

Article

Promoting Urban Health through the Green Building Movement in Vietnam: An Intersectoral Perspective

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Abstract: The health of urban citizens is largely defined by how their living environments are planned, built, and operated, but scientific and policy discourse about sustainable building has often ignored this. Furthermore, while the complex relations between health and the characteristics of built environments require system-orientated thinking and interdisciplinary interventions, they have—until recently—mainly been addressed with conventionally narrow sector-based (mostly technocratic) approaches (e.g., in regard to energy efficiency or carbon reduction). This paper, however, investigates how health co-benefits are perceived by stakeholders in the field of sustainable building in Vietnam. It examines empirical insights collected from a large-scale household survey—with a focus on a green building-certified project case study—conducted in Ho Chi Minh City, Vietnam, six thematic webinars, and eleven expert interviews. Among other things, the paper points out a challenging mismatch between the high importance homebuyers place on green building health benefits, and the focus of stakeholders on energy-saving benefits, which are not necessarily the homebuyers’ most pressing concerns. Therefore, the paper concludes that improved health and well-being should be more strongly considered as co-benefits of green buildings. Equally important is that this paper also brings attention to the essential systemic approach in both academic and practical efforts toward the implementation of the SDG3, to “ensure healthy lives and promote wellbeing for all ages”, and SDG 11, “to make cities and human settlements inclusive, safe, resilient and sustainable”.

Keywords: green building certification; green building movement; health co-benefits; sustainable building; SDG 3; SDG 11; intersectoral approach; users’ perspectives; urban health



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1. Introduction

Cities currently account for more than half of the world’s population and will account for three-quarters of it by 2050 [1]. As hubs of major physical and socio-economic structures and activities, cities pose risks to human health due to air pollution, noise, urban heat island effects, a lack of green spaces, etc. [2,3]. At the same time, cities also provide opportunities for innovative health solutions and for preventing disease and injuries [4]. This urban health-mediating function is critically performed by residential built environments, which provide conditions necessary for everyday life (drinking water, food, fresh air, and a healthy environment for learning, working, social interaction, etc.) [5]. The multiple relationships between the diverse housing environment characteristics can influence the physical health, mental health, and social well-being of individuals, households, and population groups [6]. These impacts were clearly illustrated during the recent COVID-19 pandemic that fundamentally changed the ways people live, work, and communicate [7].

The role of the built environment in shaping human health is visualized in the prominent Health Map of Barton and Grant (2006) (Figure 1), which builds on the World Health Organization (WHO)’s urban health policy principles and the socio-ecological model of Gunnar Dahlgren and Margret Whitehead (1991), relating health to the physical/social/economic environment [8]. The Health Map, also inspired by ecosystem theories and the principle of sustainable spatial development (see Barton et al., 1995) [9], offers a

visual tool for communicating and analyzing the health–settlement relationship [5,10,11] (see Figure 1). The model additionally emphasizes that individuals, as the model’s center, can both influence and be influenced by their environment [12]. Such systemic complexities, therefore, require system thinking and a radical shift from disciplinary and multi-disciplinary contributions to more interdisciplinary and—at an even higher level—transdisciplinary approaches. In the best case, such a transformative approach integrates the contextual knowledge/know-how of researchers, policymakers, professionals, and communities, shaped by local geography, politics, economy, and culture [6,13]. This shift equally necessitates revisiting the tacit relationship between SDG 3, to “ensure healthy lives and promote wellbeing for all ages”, and SDG 11, “to make cities and human settlements inclusive, safe, resilient and sustainable”. While each SDG has been remarkably successful, the intertwined co-benefits of their implementation are still not fully elaborated on [4,14].

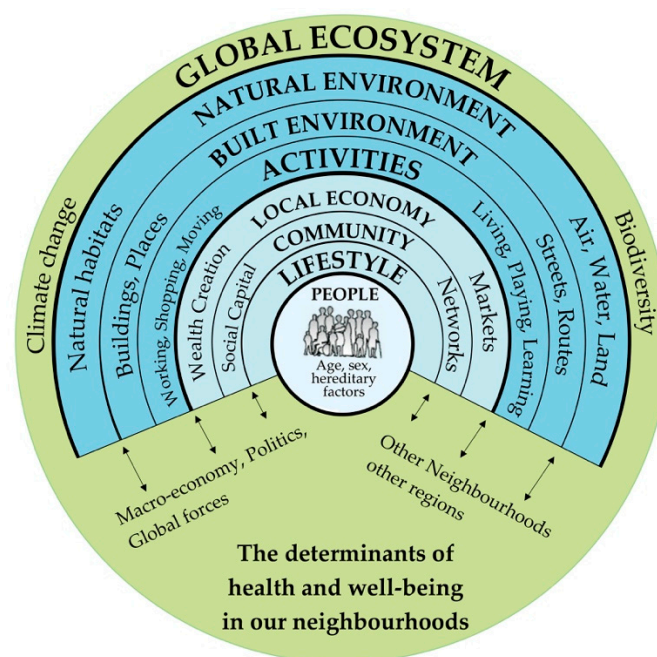


Figure 1. Health map [5].

The building and construction sector accounts for around 37% of energy- and process-related CO₂ emissions [15] and about 33% of total final energy consumption [16]. Among other things, this poses serious threats to public health due to greenhouse gas emissions and consequent air pollution. In line with the sustainable development agenda, the Green Building Movement (GBM) has emerged globally, promoting sustainable building solutions, in the case of this paper generally called “green buildings”, with innovative and energy-efficient building designs, materials, and smart technologies, combined with new forms of policies and sustainable business practices [17–19]. Challenges in promoting GBM have been largely studied in both developed and developing contexts, yet with limited insights from the building users’ perspectives. However, the implementation of a systemic approach and the intertwined relationships between health and the urban built environment remain underrepresented in public and academic GBM discussions, which predominantly focus on energy efficiency and carbon reduction benefits [20].

Since the start of the economic reform process during the mid-1980s [21], Vietnam has undergone rapid industrialization and urbanization. Even throughout the COVID-19 pandemic, it remained the best performing construction market in the Asia Pacific region [22]. The rapid economic growth of this sector has nevertheless contributed to environmental and public health deterioration due to, among other things, air and noise pollution, loss of green spaces, increase in urban heat stress, etc. [23]. At the moment, Vietnam’s booming building sector accounts for about 43% of energy consumption and for about

30–40% of carbon emissions [24]. In the last two decades, high-rise residential buildings (HRBs) have been the fastest growing housing typology, erected mainly to save land and to house the ever-increasing urban population [25,26]. Along with national commitments toward global sustainable development, climate change agendas, and foreign assistance programs, energy-efficient buildings have also been promoted [24]. In addition to governmental efforts, market-based green building rating tools have been introduced in Vietnam, including the most popular ones, like the Leadership in Energy and Environmental Design (LEED), Green Building Rating System, and LOTUS, a set of market-based green building rating tools developed by the Vietnam Green Building Council (VGBC), and more recently EDGE (Excellence in Design for Greater Efficiencies), introduced to Vietnam in 2015 by the International Financial Corporation (IFC), the World Bank Group, and GREEN MARK (developed in the Singapore) (see [27,28]). These certification tools mainly originate internationally and follow building physics science to evaluate the environmental performance of a building [29].

Several studies have mapped out key challenges for the GBM in Vietnam, in general [30–32]. However, these mainly address the questions using either highly technocratic indicator-based methods, or focus on professional groups, while mostly overlooking the perspectives of homebuyers/building users. In addition, little knowledge of the perceptions of health co-benefits of GBM in Vietnam is found in the current literature, at least to the authors' awareness.

Therefore, the main research question of this paper is how health co-benefits are being perceived by stakeholders of Vietnam's construction sector, thereby explicitly including the view of homebuyers/building users. Based on interdisciplinary social science-based research, the paper examines empirical insights, collected from six thematic webinars, expert interviews, and a large-scale household survey conducted in Ho Chi Minh City, Vietnam, with a focus on a green building-certified project case study. Among other things, the paper points out a challenging mismatch between the high importance homebuyers place on green building health benefits, and the focus of GBM stakeholders on energy-saving benefits, which are not necessarily the homebuyers' most pressing concerns.

The following parts provide a relevant literature overview, explain the paper's methodology, and discuss empirical evidence. The discussion of empirical evidence starts with the quantitative results of the household survey, which are discussed in the following section with reference to the complementary qualitative insights collected from expert interviews and thematic webinars. The paper finishes with concluding remarks and the identification of further research needs.

2. Literature Overview

The literature of past decades has been dominated by conventionally narrow sector-based approaches and a lack of empirical findings that systematically analyze the dynamic, non-linear, and complex relations between health and built environments [6,33].

Green buildings are globally certified with a variety of international and national commercial and non-mandatory rating schemes [19]. Some major schemes are Leadership in Energy and Environmental Design (LEED) in the United States, British Research Establishment Environment Assessment Methodology (BREEAM), Deutsche Gesellschaft für Nachhaltiges Bauen (DGNB), Haute Qualité Environnementale (HQE) in France, BEAM Plus (Hong Kong), Green Mark (Singapore), and Green Star (Australia) [34,35]. Their crediting focus varies across markets but generally considers key criteria of Site, Energy, Water, Indoor Environment Quality, Material, Waste and Pollution, and Management [36]. Energy, however, remains the most important criterion, followed by Indoor Air Quality and Water [36].

In response to increasing public concerns about healthy built environments, several health-oriented green building rating tools have recently joined the market, distinguishing themselves by endorsing health and wellness factors. Examples include WELL and Fitwel. WELL claims to promote healthy buildings by applying physical and social environmental

science to improve users' health, well-being, and performance [37]. The tool is evaluated to exceed the scope of normal rating systems, as it demands efforts to evaluate criteria related to food, physical recreation, etc., which are not always prioritized by investors [34]. Fitwel makes known its vision for a healthier future of healthier occupants and healthier communities [38]. As of now, the total number of WELL- and Fitwel-certified and pre-certified projects globally is still comparatively low—only in the four-digit range. Other current rating tools have also developed specialized categories underscoring buildings' operational aspects (e.g., LEED O + M and the DGNB In-Use) [34]. These assessments extend beyond the initial stages of design and construction, offering more comprehensive health benefits for users [39].

Among the advocated tangible and intangible benefits (see [19,40]), health co-benefits have been reported due to optimized indoor environments (i.e., natural lighting, ventilation, reduced contaminants like VOCs, formaldehyde, allergens, ETS, NO₂, and PM) and reduced local impacts to building sites (i.e., air and noise pollution, etc.) [41–43]. Empirical findings reveal reduced sick building symptoms (i.e., cardiovascular/respiratory symptoms and other illnesses) and mortality rates and increased productivity of occupants in green buildings [43–46]. Health co-benefits are also enhanced because they use recycled, non-toxic, long-life-cycle, and ecologically friendly materials [30]. Buildings with innovative design and engineering measures for improving built environments are asserted to contribute to SDG implementation, especially SDG 3 and SDG 11 [46].

However, localized green building codes, especially in the developing world, do not systematically highlight health improvement as a crucial co-benefit [36,47]. In addition, health co-benefits are found to be largely omitted in the burgeoning literature evaluating sustainable buildings (for examples, see [19,48–50]). Although health benefits are found to be nearly equivalent to energy savings of green buildings in the United States, and up to 10 times higher in developing countries, health benefits have not been adequately examined alongside energy saving and reduced air pollution benefits [45]. The promotion of health-oriented green building rating tools is equally challenging. On one hand, the real estate sector's interest is seen in the increasing number of buildings following health-oriented rating schemes (see [43]). On the other hand, specific criteria concerning health—for example, healthy diet provision or physical recreation opportunities—are perceived to be time- and effort-consuming, often going against investors' interests [34]. Furthermore, health-oriented rating tools may be appropriate for certain countries but not for others, as they relate to specific national health regulations and require a clear understanding of a country's unique legislation before being adopted in the building market [34].

In addition, building users' perspectives have been mostly overlooked in studies on GBM challenges. Specifically, Ametepey et al. (2015) [51] report six groups of barriers: financial barriers, political barriers, management/leadership barriers, technical barriers, socio-cultural barriers, and knowledge/awareness barriers. Other studies further emphasize obstacles caused by the following: a lack of policy guidelines and governmental incentives [52,53]; a lack of knowledge and technical skills (i.e., interdisciplinary cross-team collaboration, critical thinking, stakeholder engagement and communication, etc.) [54,55]; higher risks in project management (contracting, work scheduling, budgeting, communication, multiple stakeholder engagement, etc.) [55]; and a lack of financing schemes (e.g., bank loans, surety bonds) or insurance arrangements [52,56]. Among these challenges, higher costs of green building projects are reported to remain a top barrier for the green building market in both developed and developing contexts [52].

In Vietnam, although the GBM has gained attention from both public and private sectors, it still struggling to penetrate “a market crowded with conventional buildings” [18,30]. While about 250,000 new housing units are added each year in Hanoi and Ho Chi Minh City alone, there are only 266 certified green buildings that are completed and put into use nationwide as of December 2022, mainly distributed in big cities [31,57]. Out of these, industrial buildings comprise about 38%, residential buildings comprise about 37%, followed by office spaces (more than 12%) and hospitality spaces (approx. 9%) [57]. Among certified

residential projects in Vietnam, the EDGE certificate overwhelmingly dominates the market with a share of 97.6%, followed by LEED (2.3%) and LOTUS (0.1%) [57]. Health-oriented tools like WELL and Fitwel are not yet applied in the Vietnamese market.

Major challenges for the GBM in Vietnam in general have been mapped out, including a lack of legislative regulations (i.e., technical codes, standards, guidelines), a lack of competent consultants and general contractors to execute Green Building projects, and a limited market of sustainable materials and products [27,31]. Seven main barriers to market growth in Vietnam are reported by Nguyen et al. [18] to consist of the low electricity price, lack of government incentives, limited supply of skilled employees, short-term thinking, misaligned incentives between building developers and users, low awareness, and price sensitivity discouraging property developers. Through the perspectives of general contractors, Nguyen et al. [58] identify a lack of owner determination, technical knowledge, and experience among designers and projects. Tran and Huang (2022) [59] point out four major obstacle groups concerning planning and organizational activities, onsite management, control activities, and the green supply chain. Among those, the non-readiness of the external supply chain is the most dominant. Pham et al. (2019) [30] emphasize the lack of knowledge and experience among general contractors for implementing sustainable building projects and highlight the need for professional training. Other challenges include project manager incompetence, unavailability of sustainable materials and technologies, and developer resistance to the change toward sustainability [60].

These above studies have, however, mainly used either highly technocratic indicator-based methods, or focused purely on professional groups, while overlooking building users' perspectives. Specifically, although building users' low awareness is summarized as a challenge by Dung et al. [31], the cited studies (see [18,30,32]) hardly discuss this in detail or provide any empirical insights. What is known so far is that the uptake of GBM is explained by the benefits brought to building users [30]; building project developers consider cost efficiency in order to meet users' satisfaction levels [30]; and while stakeholder involvement is statistically analyzed to be the most important factor in project preparation, building users are not specifically identified [32]. GBM is hindered by the ownership structure (e.g., developers pay for up-front costs, whilst operational cost savings benefit the occupants) and the behavior of occupants (e.g., occupants consume more electricity when using energy-saving equipment) [18]. Again, little knowledge on the perceptions of health co-benefits of GBM in Vietnam is found in the current literature, at least to the authors' knowledge.

3. Methodology

This pilot study builds on intersectoral social science-based research, thereby trying to answer the question "How are health co-benefits perceived by stakeholders of the Green Building Movement in Vietnam?".

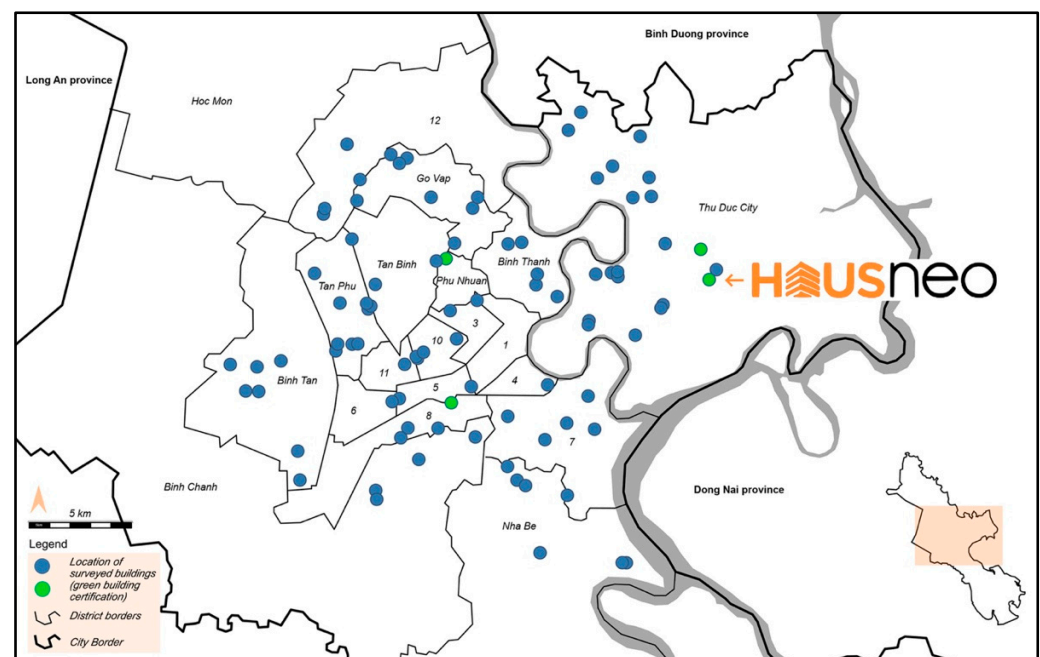
It follows an exploratory approach involving different stakeholders in different sectors—building construction, energy, health, etc.—based on quantitative data gained through a household survey among residents of high-rise buildings in Ho Chi Minh City. It also draws from qualitative data from six thematic webinars and eleven expert interviews which included stakeholders from various sectors related to the urban built environment and also related to urban health in Vietnam.

In particular, our quantitative data are based on a large-scale household survey in Ho Chi Minh City with a focus on the case study of HausNeo building project certified by EDGE. The total sample number is 560 households, including 169 from HausNeo, 31 from other certified green building projects, and 360 from conventional buildings (not certified as green buildings) (see also Table 1).

Table 1. List of survey samples of the survey in Ho Chi Minh City.

Number	Building Type	Number of Interviews in Each Building Type	Share
1	EZ LAND HausNeo	169	30.2%
2	Other certified green buildings	31	5.5%
3	High-range non-certified buildings	94	16.8%
4	Mid-range non-certified buildings	92	16.4%
5	Low-range non-certified buildings	174	31.1%
Total		560	100.0%

The main survey took place in February 2020 (see questionnaire in English language: Appendix B, Table A3; in Vietnamese language: Appendix C, Table A4), with an extra section surveyed in July 2021. All interviews were conducted directly between contracted and trained Vietnamese interviewers and the household representatives. Apart from the HausNeo case study building, all of the other buildings were randomly selected to ensure the representation of both certified and non-certified buildings. Inside each building, the households were also randomly approached depending on their availability. An overview of the spatial distribution of the surveyed high-rise buildings within the administrative borders of Ho Chi Minh City can be found in Figure 2.

**Figure 2.** Location of survey buildings and HausNeo case study within the borders of Ho Chi Minh City.

The questionnaire was jointly developed by the research project teams in Germany and in Vietnam. Pre-testing interviews were conducted encompassing 50 households in January 2020. The subsequent refining process of the questionnaires was then supported by the local research partners from Hanoi University of Civil Engineering and from Ton Duc Thang University in Ho Chi Minh City. The content of the questionnaires in both English and Vietnamese can be found respectively in Table A3, Appendix B and Table A4, Appendix C. The collected data were analyzed with SPSS software, mainly based on descriptive statistics, crosstabs, and Average Likert Values (ALV) analysis. Accordingly, the ALV has a negative relation with each factor's level of importance, meaning that the higher the ALV value, the lower the level of importance or concern placed on the studied factor by the homebuyers.

The surveyed conventional buildings were categorized into buildings of high-, mid-, and low-range markets based on the selling price per square meter (see Table 1). Low-range market buildings have prices below VND 20,000,000/square meter (sqm) (below USD 850), mid-range market buildings sell for VND 20,000,000 to 35,000,000/sqm (about USD 850 to 1500), and high-range market buildings are sold for more than VND 35,000,000/sqm (more than USD 1500). The prices of building units are either reported by respondents or collected from each building project's website homepage.

Other certified green buildings, besides HausNeo, include the Orchard Garden with EDGE certificate, Fuji Flora with EDGE certificate, and Diamond Lotus with LOTUS certificate. The locations of these green buildings are identified in Figure 2.

The empirical qualitative data were collected from expert interviews, participant observations, and discussions of six thematic webinars organized by the authors. Interviews have been conducted with eleven experts altogether, among them architects, construction engineers, managers, developers, university researchers, and lecturers. These experts are all professionally trained either in Vietnam or overseas and are experienced in their field. Most of them are also known for being actively involved in Vietnamese green building certification schemes, either as qualified consultants, trainers, or representatives from developing companies. The detailed list of interviewed experts and codes is mentioned in Table A2, Appendix A. Data from the webinars were analyzed based on three keynote speeches per webinar, the panel discussions (usually featuring four to five panelists), and the open exchanges with the online audience ranging from 100 to 500 participants. Keynote speakers and panelists are active in the fields of urban health, sustainable neighborhood development, and sustainable building. Their professional backgrounds include academia, the national and municipal policy-making level, practitioners, and private developers, as well as civil society and community organizations. Insights provided in the results section of this paper are major points commonly raised by these experts and the audience. They are coded with a capital W + the number of the specific webinar. For example, insights from Webinar One are coded W1, from webinar three W3, etc. The detailed list of webinar topics and codes is mentioned in Table A1, Appendix A.

4. Results

4.1. Introduction to HausNeo Building Characteristics

The HausNeo building project, an EDGE-certified green building (hereafter called HausNeo for short), has been developed by EZ Land Vietnam Development Joint Stock-Company (JSC) in the rapidly urbanizing and newly founded Thu Duc sub-city (until the year 2020 part of District 9) in Ho Chi Minh City. HausNeo claims to follow the German Bauhaus style, offering two high-rise 18-story blocks of 568 so-called "European-styled" mid-range market condominiums with units from 45 to 67 m² in size. A view of HausNeo building is shown in Figure 3.

HausNeo received an EDGE certificate in 2019 describing itself to follow a strict procedure, from site selection, design, and construction to operation and maintenance. HausNeo apartments feature passive design solutions (i.e., reduced window-to-wall ratios, installed external shading devices, etc.), energy-efficient lighting, low-flow faucets, and lower embodied energy building materials, with firm control in the process of construction and handover to optimize costs and raw material use. According to its specific EDGE certificate, HausNeo apartments save 29% in energy, 32% in water, and 47% in embodied energy in materials compared to conventionally constructed buildings of the same typology [61]. During an informal interview with the CEO and the Director of Development of EZ Land Vietnam, the authors were informed that the investments required to achieve the (Standard) EDGE certification in the case of HausNeo only increased the total building expenses by about 1%. According to them, this is because Standard Edge is focused more on the end-user's apartments than on the primary building system. As it happened, the increased costs of upgrading specs for the apartments did not have a significant impact on the total construction costs. The increase in building costs due to the green building certification

was relatively minor due to standardized designs and standardizing products for all units and through choosing appropriate resource-saving options. The Director of Development of EZ Land Vietnam gave the example that, in the case of building materials, the internal partition walls were built using non-burned brick.



Figure 3. Panorama view of HausNeo case study building in Thu Duc City, Ho Chi Minh City, Vietnam.

EZ Land is marketing the HausNeo project towards middle-income young families as its main target group and is further claiming to advocate for environmentally friendly lifestyles in general.

4.2. Households' Socio-Economic Conditions

Our survey showed that HausNeo indeed has younger and smaller-sized families, compared with those in conventional projects. Most respondents (90%) are between 25 and 40 years old and live in families of less than 4 members. They have higher education and more professional backgrounds; nearly 90% received a bachelor's degree or higher education, compared with 67% in conventional buildings. More HausNeo families have an average income of less than VND 45 million/month (about USD 1920) and own less high-value assets (cars or property for rent). The survey also showed that HausNeo households own significantly fewer air conditioning (A/C) devices, and the devices they do own usually possess a higher energy efficiency rating, which is evident through the energy consumption labelling system in Vietnam (see Figures 4–8).

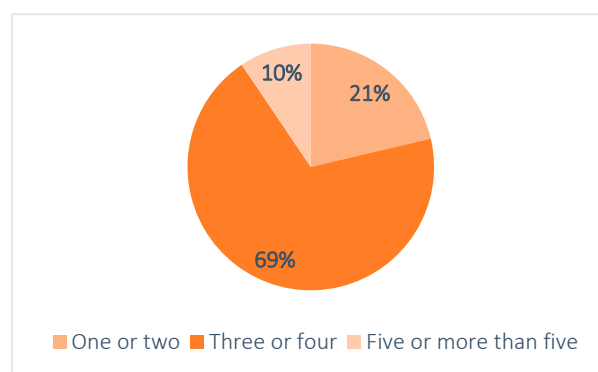


Figure 4. Percentage of HausNeo household size ($N = 169$).

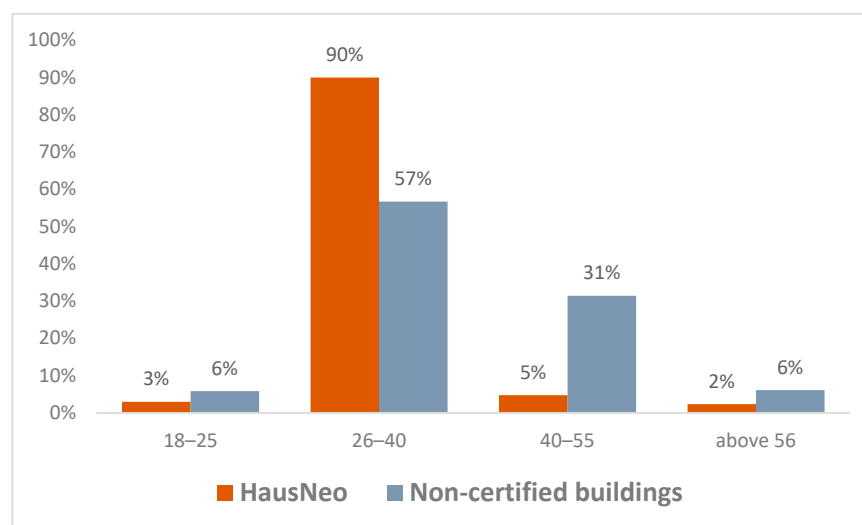


Figure 5. Percentage of age groups of households in HausNeo and conventional buildings ($N = 534$).

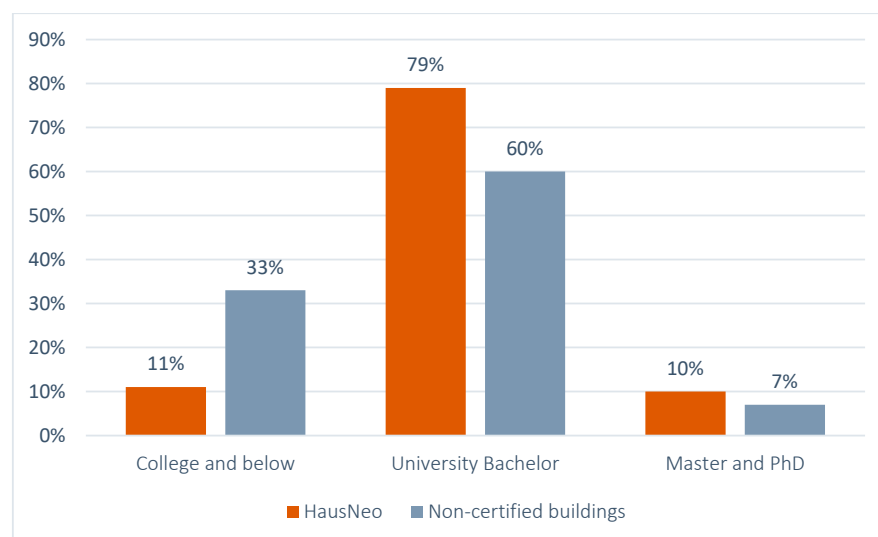


Figure 6. Percentage of education groups of households in HausNeo and conventional buildings ($N = 534$).

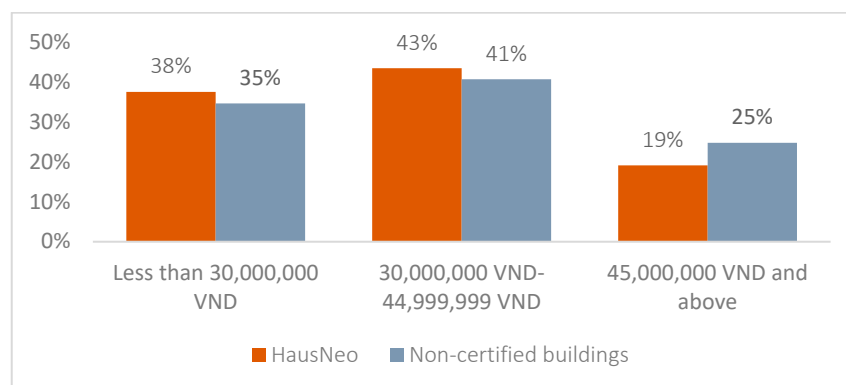


Figure 7. Percentage of income groups of households in HausNeo and conventional buildings ($N = 516$).

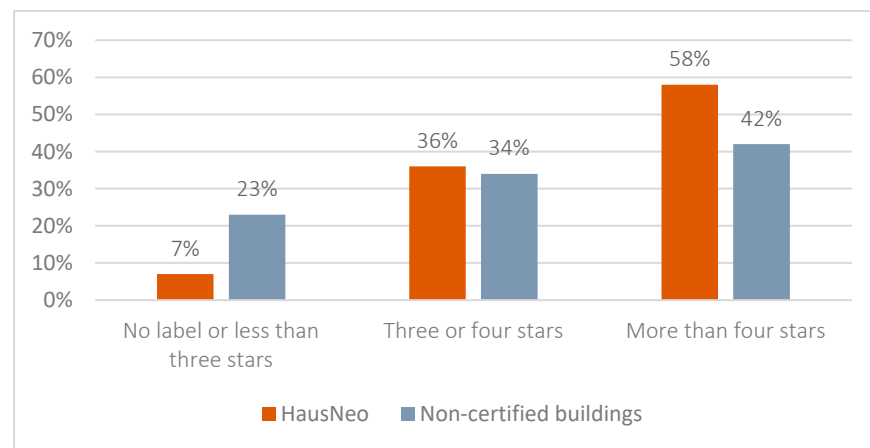


Figure 8. Ownership of A/Cs energy labelling stars (%) ($N = 481$).

4.3. Power Consumption

Data show that, compared with conventional building households, those living in HausNeo households exhibit significantly less monthly power consumption. HausNeo households also consume less power per sqm, showing that their relatively small apartment size is not a key influencing factor in this. Together, the survey could prove that residents living in environmentally certified buildings pay about 37% less for their monthly electricity bill compared to households living in conventional buildings (Figures 9 and 10).

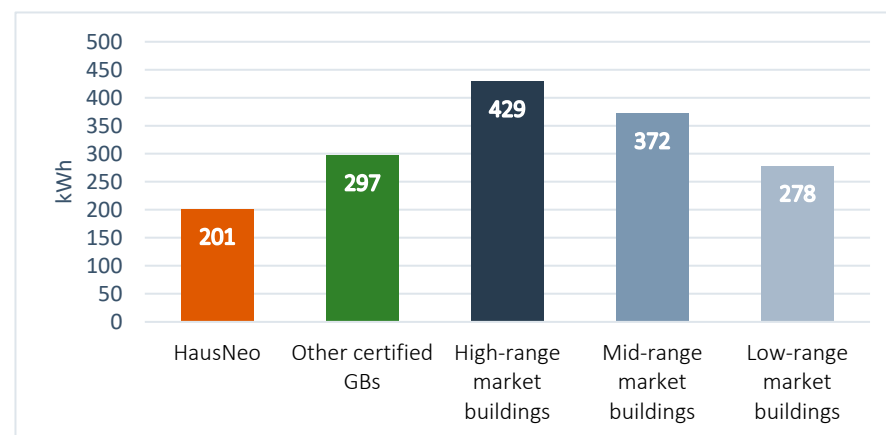


Figure 9. Average monthly power consumption (kWh) of different building categories ($N = 295$, including 113 households living in certified buildings and 182 households living in conventional buildings).

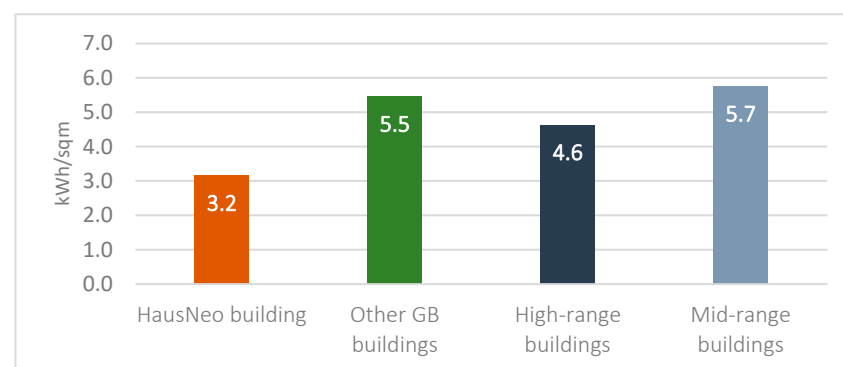


Figure 10. Average monthly power consumption (per sqm) between different building categories ($N = 126$).

The significantly lower power consumption of HausNeo households might result from building features supporting passive cooling like constructive shading (in addition to factors like building users' environmentally friendly habits and lifestyles). These facilitate better natural lighting and ventilation, thus lowering the need for artificial lighting and mechanical cooling. These features combined certainly improve the health of building users.

4.4. Knowledge about Green Building Certification

Surprisingly, our survey revealed that a large part (41%) of the interviewed HausNeo residents are unaware that there are green building certifications, although they are living in such a building (see Figure 11). In contrast, it is less surprising that 62% of respondents living in conventional buildings are unaware of green building certifications. All in all, this is a highly interesting finding, implying a general lack of public awareness about green building concepts and respective certification schemes.

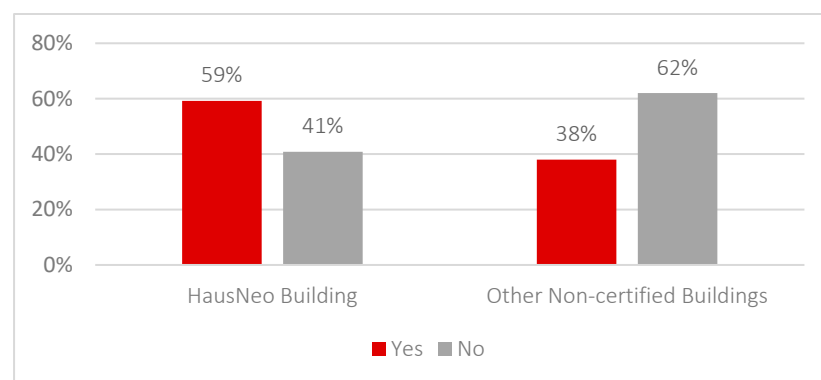


Figure 11. Awareness of Green Building certificates like EDGE, LEED, LOTUS (%) ($N = 514$).

4.5. Factors Influencing Homebuyers' Decisions

Factors influencing households' homebuying decisions were evaluated based on Likert scales (1 being most important and 5 being least important). The perception of each factor's importance is examined based on ALV scores. Results are presented in Table 2.

Table 2. Average Likert Value for important factors influencing homebuying decisions.

	Apartment Price Per Sqm	Bright Rooms and Big Windows	Good Natural Ventilation of the Rooms	Apartment Investment Value	Good Construction Quality	Fengshui Alignment	Technical Features for Energy Saving
HausNeo	1.4 ($N = 169$)	1.4 ($N = 169$)	1.2 ($N = 168$)	1.7 ($N = 116$)	1.2 ($N = 169$)	2.1 ($N = 169$)	1.6 ($N = 169$)
Conventional buildings	1.7 ($N = 363$)	1.6 ($N = 345$)	1.5 ($N = 363$)	1.7 ($N = 358$)	1.4 ($N = 363$)	1.7 ($N = 345$)	1.6 ($N = 362$)
Total	1.6 ($N = 532$)	1.5 ($N = 514$)	1.4 ($N = 531$)	1.7 ($N = 474$)	1.3 ($N = 532$)	1.9 ($N = 514$)	1.6 ($N = 531$)

4.6. Sustainable Building Features

Among other things, a building's physical sustainable conditions are perceived as most important by HausNeo households, including good construction quality (i.e., windows, walls, cooling insulation) (1.2), the natural ventilation system (1.22), and bright rooms with big windows (1.37) (see Table 2). Home features for natural cooling and ventilation are also very important factors to conventional building households (1.39 and 1.52, respectively). This finding positively reveals that households pay attention to green building features. However, the thematic webinars reveal the participants' shared view that there is a need to increase public awareness of green building features like environmentally friendly design, sustainable construction methods and materials, and energy sources or water usage (W1, W2, W3, W5, W6, W7). In their view, both homebuyers and businesses still often

misunderstand “green buildings”, thinking that means planting many trees in front of the building, green façades only, or just having plant pots on the balcony.

4.7. Apartment Price Per Sqm and Energy-Saving Technical Features

Another astonishing result is that apartment prices per sqm are perceived as less important than green building features by HausNeo households (1.4) (see Table 2). It is even perceived as least important by conventional building households (1.7). In the case of HausNeo households, technical features supporting energy saving are perceived as less important than apartment prices (1.6), but still more important compared to apartment prices to conventional building households (1.6).

It is remarkable that these findings are inconsistent with inputs of webinar participants from the corporate sector (W2, W3) and some interviewed experts (E5, E6, E7, E8, E9). Based on their market surveys, apartment price per sqm is perceived as the most important factor in homebuyers’ decisions. Energy cost saving is also perceived by webinar participants to be an important benefit for homebuyers. This is reflected in the participants’ statement: “Because homebuyers will benefit in saving future energy costs, they should be willing to pay higher to buy apartments . . . ” (W2). To them, developers are hesitant to invest in more advanced environmentally friendly technology like low-emissive glass windows and solar panels, because homebuyers are still not willing to pay higher for green building projects (W1, W2, W5). The diverging household results clearly suggest that homebuyers will not be willing to pay higher prices for projects if these projects only aim at saving energy. To them, as revealed in the survey results, apartment prices are more important than energy saving. Therefore, green building projects, to convince homebuyers, should focus on other factors that are of concern to homebuyers. The following part reveals insights into this question.

4.8. Other Homebuying Influencing Factors

According to the results in Table 2, factors like Fengshui alignment, an apartment’s good investment value, technical features for energy saving, and—surprisingly—apartment price are of the least concern for households in both green and conventional buildings. Their ALV is, respectively, 2.1; 1.7; 1.6 for HausNeo and 1.7; 1.7; 1.6 for conventional buildings. Homebuyers in general seem to be more pragmatic concerning spiritual Fengshui factors, and they are not highly concerned with apartment prices and energy costs. Instead, they pay the most attention to their home’s features that are promoted by green building projects, like construction quality, natural ventilation, and lighting. Specifically, households in both green and conventional buildings find the construction quality, a room’s good natural ventilation, and bright rooms with big windows to be most important (ALV of, respectively, 1.2; 1.4; 1.4 for certified buildings and 1.4; 1.5; 1.6 for conventional buildings). These results imply the high concern of homebuyers for features that are beneficial for human health and well-being. This implication is in line with the current literature. Accordingly, a building’s healthy structural features are found to be top driving factors in homebuyers’ decisions; they are willing to pay for it, as long as the structure provides them with a healthy, safe, and comfortable environment [62,63].

4.9. Households’ Concerns

Households’ concerning factors are also evaluated with ALV scores (1 being most concerned and 5 being least concerned). The consistent trend is that family health is perceived as most important by both HausNeo and conventional building households (1.1 and 1.3, respectively) (Table 3). In HausNeo, 100% of respondents perceive family health as either very important (88%) or somewhat important (12%) (Table 3).

Table 3. Average Likert Value of main concerns of HausNeo and conventional building households.

	Family Education	Time with Family	Energy Price	Family Health	Saving for High Value Products and Services	Environmentally Friendly Lifestyle
HausNeo (N = 169)	1.2	1.3	1.8	1.1	2.2	1.6
Conventional buildings (N = 345)	1.3	1.3	1.6	1.3	1.8	1.6
Total (N = 415)	1.3	1.3	1.7	1.2	2.0	1.7

The percentages vary, however, across age, education, and employment groups. Noticeably, higher age groups perceive health more as “very important” than younger groups, while higher education groups perceive it more as “somewhat important” (Table 4).

Table 4. Correlation between age groups and concern for family health in HausNeo (N = 132).

	Age Group 18–25 (%)	Age Group 26–40 (%)	Age Group 41–55 (%)	Age Group above 56 (%)	Total
Very important	60 (N = 3)	87 (N = 86)	88 (N = 7)	100 (N = 4)	86 (N = 100)
Somewhat important	40 (N = 2)	13 (N = 13)	13 (N = 1)	0 (N = 0)	14 (N = 16)

Interestingly, results in Table 3 also show that there is not much difference between HausNeo and conventional building households in their concern for environmentally conscious lifestyles and their families’ education and time. These results are relevant to data shown in Figures 3 and 4, that families living in high-rise apartments are mainly young or middle-aged and educated. These families follow the popular movement pattern to high-rise apartments of the rapidly increasing urban middle class in Vietnam [64–66]. Their concern for family factors somewhat reflects traditional family values in Vietnamese society [67]. The preference for an environmentally friendly lifestyle contributes to discussions on the rather high motivation of the Vietnamese urban middle class to live healthy lifestyles and protect the planet for future generations [68]. Such motivation, however, does not necessarily mean high awareness and knowledge of environmental issues or sustainable consumption [68].

For both groups of data, while family health is the most concerning factor, energy price is nearly the least concerning (ALV of 1.77 and 1.6). One reason for the low concern for energy prices might be that the energy price in Vietnam is relatively low compared with what people can afford. This assumption is consistent with the study of [69], which identifies that the current average retail electricity price in Vietnam is still low, about USD 0.09/kWh, and is among the lowest in the region [70].

Again, family health is perceived as most important in the general survey in HCMC (1.2 ALV), in which 80% of respondents perceive health as very important, 18% perceive health as somewhat important, and 2% perceive health as “so-so”. Among building categories, the percentage of respondents who perceive health as more important is highest in certified green buildings (88%) and higher market conventional building projects (87%) (Table 5). This finding implies that households valuing health as more important are more willing to pay more for apartments. It is also consistent with the above results showing homebuyers’ comparatively low concern about apartment price. This willingness of homebuyers to pay a premium for green homes in order to enjoy a healthy living environment has also been confirmed in recent literature (see, for example [59]).

Table 5. Correlation between building type and perception of family health in HCMC (N = 528).

	HausNeo	High-Range Market Buildings	Mid-Range Market Buildings	Low-Range Market Buildings
Very important	88% (N = 165)	87% (N = 64)	79% (N = 73)	68% (N = 119)
Somewhat important	12% (N = 23)	12% (N = 9)	21% (N = 19)	26% (N = 46)
So so	0% (N = 0)	1% (N = 1)	0% (N = 0)	5% (N = 9)

This means that consumers are willing to pay increased personal costs to pursue these goals. This finding added the fact that non-normative motivations, such as the benefits of a green home producing a healthier living environment, and potential future monetary return, may also explain their willingness to pay a premium for green homes.

According to the results of Table 5, family health is the most concerning factor for households in all building types (ALV of 1.1 and 1.3, respectively). This finding is consistent with the above results, confirming that households share a high concern for the health benefits of their living environment.

4.10. Experts' Opinions on Health Co-Benefits of Green Buildings

Health improvement is somewhat mentioned as a co-benefit of buildings' energy efficiency and carbon reduction features. According to the Vietnamese Green Building Council (VGBC) Chairperson, energy efficiency, carbon reduction, and health improvements are interconnected and form three pillars in the strategies of the World Green Building Council, of which VGBC is a member (W6). To webinar participants, although these tools are gaining global attention for prioritizing health-oriented criteria, they are not yet embraced in Vietnam due to higher investment demands. Participant observation in the webinars shows that health co-benefits, despite being implicitly understood to be co-benefits of certified green building features, have not been explicitly expressed by participants as a strategic benefit of green building projects.

The green building market in Vietnam is still at its initial stage and mainly focuses on energy-saving solutions, instead of more advanced health-impacting and carbon emission reduction solutions. Specifically, a participant emphasized: "Vietnam's green building market is not quite there yet, at the stage of passing the energy efficiency part to promote material embodied carbon reduction or environmental product declaration part" (W2). To address this, participants commonly recommended the critical role of the government in reinforcing building codes and enabling a higher market level.

5. Discussion

The above survey findings, in combination with expert interviews and webinar discussions, shed light on the following implications on how health co-benefits of Green Buildings are perceived by construction sector stakeholders in Vietnam.

5.1. Green Buildings' Low Energy Consumption and The Potential to Improve Users' Health

The HausNeo case study provides initial evidence of the lower average power consumption. While the lower power consumption might be explained by the slightly smaller family sizes or the specific users' habits, it also clearly relates to the buildings' passive design solutions and physical structures (for example, the installation of energy-efficient lighting systems). The multiple design and engineering features of sustainably erected buildings allow for apparent health benefits such as more natural lighting and ventilation, improved indoor air quality, reduced noise, less building contaminants, etc.; see also [41–46]. Consequently, the authors advocate for a stronger public dissemination of such potential health benefits by multiple stakeholders in Vietnam in order to raise awareness of these inherent benefits of sustainable buildings.

5.2. High Attention to Green Building Features Versus Low Awareness about Green Building Certification

Although empirical evidence has shown that sustainable building features are most influential in the homebuying decisions of both HausNeo and conventional buildings' households, there is unexpectedly a comparatively low social awareness of green building certification, as revealed not only in the household survey data but also in the experts' discussion (E1, E2, E3, E5, E6, E7, E10). Homebuyers seem to value building features that are environmentally friendly and health-beneficial, but they are shown to be unfamiliar with green building certification approaches. These findings are remarkable. On one hand, they imply a positive potential for the green building market in Vietnam. On the other hand, they reveal persisting social and cognitive barriers for Vietnam's green building movement. Consequently, the authors advocate for more public awareness-raising programs, either from the different government levels, the developer companies, or from professional organizations. Knowledge-building and communication programs should not only be about the types of green building rating tools but also about specific green building features which highly attract homebuyers. Furthermore, common green building rating tools like EDGE or LEED should consider adding more components of health-related aspects.

5.3. Health Concern Versus Low Priority for Apartment Price and Energy Savings

Both HausNeo and conventional buildings' households are mostly concerned about family health. In contrast, apartment price and energy cost savings are perceived as less important by all respondents. Together with the above, these findings suggest that households prioritize well-being and health benefits more than purely cost issues. This general finding contrasts with the views from the webinar discussions.

According to the expert interviews and webinar participants, a significant obstacle is the well-known paradox between investors' higher investment costs and homebuyers' unwillingness to pay more, despite their future lower operation cost benefits. They emphasize that "green building investment cost is undoubtedly the question of the future and green buildings should be more affordable" (E3, E5, E7, E8, E9, E4, W2, W4, W5, W6).

This shows that there are still incorrect perceptions, even among local experts in the field. Such contradictions need to be further investigated. Our survey indicated that homebuyers might be willing to pay higher prices if they understand that the apartments meet their expected sustainable building features and health benefits.

Additionally, because saving energy and energy costs are not homebuyers' most concerning issues, reduced energy bills should not be the most important benefit communicated to homebuyers. Instead, the health co-benefits of green building features should be given significantly higher attention for both developers and homebuyers. Therefore, the authors advocate to put more focus on health benefits in the context of green building promotion schemes which then might justify a premium on the side of the developer company and achieve greater acceptance from the buyer side. In addition, public awareness-raising programs should therefore target not only homebuyers but also developers and professionals who play an important role in driving the green building market.

5.4. The Need for Consideration of Health Co-Benefits in Vietnamese GBM

Together, the findings of the household survey and the experts' opinions (E1, E2, E4, E10, E11) show that as of now, there is a lack of consideration of the health co-benefits of the GBM in Vietnam, which, like other ongoing sustainability efforts, primarily target environmental and economic efforts instead of health. This mismatch between health and the GBM in Vietnam can be clearly seen through the lack of health-related topics in reviewed academic literature, the focus of webinar participants on cost and energy issues rather than on green building health co-benefits, the paradox between homebuyers' high concern for health and low interest in green building certifications, and the paradox between investors' high concern for investment cost and homebuyers' low concern for apartment price per sqm. In addition to the reviewed challenges of the Vietnamese GBM, the paper uncovers

that the country's GBM is challenged by the lack of consideration of health co-benefits by GBM stakeholders, which are proved to be of high concern for homebuyers.

The mismatch between concepts of health and built environments investigated in this paper emphasizes the need for a system governance approach prioritizing advancing health and health equity in urban settings. Indeed, as suggested by Lawrence (2017) [12], housing and health should be considered fundamental societal challenges rather than disciplinary subjects of professional expertise. They require coordinated research agendas to achieve collective understanding and action across practitioner professions [7]. This will be critical in research and practice to address the complex challenges of SDG implementation and promotion of the New Urban Agenda [3,12].

6. Conclusions

Following the call for a more systemic approach in considering urban health in the field of sustainable building, this pilot study investigates how health co-benefits are perceived by stakeholders of the green building movement in Vietnam.

To answer this question, quantitative data from a large-scale household survey were combined with qualitative data that were gained through interdisciplinary insights from multiple stakeholders who were from various sectors related to the urban built environment and were also related to urban health.

The evidence-based findings indicate that there is a lack of awareness concerning the green building health benefits, which are apparently of strong concern for homebuyers, while factors like apartment price and reduced energy costs are not necessarily among the building users' biggest concerns. According to the authors, the widespread lack of awareness of green building health benefits requires stronger attention from relevant stakeholders (i.e., policymakers, professionals, developers, etc.) if the Vietnamese GBM is to take off. For example, in terms of policies, the health benefits of green buildings should be identified as an essential criterion for the evaluation of the project to be certified with an established measurable indicator system. For the market, developers should emphasize the evidence-based health co-benefits of their projects in their marketing and customer communication strategies to improve public understanding of the health impacts of a green building living environment.

From the perspective of relevant indicators, health co-benefits of green building features (i.e., thermal comfort, lower air pollution levels, carbon emission reductions, reduced stress levels, life satisfaction, emotional stability, etc.) should be further studied. There is also a crucial need to understand the extent to which health and well-being are covered within the national legislation and the regulatory framework on all administrative levels, particularly concerning the built environment.

It has to be admitted that this paper is still of an exploratory nature, limited to a single case study, and a comparatively small number of participants and institutions. Nevertheless, various insights from this pilot study are considered to be helpful to test such an interdisciplinary methodological framework. For further refinement, it should be applied in a truly transdisciplinary way, which would achieve, among other things, more empirical evidence from a larger number of certified green building projects and a facilitated discursive exchange among a larger sample of involved stakeholders as part of a semi-structured transformative change process.

The paper concludes that the aspects of health and well-being should be highlighted more strongly as essential co-benefits of green buildings, alongside well-known aspects like energy efficiency. Furthermore, this paper increases attention to the need for a more comprehensive and systemic approach, in a transdisciplinary way. This is regarded as essential to ensure the intertwined co-benefits globally discussed in relation to the current implementation of SDG3, to "ensure healthy lives and promote wellbeing for all ages", and SDG 11, "to make cities and human settlements inclusive, safe, resilient and sustainable".

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T.T.T.N. and M.W.; writing—original draft preparation, T.T.T.N.; writing—review and editing, T.T.T.N. and M.W.; visualization, M.W. and T.T.T.N.; supervision, M.W.; project administration, M.W. and T.T.T.N.; funding acquisition, M.W. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board (or Ethics Committee) of Hamburg University.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

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Appendix A

Table A1. Overview of thematic webinars.

Order	Webinar Title	Date	Code
1	Presentation on primary research analysis results with the Developer Company of HausNeo, EZ Land, Ho Chi Minh City, Vietnam	5 April 2021	W1
2	Challenges and Opportunities of Green Building Movement in Vietnam, collaboration with Green Sector Business Committee of European Chamber of Commerce, Ho Chi Minh City, Vietnam	6 September 2021	W2
3	Challenges and Opportunities of promoting green buildings in the coastal areas of Central Vietnam, collaboration with Central University of Civil Engineering (MUCE), Tuy Hoa, Vietnam	16 December 2021	W3
4	HOPE 1: Policies and Practices to engage with building users in creating well-being and sustainable living environment in Vietnamese cities, collaboration with the Competence Center for Sustainable Buildings in Vietnam (CCSB-VN) and Konrad Adenauer Foundation, Hanoi, Vietnam	20 April 2022	W4
5	HOPE 2: Health Governance to promote inclusive urban planning approaches targeting the quality of life for citizens in Vietnam collaboration with the Competence Center for Sustainable Buildings in Vietnam (CCSB-VN) and Konrad Adenauer Foundation, Hanoi, Vietnam	30 June 2022	W5
6	HOPE 3: Green building design and sustainable neighborhood development towards public health in the built environment of Vietnam collaboration with the Competence Center for Sustainable Buildings in Vietnam (CCSB-VN) and Konrad Adenauer Foundation, Hanoi, Vietnam	18 August 2022	W6
7	HOPE 4: Health governance to promote comprehensive life cycle assessment of materials in regard of sustainable construction in Vietnam collaboration with the Competence Center for Sustainable Buildings in Vietnam (CCSB-VN) and Konrad Adenauer Foundation, Hanoi, Vietnam	28 September 2022	W7

Table A2. Overview of expert interviews.

Order	Experts' Anonym and Position	Date	Code
1	Dr. A, Lecturer at Hanoi University of Civil Engineering	15 November 2021	E1
2	Assoc. Prof. B, Lecturer at Hanoi University of Civil Engineering	5 June 2021	E2
3	MA. C, Engineer, Construction Company, Vietnam	2 July 2021	E3
4	Mr. D, Engineer, Landscape Design Company, Vietnam	20 January 2022	E4
5	Mr. E, Architect, Green Building Consultant, Vietnam	18 March 2022	E5
6	Mr. F, Architect, Architectural Design Studio, Vietnam	25 March 2022	E6
7	Mr. G, Green Building Developer, Vietnam	07 May 2021	E7
8	Mr. H, Green Building Development, Vietnam	24 May 2022	E8
9	Dr. I, Economist, Green Building Developer, Vietnam	08 November 2021	E9
10	Ms. J, Engineer, Green Building Certifying Organization, Vietnam	31 May 2022	E10
11	Mr. K, Engineer, Green Building Certifying Organization, Vietnam	05 June 2022	E11

Appendix B

Table A3. Household questionnaire (English).

1	INTERVIEW DATE AND CONTACT
	This section helps (1) to identify the interviewer for eventual check-backs and (2) to link the questionnaire to the building fact sheet.
1.1	date of interview (dd/mm/yyyy)
1.2	Name of the interviewee
	If interviewee is under 18 years, ask another person in the household; if there is none, end the interview.
1.3	Phone number of interviewee (optional)
2	INFORMATION ABOUT THE BUILDING
2.1	Name and address of the building
2.2	Name of investor/developer
2.3	Date of opening after completion of construction in month and year
2.4	Type of buildings (Single HRB of multi-purposes/complexed urban center/KĐT)
2.5	Geographical condition (city core center/city sub-core center/newly developed peripheral area)
2.6	Average price range per m ²
2.7	Total number of floors (excluding basements), apartments, construction density
2.8	Select the type of green certification, the building has:
2.9	Do the building have any solution to increase EE/reduce energy consumption (e.g., window materials/window-wall ratio/shading solution/renewable energy generation)
2.10	Does the building have any distinguished facilities, compared with other HRB
3	INFORMATION ABOUT THE APARTMENT
3.1	Room number
3.2	Floor
3.3	Size
3.4	Orientation
3.5	Energy Efficiency Solutions (Window material, Window-to-wall ratio, etc.)
4	INFORMATION ABOUT THE INTERVIEWEE
4.1	Gender:
	male/female/other
4.2	What is your age?
	If interviewee is under 18 years, ask another person in the household; if there is none, end the interview.
4.3	Are you a decision maker in your household? e.g. you know details about the spending of the household and the maintenance of the apartment.
	If not, ask for another person in the household; if there is none, end the interview.
5	HOUSEHOLD PROFILE
	We would like to know more about the comfort in your apartment and your satisfaction with it. But before, we would like to ask you some general questions about your household situation and apartment.
5.1	How many people live in your apartment permanently, you included? Mark the number of adults and children.
	Adults

Table A3. Cont.

	1/2/3/4/5
	Individuals below the age of 18 years
	0/1/2/3/4/5
5.2	What is your household's monthly income (total in VND)? Of course, you can refuse to give this information. below 5,500,000/5,500,000–6,499,999/6,500,000–7,499,999/7,500,000–8,499,999/8,500,000–9,499,999/9,500,000–10,499,999/10,500,000–11,499,999/11,500,000–12,499,999/12,500,000–13,499,999/13,500,000–14,999,999/15,000,000–29,999,999/30,000,000–44,999,999/45,000,000–74,999,999/75,000,000–149,999,999/150,000,000 and higher
	Tick, if interviewee refuses to answer this question
5.3	What is the highest educational level within your household? less than high school/high school/college/university Bachelor/university Master & PhD
5.4	Did someone in your household got education abroad? Master abroad PhD abroad
5.5.	How many cars and/or motorcycles does your household own? 0 means, your household does not own cars/motorcycles. cars motorcycles
5.6	Do you own and rent out real estate?
5.7	How much do you pay for the building management fee per month (without parking) in VND?
5.8	Could you please provide us the power consumption records of the year 2019 and 2020. (The data can be accessed via evnhanoi.com.vn with your household's customer number and password) Tick, if interviewee refuses to give the information After giving information about your household's energy consumption, would you tell us about the high-energy domestic appliances your household owns?
5.9	How many of these items owns your household? 0 means, you don't own the article. e-car e-bike microwave TV fridge baking oven washing machine (with and without drying option) water heater (privately owned) A/C
6	HOUSEHOLDS' HABITS/BEHAVIOUR AND ATTITUDE We are interested in your satisfaction with the temperature, humidity and general air quality with your apartment. Before we ask you about that, we would like to understand better, what kind of climate regulation you use and how.
6.1	What is the type of cooling system that you use in your apartment? Select one of the options given below. completely air-conditioned apartment/mixed: partly air-conditioned, partly with fans and natural ventilation/mechanical ventilation (fans, movable or ceiling)/completely naturally ventilated (windows) in all rooms/I am not sure
6.2	When you buy electric appliances, how important are price, brand, and energy label for your decision? Please rate with very important, important, so-so, less important, not important. How important is the price of electric appliances, e.g., air-conditioner, fridge, or water boiler, for you? very important/important/so-so/less important/not important How important is the brand of electric appliances, e.g., air-conditioner, fridge, for you? very important/important/so-so/less important/not important How important is the energy star label of electric appliances, e.g., air-conditioner, fridge, for you? very important/important/so-so/less important/not important
6.3	Now, we would like to know more about the energy-efficiency of your A/C. Have you bought the A/Cs in your apartment yourself? How many energy stars have your A/Cs? If you own more than one A/C with several energy star ratings, please select the energy star rating with the lowest rating. no certificate/1 star/2 stars/3 stars/4 stars/5 stars

Table A3. Cont.

	What is the brand of your A/C?
	We would like to know more about how exactly you use the A/Cs in the living room and your sleeping room. We will ask you about how you use them in springtime, in summer, in autumn and in winter. Please have a look with me at the matrix (matrix 2)
6.4	How do your household use the A/Cs in the sleeping room (when, mode, temperature setting and temperature change)
6.5	How much do you agree to the following statements? Please rate with I strongly agree/I somewhat agree/so-so/I somewhat disagree/I strongly disagree.
	Whenever possible, I turn off the A/C and switch to window and electric fan.
	I strongly agree/I somewhat agree/so-so/I somewhat disagree/I strongly disagree
	In the hot season, I let the A/C run the whole night in the sleeping room.
	I strongly agree/I somewhat agree/so-so/I somewhat disagree/I strongly disagree
	I use an A/C temperature and A/C mode that helps me to save energy costs.
	I strongly agree/I somewhat agree/so-so/I somewhat disagree/I strongly disagree
	I turn off the A/C after a while, because the climate gets uncomfortable, e.g., too cold, or too dry.
	I strongly agree/I somewhat agree/so-so/I somewhat disagree/I strongly disagree
	I keep the windows closed, because the high noise level outside disturbs me.
	I strongly agree/I somewhat agree/so-so/I somewhat disagree/I strongly disagree
	I keep the windows closed to protect my home from dust and outdoor pollution.
	I strongly agree/I somewhat agree/so-so/I somewhat disagree/I strongly disagree
6.6	When you decided to buy the apartment, how important were the following factors for your decision? Rate with very important/somewhat important/so-so/somewhat unimportant/unimportant
	the services offered within the building (swimming pool, shops, playground, gym, etc.)
	very important/somewhat important/so-so/somewhat unimportant/unimportant
	apartment is on the “cooler”, sun- and weather-protected side of the building
	very important/somewhat important/so-so/somewhat unimportant/unimportant
	the location of the building, e.g., proximity to workplace, family members, schools
	very important/somewhat important/so-so/somewhat unimportant/unimportant
	good price/sq. m of the apartment
	very important/somewhat important/so-so/somewhat unimportant/unimportant
	Bright rooms and big windows
	very important/somewhat important/so-so/somewhat unimportant/unimportant
	Good natural ventilation of the rooms
	very important/somewhat important/so-so/somewhat unimportant/unimportant
	Apartment is a good investment and its value develops positively
	very important/somewhat important/so-so/somewhat unimportant/unimportant
	A good construction quality (e.g., of windows, walls, cooling system, insulation)
	very important/somewhat important/so-so/somewhat unimportant/unimportant
	A good noise protection by sound insulation
	very important/somewhat important/so-so/somewhat unimportant/unimportant
	Apartment suits to feng shui
	very important/somewhat important/so-so/somewhat unimportant/unimportant
	Technical features of the apartment and building support energy-saving
	very important/somewhat important/so-so/somewhat unimportant/unimportant
	A great view
	very important/somewhat important/so-so/somewhat unimportant/unimportant
6.7	Please answer the following questions about energy-saving, health, and certifications.
	I would like to know more about solutions that help me to save energy in my home.
	I would like to know more about how the indoor climate of my apartment affects the health of my family
	I trust the energy certification of electronic devices, e.g., energy star.
6.8	Do you know green building certificates like Lotus, EDGE, LEED?
	If yes, how much do you agree with the following statements?
	I trust Green Building certificates, such as Lotus, EDGE, LEED.
	I strongly agree/I somewhat agree/so-so/I somewhat disagree/I strongly disagree
	when buying my apartment, a green building certificate was important to my decision.
	I strongly agree/I somewhat agree/so-so/I somewhat disagree/I strongly disagree
6.9	What are the main concerns for your household? Please rate from very important/somewhat important/so-so/somewhat unimportant/not important at all for each item.
	education and career

Table A3. Cont.

	very important/somewhat important/so-so/somewhat unimportant/not important at all
	leisure and vacation
	very important/somewhat important/so-so/somewhat unimportant/not important at all
	spending time with my family
	very important/somewhat important/so-so/somewhat unimportant/not important at all
	the energy prices
	very important/somewhat important/so-so/somewhat unimportant/not important at all
	family health
	very important/somewhat important/so-so/somewhat unimportant/not important at all
	saving for high-value products and services (a car, a travel abroad etc.)
	very important/somewhat important/so-so/somewhat unimportant/not important at all
	to live environmental-friendly (e.g., save water and energy, eat less meat, etc.)
	very important/somewhat important/so-so/somewhat unimportant/not important at all
	END OF QUESTIONNAIRE—THANK YOU FOR YOUR TIME

Appendix C

Table A4. Household Questionnaire (Vietnamese).

NỘI DUNG BẢNG HỎI	
1	THỜI GIAN VÀ NGƯỜI PHỎNG VẤN
1.1	Phần này giúp (1) xác định người phỏng vấn để kiểm tra lại sau cùng và (2) liên kết bảng câu hỏi với tờ thông tin về tòa nhà.
1.2	Ngày phỏng vấn (ngày/tháng/năm)
1.3	Tên người được phỏng vấn
1.3	Nếu người phỏng vấn dưới 18 tuổi, phải hỏi người khác trên 18 tuổi không có ai trên 18 tuổi, kết thúc cuộc phỏng vấn.
1.3	Số điện thoại liên hệ của người được phỏng vấn
2	THÔNG TIN VỀ TOÀ NHÀ
2.1	Tên và địa chỉ toà nhà
2.2	Tên chủ đầu tư/đơn vị phát triển nhà
2.3	Ngày khởi công/hoàn thành dự án nhà chung cư
2.4	Loại dự án chung cư (Toà nhà phức hợp nhiều mục đích/Tổ hợp khu đô thị mới)
2.5	Vị trí địa lý (Trung tâm lõi thành phố/Khu vực kề trung tâm thành phố/Khu ngoại vi mới đô thị hoá)
2.6	Khung giá trung bình/m ² .
2.7	Số tầng (không tính tầng hầm), số căn hộ, mật độ xây dựng
2.8	Loại chứng chỉ công trình xanh của dự án (nếu có)
2.9	Toà chung cư có áp dụng giải pháp nào để tăng cường tiết kiệm năng lượng/giảm sử dụng điện (e.g., vật liệu cửa sổ/tỉ lệ giữa tường và cửa sổ/giải pháp tạo bóng râm/năng lượng tái tạo)
	Dự án chung cư có dịch vụ/cơ sở vật chất nào khác biệt so với các chung cư thông thường khác
3	THÔNG TIN VỀ CĂN HỘ
3.1	Số phòng
3.2	Tầng
3.3	Diện tích
3.4	Hướng
3.5	Giải pháp tiết kiệm năng lượng (vật liệu cửa sổ, tỉ suất giữa tường và cửa sổ, vv)
4	THÔNG TIN VỀ NGƯỜI ĐƯỢC PHỎNG VẤN
4.1	Giới tính
	Nam/Nữ/Khác
4.2	Tuổi
4.3	Bác/Cô/Chú/Anh/Chị có phải là chủ hộ gia đình không? Ví dụ, Bác/Cô/Chú/Anh/Chị có biết mức độ chi tiêu trong gia đình và việc bảo trì căn hộ không?
	Nếu người phỏng vấn cần phải là chủ hộ. Nếu không cần dừng cuộc phỏng vấn.
5	THÔNG TIN VỀ HỘ GIA ĐÌNH
5.1	Có bao nhiêu người sống trong hộ gia đình Bác/Cô/Chú/Anh/Chị
	Người lớn
	1/2/3/4/5

Table A4. Cont.

	Người dưới 18 tuổi
	0/1/2/3/4/5
5.2	Tổng thu nhập của hộ gia đình là bao nhiêu (bằng VNĐ). Người được phỏng vấn có thể không cần chia sẻ thông tin này Dưới 5,500,000/5,500,000–6,499,999/6,500,000–7,499,999/7,500,000–8,499,999/ 8,500,000–9,499,999/9,500,000–10,499,999/10,500,000–11,499,999/11,500,000–12,499,999/12,500,000– 13,499,999/13,500,000–14,999,999/15,000,000–29,999,999/30,000,000–44,999,999/45,000,000–74,999,999/75,000,000– 149,999,999/150,000,000 và cao hơn
5.3	Tích vào ô nếu người được phỏng vấn từ chối Trình độ học vấn cao nhất trong hộ gia đình
	Dưới mức trung học phổ thông/Trung học phổ thông/Cao đẳng/Đại học/Thạc sỹ & Tiến sỹ
5.4	Trong gia đình có ai được đào tạo ở nước ngoài không?
	Thạc sỹ
	Tiến sỹ
5.5.	Hộ gia đình Bác/Cô/Chú/Anh/Chị có bao nhiêu xe ô tô và xe máy?
	Ô tô
	Xe máy
5.6	Gia đình Bác/Cô/Chú/Anh/Chị có bất động sản cho thuê không?
5.7	Hộ gia đình Bác/Cô/Chú/Anh/Chị phải trả bao nhiêu phí quản lý dịch vụ căn hộ một tháng?
5.8	Bác/Cô/Chú/Anh/Chị có thể chia sẻ thông tin về chỉ số điện sử dụng của hộ gia đình trong năm 2019 và 2020 không? Thông tin cần được truy cập qua tài khoản với mã số khách hàng trên website của Điện lực Việt Nam (evnhanoi.vn) Tích vào ô nếu người được phỏng vấn từ chối Sau khi chia sẻ thông tin về chỉ số điện, Bác/Cô/Chú/Anh/Chị có thể cho biết thiết bị điện nào sử dụng nhiều điện nhất trong gia đình
5.9	Gia đình Bác/Cô/Chú/Anh/Chị có bao nhiêu phương tiện/thiết bị nào sau đây?
	Ô tô điện
	Xe đạp điện
	Lò vi sóng
	TV
	Tủ lạnh
	Lò nướng
	Máy giặt (có hoặc không có máy sấy)
	Bình nước nóng (riêng trong căn hộ)
	Điều hoà
	Quạt điện
	Máy rửa bát
	Khác
6	THÔNG TIN VỀ THÓI QUEN/THÁI ĐỘ CỦA HỘ GIA ĐÌNH
6.1	Gia đình Bác/Cô/Chú/Anh/Chị làm mát căn hộ bằng cách nào? hoàn toàn bằng máy điều hoà/kết hợp giữa máy điều hoà, thông gió tự nhiên và quạt/chỉ bằng quạt (quạt cây, quạt trần)/hoàn toàn thông gió tự nhiên ở tất cả các phòng/không chắc chắn.
6.2	Khi Bác/Cô/Chú/Anh/Chị mua thiết bị điện, các yếu tố sau đây có tầm quan trọng như thế nào? Bác/Cô/Chú/Anh/Chị hãy chọn một trong các phương án. Giá thiết bị điện có tầm quan trọng như thế nào (như điều hoà, tủ lạnh, bình nước nóng, vv) ? rất quan trọng/cũng quan trọng/bình thường/không quan trọng lắm/hoàn toàn không quan trọng Thương hiệu thiết bị điện có tầm quan trọng như thế nào (như điều hoà, tủ lạnh, bình nước nóng, vv) ? rất quan trọng/cũng quan trọng/bình thường/không quan trọng lắm/hoàn toàn không quan trọng Nhãn dán năng lượng có tầm quan trọng như thế nào (như điều hoà, tủ lạnh, bình nước nóng, vv) ? rất quan trọng/cũng quan trọng/bình thường/không quan trọng lắm/hoàn toàn không quan trọng
6.3	Bác/Cô/Chú/Anh/Chị có thể chia sẻ thông tin về điều hoà trong gia đình không? Hộ gia đình có tự lắp điều hoà không? Nhãn dán năng lượng của máy điều hoà của hộ gia đình có mấy sao? Lấy số sao cao nhất trong hộ gia đình Không có nhãn dán năng lượng/1 sao/2 sao/3 sao/4 sao/5 sao
	Thương hiệu máy điều hoà
6.4	Gia đình Bác/Cô/Chú/Anh/Chị sử dụng điều hoà như thế nào? (khi nào, chế độ, nhiệt độ, việc thay đổi nhiệt độ)
6.5	Bác/Cô/Chú/Anh/Chị đồng ý như thế nào với các mệnh đề sau? Hãy chọn một trong các phương án: rất đồng ý/cũng đồng ý/bình thường/không đồng ý lắm/phản đối. Khi nào có thể, tôi tắt điều hoà và chuyển sang mở cửa sổ và dùng quạt

Table A4. Cont.

	rất đồng ý/cũng đồng ý/bình thường/không đồng ý lắm/phản đối.
	Vào mùa nóng, tôi bật điều hoà suốt đêm trong phòng ngủ
	rất đồng ý/cũng đồng ý/bình thường/không đồng ý lắm/phản đối.
	Tôi bật chế độ và nhiệt độ điều hoà theo chế độ tiết kiệm điện
	rất đồng ý/cũng đồng ý/bình thường/không đồng ý lắm/phản đối.
	Tôi tắt điều hoà sau một thời gian vì nhiệt độ trong phòng trở nên quá lạnh/quá nóng
	rất đồng ý/cũng đồng ý/bình thường/không đồng ý lắm/phản đối.
	Tôi đóng cửa sổ vì tiếng ồn bên ngoài làm tôi khó chịu
	rất đồng ý/cũng đồng ý/bình thường/không đồng ý lắm/phản đối.
	Tôi đóng cửa sổ để tránh bụi và ô nhiễm bên ngoài
	rất đồng ý/cũng đồng ý/bình thường/không đồng ý lắm/phản đối.
6.6	Khi mua căn hộ chung cư, các yếu tố sau đây tác động như thế nào đến quyết định của Bác/Cô/Chú/Anh/Chị. Xin chọn một trong các phương án rất quan trọng/cũng quan trọng/bình thường/không quan trọng lắm/hoàn toàn không quan trọng
	Dịch vụ đi kèm trong toà nhà (Bể bơi, cửa hàng, sân chơi, phòng tập gym, vv)
	rất quan trọng/cũng quan trọng/bình thường/không quan trọng lắm/hoàn toàn không quan trọng
	Căn hộ ở hướng mát, không bị ảnh hưởng bởi mặt trời, và thời tiết.
	rất quan trọng/cũng quan trọng/bình thường/không quan trọng lắm/hoàn toàn không quan trọng
	Vị trí chung cư, gần nơi làm việc, gia đình, trường học
	rất quan trọng/cũng quan trọng/bình thường/không quan trọng lắm/hoàn toàn không quan trọng
	Giá căn hộ/m2
	rất quan trọng/cũng quan trọng/bình thường/không quan trọng lắm/hoàn toàn không quan trọng
	Phòng sáng và cửa sổ to
	rất quan trọng/cũng quan trọng/bình thường/không quan trọng lắm/hoàn toàn không quan trọng
	Thông gió tự nhiên của các phòng trong căn hộ
	rất quan trọng/cũng quan trọng/bình thường/không quan trọng lắm/hoàn toàn không quan trọng
	Giá trị căn hộ tăng để làm tài sản đầu tư
	rất quan trọng/cũng quan trọng/bình thường/không quan trọng lắm/hoàn toàn không quan trọng
	Chất lượng xây dựng và vật liệu trong căn hộ (cửa sổ, tường, vv)
	rất quan trọng/cũng quan trọng/bình thường/không quan trọng lắm/hoàn toàn không quan trọng
	Căn hộ được chống ồn tốt
	rất quan trọng/cũng quan trọng/bình thường/không quan trọng lắm/hoàn toàn không quan trọng
	Phong thủy của căn hộ
	rất quan trọng/cũng quan trọng/bình thường/không quan trọng lắm/hoàn toàn không quan trọng
	Đặc tính kỹ thuật của căn hộ và chung cư giúp tiết kiệm năng lượng
	rất quan trọng/cũng quan trọng/bình thường/không quan trọng lắm/hoàn toàn không quan trọng
	Một cái nhìn tuyệt vời
	rất quan trọng/cũng quan trọng/bình thường/không quan trọng lắm/hoàn toàn không quan trọng
6.7	Xin Bác/Cô/Chú/Anh/Chị cho ý kiến về các mệnh đề sau
	Tôi muốn tìm hiểu các giải pháp giúp tôi tiết kiệm năng lượng cho căn hộ của mình
	Tôi muốn biết điều kiện vi khí hậu trong căn hộ ảnh hưởng đến sức khỏe của gia đình tôi như thế nào
	Tôi tin tưởng nhân dân năng lượng phản ánh đúng chất lượng tiết kiệm điện của các thiết bị
6.8	Bác/Cô/Chú/Anh/Chị có biết các chứng chỉ công trình xanh như Lotus, EDGE, LEED không?
	Nếu có, Bác/Cô/Chú/Anh/Chị đồng ý như thế nào với các mệnh đề sau
	Tôi tin các chứng chỉ công trình xanh
	rất đồng ý/cũng đồng ý/bình thường/không đồng ý lắm/phản đối.
	Khi mua căn hộ chung cư, việc dự án có chứng chỉ công trình xanh ảnh hưởng đến quyết định của tôi
	rất đồng ý/cũng đồng ý/bình thường/không đồng ý lắm/phản đối.
6.9	Mối quan tâm của gia đình Bác/Cô/Chú/Anh/Chị là gì. Xin Bác/Cô/Chú/Anh/Chị lựa chọn một trong các phương án sau: rất quan trọng/cũng quan trọng/bình thường/không quan trọng lắm/hoàn toàn không quan trọng
	Giáo dục và sự nghiệp
	rất quan trọng/cũng quan trọng/bình thường/không quan trọng lắm/hoàn toàn không quan trọng
	Vui chơi, kỳ nghỉ
	rất quan trọng/cũng quan trọng/bình thường/không quan trọng lắm/hoàn toàn không quan trọng
	Dành thời gian cho gia đình
	rất quan trọng/cũng quan trọng/bình thường/không quan trọng lắm/hoàn toàn không quan trọng
	Chi phí sử dụng năng lượng
	rất quan trọng/cũng quan trọng/bình thường/không quan trọng lắm/hoàn toàn không quan trọng
	Sức khỏe gia đình

Table A4. Cont.

	rất quan trọng/cũng quan trọng/bình thường/không quan trọng lắm/hoàn toàn không quan trọng
	Tiết kiệm tiền để mua phương tiện đắt tiền (xe ô tô) hoặc đi du lịch
	rất quan trọng/cũng quan trọng/bình thường/không quan trọng lắm/hoàn toàn không quan trọng
	Sống thân thiện với môi trường (tiết kiệm nước, điện, giảm ăn thịt, vv)
	rất quan trọng/cũng quan trọng/bình thường/không quan trọng lắm/hoàn toàn không quan trọng
	KẾT THÚC PHÒNG VẤN—CẢM ƠN SỰ THAM GIA CỦA Bác/Cô/Chú/Anh/Chị

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