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A Partial Least Squares Analysis of the Perceived Impact of Sustainable Real Estate Design upon Wellbeing

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Abstract: Improving communities and the urban built environment to promote good health, wellness, and wellbeing has become a top priority globally. This growing trend, evident also in the Sustainable Development Goals' urgent call for action, has a significant influence on the real estate sustainable development process, which is mostly expressed through design, and is understood as a key value creator in the real estate sector, for all dimensions of the build environment. In order to shed further light on this complex matter, with reference to the perceived impact of sustainable real estate design upon wellbeing, cross-sectional data collected through a survey ($n = 150$, $RR = 75\%$) were used. The results, obtained from descriptive statistics, regression analysis, variables correlation, and partial least squares-structural equation modeling analysis that incorporated the assessment of measurement and structural models, suggest a positive correlation among the design elements and health, wellness, and wellbeing aspects. The findings are considered significant in terms of filling the gap in the currently published scholarly literature, further supporting the importance of interdisciplinary urban sustainability among real estate professionals.

Keywords: sustainability; health city science; built environment; real estate; design theory; user experience; urban wellbeing; SDGs



Citation: Cortesi, A.; Vardopoulos, I.; Salvati, L. A Partial Least Squares Analysis of the Perceived Impact of Sustainable Real Estate Design upon Wellbeing. *Urban Sci.* **2022**, *6*, 69.

<https://doi.org/10.3390/urbansci6040069>

Academic Editors: Luis Hernández-Callejo, Sergio Nesmachnow, Pablo de Frutos Madrazo, Tigran Haas, Yu-Sheng Shen and Marcia Eugenio-Gozalbo

Received: 3 September 2022

Accepted: 2 October 2022

Published: 6 October 2022

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1. Introduction

Improving communities and the urban built environment in order to promote good health, wellness, and wellbeing (herein referred to as HWWb) has become a top priority globally [1,2]. This growing focus on developing healthy communities stems from the increased recognition of the physical and operational characteristics of personal environments (such as homes, workplaces, public spaces, schools, and transportation systems) and their significant influence upon HWWb [3,4], especially since humans have become an indoor and mostly sedentary species [5], spending approximately 90% of their time inside a building [6].

For the past few years, people have opted for a better lifestyle that incorporates the concept of communities [7], families and their values, mental [8] and physical health, and most importantly, their personal wellness. Academia has also made significant efforts to stress the impact of HWWb and how it can be incorporated and embedded into the notable aspects of people's lives [4,9]. HWWb, due to its diverse and complex nature, has been studied through various perspectives, covering fields that ranged from environmental and health sciences to social sciences, and is defined differently by various scholars in different disciplines [10–13]. As a term, it gained popularity after WWII, when it was used to describe a good life that focused more on issues such as employment, environment, visual arts, health, and housing [14]. In social sciences, for example, the term is defined through the concepts of employment, education, housing facilities, cultural values, community

involvement, family ties, etc. [15], whereas, in environmental sciences, it is defined through the concepts of pollutions, waste management, climate change, etc. [16–18].

Thomas (2009) [19] argues that ‘wellbeing’ is a notion that is very hard to define and measure. The idea of ‘wellbeing’ stemmed from the impression of happiness, which led to the term ‘objective wellbeing’. In ancient Greek literature, *εὐτυχία*, happiness, meant a great life. A happy person was considered to be satisfied with his/her life and more focused on their religion over their life span. In the 18th century, this traditional concept of happiness started transforming into various different concepts, such as life satisfaction, quality of life, prosperity and wellbeing. Happiness was henceforth referred to as temporarily pleasing emotions. Life satisfaction, on the other hand, gained the meaning of the overall satisfaction of life in the long term. The concept of prosperity expresses the economic conditions that are tangible in nature, while the concept of ‘wellbeing’ is defined by Ruut Veenhoven as the overall quality of life with the underlying concepts of happiness and life satisfaction [20]. Dodge et al. (2012) [21], in defining ‘wellbeing’, took under consideration the following two specific aspects: the hedonic tradition (which emphasized the positive effect, happiness, low negative affect, and satisfaction with life) and the eudemonic tradition (which highlighted human development and positive psychological functioning). Their study concluded by providing a simple (as a basis for measurement) definition of ‘wellbeing’ that is universally applicable, conveying the multidimensional nature of the term to enable stakeholders and policymakers to advance their understanding.

HWWb is explained via psychological, philosophical, medical and health conceptualization. In the psychological conceptualization of ‘wellbeing’, the ‘subjective wellbeing’ indicator is used to examine the individual’s perceived wellbeing. In philosophical conceptualization, wellbeing is examined in term of ethics and the nature of living of an individual. Wellbeing via health conceptualization is explained in terms of complete physical and mental health state of an individual. Gillett-Swan and Sargeant (2015) [22] gave a new perspective to ‘wellbeing’, as a process of accrual. The advantages of considering ‘wellbeing’ as an accrual process reside in the ability to build upon one’s life experiences (psychological and physical) to inform the future direction of ‘wellbeing’. Eger and Maridal (2015) [23] support the idea that the most effective factors that define HWWb are happiness, and satisfaction. Their study provides empirical support for the following six livability factors of HWWb: living standard, freedom, health, peace, personal and community relationships, and security. The results of this study confirmed the findings in the prior published scholarly literature, but also provided some new insights and paved the way for future research.

Since HWWb considerations have significantly increased, the literature shows that real estate has also turned its focus to this area [9,24,25]. Modern real estate projects are developing assets based on the Sustainable Development Goals [26,27], in particular goals 1 to 6, which directly (or indirectly) address HWWb. Real estate entities, developers, and construction companies are addressing HWWb-related issues, such as the need for outdoor activities, the need to improve vitamin D levels by sun exposure, the need of avoiding stress at work, the quality of the indoor environment, occupational safety, etc. [28–30]. Indoor air quality, ventilation, thermal comfort, water quality, moisture control, safety, and security, lighting, and views, noise control, and the limitation of dust and pests are among the elements considered most important for the inhabitants of any building [31].

HWWb is significantly influenced by the operation and the design of the communities where people live, work, play and learn. Within the real estate industry, the large impact of community development [32], transportation [33], urban design [34], and other development projects [35–38] might be viewed as positive or negative impacts as economic externalities that could be unmeasured, unconsidered, and unregulated. It was observed by Trowbridge et al. (2014) [24] that those externalities or lack of transparencies would lead to an increase in inefficiency for real estate investment, which is a main concern for promoting HWWb. Within the real estate industry, those externalities also limited the market incentives for innovation. The research concluded that within the real estate indus-

try, HWWb metrics are required, as well as investments from multiple sectors, including health and care, in order to expand market adoption and enable more effective HWWb design considerations.

Mensah et al. (2016) [39] research's adds to this idea of community planning, especially urban design. The authors examined the relationship between quality of life and green spaces from different perspectives of life, such as social, economic and environmental perspectives, to better understand the different ways in which green spaces enhance human life. Their study concluded that green spaces help towards enhancing social, physical, emotional, psychological and material HWWb, which improves the quality of life of an individual. These results suggested that the governing and policy-making bodies should promote green spaces to provide high levels of quality of life to the citizens, and enable sustainable development of the economy [40,41].

Hogan et al. (2014) [42], in their attempt to optimize the process of co-design and deliberation by citizens, experts, and policy-makers, noted that there is a need to explore new policies and measures to improve HWWb. In addition, the authors argue that there is a need to establish a measure for the national HWWb and social progress, in addition to the economic activity measure, as reflected by the gross domestic product.

The recently arising theory for conscious cities has further shifted the real estate focus to HWWb-led design [43]. Design, understood from all dimensions of the built environment, including urban, landscape, architecture, interior design, and industrial design, is a key value creator in the real estate development process. Design impacts the way humans function [44] and how they occupy space. The capacity of a space to attract people depends heavily on its design [45], which may either provide a feeling of ontological security or social capital qualities, which are critical for promoting pro-social behavior and improving HWWb [46]. To enhance the living conditions and the usage of architectural spaces, while taking the environment and technology into consideration, the designers need to focus more on the psychological and physical impacts of the design on residents' needs, preferences, and expectations [47]. An impactful design can have a very strong effect on the residents' physical and mental state, i.e., their HWWb. Nevertheless, shifting the focus onto HWWb and experience does not necessarily mean compromising on design [48,49].

There is a significant relationship between HWWb and place, predicted by a mechanism of curiosity in which place is mobilized. The study by Philips et al. (2015) [50] addressed different questions of HWWb and place-mobilized curiosity, such as what forms curiosity would take when it is mobilized as practices of HWWb, and also how that curiosity might be supported and understood. Two sets of curious practices were identified. One emphasized places, while the other set of practices strongly emphasized the things associated with those places, highlighting collective, shared and interactive forms of curiosity. On the other hand, people might be curious about each other, which leads us to understand the association or relationship between places and HWWb. Nevertheless, the study notes that place, HWWb, and curiosity are interlinked in terms of objects, people and practices.

Steen (2016) [51] argues that design promotes human HWWb. The author discusses that design for HWWb projects is different from the projects of 'traditional' design with their aim to engage people in creative and meaningful activities so that they can flourish. Loftness et al. (2007) [52] presented three main ideas for healthy building designs, namely sustainable development, individual behavior for ensuring the air quality or environment indoors, and the latest building material trends to provide a healthier environment. Their research concluded that quality of life sustainable design consists of good infrastructure, higher durability, recyclability, and lower energy consumption.

An increasing value-beyond-value, as strictly defined by real estate, is being attached to the significance of the space in which people live, in terms of HWWb. As an example, one can refer to the expanded published scholarly literature that relates to HWWb and design of medical facilities and educational establishments [53–55]. Thus, in order to enhance sustainability, resilience, effectiveness, and performance at workplaces, educational institutes, hospitals, or residential buildings, HWWb-led design and architectural and

technical solutions must be adopted. Supportive design and a positive environment are important for the occupants of a building. According to Loftness et al. (2007) [52], various design elements, such as colors, lighting, efficient use of space, etc., can have significant influence on the HWWb and the efficiency of the occupants / residents of a building. Yet, there is no empirical study, to the best of one's knowledge, that bears strong evidence of the relation among design and occupants / residents HWWb.

In order to address this gap, this study aims to obtain residents' perceptions, to address the following two research questions:

RQ1: What is the relationship between the design elements (lighting, ventilation, acoustics, color, texture, use of space, ergonomics and universal design) and all the dimensions of HWWb?

RQ2: What are the opinions of everyday people about the relationship between design and wellness?

2. Materials and Methods

2.1. Scope Determination

HWWb does not encompass merely the physical and mental state; rather, it is the embodiment of every dimension, including emotions, social life, and spirituality. This study, in order to frame HWWb, will use the Six Dimensions of Wellness Model originally offered by the National Wellness Institute (www.nationalwellness.org, accessed on 1 October 2022), namely intellectual, emotional, social, spiritual, occupational, and physical dimensions.

Physical Wellness: This dimension focuses on the need for regular physical activity [56]. When a person focuses on this aspect of their health, it encourages them to observe the other dimensions of wellness as well, including a focus on the quality of their diet and nutrition and avoiding harmful things, such as tobacco and drugs [57]. An individual can achieve peak wellness not by just physical activity, but also through healthy eating habits [58]. Personal care, building strength and medical self-care also contribute to the achievement of physical wellness [59]. An individual must be responsible and caring toward their own health and should know when to seek medical attention [60]. Usually, building a healthy and athletic-looking body leads to improved mental health and especially confidence of the individual [61,62]. This dimension provides higher self-esteem, self-determination, self-control and a sense of direction [63].

Emotional Wellness: This dimension relates to emotions, feelings and awareness and acceptance of those feelings [56]. It is focused around feeling positive about life [64]. Emotional wellness places great emphasis on emotional intelligence, i.e., managing and understanding one's own emotions and coping with stress through keeping in mind others' emotions as well [65]. An emotionally intelligent person understands the feelings and emotions of oneself, as well as those of the people around them [63]. This helps the individual to maintain healthy, satisfying relationships with oneself, as well as others. They make decisions by analyzing their feelings, thoughts, philosophies and behavior, as well as seeking appreciation of others' support and assistance [66]. Emotionally intelligent people have the ability to maintain relationships that are built on mutual understanding, commitment, trust and respect [65]. The ability to accept challenges and risks is a significant factor in emotional wellness. The conflict is considered as potentially healthy. Emotional wellness involves managing one's own life and taking responsibility for one's own actions [56,65].

Spiritual Wellness: Spiritual wellness is focused on the meaning and purpose of our existence [56,67]. It is related to soul searching [68]. It expands beyond human life to accepting and appreciating the natural forces of the universe [69]. It means creating harmony between one's emotions, feelings and the tumultuous journey of their life [70]. It involves accepting and owning one's experiences of self-doubt, despair, fear and disappointment, as well as the pleasure, joy and happiness [71]. It also involves keeping a positive balance between one's feelings, thus achieving inner peace and happiness and reflecting this through one's actions [72].

Intellectual Wellness: This is related to creativity [56]. An intellectually well person builds their knowledge and skills and shares these with others [63]. They cherish intellectual growth and discover the potential of sharing this gift with others [73]. A well person has many healthy habits, such as reading books and a continued pursuit toward learning new skills [74]. They are curious in nature and this curiosity keeps them chasing greater intellect, challenging their mind and encourages them to be more creative [75]. This becomes a significant part of their life.

Occupational Wellness: This dimension is related to life satisfaction and enrichment through one’s career and work [56]. A person’s occupational development impacts upon their attitude towards work [65,76]. If an individual can contribute to their occupation with their true skills and talents, this contribution helps them to achieve occupational wellness [63,77]. The contribution of personal values, enthusiasm and a passion for one’s choice of profession, or career, and the feeling of reward for that effort is occupational wellness [30,78,79].

Social Wellness: This dimension recognizes an individual’s contribution towards their environment and community [56]. A socially well person exhibits interdependence between nature and other people [80]. This person will focus on nature, the balance of nature, and also look to their environment to gain strength [81]. This strength helps them to achieve all other dimensions of wellness and most importantly, inner-peace [82]. It involves making healthy choices about life and living, communicating with others and contributing towards building a better environment for everyone [83].

2.2. Empirical Analysis

The literature review implies a link between HWWb and the role of design as the key value creator in the real estate development process, which must be understood from all dimensions of the built environment, including urban, landscape, building design and architecture, with an emphasis on interior design. In order to test this, a model was developed that includes two hypotheses, as presented in Figure 1.

| HWWb | Design |
|---|--|
| <ul style="list-style-type: none"> • Physical Dimension • Spiritual Dimension • Intellectual Dimension • Social Dimension • Occupational Dimension • Others | <ul style="list-style-type: none"> • Lighting • Ventilation • Acoustics • Color • Texture • Use of Space • Ergonomics • Universal Design Principles • Incorporation of Nature • Art • Green Design Principles |
| H1: HWWb is dependent on the design | |
| H2: Dimensions of HWWb are associated with dimensions of design | |

Figure 1. Hypotheses Model.

To prove these hypotheses correct or otherwise, cross-sectional data collected through a survey questionnaire were used. Cross-sectional analysis is the study of a group’s attitudes, beliefs or opinion at a specific point in time [84]. The questionnaire used for this survey was developed based on the one used by Kathy F. Montgomery (2004) for her study on design and wellness [85]. Likert scale-based questions allowed respondents to indicate the degree to which they agree with the statements. A Likert scale asks for responses that range from strongly agree to strongly disagree. A Likert item is an anchored rating

scale in which the anchors represent different levels of agreement or disagreement for a given parameter. For the scope of this study, the scale was organized into 5 score items, ranging from 5 (complete level of agreement) to 1 (complete level of disagreement), and respondents were invited to express their views using the entire scale. Five-point Likert scale survey questions are a widely applied measuring attitude method in urban science, as well as in other fields [86–91].

The questionnaire was created electronically and the link was sent using email. It should be noted that all candidates, technically, were ultimately interviewed by chance. The main purpose for distributing the questionnaire via email was to maximize the reach and number of responses. It is also a cost effective, easier, and quicker way to collect data. This mode of data collection also facilitated the compilation of responses into a database that tabulates the responses for each question. Convenient sampling was used in this survey. The emails of the residents were collected through LinkedIn and other social media public profiles. Later, the email was sent with the link to the questionnaire and the recipients were given 15 days to respond. The respondents filled in the survey of their own free will. An introductory cover letter that explained the purpose of the survey and how the findings would be used was attached to the front page of the email message. The cover letter was sent with the survey form. Instructions for completing the form were also included in the letter. After one week, a second reminder e-mail was sent. A final email was sent to all respondents upon completion. This message was to thank them for their participation and the time they spent in responding to the survey.

The survey was organized into categories. Section 1 asked for personal background and demographic information. Section 2 was comprised of questions that asked the respondent for their opinion on design and its impact on HWWb. Section 3 asked the respondents for their opinions about HWWb. The Six Dimension of Wellness Model was used to explain the term(s). Each dimension listed was supported by bullet points that together explain that dimension. This section and this definition were provided to the respondents to help them to consider the design elements that may impact the six dimensions of HWWb listed in Section 4. In Sections 3 and 4, respondents are asked to indicate the degree to which they think each dimension affects HWWb, and the degree to which each design element may impact the HWWb of occupants using that space. This is considered the most appropriate methodology for the current context.

3. Results

The data were collected at one time using a cross-sectional study approach. Initially, the survey questionnaires were distributed among 200 people. However, 150 responses were received because some respondents did not return the questionnaires or did not complete the questionnaires properly. Furthermore, incomplete questionnaires were also excluded, which resulted in 150 responses. Therefore, the response rate was 75%.

To understand composition of the sample, this study took two demographical variables. The first is years and the second is employment status. According to the analysis, 12% of the people were less than 20 years old. Around 13% had an age of between 21 and 25. Around 27% of the people were between 26 and 30 years. Around 25% of the people were aged between 31 and 35. In addition, around 23% of the people were above 35 years of age. In terms of employment status, around 6% of the people were employed and around 14% of the people were unemployed. Table 1 explains the details of the demographic profile of the survey respondents.

The descriptive statistics reveal interesting insights. As presented in Table 2, the mean values for 'texture' and 'lighting' are 2.75 and 2.70, respectively. This shows that the respondents prefer natural day lighting and that the texture adds to the overall aesthetic quality. On the other hand, the respondents consider 'art' and the 'green design principles' as the least important factors. On the HWWb side, the mean value of 'intellectual dimension' and 'occupational dimension' is 3.31 and 3.08, respectively, and these are the most dominant

dimensions. The value range between -2 and $+2$ for skewness and kurtosis indicates that these data fulfill the normality conditions.

Table 1. Demographic Profile of the Survey Respondents.

| | | Frequency | Percent | Cumulative Percent |
|-------------------|--------------|-----------|---------|--------------------|
| Age | Less than 20 | 18 | 12.0 | 12.0 |
| | 21–25 | 19 | 12.7 | 24.7 |
| | 26–30 | 40 | 26.7 | 51.3 |
| | 31–35 | 38 | 25.3 | 76.7 |
| | Above 35 | 35 | 23.3 | 100.0 |
| | Total | 150 | 100.0 | |
| Employment Status | Employed | 129 | 86.0 | 86.0 |
| | Unemployed | 21 | 14.0 | 100.0 |
| | Total | 150 | 100.0 | |

Table 2. Descriptives.

| Items | Minimum | Maximum | Mean | Std. Deviation | Skewness | | Kurtosis | |
|-----------------------------|-----------|-----------|-------------|----------------|-----------|------------|-----------|------------|
| | Statistic | Statistic | Statistic | Statistic | Statistic | Std. Error | Statistic | Std. Error |
| Lighting | 1 | 5 | 2.70 | 1.309 | −0.082 | 0.198 | −1.347 | 0.394 |
| Ventilation | 1 | 5 | 2.62 | 1.224 | 0.140 | 0.198 | −1.239 | 0.394 |
| Acoustics | 1 | 5 | 2.63 | 1.255 | 0.167 | 0.198 | −1.232 | 0.394 |
| Color | 1 | 5 | 2.62 | 1.319 | 0.180 | 0.198 | −1.314 | 0.394 |
| Texture | 1 | 5 | 2.75 | 1.254 | −0.274 | 0.198 | −1.399 | 0.394 |
| Use of space | 1 | 5 | 2.55 | 1.196 | 0.063 | 0.198 | −1.304 | 0.394 |
| Ergonomics | 1 | 5 | 2.63 | 1.282 | 0.096 | 0.198 | −1.290 | 0.394 |
| Universal design principles | 1 | 5 | 2.62 | 1.288 | 0.150 | 0.198 | −1.319 | 0.394 |
| Incorporation of nature | 1 | 5 | 2.69 | 1.220 | −0.155 | 0.198 | −1.213 | 0.394 |
| Art | 1 | 5 | 2.41 | 1.050 | 0.268 | 0.198 | −0.847 | 0.394 |
| Green design principles | 1 | 5 | 2.39 | 1.055 | 0.303 | 0.198 | −0.842 | 0.394 |
| Physical dimension | 1 | 5 | 2.73 | 1.123 | −0.077 | 0.198 | −0.842 | 0.394 |
| Spiritual dimension | 1 | 5 | 2.68 | 1.149 | −0.019 | 0.198 | −0.943 | 0.394 |
| Intellectual dimension | 1 | 6 | 3.31 | 1.396 | −0.381 | 0.198 | −1.074 | 0.394 |
| Social dimension | 1 | 6 | 2.83 | 1.079 | −0.103 | 0.198 | −0.271 | 0.394 |
| Emotional dimension | 1 | 5 | 2.91 | 1.209 | −0.201 | 0.198 | −1.104 | 0.394 |
| Occupational dimension | 1 | 5 | 3.08 | 1.303 | 0.071 | 0.198 | −1.092 | 0.394 |

A regression analysis was carried out in order to test H1. The full model regression analysis is presented in Tables 3–5.

Table 3. Regression Model Summary.

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|--------------------|----------|-------------------|----------------------------|
| 1 | 0.906 ^a | 0.821 | 0.820 | 0.47782 |

^a Predictors: (constant), ID.

Table 4. ANOVA ^a.

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|-------|------------|----------------|-----|-------------|---------|--------------------|
| 1 | Regression | 154.690 | 1 | 154.690 | 677.547 | 0.000 ^b |
| | Residual | 33.790 | 148 | 0.228 | | |
| | Total | 188.479 | 149 | | | |

^a Dependent variable: HWWb. ^b Predictors: (constant), ID.

Table 5. Full Model Regression Coefficients ^a.

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|-------|------------|-----------------------------|------------|---------------------------|--------|-------|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 0.693 | 0.094 | | 7.357 | 0.000 |
| | ID | 0.857 | 0.033 | 0.906 | 26.030 | 0.000 |

^a Dependent variable: HWWb.

In Table 3, the regression model summary is presented. In this summary, the R-square value is 0.821, which indicates that around 82% of HWWb is predicted by the design elements. Thus, H1 is verified.

In Table 4 the significance value ($p < 0.01$) of the F-value (677.547) indicates that the regression is significant.

In Table 5, the unstandardized beta value is 0.857; however, the standardized coefficient beta value is 0.906, with a significance value of 0.000. This indicates that one unit of the design element will increase around 91% of HWWb.

In Table 6, and in order to provide answers for RQ1, a detailed analysis was conducted to examine which dimension of design elements affect which dimension of HWWb (see H2). According to the analysis, the 'physical dimension' is significantly predicted by 'color', 'use of space', and 'universal design principles'. The 'spiritual dimension' is predicted by 'ergonomics'. The 'intellectual dimension' is predicted by 'art'. The 'social dimension' is predicted by 'color', 'universal design principles', and 'incorporation of nature'. The 'emotional dimension' is predicted by 'incorporation of nature', 'art', and 'green design principles'. The 'occupational dimension' is predicted by 'color', and 'art'.

Table 6. Regressions Coefficients.

| Items | Physical Dimension | | Spiritual Dimension | | Intellectual Dimension | | Social Dimension | | Emotional Dimension | | Occupational Dimension | |
|-----------------------------|--------------------|------|---------------------|------|------------------------|------|------------------|------|---------------------|------|------------------------|------|
| | β | Sig. | β | Sig. | β | Sig. | β | Sig. | β | Sig. | β | Sig. |
| Lighting | 0.21 | 0.35 | −0.02 | 0.92 | 0.18 | 0.51 | −0.05 | 0.82 | 0.00 | 0.99 | 0.11 | 0.67 |
| Ventilation | 0.14 | 0.69 | 0.00 | 0.99 | −0.55 | 0.18 | −0.23 | 0.51 | 0.02 | 0.96 | −0.09 | 0.81 |
| Acoustics | 0.05 | 0.89 | −0.09 | 0.81 | 0.04 | 0.94 | 0.00 | 0.99 | −0.33 | 0.47 | −0.29 | 0.49 |
| Color | 0.45 | 0.04 | 0.27 | 0.23 | 0.34 | 0.21 | 0.96 | 0.00 | 0.07 | 0.80 | 0.43 | 0.07 |
| Texture | 0.18 | 0.30 | 0.19 | 0.28 | −0.10 | 0.63 | 0.00 | 1.00 | 0.02 | 0.92 | −0.09 | 0.62 |
| Use of space | 0.46 | 0.02 | 0.26 | 0.20 | 0.38 | 0.12 | 0.25 | 0.23 | 0.12 | 0.61 | 0.34 | 0.13 |
| Ergonomics | 0.08 | 0.79 | 0.59 | 0.04 | 0.19 | 0.57 | 0.18 | 0.53 | 0.28 | 0.40 | 0.22 | 0.47 |
| Universal design principles | 0.53 | 0.03 | 0.15 | 0.51 | 0.26 | 0.36 | 0.86 | 0.00 | 0.32 | 0.24 | 0.28 | 0.26 |
| Incorporation of nature | 0.18 | 0.29 | 0.11 | 0.52 | 0.56 | 0.01 | 0.77 | 0.00 | 0.58 | 0.00 | 0.35 | 0.05 |
| Art | −0.36 | 0.24 | −0.28 | 0.36 | 0.04 | 0.92 | −0.38 | 0.22 | 0.83 | 0.02 | 0.28 | 0.40 |
| Green design principles | 0.02 | 0.96 | 0.01 | 0.97 | 0.02 | 0.96 | 0.11 | 0.71 | −0.40 | 0.26 | −0.08 | 0.81 |

Furthermore, and in order to understand the correlation between the variables of this study, a two-tailed Pearson correlation analysis was conducted. The results are presented

in Table 7. The results indicate that the construct ‘years’ is insignificantly related to employment status ($\beta = 0.083, p > 0.05$), design ($\beta = 0.055, p > 0.05$) and HWWb ($\beta = 0.130, p > 0.05$). This shows that ‘years’ have no impact on other study constructs. Regarding employment status, the results are also insignificant with design ($\beta = 0.123, p > 0.05$) and HWWb ($\beta = 0.065, p > 0.05$). Regarding design and its correlation with HWWb, the correlation was found to be positively significant ($\beta = 0.906, p < 0.01$).

Table 7. Inter-Constructs’ Correlation.

| Sr. | Construct | 1 | 2 | 3 | 4 |
|-----|-------------------|-------|-------|-------|---|
| 1 | Years | 1 | | | |
| 2 | Employment status | 0.083 | 1 | | |
| 3 | Design | 0.055 | 0.123 | 1 | |
| 4 | HWWb | 0.130 | 0.065 | 0.906 | 1 |

In partial least square structure equation modeling (PLS–SEM), both measurement models were evaluated to check the reliability and the validity of the constructs and methodology [92]. The reliability of the constructs was measured by assessing the composite reliability, as mentioned in Table 8. The average variance extracted values were above 0.5, which fulfills the criteria for validity. The average variance extracted values for both design elements and HWWb were 0.944 and 0.865, respectively. The internal consistency of the constructs was above the threshold value of 0.7 [93]. Therefore, it is considered that all the constructs fulfill the internal consistency of their items.

Table 8. Reliability and Average Variance Extracted.

| Variable | Cronbach’s Alpha | rho_A | Composite Reliability | Average Variance Extracted |
|----------|------------------|-------|-----------------------|----------------------------|
| Design | 0.994 | 0.994 | 0.995 | 0.944 |
| HWWb | 0.969 | 0.969 | 0.975 | 0.865 |

For indicator reliability, the factor loading of the constructs was evaluated. The outer model presented in Figure 2 shows the factor loadings of both the constructs. Thus, no items of the constructs were deleted and all the items of the constructs were noted in the further analysis.

To assess the discriminant validity, the heterotrait-monotrait ratio of correlations was used [93–95]. Table 9 shows that the values for HTMT_{.85} and HTMT_{.90} are below 0.85 [96] and 0.90 [97], respectively. Hence, the discriminant validity is established.

Table 9. Heterotrait-Monotrait Ratio.

| Variable | Design |
|----------|--------|
| Design | |
| HWWb | 0.923 |

The model also evaluates the R square value of HWWb, which is 0.821 (Table 10). This indicates that interior design elements predict around 82% of wellness.

Table 10. R Square Value.

| Construct | R-Square |
|-----------|----------|
| HWWb | 0.821 |

After evaluating the measurement model, the structure model was formulated (Figure 3).

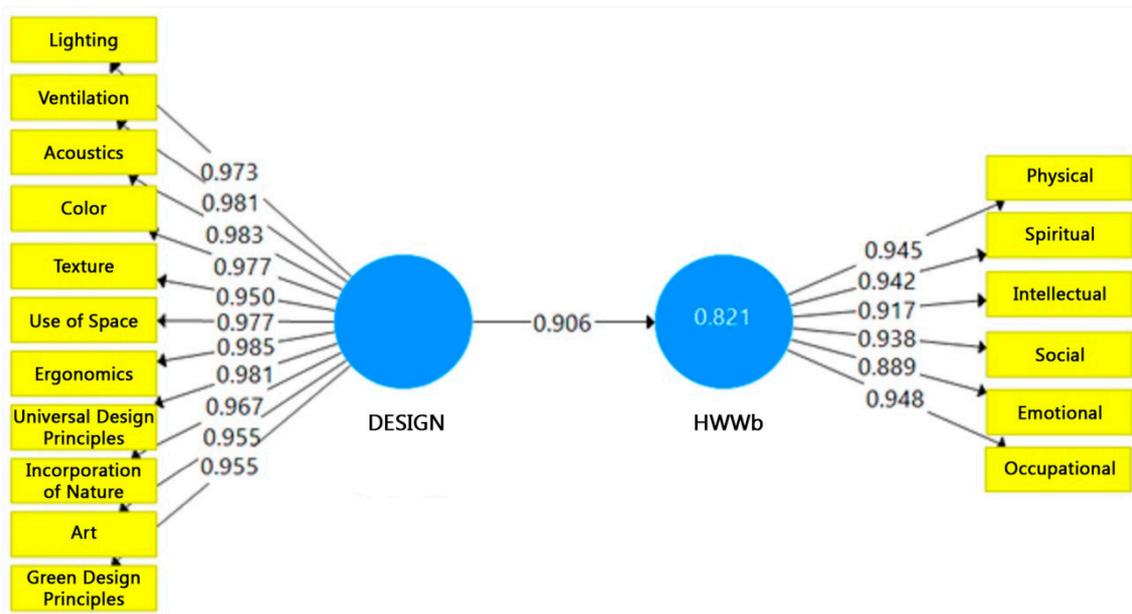


Figure 2. Measurement Model.

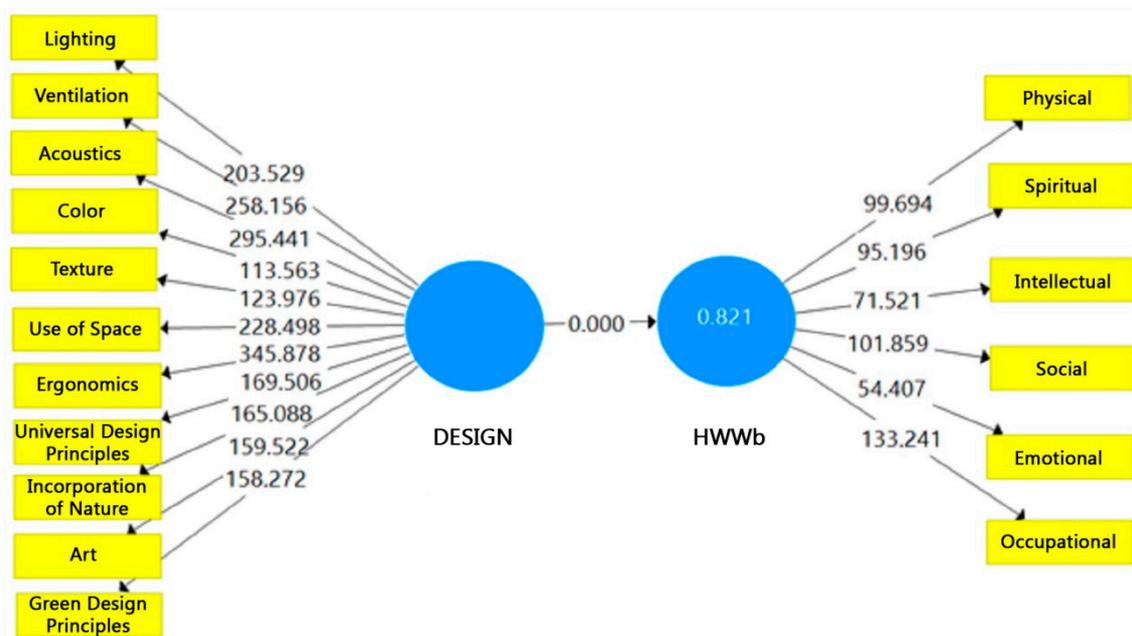


Figure 3. Structural Model.

In the structural model, other than the quality statistics and factor loadings, the path coefficient determined by significance and the T-value, using the bootstrap procedure [98], are also calculated. All the T-values greater than 1.645 and the significance value greater than 0.05 are considered to be a significant path [99]. The outer model in Figure 3 represents the T-values with all the indicators of the constructs, whereas the inner model represents the significance value between the construct, which is significant at a p -value less than 0.00. The path coefficient in Table 11 indicates that the relationship between design and HWWb is positively significant ($\beta = 0.91$, $t = 64.72$, $p < 0.01$).

Table 11. Path Coefficient.

| Path | Original Sample | Sample Mean | Standard Deviation | T Statistics | p Values |
|---------------|-----------------|-------------|--------------------|--------------|----------|
| Design → HWWb | 0.91 | 0.91 | 0.01 | 64.72 | 0.00 |

Table 12 indicates the Q-square value. The Q-square value is assessed by the blind-folding technique in PLS–SEM [100,101]. This technique helps in assessing the predictive relevance of the structural model. In this technique, the resampling procedure is executed in a specified number of iterations to assess the data points of the endogenous construct. After that, the predictive value and the original value are compared. If the value difference is small, then it shows that the predictive relevance is greater [98]. However, the value should be greater than zero. Thus, the data presented in Table 12 indicate that the Q-square value of HWWb is 0.706, which is greater than the threshold of 0. This indicates that the model has good predictive relevance.

Table 12. Q-Square Value.

| Construct | SSO | SSE | Q ² (= 1 – SSE/SSO) |
|-----------|------|---------|--------------------------------|
| Design | 1650 | 1650 | |
| HWWb | 900 | 264.948 | 0.706 |

4. Discussion and Conclusions

The survey responses provide meaningful insights into the role of design as a key value creator in the real estate development process. A total of 99% ('strongly agree' and 'agree') of the respondents believe that design has a substantial effect on the HWWb of the residents of a building, a finding that is consistent with the wider literature [102]. The respondents also indicated a clear preference for buildings that include design and planning considerations for the HWWb of the occupants. The responses to the following statement varied: 'HWWb is an important factor in the design of a corporate building'. A total of 57% of participants responded as 'neutral', while 36% agreed with the statement (23% responded as 'strongly agree' and 13% as 'agree'). In addition, 7% disagreed with the statement. These responses show that majority of people are ambivalent towards HWWb concerns in regard to the design of a corporate building. It is not viewed as important and they do not seem to care either way whether their workplace incorporates HWWb-led design or not.

In the detailed data analysis, the responses show that different dimensions of HWWb are predicted by different dimensions of design. The 'physical dimension' is significantly predicted by 'color', 'use of space', and 'universal design principles'. The 'spiritual dimension' is predicted by 'ergonomics'. The 'intellectual dimension' is predicted by 'art'. The 'social dimension' is predicted by 'color', 'universal design principles', and 'incorporation of nature'. The 'emotional dimension' is predicted by the 'incorporation of nature', 'art' and 'green design principles'. The 'occupational dimension' is predicted by 'color' and 'art'.

According to the results displayed in Table 2, the respondents consider that natural day lighting has a very positive effect on HWWb. They also state that texture adds to the aesthetic quality of the interior environment. Thus, when designers work on interiors, they must pay attention to the lighting, as well as aesthetic quality. This finding further supports Morales-Bravo and Navarrete-Hernandez's 2022 study [103], which demonstrates that natural lighting conditions have a major impact design on the perceived HWWb in residential spaces.

The least importance was given to the use of 'art' in the interior environments, although previous studies support the contribution of art and cultural development and community wellbeing [104], and the 'green design principles', which are considered design practices that conserve the natural environment. This is not in complete agreement with evidence

found earlier in the published scholarly literature (for example, see [105]), thus offering further insights and posing further questions regarding HWWb and the design in the built environment. The current analysis also suggests that design predicts 82% of HWWb and 1 unit change in design will bring 91% change in HWWb. This is a significant predictor of the dependent variable.

As hypothesized in the model of this study, the relationship between design and HWWb is found to be positively significant, also concurring well with earlier attempts [106]. To obtain the results, several analyses, including descriptive statistics, regression analysis, variables correlation, and PLS-SEM that incorporates assessment of measurement and structural models, were conducted. The results conclusively explain that design elements are positively linked with HWWb.

Sustainable real estate development is directly related to HWWb [107]. However, since the sector, driven by the contemporary target market, has shifted its focus from 'luxury' to 'wellbeing', all stakeholders involved in the process need to better understand and comprehend, in a progressive and exponential way, all aspects around sustainable healthy development and design.

This study was limited to a small sample, which is, however, adequate to support the findings [91]. Future research could further expand the sample using data from real estate developers, professional designers and the residents/ occupants in order to further validate the arguments of the current research, compare the differences among these stockholders, and provide valuable insights for the real estate sector. Additionally, future research could study the effects of all the HWWb dimensions on all the dimensions of real estate development, considering them as separate and independent variables.

The results of the current research are significant in terms of filling a significant gap in the literature regarding HWWb in relation to real estate assets, further supporting the importance of interdisciplinary urban sustainability, as well as real estate professionals within the HWWb industry, such as those working in hotel retreats, spas, elderly care facilities, hospitals, and rehabilitation centers.

HWWb real estate is a rising market that has the ability to address the current urban concerns. It reflects a paradigm change that clearly prioritizes people's HWWb in the concept, design, construction, renovation, development and redevelopment of the built environment. Many components of the sustainable construction movement, the design-driven movements, and other similar endeavors are presently transformed in the new and forthcoming HWWb-focused real estate. As we look into the future of HWWb real estate, this study has contributed to enhancing our understanding of the new metrics to capture HWWb, in addition to the relationships among personal HWWb, the built environment, and community HWWb.

Author Contributions: A.C. conceived the original idea. I.V. encouraged A.C. to investigate health, wellness, and wellbeing aspects in the real estate sector, and supervised the findings of this work. A.C. developed the theoretical formalism, performed the analytic calculations and performed the numerical simulations, with the support of L.S. L.S. applied statistical techniques to analyze the data in order to verify the analytical methods. A.C. wrote the manuscript with support from I.V. L.S. took the lead in formulating the revised version. A.C., I.V. and L.S. contributed to the final version of the manuscript. I.V. supervised the project. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Ethical review and approval were waived for this study. The survey was anonymous, gathering no sensitive data, and the participants gave consent to use their answers for research.

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

Data Availability Statement: The data presented in this study are contained within this manuscript for reproducibility purposes.

Acknowledgments: We would like to thank all the people who have directly or indirectly helped us in carrying out this study.

Conflicts of Interest: The authors declare no conflict of interest.

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