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Article

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Suggested Citation: Valero, Alfonso (2024) : Appraisal of mixed-use developments through multiple criteria decision making: insights from Shanghai's megacity context, Cogent Business & Management, ISSN 2331-1975, Taylor & Francis, Abingdon, Vol. 11, Iss. 1, pp. 1-19, <https://doi.org/10.1080/23311975.2024.2332500>

This Version is available at:

<https://hdl.handle.net/10419/326181>

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To cite this article: Alfonso Valero (2024) Appraisal of mixed-use developments through multiple criteria decision making: insights from Shanghai's megacity context, Cogent Business & Management, 11:1, 2332500, DOI: [10.1080/23311975.2024.2332500](https://doi.org/10.1080/23311975.2024.2332500)

To link to this article: <https://doi.org/10.1080/23311975.2024.2332500>



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Appraisal of mixed-use developments through multiple criteria decision making: insights from Shanghai's megacity context

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ABSTRACT

This paper investigates the selection criteria and success factors of retailers within mixed-use developments in Shanghai, from the 2009 financial crisis to the COVID-19 pandemic. By using Multiple Criteria Decision Making focused on three groups of key performance indicators: External, specifics of the Industry, and Users, the study aims to provide a comprehensive review of retail location selection within the emerging paradigm of mixed-use environments. The assessment reveals that connectivity, specifically with metro stations within 500 m, is paramount to a project's success. Moreover, 73% of the projects surveyed feature more than two underground levels, with the top 10 ranking projects boasting 3–4 floors above ground, occupied by both offices and retail spaces. Structurally, almost 90% of the mixed-use developments being studied have commercial areas exceeding 35,000 sqm. The optimal project size is determined to be around 200,000 sqm, with retail making up half of the built area. The preferred land plot size ranges from 35,000 to 40,000 sqm. However, the study also identifies a lack of comprehensive sustainability strategies and net-zero carbon certifications in many of these developments. The findings also contribute to urban researchers and policymakers by offering a multi-criteria matrix to assess and scale mixed-use developments, not only in Shanghai but also in other geographical locations. This foundational study serves as a basis for future MCDM research and provides a comprehensive understanding of the real estate market in Shanghai's mixed-use developments, offering practical recommendations for enhancing their performance and sustainability.

ARTICLE HISTORY

Received 9 October 2023
Revised 9 March 2024
Accepted 14 March 2024

KEYWORDS

Retail performance;
multiple-criteria
decision-making (MCDM);
mixed-use developments;
KPIs; performance
appraisal; sustainability;
marketing strategies

REVIEWING EDITOR

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Great Britain and
Northern Ireland

SUBJECTS

Architecture; Building and
Construction; Planning;
Property; Cities and The
Developing World; Urban
Development; Economics
and Development;
Research Methods in
Development Studies;
Urban Studies; Urban
Research Methods

Introduction

The city of Shanghai, known for its economic influence and liveliness, has been a prominent example of resilient and dynamic urban development in recent years (Shi et al., 2021). With over 25 million people, the city has undergone rapid urban changes due to major events from the 2009 financial crisis to the COVID-19 pandemic. These transformative experiences have led to the creation of ~30 mixed-use assets, encompassing over three million square metres in the Central Business District (CBD). The emergence of these projects (Shen & Kee, 2016) has positioned Shanghai as a local and global model for urban development, particularly in the context of macro-retail complexes (Aparna, 2020), which reshape urban life and offer insights into the future of retail in urban centres (Engel et al., 2018).

However, despite the proliferation and apparent success of these mixed-use developments, the strategies (Lee & Kim, 2018) and decision-making processes guiding retailers' location choices within these complexes remain inadequately understood (Uncles, 2010). Scholars, like Delfim and Hoesli (2019), have highlighted the scarcity of research exploring the factors that influence retailers' selection of locations, which is a critical aspect of the broader discourse on urban development and economic sustainability (Feng & Hou, 2023). Thus, this study aims to fill this research gap by providing a comprehensive

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 Supplemental data for this article is available online at <https://doi.org/10.1080/23311975.2024.2332500>

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understanding of the factors that influence retail location selection within the emerging paradigm of mixed-use environments (Gao & Samson, 2023).

This research holds significance in uncovering the complexities of selecting retail locations within mixed-use structures, an area of considerable economic importance that has received limited attention in existing literature (Lee, 2022).

While the crucial role of the retail sector in urban economies is widely acknowledged, its intricate relationship with the spatial and social aspects of mixed-use developments in megacities like Shanghai remains less understood (Shen & Wu, 2012). Through an analysis of the connections between retail location strategies, key performance indicators, and urban growth dynamics, this study aims to provide insights that can guide future investments and developments (Ahmad et al., 2023). Shanghai, being a hub for large-scale urban projects, provides an excellent opportunity to understand the intricacies of retail placement (Fei et al., 2010).

Specifically, we want to understand how retailers cooperate and compete within the local and overall contexts of mixed-use developments (Aranda et al., 2018). Additionally, we will examine how these decisions align with customer needs and contribute to the overall success of mixed-use developments. Achieving a balance between business, residential, and recreational uses is crucial in this endeavour (Ghosh & Raval, 2022).

Therefore, this article aims to answer two main questions:

- How do retailers select their locations within mixed-use assets?
- What are the key performance indicators and factors that contribute to the success of retail developments in Shanghai's mixed-use projects?

Ultimately, the aim of this research is to fill the literature void by providing a well-rounded elucidation of the factors influencing retail location selection in mixed-use environments. Through an analysis of retail location strategies, key performance indicators, and urban growth dynamics, this study will provide insights that can guide future investments and urban planning efforts. Examining the city's retail positioning, along with mapping out key performance metrics and examining urban development trends, provides valuable knowledge that can steer investments and urban planning policies (Wu et al., 2022). Insights gained from Shanghai's diverse, bustling, and innovative landscape hold potential lessons that can be adapted and applied to other major cities globally, empowering stakeholders everywhere to achieve sustainable urban development (Engel et al., 2018). The ultimate objective is to align the interests and objectives of various stakeholders—urban planners, retail conglomerates, and policymakers—more effectively, resulting in economically sustainable urban development paradigms (Chen, 2022).

To address these research questions, this study employs a Multi-Criteria Decision Making (MCDM) methodology (Afshari et al., 2016), leveraging previous research on valuation and urban performance.

Furthermore, this study analyses the buildings through an MCDM study using three groups of key fundamental indicators.

- External factors (social, macroeconomic, urban, or e-commerce),
- Specifics of the real estate Industry (developers, consultants, occupancy),
- User-related considerations (the balance between retailers and consumer demand).

The paper is structured as follows: Section Literature review provides an extensive literature review and highlights gaps in existing research. Section Methods details the research methodology and key performance indicators. Section Research calculation delves into the research calculations, presenting the statistical framework and tools used to analyse the data. Section Results interprets the empirical results, and the concluding sections synthesise the findings, present valuation considerations, and propose strategic recommendations for retailers and other stakeholders embedded in the real estate industry.

Literature review

Over the past three decades, Shanghai has undergone significant immigration and economic and social transformations (Wang & Zhang, 2005) as part of urban development, especially in Pudong in the eastern part of the city. The city has seen fast urban growth and change, requiring quick adaptations to welcome significant foreign investments due to Special Economic Zones (Kaiming et al., 2022), leading to major building projects in the Central Business District (AbedRabbo et al., 2022).

Existing literature concentrates on the macroeconomic and infrastructural evolution within Shanghai, often overlooking critical aspects, such as the performance metrics of international retailers operating within the city's mixed-use complexes. There is also a notable void in analysing how these retail spaces integrate within the broader residential and commercial tapestry, particularly in terms of their contribution to urban renewal initiatives and sustainability goals, including adherence to green certification standards (Yue et al., 2014). Furthermore, the interplay between the burgeoning domain of e-commerce and traditional brick-and-mortar stores within these developments remains underexplored, despite its significant influence on urban retail dynamics (Klein & Popp, 2023).

This scarcity of information extends to the holistic socio-economic impact that these mixed-use projects wield on urban transformation (Tan et al., 2016). In addressing this research gap, our study endeavours to construct an intricate profile of the various determinants driving retail location choices within Shanghai's multi-functional urban fabric and investigate the ramifications of these choices for the mixed-use landscape (Duchemin et al., 2013).

This study found a strong connection between urban mobility (Ge et al., 2017), infrastructure development (Lin et al., 2020), underground expansion (Xiao-Rong & Hai-Xiao, 2017), and the growth of large railway hubs due to local regulations (Almansoub et al., 2022).

However, there have been limited analyses on the integration of mixed-use buildings (Wu, 2011) or international retailers' performance (Li et al., 2023). Additionally, there is not much research available on the relationship between residential developments (Zandiataashbar et al., 2019), job-housing imbalances (Tao et al., 2022; Xiao et al., 2021) and urban regeneration and urban regeneration (Chen & Duan, 2022) nor on how these assets participate in the cities' transformations (Li et al., 2022) and their masterplans (Zhu & De, 2022).

Furthermore, there is limited research on e-commerce competition with brick-and-mortar assets (Patten et al., 2020; Ren et al., 2021; Shao et al., 2022; Souiden et al., 2019), or analysing the role of mixed-use assets in the transformation of cities and their CBDs (Pantano et al., 2021).

Although the city boasts an extensive hospitality offering (Zhao et al., 2022), there is a lack of research on sustainability initiatives (Vadakkepatt et al., 2021) or alignment with the city's urban transformation (Ye & Shi, 2017). Additionally, there has been no analysis of how mixed-use facilities comply with green certifications (Dae-Chul et al., 2018) through global or local standards or investors' preferences for those sustainable assets (Cheung & To, 2019).

Some research on Environmental, Social, and Governance (ESG) factors has been done in major China Mega Cities (Chiu, 2012) and the wider socioeconomic imperatives (Chatterji, 2016). A previous MCDM analysis was developed around sustainability (Nomeda, 2017), and recently, there has been research on ESG factors, which improve sustainability engagement and boost investment returns (Mercereau et al., 2022), enhancing its importance to all asset managers (De Jong & Rocco, 2022).

The study examines important measurements that show how well retail locations do in business competition (Zhang et al., 2010) and the behaviour of real estate markets (Pandya & Patel, 2020). Also, property valuation (Kowalski & Kazak, 2020) risks related to sustainability (Laposa & Villupuram, 2010) measured different aspects of cities' performances, as explored by Xing and Meng (2020).

From a location perspective, most mixed-use developments converge with Shanghai's primary streets (Wu et al., 2021). Connected with the study done by Zheng et al. (2023) on the identification and prediction of mixed-use functional areas (Hangebruch, 2020), Azian et al. reviewed the relationship between service quality and occupants' satisfaction in mixed-use buildings (2023).

Other authors have studied MCDM in mixed-use and urban developments. Pérez-Gladish et al. (2021) reviewed the contributions related to the 2030 agenda for Sustainability Development while Zavadskas and Turskis (2011) examined methods in economics.

And in terms of architecture and design, those with offices and hotel use (Liu et al., 2020) or shopping centres had global design firms' involvement (Madsen & Petermans, 2020).

Big international companies (Liang & Wilhelmsson, 2011), including well-known mass-market brands (Woohyoung et al., 2020) and franchise chains (Welsh et al., 2006), have a major presence in many of Shanghai's development projects. High-end luxury brands (Singh et al., 2022) are also significant and indicate potential for retail businesses (Pantano et al., 2021), regardless of high-end industry trends (Welté et al., 2022).

For KPIs and indicators, a thorough examination was conducted using core competitive parameters (Zhang et al., 2010), market dynamics (Pandya & Patel, 2020), and comprehensive reports (Ke & White, 2015), which include details of real estate holdings, asset valuation (Kowalski & Kazak, 2020), related risks (Laposa & Villupuram, 2010), and a group of indicators (Lin & Shao, 2013).

The results of this study aim to provide insights and recommendations into retail best practices and offer a framework for future MCDM studies in other urban settings. The importance therefore lies in providing insights into the retail performance of these mixed-use developments and their hybrid assets, which can inform retail investment and development decisions.

Methods

This research paper presents an MCDM appraisal to understand how international firms choose locations in Shanghai's buildings that have a mix of uses like shopping, living, and working spaces (Yang et al., 2019). We look at different key measurements that help us figure out what makes a retail location successful in these complex city environments (Thompson, 2018).

Through an extensive collection of data from 26 large developments, we identify 26 indicators by sorting them into three interrelated groups: external influences, industry-specifics, and user-centred factors. This categorization allows us to engage comprehensively with stakeholders ranging from developers and consultants to end consumers, providing a 360-degree view of the defining characteristics of Shanghai's mixed-use real estate market.

By leveraging the MCDM framework, we delve into the intricate array of factors that impact retail location decisions, capturing the collaborative and competitive dynamics between retailers and their orientation towards consumer needs (Ghaffar et al., 2023). This methodology offers us a detailed and layered assessment that aims to reflect current urban development patterns and predict future retail trends and strategic directions (Moreno-Monroy et al., 2021).

The study begins with the analysis of the agents involved and the selection of different indicators that have been grouped around the real estate development cycle in its separate phases (Trinh, 2022), and from there, they are categorised by key stakeholders. The stakeholder selection criteria follow mixed-use uniqueness (McBride, 2014) specific to this asset type and definitions from the Project Management Institute (Smith, 2000).

To ensure a comprehensive analysis of the indicators, prominent real estate firms, and group companies with a substantial presence in Shanghai's mixed-use projects between 2009 and 2019 were specifically selected (Deng et al., 2017).

To determine an appropriate methodology for analysis, interviews with local developers and industry leaders from the Urban Land Institute (ULI)¹ have been confirmed to simulate the work that Mantogiannis and Katsigiannis (2020) conducted on alternative investments. Then Multiple Criteria Decision-Making (MCDM) has been used to determine the attractiveness of the retail assets (Ersoy, 2017). Some indicators are more significant due to the direct impact they have on the buildings. For example, access to the metro, office use and rents, catchment area (Dolega et al., 2016), previous experience in developing, or presence of international brands (Léo & Philippe, 2010).

Table 1 organises information into three categories (*E*, *I*, and *U*) that describe different features of real estate properties and how important they are, rated on a scale from 1 to 6. An expert not involved in the project can give a score between 0 and 10 for each of these categories.

KPIs are described in the [Supplementary Materials](#).

Table 1. Three groups of indicators (*E*, *I*, and *U*) with weight criteria for relative performance.

Group (<i>E</i> , <i>I</i> , <i>U</i>)	Mixed-use appraisal		Rating 1–6
	(1–26)	Indicator	
External indicators	1	E1	Country stability
	2	E2	Population growth
	3	E3	Catchment area
	4	E4	Access to metro
	5	E5	E-commerce
	6	E6	Regen-experience
	7	E7	Competitors
Industry indicators	8	I1	Scalable branding
	9	I2	Listed developer
	10	I3	Similar experience
	11	I4	Global designers
	12	I5	Intl Awards
	13	I6	Retail GLA/tenants
	14	I7	Total sqm/plot size
	15	I8	Project duration
	16	I9	Above/below ground
	17	I10	Parking
	18	I11	Dedicated CRE teams
	19	I12	Sustainability
	20	U1	Mix rent-roll
User indicators	21	U2	Supermarket/cinema
	22	U3	Luxury anchors
	23	U4	Flex Office
	24	U5	Living (Hotel/Resi)
	25	U6	Disposable income
	26	U7	Population profile

Research calculation

The analysis of 26 mixed-use projects in Shanghai can be studied from various indicators and perspectives (Bhole, 2018); hence, a Multiple Criteria Decision-Making (MCDM) is suggested.

We select n_E indicators of type *E*, n_I of type *I*, and n_U of type *U* such that:

$$m = n_E + n_I + n_U$$

where 'm' is the total number of KPIs (26 indicators in our case). Each KPI has a given score, denoted by:

$$E_j = 0 \leq j \leq n_E, I_j = 0 \leq j \leq n_I \text{ and } U_j = 0 \leq j \leq n_U$$

that for the mixed-use projects, take values from a given internal criteria² from 1 to 6, that is:

$$1 \leq E_j \leq 6, \text{ with } 0 \leq j \leq n_E$$

$$1 \leq I_j \leq 6, \text{ with } 0 \leq j \leq n_I$$

$$1 \leq U_j \leq 6, \text{ with } 0 \leq j \leq n_U$$

To ensure our Multi-Criteria Decision Making (MCDM) approach is both robust and relevant, we engaged in an iterative process for establishing our evaluation criteria. This involved multiple consultations with a diverse panel of urban development experts, including researchers, policymakers, and practitioners. All experts consent to participate in the methodology. These experts were involved in a series of preliminary tests using our framework on specific mixed-use developments, which helped us capture practical insights and refine our criteria and weightings. These interviews were designed to extract deep insights from the experiences and professional evaluations of these stakeholders, with a special focus on the evolving nature of Shanghai's mixed-use developments. The insights gained during this stage played a critical role in informing our analytical approach and ensuring that the study captured the nuances of the market conditions (Fukuyama & Tan, 2023).

Table 2. $T_{EIU} = 100$.

E							I						U															
E1	E2	E3	E4	E5	E6	E7	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	U1	U2	U3	U4	U5	U6	U7			
TAP_{EIU}	3	5	4	Catchment area	Access to metro	E-commerce	Regen-Experience	Competitors	Scalable branding	Listed developer	Similar experience	Global designers	Intl Awards	Retail GLA/tenants	Total sqm/Plot size	Project duration	Above/Below ground	Parking	Dedicated CRE teams	Sustainability	Mix rent-roll	Supermarket/Cinema	Luxury Anchors	Flex Office	Living (Hotel/Resi)	Disposable income	Population profile	Total score

The total scoring ' T_{EIU} ' for the 'm' indicators considered is,

$$T^{EIU} = \sum_{j=1}^{n_E} E_j + \sum_{j=1}^{n_I} I_j + \sum_{j=1}^{n_U} U_j$$

In our case, with $m=26$, we assign the following values shown in Table 2.

Criteria

The provided explanation outlines an appraisal methodology using MCDM, with the evaluative measure being a score (C_j) ranging from 0 to 10 for each key performance indicator categorised as E (external factors), I (specifics of the real estate industry), and U (user-related considerations).

Therefore, the criteria for appraisal will be $0 \leq C_j \leq 10$. A higher score signifies greater compliance with the given criteria, addressing how well mixed-use projects align with the established standards for success (Taherdoost & Madanchian, 2023). This scoring enables a precise assessment of each project, reflecting individual strengths and aligning with strategic objectives.

In this MCDM framework, the critical aspect is the weighting of each criterion (Wu et al., 2018). The weighted sum model (WSM) was selected for its efficacy and simplicity, enabling the prioritisation of factors based on their perceived importance as determined by expert judgement. Each weight is derived from a collective understanding of the indicators' impact on the effective location strategy of retail within mixed-use developments.

Furthermore, sensitivity analysis serves as an essential component to test the stability of the evaluation against changes in weights. This analysis ensures that the MCDM framework can accommodate various market contexts by adjusting the weights based on local and cultural conditions. The methodology discussed provides a comprehensive and adaptable approach to evaluating mixed-use developments not just within Shanghai but also in a global context, establishing it as a valuable tool for stakeholders who seek to understand and implement effective location strategies in diverse environments.

Condition

To ensure there is a minimum weight and value given by each group (E , I , and U), a minimum value of $x\%$ is assigned for each of the three KPIs:

$$\sum_{j=1}^{n_E} E_j \geq \% \sum_{j=1}^m C_j, \sum_{j=1}^{n_I} I_j \geq \% \sum_{j=1}^m C_j, \text{ and } \sum_{j=1}^{n_U} U_j \geq \% \sum_{j=1}^m C_j$$

In our case, we assume all groups should have at least 15% $\sum_{j=1}^m C_j$ value.

Appraisal

As per the MCDM analysis, the Total Asset Performance (TAP) for 26 indicators, grouped in three categories, E , I , and U , weighted by C_j criteria, results in:

$$TAP^{EIU} = \frac{\sum_{j=1}^{n_E} E_j \times C_j + \sum_{j=1}^{n_I} I_j \times C_j + \sum_{j=1}^{n_U} U_j \times C_j}{T_{EIU}}$$

Table 3. C_j values (0–10) for TAP_{EIU} calculation.

C_j	E1	E2	E3	E4	E5	E6	E7	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	U1	U2	U3	U4	U5	U6	U7
8.31	10	8	6	10	5	10	8	10	10	10	10	8	5	5	8	8	10	9	7	5	9	10	10	9	9	

As an example, the analysis done for one of the recently opened projects in Shanghai (HKRI Taikoo Hui) is shown in [Table 3](#) below. An external advisor could assign the following C_j criteria for each of the E , I , and U KPIs:

Scoring TEIU, from 1 to 6, is assigned to the 26 KPIs. Then an external advisor could assess the mixed-use projects against these indicators, ranking them from 0 to 10. Input is taken from the data included in [Table 3](#).

Results

The Multi-Criteria Decision Making (MCDM) analysis has provided crucial insights into the factors that drive the success of Shanghai's mixed-use projects. The comprehensive nature of our approach highlights how the choice of a retail location correlates with business outcomes. Specific factors related to retail, such as Gross Leasable Area (GLA), the size of the catchment area, and the experiences gained from urban regeneration efforts, emerged as significant influencers of a development's performance and desirability (Liu-Thompkins et al., 2022).

These insights affirm the effectiveness of the MCDM method suggested for stakeholders like urban developers, retail businesses, policymakers, and investors (Pulkka & Junnila, 2023). Furthermore, the findings go beyond simple rankings or scores. They reveal the broader context of urban development trends and the compelling influence of strategic retail location planning.

An analysis of all 26 mixed-use projects against the given T_{EIU} , assessed with an external score from 0 to 10, is presented in [Table 4](#).

The study scores each project from 0 to 10 using an external auditor opinion, based on how well they do against external parameters, industry factors, and user preferences. The scoring compares different projects to evaluate their performance against the weighted measurements (Shi et al., 2021). Details from [Table 4](#) help us to understand that a high score shows a more attractive project, whereas a low score suggests less attractivity.

In the overall context of the study, these scores not only reflect individual project viability but also contribute to a broader understanding of what constitutes success within Shanghai's mixed-use development landscape. They offer invaluable guidance for strategic enhancements and investment focus, aligned with the multi-dimensional nature of urban real estate development.

The scoring for HKRI Taikoo Hui, as of 31 December 2019, with retail occupied at 98%, offices at 99%, and residential at 91%, is shown in [Table 5](#).

The scoring reflected in [Table 5](#) assigns values from 1 to 6 across a spectrum of 26 critical performance indicators to gauge the development's overall effectiveness. The high occupancy rates cited for HKRI Taikoo Hui suggest that this mixed-use development excels in several key performance areas, marking it as a successful urban complex. The achievement of high occupancy across the board paints HKRI Taikoo Hui as a model of successful mixed-use development.

For this project and $m=26$ KPIs, the max C_j

$$\sum_{j=1}^m C_j$$

will be 219, with 15% equal to 33, being $\sum_{j=1}^{n_E} E_j$, $\sum_{j=1}^{n_I} I_j$ and $\sum_{j=1}^{n_U} U_j \geq 33$

HKRI Taikoo Hui TAP^{EIU} is 8.31. [Figure 1](#) shows an image of the project.

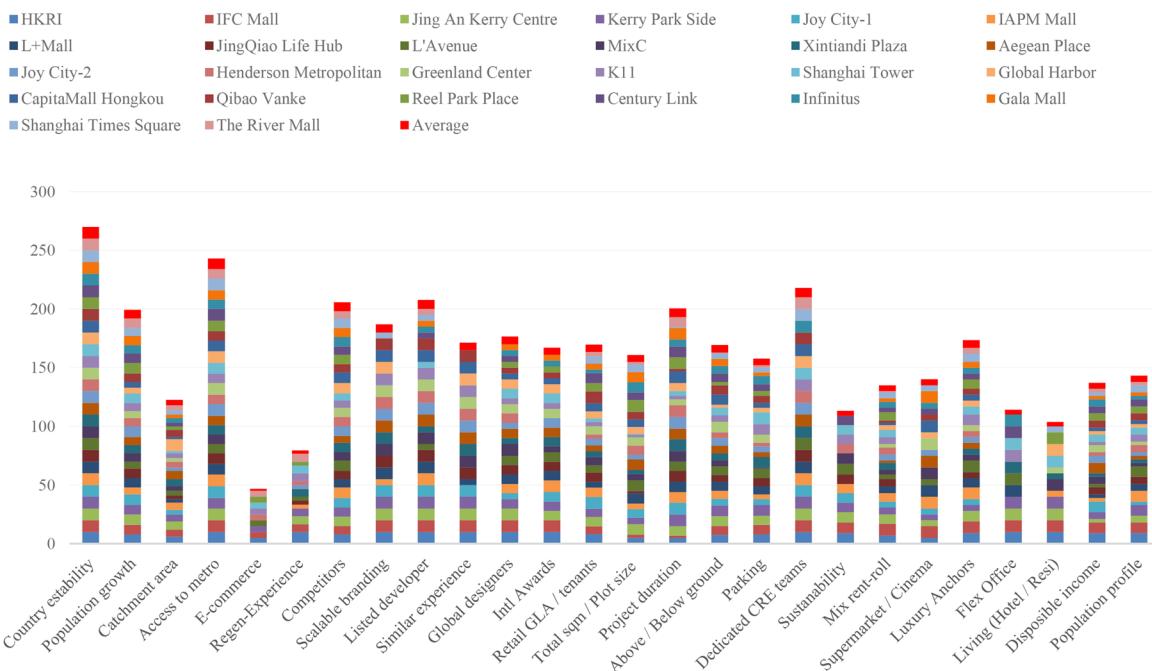
We then analyse all 25 remaining mixed-use projects against the given criteria T_{EIU} , assessing them with an external score of 0 to 10. Full results are shown in the [Supplementary Materials](#). [Figure 2](#) presents a summary below.

HKRI Taikoo Hui, well-established in Jing'An District, exemplifies how the strategic positioning of mixed-use developments is pivotal to their success, particularly in Shanghai, where location is at a

Table 4. Twenty-six mixed-use projects assessed from 0 to 10 for a given TAP_{EU}.

Table 5. Taikoo Hui C_j and T_{EIU} parameters for TAP_{EIU} calculation.

	E							I							U											
	E1	E2	E3	E4	E5	E6	E7	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	U1	U2	U3	U4	U5	U6	U7
	Country stability	Population growth	Catchment area	Access to metro	E-commerce	Regen-Experience	Competitors	Scalable branding	Listed developer	Similar experience	Global designers	Intl Awards	Retail GLA/tenants	Total sqm/Plot size	Project duration	Above/Below ground	Parking	Dedicated CRE teams	Sustainability	Supermarket/Cinema	Luxury Anchors	Flex Office	Living (Hotel/Resi)	Disposable income	Population profile	
TAP_{EIU}	3	5	4	6	2	5	3	3	3	4	5	3	4	6	5	3	4	3	4	5	3	2	3	6	2	100
C_j	E1	E2	E3	E4	E5	E6	E7	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11	I12	U1	U2	U3	U4	U5	U6	U7
8.31	10	8	6	10	5	10	8	10	10	10	10	10	8	5	5	8	8	10	9	7	5	9	10	10	9	219

**Figure 1.** HKRI Taikoo Hui project opened in Jing'An District in 2017. Image available at <https://www.hkri.com/>, Accessed August, 2023.**Figure 2.** T^{EU} summary of the 26 projects analysed.

premium (Nakamura et al., 2018). The district's mature development and the project's integration with the surrounding urban fabric notably contribute to its strong performance metrics.

To better understand the results, it is suggested to conduct a sensitivity analysis to review the impact of each indicator on the total score of the projects. With the criteria given to each of the KPIs, we calculate the correlation coefficient to measure the strength and direction of the relationship between each indicator and the total score. A positive correlation coefficient indicates a positive relationship, meaning that an increase in the criterion leads to an increase in the total score. Therefore, a negative correlation coefficient indicates a negative relationship, meaning that an increase in the criterion leads to a decrease in the total score.

Based on the data provided, we will use the standard correlation coefficient,

$$r = \frac{1}{(n-1)} \times \sum \frac{[(X_i - \bar{X}) \times (Y_i - \bar{Y})]}{(S_x \times S_y)}$$

where:

X_i and Y_i are the values of the criteria and the total score, respectively.

\bar{X} and \bar{Y} are the means of the criteria and the total score, respectively.

S_x and S_y are the standard deviations of the criteria and the total score, respectively. n is the number of data points.

By calculating the correlation coefficient for each indicator, we can determine the sensitivity of the total score to each parameter. A higher correlation coefficient indicates a higher sensitivity.

As per the above calculations using the standard correlation coefficient on each indicator, it is observed that the following factors displayed the highest sensitivity towards the total score: Retail GLA/Tenants, Catchment Area, Regen-Experience, Total sqm/Plot Size, and Population Growth.

Figure 3 shows the correlation coefficients for each indicator:

Analysing the mixed-use projects in Shanghai, we found that certain factors, such as the amount of retail space, the size of the area where customers come from, and experience in refurbishing areas, can affect how well these developments do. On the other hand, how long a project takes to build, the involvement of specialised real estate teams, and the kinds of people living nearby do not seem to influence the overall success and appeal as much.

The best practices and design principles for integrating metro systems and mixed-use developments should be further investigated and refined in future research. Some of these best practices include the use of green spaces and design principles (Ugolini et al., 2018) or creative and sustainable approaches to urban regeneration (Nesticò & Somma, 2019). It is crucial to remember, though, that imprecise reasoning may imply a favourable relationship between population growth and CO₂ emissions (Zagow, 2020).

For example, certain elements will need further investigation, such as the relationships between developers and authorities (Hietanen et al., 2016) and external macro-economic factors (Feng & Baijie, 2018) that may impact their results.

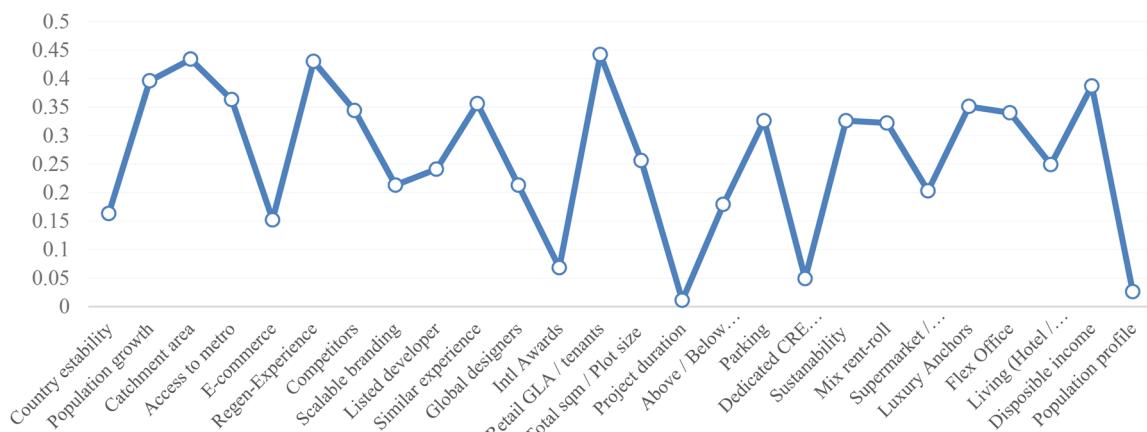


Figure 3. Correlation coefficients for KPIs.

Discussion

Successful mixed-use development projects hinge on several critical factors. First, their location near major transportation hubs, like metro stations, is vital for accessibility and urban development (Liu et al., 2018). Specialised teams and prior retail experience are common traits among top firms, underscoring the importance of expertise in project management (Metzinger, 2021). Implementing omnichannel strategies and maintaining a diverse tenant mix, including local and international brands, are essential for a thriving retail sector (Husain et al., 2022). A variety of leisure offerings within these projects encourage community interaction and extend visit duration. Architecturally, the most effective projects are designed by international firms (Sklair, 2013), often featuring two underground levels and a few above-ground floors (Chen et al., 2023). Economic stability within a country fosters an encouraging environment for commercial real estate investments (Cheng & Ng, 2023), and urban regeneration initiatives attract investments and contribute to the sector's success (Zhu, 2023). Retail ecosystem decisions in mixed-use projects are complex and must consider various factors, including, among others, socio-economic and industry-specific factors like construction duration (Kim et al., 2019). Lastly, these developments offer a strategic investment advantage by diversifying risks across different types of spaces (Locurcio et al., 2020), such as retail, hospitality, office, and residential. In detail and based on the results, it is found that:

- Connectivity with major commercial arteries is necessary, including access to a metro station (100% have access within 500 m of a metro entrance).
- Previous retail experience and specific teams in different phases of development are key factors. This practice is extended across most of the listed firms (Meijer & Buitelaar, 2023).
- Strategies to enhance omnichannel brands are needed (Rahman et al., 2022), ensuring a balanced commercial mix between local (Davies, 2002) and international brands (Pangarkar et al., 2022).
- A great offer of food and restaurants helps to facilitate traffic between offices, hotel, and residential spaces, and the retail podium (Ye et al., 2020).
- From an architectural point of view, 73% of the projects have more than two floors below ground, and the top ten ranked projects have 3–4 floors above ground (95% of the buildings).
- Almost 90% have a minimum commercial area of 35,000 sqm.

From an investment perspective, these hybrid assets offer the advantages of balancing and distributing risk among different uses (Yue et al., 2012). This shares the investment between retail (shopping centres and experiences), hospitality (hotel), offices (flex), and residential (living, apartments).

Property owners can lease the offices with additional service offerings when there is a shopping centre on the podium. And hotel and apartments have the convenience of enjoying the services provided by retail (Ye et al., 2020), entertainment areas, or as tourist destinations (Mustelier-Puig et al., 2018).

It has been found, for example, that offices for international companies, such as law firms, will pay between 5 and 20% more rent if they are in the CBD. In our case, the top ten China law firms have their offices in the inner ring, with seven of them in Pudong, Jing'An, and Xuhui districts (Limehouse & McCormick, 2011), which are the same as the mixed-use projects.

The methodology and appraisal of the three groups of indicators can be adapted to different agents across the entire real estate ecosystem due to the universality of the factors it considers (Gielens & Roggeveen, 2023). It includes social dynamics, economic trends, and industry-specific conditions (Aversa et al., 2018). Given the diversity and complexity of these elements, the indicators provide a structured and quantitative basis for analysing potential investments across geographies (Zhou & Liu, 2021).

Therefore, they are intended to be applicable to all real estate industry advisors and, ideally, to each firm involved in the development, whether corporate real estate leaders, investors, developers, or each local Administration. In fact, the Mayor of Shanghai revealed in June 2021 the creation of '*China's largest fund for Urban Renewal*' with over 80 billion RMB to attract additional investment to support the redevelopment of old neighbourhoods and urban renewal, emphasising the significance of public involvement and partnership with the business community (Azzam & Alhababsah, 2022).

This is a clear indication that projects, such as those reviewed in this article not only create value for the shareholders of each development company but also for the cities and society that surround them.

Therefore, this triple evaluation of indicators for mixed-use projects is proposed for large cities under development as well as for other international urban locations, e.g. Kinshasa, Lagos, New Cairo, Jakarta, or Manila, cities with a forecast population of 15 million by 2050.³ International retailers can find in this study insights for future expansion (Batsakis et al., 2023).

The Shanghai and other participants in the above-mentioned projects will be able to continue making the 'Pearl of the Orient' one of the most important cities on the planet, which is among the top ten positions in many of the global rankings, including Cities in Motion (IESE, 2019), Global Cities (Kearney, 2021), Mori Foundation (Mori, 2019), Schroders (Schroders, 2019), GaWC (Gawc, 2019), and CRE Investment Global Cities (JLL, 2019), among others.

Valuation considerations

This research article focuses on analysing the key performance indicators of large real estate developers from Hong Kong, China, and Singapore (Zheng, 2013), with a specific emphasis on their funding and mixed-use assets completed in Shanghai during the period from 2009 to 2019. Through rigorous analysis, the research assesses the relative importance of each decision criterion used by developers (Erdogan & Naumčík, 2019), providing valuable insights into their prioritisation strategies and internationalisation decisions. Certain elements will need further investigation, such as the relationships between developers and authorities (Hietanen et al., 2016), the ownership decision structure of firms (Tang & Mori, 2016), and external macro-economic factors (Feng & Baijie, 2018) that may impact their results. This information can assist stakeholders (Ranfagni & Guercini, 2014) in making informed choices and allocating resources effectively (Kumar et al., 2017).

While the goal of a listed firm is to create value and maximise shareholders' wealth (Zhao, 2023), it is worth noting that listed firms have a significant impact on the cities they operate in (Musil, 2011), particularly when they are committed to a region and have a long-term strategy linked to a corporate brand and social responsibility (Khanna et al., 2013).

The study suggests that indicators M1 and M2, and firms with significant compliance and certification of ESG (Białkowski et al., 2023), are better positioned to protect stakeholders' interests (Elg & Welinder, 2022). Therefore, including ESG practices in corporate governance (Cai et al., 2017; Kaiser, 2020), and strategic partnerships with local authorities (Lichtenberg & Ding, 2009) is strongly recommended (Ionaşcu et al., 2020).

Limitations

The three groups of indicators are based on qualitative analysis, articles, and financial reports of listed companies (Hui et al., 2013). The research is also based on interviews with international real estate professionals involved in the design, management, and construction of the referred assets, developers of mixed-use spaces, architects, and retail representatives of the sector in Shanghai and other Chinese cities. Plus, 140 people responded to an anonymous online questionnaire to confirm the assessment of the Ind-U1 to Ind-U7 indicators. Likewise, a quantitative analysis of the projects has been carried out from various angles. A correlation is proposed that is useful for all the advisors participating in these projects. The limited number of assets (26) and the confidentiality of some data (unpublished or accessible only to shareholders of the listed firms) require further development by key stakeholders, who could elaborate on the information by providing their own data on the proposed indicators and performance model. An extended group of respondents would help detail some indicators. Similarly, more information is required to benchmark office, hotel, and residential uses.

It is possible to examine these assets and their developers as part of this specific study between crises (Ng et al., 2024). Moreover, it is crucial to consider the city's competitive landscape and which districts are open to future development (Elmedni et al., 2018). This can have a significant impact on development, investment, asset management, and urban policy opportunities (Lai et al., 2020).

Lastly, future research can adopt the same approach and study different asset classes or add different corporate and finance parameters to compare the results with those obtained in this paper.

Conclusions

This article provides insights into business and marketing strategies for large developments in megapolis areas. Specifically, it focuses on the evaluation of large mixed-use developments in Shanghai between 2009 and 2019, employing three distinct groups of key performance indicators. The research reveals that the most attractive projects exhibit higher rents and occupancy levels, along with enhanced adaptability to the urban environment, including at least two primary uses: retail and offices.

The findings of the study hold significance for marketing consultants, global brands, and future studies in Multi-Criteria Decision Making (MCDM) in real estate developments. By considering the demands of both occupiers and consumers, the research offers valuable insights and recommendations that can inform decision-making processes and business planning. To establish a solid foundation for these insights, the study draws on research data from prominent real estate firms, consulting companies, investors, and international brands.

The article further provides recommendations tailored to global corporations, architects, authorities, and real estate stakeholders: Access to the metro system, particularly with a connection to Line 2, is essential for successful large-scale projects. Additionally, the ideal project size is ~200,000 sqm, with 50% of the built area allocated to retail use. The land plot should span between 35,000 and 40,000 sqm and involve international advisors. Podium and shopping centre space should accommodate 200 occupiers across 5–6 floors above ground and two floors underground, along with 1,000 parking spaces, as incentives linked to staying and consumption (Mingardo & Meerkerk, 2012).

That will show, on average, rents between 25 and 30 RMB/sqm/day, but this can be doubled in prime areas and 50% in secondary rings. Customers look for spaces that promote experience, luxury, and leisure amenities (Shahid & Paul, 2021). International backgrounds and listed firms with their own specific real estate divisions (property, lease, and asset management) are beneficial.

While the data available to study sustainability impacts across asset classes is limited, carbon-neutral or very low-emission assets will be required. Additionally, social and governance improvements are encouraged for retailers and other agents (Ly, 2021). For future analysis and discussions, it is recommended to conduct a more comprehensive examination of the sustainability strategies necessary for these assets. This includes the pursuit of net-zero carbon certifications, even in developing markets (Gupta & Ramachandran, 2021). Moreover, further research can delve into specific typologies, such as mixed-use assets, listed developers, retail complexes, or different megacities, enhancing our understanding of their unique dynamics and implications.

The conclusions of our Shanghai mixed-use development study suggest a more versatile and adaptable MCDM framework to decode the complex relationship between retailer location strategies and their outcomes. The three-part indicator system (External, Industry-specific, and Usage-based) provided in-depth insights that require real-world verification through quantitative data and stakeholder feedback.

Additionally, alternative methods like Fuzzy Logic, Machine Learning, Agent-Based Modeling, and System Dynamics can be employed to overcome MCDM limitations and gain varied perspectives. Selecting and combining these methods depends on the research's complexity, objectives, and data availability and can lead to a more comprehensive understanding of mixed-use project success (Gabrielli & French, 2020; Nikoloudis et al., 2020; Zhu et al., 2021).

These include implementation challenges, urbanisation, regeneration, densification, and urban growth. Policymakers, marketing practitioners, retailers, real estate developers, and investors, including international city-to-city partnerships, can benefit from adopting this approach.

Notes

1. Urban Land Institute, members from the APAC region. <https://asia.ulic.org/>.
2. An external advisor could assign a correlative value to each *E*, *I*, and *U* indicator. In our case, 1–6.
3. Un.org. 'World Urbanization Prospects'.

Ethical approval

Participants have given their informed verbal consent for the interviews.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Funding

Not applicable.

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Data availability statement

The author confirms that the data supporting the findings of this study are available within the article [and/or] its **Supplementary Materials**. The data that support the findings of this study are available from the corresponding author, [AV], upon reasonable request.

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