clarity of reasoning, confidence, and internal consistency rather than exerting a direct, deterministic effect on valuation outcomes.

Phase 2 represents the central operational layer of the IVDPF, where VJ is mediated through professionalism and hybrid valuation support. The results indicate that judgement quality

alone is insufficient to generate trusted valuation outcomes unless it is embedded within transparent professional conduct and supported by accountable, explainable decision-support systems. This finding challenges assumptions in both traditional valuation practice and AVM-centred research that improvements in model accuracy and professional expertise independently lead to higher PVQ. Instead, the framework reflects a sociotechnical alignment perspective, where human reasoning, institutional procedures, and technological systems must operate in concert to produce defensible and legitimate valuation decisions (Kasim et al., 2025a; Klamer et al., 2017). The positioning of professionalism and hybrid supports as governance mechanisms reinforces the view that valuation credibility is shaped as much by how decisions are explained, documented, and validated as by the numerical estimate themselves. While phase 2 demonstrates the mediating role of professionalism and hybrid support, the measurement assessment indicated below-threshold convergent validity for the PPQ construct. This suggests that PVQ may operate as a multidimensional and perceptual construct, where shared variance across indicators is inherently distributed across governance, contextual, and professional dimensions. Therefore, the structural relationships should be interpreted with methodological caution and warrant further refinement in future empirical validation.

Phase 3 positions trust as the central mediating mechanism linking valuation processes to market and institutional outcomes. The empirical results demonstrate that both professionalism and hybrid valuation support exert strong, positive and statistically significant effects on trust formation, which in turns influences perceived PVQ. This finding extends AVM research by showing that stakeholder confidence does not arise from automation or professional authority alone, but from the interpretability, transparency, and governance of hybrid valuation systems. This aligns with recent work on explainable and accountable AI in professional decision-making, which emphasises that trust is co-produced through the interaction of expert judgement and transparent technological support (Amidu, 2011; Kasim et al., 2025a).

Overall, the IVDPF synthesises the empirical findings into a coherent input-process outcome architecture structured around a core decision spine that explains how PVQ is formed in practice rather than produced mechanically. The outcome stage captures how these processes culminate in stakeholder trust and informed decision outcomes, which collectively

define perceived PVQ. The decision impact journey illustrates how this trust-driven process improves market behaviour by enabling more responsible transactions, balanced lending and investment decisions, and reduced risk across stakeholder groups. In parallel, the knowledge advancements pathway highlights the study' theoretical contribution by extending valuation research beyond accuracy-centred paradigms towards hybrid governance-oriented understanding of evolution as a transparent, socially situated, and continuously learning decision system that integrates professional VJ with data-driven support.

7.5.1 Practical and Policy Implications

In practice, the framework shows that a valuation does not begin with a price, but with the quality of information that enters the system. Market data, AVM pre-estimates, and local knowledge for the initial inputs, but these signals only become meaningful once they pass through professional VJ. PVs interpret, challenge, and explain this information, transforming model outputs into defensible reasoning rather than mechanical numbers. This "core decision spine" highlights how professionalism and hybrid decision support work together to identify anomalies, document uncertainty, and align automated insights with institutional standards and local market realities.

For industry, this process clarifies why trusted valuation outcomes depend on transparency and accountability, not just model accuracy. Banks, investors, and home buyers do not rely on the final figure; they respond to the logic, assumptions, and consistency between automated tools and human judgement. As a result, decisions about lending, pricing, and investment become more confident and less exposed to hidden risks.

From a policy perspective, the framework reframes property valuation as a governance process rather than a technical output. It suggests that professional standards, data quality requirement and expectations for explainability should be embedded alongside the adoption of AVMs. By positioning trust as the central mechanism linking VJ to market action, the framework provides a basis for regulatory guidance that promote transparency, ethical practice, and responsible use of AI in valuation. At the knowledge level, it advances valuation theory by moving beyond accuracy metrics toward a process-oriented understanding of how valuation quality emerges through sociotechnical interaction between data, professionals, and institutions.

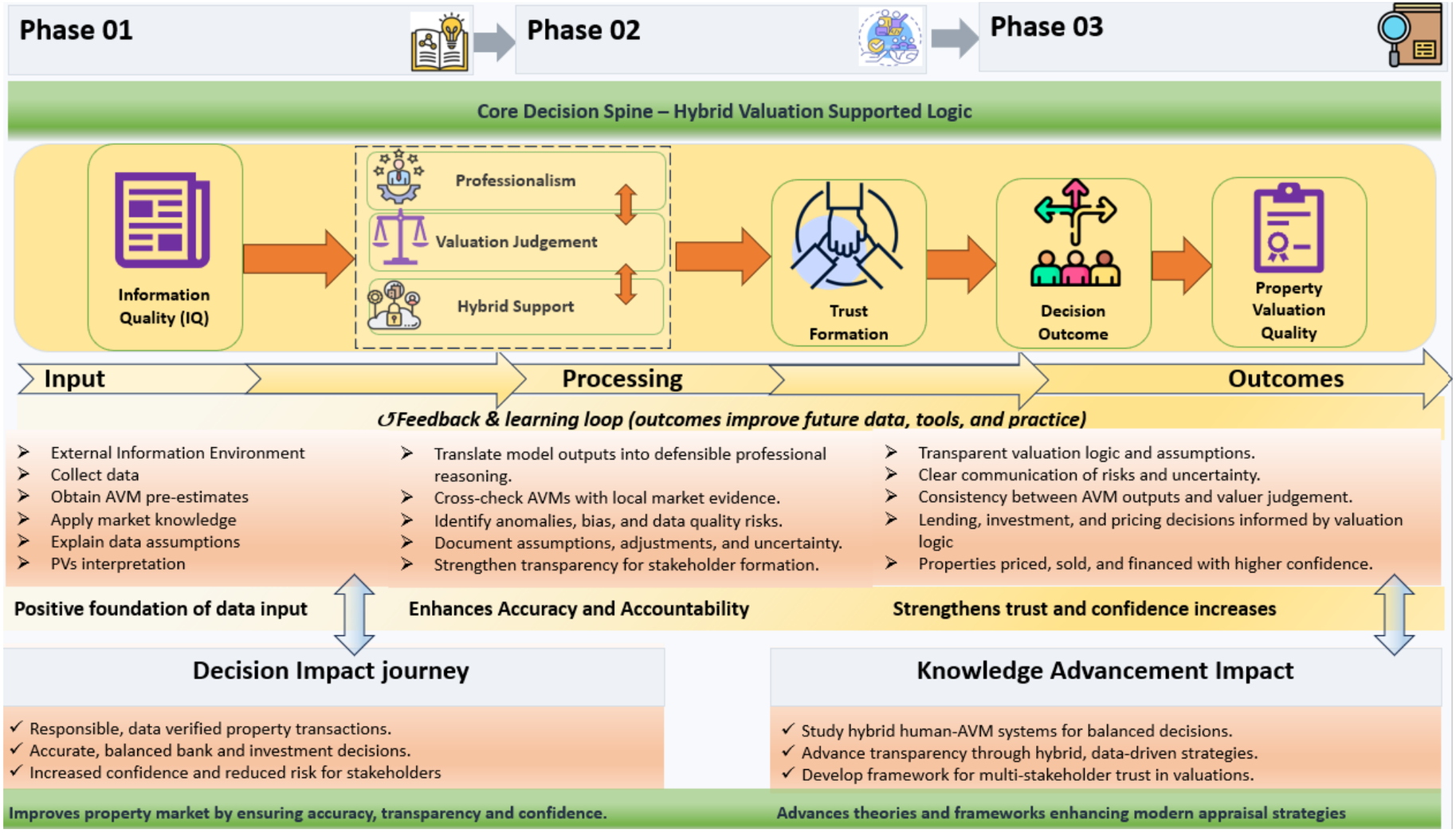


Figure 7.7: Integrated Valuation Decision Process Framework (IVDPF) illustrating the multi-stage formation of property valuation quality (PVQ)

7.6 Conclusion

This study demonstrates that PVQ emerges through a multi-stage valuation process rather than as a direct technical output of valuation models. Valuation inputs shape professional judgement, which is operationalised through professionalism and hybrid valuation support, and ultimately legitimised through stakeholder trust. The findings indicate that technological systems enhance PVQ only when embedded within transparent governance structures and accountable professional practice. In this sense, PVQ is not determined solely by predictive accuracy, but by the credibility, interpretability, and contextual alignment of hybrid human-ABM systems. By positioning trust as the central mediating mechanism, the study advances valuation research beyond accuracy-driven paradigms toward a process-oriented and socio-technical understanding of how PVQ is formed across stakeholder contexts.

Despite these contributions, several limitations should be acknowledged, First, the empirical findings are based on cross-sectional data, which limits the ability to examine how trust evolves over time within AI-integrated valuation environments. Second, while the framework integrates qualitative and quantitative evidence, the measurement assessment indicated below threshold convergent validity for the PPQ construct, suggesting that further refinement of PVQ measurement dimensions is required. Third, the study is situated within a specific institutional and regulatory contexts, which may limit generalisability across jurisdictions with differing governance structures, professional standards, and level of AVM adoption.

Future research should therefore extend the framework through longitudinal analysis to capture dynamic trust formation processes and validate the structural relationships over time. Cross-jurisdictional comparative studies would help assess the applicability of the framework across different regulatory and market systems. Additionally, expert-based validation and refinement of PVQ dimensions could strengthen construct robustness and enhance the operational deployment of hybrid valuation systems in practice.

EPILOGUE – PART THREE

This section of the thesis advances the research from conceptual development to empirical substantiation, systematically integrating qualitative interpretation with quantitative validation and achieved objective 2 and objective 3 along with related RQs. CHAPTER 06 generated in-depth qualitative evidence through stakeholder engagement, elucidating how VJs are formed, interpreted, and negotiated within professional and market contexts following RQ1 to RQ5 for objective 2. The findings identified the interactive roles of PVIFs, professional VJ, hybrid digital decision-support mechanisms, and trust formation across differentiated stakeholder groups. On this basis, six SPs and Ops were formulated to operationalise PVQ within a hybrid human-technology governance structure. These principles articulated the contextual, institutional, and communicative conditions under which valuation reasoning gains legitimacy and stakeholder acceptance in real-world residential markets.

Building on these qualitative insights, CHAPTER 07 subjected the proposed relationships to rigorous quantitative testing using PLS-SEM and answered RQ1 to RQ3 objective 3. The statistical analysis empirically examined the pathways linking PVIFs, professional VJ, hybrid support mechanism, and trust to perceived PVQ, thereby evaluating the explanatory structure of the framework. The results provided model-based confirmation that PVQ functions as process-oriented, trust-mediated construct shaped by the interaction of professional reasoning, digital support, and stakeholder interpretation, rather than as a direct outcome of technical accuracy alone.

Collectively, CHAPTER 06 and CHAPTER 07 complete the empirical investigation of the study by triangulating interpretive stakeholder evidence with quantitative structural validation. This integrated empirical foundation provides the basis for the subsequent development of the stakeholder-centric modular hybrid PVQ framework, its expert evaluation, and the interpretation of its theoretical, professional, and policy implications in the concluding part of the thesis.

PART 4

STAKEHOLDER CENTRIC HYBRID PVQ FRAMEWORK DEVELOPMENT

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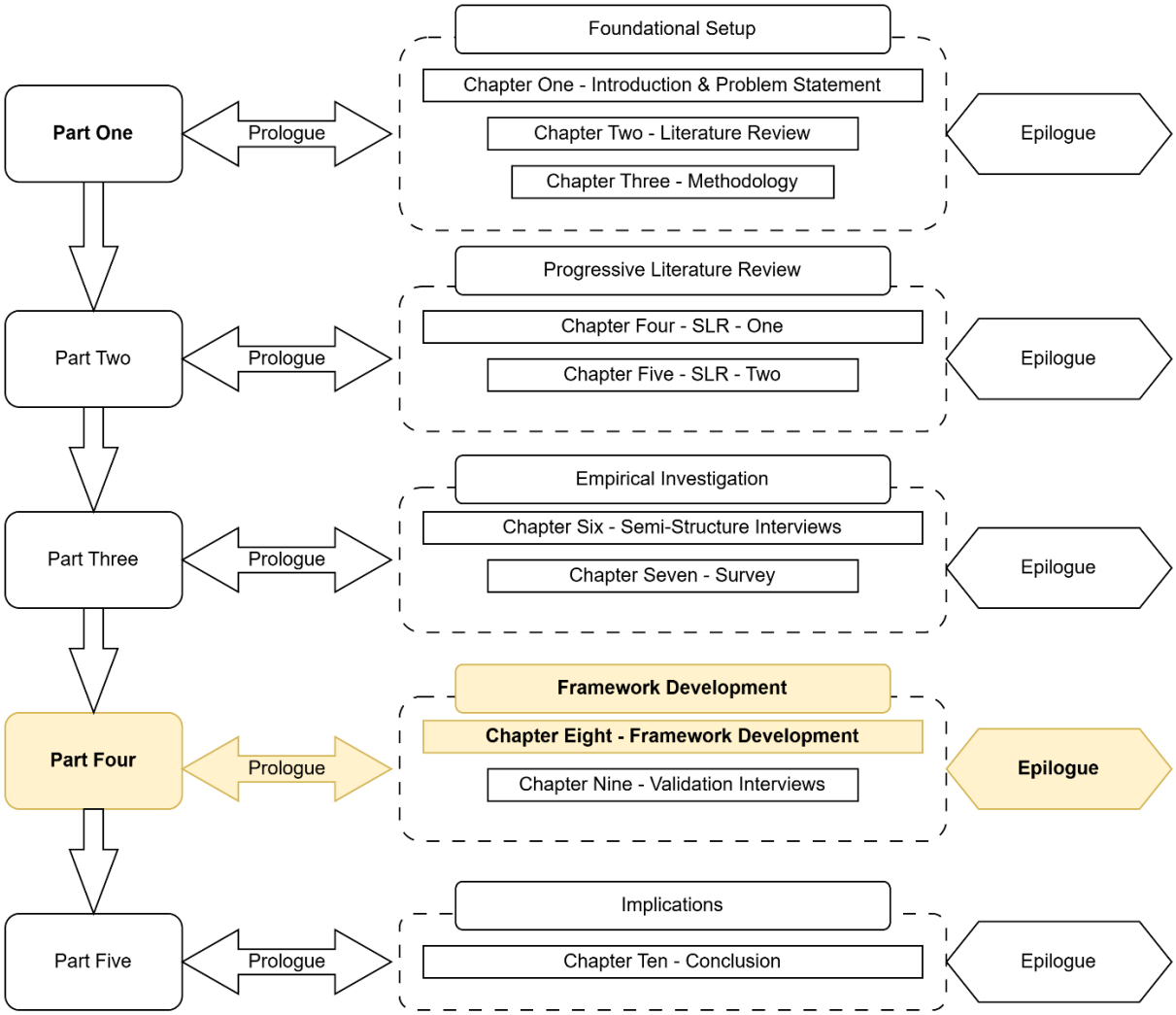
Framework Evaluation

PROLOGUE – PART FOUR

The empirical phase of the thesis focuses on integrating the conceptual and empirical findings into a structured, practice-oriented framework and evaluating its professional validity within real-world valuation contexts. Following the theoretical consolidation and multi-method empirical investigation presented in earlier chapters, this stage advances from analytical testing to systematic integration and evaluation to achieve remaining objective 3 and address RQ4. CHAPTER 08 presents the stakeholder-centric modular hybrid PVQ framework developed through synthesis of the SLRs, qualitative stakeholder engagement, and quantitative structural modelling. The framework consolidates the identified PVIFs, professional VJ, hybrid technological decision-support mechanisms, and stakeholder trust constructs into a coherent socio-technical architecture. Its modular design reflects the empirical findings that valuation processes are not linear and uniform but are shaped by differentiated stakeholder pathways, including those of PVs, RAs, RPIs, and HBs. The framework formalises the decision spine connecting valuation inputs, mediating governance mechanisms, and perceived PVQ outcomes thereby providing a structured representation of hybrid human-technology interaction within residential valuation practice.

CHAPTER 09 evaluates the credibility, applicability, and professional alignment of the proposed framework through structured expert evaluation interviews with experiences industry practitioners and to answer RQ4 for objective 3. This evaluation phases assesses the framework's conceptual clarity, operational feasibility, interpretive transparency, and consistency with established professional standards. Expert feedback is systematically analysed to identify areas of refinement, strengthen governance coherence, and ensure alignment with contemporary valuation workflows. Through this process, the framework is empirically reinforced and refined prior to final consolidation.

Together CHAPTER 08 and CHAPTER 09 establish the transition from empirical modelling to validated framework development. They demonstrate that the proposed hybrid PVQ architecture is not only theoretically derived and statistically supported, but also professionally grounded and contextually applicable within New Zealand's residential property valuation environment.


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CHAPTER 08

8. STAKEHOLDER CENTRIC MODULAR HYBRID FRAMEWORK DEVELOPMENT

8.1 Introduction

This chapter consolidates the empirical findings of the thesis into a coherent, applied framework for understanding and improving PVQ within hybrid human-technology environments. While CHAPTER 06 and CHAPTER 07 established how PVIFs, professional VJ, professionalism, hybrid valuation support, and trust interact in practice and were statistically validated across stakeholder groups, this chapter translates those relationships into a structured, industry-facing model with practical applications. The purpose is to move from analytical explanation of proposed IVDPF in CHAPTER 07 to practical guidance developing stakeholder centric modular hybrid PVQ framework by formalising an evidence-based framework that can be interpreted, evaluated, and refined through expert judgement.

Rather than positioning the framework as a purely conceptual construct, this chapter treats it as an outcome of cumulative empirical evidence. Qualitative insights revealed how valuation decisions are experienced, negotiated, and legitimised in real-world settings, while quantitative modelling confirmed the structural pathways with theoretical grounding through which PVIFs are mediated by VJ, professional governance, and hybrid technological support to shape trust ad perceived PVQ. These complementary strands form the empirical foundation upon which the hybrid PVQ framework is developed and validated.

8.2 Logic of Framework Development

The development of the framework followed a progressive, evidence-driven process rather than a purely conceptual design. Its structure reflects a synthesis of three complementary knowledge streams: systematic literature evidence, stakeholder interpretation, and empirical model testing as shown in Figure 8.1.

The first foundation was established through the progressive SLRs presented in **Error! Reference source not found.** and CHAPTER 05. These reviews identified that PVQ is increasingly shaped by digital transformation, hybrid human-AI systems, and institutional trust rather than technical accuracy alone (Adilieme et al., 2023). The literature also highlighted persistent challenges related to explainability, regulatory alignment, and

stakeholder confidence in AVMs (Ahiadu et al., 2025). The second foundation emerged from the qualitative interviews in CHAPTER 06.

Existing frameworks, such as the PVQ model proposed (Amidu, Levy and Kasim (2025b) , provide a strong foundation by emphasising professional competence, ethical conduct, and trust as central determinants of PVQ. Their framework advances understanding of valuation legitimacy by linking behavioural and professional standards to perceived quality outcomes. However, it remains primarily professional-centric and does not explicitly model the structured interaction between digital decision-support systems, stakeholder heterogeneity, and governance mechanisms within a hybrid valuation environment. This study extends this foundation by introducing a stakeholder-centric modular socio-technical architecture that operationalises PVQ through defined SPs and OPs.

Therefore CHAPTER 06 proposed a set of SPs and OPs to operationalise PVQ within a structured socio-technical framework. These principles translate theoretical constructs into actionable governance and workflow mechanisms, enabling the practical integration of professional VJ, digital decision-support systems, and stakeholder trust in valuation practice. Stakeholders consistently described valuation as an interpretive and communicative process rather than a mechanical calculation. PVs emphasised professional reasoning and accountability, agents highlighted market signalling and negotiation logic, RPIs focused on risk and return translation, HBs prioritised clarity and decision confidence. These perspectives revealed that PVQ is experienced differently across user groups, not professional focused only. but consistently mediated through trust, transparency, and explanation (Ali et al., 2025a).

The third foundation was provided by the quantitative validation in CHAPTER 07. The PLS-SEM demonstrated that PVIFs do not directly determine PVQ. Instead, their influence operates through professional VJ, professionalism, and hybrid valuation support, which jointly shape stakeholder trust. Trust was empirically confirmed as the central mediating mechanism linking valuation practice to perceived PVQ. Together, these findings shaped the framework's core design principle as following IVDPF in CHAPTER 07 Figure 7.1 PVQ emerges through multi-stage decision process rather than a single technical output.

While traditional valuation research has primarily operationalised PVQ in terms of accuracy and error based metrics (AlZaidan et al., 2025), the integrated findings of this study support a process oriented interpretation in which PVQ emerges through a multi-stage decision process rather than a single technical output.

8.3 Structural Design of the Framework

The framework is organised into three connected domains supported by a central processing structure referred to as the core decision spine in Figure 8.1.

Domain A, findings of CHAPTER 04 and CHAPTER 05 represents the theoretical grounding of the framework. It positions valuation as a socio-technical and behavioural process in which professional VJ, institutional governance, and technological systems interact. Rather than treating valuation as an objective computation, this domain reflects the literature's view that valuation outcomes are shaped by interpretation, contextual reasoning, and stakeholder perception. The layer ensures that framework remains anchored in valuation theory, behavioural decision-making research, and professional standards, providing legitimacy an academic coherence (Mohammad et al., 2018).

Domain B, findings of CHAPTER 06 aligned with ontological and epistemological stance from CHAPTER 3 captures how valuation is performed in real-world settings. It reflects the empirical findings that valuation work is shaped by data availability, regulatory constraints, market conditions, organisational procedures, and technology use. Professional VJ is enacted through documentation, explanation, system use, and communication with client and institution. This domain bridges theory and practice where proposed SPs and Ops for operationalising by showing how abstract valuation principles are translated into professional actions and institutional workflows (Fedyunina & Oganesyan, 2019).

Domain C, findings of CHAPTER 07 defines how PVQ is recognised and validated in practice. Rather than focusing solely on technical accuracy, quality is evidenced through stakeholder acceptance, decision confidence, transaction outcomes, and institutional trust. This reflect the study's empirical findings that PVQ becomes meaningful only when it is trusted, sued, and defensible in real-world decision contexts (Leitch et al., 2010a).

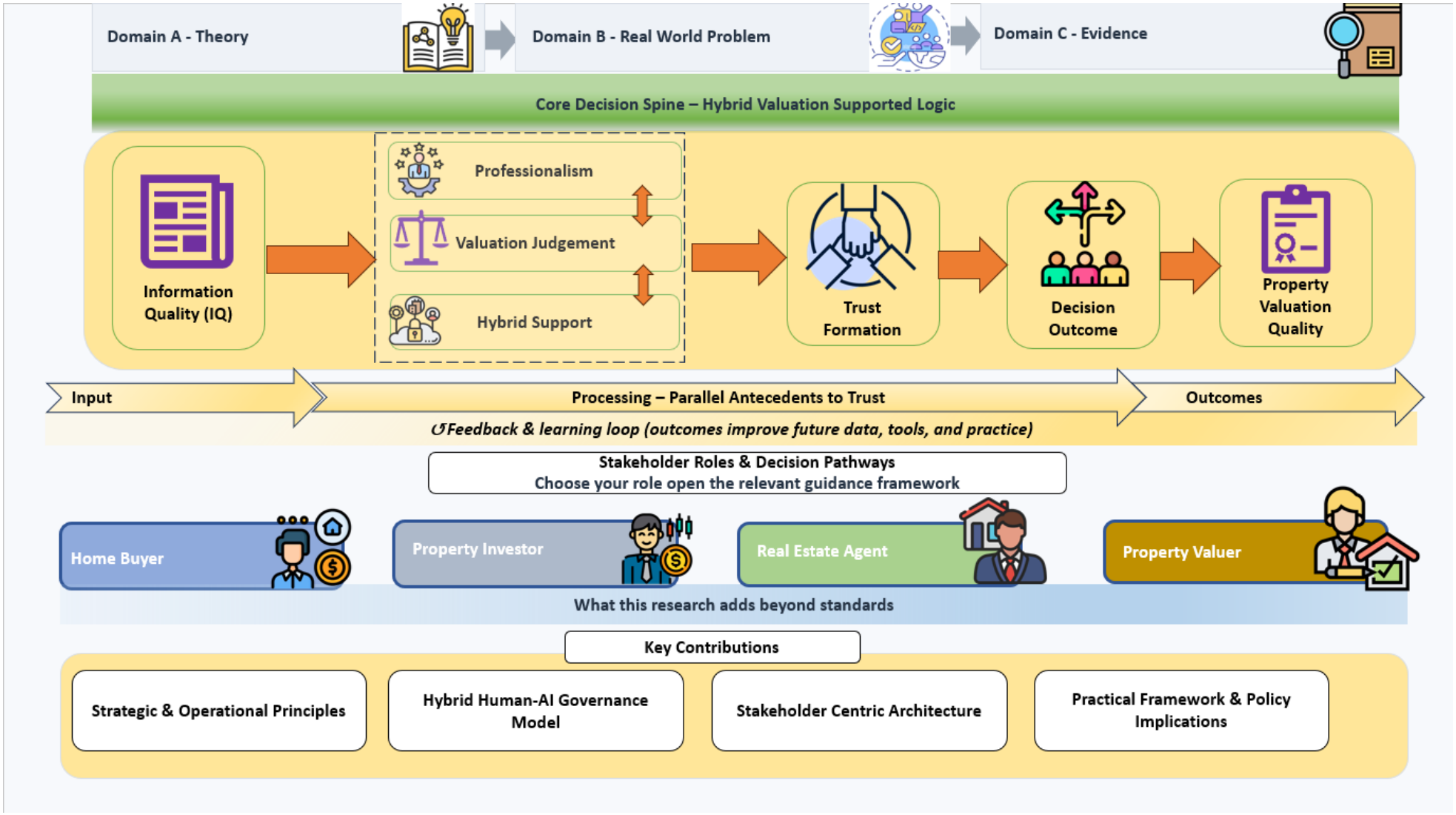


Figure 8.1: Stakeholder-centric modular hybrid PVQ industry guidance framework

Furthermore, at the centre of the framework in Figure 8.1 is the core decision spine, which represents the processing logic through PVIFs are transformed into decision outcomes. The spine begins with information quality, which assesses whether PVIFs are complete, current, comparable, and risk visible. This reflects the empirical findings that data volume alone does not improve PVQ unless information is interpretable and decision relevant (Klamer et al., 2021b). This information is then processed through VJ, where professional reasoning is applied to interpret comparables, contextual signals, and conflicting market evidence. This stage reflects the behavioural nature of valuation (Klamer, 2021), identified in both interviews and structural modelling. Furthermore, VJ is operationalised through two parallel mechanisms, where PPQ and HAV represent respectively, the governance role of ethical conduct, transparency, and documentation, and the structured used of automated tools as decision support rather than substitutes for expertise. As reported in CHAPTER 07,, the PPQ construct demonstrated acceptable composite reliability but comparative lower convergent validity (AVE = 0.308). Rather than indicating conceptual weakness, this finding suggests that professionalism within hybrid valuation environment operates as a multidimensional governance construct, encompassing ethical conduct, documentation rigour, transparency, accountability, and institutional compliance. The lower internal convergence reflects the layered socio-technical nature of professional governance, where behavioural standards, regulatory expectations, and technological oversight mechanisms function in parallel rather than as a single unified trait. Retaining PPQ as a distinct structural mechanism therefore preserves conceptual completeness and reinforces the framework's design decision to model governance and hybrid technological support as complementary but independent drivers of trust formation.

The socio-technical configuration aligns with research emphasising that effective valuation systems depend on the alignment between human judgement, institutional controls, and technological affordances (Ropohl, 1999). However as reported in CHAPTER 07, the AVE for PPQ is 0.308, which falls below the recommended threshold of 0.50 for convergent validity. This indicates that the construct explains less than half of the variance in its indicators, suggesting limited internal convergence. Although composite reliability remained within acceptable bounds, the low AVE implies that PPQ construct was retained to preserve

conceptual completeness of the governance dimension; however, this limitation may influence the stability of structural relationships.

These mechanisms jointly shape trust formation, which the quantitative model confirmed as the key mediator between valuation practice and perceived PVQ as tested in CHAPTER 07. Trust subsequently enables downstream decision outcomes, including purchasing, lending, pricing, and investment actions, through which PVQ becomes visible and consequential in real-world contexts.

8.4 Role-Based Modular Design

The framework is designed as an interactive and modular system in which the core decision spine provides a common valuation logic, while role-specific pathways allow users to engage with this logic through their own professional and market perspective. In practical terms, the main framework in Figure 8.1 operates as a navigational layer: by selecting a stakeholder role, users are directed to a dedicated module that translates the same underlying decision process into role relevant priorities, risks, and actions. This design is informed by stakeholder-oriented decision support literature, which emphasises that system usability and perceived legitimacy increase when complex analytical processes are presented through role-relevant interfaces rather than uniform technical outputs. In current valuation practice, professional reports and automated outputs are typically presented in a standardised, technically framed format that assumes a high level of valuation literacy which is also highlighted in CHAPTER 2. This often leaves non-expert stakeholders particularly HBs and smaller RPIs without structured guidance on how to interpret valuation inputs, assess data quality, and understand the role of professional VJ and automation in shaping the outcome. As a result, PVQ is frequently conflated with price accuracy alone, rather than with the transparency, explainability, and decision support functions that underpin informed market participation.

This framework architecture in Figure 8.1 contributes to valuation theory and practice that explains how PVQ is formed as a coordinated socio-technical process rather than as a single technical output. Additionally, the framework is structured around SPs and OPs that translate abstract valuation concepts into practical governance and workflow mechanisms. Strategically, the model embeds trust, governance alignment, and hybridisation as foundation conditions, ensuring that professional VJ and AI-enabled decision support tools operate within transparent, ethically accountable, and institutionally guided structures. Operationally,

these principles are enacted through contextualisation of property factors, structured orchestration between automated outputs and human review, and continuous adaptation supported by training and feedback. In this way, AVMs are positioned not as substitutes for expertise but as structured decision-support mechanisms within a balanced human-AI valuation system.

Figure 8.1 narrates this logic through differentiated stakeholder pathways, presenting valuation as a shared decision journey rather than an isolated professional act. Each stakeholder engages with the valuation process through a role-specific yet interconnected pathway. These pathways differ in orientation, they converge toward a common objective: strengthening transparency, accountability, and stakeholder trust in valuation outcomes. Within the modular design of the framework, selecting or "clicking" on each stakeholder role directs the reader to the corresponding detailed module, where the specific governance logic, communication structure, and PVQ operational mechanisms for that stakeholder are fully articulated.

Collectively, the framework provides not only a theoretical advancement repositioning PVQ as a dynamic, trust mediated socio-technical construct, but also a practical roadmap. It offers guidance for valuation firms seeking structured documentation and quality assurance, for regulators aiming to balance innovation with accountability, for digital platform developers integrating AI responsibly, and for professional training programs that seek to enhance hybrid reasoning skills and AI literacy. Through this integrated architecture, PVQ is operationalised as a communicative, governance-aligned, and hybrid decision process that supports responsible digital transformation in contemporary residential property markets.

Figure 8.2 presents the Buyer-focused valuation guidance (Module 1), which operationalises the stakeholder-centric modular hybrid framework within the decision context of residential HBs. The module translates the broader socio-techincal architecture into a structured buyer-oriented pathway, integrating theoretical foundations, observed market frictions, and validated hybrid decision mechanisms. Rather than treating valuation as a purely technical price estimation exercise, the module conceptualises buyer engagement with valuation as a risk-interpretive and trust-mediated process.

Domain A synthesises theoretical insights from behavioural theory and housing decision research, emphasising that HB decision-making is shaped by risk translation, trust triggers, and contextual weighting of information. HBs do not rely solely on numerical estimates; instead, they interpret valuation outputs through perceived financial exposure, neighbourhood desirability, and uncertainty signals. Within this structure, VJ functions as a sense-making interface, translating technical inputs into understandable reasoning pathways that support informed action.

Domain B identifies real-world frictions commonly observed in residential markets, including conflicting price signals between listing prices, AVMs, and formal valuations; hidden risks and data asymmetries; excessive information without interpretive clarity; and limited transparency regarding valuation logic. These challenges reflect structural information asymmetry and cognitive overload documented in housing market research, reinforcing the need for structured hybrid decision support.

Domain C presents the validated pathway derived from the broader framework, where trust operates as a mediating mechanism linking valuation logic to decision behaviour. Within this configuration, AVMs are positioned as governance-support tools rather than decision authorities. The model emphasises that decision quality is not verified solely by pricing precision but by HB behaviour that reflects confidence, clarity of reasoning, and risk awareness. Thus, PVQ is operationalised as legitimacy and defensibility in buyer action rather than statistical accuracy alone.

The HB action checklist further translates the hybrid logic into structured behavioural rules. For example, wide AVM value ranges (e.g., greater than 10%) are treated as uncertainty indicators rather definitive pricing guidance. Similarly, limited comparable sales evidence and weak information quality are interpreted as risk signals requiring additional scrutiny. The framework introduces threshold-based decision triggers such as negotiation under moderate warning signals and reconsideration under heightened uncertainty thereby embedding governance logic within buyer interpretation.

Collectively, this module demonstrates how the stakeholder-centric modular hybrid architecture reduces information asymmetry, strengthens explainability, and aligns valuation outputs with HBs cognition.

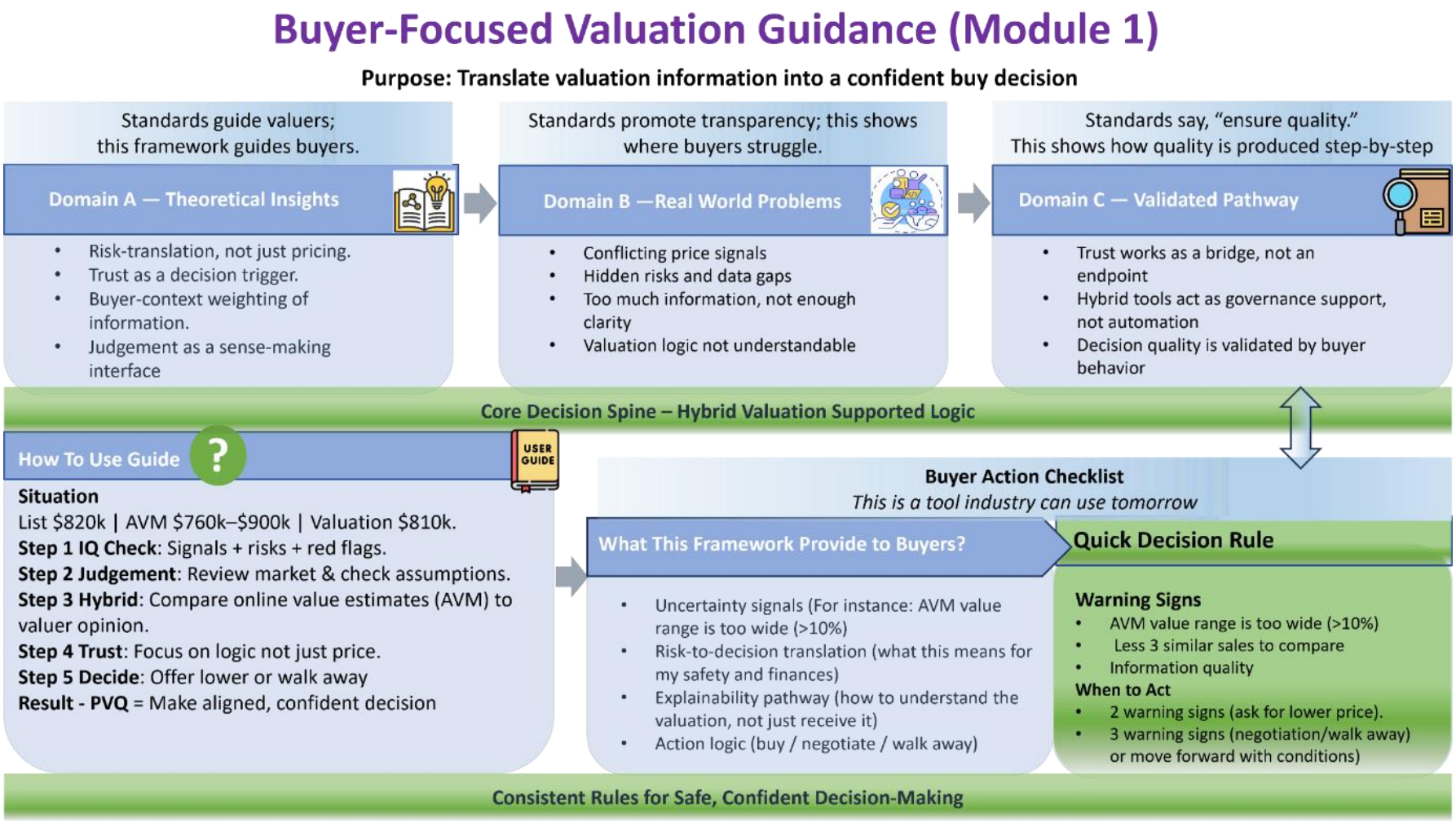


Figure 8.2: Buyer-focused valuation guidance framework

By converting abstract principles of trust, governance, and hybridisation into actionable guidance, the module illustrates how PVQ emerges structured communication, contextual reasoning, and risk-aware decision behaviour within residential property markets.

Figure 8.3 presents the Investor-focused valuation guidance (Module 2), which operationalises the stakeholder-centric modular hybrid PVQ framework within the strategic decision context of residential property investors. Unlike buyer-oriented, which priorities fairness and clarity, investor valuation is fundamentally return and risk oriented. This module therefore reframes PVQ as strategy alignment and performance validation rather than price confirmation alone.

Domain A reflects theoretical insights from investment appraisal, portfolio theory, and risk-based valuation. Here, value is conceptualised as expected return potential rather than simply current market price. Risk is interpreted through volatility exposure, downside protection, liquidity constraints, and interest-rate sensitivity. Trust, in the investor context, is defined as confidence in cash flow sustainability, yield assumptions, and exit valuation credibility. VJ operates as strategic alignment, supporting hold, flip, rent, refinance, and exit decisions rather than merely confirming transactional fairness.

Domain B identifies real-world investment frictions, including rental yield uncertainty, interest rate fluctuations, tax, and regulatory shifts, resale liquidity risk, and the structural limitation that AVMs typically ignore income performance and portfolio-level metrics. These issues reflect documented limitations of price based automated models, which often estimate asset value without incorporating income sustainability, finance structure, and scenario-based stress testing.

Domain C presents the validated hybrid pathway, in which trust links valuation logic to projected cash flows and exit strategies. Within this structure AVMs are positioned as analytical support mechanisms for scenario testing such as yield sensitivity, rate shocks, and resale conditions rather than as deterministic pricing authorities. Quality, therefore, is validated not by static pricing accuracy but by portfolio performance consistency and risk-adjusted strategic coherence.

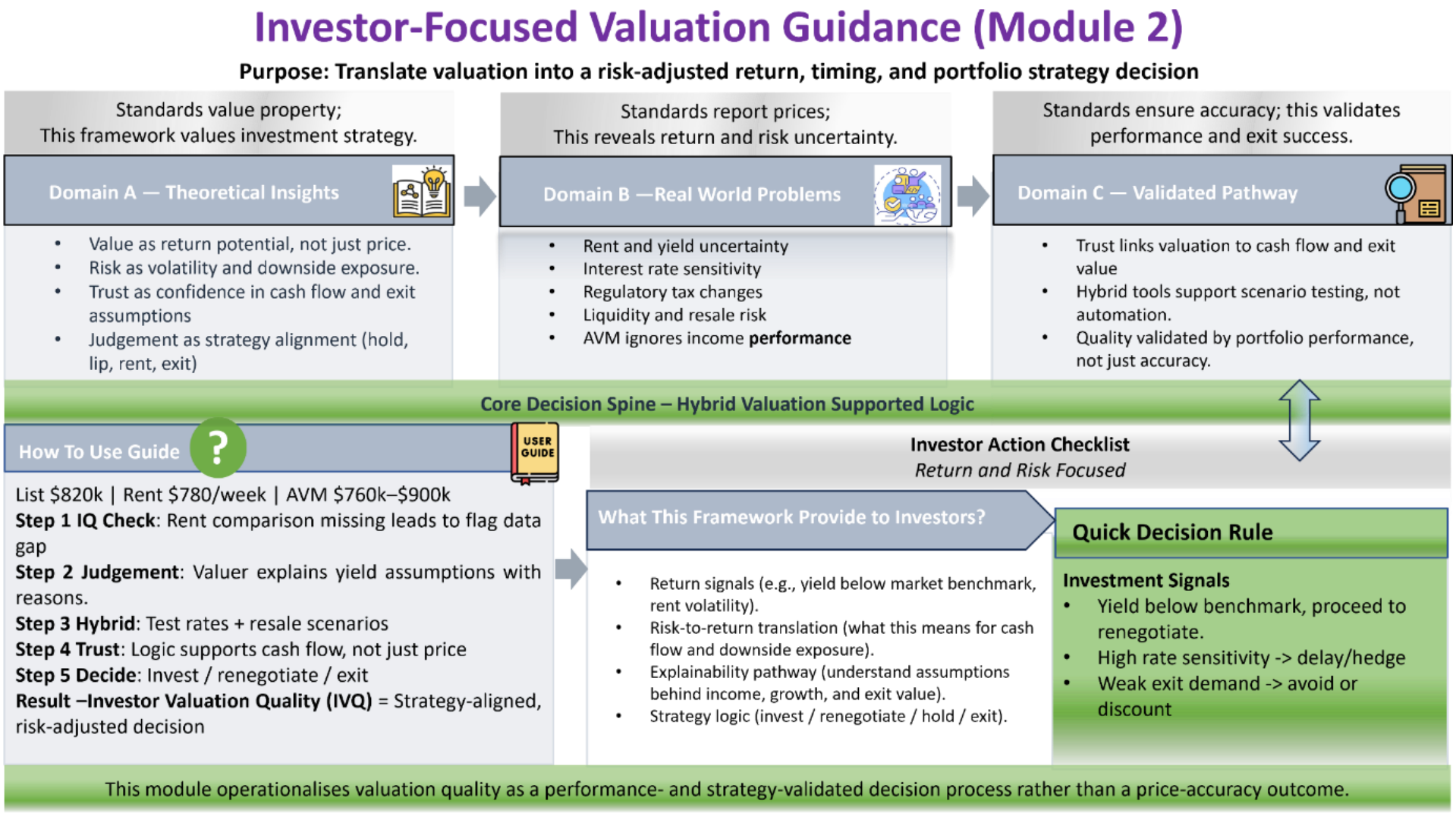


Figure 8.3: Investor-focused valuation guidance framework

The RPI action checklist further translates the hybrid logic into structured investment decision rules. For example, yields below benchmark thresholds trigger renegotiation signals; high interest-rate sensitivity prompts hedging and delayed acquisition; and weak exit demand indicates discounting and avoidance. These structured thresholds embed governance logic within capital allocation decisions, converting valuation outputs into disciplined investment strategy.

Collectively, this module demonstrates how the hybrid PVQ framework adapts a stakeholder heterogeneity by aligning valuation interpretation with investment objectives. It operationalises PVQ as a performance and strategy validated decision process, reducing overreliance on price estimation and strengthening risk-aware investment governance. Through this architecture, PVQ is reframed as the alignment between valuation reasoning, hybrid analytical support, and sustainable portfolio outcomes within residential property markets.

Figure 8.4 presents the Agent-focused valuation guidance (Module 3), which operationalises the stakeholder-centric hybrid PVQ framework within the decision environment of RAs. Unlike HBs and RPIs, whose decision centre on risk or return, RAs operates within a market-signalling and negotiation context. Accordingly, this module reframes PVQ as transaction credibility, pricing alignment, and communication effectiveness rather than solely price accuracy.

Domain A reflects theoretical insights from market signalling theory and brokerage practice. For RAs valuation functions as a market signal that shapes buyer expectations and vendor confidence. Trust operates as client credibility and buyer engagement, while information serves as a narrative and positioning tool rather than a purely techincal dataset. VJ is therefore interpreted as pricing and negotiation strategy, balancing vendor aspirations, buyer perception, and comparable market evidence.

Domain B identifies practical frictions observed in brokerage environments, including conflicting AVM estimates and HBs expectations, overpricing leading to extended days on market, limited explainability of valuation logic to vendors and purchasers, and inconsistent data quality in listings. These challenges reflect documented issues in residential market

efficiency, where misaligned pricing signals and communication gaps contribute to reduced liquidity and weakened transaction confidence.

Domain C presents the validated hybrid pathway, in which trust links valuation reasoning to client confidence and HB engagement. Within this structure, AVMs are positioned as strategic support mechanisms for pricing analysis, market comparison, and communication enhancement rather than as autonomous pricing authorities. Quality is validated through transaction outcomes reduced times on market, credible pricing alignment, and smoother negotiation flow rather than through numerical precision alone.

The RAs action checklist operationalises this logic through structured decision steps. RAs are guided to identify gaps in comparable evidence, translate pricing logic clearly to vendors and HBs, triangulate AVMs with PVs opinions and recent sales data, and adjust positioning based on market signals. Warning indicators, such as wide AVM ranges, low inquiry despite strong listing visibility, or HB challenges to pricing logic function as governance triggers requiring explanation refinement, repositioning, and price adjustment. These structured thresholds embed hybrid reasoning within brokerage practice.

Overall, this module demonstrates how the framework adapts to the intermediary role of agents by aligning valuation interpretation with communication strategy and market signalling. It operationalises PVQ as a communication and transaction validated process, reinforcing that PVQ in brokerage contexts is achieved through transparent reasoning, strategic positioning, and trust-mediated engagement rather than price reporting alone.

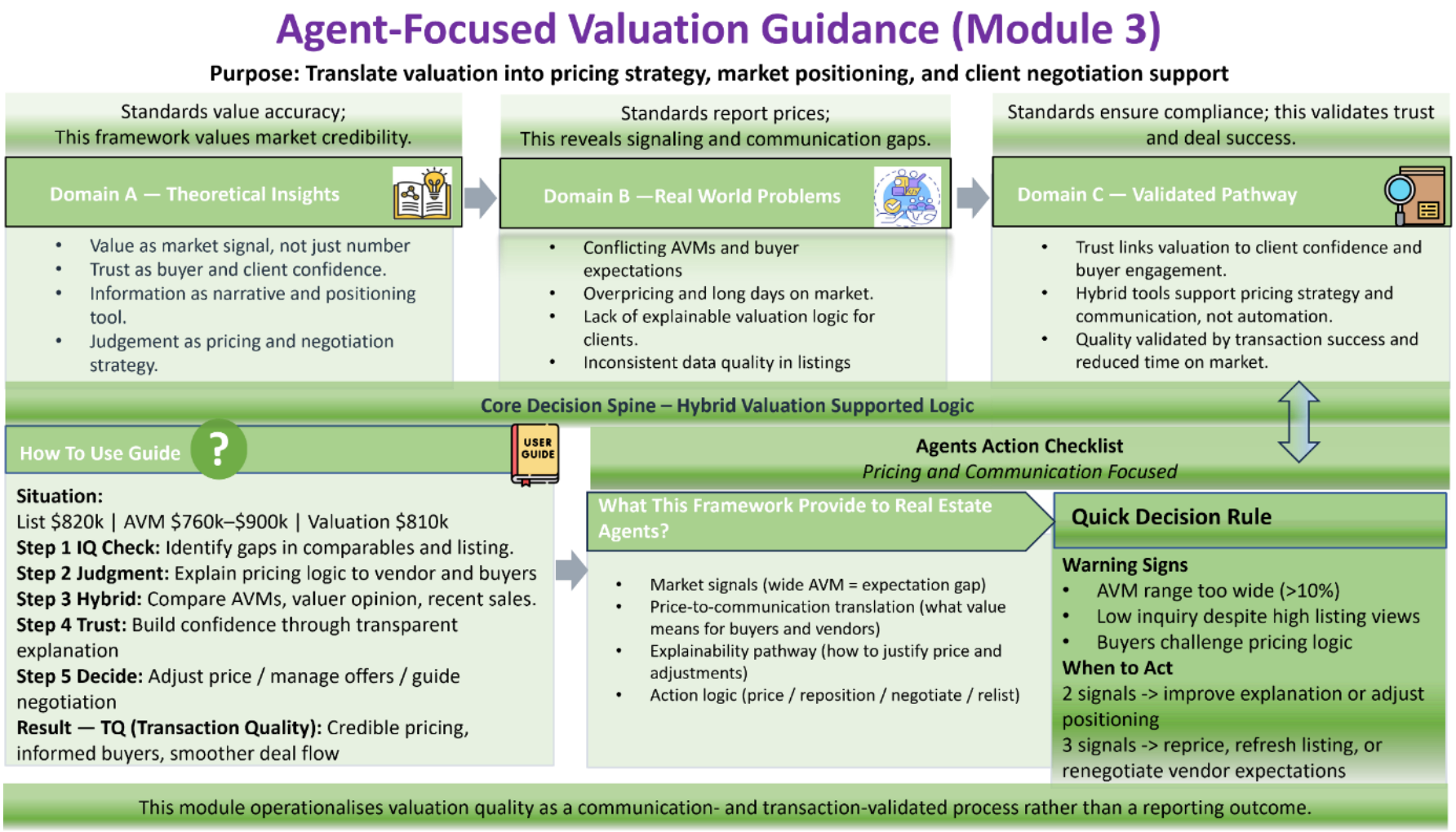


Figure 8.4: Agent-focused valuation guidance framework

Figure 8.5 presents the Valuer-focused valuation guidance (Module 4), which operationalises the stakeholder-centric hybrid PVQ framework within the professional decision environment of PVs. Unlike other stakeholder modules, this pathway centres on professional accountability, defensibility, and governance compliance. It reframes PVQ not as numerical precision alone, but as a structured, documented, and ethically grounded judgement process embedded within institutional and regulatory oversight.

Domain A reflects theoretical foundations drawn from professional valuation standards, behavioural judgement theory, and governance literature. Within this context, value is conceptualised as a professional judgement process rather than a mechanical calculation. Trust is interpreted as defensibility and auditability confidence that valuation reasoning can withstand peer review, client scrutiny, and regulatory assessment. Information is treated as evidentiary quality, and judgement is framed as contextual, ethical, and standards aligned reasoning rather than simple data aggregation.

Domain B identifies real-world professional pressures and constraints, including incomplete comparable evidence, client and lender pressure, market volatility, over-reliance on AVMs, and limited transparency in key assumptions and adjustments. These conditions reflect documented challenges in contemporary valuation environments, where increasing automation, compressed turnarounds times, and heightened accountability requirements create tension between efficiency and professional rigour.

Domain C presents the validated hybrid pathway, where trust is built through explicit assumptions transparent documentation, and structured reasoning. Within this configuration, digital tools are positioned as quality control and bias-detection mechanisms rather than automated substitutes for expertise. Hybrid support enhances reproducibility, supports internal reviews, and flags uncertainty signals, but ultimate responsibility remains with the PV. Quality is validated through peer review, consistency, reproducibility, and compliance with professional standards rather than solely through alignment with market transaction prices.

The PV action checklist further translates this governance logic into structured professional practice. PVs are guided to assess comparability completeness, evaluate contextual adjustments, triangulate AVM outputs with local evidence and explicitly document key

assumptions and uncertainty factors. Warning indicators such as significant divergence between AVM and professional VJ, thin comparable datasets, and strong client pressure serve as governance triggers requiring strengthened documentation, disclosure, peer review, or re-scoping of the valuation. These structured thresholds embed professional accountability within hybrid valuation workflows.

Collectively, this module demonstrates how the framework operationalises PVQ as a governed, explainable, and professionally accountable decision process. It reinforces that PVQ in professional contexts is achieved through transparent reasoning, ethical oversight, and structured integration of digital tools within regulatory standards. By doing so, the framework aligns with hybrid human-AI interaction with institutional controls, strengthening defensibility, credibility, and trust in contemporary residential valuation systems.

Taken together, Module 1 -4 demonstrate how stakeholder-centric hybrid PVQ framework adapts to differentiated decision logics while maintaining a unified socio-technical architecture. Although each stakeholder engages with valuation through distinct objectives and interpretive priorities, all pathways operate within the same strategic and operational structure. For HBs, PVQ is validated through clarity, fairness, and risk awareness; for RPIs, through return alignment and portfolio performance; for RAs, through market credibility and transaction efficiency; and for PVs, through defensibility, transparency, and professional compliance. Despite these differences, each module reinforces the same underlying principles: trust as a mediating mechanism, hybrid human-AI integration as structured support rather than substitution, governance as a stabilising force, and explainability as a foundation for legitimacy. This structural consistency across heterogenous stakeholders' evidence that PVQ is not a fixed technical metric but a context-sensitive outcome emerging from coordinated judgement, technological support, and institutional accountability.

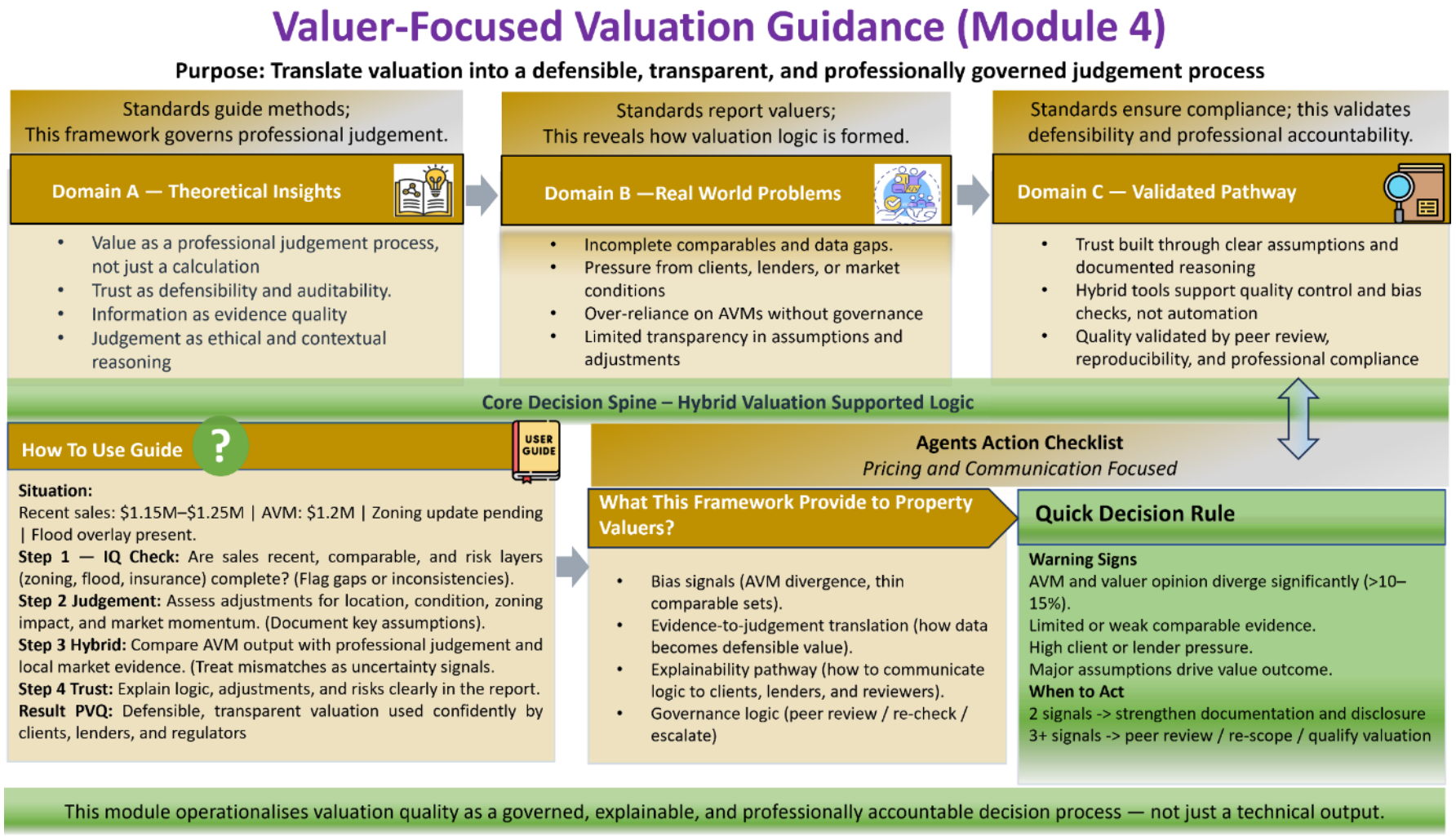


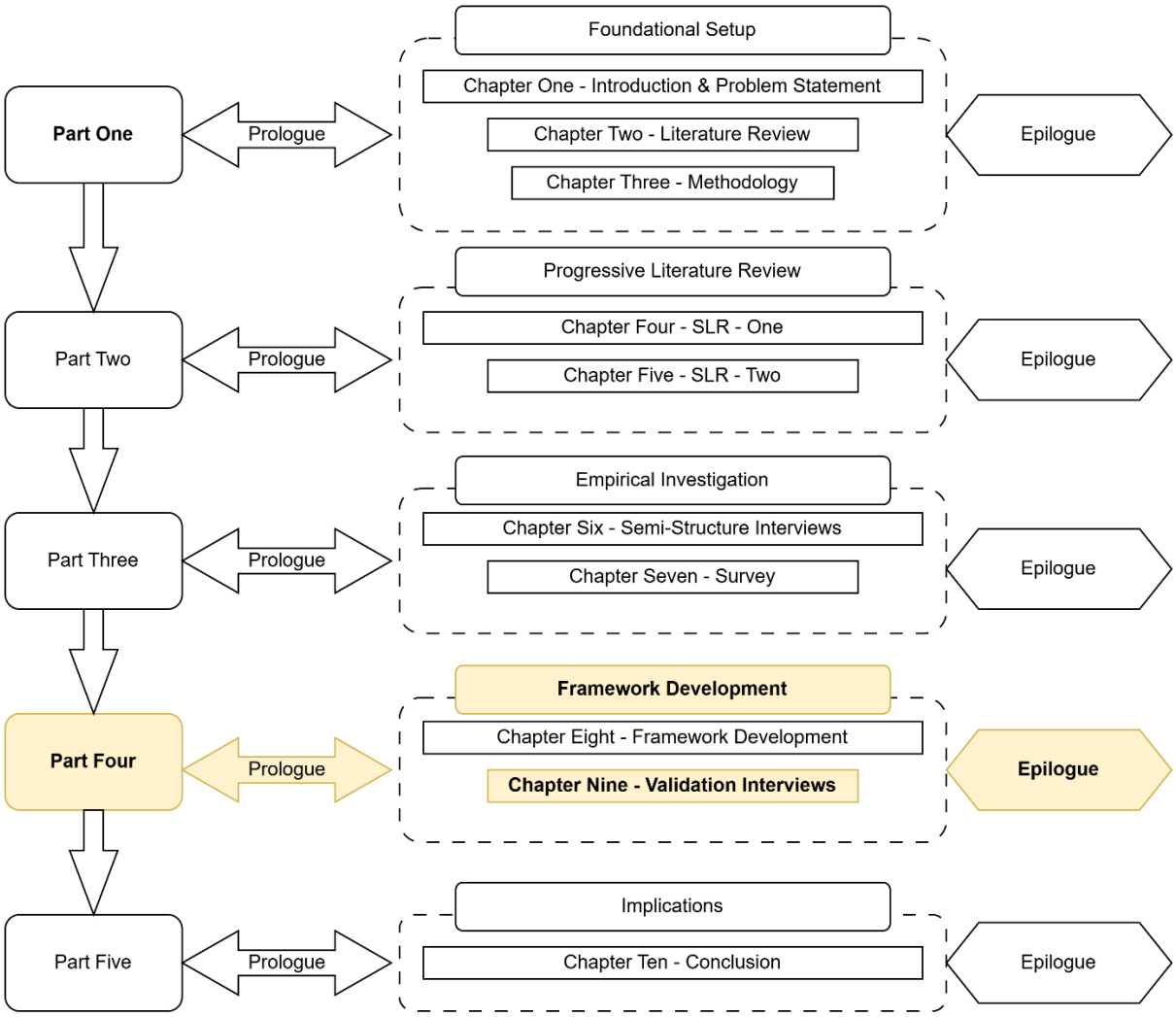
Figure 8.5: Valuer-focused valuation guidance framework

8.5 Contribution of the Framework

The framework extends traditional valuation models in three keyways.

- First, it reconceptualises PVQ from a predominantly accuracy-based metric to a process-oriented and trust-mediated outcome, emphasising how valuation quality emerges through professional VJ, transparency, and stakeholder interpretation rather than numerical precision alone.
- Second, it formally integrates human judgement and AI-enabled systems within a hybrid governance structure, positioning technology as structured decision support embedded within professional and institutional controls rather than as a competing decision authority.
- Third, it introduced a stakeholder-facing architecture that translates valuation logic into role-specific decision pathways, enabling different user groups to engage with the same valuation information through tailored interpretive and action-oriented modules.

This positions the framework as both a theoretical contribution to behavioural valuation research and a practical tool for professional training, communication, and quality assurance.


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CHAPTER 09

9. Framework Evaluation

9.1 Introduction

This chapter presents the expert evaluation of the proposed Stakeholder-Centric Modular Hybrid PVQ framework through in-depth interviews with industry professionals aligned with RQ4 in objective 3. The purpose of this phase is to assess the framework's realism, clarity, and practical relevance, and to examine its potential contribution to professional practice, training, and valuation governance within digitally mediated residential property markets. Whereas the preceding CHAPTER 08 established the framework through literature synthesis, qualitative exploration, and quantitative model testing, this chapter adopts a practice-oriented perspective focused on professional sense-making and applied credibility. Expert evaluation is therefore approached not as a statistical exercise, but as an interpretive process that evaluates whether the framework reflects how valuation decisions are formed, justified, and communicated in real-world institutional and market settings. The evaluation phase includes an expert interview following Bogner et al. (2009) with PVs, flipping RPIs, HBs, and RAs with extensive experience in RPV. This perspective provides an initial, in-depth assessment of the framework's conceptual coherence, usability, and alignment with existing professional standards and emerging hybrid valuation practices. The chapter is structured to present the evaluation design, ethical considerations, and analytical approach, followed by a detailed thematic presentation of expert feedback mapped to the framework's core domains and decision spine.

This chapter strengthen the study's methodological framework rigour by extending statistical validation beyond model-based testing to include professional judgement and experiential insight, thereby reinforcing the framework's credibility, transferability, and potential for adoption within industry and regulatory contexts.

9.2 Method and Expert Profile

9.2.1 Evaluation Method

The evaluation phase employed a qualitative, expert-based interview approach designed following Park and Lee (2025) to assess the practical realism, conceptual clarity, and professional relevance of the proposed stakeholder-centric modular hybrid PVQ framework.

This method aligns with interpretive and practice-oriented evaluation traditions (Moore, 2015), which emphasise professional VJ, experiential insight, and applied credibility rather than statistical generalisation. A semi-structured interviews format was adopted to ensure consistency across core evaluation themes while allowing flexibility for the expert to elaborate on issues of professional significance (Ahlin, 2019). The interview guide was organised around the framework's central domains and core decision spine, focusing on: (1) alignment with real-world valuation workflows, (2) clarity and usability of the modular structure, (3) integration of professional VJ and hybrid valuation support, (4) implications for trust governance, and professional standards, and (5) perceived strengths, limitations, and opportunities for refinement. This approach enabled systematic exploration of how the framework is interpreted by an experienced practitioner, while preserving the openness necessary to capture unanticipated insights related to regulatory contexts, organisational practice, and stakeholder communication (Sánchez-Guardiola Paredes et al., 2021).

9.2.2 Expert Profile and Selection criteria

The evaluation phase involved 5 industry experts, following participants were purposively selected based on their professional experience, senior roles, and direct involvement in valuation and market decision-making processes. All experts were employed within medium sized organisations and possessed extensive industry experience, enabling them to provide informed and practice-based feedback on the framework. Pseudonyms were used to ensure confidentiality while preserving professional context (Tongco, 2007). Experts were selected according to three criteria: demonstrated expertise in property valuation and real estate practice, active participation in valuation-related decision-making, and the capacity to critically assess the framework's clarity, realism, and practical applicability. In Table 9.1 medium-sized company is an organisation with a moderate scale of operations, typically characterised by a defined organisational structure, a stable market presence, and a workforce and resources larger than small firms but smaller than large corporations. Furthermore, RAs can help evaluate property valuation framework findings through their practical market knowledge, transaction experience, and understanding of local property trends, ensuring that valuation outcomes align with real market conditions. As the proposed framework focuses on RPV, particular attention was given to selecting experts with relevant residential property experience. The three PVs regularly undertake residential property

valuations within the New Zealand housing market as part of their professional practice, while the two real estate professionals are actively involved in residential property sales, market analysis, and buyer–seller transactions. Their combined expertise in residential property valuation and market practice ensured that the framework was evaluated by professionals with direct knowledge of residential valuation processes, market behaviour, and practical decision-making, thereby strengthening the credibility and contextual relevance of the framework evaluation. This ensured that the evaluation process captured informed professional VJ rather than theoretical evaluation.

Table 9.1: Demographic and Professional Characteristics of Interview Participants

No.	Pseudonym	Position / Level	Organization Size	Nature of the Organization	Years of Experience
1	PV 1	Registered Property Valuer	Medium Size	Property Valuation	15 years
2	PV 2	Senior Property Valuer	Medium Size	Property Valuation	22 years
3	PV 3	Director / Principal Valuer	Medium Size	Property Valuation	30 years
4	RA 1	Licensed Real Estate Agent	Medium Size	Real Estate Agency	12 years
5	RA 2	Sales Manager	Medium Size	Real Estate Agency	18 years

The evaluation phase was conducted using quotation-based qualitative approach rather than formal coding procedures. Interview transcripts were reviewed in full, and relevant participants statements were selectively extracted to directly support key evaluation themes, such as framework realism, usability, stakeholder relevance, and suggested refinements. These quotations were used to illustrate convergence and divergence in expert perspectives and to substantiate evaluation outcomes. The analysis focused on confirming and refining the framework through practitioner insight rather than generating new analytical categories, with expert feedback informing final adjustment to the framework.

9.3 Experts Response to Question One

Q1. How do you interpret the overall framework in terms of representing how property valuation decisions are formed in practice?

9.3.1 Expert 1 - PV

Expert 1, a registered PV with over 20 years of professional experience across valuation, client advisory, and regulatory-facing practice, evaluated the framework as conceptually sound and closely aligned with real-world valuation workflows across multiple stakeholders' contexts. The expert describes the structure as "*very sound*" and notes that it "*felt natural*" in relation to how valuation decisions are formed in practice. According to expert, the framework reflects the procedural logic followed in professional settings, beginning with property inspection and information gathering, progressing through market interpretation, and culminating in the formation of a defensible professional VJ. As the expert explains, "*the way it's laid out seems to follow the same sort of process we go through in practice going out, inspecting the property, gathering the information, looking at the market, and then pulling it all together into a final judgement".* Importantly, the expert indicates that this logic extends beyond the PVs roles and remains applicable across the broader stakeholder modules. From this cross-stakeholder perspective, the expert reports no significant conceptual gaps between the framework and operational realities, stating that *"I did not really see any obvious gaps where I thought this does not match what happens in the real world".*

9.3.2 Expert 2 - RA

The RA perceived the framework as a realistic reflection of how property valuation decision is formed in practice, particularly because it recognises the involvement of multiple stakeholder groups rather than treating valuation as an isolated activity. As the RA stated, "*I believe it's been put into each individual group, as the buyer, the agent… it's been put into perspective well, so yeah it aligns*." The framework was seen as successfully capturing the different ways stakeholders interpret value. The RA explained that "*different people like buyers, agents, and valuers are all part of the same process, but each one looks at the value of a property from their own point of view.*" From this perspective, buyer focus on affordability and long-term worth, while RAs concentrate on market position and comparable properties. The RA also emphasised that the framework reflects valuation as an evolving process rather than a single outcome. As noted, "*it's not just about one final figure*,' but instead about "*how*

people talk through the data, the condition of the property, and the market situation before they settle on a decision." This ongoing discussion and checking information were viewed as consistent with real-world practice, where valuation develops "*through discussion, checking information, and building confidence in the numbers and advice being given*." Overall, the RA described the framework as "*quite close to how things work in the real world*," highlighting its practical relevance and alignment with actual property valuation decision-making.

9.3.3 Expert 3 - PV

The PV viewed the framework positively, describing it as "*a good framework*" that "*looks mostly common sense*." PV noted that it "*steps out what you think is kind of going on anyway*," suggesting that it reflects how valuation decisions are already formed in practice, but with added clarity and structure. In this regard, the framework was seen as "*bringing some formality to it*." While acknowledging that the framework is "*quite detailed*" and that there is "*a fair bit in there*," the PV emphasised that "*at a high level it all looks pretty sensible*" and "*make sense*." Even without reviewing "*all the details*," they felt that "*at a high level it looks pretty good*."

9.3.4 Expert 4 – RA

The RA interpreted the framework as closely reflecting how valuation-related decisions are formed in practice, particularly from an RA perspective. RA explained the that the process "*really starts with the information,"* whether it is *"electronic"* or *"paper-based,"* and that this information is *"all put together"* to understand where a property sits in the current market. As RA noted, once everything is combined, it helps determine "*what potentially is a price range to present*." The RA was clear about the distinction between valuation and their professional role, emphasising that "*we deter from using the word evaluation*," and instead prefer "*comparative market analysis*," because "we always let people know we're not valuators." In this sense, decision-making was described as "*determined by all those factors*," including comparable properties market conditions, rather than producing a formal valuation figure. RA felt the framework aligned well with this approach, as it shows that valuation decisions are "*not just about jumping straight to a number*," but that "*there's a process behind it*." The RA participant highlighted that the framework reflects how information is gathered, processed, and interpreted to guide stakeholders, noting that it "*shows how the information*

comes in, how it gets processed, and how you end up with a price range that makes sense," while also recognising that "*not everyone's doing the same role in the process."*

9.3.5 Expert 5 – PV

The PV interpreted the framework as closely reflecting how valuation decisions are formed in practice, particularly in its ability to articulate process that practitioners often undertake intuitively noted that the framework "*feels quite familiar*" and "*puts into words what you're already doing without really thinking about it*." This suggests that the framework aligns with existing professional reasoning while making implicit practices more explicit. Th PV emphasised that valuation decisions do not occur in "*one clean step*," but instead "*build up over time*" through a sequence of activities. As described, this process involves "*gathering information*," "*talking things through*," "*comparing*," and "*sanity checking*," with decisions sometimes adjusted "*as new information comes in*." The PV perceived the framework as accurately following this flow, highlighting that it does not present valuation as "*producing a value out of thin air*," but rather as an iterative and judgement-based process. Overall, the PV viewed the framework as a realistic representation of how valuation decisions emerge through gradual refinement, professional VJ, and ongoing information review in practice.

9.4 Experts Response to Question Two

Q2. What connections do you see between the three stages (conceptual, practice-based, and statistical validation), and how clearly do these stages flow for you?

9.4.1 Expert 1 - PV

Expert 1 perceives a strong and coherent connection between the three stages of the framework, characterising their relationship as both logical and reflective of everyday professional practice. The expert notes that the overall structure "*connected very well*" and that the flow "*seemed like a natural extension of what we do on a day-to-day basis*," indicating that the transition from conceptual foundations to applied practice and statistical validation aligns closely with operational valuation workflows. In elaborating on the role of the conceptual stage, the expert interprets this domain as representing the formal and institutional dimensions of valuation, including professional standards, regulatory expectations, and normative guidelines. As the expert explains, "*the conceptual part feels like the rules we are supposed to follow the standards and expectations*." These framing positions the conceptual domain as a governance layer that shapes and constrains professional action.

The practice-based stage is perceived as the operational translation of these formal rules into professional routines, including inspection, data interpretation, market analysis, and client communication. The expert's emphasis on continuity across stages suggests that the framework successfully models valuation as a progression from institutional principles to professional enactment and, ultimately, to validation through defensibility and stakeholder acceptance.

This feedback reinforces the internal coherence of the framework and supports its capacity to function as both a theoretical guide and a practical workflow model. The expert's interpretation across stages further strengthens the framework's relevance for professional training, quality assurance, and regulatory engagement, where clarity of process and alignment with standards are critical for institutional credibility.

9.4.2 Expert 2 - RA

The RA perceived a strong and clear connection between the three stages, describing them as "*equally important rather than separate or disconnect parts."* They felt the stages "*flow quite well*" because the valuation process is ultimately "*for all parties, the buyer, the agent, and the valuer*." The conceptual stage was viewed as the starting point, with the RA noting that "*the conceptual stage makes sense as the foundation*," as it "*sets out the main ideas and assumptions about how valuation should work*." The practice-based stage was described as "*where those ideas actually get tested in the real world*," through "*what valuers, agents, and buyers really do with the information*." The evaluation stage was seen as completing the process. As the RA explained, "*the validation stage, for me closes the loop*." By checking "*whether what's been designed and observed actually makes sense and works for the people who are using it*." The RA emphasised that the clarity of flow comes from the valuation report acting as "*a shared point of reference*." They noted that "*everyone is looking at the same document," each party uses it slightly differently depending on their roles*." As a result, the stages were seen not as fixed steps, but as "*parts of a continuous process*," involving "*back and forth*," which makes the framework feel "*coherent and practical rather than just academic*."

9.4.3 Expert 3 - PV

The PV described the connection between the conceptual, practice-based, and statistical validation stages as "*very clear*" emphasising that "*the visual version of it is really good*." PV noted that they could "*quite clearly see each of those stages, the way they flow together*," as well as "*each of the interim stages that are important for it to work*." Overall, they stated, "*the flow is definitely there*," and "*it makes sense*." While acknowledging that the framework is "*quite detailed*" and that there is "*a fair bit in there*," the PV emphasised that "*at a high level it all looks pretty sensible*" and "*makes sense*." Even without reviewing "*all the detail*," felt that "*at a high level it looks pretty good*."

9.4.4 Expert 4 - RA

The RA viewed the connection between three stages as logical and easy to follow. RA explained that the conceptual stage is about "*analysing what information is out there*," including "*sales data, market trends, and property details*," describing it as "*the thinking and research part*" that helps build an understanding of the market. The practice-based stage was seen as where that information is actively used. As the RA noted, it involves "*preparing it, comparing properties, and making sense of how it applies to a specific house*," turning analysis into something "*practical that we can work with and explain*." The statistical validation stage was described as a final check, asking whether the outcome "*actually makes sense in the current market*" and whether it is "*something we're confident presenting to a client*." Overall, the participant felt the flow was "*pretty clear*," moving from analysis, to application, to confirmation. Rather than three separate steps, RA described it as "*one continuous process*" that builds toward a value or price range they are "*comfortable standing behind as agents."*

9.4.5 Expert 5 - PV

The PV perceived a clear and logical connection between the three stages. The PV explained that first stage involves "*setting things up*," including "*understanding the market, the purpose of the valuation, and what information you need*." The practice-based stage was described as the point where practitioners "*actually do the work*," such as "*site visits, assessing the property, and analysing comparable sales*." The statistical validation stage was viewed as a critical "*sense-check*," where practitioners consider whether "*the value actually stacks up*" and whether they would feel "*comfortable standing behind it*." The PV noted that this stage

can involve revisiting earlier steps "*if something doesn't quite fit*." Overall, the PV felt that "*the flow makes sense*," moving from "*planning, to doing, to checking*," and described the stages as "*one continuous process rather than three separate steps*," reflecting how valuation decisions are formed in professional practice.

9.5 Experts Response to Question Three

Q3. How does this framework reflect your experience of how valuation decisions are made in professional practice today?

9.5.1 Expert 1 - PV

Expert 1 interprets the framework as closely mirroring the lived realities of contemporary valuation practice, particularly in its representation of the transition from formal standards to real-world application and professional self-validation. The expert characterises the overall structure as reflective of everyday workflows, stating that it "*just follows what we do on a day-to-day basis*" and that, in practical terms, "*it works quite well*." In describing the conceptual domain, the expert frames this stage as a governance layer that embodies institutional rules, standards, and normative expectations. As the expert explains, "*the conceptual part feels like the rules we're supposed to follow, the standards and expectations*." This interpretation positions the framework's theoretical foundation as a formal reference system that guides and constrains professional action. The practice-based domain is described in more interpretive and contingent terms, capturing the uncertainty and complexity of operational valuation work. The expert notes that "*the practice part is the messy, real-world side of things, where not everything lines up perfectly*," highlighting the role of professional VJ in navigating incomplete data, conflicting market signals, and contextual constraints. Finally, the statistical validation domain is understood as a reflexive and accountability-oriented stage in which valuation outcomes are assessed for defensibility and professional legitimacy. As the expert articulates, "*the statistical validation side feels like that final check we all do, either in our heads or with a colleague, just to make sure the number stacks up and can be justified if someone questions it*." This framing underscores the role of peer review, self-audit, and institutional accountability in shaping valuation quality.

Collectively, this response supports the framework's depiction of valuation as a multi-stage, judgement-driven process embedded within professional standards, real-world complexity, and reflexive validation practices. It reinforces the framework's applicability for professional

training, internal quality assurance, and regulatory-facing communication, where transparency, justification, and procedural clarity are essential.

9.5.2 Expert 2 - RA

The RA indicated that the framework closely reflects how valuation decisions are made in professional practice today. As noted, I agree with it," because "*each valuation, depending on who's the receiver, has to be developed in a way that suits their needs."* RA emphasised that valuation "*isn't just about producing a number*," but about "*shaping the information*" so it fits "*the needs, expectations, and decisions*" of different stakeholders. The RA further highlighted that the framework acknowledges how valuation outputs are used differently in practice, stating that information must be presented in a way that "*works for the people involved in the process*." This was seen as consistent with real-world valuation, where decisions depend not only on accuracy, but on how clearly and appropriately valuation information is communicated.

9.5.3 Expert 3 - PV

The PV noted that the framework reflects professional valuation practice, although it appears "*more detailed than what anyone would ever care to think of*." While practitioners may consciously articulate the process in such depth, the PV felt that "*it probably is a reflection of what goes on*," even if "*people wouldn't think of it quite this detailed*." PV explained that valuation typically involves "*that gathering of information*," including "*getting comparable sales*," "*doing the assessment of where it sits*," and "*producing that final outcome*," alongside "*other forms of information,"* such as "*hazard information*," "*broader market information*," and "*the total economy*." In this sense, the framework was seen as capturing the full range of inputs that information valuation decisions. Importantly, the PV highlighted that many of these activities occur "*almost subconsciously*," noting that practitioners "*wouldn't be thinking they're doing it, but they generally are*." PV also observed that while "*you wouldn't spend the same amount of time in each of those seven steps*," "*they probably all happened to some degree*." This suggests that although the framework articulates the process more explicitly than practitioners typically perceive, it remains "*a fair reflection of probably what goes on*" in contemporary valuation practice.

9.5.4 Expert 4 - RA

The RA felt that the framework reflects contemporary valuation-related decision-making by recognising the combination of data-driven and locally grounded inputs used in practice. RA explained that while practitioners "*utilise electronic*" and "*print media*," a significant part of decision-making also comes from "*talking to your neighbours*" and "*the local community you're serving*," which is described to "*add value*," beyond what automated systems provide. RA noted that "*electronic systems don't take into account*" factors such as whether "*the property owner did renovations*" or whether "*there is damage to the property*," highlighting the importance of personal judgement and on the ground insight. The RA also emphasised that valuation decisions are shaped by understanding the client's role and intentions. As RA explained, "*when you're interviewing the client, you've got to determine are they a buyer? Are they an investor?*" This qualification process helps clarify "*what sort of market to target*," as "*investors*" and "*buyers*" have different expectations and motivations. RA described this is as a process of "*breaking it down through questions*," where practitioners "*qualify through the process what the clients want*," and then "*make those determinations*" to guide market focus. Overall, the RA felt that framework reflects practice by showing how valuation-related decisions emerge through a mix of data, local knowledge, professional judgement, and client-specific questioning, rather than relying on automated or standardised inputs.

9.5.5 Expert 5 - PV

The PV indicated that the framework closely reflects how valuation decisions are made in contemporary professional practice. The emphasised that valuation is "*never just one thing that drives the decision*," but instead involves "pulling information from different places," using "*systems and data*," alongside "*experience and judgement*." This combination of quantitative inputs and professional interpretation was seen as consistent with real world practice. The PV further explained that while valuation often begins with data, "*once you're on site or talking things through, you realise there are things the numbers don't capture*." As a result, practitioners "*adjust,*" "*double check*," and "*compare again*" before finalising an outcome. The framework was perceived as accurately reflecting this "*mix of data, observation, and judgement*," rather than presenting valuation as a purely automated or formula-based process. In addition, the PV highlighted the iterative nature of valuation decision-making, noting that practitioners do not "*just set a value and move on*," but instead

"*review it,*" "*test it against the market*," and "*sometimes change it before finalising*." The PV viewed the framework as effectively acknowledging how valuation decisions are formed in professional contexts today.

9.6 Experts Response to Question Four

Q4. What aspects of this framework do you consider to be new or different compared to traditional valuation models or professional guidelines?

9.6.1 Expert 1 - PV

Expert 1 distinguishes the framework's contribution not as a departure from established professional standards, but as a formalisation of the underlying reasoning process that typically remains implicit in traditional valuation practice. The expert notes that, at a foundational level, the framework "*still lines up pretty closely with the standards and guidelines we already follow things like inspections, comparable sales, and making sure the report meets professional requirements*," indicating continuity with existing institutional and professional expectations. However, the expert identifies novelty in the framework's explicit structuring of professional reasoning and hybrid tool use. As the expert explains, "*what does feel different is the way it lays out the thinking process a bit more clearly*," particularly in showing "*how you've moved from the raw data and what you see on site, through your own judgement, and then into using tools or models as a way to check yourself, rather than just as something that spits out a number*." This observation highlights the framework's emphasis on transparency, explainability, and reflexive use of automated valuation tools as structured decision support rather than as substitute decision authorities. The expert further notes that this structured articulation of reasoning has value in external communication and governance contexts. According to the expert, "*that could be really useful when you're trying to explain a valuation to someone who isn't a valuer like a client, a bank, or a regulator because it helps show the logic behind the number, not just the number itself*." This reinforces the framework's contribution as a stakeholder-facing architecture that supports defensibility, trust formation, and institutional accountability.

At the same time, the expert reiterates the continued primacy of professional standards and human judgement, observing that "*we, as valuers, tend not to rely on AVMs, but they can be a supportive tool*," and concluding that "*the system follows the guidelines that we are required*

to meet, professional guidelines." This balance between innovation and continuity underscores the framework's positioning as a hybrid governance model that enhances, rather than replaces, established professional valuation practice.

9.6.2 Expert 2 - RA

The RA noted that the framework does not completely depart from traditional valuation principles, particularly in relation to objectivity and client focus. As explained, "*from the beginning, they've always looked at the client, the person who they're making the report for, and keeping it as non-biased as possible*." In this sense, the RA felt that "*historically it aligns*," and that "*the core idea of being objective and client-focused has always been part of valuation practice*." However, the RA identified the novelty of the framework in how it expands and structures this process across a wider group of stakeholders. RA emphasised that what feels new is "*how your framework makes this process more transparent and structured across all stakeholders, not just the direct client*." Rather than viewing valuation as "*a one-way report*," the framework was seen as presenting valuation as "*a shared quality system*," where "trust, data sources, professional judgement, and feedback" from "*buyers, agents, and valuers*" are "*all visible and connected."* This *"system-level view of valuation quality*" was described as something the participant *"doesn't usually see laid out so clearly in traditional models."*

9.6.3 Expert 3 – PV

The PV identified several aspects of the framework that differ from traditional valuation models, particularly the inclusion of "*hybrid support*" and the explicit treatment of "*trust formation*." PV noted that hybrid support "*makes sense in terms of how you're using, whether it's AI or statistical models to assist what's going on*, "highlighting that this area is "*evolving quite quickly*" compared to earlier practice, where "*we hadn't had as much use or as much time spent there*." The PV also reflected on the framework's treatment of professionalism, trust, and communication, suggesting these are often implicit in practice but made more visible in the framework. As PV explained, "*professionalism I sort of see more as something that would oversee all of it*," adding that "*trust almost comes in the same*." PV described these elements as "*all in one role*," where "*professional trust communication all comes together*." Rather than operating as isolated steps.

A key different identified by the PV was the framework's role in formalising surfacing decision-making processes that are often taken for granted. PV noted that the framework "*forces you to ensure that you're considering all those things*," such as "*have I acknowledged that there are hazards here?*" even when these checks are typically undertaken "*almost subconsciously*." This formalisation was seen as encouraging more deliberate reflection on valuation inputs and judgement. At the same time, the PV recognised potential practical challenges, observing that more experiences valuers "*could see this as just extra admin*," and questioning "*how onerous that might be*." Despite this, PV viewed the framework as "*forcing a conversation, or at least a thought process*," which they identified as a meaningful distinction from traditional valuation models and professional guidelines.

9.6.4 Expert 4 - RA

The RA viewed the framework as offering a clearer and more structured approach then traditional valuation models or professional guidelines. RA explained that, in current practice, decisions are often based on "*theory and what we know*," whereas the framework provides "*a structure of that nature*," which is described as "*the first time I've seen*" such as approach laid out so explicitly. As a result, RA believed the framework "*will help us and the industry understand things a little bit better*." What the RA found particularly different was the stakeholder-specific design. From their perspective as an agent, noted that "*I would read everything to do with an investor*," suggesting that the framework allow users to focus on the sections most relevant to their role or client type. RA described this as "*almost like a tailor system set out in front of you*," rather than having to "*hunt here and hunt there* "across different methods or sources. Overall, the RA felt that framework's ability to organise valuation-related knowledge by stakeholder perspective, such as "*an investor side of it*" and direct users toward relevant platforms or information pathways represents a meaningful departure from more generic or fragmented traditional models.

9.6.5 Expert 5 - PV

The PV identified several aspects of the framework as different from traditional valuation models and professional guidelines. PV noted that the framework "*pulls a lot of things together that usually sit in different places*," whereas conventional practice often involves "*following the standards, doing the report, and that's it*." In contrast, the framework was seen as showing "*the whole process and who's involved,"* rather than focusing solely on technical

reporting steps. A key distinction highlighted by the PV was the framework's recognition of multiple stakeholder perspectives. The PV appreciated that it "*doesn't just focus on the valuer's point of view*," but instead acknowledges that "*buyers, agents, and others all influence how value is formed*," even if they are not formally responsible for signing off the valuation. The PV noted that this broader, stakeholder-inclusive representation is "*not something you really see laid out clearly in traditional models*." The PV also emphasised the framework's explicit treatment of professional judgement and review. While traditional guidelines often assume these activities occur implicitly, the framework "*actually shows it as part of the process*." The PV described this as "*formalising things that usually just happen in the background*," which they viewed as particularly useful for explaining "*how decisions are made rather than just what the final value is*." Overall, the PV perceived the framework as offering greater transparency and process clarity compared to conventional valuation approaches.

9.7 Experts Response to Question Five

Q5. How could this framework be used to explain valuation decisions to clients, regulators, or other stakeholders in your professional context?

9.7.1 Expert 1 - PV

Expert 1 characterises the framework as a validation and communication tool that strengthens the defensibility and transparency of valuation outcomes. The expert notes that it can function as "*a really useful validation tool*" that "*would hopefully support whatever number the valuer came up with*" by providing a structured reference alongside conventional valuation processes. In stakeholder communication, the expert emphasises its explanatory value, observing that "*a lot of the time, people just see the final value and don't really understand how you got there*." By enabling valuers to "*walk them through what data you used, what you checked, and where judgement came in*," the framework helps make valuation reasoning more transparent and defensible, particularly in interactions with clients, lenders, and regulators.

9.7.2 Expert 2 - RA

The RA indicated that the framework could be used as "*a visual guide*" to support communication with clients, regulators, and other stakeholders. RA explained that "*by*

walking them through the diagram," PVs can "*break down the purpose of the valuation, how the process actually works, and what factors are being considered at each state*," rather than "jumping straight to the final number." The RA also noted that the framework helps make professional judgement and neutrality more visible. As stated, it "*helps explain how neutrality and professional judgement are built into the process*," allowing stakeholders to "*see how the decisions were formed, not just what the outcome was*." This transparency was seen to" *build more trust"* with "*clients, regulators, or other parties*."

9.7.3 Expert 3 - PV

The PV viewed the framework as a useful tool for explaining valuation decisions to different stakeholders, particularly because it recognises that "*each of the modules is for each person that's involved*," and that different participants are "*interested in a different viewpoint of what the valuation process is*." PV emphasised the importance of relatability, noting that communication should reflect "*what do they want to know?*" depending on whether the stakeholder is a "*home buyer*" or another participant in the process. At the same time, the PV acknowledged that stakeholders may not require "*that much detail*." Instead, they suggested the framework could sit behind communication efforts, helping PVs "*express something to show the robustness of a process*," and demonstrate "*that this is all the stuff that goes on*." This was seen as particularly important given current perceptions in the market, where there is "*a misunderstanding out there*" that "*you can just get an AVM or whatever*."

The PV highlighted the framework's value in helping justify the need for a full valuation compared to automated alternatives, noting the challenge of explaining "*why a full market might be required as opposed to an AVM*," especially when "*the cost difference is so massive*." They suggested the framework supports "*quickly, easily and sensibly*" communicating the value of professional valuation work, even when "*a model is getting pretty close these days.*" Importantly, the PV noted that "*what's going to convince them is going to be quite different*" for each stakeholder and appreciated how the framework is "*structured across each of the different buyers or participants*." PV emphasised that while the framework itself may not be shown directly to clients, "*that's a good process to go through*," enabling valuers "*to make it simple and easy to communicate*," which can "*build that trust*" and help stakeholders " *see the value in the work that's being done,"* including "going to the property," which PV described as "so important."

9.7.4 Expert 4 - RA

The RA indicated that the framework could be effectively used to explain valuation decisions to clients, regulators, and other stakeholders by improving transparency and clarity around the decision-making process. RA noted that stakeholders often focus only on "*the final number*" and may not fully understand "*what went into it*." In this context, the framework was seen as providing a structured way to demonstrate "*this is the process we've followed*," rather than relying solely on professional authority. The RA emphasised that while the full framework may not be presented in detail to all stakeholders, it supports simplified communication by helping practitioners explain "*how the information was gathered*," "*what was looked at*," and "*why certain judgements were made*." This was viewed as particularly valuable when addressing questions or challenges related to valuation outcomes, such as comparisons with automated estimates. Overall, the framework was perceived as enhancing transparency and trust by showing that valuation decisions are not based on individual opinion alone but are derived from a structured and systematic process.

9.7.5 Expert 5 - PV

The PV indicated that the framework could be effectively used to explain valuation decisions to clients, regulators, and other stakeholders, particularly in situations where outcomes are questioned. The PV noted that stakeholders often "*only see the final value*" and "*don't really understand how you got there*," and viewed the framework as providing a structured way to demonstrate "*this is the process we followed*." The PV explained that while it may not be necessary to "*walk someone through every step in detail*," the framework supports clearer communication by showing "*how the information was gathered,"* "*how the judgement was applied*" and "*why certain decisions were made along the way*." This was seen as especially useful when valuation is compared with "*an AVM or another figure*," and stakeholders' questions "*why they're different*." From a regulatory perspective, the PV emphasised the value of transparency and consistency. The PV noted that the framework allows PVs to demonstrate that decisions are "*not just a personal opinion*," but part of "*a systematic process*" that considers "*data, inspection, and professional judgement*." Even when simplified for different audiences, the PV felt that having the framework underpinning communication makes it "much easier to justify the valuation" and "*build confidence in the work that's been done*."

9.8 Experts Response to Question Six

Q6. In what ways could this framework be applied within your organisation for training, quality assurance, or improving how valuation decisions are communicated?

9.8.1 Expert 1 - PV

Expert 1 identifies the framework as a training and quality assurance support tool, particularly valuable for early-career professionals. The expert describes it as "*a training model*" that provides "*a roadmap to follow, so they don't skip steps*," highlighting its role in reinforcing procedural completeness and professional standards among junior valuers. In terms of quality assurance, the expert notes that the framework can assist senior staff by offering a structured basis for review, enabling them "*to go through a report and make sure everything's been properly thought through and documented*." This reinforces the framework's utility for internal audit, peer review, and the institutionalisation of transparent and defensible valuation practices.

9.8.2 Expert 2 - RA

The RA indicated that the framework could be applied across "*all three*" areas: training, quality assurance, and communication. As stated, "*I agree with them*" particularly in using the framework for "*explaining the product,*" "*what it's used for*," and "*helping people understand the process and how it's used*." This suggests the framework could support clearer internal understanding and more consistent communication of valuation decisions within the organisation.

9.8.3 Expert 3 - PV

The PV suggested that the framework could be applied to support training, quality assurance, and communication, particularly in situations where "*people don't understand valuation or trust it, and it falls on us*." PV highlighted its potential value in improving communication "*in between valuers and banks*," which PV described as "*a pretty core part of the valuation industry*," noting that the framework provides "*that detail to understand and communicate about what goes on*." The framework was also seen as useful for education and professional development. The participant suggested it could act "as a substitute, as an addition, as supplement" to existing training, helping to "*formalise*" and "*really make it clear as to the full process that goes on*." PV further noted that it could provide "*some collateral to have those*

conversations" with others in the industry who may not "*truly appreciate, understand, or recognise the work that's done*."

9.8.4 Expert 4 - RA

The RA indicated that the framework could be applied within organisations particularly to support training and skill development for less experienced staff. As they stated, "*I can confirm that will be the case*," noting that the framework would be especially useful "*with never industry people*." RA suggested that having a structured framework helps newcomers "*be more specific*" in how they understand and communicate valuation decisions. The RA further implied that the framework could assist in improving consistency and clarity by giving newer practitioners "*something to follow*" and "*a clearer idea of what's expected*." By setting out the process in a more explicit way, the framework was seen as helping staff "*explain themselves better*" and "*communicate more clearly*" with other involved in the valuation process, thereby supporting both internal quality assurance and external communication.

9.8.5 Expert 5 - PV

The PV indicated that the framework could be applied in multiple ways within an organisation, particularly for training, quality assurance, and communication. From a training perspective, PV noted that it would be "*really helpful for newer staff*," as it provides "*a clear pictures of the whole process*" rather than learning "*bits and pieces as they go*." This was seen as helping staff understand "*how everything connects*," rather than focusing solely on "*the final report*." In terms of quality assurance, the PV suggested that the framework could serve as a reference point to ensure consistency and completeness. The PV explained that it offers "*something to check against*," helping to ensure that "n*othing important has been missed*" and that "*the same steps are being followed consistently*." Importantly, PV emphasised that this use is "*not about ticking boxes*," but about promoting "*a common way of thinking about how valuations are done*." The PV also highlighted the framework's value in improving communication. The PV noted that it helps practitioners "*explain their decisions better, both internally and externally*," and that when "*everyone's working from the same framework*," it becomes easier to "*talk through why a decision was made and what was considered*." Overall, the framework was viewed as a practical tool for supporting staff development, maintain PVQ, and strengthening communication across the organisation.

9.9 Experts Response to Question Seven

Q7. What refinements or changes would you suggest improving the framework's clarity, usability, or practical relevance?

9.9.1 Expert 1 - PV

Expert 1 reports that the framework is "*easy to follow*" and "*logical in the way it's laid out*," indicating no need for major structural changes. The expert suggests only minor refinements aimed at enhancing practical usability, particularly for early-career professionals and non-technical stakeholders. One recommendation is the inclusion of "*a simple, practical example or short checklist at each stage*" to illustrate how the framework operates in real cases rather than only at a conceptual level. A second refinement relates to improving transparency around data provenance. The expert advises making it clearer "*where the information is actually coming from at each step*," specifically distinguishing between inputs "*gathered directly by the valuer like measurements, photos, condition, and on-site observations" and those derived from "external databases or automated systems*." The expert notes would increase confidence in the reliability and credibility of valuation inputs.

With respect to professional standards, the expert does not view the framework as a mechanism for creating entirely new formal guidelines. Instead, they emphasise its role in strengthening the practical application of existing standards. As the expert explains, the framework could "*sit alongside them as a practical guide*," providing a clearer structure for how data, professional judgement, and technology use are documented, checked, and explained in day-to-day valuation work. This positions the framework as a support tool for professional bodies, firms, and regulators seeking to promote best practice, particularly in contexts of increasing automation and digital decision support.

9.9.2 Expert 2 - RA

The RA indicated that no major refinements were required, describing the framework as "*very clear and easy to follow as it is.*" RA noted that "*the way it's laid out makes the steps and roles quite straight forward*," and that they "*don't really feel lost at any point in the process*." The only suggested enhancement was the inclusion of a practical aid. As the RA explained, "*If I had to add anything*," it would be "*a simple, real-world example or short checklist at each*

stage," particularly "*for newer staff or people outside the profession*," to help them "*quickly see how the framework works in practice rather than just at a conceptual level*."

9.9.3 Expert 3 - PV

The PV responded positively to the framework but suggested refinements to improve clarity and usability. They noted some tension between simplicity and detail, stating that "*in some areas I go, give me a little bit more detail,"* while in others "*it looks a bit detailed as well*." They questioned "*what does evaluation judgement actually mean*," and whether some elements represent "actual work required" or operate as "overarching" principles. Professionalism and trust were viewed as concepts that "happen throughout the whole process," rather than as discrete stages. Despite this, the participant strongly supported the overall structure, describing the "*input processing outcome*" logic as "great." They suggested clearer identification of practical activities, such as "visiting the property where does that come in?" and highlighted the value of setting expectations in an industry "*under a bit of pressure with timing*." The PV particularly valued the stakeholder focus, stating "*love getting into the mindset of each of the participants in the process,"* and suggested explicitly including banks, noting that banks are "*all about speed*" and have different expectations. Overall, they saw clear value in "*bringing it all together in one place,"* to make "e*xpectations, what goes on and where the value is*" more transparent for all participants.

9.9.4 Expert 4 - RA

The RA suggested that improvements to the framework clarity and practical relevance should focus on alignment with legal requirements and professional conduct. RA emphasised that "*whatever I practise has to be within the guidelines legally and out professional conduct*," noting that much of their work is based on "*clarity in those areas*." From this perspective, the framework was seen as adding value by allowing users to "*go directly into whatever platform you have and just focus on that*," depending on whether the stakeholder is "*the client, the investor, the valuer, and all that sort of stuff*." The RA also highlighted the importance of keeping the framework current, particularly in relation to regulatory change. As RA noted, "*obviously, you have to be up to date with whatever is being introduced*," warning that "if *you're lagged in that, then it'll be a costly mistake*." RA suggested that framework usability would be strengthened if it clearly supports ongoing compliance, helps practitioners, "*stay on top of changes*," and ensures that "*nothing important gets missed*." Overall, the RA viewed

the framework as most effective when it supports legally sound, role specific practice while remaining adaptable to evolving professional standards.

9.9.5 Expert 5 - PV

The PV suggested that minor refinements could enhance the framework's clarity and practical relevance, particularly in relation to prioritisation. The PV noted that "*not every step gets the same amount of time or attention*" in practice and suggested that clearer guidance on "*what's critical versus what's more supportive*" would make the framework easier to apply in "*real situations where time is right*." Despite this suggestion, the PV expressed views on the framework's overall structure, describing it as "*logical and easy to follow*." The PV emphasised that any refinements should focus on "*making it faster to use and easier to translate into everyday practice*," rather than altering the core structure or intent of the framework. Overall, the feedback indicates that the framework is viewed as conceptually sound, with suggested improvements centred on usability and efficiency rather than fundamental change as mentioned in Table 9.2.

Table 9.2: Common expert suggestions for refining the framework

Question	Supported	Suggested Changes	Overall Feedback from Experts	Common Patterns
Q1. Interpretation of the overall framework	5	2	Experts generally viewed the framework as conceptually sound, realistic, and closely aligned with how valuation-related decisions are formed in practice.	The framework was seen as reflecting a real process, not just a theoretical model. Experts appreciated that it captures valuation as multi-stage, judgement-based, and stakeholder influenced.
Q2. Connection between three stages	6	1	Experts found the connection between the conceptual, practice-based, and validation stages clear, logical, and easy to follow.	Most described the stages as a continuous flow rather separate steps, often summarised as planning, doing, and checking.
Q3. Reflection of current professional practice	6	1	Experts agreed that the framework reflects how valuation decisions are made in current practice, although some noted that it is more explicit and detailed that how practitioners normally describe their work.	The framework was seen as making implicit professional reasoning more visible, especially the interaction of data, judgement, local knowledge, and review.
Q4. New aspects of the framework	4	3	Experts saw the main novelty in the framework's hybrid structure, stakeholder focus, and explicit treatment of trust, judgement, and technology support.	Unlike traditional valuation models, the framework was seen as showing how decisions are formed, not just the final value or report.
Q5. Use for explaining valuation decisions	6	1	Experts believed the framework could help explain valuation decisions to clients, regulators, and other stakeholders by making the process more transparent.	A strong theme was that the framework helps people understand how a value was reached, rather than only seeing the final figure.

Q6. Organisational use, training, QA, communication	4	3	Experts considered the framework useful for training newer staff, quality assurance, and improving internal and external communication.	The framework was viewed as a practical guide or roadmap, especially useful for ensuring consistency and helping others understand valuation work.
Q7. Suggested Refinements			Experts suggested only minor refinements rather than major changes.	Common suggestions included adding practical examples/checklists, improving clarity around data sources, showing priority of steps, and keeping the framework aligned with legal/professional updates.

9.10 Framework Refinement

Following the expert evaluation interviews, the proposed stakeholder-centric modular hybrid PVQ framework was further refined to enhance conceptual clarity, operational transparency, and practical applicability. Two substantive refinements were incorporated based on expert feedback.

First, the construct of information quality was explicitly expanded to clarify the provenance, structure, and improvement pathways of valuation data. Experts emphasised that PVQ is fundamentally contingent on the origin, integrity, and contextual relevance of underlying data inputs. As a result, the refined framework now distinguishes the primary data domains informing valuation decisions, including market transaction data, property-specific attributes, regulatory and zoning information, macroeconomic indicators, geospatial variables, and risk-related overlays (e.g. flood exposure, insurance constraints). The refinement also makes explicit that information quality is not limited to data accuracy alone but encompasses completeness, timeliness, comparability, contextual adequacy, and governance traceability. By foregrounding the data generation and verification layer, the framework clarifies how improvements in data ecosystems directly strengthen valuation reasoning, hybrid analytics, and ultimately stakeholder trust.

Second, expert feedback indicated that while the SPs and Ops were theoretically articulated in CHAPTER 06 and CHAPTER 08, their operational visibility within the visual framework required strengthening. Accordingly, the refined framework explicitly embeds the SPs and OPs architecture as the governance backbone of the hybrid valuation process. The SPs, Trust, governance alignment, and hybridisation are now positioned as foundational system condition shaping how VJ and digital tools interact. The OPs, contextualisation, orchestration, and adaptation are incorporated as procedural mechanisms guiding the translation of data into defensible, explainable, and stakeholder-responsive outcomes. This refinement ensures that the framework does not merely describe valuation components but clearly demonstrates how PVQ is operationalised through structured governance and decision workflows. These distinction enhances the transparency and addresses concerns raised in prior literature regarding the “black box” of AVMs and data-driven decision tools (Nweke & Bakare, 2025). By making information sources visible rather than implicit, the framework strengthens its epistemic clarity and supports explainable valuation practice.

These refinements strengthen the analytical coherence of the framework by clarifying data origins and improvement pathways, and by explicitly integrating the SP-OP architecture as a visible and actionable operationalisation mechanism. The refined framework therefore enhances transparency, governance alignment, and practical usability while preserving the theoretical integrity of the stakeholder-centric modular hybrid PVQ framework structure.

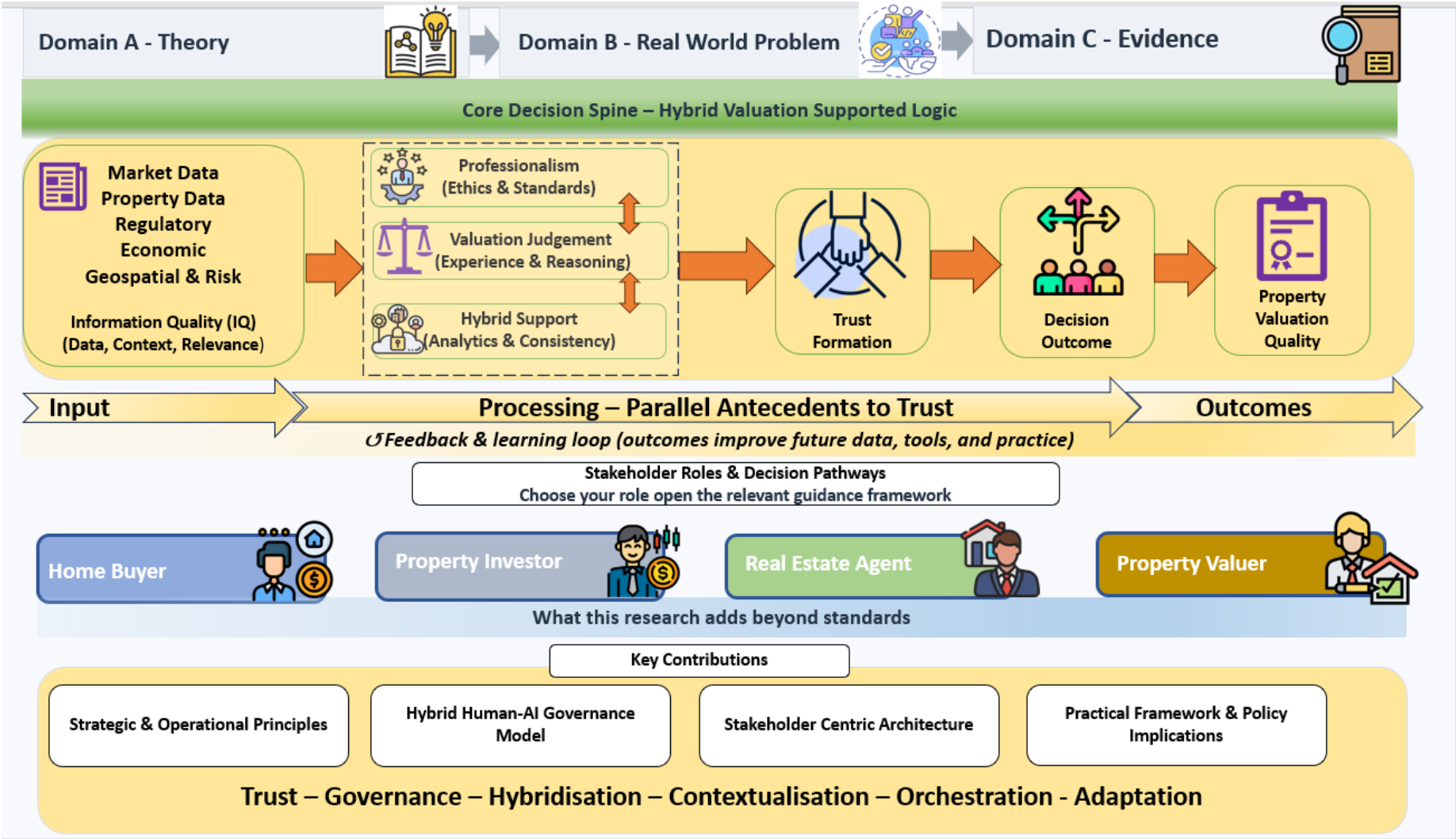


Figure 9.1: Stakeholder-centric modular hybrid PVQ industry guidance framework

EPILOGUE – PART FOUR

CHAPTER 08 and CHAPTER 09 consolidate the empirical and analytical outputs of this study through structured framework integration and professional evaluation. CHAPTER 08 formalised the stakeholder-centric modular hybrid PVQ framework by synthesising findings derived from SLRs, qualitative stakeholder engagement, and quantitative structural modelling. The framework operationalises the interaction between PVIFs, professional VJ, hybrid technological decision-support mechanisms, and stakeholder trust within a unified socio-technical architecture. Its modular configuration reflects empirically identified differentiation across stakeholder groups, including PVs, RAs, RPIs, and HBs. The framework establishes a structured decision spine linking valuation inputs, mediating governance mechanisms, and perceived PVQ outcomes.

CHAPTER 09 evaluated the structural integrity and professional applicability of the proposed framework through structured expert evaluation interviews and achieved objective 3 by answering RQ4. The evaluation process assessed conceptual clarity, operational feasibility, interpretive transparency, and alignment with established professional standards. Analytical incorporation of expert feedback resulted in refinement of framework components, strengthening governance coherence and practical implementation. The expert evaluation phase confirmed that the hybrid PVQ architecture is consistent with contemporary valuation workflows and regulatory expectations within the New Zealand residential property context.

Collectively, CHAPTER 08 and CHAPTER 09 demonstrate that PVQ can be systematically modelled and operationalised as a hybrid socio-technical system in which professional VJ, digital augmentation, and stakeholder trust function as interdependent components. The resulting validated framework provides an empirically grounded and professionally aligned structure for enhancing transparency, interpretability and accountability in residential property valuation practice.

PART FIVE

IMPLICATIONS OF STUDY

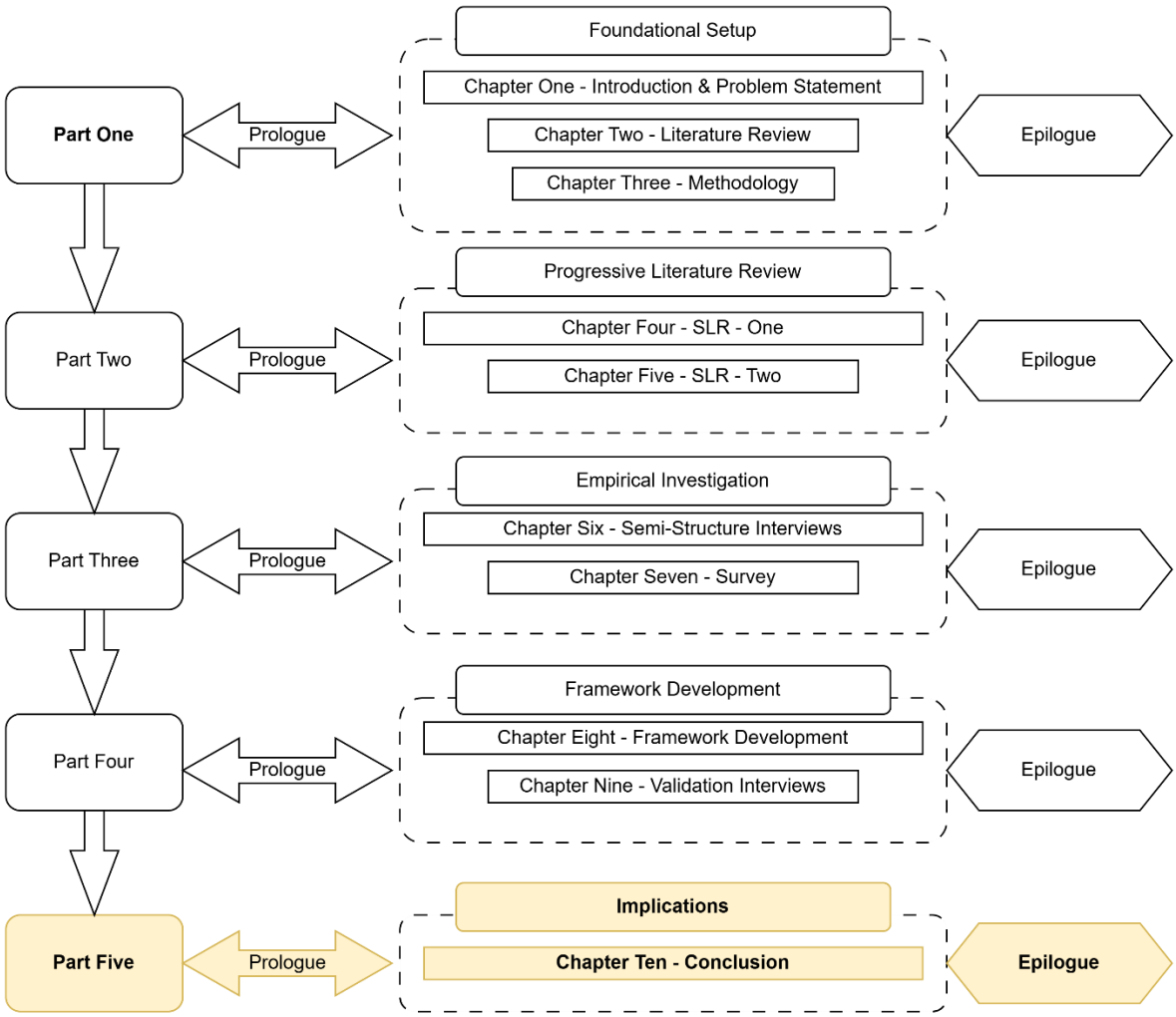
PROLOGUE – PART FIVE

CHAPTER 10 consolidates the analytical, empirical, and structural developments presented throughout this thesis and articulates their broader significant for property valuation research and professional practice. Following the development and expert evaluation of the framework in previous chapters, this chapter synthesis the principal findings of the study and evaluates their theoretical, methodological, contextual, practical, and policy implications.

CHAPTER 10 revisits the research objectives and RQs to demonstrate how they have been systematically addressed through the progressive literature synthesis, stakeholder engagement, and quantitative structural modelling undertaken in earlier chapters. It then positions the contribution for the study within the broader domains of behavioural valuation research, socio-technical systems theory, and digital transformation in real estate.

In addition, CHAPTER 10 examines the practical applications of the validated framework within professional valuation environments and regulatory contexts. It further outlines the limitations of the study and identifies structured directions for future research aimed at extending the framework across alternative institutional and asset-class settings.

Through this synthesis, CHAPTER 10 provides a comprehensive closing assessment of how PVQ can be conceptualised, modelled, and operationalised within hybrid human-technology valuation systems in digitally evolving residential property markets.


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CHAPTER 10

10.CONCLUSION AND IMPLICATIONS

10.1 Introduction

This chapter concludes the thesis by synthesising the key findings of the study and revisiting the original research aim and objectives. It consolidates the theoretical, methodological, and practical contributions of the proposed stakeholder-centric hybrid modular PVQ guidance framework. In doing so, the chapter demonstrates how the research advances understanding of PVQ beyond traditional technical measures by positioning it within a broader socio-technical and stakeholder-informed context. The limitations of the study are critically acknowledged, and meaningful directions for future research are identified to further refine and extend the framework. By integrating insights from Part 2 (the progressive literature review) and Part 3 (the empirical investigation), the thesis provides a comprehensive and evidence-based explanation of how PVQ emerges through the dynamic interaction of professional judgement, technological support systems, and stakeholder trust within New Zealand's residential property market. Together, these findings establish a coherent foundation and framework in Part 3 (Framework Development and Expert Evaluation) for strengthening valuation reliability, transparency, and trust in an increasingly digital property environment.

10.2 Recapitulation of Findings

The primary aim of this research was to develop and validate a stakeholder-centric hybrid modular PVQ framework that explains how quality is formed through the interaction of technological support and professional judgement in New Zealand's residential property market. Accordingly, CHAPTER 2 presents the conceptual framework (Figure 2.3), which establishes the theoretical foundation for this study. This framework is further explored and operationalised in CHAPTER 06 and subsequently empirically tested and validated in CHAPTER 07 (Figure 7.6). To operationalise this aim, three interrelated objectives were pursued, each aligned with a distinct phase of data collection, analytical technique, and framework development, as synthesised Table 10.1.

Objective 1 addressed in CHAPTER 04 and CHAPTER 05 where the conceptual grounding of the framework by synthesising how digital technologies support property valuation decision-making in real estate. This objective was pursued through a PRISMA-based SLR and thematic synthesis of scientific trends in SRE, AVMs, explainable AI, and socio-technical decision systems. The findings revealed a consistent shift in valuation research from accuracy-dominated evaluation metrics toward interpretability, transparency, and institutional trust as defining dimensions of PVQ. While innovative technologies were shown to enhance data availability and analytical capacity, their effectiveness was found to depend on their integration into professional reasoning and stakeholder communication processes. These insights established the theoretical foundation for positioning PVQ as a behavioural and socio-technical process and informed the development of the framework's core decision spine.

Objective 2 focused on the construction and operationalisation of the hybrid modular PVQ framework through the integration of technological valuation support, professional VJ, and stakeholder interpretation in CHAPTER 06. This phase was informed by semi-structured interviews with PVs, RAs, RPIs, and HBs, analysed using thematic coding and causal loop modelling. The analysis demonstrated that PVQ is interpreted differently across stakeholder groups but is consistently mediated through explanation, credibility, and trust. PVs prioritised professional defensibility and ethical accountability, RAs emphasised market signalling and negotiation credibility, RPIs focused on risk–return translation and portfolio alignment, and HBs prioritised clarity and decision confidence.

Objective 3 aimed to empirically test, develop, and validate the stakeholder-centric hybrid modular PVQ framework in CHAPTER 07. This objective was operationalised through a cross-sectional survey and advanced multivariate analysis, including EFA, cluster analysis, and PLS-SEM. The results demonstrated that PVIFs do not exert a direct effect on perceived PVQ. Instead, their influence is mediated through professional VJ, professionalism, and hybrid valuation support, which collectively shape stakeholder trust. Trust was empirically confirmed as the central mediating construct linking valuation practice to perceived PVQ. Across Part ONE to Part Three of the thesis, a stakeholder-centric hybrid modular PVQ framework was systematically developed. Drawing on insights from the progressive literature review and empirical investigation, the framework was consolidated and formally presented in CHAPTER 08. It was subsequently validated and refined through expert evaluation in CHAPTER 09,

Table 10.1: Synthesis of Research Objectives and Key Findings Across the Study

Research Objective	RQs Addressed	Key Findings	Objective achieved Chapters
Develop a conceptual framework synthesising how digital technologies support property valuation decision-making	RQ1–RQ6	Established the theoretical foundation for positioning PVQ as a socio-technical, trust-mediated process.	CHAPTER 2 (Conceptual framework) and CHAPTER 04 & CHAPTER 05 (SLR findings and Frameworks)
Construct a hybrid PVQ framework integrating technological support and professional judgement	RQ1–RQ4	Informed the modular stakeholder architecture (HB, RPI, RA, PVs pathways) and validated the role-specific interpretation logic of the framework.	CHAPTER 06 (Framework construction and operationalisation principles)
To empirically test, develop and evaluate the practical application of the stakeholder-Centric modular hybrid property valuation quality framework.	RQ1–RQ4	Provided empirical testing and development of the decision spine and stakeholder modules, resulting in a professionally validated, role-specific, and trust-mediated PVQ architecture suitable for training, quality assurance, and regulatory interpretation.	CHAPTER 07 (PLS-SEM results and statistical validation) CHAPTER 08 (Framework development and consolidation) CHAPTER 09 (Expert Evaluation)

ensuring its theoretical robustness, methodological coherence, and practical relevance. Expert evaluation interviews complemented these findings by confirming the framework's clarity, professional realism, and practical usability, and by informing refinements related to transparency, data provenance, and training application.

The objectives of this study were established through a comprehensive synthesis of valuation, decision-making, and digital transformation literature, as discussed in CHAPTER 2 through CHAPTER 05

. While considerable efforts have been made to enhance the technical accuracy and computational sophistication of valuation systems, existing research has increasingly recognised that PVQ is shaped by interpretive reasoning, institutional trust, and stakeholder sense-making rather than numerical precision alone (Adilieme et al., 2023; Ahiadu et al., 2024). Determining not only what valuation information is available, but how it is perceived, explained, and legitimised across professional and non-professional actors is therefore central to understanding how PVQ is formed in practice as also informed by Al-haimi et al. (2025). Accordingly, this research sought to identify the PVQ preferences and interpretive needs of key stakeholders involved in New Zealand's residential property market, including PVs, RAs, RPIs, and HBs. By examining how these actors engage with valuation inputs, professional VJ, and automated decision-support tools, the study extends stakeholder-based perspectives on decision legitimacy and institutional credibility within socio-technical systems (Goode et al., 2025).

Following the research aimed to develop and validate a stakeholder-centric hybrid PVQ framework that supports structured decision-making, professional accountability, and transparent communication in digitally mediated valuation environments. This objective is particularly significant given the growing reliance on AVMs and data-driven systems, and the limited empirical guidance available on how such technologies can be integrated into professional practice without undermining trust and ethical governance.

The theoretical foundation underpinning this investigation draws on behavioural decision theory, stakeholder theory, and socio-technical systems theory, as outlined in CHAPTER 2. Establishing such a foundation is essential in applied social and professional research, as it provides a conceptual model for explaining how human judgement, institutional governance,

and technological systems interact to shape decision quality and perceived legitimacy. Specifically, the study advances a trust-mediated valuation model in which information quality and PVIFs are filtered through professional valuation judgement, professionalism, and hybrid valuation support mechanisms. These processes collectively shape stakeholder trust, which in turn determines how valuation outcomes are accepted, used, and defended in market and institutional contexts.

10.3 Theoretical Contributions

This study makes several significant theoretical and industry-oriented contributions to valuation and decision research.

First it advances behavioural valuation theory by repositioning PVQ as a trust mediated and process-oriented construct rather than merely an accuracy-based technical output. Traditional valuation models have largely equated quality with numerical precision and statistical performance. In contrast, this research demonstrates that in professional practice, PVQ is shaped by how decisions are reasoned, communicated, and perceived by stakeholders. By incorporating interpretive judgement, institutional credibility, and stakeholder trust into the conceptualisation of quality, the study bridges the gap between theoretical valuation accuracy and practical market acceptance. This reframing aligns closely with industry realities, where the legitimacy and defensibility of valuation are as important as the price estimate itself.

Second, the study contributes to socio-technical systems theory by empirically demonstrating how professional VJ and AI operates as complementary governance mechanisms rather than competing decision authorities. In industry discourse, AI is often positioned either as a replacement for professional expertise or as a purely technical efficiency tool. This research challenges that binary framing by evidencing a hybrid model in which AVMs enhance analytical depth, consistency, and scalability, while professional VJ provides contextual interpretation, ethical oversight, and accountability. The proposed framework operationalises this hybrid valuation support structure, illustrating how AI strengthens with six OP and SP principles developed in CHAPTER 06 rather than substitutes, professional reasoning when embedded within transparent, regulated, and professionally governed practices. This has direct implications for regulatory bodies, valuation firms, and digital platform developers seeking to integrate AI responsibly.

Third, the research introduces a stakeholder-centric modular architecture to valuation theory, extending stakeholder theory into the domain of property valuation decision processes. The findings demonstrates that different stakeholder groups, including PVs, RAs, RPIs, and HBs engage with valuation outputs through distinct interpretive pathways shaped by their roles, incentives, and risk perceptions. By formally structuring these pathways within a modular framework, the study explains how PVQ is socially constructed, negotiated, and validated across diverse market actors. This industry aligned perspective provides a clearer understanding of why valuation disputes arise, how trust is formed and eroded, and how communication strategies can be improved to enhance transparency and market confidence.

Collectively, these contributions reposition PVQ as a dynamic socio-technical process embedded within professional practice, digital performance, and stakeholder governance. In doing so, the research offers both a theoretical advancement and practical roadmap for strengthening reliability, accountability, and trust in contemporary property valuation systems.

10.4 Methodological Contributions

Methodologically, this study advances property valuation research by establishing a structural modelling architecture in CHAPTER 07 which is capable of capturing the socio-technical and stakeholder mediated nature of property valuation systems. Traditional valuation research has largely treated valuation outcomes as technically derived price estimates, frequently analysed using measures, regression models, and model accuracy comparisons. Such approaches, while analytically useful, often overlook the behavioural governance, and interpretive dimensions that shape valuation acceptance and market legitimacy.

This research contributes by demonstrating how PVQ can be operationalised as a multi-layered construct embedded within interacting professional, technological, and stakeholder systems. By integrating stakeholder heterogeneity and trust mediation into a single structural modelling framework, the study provides an analytical pathway for examining valuation not merely as a pricing mechanism but as a governance influenced by accountability, transparency, and perception.

A further methodological advancement lies in the explicit modelling of trust as mediating variable within valuation systems. Rather than if improved data and algorithmic precision

automatically enhance PVQ, the research evidence that the impact of hybrid digital tools depend on stakeholder confidence in the decision process. This introduces a governance-sensitive modelling perspective that is particularly relevant in contemporary property markets characterised by increasing automation and regulatory oversight.

Additionally, the structured incorporation of stakeholder segmentation in CHAPTER 06 within the analytical framework challenges the assumption homogeneity across market sectors. By modelling differentiated interpretive pathways, the study provides a scalable approach for future valuation research to examine how diver professional roles, risk orientations, and decision priorities shape valuation outcomes. This is especially important in residential market where HBs, PVs, RPIs, and RAs evaluate valuation outputs through distinct behavioural and institutional lenses.

Collectively, this research establishes a transferable methodological template in CHAPTER 06 and CHAPTER 07 for analysing hybrid valuation systems operating within digitally evolving property markets. It provides a research design capable of capturing complexity without sacrificing empirical rigour and offers a replicable modelling structure for future studies investigating transparency, governance, automation, and trust in real estate decision-making environments.

10.5 Practical Implications

From a practical standpoint, the proposed framework offers a structured decision-support architecture for strengthening valuation practice across professional roles. By explicitly mapping the interaction between valuation inputs, professional VJ, digital tools, and stakeholder interpretation, the framework enhances transparency in how valuation outcomes are formed and justified.

For valuation firms, the framework provides a systematic reference model for training, mentoring, and internal quality assurance. By making the reasoning pathway explicitly, it supports junior PVs in developing defensible professional VJ and structured report-writing practices. Simultaneously, it equips senior PVs and PVQ reviewers with a structured mechanism for evaluating methodological consistency, interpretive transparency, and governance compliance within valuation reports.

For RAs and RPIs, the framework clarifies how pricing recommendations, risks assessments, and investment decisions can be aligned with professional valuation logic rather than purely market sentiment and heuristic judgement. This alignment improves decision coherence and reduces misinterpretation of valuation outputs. For HBs, the framework enhances perceived fairness and decision confidence by improving explainability and transparency, thereby reducing informational asymmetry in residential transactions.

More broadly, the framework supports firms operating in increasingly digital valuation environments by offering a practical model for integrating AVMs and AI tools within professionally accountable workflows. Rather than positioning technology as a substitute for expertise, the framework operationalises hybrid valuation support, reinforcing professional oversight while leveraging digital efficiency.

10.6 Policy and Regulatory Implications

At an institutional level, the framework provides a structured implications for professional bodies, regulatory agencies, and valuation standard setting institutions. Rather than proposing a revision of existing valuation standards, the framework introduces an interpretive governance layer that strengthens the practical implementation of those standards in digitally evolving markets.

The findings suggests that PVQ should not be assessed solely in terms of techincal compliance and price variance, but also through transparency of reasoning, explainability of digital inputs, and demonstrable professional accountability. Accordingly, the framework offers a basis for developing regulatory guidance on:

1. Transparent integration of AVMs within valuation workflows
2. Documentation standards for hybrid decision-making processes
3. Ethical governance of AI-assisted valuation
4. Stakeholder communication protocols to enhance trust

In markets experiencing rapid digitalisation, regulatory frameworks must balance innovation with accountability. The proposed modular architecture provides a policy-relevant model for achieving this balance embedding trust mediation and stakeholder validation within valuation processes. This is particularly relevant for jurisdiction seeking to modernise valuation practice while maintaining professional integrity and public confidence.

Overall, the practical and policy implications of this research contribute to strengthening valuation governance, enhancing market transparency, and supporting responsible digital transformation within residential property markets.

10.7 Contextual Contribution

This study makes a contextual contribution by empirically examining PVQ within the institutional, regulatory, and market specific conditions of New Zealand's residential property sector. While IVSC research has largely focused on model performance, price dispersion, and algorithmic accuracy in larger and more data-intensive markets, limited empirical work has investigated how PVQ is constructed and legitimised within smaller, highly regulated, and trust-sensitive environments.

New Zealand's residential property market is characterised by relatively high price volatility, concentrated professional valuation practice, regulatory oversight under established valuation standards, and increasing integration of AVMs within lending and advisory processes. In this context, valuation outcomes are not assessed solely on predictive accuracy but also on professional defensibility, transparency of reasoning, and stakeholder acceptance. The findings of this study demonstrate that PVQ is significantly shaped by trust-mediated interactions between professional VJ, digital decision support tools, and stakeholder expectations. This contextual evidence refines dominant accuracy-centric models of PVQ by demonstrating that technical precision alone does not determine valuation legitimacy within governance-intensive markets.

Furthermore, the research provides empirical and expert evaluation of hybrid valuation structures within a digitally transitioning but professionally regulated environment. By modelling stakeholder heterogeneity and trust mediation within the New Zealand context, the study offers context-sensitive insights into how valuation governance operates under conditions of regulatory accountability and institutional credibility. Although grounded in New Zealand, these findings have broader relevance for residential property markets experiencing similar pressures from digital transformation, risk regulation, and increasing demand for explainable AI in valuation practice.

10.8 Applications of Framework

The framework developed in this study is designed not only as a conceptual model but as an applied decision-support architecture capable of informing valuation practice, governance, and digital integration within residential property markets. By explicitly structuring the interaction between PVIFs, professional VJ, hybrid digital tools, and stakeholder trust, the framework provides a scalable mechanism for strengthening transparency, accountability, and consistency in valuation processes. Its modular design enables adaptation across firm-level operations, regulatory oversight, professional training, and technology-enabled valuation systems, particularly in markets undergoing digital transformation and increased governance scrutiny.

The principal applications of the framework include:

1. Structured supported for documenting valuation reasoning, strengthening report defensibility, and improving internal quality assurance procedures within valuation firms.
2. Operational guidance for embedding AVMs and AI tools within professional accountable workflows rather than using automated outputs as standalone estimates.
3. A structured interpretive layer supporting transparency, explainability, and ethical use of digital valuation systems under professional standards and regulatory oversight.
4. Clear mapping of valuation pathways that enhance interpretability for RPIs, RAs, and HBs, thereby reducing information asymmetry and improving perceived fairness.
5. A pedagogical model for training emerging property professional in hybrid valuation reasoning, governance awareness, and responsible technology integration.
6. A conceptual blueprint for developing valuation software and decision-support dashboards that incorporate governance checkpoints and trust indicators within automated processes.

10.9 Limitations of the Study

Notwithstanding its theoretical and practical contributions, this study is subject to several methodological and contextual limitations that delimit the scope of inference.

Firs the empirical investigation is geographically bounded to the New Zealand residential property market. Although this context provides a well-defined regulatory and digitally

transitioning valuation environment, the institutional structure, market scale, and professional governance conditions may differ from those in larger and less regulated jurisdictions. Consequently, the external validity of the findings should be interpreted with cautions, particularly in markets characterised by alternative valuation standards, differing levels of AVM integration, and distinct stakeholder compositions.

Second, the quantitative phase employed a cross-sectional survey design, capturing stakeholder perceptions and behavioural orientations at single temporal point. While appropriate for structural modelling of relationships among constructs, this design does not allow for examination for temporal dynamics, causal evolution, and longitudinal shifts in trust, technology adoption, and professional valuation practice. Residential property markets are inherently cyclical and sensitive to macroeconomic conditions; therefore, stakeholder perceptions of PVQ and digital tools may vary over time.

Third, although the framework conceptually integrates AVMs and AI-assisted decision-support systems, the study does not empirically evaluate specific machine learning algorithms, predictive accuracy metrics, and system architectures. The analytical focus is directed toward stakeholder interaction with hybrid valuation processes rather than algorithmic optimisation and model performance benchmarking. Accordingly, the findings should not be interpreted as an assessment of the technical superiority of AVM methodologies but rather as an examination of governance, interpretive reasoning, and trust-mediated PVQ.

Although the proposed framework was evaluated by five experienced industry experts representing relevant stakeholder groups, the relatively small number of validation experts may not fully capture the diversity of perspectives, experiences, and professional practices across the broader residential property valuation industry. While the expert evaluation provided valuable insights into the framework's relevance, practicality, usability, comprehensiveness, and potential industry applicability, the evaluation remained conceptual in nature. The framework was not implemented, piloted, or field-tested using real residential property valuation cases or integrated into actual valuation workflows. Consequently, the ability of the framework to improve valuation quality, enhance consistency, increase transparency, strengthen stakeholder trust, or support decision-making has not yet been

empirically demonstrated in operational settings. Therefore, these outcomes should be interpreted as anticipated benefits based on expert assessment rather than confirmed practical outcomes.

In addition, the framework was evaluated within the context of the New Zealand residential property market, where institutional arrangements, regulatory requirements, market conditions, and professional valuation practices may differ from those of other jurisdictions. As such, although the framework provides a comprehensive and theoretically grounded approach to improving PVQ, its broader applicability and effectiveness in different geographical, regulatory, and market contexts remain to be established.

Finally, the modelling approach priorities stakeholder-mediated constructs and perceived PVQ outcomes. While this strengthens behavioural, and governance insights, objective performance indicators such as transaction-based variance analysis and forecast error measurement were not incorporated within the structural model. Future integration of behavioural and technical performance metrics would enhance the comprehensiveness of hybrid valuation assessment.

These limitations do not undermine the analytical validity of the study but instead delineate its epistemological and empirical boundaries, thereby providing a foundation for targeted future research.

10.10 Directions for Future Research

Building one the empirical and contextual boundaries of this study, several avenues for future research emerge.

First, cross-jurisdictional comparative studies are required to examine the applicability and adaptability of the stakeholder-centric hybrid modular PVQ framework across different, national, institutional, and regulatory environments. Residential property markets operate under diverse governance structures, valuation standards, and levels of digital maturity. Replicating the framework in alternative regulatory contexts would allow examination of how institutional arrangements, professional accreditation systems, and technology adoption regimes influence the relationship between trust, professional VJ, and PVQ. Such comparative analysis would strengthen the external validity of the framework and refine its scalability beyond the New Zealand context.

Second, longitudinal research designs would provide deeper insight into the temporal dynamics of stakeholder trust and hybrid valuation adoption. Property markets are cyclical and sensitive to macroeconomic fluctuations, credit conditions, and regulatory reform. Future panel-based and repeated-measure studies could examine how stakeholder confidence in valuation processes evolves over time, particularly during periods of market volatility and technological transition. This would enable investigation of causal pathways and dynamic mediation effects that cannot be captures through cross-sectional modelling.

Third, further research should integrate system-level empirical testing of specific explainable AI tools within the framework. While the present study conceptualises hybrid digital-professional interaction, future work could experimentally assess how varying levels of algorithmic transparency, interpretability, and decision traceability influence professional reasoning, regulatory compliance, and stakeholder acceptance. Comparative evaluation of different explainability architectures would provide evidence on optimal governance configurations for AI-assisted valuation systems.

Fourth, expansion of the framework beyond residential property to commercial, industrial and infrastructure asset classes would provide a broader understanding of how PVQ operates across markets with differing risk structures, cash flow modelling requirements, and regulatory oversight mechanisms. Asset classes characterised by income capitalisation, development risk, and public-sector involvement may exhibit distinct trust and governance dynamics that warrant empirical examination.

Furthermore, future research should therefore focus on implementing the framework in real-world residential property valuation practice, testing its performance using actual valuation assignments, and comparing valuation outcomes before and after its adoption. Further validation involving larger and more diverse panels of valuers, real estate professionals, investors, lenders, policymakers, and homebuyers across multiple jurisdictions would provide stronger empirical evidence regarding the framework's effectiveness, generalisability, and long-term practical value.

Finally, integration of behavioural constructs with objective technical performance indicators represents a valuable extension. Future studies could combine stakeholder-mediated modelling with transaction-based variance analysis, forecast error measurement, and

algorithmic performance benchmarking to develop a more comprehensive hybrid evaluation architecture for PVQ.

Collectively, these research directions establish a structured agenda for advancing valuation scholarship in digitally evolving, governance-sensitive property markets.

10.11 Conclusion

This research establishes that PVQ extends beyond technical accuracy and data sophistication, emerging instead from a structured socio-technical process shaped by professional VJ, hybrid digital support, and stakeholder trust. By systematically integrating theoretical development, empirical structural modelling, and expert evaluation, the study advances a coherent stakeholder-centric hybrid framework that reconciles valuation theory with contemporary professional practice. The proposed framework contributes to behavioural and socio-technical valuation scholarship by reframing PVQ as a multidimensional, trust mediated construct embedded within governance institutional contexts. Simultaneously, it offers a professionally grounded decision-support architecture capable of enhancing transparency, interpretability, and accountability in real-world valuation environments.

In an era characterised by increasing digitalisation, regulatory scrutiny, and reliance on AVMs and AI-enabled tools, the framework provides a structured pathway for integrating technological innovation with professional standards and stakeholder expectations. By embedding hybrid reasoning within a modular and adaptable structure, the research supports the responsible evolution of valuation systems while preserving institutional legitimacy and market confidence.

EPILOGUE – PART FIVE

This thesis in CHAPTER 10 has demonstrated that PVQ cannot be adequately understood as a function of technical precision and model sophistication alone. Through theoretical synthesis, multi-method empirical investigation, and structured professional evaluation, the research establishes that PVQ emerges from the interaction between professional VJ, hybrid technological decision-support mechanisms, and stakeholder trust within governance-sensitive institutional environments.

The progressive analytical design beginning with sector-level digital transformation mapping, narrowing to valuation specific technological integration, and advancing through stakeholder-based empirical modelling has enabled a comprehensive examination of how valuation decisions are formed, interpreted, and legitimised in practice. The findings confirm that hybrid valuation systems operate most effectively when technological augmentation is embedded within accountable professional reasoning and transparent decision pathways. Trust is shown to function as a mediating construct linking valuation logic to real world acceptance and action.

The validated stakeholder-centric modular hybrid PVQ framework provides an empirically grounded and structurally coherent architecture for strengthening transparency, interpretability, and professional defensibility in residential property valuation. By modelling differentiated stakeholder pathways and governance mechanisms, the study advances valuation research beyond accuracy-centric paradigms and contributes a structured approach for managing digital transformation in property markets.

While the empirical investigation is situated within the New Zealand residential property context, the conceptual architecture and analytical insights extend to property systems experiencing similar pressures of automation, regulatory oversight, and increasing demands for explainable decision-making. The research therefore contributes both a theoretical reframing of PVQ and a validated practical framework capable of informing professional practice, policy development, and future research.

Collectively, CHAPTER 10 affirms that the sustainable evolution of property valuation depends on structured hybridisation where advances in data analytics and AI are integrated with accountable professional VJ and trust-based institutional governance. In doing so, it

provides a rigorous and contextually grounded foundation for enhancing PVQ in digitally transforming real estate systems.

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APPENDIX A: HUMAN ETHICS NOTIFICATION

Gmail

Wajahat Ali <[redacted]>

[HE007] - Human Ethics Notification - 4000028413
2 messages

humanethics@massey.ac.nz <humanethics@massey.ac.nz> Tue, Dec 12, 2023 at 3:30 PM
To: [redacted] D.Samarasinghe@massey.ac.nz, Z.Feng1@massey.ac.nz
Cc: humanethics@massey.ac.nz

Kia ora,

Link to application
HoU Review Group

Ethics Notification Number: 4000028413
Title: AI-Enhanced Decision Support System for Real Estate Management in New Zealand

Thank you for submitting a low risk notification for your research/teaching/evaluation.

This email is to acknowledge receipt of the low risk notification and to inform you that the details of your project have been recorded in our database for inclusion in the annual reports to the Health Research Council Ethics Committee (HRCEC) and the Massey University Research Committee (URC).

You may proceed with your research, though it is advisable to provide a couple of weeks before commencing, as all low risk notifications are checked for completeness and clarity by a Research Ethics Advisor. You may be contacted if your application is incomplete and/or further clarification is required.

The low risk notification for this project is valid for a maximum of three years.

Please notify me if situations subsequently occur which cause you to reconsider your initial ethical analysis.

If a sponsoring organisation, funding authority (e.g., the Health Research Council) or a journal require evidence of ethical approval from a Human Ethics Committee (with an approval number), you need to complete a full Massey University Human Ethics application to be reviewed and approved by one of our Human Ethics Committees. Applications must be submitted and approved prior to the commencement of the research.

Please note that travel undertaken by students must be approved by the supervisor and the relevant Pro Vice-Chancellor and be in accordance with the Policy and Procedures for Course-Related Student Travel Overseas. In addition, the supervisor must advise the University's Insurance Officer.

Please include the following statement on all public documents (e.g., information sheet, consent form) related to your project:

> ***This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named above are responsible for the ethical conduct of this research.***
>
> ***If you have any concerns about the ethical conduct of this research that you want to raise with someone other than the researcher(s), please contact Massey University Human Ethics by email:*** *humanethics@massey.ac.nz*.

I wish you all the best in your research, teaching or evaluation activities and appreciate your thoughtful consideration of ethics principles and practices.

If you wish to print a copy of this letter:

1. Please login to the RIMS system (https://rme.massey.ac.nz).
2. In the Ethics menu, select Ethics Applications.
3. Using the Advanced option, select Ethics Applications (Area), Application ID (Search On), enter the ethics notification number in the Value area and select Find on the toolbar.
4. With the application in the Results Tab, tick the empty box on the far left of the application and select Reports from the toolbar.
5. Select the "Human Ethics - Low risk notification letter" link, this will open the report viewer.
6. Select the application code from the Report Parameters dropdown and submit. You can then select an export option from the top toolbar (Print, Save).

Ngā mihi nui,

Professor Tracy Riley
Acting Chair, Research Ethics Chairs' Committee and Acting Director, Research Ethics

---

Wajahat Ali <[redacted]> Sat, Feb 7, 2026 at 7:45 PM
To: Wajahat Ali <[redacted]>

[Quoted text hidden]

APPENDIX B: PARTICIPANT INFORMATION SHEET



A Stakeholder-Centric Hybrid Framework for Enhancing Property Valuation Quality and Decision-Making in New Zealand

PARTICIPANT INFORMATION SHEET

I hope this email finds you well.

I am currently undertaking a PhD within the School of Built Environment at Massey University. This research explores how property valuation decisions are formed in practice and aims to develop a practical framework that enhances valuation quality through stakeholder integration within the New Zealand residential property sector.

You are invited to participate in a semi-structured interview designed to capture professional experiences, decision-making practices, and perspectives on property valuation processes. The insights gained from this interview will be used to refine and validate the proposed framework to ensure it reflects real-world industry practice.

The interview is expected to take approximately 20–30 minutes. Participation in this study is entirely voluntary, and you are under no obligation to take part.

If you agree to participate, you have the right to:
- Decline to answer any question,
- Withdraw from the interview at any time,
- Ask questions about the study at any stage, and
- Expect that your identity will remain confidential unless you provide consent for disclosure.

All information provided will be used solely for academic research purposes. Pseudonyms will be used in all reporting to protect participant identity.

Thank you for considering participation in this research. Your professional insights will make a valuable contribution to this study.

If you have any questions, please contact:

Wajhat Ali
PhD Researcher
School of Built Environment, Massey University

APPENDIX C: PARTICIPANT CONSENT FORM



A Stakeholder-Centric Hybrid Framework for Enhancing Property Valuation Quality and Decision-Making in New Zealand

PARTICIPANT CONSENT FORM

Researcher: Wajhat Ali, PhD Candidate
School of Built Environment, Massey University

Please read the statements below and indicate your consent by signing at the end of this form.

1. I have read and understood the Participant Information Sheet for this study.
2. I have had the opportunity to ask questions about the research and have received satisfactory answers.
3. I understand that my participation in this research is voluntary.
4. I understand that I may decline to answer any question and may withdraw from the interview at any time without penalty.
5. I understand that the interview will be used for academic research purposes only.
6. I understand that my identity will be kept confidential and that pseudonyms will be used in any publications or reports, unless I give explicit permission otherwise.
7. I understand that anonymised quotations from the interview may be used in the researcher's thesis and related academic publications.
8. I understand that data collected during this study will be securely stored and accessed only by the research team.
9. I agree to participate in this research study.

Participant Declaration

I have read the information provided above and consent to participate in this research.

Participant Name: _____

Signature: _____

Date: _____

Researcher Declaration

I confirm that I have explained the purpose and procedures of this research to the participants.

Researcher Name: Wajhat Ali Signature: _____

APPENDIX D: PARTICIPANT INFORMATION SURVEY



Participant Information - Survey

You are invited to take part in a research survey titled "Property Valuation and Decision-Making Process in Real Estate." The purpose of this survey is to explore the factors that influence property valuation and the decision-making process involved in purchasing residential properties, with a specific focus on stand-alone and duplex houses. The survey also seeks to understand participants' views on the use of technology and artificial intelligence (AI) in property valuation. If you choose to participate, you will be asked to complete an online questionnaire that includes questions related to your demographic background, factors considered in property valuation, decision-making factors when buying residential houses, and your perceptions of technology and AI in property valuation.

The survey is expected to take approximately 10–15 minutes to complete. There are no known risks associated with participation in this study. Your responses will contribute to a better understanding of real estate decision-making and the role of technology in property valuation, which may support future research and industry development in this field.

Your participation is completely voluntary. You may choose not to answer any question and may withdraw from the survey at any time without penalty. If you decide not to participate or withdraw, there will be no negative consequences. All responses will be kept confidential. No personally identifiable information will be collected, and all data will be stored securely and accessed only by the research team for academic purposes.

If you have any questions about this research, please contact:

Wajhat Ali

PhD Candidate, Massey University

Email: wali1@massey.ac.nz

APPENDIX E: RESEARCH POSTER PRESENTED

2023 Built Environment Research Workshop

AI-Enhanced Decision Support Systems for Real Estate Management

Authors: Wajhat Ali, Don Amila Sajeevan Samarasinghe, Zhenan Feng, Suzzane Wilkinson
School of Built Environment, Albany Campus,
Massey University, New Zealand



1. Background

Real estate technology-based companies have raised almost $6.4 billion in funding across 817 deals in the United States alone since 2012. The global real estate industry worth $11 trillion, has been lagging in adopting technology, creating a need for research and innovation in this field. Websites play a crucial role and 95% of searches involve websites.

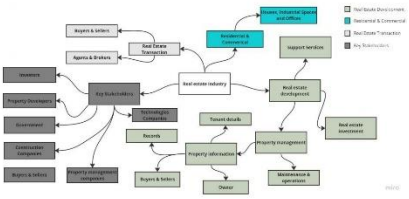


Figure 1: Overview of Real Estate Industry and Key Stakeholders

2. Problem statement



Figure 2: Identification of Problems through PEST Analysis

3. Research Aim

To develop a Smart Real Estate (SRE) application with the integration of Artificial Intelligence (AI) with a focus on improving efficiency, sustainability, and user experience, and to provide a platform for successful adoption and integration

4. Contribution to Industry



Figure 3: Transforming Real Estate to Smart Real Estate (SRE)

5. Methodology

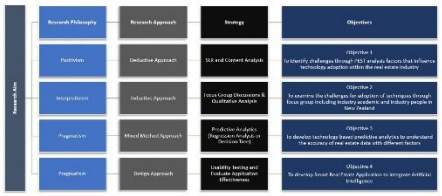


Figure 4: Research Methodology

6. Preliminary Findings

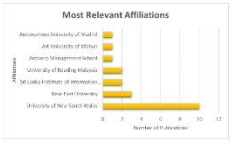


Figure 5: Most Relevant Affiliations

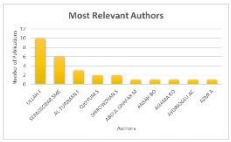


Figure 6: Most Relevant Authors

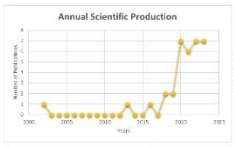


Figure 7: Scientific Production

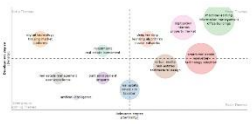


Figure 8: Thematic analysis

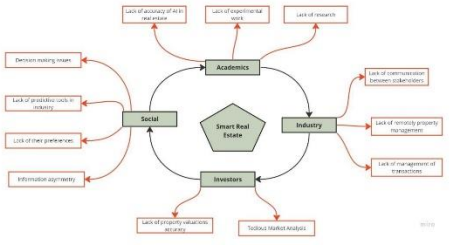


Figure 9: Identification of problems from stakeholders

Conclusion

In summary, a smart real estate application utilizing AI can revolutionize decision-making in the industry. Prioritizing efficiency, sustainability, and user experience, it offers a platform for seamless adoption and integration, promising a transformative future for real estate.

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APPENDIX F: MASSEY VENTURE INNOVATION FINALIST

APPENDIX G: Questionnaire Survey

Survey

You are invited to participate in a survey titled "Property Valuation and Decision-Making Process in Real Estate." The purpose of this survey is to understand the factors influencing property valuation and the decision-making process for buying residential houses focusing on standalone or duplex houses, as well as your opinions on technology and AI for property valuation. If you agree to participate, you will be asked to complete a survey that includes questions about your demographics, Property Valuation factors, and factors related to your decision-making process for buying houses, and your views on technology and AI in property valuation. The survey will take approximately 10-15 minutes to complete. There are no known risks associated with this study, and your participation will help us gain insights into real estate trends and technology usage in property valuation, which may benefit future research and development in this field. Your responses will be kept confidential, with no personally identifiable information collected. Data will be stored securely and only accessed by the research team. Participation is voluntary, and you may withdraw at any time without penalty. If you decide not to participate, there will be no negative consequences. If you have any questions about this study, please contact Wajhat Ali at wali1@massey.ac.nz. By clicking "I Agree" below, you acknowledge that you have read and understood the above information, and you agree to participate in this survey.

Background and Demographic Section

1. What is your age group?
   a) 18-24
   b) 25-34
   c) 35-44
   d) 45-54
   e) 55-64
   f) 65 and above

2. What is your gender?
   a) Male
   b) Female
   c) Non-binary
   d) Prefer not to say

3. How many years of experience do you have in the real estate industry?
   a) Less than 5 years
   b) 5 – 9 years
   c) 10 or more years

4. Which best describes the real estate company you work for?
   a) Franchise (e.g., Barfoot and Thompson, Harcourts or Ray White)
   b) Independent company (not part of a franchise)
   c) Small agency (Less than 20 employees)
   d) Medium agency (20 to 99 employees)
   e) Large agency (100 or more employees)

5. What is your role in the real estate industry?
   a) Real Estate Agent
   b) Property Manager
   c) Valuer
   d) Developer
   e) Other (Please Specify)

Section – 2.1

Property Valuation Important Factors for Valuation Judgement

1. How important are the following factors in your property valuation for residential stand alone or duplex houses. (Please rate each factor from not important to Very Important)

Factors	Not Important	Slightly Important	Moderately Important	Fairly Important	Very Important
Location of the property					
Size of the land					
Floor area (Internal size)					
Age of the property (How many years old)					
Proximity to public transport					
Proximity to schools					
Proximity to shopping centres					
Proximity to recreational areas					

Flood risk (Refers to the risk of property damage due to flooding, often determined by location and historical flood data).					
Crime rate in the area					
Zoning regulations (Legal restrictions that dictate how the land can be used or developed (residential, commercial, mixed-use, etc.).					
Proximity to the beach					
Lot orientation (Refers to the orientation of the property (e.g., north-facing for sunlight).					
Proximity to health care					
Noise pollution level					
Air Quality in area					
Storm water management system					
Parking Availability (Off street parking)					
Walkability score (Ease of walking to stores)					
Proximity ot employment hubs					
Housing demand and supply in suburb					

How important are the following features in your property valuation residential houses stand alone or duplex houses? (Please rate each feature from Not Important to Very Important)

Factors	Not Important	Slightly Important	Moderately Important	Fairly Important	Very Important
Number of bedrooms					
Number of bathrooms					
Open-Living areas					
Home office space					
Outdoor entertainment area					
Number of car parks					
Garage condition					
Swimming pool or spa pool					

Fencing and gates					
Steepness of land					
Exterior wall conditions					
Roofing type and condition					
Windows type					
Foundation Condition					
Laundry area					
Balcony					
Kitchen size and condition					
Driveway condition					
Quality of lighting systems					

How important are the following functional features in your property valuation for residential stand-alone or duplex houses?

(Please rate each feature from Not Important to Very Important)

Factors	Not Important	Slightly Important	Moderately Important	Fairly Important	Very Important
Energy efficiency features					
Air conditioning					
Solar Panels					
Fire safety systems					
Smart home systems (Refers to integrated smart technologies such as automated lighting, security systems, and thermostats).					
Accessibility features (Wide doorways and hallways, grab bars in bathrooms, Ramp and wheelchair access)					

When assessing the value of a property, how do the following aspects of its condition influence your or client decision?

(Please rate each feature from Not Important to Very Important)

Factors	Not Important	Slightly Important	Moderately Important	Fairly Important	Very Important
Age of property					
Recent renovations					
Structural Integrity					
Aesthetic Appeal (Design, Finishes, paintwork)					
Insulation quality					
Immediate need for repair					

How important are the following factors and their sub-factors in your or client decision to purchase a property?

(Please rate each feature from Not Important to Very Important)

Factors	Sub-Factors	Not Important	Slightly Important	Moderately Important	Fairly Important	Very Important
Financial Aspects	Affordability					
	Mortgage rates					
	Property Taxes					
	Maintenance cost					
Location	Proximity to work					
	Proximity to school					
	Proximity to public transport					
	Proximity to shopping centres					
	Neighbourhood Environment					
Neighbourhood	Safety					
	Community vibe					
	Local services					
Structural Attributes	Construction Quality					
	Layout and Floor Plan					
	Size and Space					
	Age of the Property					
Design and Aesthetics	Interior Design					
	Exterior Appearance					
	Quality of finishes					
Future Appreciation Potential	Development Plans in area					
	Resale Value					

Superstitious beliefs	Location features (facing a certain direction)					
	Street features					
View and Ventilation	Natural Views					
	Airflow and Ventilation					
	Sunlight Exposure					
	Noise Pollution					
Environmental Impact	Energy efficiency of property					
	Use of sustainable material					
	Eco-friendly features (Solar panels)					
Legal Considerations	Zoning Law					
	Legal Fees					
Future Potential Appreciation or Resale Value						

Please indicate your level of agreement with the following statements about valuation judgement. Use a 5-point Likert scale: 1 = Strongly Disagree, 5 = Strongly Agree.

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Valuation reasoning is clearly explained in valuation reports					
Valuation decisions are applied consistently across similar properties					
Valuation judgements are supported by sufficient market evidence					
I am confident in the professional judgement underlying valuation outcomes					

Please rate the following statements regarding professional valuation practice using the same 5-point Likert scale.

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Valuation reports demonstrate a high level of ethical conduct					
Valuation processes are transparent and clearly communicated					
Valuers take responsibility for the accuracy of valuation outcomes					
Professional communication enhances confidence in valuation results					

Please indicate your agreement with the following statements about the use of technology and AI-supported valuation tools.

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Automated valuation tools support professional valuation judgement					
The data used in valuation technologies are reliable and transparent					
AI-based tools improve decision-making efficiency					
Clients accept valuation outcomes supported by automated tools					
Valuation technologies are used as decision-support rather than replacements for professionals					

APPENDIX H: Semi Structure Interview Questions



Exploratory Semi-Structured Interview Guide

Purpose of the Interview

The purpose of these interviews is to explore current property valuation influencing factors and pricing practices, decision-making processes, stakeholder influences, and the use of data and technology in the New Zealand residential property sector. The insights from these interviews will inform the development of an initial conceptual framework for enhancing property valuation quality and decision-making.

1. Can you describe your current role and professional experience within the property sector and how long have you been involved in property market?
2. What types of properties or clients do you primarily work with?
3. Can you describe a recent valuation decision and how it was formed?
4. What factors most strongly influence your valuation decisions?
5. How do professional judgement and experience shape your final decision?
6. What digital tools, data platforms, or automated valuation models (AVMs) do you currently use? How do these tools support your decision-making process?
7. What limitations or risks do you associate with automated or data-driven valuation tools?
8. Who are the key stakeholders involved in valuation in your professional context?
9. How do stakeholder expectations influence how you approach valuation decisions?
10. What are the main challenges you face in current valuation practices?
11. In your view, where could decision-making processes be improved?
12. What types of information, tools, or support would help improve valuation quality?