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Modelling vitality in the intermediate spaces of mid-rise residential complexes: a structural approach with a case study of Tehran

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Abstract:
This mixed-methods study, combining quantitative and qualitative approaches, examines the structural model of vitality in mid-rise residential complexes in District 22 of Tehran, Iran. Data were collected from 250 residents using a structured questionnaire and selected via random cluster sampling. The adequacy of the sample was confirmed with the Kaiser–Meyer–Olkin (KMO) test (KMO = 0.879), and the instrument's reliability was verified through Cronbach's alpha ($\alpha = 0.976$). Structural equation modelling and path analysis were conducted using SPSS and AMOS software. The findings indicate that physical factors, as independent variables, significantly affect residents' vitality through mobility-related factors, which serve as mediators. Among physical factors, form and integrity showed the most potent direct effects, whereas desirability and comfort were the most influential among mobility-related factors. Mobility was identified as the most critical element of overall vitality. Three primary relationships emerged from the analysis: (1) physical values influence vitality via mobility; (2) mobility values affect vitality through behavioural; and (3) vitality values are shaped by physical factors. Overall, vitality is a multidimensional concept shaped by the interplay of physical, mobility, and vitality elements, with mobility experiences mediating these interactions. The proposed model provides practical insights for enhancing the vibrancy and liveliness of communal spaces in urban residential environments.

Keywords:
Structural model, residents' vitality, public spaces, residential complex, mid-rise complex

1. Introduction

Housing is one of the fundamental human needs, yet in contemporary cities, it has become increasingly challenging to secure, especially for low income groups. Rapid population growth and shifts in demographic patterns have intensified housing challenges worldwide, making the coming decade a critical period for restructuring residential environments and improving the quality of urban living [1]. In many cities, including Tehran, the pressure of urbanisation has reshaped residential development patterns. Tehran's District 22, one of the city's rapidly expanding areas, provides a significant example of how large scale residential complexes have become the dominant form of housing. Understanding the dynamics of vitality within these mid-rise complexes is therefore essential for planners and policymakers, particularly in regions undergoing rapid spatial transformation.

Urban spaces play a central role in shaping contemporary urban life; however, in the digital age, many physical public spaces have lost vitality as online activities increasingly substitute for traditional urban functions [2]. This shift has reinforced the need to re-examine the foundational factors that contribute to urban vitality and to develop effective tools for assessing and improving it. Although strengthening vitality has long been a planning priority, knowledge about how complex built-environment factors influence it remains limited [3]. Measuring and evaluating the strength of urban vitality has always been a central topic in Chinese urban vitality research. Existing studies have already made comprehensive attempts from different data perspectives: some employed traditional indicators from statistical yearbooks [4,5]. While many others measured urban vitality in a finer-grained manner from the big data perspective [6,7,8]. Nevertheless, the current evaluation framework for urban vitality is not yet sophisticated, leaving ample room for further improvement. On the other hand, many Chinese scholars have conducted various explorations into the mechanisms underlying urban vitality, which can be mainly attributed to two aspects: the built environment [9,10,11]. At the same time, evolving lifestyles and increasing expectations for high-quality living environments have amplified the need for residential settings that actively support well-being, social interaction, and everyday liveliness [12].

Despite the growing interest in urban vitality, relatively few studies have specifically examined vitality in residential complexes, particularly the mechanisms that generate it (GMUV) or the essential components that sustain it [13]. This research gap is especially evident in regions such as Tehran, where rapid development of mid-rise residential complexes has created new spatial configurations, whose vitality is not yet fully understood.

Recent advancements highlight the importance of approaching vitality through three interconnected dimensions: physical, mobility, and vitality values. Resident vitality refers to a residential environment's ability to promote liveliness, well-being, and social engagement among its occupants. The physical value encompasses perceptibility, comfort, mobility, and spatial unity, shaping residents' sensory and functional experience of space. The mobility value reflects group activities, social interactions, responsiveness, and a sense of belonging, indicating how residents use and engage with their environment. The vitality value includes psychological outcomes such as happiness, mental wellness, and overall life satisfaction. Recent studies [14,15,16] show that interactions among the physical, mobility, and vitality dimensions collectively enhance resident vitality. These findings suggest that lively residential environments result from the dynamic interplay between architectural qualities, patterns of social interaction and mobility, and residents' psychological experiences.

Accordingly, the present study investigates the structural model of vitality in the intermediate spaces of mid-rise residential complexes in Tehran's District 22, aiming to identify how physical, mobility, and vitality values interact to shape residents' lived experience and to provide insights for improving urban residential environments.

1.1. Vitality

Urban vitality is often associated with a city's overall appeal and is regarded as a fundamental force driving urban development [17]. The concept has its roots in biology and ecology, where it denotes the ability of living systems to endure and adapt over time. As noted in The Dictionary of New Terms and Phrases of Contemporary China, vitality is understood as the power that enables cities to maintain continuity and achieve progress. This notion has been broadly applied across various disciplines, with its interpretation shaped by specific contexts. At the scale of cities or neighbourhoods, studies on vitality often highlight its organic characteristics, such as: (1) planning approaches that promote decentralisation and diversity, and (2) dynamic interactions facilitated by urban design strategies. For instance, Peter Katz and his collaborators outlined several crucial elements influencing urban vitality, including mixed land use, block compactness, pedestrian friendly accessibility, and streets designed at a human scale [18].

Regarding indicators and planning strategies, Peter Katz and colleagues emphasised several fundamental factors influencing the vitality of urban blocks, including functional diversity, compact spatial layouts, walkable scales, and appropriate building density [19].

In a similar vein, John Montgomery introduced design principles intended to strengthen urban form, reinvigorate street life, and enrich urban culture. His work also explored pedestrian focused strategies in traditional European cities and outlined 12 indicators of vitality, addressing aspects such as human scale, street connectivity, urban texture, and density, that provide valuable guidance for enhancing street vitality [20].

Since the early 2000s, numerous Chinese scholars have conducted extensive research on urban vitality. For instance, Jingyuan Jia and co-authors suggested that night time light brightness could serve as a measure of vitality intensity across large areas, while also analysing its connection with the three-dimensional characteristics of the built environment [21]. In another study, Na Ta and colleagues assessed the economic, social, and cultural aspects of vitality using data sources such as public reviews, taxi trajectories, and points of interest (POI) for cultural facilities. They further developed an econometric model to evaluate how built environment factors affect vitality [22].

Collectively, these studies highlight that public space serves as the foundation of urban vitality and acts as the medium for human activities, shaping the type, frequency, and scale of urban interactions. Additionally, elements such as population concentration, activity patterns, and their frequency directly influence vitality. More specific determinants include land use functions, the degree of land-use mix, intersection density, building compactness, sky visibility, and green coverage [23,24,25].

1.2. Research variables

In the relevant literature, residential vitality is understood as the outcome of interactions among physical, mobility related, and perceptual dimensions of the urban environment. Following this perspective, the present study conceptualises physical characteristics as the independent variable, mobility as the mediating variable, and vitality as the dependent variable. This framework is consistent with prior research showing that physical spatial conditions shape patterns of movement and interaction, which subsequently influence residents' psychological and experiential responses to their surroundings [26,27]. These theoretical relationships form the basis of the structural model examined in this study.

Dependent variable (vitality): Vitality is treated as a multidimensional experiential construct encompassing integrity, satisfaction, tranquillity, attachment, mobility, sense of belonging, responsiveness, collectivism, opportunity, and safety. Across the literature, vitality is commonly regarded as emerging from the dynamic interplay between spatial environments and human activities [28]. It is widely recognised as a core component of urban quality of life [29]. Jacobs (1961) characterises vitality as the continuous presence and movement of people in urban space over time, shaped by diversity, permeability, and sustained activity. Subsequent studies, such as those reviewed by Shach-Pinsly (2019), expand this understanding by linking vitality to broader dimensions of resilience, creativity, economic competitiveness, and social engagement [30]. These exact dimensions inform the interpretation of perceptual vitality indicators in the present research.

Vitality is also shown to influence long-term urban development and resident well-being [31] and today is a central concept across planning, geography, economics, and sociology, frequently incorporated into contemporary policy frameworks [32,33]. Lynch (1984) further conceptualises vitality as a system's capacity to sustain life, growth, and ecological stability, associating it with qualities such as safety, harmony, and coherence attributes directly reflected in perceptual vitality factors such as safety, attachment, and spatial clarity. Other studies likewise identify strong associations between vitality and resilience, livability, public health, and social inclusiveness [34,35,36].

Independent variables (physical): In the relevant literature and supported by interviews with 25 architectural experts' physical characteristics of residential environments are generally categorised into five main dimensions: form, function, concept, technology, and integrity [27].

Form refers to the spatial configuration and visible attributes of architectural elements, including proportions, scale, and organisation. Prior work shows that form plays an essential role in shaping perceptual clarity, legibility, and comfort [37,38,39], and visual qualities such as colour, scale, and texture contribute to spatial usability [40].

Function encompasses the roles and uses of architectural spaces, such as living facilities, shared amenities, and service areas. Functional adequacy is closely related to accessibility, walkability, and use patterns, key components in urban vitality literature [26,41,42].

Concept denotes the underlying design idea or cultural semantic principle expressed through architecture. As shown in the literature, design concepts influence spatial identity, meaning, and symbolic interpretation, affecting psychological responses such as place attachment and belonging [43,44,45].

Technology includes construction methods and structural systems, from traditional techniques to modern engineering solutions. These systems contribute to safety, durability, and expressive potential [46,47], and have historically shaped both architectural identity and perceived stability [48]. In residential developments, technologies such as reinforced concrete and steel systems affect structural performance and environmental character.

Integrity refers to the coherence and unity among physical elements, bringing together form, function, concept, and technology to create a holistic spatial experience [49].

This unified perception contributes to qualities such as harmony, satisfaction, and perceptual clarity, directly shaping residents' experiences of communal spaces [50,51,52]. Physical characteristics strongly shape mobility patterns in communal spaces. Comfortable seating, appropriate furniture placement, pauses, permeability, and walkable networks shape residents' presence and movement [53]. Climate responsive design further reinforces comfort and supports active use of outdoor and semi open communal areas.

Mediating variable (mobility): Mobility, particularly walking, plays a central role in shaping how individuals perceive, occupy, and interact within urban environments. In the literature, mobility is described not only as physical movement but also as a social and cultural mode of engagement with space [54]. Every day and leisure activities contribute to social connection and personal development, and their spatial settings must provide supportive physical, social, and psychological conditions. Environments that accommodate diverse activities encourage more frequent encounters and stronger social bonds, enhancing residents' sense of belonging [55]. Empirical studies show that pedestrian movement patterns significantly influence the liveliness, usability, and social presence of public and semi public spaces [56]. Recent scholarship also underscores the importance of temporal and spatial diversity in activity patterns, arguing that vibrancy depends not only on functional diversity but also on variation across time and within different spatial sectors [57]. Additional research demonstrates that urban vitality emerges from energy based interactions among behavioural efficiency, spatial configuration, and activity density. These findings suggest that population density alone is insufficient as a predictor and that classical vitality indicators remain incomplete [58].

Consistent with this view, Sheng et al. (2025) show that vitality results from complex interactions among pedestrian pathways, activity intensity, and spatial accessibility, highlighting mobility as a significant determinant of how vitality is distributed across neighbourhoods [59]. At the micro behavioural scale, perceived safety, particularly among older adults, strongly influences mobility and social engagement, and transportation infrastructure plays a key role in shaping how residents navigate and use their environment [60,61]. Kang (2020) likewise emphasises that diversity in movement and activity is foundational to sustainable and vibrant urban environments [62], aligning with the behavioural functional mechanisms discussed in this study.

Building on Jacobs's foundational insights, more recent studies reaffirm that land use diversity, building age, intersection density, and urban density shape movement and help determine the presence of people in space [63]. Contemporary research, therefore, conceptualises mobility and walkability as central to the continuous activity and social presence necessary for vibrant communal environments [64], mediating the relationship between physical design and perceptual vitality outcomes [65,66].

2. Method

This study aims to enhance vitality in the communal areas of mid-rise residential complexes by examining three main dimensions: physical, mobility, and vitality factors. To achieve this, a mixed-methods research design integrating both quantitative and qualitative approaches was adopted to identify, validate, and structurally model the variables influencing vitality. The research process was organised into four consecutive stages: identification of variables, verification of variables, discovery of factors, and structural modelling, as illustrated in Fig. 1.

Given the specialised nature of the concepts and variables under investigation, the study population consisted of both residents and experts associated with mid-rise residential complexes in Tehran. A total of 250 participants were selected using a random cluster sampling technique, ensuring that every individual in the population had an equal chance of being included [67], thereby maintaining the sample's representativeness and randomness. The fieldwork was conducted in three mid-rise residential complexes located in District 22 of Tehran: Sadra, Olympic, and Mahestan. These complexes were selected because they represent some of the most prominent residential developments in the district and exhibit key characteristics typical of mid-rise complexes, including sizable populations, defined communal spaces, pedestrian oriented circulation, and diverse land uses. These features provided a suitable empirical context for examining mobility patterns, physical configurations, and indicators of vitality in a real, applicable urban environment.

The study variables were categorised into three main groups:

1. Vitality factors
2. Physical factors
3. Mobility factors

These variables were first identified through content analysis, then validated through an expert survey, and subsequently factor extracted using factor analysis techniques. Finally, the validated factors were incorporated into the structural model.

The adequacy of the sample was assessed using the Kaiser-Meyer-Olkin (KMO) test, which is calculated based on the formula where r_{ij} represents the simple correlation between variables and a_{ij} denotes their partial correlation [68]. A KMO value above 0.6 is considered indicative of acceptable sampling adequacy [69,70]. In this study, the questionnaire produced a KMO score of 0.879, confirming that the sample was sufficient (Table 1).

Data were collected using a structured questionnaire. To measure the study variables, a survey comprising 166 items was developed, utilising a 5-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree) [71]. This scale enabled systematic ranking and quantification of the variables [72].

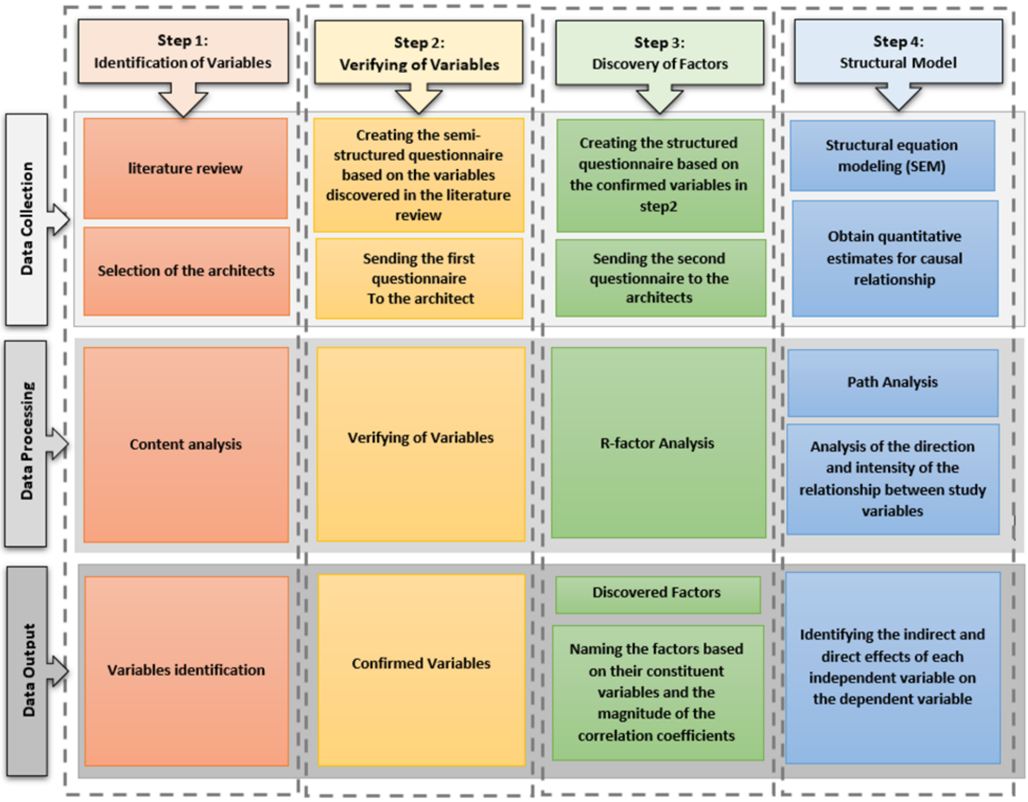

Fig. 1. The methodology steps

Table 1. KMO and Bartlett's test Results

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.879
Bartlett's Test of Sphericity	Approx. Chi-Square	7080.4
	df	1830
	Sig.	0.000

The survey questions were developed using a Table of Specifications (TOS), which ensures that the test adequately measures the intended variables [73]. In this table, the independent variables are presented in the columns, while the mediating and dependent variables are displayed in the rows. Questions were formulated based on the intersections within this matrix, enabling a systematic examination of the relationships among the variables.

Participants, including both residents and experts, were asked to complete the questionnaires online carefully. To verify the reliability of the collected data, Cronbach's alpha was applied. A coefficient value above 0.7 indicates acceptable reliability. This statistic measures both the variance of individual items and the variance of the total set. When participant responses are consistent, the overall variance of the items is lower than the sum of individual variances, resulting in a higher alpha value. Conversely, inconsistent or unrelated responses lower the coefficient toward zero. Cronbach's alpha thus reflects whether all items within the instrument consistently measure the same construct [74].

In general, an alpha value of 0.7 or higher demonstrates sufficient reliability of the measurement tool. As shown in Table 2, the alpha value for the residents' responses was 0.976, indicating strong reliability for the questionnaire items.

Cronbach's alpha measures explicitly internal consistency, reflecting the stability of responses across multiple items. However, some scholars have argued that this index alone may not always be sufficient. For instance, Taber's review of 69 studies suggested that additional reliability statistics should also be considered [75]. Estimates of reliability based on Structural Equation Modelling (SEM) are often indicated as either alternatives or complements to Cronbach's alpha [76]. Accordingly, in this study, the reliability of the research instrument was further confirmed through the structural model fit indices, as presented in Table 3.

Table 2. Reliability Statistics of Residents

Cronbach's Alpha	N of Items
0.976	166

The relationships among the independent variables (physical phenomena), the mediating variable (mobility), and the dependent variable (vitality) were examined using path analysis in SPSS and AMOS software. AMOS, a visual platform for Structural Equation Modelling (SEM), enables the use of standardised regression coefficients (beta coefficients) to model structural relationships. The primary purpose of path analysis is to provide quantitative estimates of causal links among a set of variables [77]. This analysis produces path coefficients that indicate the strength and direction of these relationships. As these coefficients are equivalent to standardised regression coefficients, path analysis essentially relies on the principles of simple linear regression [78,79].

Path analysis extends beyond basic regression by allowing researchers to examine not only the direct effects of independent variables on dependent variables but also their indirect effects [80]. This dual capacity represents a key advantage over traditional regression models, which only capture direct relationships [81]. Furthermore, whereas regression analysis typically produces a single linear equation, path analysis involves multiple standardised regression equations, making it a more advanced technique for exploring complex causal structures

[82]. The model's fit was assessed using several goodness-of-fit indices, including p-value > 0.05, CMIN/DF < 2, GFI > 0.9, CFI and NFI > 0.9, RMSEA ≈ 0.1, and PCLOSE > 0.9, all of which were found to be within acceptable thresholds [83] (see Tables 5 and 6). One critical indicator of model acceptability is the p-value; in this study, the p-value for the residents' model was 0.999 (Table 3), confirming its suitability. A p-value of 0.999 suggests that if the model were tested 1,000 times, it would yield consistent results 999 times, highlighting its robustness.

Table 3. Reliability Statistics of Residents

Model	NPAR	CMIN	DF	P	CMIN/DF	GFI	NFI Delta1	CFI	RMSEA	PCLOSE
Default model	85	24,138	51	0.999	0.473	0.998	0.993	1.000	0.000	1,000

3. Research findings

In this chapter, the analytical process and the resulting findings are presented in an integrated manner to maintain narrative continuity while ensuring conceptual clarity, in accordance with the reviewer's recommendations. The factors extracted from the data were named based on the variables they encompassed and their correlation coefficients, with particular emphasis on the variable that contributed most to each factor [84]. This procedure served as the basis for interpreting the model's structural relationships. Using structural equation modelling (SEM) in SPSS and AMOS, the relationships among independent variables (physical factors), the mediating variable (mobility related factors), and dependent variables (vitality related factors) were examined. The analysis allowed for the calculation of direct, indirect, and total effects, providing a clearer understanding of how physical conditions influence mobility patterns and, ultimately, vitality within communal residential spaces. A total of eleven factors were identified for the resident dataset, each representing a dimension contributing to the dynamism of communal spaces. The results of the SEM demonstrate that the strongest combined (direct and indirect) effects between independent variables and the mediating variable occurred between form and mobility value, as well as between form and physical value, highlighting the central importance of architectural form in shaping both movement patterns and perceptions of the physical environment.

Regarding independent variables exerting the most substantial direct influence on the dependent variables, the model shows that the relationships between integrity and satisfaction and between concept and mobility have the highest effect sizes. These findings suggest that spatial coherence and conceptual clarity in residential complexes play key roles in enhancing residents' satisfaction and facilitating mobility related experiences.

In terms of the mediating variable's influence on the dependent variables, the most potent direct effects were observed in the relationships between physical value and mobility, and between vitality value and attachment. This indicates that improved physical quality directly enhances mobility, while vitality related perceptions strengthen residents' emotional ties to their surroundings. Among vitality related dependent variables, including satisfaction, integrity, calm, mobility, responsiveness, and attachment, mobility and satisfaction were identified as the most influential contributors to overall vitality, underscoring their centrality in shaping lively and engaging communal spaces.

The detailed numerical results of these relationships, including direct, indirect, and total effect sizes, are presented in Table 4 and Fig. 2, which summarises the structural dynamics within the resident model. These patterns collectively reinforce the conceptual understanding that physical design characteristics influence vitality both directly and indirectly through mobility-related experiences, which serve as an essential mediating mechanism in residential environments.

Table 4. Direct, indirect, and total effects of variables based on the relations in the resident model

Effective variable	Relation direction	Affected variables	Direct effect	Indirect effect	Total effect
Form	--->	Physical value	1.012	0.000	1.012
Form	--->	Physical value	0.414	0.000	0.414
Form	--->	Mobility value	0.598	0.000	0.598
Form	--->	Mobility value	1.066	0.000	1.066
Function	--->	Vitality value	0.447	0.000	0.447
Integrity	--->	Physical value	0.236	0.000	0.236
Integrity	--->	Vitality value	0.239	0.000	0.239
Integrity	--->	Physical value	0.266	0.000	0.266
Vitality value	--->	Attachment	0.201	0.000	0.201
Territoriality	--->	Satisfaction	0.166	0.000	0.166
Physical value	--->	Integrity	0.095	0.000	0.095
Physical value	--->	Integrity	0.102	0.000	0.102
Mobility value	--->	Attachment	0.083	0.000	0.083
Vitality value	--->	Responsiveness	0.154	0.000	0.154
Form	--->	Responsiveness	0.465	0.000	0.465

Effective variable	Relation direction	Affected variables	Direct effect	Indirect effect	Total effect
Function	--->	Calm	0.727	0.000	0.727
Function	--->	Integrity	0.310	0.000	0.310
Integrity	--->	Satisfaction	0.937	0.000	0.937
Concept	--->	Responsiveness	-0.095	0.000	-0.095
Concept	--->	Mobility	0.771	0.000	0.771
Concept	--->	Attachment	0.233	0.000	0.233
Concept	--->	Calm	0.149	0.000	0.149
Technology	--->	Mobility	0.448	0.000	0.448
Physical value	--->	Mobility	0.311	0.000	0.311

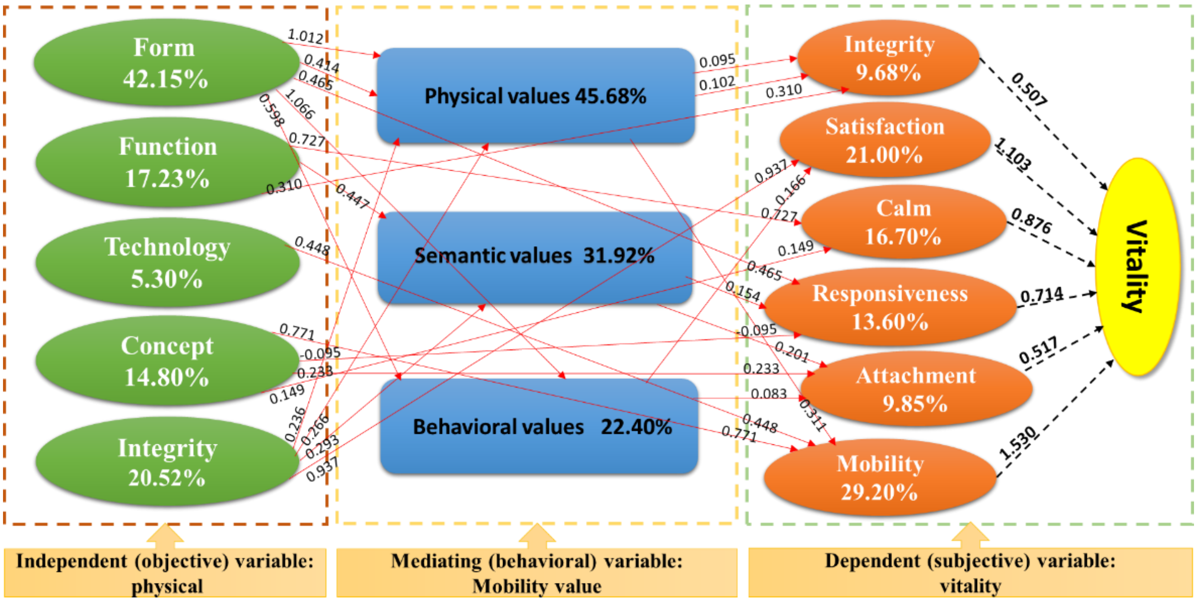

Fig. 2. The vitality model of the communal spaces in residential complexes in Tehran according to the residents' opinions

According to the results from the resident model, the following findings were obtained. As shown in Fig. 3 and Fig. 4, residents report that all physical factors (independent variables), including integrity, form, concept, technology, and function, affect vitality. Form (42.15%) has the most significant impact on vitality.

As seen in Fig. 5 and Fig. 6, according to residents, all mobility factors (as mediating variables), including comfort, desirability, unity, territoriality, conformity, comfort, and legibility (physical values), attractiveness, responsiveness, desirability, happiness, alluringness (vitality values), territoriality, perception, interactions, attendance, mobility (mobility values) affect vitality. Physical values (45.70%) have the most significant impact on vitality.

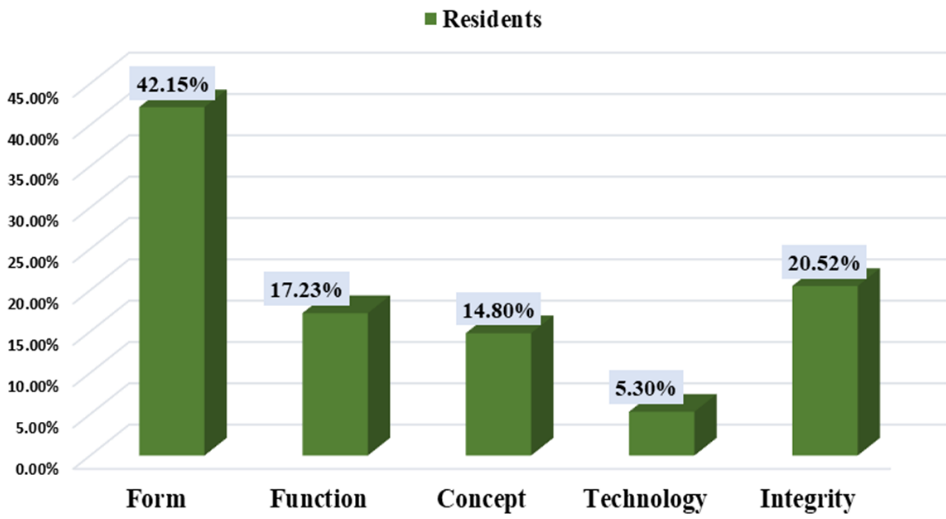

Fig. 3. Frequency of independent variables of vitality from the perspectives of residents

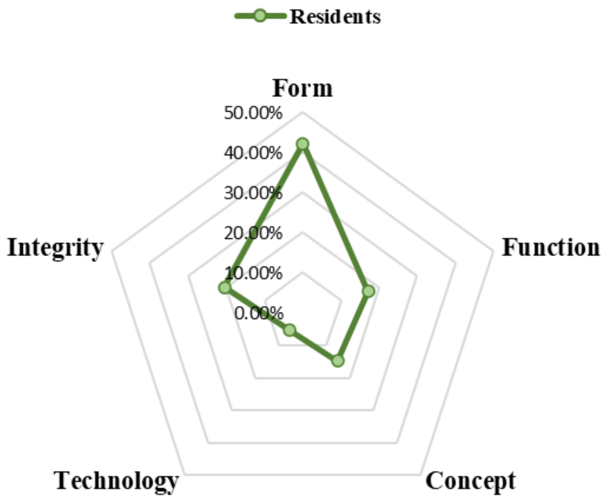

Fig. 4. Comparison of independent variables (physical) affecting vitality from the perspectives of residents

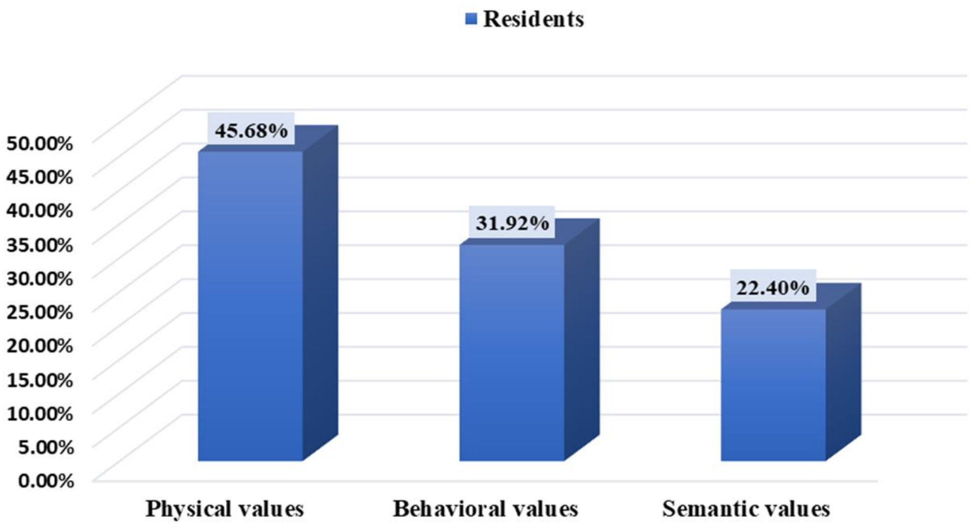

Fig. 5. Frequency of mediating variables of vitality from the perspectives of residents

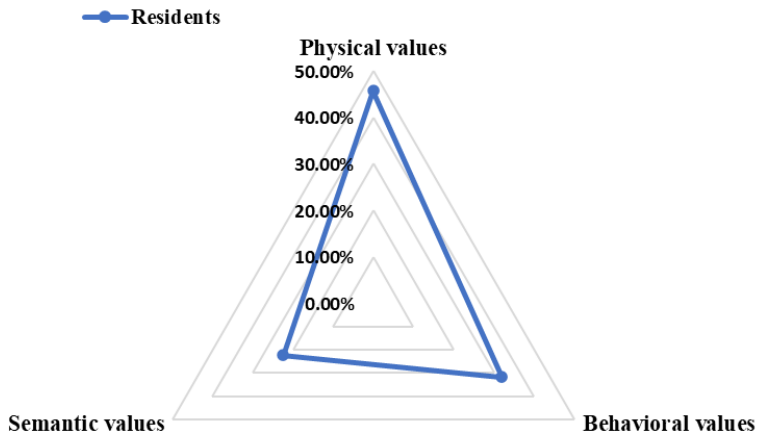

Fig. 6. Comparison of mediating variables (mobility) affecting vitality from the perspectives of residents

As seen in Fig. 7 and Fig. 8, regarding vitality factors (dependent variables), residents report that factors such as integrity, satisfaction, calm, responsiveness, attachment, and mobility influence vitality. Mobility (29.20%) has the most significant impact on vitality.

4. Discussion

This study finds that the vitality of communal spaces in mid-rise residential complexes is influenced by interactions among three main groups of factors: physical factors, mobility factors, and vitality factors. Interpreting the results within these three groups provides a better understanding of how vitality is formed and how residents experience their environment.

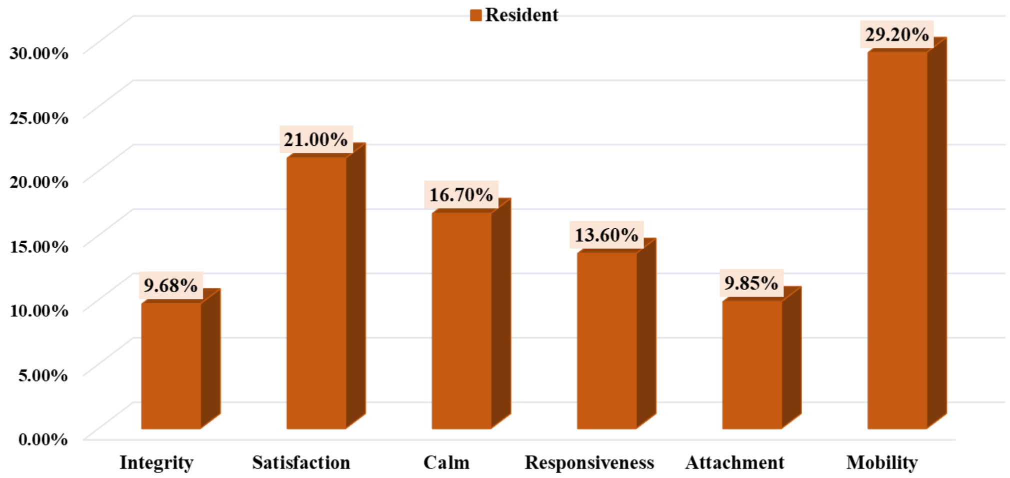

Fig. 7. Comparison of mediating variables (mobility) affecting vitality from the perspectives of residents

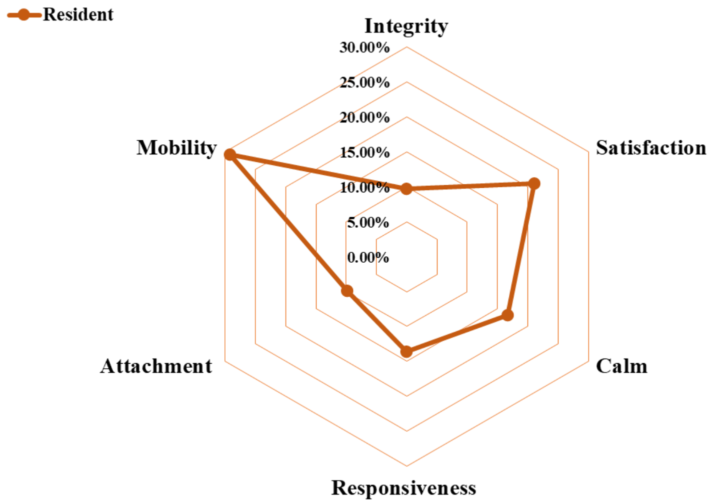

Fig. 8. Comparison of dependent variables of vitality from the perspectives of residents

4.1. *The impact of physical factors on mobility and resident interactions*

The findings show that physical characteristics of the environment, including spatial design, building form and integrity, and the quality of materials and architectural elements, play a key role in mobility patterns and the use of communal spaces. Well designed environments with proper accessibility, thermal comfort, security, and spatial coherence increase residents' presence and facilitate social and economic interactions. In contrast, poorly designed spaces can reduce participation and overall vitality. Furthermore, spatial layout and furniture arrangement, permeability, pedestrian networks, and attention to climate responsive design directly influence residents' behaviour and movement, providing more opportunities for social interaction. These results suggest that vitality is challenging to achieve without adequate physical quality, emphasising the importance of spatial design in creating dynamic and engaging residential environments.

4.2. *The impact of physical factors on residents' vitality experiences*

Analyses indicate that the physical quality of a space directly affects the perceptual and mental dimensions of vitality. Features such as aesthetics, safety, visual coherence, and attention to environmental details influence residents' perception of space and enhance their experience of presence. Spaces designed with memorable elements and visual consistency increase residents' sense of belonging and satisfaction, promoting social interaction and continued use of communal areas. These findings demonstrate that the perceptual and psychological aspects of vitality, including satisfaction, belonging, and enjoyment of space, are strongly dependent on the physical quality and mobility experience of residents. Creating meaning and personal connection with a space similar to Relph's concept of "Place" strengthens residents' attachment and enhances environmental vitality.

4.3. *The role of mobility and behavioural activities in shaping vitality*

Mobility and daily or leisure activities in communal spaces not only fulfil physical needs but also strengthen social bonds and enhance residents' sense of belonging. The design of shared spaces should facilitate interactions among diverse groups, support a variety of activities, and provide cultural and social experiences to foster vitality naturally. The results indicate that alignment between mobility patterns and spatial organisation is critical for the effective functioning of communal spaces. Mismatches between activities and spatial design can reduce resident satisfaction and limit social interaction. Therefore, designing vibrant residential environments requires careful consideration of user needs, cultural context, historical identity, and collective memory to create spaces that are both functionally efficient and socially and emotionally engaging.

5. Conclusion

Based on the presented methodology, this research can serve as a framework for revitalising other residential environments. In this approach, the building's function is first examined, and the variables influencing vitality are identified through literature review, field studies, and interviews with users. The collected data are then analysed quantitatively to determine the relationships among these variables, forming the basis for interventions aimed at enhancing vitality in residential settings.
The results indicate that physical factors, as independent variables, exert the strongest influence on the vitality of mid-rise residential complexes through mobility as a mediating factor. Among these independent variables, "integrity" has the most significant effect on satisfaction, the primary dependent variable in the resident based model. Path analysis further demonstrates three main mechanisms shaping vitality within the model: 1. the preservation of perceptual and vitality values acts as intangible factors that contribute to overall vitality, 2. the maintenance of physical values, influenced by form, function, technology, concept, and integrity, fulfills the tangible aspects of building vitality, and 3. the preservation of mobility and functional values, mediated by mobility, supports the semi-tangible dimension of vitality. Residents identified mobility as the most influential factor for overall vitality, and among mobility related variables, desirability has the most significant impact on the constituent elements of vitality. These findings emphasise that vitality is inherently multidimensional, requiring the interaction of multiple factors rather than a single element. Independent variables affect dependent variables, the constituent elements of vitality, through mediating factors. Regarding mobility as a mediator, social life must maintain a continuous flow, as mobility is a fundamental characteristic of vitality. From an architectural perspective, designing attractive, responsive, and engaging social spaces that support activities across perceptual, physical, and mobility dimensions provides the foundation for this mobility, demonstrating how mobility oriented architecture can energise both mobility and cognition, creating dynamic and lively environments.

Ethics approval and consent to participate

Not applicable

Competing interests

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Authors' Contributions

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