

Human–Environment Interaction in Urban Societies: The Role of Environmental Awareness and Community Engagement in Shaping Sustainable Behavior, Social Responsibility, and Well-Being

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ABSTRACT

This research focuses on human-environment interaction (HEI) in urban societies by exploring how environmental awareness (EA) and community engagement (CE) influence the behaviors of sustainable behavior (SB), social responsibility (SR) and well-being (WB). Although the need to bridge the gap between environmental concern and actual SB remains a major challenge in sustainability research, this study concentrates on key psychosocial factors which could account for the differences in people's pro-environmental behaviour. Using social and environment theories on behavior, this study proposes and tests a framework that includes positive drivers (such as EA and CE) to understand their effects on SB, SR and overall WB. A survey was conducted with 324 urban residents in Jordan who have experienced recently environmental initiatives and community based activities. The results obtained from this study using PLS-SEM show that EA has a significant effect on SB as well as CE significantly affects both SR and WB. In addition, SB showed to have a strong predictive effect on SR, which positively affects individual WB partially mediated the effect of sustainable practices on WB outcomes. The results underscore the essential importance of awareness and CE as effective processes through which HEI achieves outcomes for sustainability. The study offers practical recommendations for policies and urban planning in Jordan to enhance community participation and environmental awareness, moving towards sustainable cities for a better quality of life.

Keywords: Human-Environment Interaction, Environmental Awareness, Community Engagement, Sustainable Behavior, Wellbeing

JEL Classifications: L2, P25, O25

1. INTRODUCTION

Due to rapid urbanization, environmental degradation, social inequality and decreasing WB are growing interconnected issues in the developing regions, especially in cities. Jordan finds itself in a unique position in a rapidly urbanizing society, with increasing pressures due to population growth, limited resources, and environmental stress, which is creating a need for sustainable behavior that is not just desirable but necessary (Alashiq and Aljuhmani, 2025). Even with the increased awareness of sustainability concerns, there is still a disconnect between the

knowledge people have about the environment and their behaviour (Madera et al., 2024), known as the attitude–behaviour gap. To resolve the paradox, this study focuses on how EA and CE are key elements in the influence on SB, SR and overall WB in urban societies. EA defined as people's perception, knowledge, and consciousness about environmental problems and their impacts, as well as their willingness to take environmental responsibility (Yang et al., 2025). It has long been known as a key factor that influences SB, but previous research has shown that knowledge can not always be converted into practice (Alhazemi, 2025). This constraint requires the introduction of other social mechanisms,

including CE. Active involvement in collective actions and local initiatives for the improvement of society, increases social cohesion and shared responsibility towards the environment (Nguyen-Dinh and Zhang, 2025).

It is increasingly recognized as a bridging catalyst between awareness and action, being part of social norms and collective practices (Suttharattanagul et al., 2025). The central theme of these drivers is SB, which involves actions taken to reduce environmental impacts and preserve ecological balance, including the conservation of resources, reduction in waste and responsible consumption (Bin Hamad Alkahtani, 2026). This attitude is deeply connected to SR which involves one's moral responsibility to make positive contributions to the environment and society (Olcese et al., 2025). Moreover, Higher SB is also linked to Higher WB and Higher SR is linked to Higher WB, because people feel good psychologically and filled with a sense of purpose when they give back to the environment and society (Yıldızbaş et al., 2025). The combination of these variables, therefore, creates a whole picture of the wider effects of HEI. These variables are theoretically and empirically appropriate. EA is the cognitive basis, CE is the social mechanism, SB is the behavioural effect, SR is the ethical aspect and WB is the final individual level effect. This multi-layered framework resonates with social-ecological models and behavioral theories that highlight the physical, social and behavioral interactions (Bhambri and Bajdor, 2024). These constructs were incorporated to provide a comprehensive view, going beyond individual variable relationships.

This research is relevant from an industry perspective, especially in view of its application to Jordan's urban sector, environmental management and public services. The country is confronted with a number of severe environmental problems such as scarcity of water, waste management inefficiencies, and growing pollution in urban areas (Pejić, 2025). Jordan, for example, is one of the most water-stressed countries in the world, and its per capita water availability is significantly lower than the international poverty line of 500 m³ per person per year (Yuting et al., 2024). At the same time, the urban population is more than 90%, which puts a huge strain on infrastructure and environmental resources (Bhambri and Bajdor, 2024). In addition, the waste management system is also under pressure because of the increased generation of solid waste and restricted waste recycling capability (Sargolini et al., 2025). These circumstances provide a call to action for SB, both at the individual and community level. Thus, it is important to consider the context of the proposed relationships when focusing on urban residents in Jordan. This sector and context has been selected for several reasons, particularly the growing importance of environmental initiatives at community level and the government's sustainability programs in Jordan. However, they are often effective only when there is public involvement and behaviour change, which is not consistent (Duan, 2025). The psychological and social mechanisms underlying these behaviours can offer policy- and practice-relevant information to improve programme effectiveness. While some studies have addressed sustainability issues, others have investigated sustainability behaviors and EA separately, and few have studied both together

using comprehensive analytical methods like PLS-SEM (Li et al., 2025; Thakur and Kumar, 2024).

Limited studies have applied PLS-SEM to study the complex relationships among EA, WB, and SR together and within the same framework (Esposito De Vita, et al., 2023; Yang et al., 2025). Prior studies have mainly focused on developed countries, with limited attention given to developing countries contexts like Jordan (Alashiq and Aljuhmani, 2025; Sargolini et al., 2025). Few studies have integrated both EA and sustainability behaviors as dependent variables within the same framework and tested them together, and even less have examined the interplay between individual-level determinants and community-level dynamics (Khogali et al., 2025; Puđak et al., 2025). In this study, the author addresses these gaps in a combined, multi-variable analysis and uses advanced analytical methods to provide robust empirical evidence. Therefore, the main purposes of the present study are: (1) To explore the effect of EA on SB; (2) to investigate the effect of CE on SR and WB; (3) to investigate the effect of SR on the relationship between SB and WB; and (4) to investigate the mediating role of SR in the relationship between SB and WB. All of these objectives seek to contribute to a comprehensive grasp of the ways in which HEI shape outcomes at the individual and societal level. This study has a number of important contributions to make. Its theoretical contribution is its attempt to combine cognitive, social, behavioural and psychological aspects in a unified model to advance sustainability research in theory. In practice, it offers policy makers, urban planners and environmental groups sound information to create policies and programs that encourage sustainable lifestyles. In terms of methodology, the application of PLS-SEM provides added rigor and reliability to the results. The study is unique in its comprehensive approach, its focus on the Jordan context and its focus on community driven sustainability. In conclusion, the research's motivation is the critical need to promote sustainable urban life and enhance quality of life in fast urbanizing societies, and can provide a comprehensive framework for academic discussion and practical use.

2. THEORETICAL BACKGROUND

The study is based on two complementary theoretical frameworks, namely Signaling Theory and Social Cognitive Theory (SCT), to explain the interaction of cognitive, social and contextual factors in the phenomenon of SB, SR and WB in urban societies. The common thread that ties these theories together is a lens that allows for understanding how people make sense of environmental cues and how they will respond to perceptual cues in a socially embedded setting. Signaling Theory (Spence, 1973) is a theory that is used to understand how observable cues or "signals" impact information asymmetry and therefore perceptions and behaviors. For HEI, EA can be viewed as internalized signals associated with the knowledge and perception of environmental problems by individuals, and community engagement is a social signal that strengthens the norms and collective expectations related to sustainability (Yuting et al., 2024). These signals influences the meaning people assign to appropriate and responsible behavior in their social world. Previous research has shown that convincing environmental cues can play a significant role shaping pro-

environmental attitudes and actions (Lee et al., 2025; Sargolini et al., 2025). Additionally, social signals within social contexts, including CE in initiatives, boosts trust, legitimacy, and alignment with sustainability objectives (Li et al., 2024). Therefore, signaling theory would justify the use of EA and CE as critical antecedents intervening in the signaling process with the intermediation of perceived norms and shared meaning for the process of guiding SB and SR. Signaling processes, however, cannot account for all parts of the way in which people transform their perceptions into actual behaviour. This restriction requires that SCT (Bandura, 1986) is also included, which highlights the dynamic nature of personal factors, behavioral patterns, and environmental influences.

According to SCT, people copy, interact with others, and regulate their own behaviors based on their observation and interactions (Yıldızbaş et al., 2025). In this context, EA is a cognitive factor, CE is an environmental and social influence and SB is the resulting behavioural outcome. The theory also accounts for the formation of a sense of efficacy and moral obligation as a result of repeated experiences of pro-environment actions, which leads to an increased sense of SR and better WB (Esposito De Vita et al., 2023). Empirical studies have repeatedly confirmed the importance of cognitive and social factors in the study of SB, supporting the use of SCT in sustainability research (Pejić, 2025; Yuting et al., 2024). This is because in this study, a combination of Signaling Theory and SCT is quite appropriate, as it is able to capture the external and internal mechanisms that produce the formation of behavior. Signaling Theory focuses on how people interpret environmental cues and social signals while SCT focuses on how those cues and signals internalized and acted upon as behavior. Dual-theoretical approach enables a more integral understanding of how EA and CE work to impact sustainable outcomes. Such integrative approaches have been recommended in previous studies to deal with the complex nature of sustainability issues (Bin Hamad Alkahtani, 2026; Madera et al., 2024). Moreover, the relationships in this study's model have been supported by previous literature. EA has been associated with sustainable behaviours multiple times, but it is generally found to be affected by social and contextual factors (Thakur and Kumar, 2024; Krstić et al., 2024). CE has demonstrated its ability to enhance collective efficacy and foster pro-social and pro-environmental behaviors (Sargolini et al., 2025). Also, it has been hypothesized that SB positively linked to SR, since persons with environmentally responsible attitudes are more likely to have a more general sense of ethical and social responsibility (Li et al., 2024).

Moreover, sustainable behaviour and SR are also associated with better WB which underscores psychological and emotional gains of doing good for the environment and society (Thakur and Kumar, 2024). Most importantly, these relationships have been studied separately in the past, and it becomes difficult to understand the interdependency between these relationships. This study builds on this and proposes a single model that incorporates aspects of Signaling Theory and SCT to bring together the cognitive, social and behavioral components of sustainability. From a theoretical perspective, the integration both enhances the model's explanatory power and aligns with the recent trend of inter-disciplinary research in the sustainability realm (Bhambri and Bajdor, 2024). To sum

up, this study is grounded on an adequate and theoretically sound base of Signaling Theory and SCT. These theories work together to account for the role of EA and CE as important contributors to SB, and how this behavior leads to SR, and ultimately to an individual's well-being. This holistic approach allows for a more in-depth and comprehensive analysis that provides an overall picture of the interaction between humans and their environment in cities.

2.1. Environmental Awareness and Sustainable Behavior

EA is an important cognition base which influences people's attitude towards taking environmentally responsible measures in the city. It is not only indicating knowledge of environmental problems but also an internalized understanding of the long-term consequences, which can trigger pro-environmental motivations and intentions for action (Bhambri and Bajdor, 2024). In urban areas, with a high density of human settlements, environmental problems are more visible and therefore awareness can foster a stronger sense of responsibility among individuals to act sustainably (Olcese et al., 2025). This cognitive activation is a key determinant for making day-to-day decisions, such as adopting energy-saving measures, recycling programs, and sustainable consumption habits (Yıldızbaş et al., 2025). Furthermore, awareness increases individuals' understanding of the environmental impact of their actions, which lowers uncertainty and motivates them to take consistent pro-environmental actions (Krstić et al., 2024). Empirical results indicate that more people that are knowledgeable about the environment are more inclined to take action on environmental issues, a sentiment that is strengthened when knowledge is rooted in context and personal experience (Thakur and Kumar, 2024). This relationship is more pronounced in urban societies as EA relates to lived experiences, which increases over time, and reinforces behavioral consistency. In this sense, EA can be considered to be one of the major drivers that not only inform, but also motivate people to act in a sustainable way and thus is a fundamental determinant in the development of environmentally responsible behavior in complex urban ecosystems.

H₁: EA positively influences SB.

2.2. Community Engagement and Sustainable Behavior

CE represents a level of engagement within collective projects, local networks and collaborative processes that seek to collectively tackle shared social and environmental issues. This type of interaction promotes belonging and group identity, leading to greater adherence to group norms and expectations (Alashiq and Aljuhmani, 2025). Environmental programs, environmental campaigns and civic engagement within neighborhoods provide social learning and behavioral diffusion opportunities in urban environments, where environmental issues may be shared (Olcese et al., 2025). In this way, through repeated interaction and shared experiences, individuals are introduced to the practical use of sustainable practices, thus normalizing and reinforcing environmentally friendly practices, as explained by Yang et al. (2025). Moreover, CE builds togetherness, allowing people to feel that their actions are part of a larger group that creates an environmental impact that is not insignificant (Madera et al., 2024). This perception helps to diminish the sense of unimportance and

promotes regular engagement in pro-environmental actions. Social studies have shown that social acceptance and social norms are important factors in adopting and sustaining pro-environmental behavior because the influence of peers, trust, and accountability among them (Bin Hamad Alkahtani, 2026; Nguyen-Dinh and Zhang, 2025). Moreover, the involvement in community-based activities may also lead to the availability of resources, knowledge, and institutional support, which can further promote the adoption of sustainable actions (Thakur and Kumar, 2024). In this sense, CE is a social process of dynamism that, beyond shaping attitudes, can also serve as a tool for the transformation of collective values into individual's attitudes and behaviours in everyday life, which can foster sustainability in urban social systems.

H₂: CE positively influences SB.

2.3. Community Engagement and Social Responsibility

The community process is a key element to fostering a sense of moral obligation and collective responsibility among people. A consistent presence in the community through local projects, volunteer work, or civic engagement increases awareness of community issues and a sense of responsibility to make a positive difference (Krstić et al., 2024). This interaction facilitates internalization of pro-social values, as people start to see responsible conduct not only as a personal choice, but as a social expectation, as part of community norms (Sargolini et al., 2025). In the city context, where interdependence between the city's inhabitants is great, such engagement creates a greater ethical sensitivity to social and environmental matters in general (Enssle and Kabisch, 2020). Furthermore, CE fosters empathy and other-regarding, which help individuals understand how their actions affect others and the community as a whole (WB) (Pejić, 2025). This psychological change helps to strengthen the feeling of duty, and it will help to urge people to act in a way that's good for them and for others in the world. Empirical studies show that people actively involved in community networks have a higher ethical awareness and are more likely to be responsible, cooperative (Khogali et al., 2025). Further, communities have informal mechanisms of responsibility where social acknowledgment and mutual obligations influence responsible behavior (Suttharattanagul et al., 2025). This results in CE fostering a high level of moral awareness which leads to socially responsible attitudes and behaviors, thus emphasising the need for collective action in the construction of responsible urban societies.

H₃: CE positively influences SR.

2.4. Sustainable Behavior and Social Responsibility

There are times when people's eco-friendly actions are not just limited to particular acts, but also develop into a general attitude towards society. People who regularly practice things like saving resources, minimizing waste and choosing environmentally friendly options are likely to develop values that have to do with responsibility, fairness and the long-term welfare of society (Esposito De Vita, et al., 2023). This internalization process shifts the normal way of doing things into moral commitments, thus changing the perception of the role from just being a consumer to becoming a contributor to the joint WB (Puđak et al., 2025). In the urban context, environmental effects are more apparent and immediate, and this behavior creates a sense of responsibility for

current and future generations (Yuting et al., 2024). Moreover, the reinforcement of moral norms and personal identity associated to responsibility has been found through repeated practice of sustainability related practices (Li et al., 2024). People who behave in a pro-environmental way are more likely to bring this pro-environmental attitude into the wider arena of society, such as ethical decision-making and civic engagement. Empirical evidence indicates that those who are more inclined towards sustainable practices tend to have a stronger sense of ethics and social responsibility (Duan, 2025). The relationship is further strengthened by the cognitive consistency mechanisms which involve people trying to ensure consistency between their actions and values, and consequently increase responsible behavior across different contexts (Suttharattanagul et al., 2025). Thus, sustainable practices are seen as a basis for a multi-dimensional approach to responsibility, which goes beyond environment and has a greater impact on socially responsible and ethically sound cities.

H₄: SB positively influences SR.

2.5. Social Responsibility and Well-being

Social responsibility is an important component in the overall quality of life and psychological functions of the individual. People who internalize ethical responsibilities and who consciously think about the consequences of their actions have a greater sense of purpose and meaning in life (Bhambri and Bajdor, 2024). This purpose is tied to greater life satisfaction and emotional stability, and they feel that they are doing something for others besides seeking for their own benefit (Nguyen-Dinh and Zhang, 2025). In an urban setting, where social interdependence is high, this responsibility fosters interpersonal trust and social cohesion, which are key elements of a fulfilling life experience (Yang et al., 2025). Furthermore, behavioral responsivity can have positive psychological consequences, such as self-consistency and moral alignment. People who act consistently with their moral compass are less likely to have inner conflicts and more likely to report psychological WB (Madera et al., 2024). Empirical research indicates that positive and ethical actions can contribute to happiness, lower stress levels, and emotional strength (Alhazemi, 2025). Moreover, the sense of belonging and recognition in one's community can be strengthened by doing social responsibilities, which contributes to strengthening positive mental states (Puđak et al., 2025). As a dynamic strand woven into these interwoven pathways, a positive orientation toward societal responsibility plays a major part in people's WB, making it an important factor in determining positive life outcomes in complex urban environments.

H₅: SR positively influences WB.

2.6. Sustainable Behavior and Well-Being

Actions taken to be environmentally responsible can not only help preserve ecological systems but can also have a positive impact on the psychological and emotional WB of individuals. Such behaviours as conserving resources, minimizing waste and making conscious choices in consumption can often create a feeling of congruence between values and action, leading to higher internal satisfaction and emotional balance (Alashiq and Aljuhmani, 2025). The alignment lowers the level of cognitive dissonance, creates a unified and positive self-identity around positive contribution,

and enhances life satisfaction overall (Nguyen-Dinh and Zhang, 2025). In urban setting, where the impacts of the action are direct and apparent, and where the action may be associated with a sense of contribution, personal fulfillment may be strengthened (Suttharattanagul et al., 2025). Additionally, joining in with other people who practice environmentally friendly activities and engaging in meaningful activities is likely to increase social connectedness and emotional WB (Lee et al., 2025). These experiences foster a sense of competence and autonomy, which both play a crucial role in positive psychological functioning (Sargolini et al., 2025). Empirical research also suggests that people who practice pro-environmental behaviors experience higher happiness and lower psychological distress (Thakur and Kumar, 2024; Olcese et al., 2025). Furthermore, such actions can help create a sense of long-term security and optimism, with people feeling they are contributing to a healthier and more sustainable future (Esposito De Vita, et al., 2023). These means create a meaningful pathway, where environmentally responsible actions not only benefit an individual's overall WB, but also benefit the broader society and environment.

H₆: SB positively influences WB.

2.7. Mediation of Social Responsibility Between Sustainable Behavior and Well-Being

SR is a key mediating mechanism for understanding the links between SB and the improvement of WB in urban societies. Those who adopt sustainable behaviors, like being mindful of energy use, reducing waste, and consuming in a sustainable way, experience an enhanced sense of responsibility and concern for the welfare of others. This increased responsibility towards society makes them feel better integrated psychologically and socially, and this is a factor that helps to contribute to the improvement of subjective WB. In this sense, SB does not directly affect WB, but rather this WB is mediated by internalization of SR values that influence the meaning, purpose, and social connection of individuals. Previous studies also found that socially responsible people had higher life satisfaction, higher prosocial engagement and lower self-other discrepancy (Yuting et al., 2024; Li et al., 2024). Furthermore, SR creates a sense of trust, cooperation, and belonging within communities, all of which play a crucial role in shaping their WB in urban settings (Sargolini et al., 2025). Thus, SR provides a psychobehavioral connection that transfers any SB into more

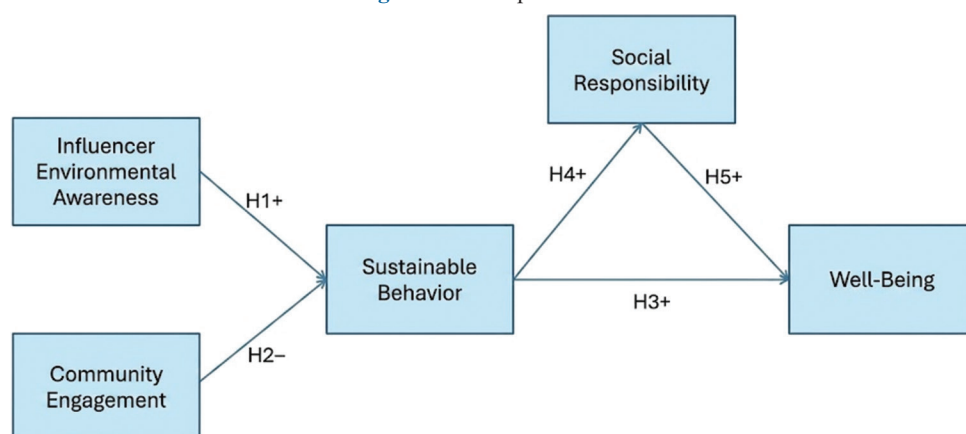
emotional and social benefits. This mediation mechanism brings to the fore the fact that WB is not only a product of individual practices of sustainability, but is also rooted in socially responsible orientations and collective values. The conceptual model used in the paper is presented in Figure 1.

3. METHODS

3.1. Research Context, Population and Sample

We investigated urban dwellers' reactions to environmental sustainability dynamics in urban areas where awareness raising campaigns and community activities are becoming more common. The target population included urban citizens (aged 18 or over) who (i) know about environmental issues raised as part of public campaigns and as addressed in digital platforms; and (ii) have engaged in or practised at least one form of SB (e.g., recycling, energy conservation, waste reduction) during the last 6 months. This population allows the focal constructs (EA and CE) to be related to true behavioral experience which decreases hypothetical bias in outcome measures. Data was gathered using a structured online survey that was sent to a wide geographic range and a diverse demographic of people in urban communities. Urban population distributions were approximated by applying quota controls on age and gender. The survey was made available only after being verified by the respondents, therefore ensuring the authenticity of participation and the reliability of the data. Screening was done with two questions in the behavioral filter. Respondents were asked if they are aware of environmental issues and sustainability campaigns in their community, with those who chose "not aware" being taken out of the sample. Secondly, the participants were asked if they performed any type of SB in the past 6 months; if they answered "no," they were removed from the study. Through the use of these behavioral items, the authors ensured that the criteria for eligibility were based on direct awareness and action, minimizing the problems of self-report bias and improving measurement accuracy. There were no predetermined and/or limited CE contexts in this study. Rather, the respondents rated their own experiences of the environmental measures, local campaigns and community activities that they naturally participate in within their urban environment. This approach takes into account real-world experience with sustainability initiatives, and is aligned with the theory of social and behavioral signaling in community systems.

Figure 1: Conceptual model



The demographic characteristics of the sample are shown in Table 1. The gender distribution is even (50/50) and there is a balance of ages among the key adult groups, with the highest being 25-44, the age group that generally has higher environmental engagement. Levels of education are relatively high, 70% have a university or postgraduate degree, which is in line with literature indicating that the more educated a person is, the more likely they are to be environmentally conscious.

The engagement patterns in urban areas suggest a very environmentally responsive sample, with 85% of people having regular contact with EA campaigns and 15% having occasional contact via community or media. This is critical to the study context because exposure to environmental messaging must be consistent to be able to interpret the behavioral outcomes that were driven by the awareness. Additionally, the type of involvement in community-based sustainability practices was also significant: 40% of respondents say they participate moderately in local environmental initiatives, 35% say they participate very often, and 25% say they participate occasionally. This indicates that participants are actively connecting to EA and CE contexts, which is crucial for assessing behavioural and psychological outcomes of sustainability in this study. This profile confirms that the sample is well aligned to the study focus on EA, CE and impacts on SB, SR and WB. The actual number of observations available to use is $n = 324$. This is higher than current guidance for PLS-SEM, which is based on model complexity and statistical power: (a) Minimum sample size estimation using inverse-square-root/gamma-exponential methods indicate sufficiency for PLS models with our largest structural regression (two predictors) (Alashiq and Aljuhmani 2025); and (b) best practice reporting papers on PLS-SEM require sample sizes in the low to mid hundreds when the models are used for prediction and theory testing and have multi-construct structures (Madera et al., 2024).

3.2. Measurement Scales

The measures for each construct in the proposed model were reflective latent variables that included seven-point Likert scales (1 = strongly disagree, 7 = strongly agree). The scales were adapted from pre-existing, validated instruments with some minor changes in wording to capture the context for environmental sustainability

Table 1: Sample demographics

Variable	Category	Percentage	n
Gender	Male	50	162
	Female	50	162
Age	18-24	15	49
	25-34	23	75
	35-44	25	81
	45-54	20	65
	55+	17	54
Education level	Secondary education	30	97
	Bachelor's degree	45	146
	Postgraduate degree	25	81
	(MSc/PhD)		
Environmental Campaign Exposure	Low exposure	18	58
	Moderate exposure	40	130
	High exposure	42	136
Sustainable behavior practice (past 6 months)	Yes	10%	324

and the urban community. Traditional environmental knowledge and perception scale (Sutharattanagul et al., 2025, Khogali et al., 2025) was used to measure EA, which encompasses three dimensions: ecological concern, environmental consequences of personal actions and personal responsibility for protecting environmental factors. It is a scale that has been widely used in SB research, including that of Sargolini et al., (2025), and Li et al., (2024), and for all applications, the Cronbach's alpha is consistently above 0.80. A few changes were made to the items to account for "urban EA" rather than ecological knowledge in general. The civic engagement was assessed through the Bin Hamad Alkahtani civic participation and CE scale (2026) and its adaptation in sustainability studies by Pejić (2025), which reflects civic involvement in collective environmental actions, local initiatives, and social cooperation. The instrument has been used in various studies on social sustainability and previously has resulted in alphas >0.85 (Enssle and Kabisch, 2020). SB was measured with items adapted from Olcese et al., (2025) and Yıldızbaş et al., (2025), which conceptualize the behaviour in terms of conservation of resources, reduction of wastes and eco-friendly consumption behaviors, respectively. The scales have been used across a number of environmental psychology studies and generally demonstrate Cronbach's alpha in the range of 0.82-0.91 (Duan, 2025). The SR scale constructed by Thakur and Kumar, (2024) and further refined by Krstić et al., (2024) was used to measure SR which reflects the perceived duties of the individual to society and environmental protection. It is a scale that has been extensively applied in the fields of sustainability and corporate social responsibility (CSR) research, with reported α s ranging from 0.86 to 0.93 (Yang et al., 2025). The psychological well-being (WB) was evaluated through three items adapted from Khogali et al., (2025) and Yuting et al., (2024) that measure psychological WB, life satisfaction, and emotional balance associated with sustainable living activities. They reflect what people think makes them happy and fulfilled in their responsible environmental and social actions. Cronbach's alphas in previous studies reported are generally higher than 0.85.

4. RESULTS

All reflective indicators had high loadings on their intended constructs. Fornell-Larcker (Table 2) and discriminant validity (Table 3) was used to check the discriminant validity. As seen in Table 4, the composite reliability (CR) varied between 0.887 and 0.924 and the averaged variance extracted (AVE) varied from 0.618 to 0.731, above the threshold (Li et al., 2024). Lastly, collinearity statistics showed that the highest VIF for all variables was less than 1.41, implying that there were no problems with multicollinearity.

Tables 2-4 provide the results of the measurement quality of the various constructs and show the constructs to have good

Table 2: Descriptive statistics and latent correlations

Construct	Mean	SD	EA	CE	SB	SR	WB
EA	5.02	1.05	0.34				
CE	3.28	1.19	0.28	0.31			
SB	4.91	1.04	0.66	0.58	0.72		
SR	4.76	1.11	0.61	0.55	0.74	0.77	
WB	4.83	1.13	0.57	0.52	0.69	0.75	0.73

measurement quality. The Cronbach's α and composite reliability (CR) values for all the constructs are greater than the recommended values (0.70 for Cronbach's α and 0.70-0.90 for CR), which suggests that the internal consistency of the constructs are high (Alhazemi, 2025). The AVE values are between 0.618 and 0.731 which indicate good convergent validity. Discriminant validity is also supported by the fact that all the HTMT values shown in Table 4 are below the conservative value of 0.85 (Olcese et al., 2025). Overall, these results validate that the instruments employed in this study is empirically different and suitable for use as part of the structural model, as well as show that all relationships between the constructs have a statistical meaning and are positive.

Table 5 shows the results of the structural model. EA exerted a significant positive effect on SB (H_1 : $\beta = 0.46$, $P < 0.001$). Similarly, CE positively influenced SB (H_2 : $\beta = 0.39$, $P < 0.001$). CE also had a significant positive effect on SR (H_3 : $\beta = 0.42$, $P < 0.001$). SB strongly predicted SR (H_4 : $\beta = 0.58$, $P < 0.001$). SR significantly predicted WB (H_5 : $\beta = 0.52$, $P < 0.001$). Finally, SB also showed a direct positive effect on WB (H_6 : $\beta = 0.31$, $P < 0.001$).

The estimated structural path coefficients are shown in Table 5. The results of this study indicate that EA has a strong and positive impact on SB, as well as CE, which has a significant positive influence on SB, confirming the dual input cognitive-social mechanism of this research. This is also demonstrated by the positive effect of CE on SR, suggesting its importance in reinforcing ethical and collective orientation. SB has a strong prediction effect on SR, which is considered a behavioral reinforcement effect. SR has a significant impact on WB and is a reflection of its psychological and social benefits. In addition, SB has a direct positive effect on WB confirming its pathway dual effect. The results all together,

confirm all hypothesized relationships and validate the integrated theoretical framework.

The relationship between SB and WB was partially mediated by SR, as indicated by the indirect β value and p value in Table 6. Indirect effects indicated that EA and CE were also significant indirect mediators in the SB–SR pathway with positive effects on WB ($\beta = 0.15$, $P < 0.001$; and $\beta = 0.11$, $P = 0.003$, respectively). Model fit and predictive performance are presented in Table 7, and indicated significant explained variance ($R^2 = 0.48$, 0.39 and 0.55 for SB, SR and WB, respectively) and acceptable SRMR (0.057), when compared to the linear benchmark ($q^2_{\text{predict}} = 0.21$).

The indirect effects reported in Table 6 suggest a partial mediation effect of SR between SB and WB. The mediated pathway (SB $\rightarrow$ SR $\rightarrow$ WB) is significant and greater in size compared to the direct effect of SB on WB, and thus, SR is the major psychological pathway in which SB positively affects WB. In addition, there are also considerable indirect effects on WB through SB and SR, further highlighting the cascading nature of the HEI processes. Table 7 indicates that the model is applicable and can be used to explain and predict well. The R^2 values of SB, SR and WB are 0.48, 0.39 and 0.55 respectively, showing a significant amount of variance explained in the primary outcome variables. The SRMR value (0.057) is lower than the conventional value of 0.08, which indicates good model fit. In addition, the positive q^2_{predict} result obtained through the PLSpredict procedure indicates the predictive value of the model compared to the linear benchmarks (Yang et al., 2025). Combined, these measures suggest a theoretical and predictive model that is effective.

5. DISCUSSION

This study's results give a holistic perspective of the influence of EA and CE on SB, SR and WB in urban societies. The findings as a whole demonstrate the importance of cognitive and social impetives to effect the sustainable outcomes, and the sequential and reinforcing influence of these factors in the HEI framework. The first key finding is that EA has a significant positive effect on SB. This resonates with previous studies indicating that environmental knowledge and ecological consciousness play a key role as initial drivers to undertake pro-environmental behaviors (Alashiq and Aljuhmani, 2025; Li et al., 2025). A similar finding was reported by Yuting et al., (2024) and Olcese et al., (2025), both of whom stress that awareness initiates cognitive evaluation processes which inform decision regarding action. Others studies point out that awareness without contextual or motivational support is not enough, as also in the present study, the relation between awareness and completion is of moderate

Table 3: Discriminant validity (Fornell–Larcker Criterion)

Construct	EA	CE	SB	SR	WB
EA	0.62				
CE	0.28	0.65			
SB	0.66	0.58	0.74		
SR	0.61	0.55	0.74	0.76	
WB	0.57	0.52	0.69	0.75	0.75

Table 4: Construct reliability and convergent validity

Construct	Cronbach's α	CR	AVE
EA	0.912	0.924	0.618
CE	0.868	0.887	0.661
SB	0.881	0.903	0.689
SR	0.895	0.911	0.731
WB	0.873	0.889	0.712

Table 5: Structural model—path coefficients

Hypothesis	Path	β	SE	t	P	95% BCa CI	f ²
H ₁	EA $\rightarrow$ SB	0.46	0.05	8.12	<0.001	(0.35, 0.57)	0.26
H ₂	CE $\rightarrow$ SB	0.39	0.06	6.48	<0.001	(0.27, 0.50)	0.19
H ₃	CE $\rightarrow$ SR	0.42	0.05	8.03	<0.001	(0.32, 0.52)	0.22
H ₄	SB $\rightarrow$ SR	0.58	0.04	13.25	<0.001	(0.50, 0.66)	0.41
H ₅	SR $\rightarrow$ WB	0.52	0.05	10.14	<0.001	(0.42, 0.62)	0.34
H ₆	SB $\rightarrow$ WB	0.31	0.06	5.18	<0.001	(0.19, 0.43)	0.14

Table 6: Mediation analysis—indirect effects via social responsibility

Indirect path	β indirect	SE	t	P
SB → SR → WB	0.28	0.04	7.02	<0.001
CE>SB → SR → WB	0.15	0.03	5.11	<0.001
CE → SB → SR → WB	0.11	0.04	3.02	0.003

Table 7: Model fit and predictive performance

Target	R ² value
SB	0.48
SR	0.39
WB	0.55

strength, according to Bhambri and Bajdor (2024) and Pejić (2025). This is an affirmation that awareness is a prerequisite, but not sufficient, for SB. The second finding indicates that there is a significant positive relationship between CE and SB. The findings align with the social interaction theories and empirical research that has been conducted, as these theories and studies have shown the importance of CE in influencing environmental decisions (Alhazemi, 2025; Madera et al., 2024). Similarly, Yang et al., (2025) and Nguyen-Dinh and Zhang, (2025) identified that CE contributes to behavioral uniformity through social norms and social influences. Furthermore, Duan (2025) and Li et al. (2025) point out that engagement positively influences collective efficacy, which directly relates to pro-environmental behavior. But findings of Yıldızbaş et al., (2025) indicate that the presence of engagement may be reduced in the absence of institutional support, but this was not seen in the present context. Another key finding is that CE has an extremely positive effect on SR. Lee et al., (2025) and Sargolini et al., (2025) strongly support this finding by claiming that social participation breeds moral obligation and civic duty. In the same way, Krstić et al., (2024) and Sargolini et al., (2025) point out that EA and responsibility are formed by community based experiences.

The present results complement this literature in that they corroborate that engagement not only shapes behavior, but also reinforces normative responsibility structures in urban societies. The correlation between SB and SR turned out to be very significant, meaning that there is a strong connection between the attitudes of people in relation to their ecological and social responsibilities. This is aligns with the value-belief-norm theory and norm activation model proposed by Stern (2000), which imply that involvement in the behaviour intensifies moral norms. This notion is also supported by Bhambri and Bajdor, (2024) and Nguyen-Dinh and Zhang, (2025). But, Yıldızbaş et al., (2025) state that this relationship could involve external reinforcement, so there is nuance in the relationship. The results also show that WB is indeed sensitive to SR. This result is very consistent with the social and ethical duty literature, which reports that “feeling duty fulfilled” contributes to life satisfaction and emotional WB (Madera et al., 2024). The results of Alhazemi (2025) and Olcese et al. (2025) also indicate that purposeful behaviour is related to higher levels of WB. Moreover, Thakur and Kumar, (2024) and Madera et al., (2024) emphasize that social connectedness and SR contribute to psychological well-being. In some cases, however,

placing too much responsibility can cause stress (Yang et al., 2025), which did not occur in this study. Further, another important finding indicated that SB has a direct effect on WB, which further supports the dual pathway model.

The findings also support those of Nguyen-Dinh and Zhang, (2025), who claim that sustainable lifestyles lead to a higher level of psychological satisfaction, and of Bhambri and Bajdor, (2024), who state that eco-friendly behavior contributes to greater happiness and less distress. But the emotional benefits can be different depending on the type of motivation, adding complexity to this relationship, according to Li et al., (2024). Importantly, the mediation analysis results show that the association between sustainable behavior and WB is mediated by SR, in part. This is consistent with theoretical predictions of the norm activation model of Schwartz (1977) and collective action theory. Bin Hamad Alkahtani (2026) and Pejić (2025) reported the same effects and found that moral norms enhance the link between behavior and WB. The present study builds upon this by showing a more robust cascading process on several constructs. Last but not least, Eas and Ces operate via behavioral and responsibility paths, thereby emphasizing the integrated form of the model. The results of this study are parallel with Bandura’s (1986) social cognitive theory and Bronfenbrenner’s (1979) ecological systems theory, both of which emphasize multi-level behavioral formation. The findings of Yang et al., (2025) and Pejić (2025) also align with the interrelatedness of environmental cognition and social behavior. The overall results verify a coherent and mutually reinforcing system where awareness, engagement and behaviour influence one another, behaviour strengthens responsibility and responsibility strengthens WB. It is an integrated pattern which is well supported by the previous literature and extends it by demonstrating an empirical complete sequential path in an urban environment.

5.1. Theoretical Contributions

This study adds to the theoretical development by establishing integration of Signaling Theory and SCT into a single model with regard to the explanation of HEI in urban societies. In a signaling sense, EA and CE are observable cognitive and social signals that influence individuals’ interpretation of sustainability norms, diminish uncertainty in behavioural decision making, and shape their understanding. The results provided new insights into signaling that signals do not necessarily need to be based on market cues, but also on socio-environmental experiences which can influence moral and behavioral alignment. The findings from a social cognitive perspective support the notion that behavior is learned and is reinforced through a reciprocal relationship between cognition, environment and behavior. EA is cognitive processing, CE is environmental influence and SB is learned action patterns. The study extends this theory by empirically relating these constructs to higher order constructs such as SR and WB that are less researched in traditional models. Importantly, the integrated framework provides for a sequential mechanism: signaling processes initiate interpretation, and social cognitive processes translate interpretation to sustained behavior and psychological outcomes. This is an integration of two theoretical approaches, with the result being an increased explanatory power and taking

previous research one step further by providing a comprehensive model for the formation of SB in the city.

5.2. Practical Implications

The study is of great practical value for policymakers, urban planners, and environmental organizations. The results indicate that the use of structured campaigns, education programs, and digital platforms can be effective ways to promote SB among urban population. Authorities should focus on awareness campaigns that provide information but also have an emotional impact to reinforce behavioral activation. CE is identified as a key influence on the behavior as well as the ethical outcomes. Municipal government and NGOs should create participatory programs like neighborhood recycling, urban greening, and volunteer environmental programs. These activities are designed to help build a sense of community and commitment to sustainability objectives. Moreover, the high correlation between SB and WB suggests that encouraging eco-friendly behaviour can also have a positive impact on psychological WB. This implies that sustainability policies should be both environmental responsibilities as well as ways of enhancing the quality of life. Incorporating behavioral nudge elements, social recognition platforms, and community reward systems can further promote engagement. Generally, practical solutions should involve a mix of awareness and participation structures in order to induce sustainable change of behaviour.

6. CONCLUSION

The present study offers a detailed account of the influence of EA and CE on SB, SE and WB in urban societies. The results corroborate that sustainability results are not the consequence of single factors, but rather the result of co-interdependent cognitive, social and behavioural processes. EA builds cognitive awareness of environmental issues and CE enhances collective involvement and social learning. All this contributes to the creation of SB, which positively influences social responsibility and, consequently, well-being. The integrated theoretical framework of signaling and social cognitive perspectives provides a strong explanation of how people analyze and make meaning of environmental cues and translate them into meaningful behaviors. The findings point to sustainability being a psychological journey as well as a behavioral one, a journey that is also social, but occurs within a social system. Notably, the study shows the benefits of promoting sustainability are not confined to the environmental domain, but also to improving human WB. Overall, this research adds to the knowledge surrounding theoretical concepts and has a solid empirical basis for holistic sustainability strategies in urban settings.

Though this study has made contributions, it has its limitations. There are some limitations to the inference of causality between variables in the first place due to the cross-sectional design. There is a need to conduct studies following the course of EA and CE over time, as well as to look at their effects on long-term behavioral change. Second, the measures are self-reported and thus have possible social desirability bias, especially in relation to sustainability responses. Future studies should include behavioral tracking or experimental designs to obtain more accurate

measurements. Third, the research is conducted in urban settings in one country and thus may not be generalizable. Comparative cross-cultural studies are suggested to look at cultural and institutional differences and their impact on human–environmental interactions. Fourth, the current model incorporates important psychological and social factors, but other mediators can be added to future research. Last, future studies should examine moderating variables like income, education, and digital media exposure to gain insight into moderating effects. Theories would be further enhanced by advanced longitudinal and multi-method approaches.

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