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Adopting Green Behaviors in the Construction Sector: The Role of Behavioral Intention, Motivation, and Environmental Consciousness

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Abstract: Non-renewable resources have been becoming scarcer on a global scale by the day, while energy demand has been rising exponentially. To tackle this problem, organizations worldwide have been striving to learn and adopt green practices to sustain themselves and benefit society. In this context, the current study aims to identify and understand the critical factors that encourage individuals working in construction organizations to adopt green behavior. The current study surveyed 121 top managers working in 150 construction firms deployed across Pakistan. It was found that knowledge and awareness significantly contributed to green behavioral adoption. Additionally, behavioral intention, motivation, and environmental consciousness have been found to positively mediate the impact of knowledge and awareness on green behavior adoption. The findings of this study highlight the important factors to consider when developing future policies. Moreover, the research provides a stepping stone for future researchers to evaluate other sectors and regions in similar contexts to draw comparisons and identify areas for improvement.

Keywords: behavioral intention; construction; environmental consciousness; green behavior; motivation; sustainability

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1. Introduction

In recent years, public concern and awareness about the environment and its protection have grown significantly [1,2]. The public's concern and awareness about the environment and its safety have significantly increased in the last decade, fueled by the growing concern about addressing climate change. As the natural environment continues to deteriorate and resources become scarcer, organizations around the world are proactively working to increase their environmental awareness and responsibility [3]. Considering this, companies are now adapting their business pursuits to prioritize environmental safety and evaluate and apply appropriate natural resource management practices while considering their availability [4].

In the ever-changing world, organizations strive to support their employees on every hierarchical level to be active contributors toward organizational goals, empowering them to apply organizational practices more effectively and efficiently. With this in mind, modern

organizations are now more focused on their employees' role in terms of protecting the environment. As a result, environmental compatibility is now one of the critical considerations for corporations in the twenty-first century [5].

Numerous approaches have been observed to motivate and urge staff to learn and adopt such practices [6]. One of these techniques is to educate workers about the potential effects of their jobs on nature and how to take counteractive action against environmental disasters. Additionally, organizations enable their employees to learn and adopt green behavior through training and awareness programs [7]. As a result, several studies have reported increased active personnel in respective organizations performing a wide range of activities associated with pro-environmental behavior [8].

Similarly, employees' behavioral intentions, knowledge, and awareness have been recognized as the principal determinants of green behavior adoption, leading to environmentally sustainable economic development for any organization, regardless of scale [9]. The adoption of green behavior by employees plays a vital role in an organization's prosperity since such behavior enhances the overall organizational performance and outlook in the relevant industry [10,11]. Once realized on a broader scale, behavioral intentions, as well as knowledge and awareness, bring about a collective impact of all individuals working towards common green behavior goals, leading to the accomplishment of corporate ecological adoptions.

With increased global attention towards environmental protection, firms are changing their business strategies to more environmentally friendly approaches. Some examples include utilizing renewable natural resources for their business production, reducing dependencies on non-renewables, and using reusable materials. Similarly, modern companies focus on creating pro-green communities [4]. In the same spirit, measures should be taken to promote the self-awareness and responsibility of managers in creating an eco-friendly environment within and outside an organization. To successfully enable an organization to move towards green advancement, management and representatives must be dynamic and accepting of environmentally friendly initiatives [7]. The ultimate objective of environmental policies is to establish regulatory systems that encourage both societal and individual behavior changes while considering the underlying motivations that drive conservation behaviors and the obstacles that may impede these actions [12].

Several studies have indicated a relationship between factors such as green awareness, shared green vision, green leadership, environmental attitude, green commitment, and pro-environmental behavior. These factors have been assessed separately to understand the green behavior of employees for a sustainable environment and development [6]. Relevant findings revealed that knowledge and awareness are key drivers of green behavior [13]. While several research studies have examined employees' adoption of green behavior, there is a need for more empirical data to generalize the results. Specifically, it is important to understand how various factors influence employees' green behavior. Although some studies have focused on certain factors, there is a lack of empirical research on the association between an individual's motivation and their green behavior [14]. Among the relevant studies, Safari, Salehzadeh, Panahi and Abolghasemian [6] provided useful insights; however, they did not study the direct relationship or influence of environmental knowledge and awareness on an individual's willingness to adopt green behavior.

Similarly, Blok, et al. [15] were among the first researchers to implement the Theory of Planned Behavior (TPB) in the context of workplaces and green behavior. However, they did not find a significant relationship between the intention to act and the green behavior of individuals. Based on these conceptual research gaps, more studies are needed to explore this relationship in detail. Keeping in view of the discussion above, the objectives of this study are as follows:

1. RO1: To evaluate the direct effect of knowledge and awareness on adopting green behavior in an organization.
2. RO2: To study how behavior intention acts as a mediator while considering the impact of knowledge and awareness on adopting green behavior.

3. RO3: To investigate how motivation acts as a mediator while considering the effect of knowledge and awareness on adopting green behavior.
4. RO4: To gauge the mediating role of environmental consciousness while considering the effect of knowledge and awareness and green behavior adoption.
5. The current study aims to determine whether behavior intention, motivation, and environmental consciousness act as effective mediators in gauging the direct relationship between knowledge and awareness and green behavior among employees at various construction sites in developing countries. It is important to consider that developing nations are at a crossroads of experimenting and adopting new technological trends [16,17]. Therefore, it will be interesting to observe the adaptability of sustainable practices in one of the leading development sectors of the country [18,19]. The key objective of this research is to examine the potential influence of environmental knowledge and awareness on green behavior while considering the mediating effects of behavioral intentions, motivation, and environmental consciousness. The results of this study aim to provide practical implications for organizations to enhance their employees' green knowledge and awareness and motivate them to adopt environmental practices for sustainable development.

The following sections will provide detailed insights into developing the theoretical framework and exploring each variable independently and in a correlational perspective by reviewing the existing literature and formulating research hypotheses. Subsequently, the relationships among the research variables will be statistically analyzed for their potential significance. Finally, the research results will be discussed in relation to prior studies and their relevance in the current era.

2. Theoretical Framework

The continuous and rapid spread of environmental concerns, associated sustainability challenges, and growing consumer awareness of environmental degradation have intensified discussions about green consumption. However, as the sustainable movement gains significance, the focus on green consumption and conservation has mainly been on behavioral aspects in developing countries [20–22].

Classifying relevant theories used in research on green behavior involves combining various strategies, potential factors, and contextual interpretations [23]. However, considering the multiple factors in promoting green behavior, a more comprehensive approach can be created by synthesizing various pro-environmental theories. In the present research study, the Theory of Planned Behavior (TPB) has been used, in association with knowledge and awareness, to examine the subjective beliefs that anticipate the intentions of purchasing energy management systems and to promote the idea of adopting green behavior on a broader scale.

2.1. Theory of Planned Behavior (TPB)

The mainstream economics approach, based on utilitarian philosophy, may not take into account the potential impact of attitudes and social dynamics on environmental behavior. However, a study conducted by [22] has indicated that many respondents engage in environmental behavior inconsistent with economic theory. To address this gap, the Theory of Planned Behavior (TPB) has been widely recognized as one of the most prominent theories in social psychology [24]. Essentially, the TPB proposes that behavioral intentions and the factors immediately preceding behavior are influenced by three psycho-social elements: individuals' attitudes towards adopting the behavior of interest, subjective norms, and perceived behavioral control.

Behavioral intention is "an individual's subjective probability of participating in a behavior" [25]. Attitudes refer to "an individual's overall evaluation of an object, person, or place and reflect positive or negative feelings about performing a particular behavior" [26]. Subjective norms refer to "the social influence exerted by important others (such as family and friends) on an individual's decision-making" [26]. Perceived behavioral control is "an

individual's perception of the ease or difficulty of performing a specific behavior" [27]. In line with the TPB, individuals with more positive perceptions of the outcomes associated with a behavior, greater social approval, and more control over the behavior are likely to have stronger intentions to engage in that behavior. Moreover, a stronger intention to perform a behavior is often indicative of a higher likelihood that an individual will actually engage in the behavior. Thus, the TPB is a useful tool for determining intentions and behaviors in various fields, such as environmental economics and behavioral studies [28–30].

TPB provides a theoretical framework for predicting behavior, supported by extensive research in different behavioral domains. Concerning the TPB theory, intentions to perform a behavior are considered the most crucial precursor to the actual behavior [31]. The aforementioned intentions are primarily the result of the combined effect of attitudes towards the behavior and subjective norms (beliefs that indicate the importance placed on the behavior by others or if others engage in the behavior themselves) and the perceived behavioral control over the behavior. Perceived behavioral control is sometimes also regarded as a direct predictor of an individual's behavior.

The Theory of Planned Behavior has been effectively applied to many areas of pro-environmental behavior, including the sustainable consumption of available resources [32], the recycling of already utilized resources and reusing of the disposed of items [31], the inclination to pay for a green environment [30], and the green behaviors of individuals [33]. Considering this, TPB comes into play in designing educational interventions tailored for specific groups.

The Theory of Planned Behavior (TPB) has been widely applied to pro-environmental behavior (PEB), among other adoptions and applications, focusing on an individual's self-interest and associated reasoned action. The theory's core premise is built upon PEB, which requires the intention to engage in such behavior, and favorable attitudes toward green behavior influence this intention. TPB proposes two approaches to achieving PEB: subjective norms, which reflect the expectations of significant others, or social pressure and perceived behavioral control, which reflects the belief in one's ability to perform the intended behavior [27].

2.2. Green Behavior

Over the last two decades, much research in the fields of behavior and environmental studies has focused on issues related to nature, including environmental or climate change [34]. Concerning the global degradation of nature, societies are faced with the challenge of reducing their environmental impact. This can be achieved, for example, by reducing energy and water consumption, shifting to sustainable energy resources, adopting green behavior at work, and striving to achieve sustainable environmental goals by encouraging employees to adopt greener lifestyles [35,36].

Behavioral researchers emphasize the determinants of environmentally friendly practices, including the underlying motivations and drivers of these actions. Similarly, policymakers have been investigating the design and description of interventions that promote sustainable lifestyle choices in societies [37]. The ultimate goal of these environmental strategies is to promote effective management mechanisms that can lead to voluntary behavior change at both the cultural and individual levels. Therefore, a key consideration is the primary motivations that drive conservation behavior and the constraints that may hinder the performance of these actions [12]. Subsequently, promoting eco-friendly practices requires developing strategies tailored to address the constraints associated with these practices. Furthermore, these strategies aim to improve the corresponding mindsets for these practices throughout the project lifecycles [34,38,39].

The Sustainable Development Goals (SDGs) are closely related to the essence of the present research, as they aim to address the global challenges of environmental sustainability and promote sustainable development. The focus of the manuscript on reducing environmental impact through sustainable lifestyle choices and promoting conservation

behavior aligns with several of the SDGs, including SDG 7 (affordable and clean energy), SDG 12 (responsible consumption and production), and SDG 13 (climate action). The SDGs provide a framework for global action on these issues and emphasize the importance of individual and societal behavioral change in achieving sustainable development goals. Therefore, the strategies and interventions discussed in the manuscript can be viewed as contributing towards the implementation of the SDGs and promoting a sustainable future for all [3,5,23].

2.3. Knowledge and Awareness

As indicated by Davenport et al. [40], knowledge itself has been defined as 'the fact or condition of knowing something with familiarity gained through experience or association'. Some researchers define knowledge as a person's understanding of data based on how closely it is related to their own experiences, abilities, and capabilities. Likewise, awareness is defined as an emotional capacity to perceive and focus on the presence of an object and its attributes [41]. Ecological knowledge represents an individual's information and awareness of environmental issues and associated aspects [42]. Then again, ecological awareness refers to "the information and concerns about the effect of people's practices on the earth" [2]. In light of a few examinations [43], while using information and awareness interchangeably in specific settings is possible, considering the scope of the current research, ecological knowledge and awareness have been treated as a singular concept.

Green knowledge is "the technique for arranging ecological conditions in practical equality through financial and social advancement" [44]. Studies have decided on various factors influencing ecological conduct. For example, Jamison [44] showed that knowledge significantly influences a person's decision-making. Individuals generally avoid situations that they are not knowledgeable about.

Researchers argue that since individuals have more know-how regarding ecological problems, they tend to spend more money on environment-friendly products [45]. In addition, providing more information on ecological issues can increase individuals' concern and awareness [42,46,47]. Many researchers have recognized ecological awareness as understanding the influence of a person's conduct on the environment. Ecological knowledge and the inclination towards actual practices are the most significant factors concerning an individual's ecological awareness [42,48].

2.4. Motivation

The concept of green behavior in the construction industry has evolved from traditional methods to a more sustainable approach to physical development. However, the complex nature of project delivery and barriers to implementing green behaviors make this transition difficult to achieve. To accelerate this change, motivation is essential and is primarily driven by individual-level motivations of project participants rather than group- or organizational-level motivations [49]. One example of individual-level motivation is a desire for environmental protection and adherence to government policies and regulations. Additionally, government incentives, such as rewards for developing green behaviors, may influence project participants. Even though this is an individual-level motivation, the external influence of government incentives can play a role in encouraging green behavior [50]. Studies have also indicated that project participants are motivated by the functional benefits associated with green behaviors, such as energy and water efficiency and improving indoor environmental quality. This underscores the significance of comprehending and addressing individual-level motivations to successfully encourage the adoption of green behaviors in the construction industry [51].

Considering this, motivations-based theory [52] shows how extrinsic factors can crowd out motivations (such as monetary rewards). Motivation is an internal force that drives individuals to undertake activities or tasks. These internal motivators reflect personal beliefs and have been linked to cognitive dissonance theory, which posits that people have an innate need to ensure that their beliefs and behaviors align. When these beliefs are

incongruous or conflicting, it leads to disharmony, which people tend to avoid. While motivation is not solely dependent on external rewards or penalties, an individual's belief systems drive it. However, external factors can also influence it. In adopting green behaviors, individuals must realize the impact they are making towards creating a more livable world, as this can lead to adopting similar patterns on a societal scale.

2.5. Behavioral Intention

As suggested by Roeck [53], employees' green intentions refer to their participation in green behaviors, such as taking actions to work in an environmentally conscious manner. The Social Information Processing Theory posits that an individual's social context and surroundings can influence their attitudes and behaviors. Following this theory, it can be assumed that an employee's perception of the work environment may affect their intentions and actions. Unfortunately, there is a lack of literature on the green behavioral intention of employees [54]. According to Roeck [53], an individual's intentions and actions are primarily determined by their cognitive processing of information cues from their work environment. This statement is based on the Social Information Processing Theory, which posits that an employee's immediate social context significantly influences their attitudes and behaviors. Employees adopt behaviors they perceive as appropriate in the workplace by interpreting the cues they receive from their work environment.

The perception of an organization's green behavior initiatives indicates how employees will behave. This is because employees interpret the company's programs and understand the expected behavior in the workplace, which increases the likelihood of participating in supportive actions [53,55]. Furthermore, employees who perceive their organization as engaged in environmentally conscious programs exhibit positive behavior intentions and demonstrate increased environmentally friendly conduct at work [56].

3. Hypotheses

Based on the pertinent literature, hypotheses are developed that are presented and discussed below.

3.1. Influence of Knowledge and Awareness on Green Behavior

Recent studies have focused on environmental knowledge and awareness [43]. The impact of knowledge on promoting green behavior has been demonstrated by researchers [6,57]. Proper environmental knowledge and analysis can prevent the failures of green projects [58].

A good understanding of environmental issues is necessary for individuals to address green behavior requirements [45]. Typically, individuals will avoid situations that they are unfamiliar with. However, if a person has sufficient knowledge of environmentally friendly behaviors, they are more likely to be aware of them and more conscious of their environmental impact [42]. Individuals aware of environmental issues are more likely to make behavioral changes in support of green initiatives [59]. Environmental knowledge, attitudes, mindsets, and willingness to engage in environmentally friendly practices are the most significant components of individual environmental awareness. These elements are influenced by deliberate and positional factors and play a crucial role in shaping an individual's environmental consciousness [42]. Green behavior is influenced not only by internal factors like knowledge and attitudes but also by external factors like social norms and cultural practices [60] and is significantly influenced by the encompassing conditions. For example, external factors, such as family, friends, neighbors, and educational experiences, account for up to 80 percent of an individual's environmental awareness within their community [42]. Therefore, a strong understanding of environmental issues can positively impact employees' willingness to engage in green behaviors. In addition, forming a personal connection to environmental causes often necessitates a certain level of knowledge and comprehension of relevant topics [10].

Research suggests that environmental awareness, concerns, and knowledge all motivate individuals to engage in environmentally friendly behaviors [61–63]. Individuals

who possess greater knowledge of environmental concerns, such as repurposing discarded materials, tend to exhibit more sustainable and eco-friendly behaviors [64]. Enhanced environmental knowledge among employees has positively impacted the acceptance of green behavior. For example, individuals and companies with greater environmental knowledge are more inclined to purchase eco-friendly goods, consume environmentally friendly products, and engage in recycling efforts [45]. Other studies have shown that knowledge and awareness of recycling programs are crucial to promoting environmentally friendly behaviors among staff members [65]. Greater awareness of environmental issues and an understanding of the importance of eco-friendly practices can motivate individuals to engage in green behavior more actively [10]. The importance of having a strong understanding of environmental issues is evident in the actions taken by individuals to promote sustainability. As such, the initial hypothesis of this study is that environmental awareness and knowledge exert a significant influence on environmentally conscious behavior:

H1. *Green knowledge and awareness are positively related to green behavior.*

3.2. Knowledge and Awareness Influencing Green Behavior through Behavioral Intention

Environmental knowledge and awareness pertain to information concerning the impact of human actions on the natural environment [10]. Information is an individual's understanding of data derived from personal experiences, skills, and abilities. On the other hand, "awareness" refers to an emotional ability to perceive and concentrate on the presence of an object in a particular environment and its related characteristics [41]. Awareness may be seen as a process that arises from acquiring knowledge and ongoing learning [66,67]. Both knowledge and awareness are used to refer to the understanding and mindfulness required to recognize environmental issues and develop solutions for them [42]. Environmental awareness is defined by an individual's beliefs and attitudes towards eco-friendly practices and issues. Numerous studies have demonstrated a correlation between this ecological awareness and environmentally conscious behavior. For example, Chan [45] concluded that ecological awareness greatly affects green conduct.

Behavioral intention refers to the level of eagerness and effort individuals are willing to put into performing a behavior that is outside of their usual behavior. The individual's beliefs determine this intention about the potential outcomes of the behavior and the perceived costs and benefits, which can result in a positive or negative attitude toward the behavior. In socio-psychological studies, intention is considered the best predictor of an individual's actual behavior [68]. Numerous studies, including [24,68], confirmed its predictive role for real conduct [69] expressed that intentions are affected by attitudes, subjunctive standards, and perceived conduct control.

The level of information people have about environmental and sustainability issues is important because it can be translated into actionable steps [70,71]. Normally, individuals tend to avoid circumstances that they lack sufficient knowledge about. On the other hand, people who possess more knowledge about environmental issues are more likely to spend their money on eco-friendly products [45]. However, extended knowledge and information about ecological issues might add to individuals' concerns and awareness [42].

Environmental information, values, mindset, and commitment to genuine practices, which are influenced by intentional and situational factors, are considered the most significant factors contributing to an individual's level of environmental awareness [45,72]. The studies by [42,60] propose that a person's green conduct can be affected by various ecological inspirations, such as knowledge, awareness, and concern. For instance, people with higher ecological awareness are more likely to buy products with eco-friendly labels and to eat organic foods. Furthermore, workers are more likely to exhibit green behavior when they are sufficiently aware of issues related to biological degradation and the importance of eco-friendly practices [10]. Based on the above, the second hypothesis of this study is proposed as follows:

H2. *Green knowledge and awareness positively influence green behavior through behavioral intention.*

3.3. Knowledge and Awareness Influencing Green Behavior through Motivation

Research reveals that motivation is positively associated with environmental practices [73]. Motivated green behavior is self-initiated and self-sustaining, resulting in feelings of commitment that enhance effort and performance. However, employees may not consistently exhibit motivated green behavior and may be inconsistent [74]. Overall, the direct connections between motivation and green behavior rely upon the type of green behavior [75]. Basic and advanced green behaviors require different levels of demands from employees. Basic green behaviors, such as reusing and conserving energy, require minimal activity, creativity, and innovation. On the other hand, advanced green behaviors, such as becoming more knowledgeable about environmental issues and finding better ways of working, require initiative, higher-level cognitive functioning (e.g., innovation and problem-solving), and ongoing employee commitment [75,76].

The rapid progress in environmental knowledge is expected to result in increased environmental awareness, which will enhance employee motivation to take a more active and conscientious approach toward environmental issues. This will lead to pro-environmental behavior. Being environmentally conscious entails being informed about environmental issues, having the ability to take actions that positively affect the environment, and being mindful of environmental problems and their underlying causes. According to [77], environmental awareness is a precursor to pro-environmental behavior and an environmentally conscious individual possesses a strong sense of responsibility towards green behavior. When this sense of responsibility is coupled with the significance of life, a sense of purpose, and a sense of belonging, it can result in a moral commitment and a personal inclination to care about the environment deeply. According to [78], employees are more likely to exhibit pro-environmental behavior when they know about environmental issues, biological degradation, and the significance of eco-friendly practices. Kollmuss [59] argued that motivation and engagement in the workplace can create a natural enthusiasm and emotional attachment to pro-environmental behavior. However, the impact of such efforts will be weakened if employees lack knowledge and motivation about the harmful effects of environmental degradation and do not consider the dangerous consequences of biological destruction.

Motivation is a key factor that determines what employees do, how they do it, and how much effort they put into it. Research has shown that motivation can increase employees' adoption of green behaviors [75]. Motivated workers may engage in green behavior due to external factors, such as seeking rewards or avoiding penalties [79]. Some companies based in the U.K. have implemented financial incentives, and there have been reports of a significant impact on employees' willingness to protect the environment [80]. Motivated workers have somewhat disguised outer messages; they accept they must perform environmentally friendly tasks and feel guilty if they do not [81]. Motivated employees adopt green behavior to satisfy their awareness qualities, such as their knowledge of the significance of sustainability. Naturally motivated employees view green behavior as enjoyable, interesting, or challenging (e.g., finding satisfaction in streamlining a process to reduce waste). Based on the above, the third hypothesis of this study is proposed as follows:

H3. *Green knowledge and awareness positively influence green behavior through motivation.*

3.4. Knowledge and Awareness Influencing Green Behavior through Environmental Consciousness

Organizations have a social obligation to implement and publicize their green activities to different stakeholders, including customers, workers, shareholders, authorities, and the community at large. In recent years, research has focused on the role of environmental awareness and related issues in promoting green behavior. For example, a study revealed that 66% of the U.S. population would pay more for environmentally friendly products and preferred adopting sustainable practices [82]. Another study investigated the link between green behavior and environmental consciousness and revealed a strong

positive correlation between environmental consciousness and the degree of environmental education. The findings indicated that environmental education was the primary factor in adopting eco-friendly behavior [83]. A comparable study conducted in the U.K. showed that users' attitudes toward environmental concerns shifted positively [51]. The authors hypothesized that personality traits and social norms were the primary predictors of environmental behavior.

According to Thiengkamol [84], gaining environmental knowledge and awareness can encourage individuals to practice sustainable behavior. Furthermore, as people become more knowledgeable about environmental issues and more aware of their surroundings, they are empowered to think empathetically, take responsibility, conserve and care for natural resources, and share their knowledge and awareness of green behavior with their family and others, to motivate them to become more environmentally conscious. Based on this, the fourth hypothesis of this study can be formulated as follows:

H4. *Green Knowledge and awareness positively influence green behavior through environmental consciousness.*

Based on the review of literature on the variables of interest and their inter-relationships, multiple hypotheses have been proposed, which can be represented graphically as shown below (See Figure 1).

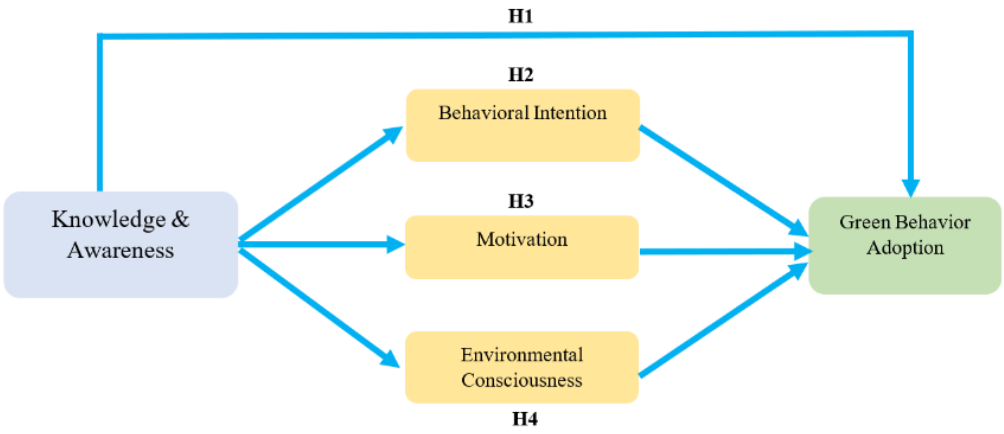

Figure 1. Proposed Hypotheses.

4. Methods, Materials and Results

Determining the appropriate sample size is an essential aspect of any research design. When using partial least squares structural equation modeling (PLS-SEM), researchers typically rely on Cohen's [85] guidelines to establish an 80% statistical power. These guidelines specify sample sizes needed to detect 10%, 25%, and 50% of variance in the endogenous construct of a research model, at significance levels of 1%, 5%, and 10%. The guidelines also account for model complexity, which is determined by the maximum number of arrows pointing to any construct in the research model. In the current study, the research team aims to detect a minimum of 10% variance in the endogenous construct with a 95% confidence interval when a maximum of four arrows point at the criterion variable of green behavior adoption. Based on Cohen's [85] rule, at least 113 responses are required to estimate statistical relationships at 80% statistical power. Therefore, the survey was distributed to 150 top- and middle-level managers in 135 firms, with 121 usable responses collected after discarding 14 responses due to missing data or no response. The questionnaire used in the study was based on predefined queries from prior studies [5,28,43], with three items adapted for behavioral intentions, six for environmental consciousness, three for green behavior, three for green knowledge awareness, and three for motivation. Responses were recorded on a 5-point Likert scale, with 1 indicating strongly disagree and 5 indicating strongly agree. The collected data was then analyzed using SMART PLS 3.0, a statistical

tool that evaluates complex research models with greater accuracy and comprehensiveness. The significance of the proposed hypotheses was tested through statistical data analysis.

4.1. Data Analysis

The current study adopted the 'Structural Equation Modeling' (SEM) technique to evaluate the collected data and then make deductions about it [86]. The SEM technique allows for analyzing the relationship between observed and latent variables, making it well-suited for studies with complex relational structures and producing accurate projections. As Fornell [87] argued, SEM is a variance-based approach to structural equation modeling used to evaluate hypothesized relationships attributed to a structural model. Similarly, [88] suggested SEM as the most suitable approach to gauge prediction-based relations to build theory. Further, [89] extended their support for the SEM method by claiming it as a suitable approach to structural models associated with small datasets or those with non-normal distribution.

4.2. Measurement Model Estimation

The measurement section is a part of the model that assesses the relationship between the latent variables, which are independent variables, and their respective measures. In the context of the SEM approach, three criteria are used to estimate the measurement model: internal consistency, convergent validity, and discriminant validity. The reliability of the constructs is assessed based on the consistency of responses using measures such as Cronbach's Alpha. Another measure provided by the PLS-SEM to assess the internal consistency reliability of the constructs is Composite Reliability. Sarstedt [86] concluded that the reliability of the constructs under study can be measured by a value between Cronbach's Alpha and Composite Reliability. Both criteria can be considered as potential indicators of construct reliability. Convergent validity is evaluated through the "Average Variance Extracted" (AVE) criterion, while discriminant validity is determined through "Cross-Loadings," "Fornell-Larcker Criterion," and "Hetero-trait-Monotrait Ratio of Correlations" (HTMT).

The threshold associated with the constructs' reliability measures, such as Cronbach's Alpha and Composite Reliability, and their respective indicators, is generally considered to be 0.7 or higher. This indicates that the measures are reliable and can be considered as valid indicators of the constructs under study [90]. Considering this, the values of the constructs and their respective indicators for the current study were above 0.7 (See Table 1), justifying the adopted queries as reliable. Further, in their research, Hair [91] concluded that the outer loadings associated with the indicators should be 0.70 or above to be considered for convergent validity. However, various studies have indicated including the indicators of constructs valued between 0.4–0.7 if their inclusion is crucial for the associated content validity [90]. Further, there is an absolute consensus upon deleting the indicators with outer loadings valued lower than 0.40. Taking that into account, all remaining indicators were included in the SEM-based statistical evaluations (See Table 1).

The AVE is a measure of the variance that is captured by the indicators of a construct. When the AVE is 0.50 or higher, the indicators capture more variance than by measurement error, which is a sign of convergent validity. In this study, all of the included indicators were found to have individual AVE values above the prescribed threshold, indicating that they were convergently valid (See Table 1).

Table 1. Constructs Reliability and Validity.

Indicator	No. of Items	Outer Loadings	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Behavioral Intentions	3		0.77	0.77	0.78	0.54
BI1		0.73				
BI2		0.75				
BI3		0.72				
Environmental Consciousness	6		0.70	0.72	0.80	0.50
ECON1		0.67				
ECON2		0.69				
ECON3		0.73				
ECON4		0.59				
ECON5		0.66				
ECON6		0.62				
Green Behavior	3		0.70	0.76	0.79	0.56
GB1		0.80				
GB2		0.84				
GB3		0.57				
Green Knowledge Awareness	3		0.78	0.78	0.88	0.54
KN&AW1		0.77				
KN&AW2		0.76				
KN&AW3		0.67				
Motivation	3		0.71	0.72	0.84	0.64
MOT1		0.84				
MOT2		0.83				
MOT3		0.72				

Note: B.I.: Behavioral Intentions, ECON.: Environmental Consciousness, G.B.: Green Behavior, KN&AW1: Green Knowledge Awareness, MOT: Motivation.

Three criteria are used to evaluate the discriminant validity of the constructs and their indicators: the Fornell-Larcker Criterion, Cross-Loadings, and the Hetero-trait Mono-trait Ratio (HTMT). Of these three, the HTMT is considered a more precise measure to evaluate discriminant validity compared to the other two [90]. Based on the three discriminant validity criteria, it was found that all the constructs and their indicators were valid (as shown in Tables 2–4). Furthermore, the criterion for discriminant validity states that the mono-trait correlations should be higher than the hetero-trait correlations, which is reflected in an HTMT value of less than 1.0. In this study, all constructs had an HTMT value of 0.90 or lower, indicating discriminant validity. Therefore, it can be concluded that the chosen research items accurately reflected the variables they were meant to represent.

Table 2. Fornell-Larcker Criterion.

Indicator	Behavioral Intentions	Environmental Consciousness	Green Behavior	Green Knowledge Awareness	Motivation
Behavioral Intentions	0.73				
Environmental Consciousness	0.33	0.64			
Green Behavior	0.27	0.39	0.75		
Green Knowledge Awareness	0.29	0.36	0.29	0.74	
Motivation	0.17	0.32	0.32	0.13	0.80

Table 3. Cross Loadings.

Items	Behavioral Intentions	Environmental Consciousness	Green Behavior	Green Knowledge Awareness	Motivation
BI1	0.73	0.25	0.16	0.22	0.11
BI2	0.75	0.27	0.19	0.21	0.09
BI3	0.72	0.21	0.23	0.21	0.17
ECON1	0.19	0.67	0.30	0.23	0.19
ECON2	0.26	0.69	0.31	0.27	0.22
ECON3	0.19	0.73	0.24	0.26	0.26
ECON4	0.15	0.59	0.26	0.23	0.17
ECON5	0.30	0.66	0.23	0.22	0.24
ECON6	0.20	0.42	0.10	0.14	0.16
GB1	0.27	0.29	0.80	0.27	0.26
GB2	0.23	0.38	0.84	0.26	0.24
GB3	0.05	0.17	0.57	0.08	0.24
KN&AW1	0.19	0.30	0.29	0.77	0.22
KN&AW2	0.22	0.22	0.21	0.76	0.05
KN&AW3	0.22	0.28	0.13	0.67	-0.01
MOT1	0.15	0.30	0.28	0.12	0.84
MOT2	0.12	0.20	0.21	0.15	0.83
MOT3	0.14	0.26	0.27	0.04	0.72

Note: B.I.: Behavioral Intentions, ECON.: Environmental Consciousness, G.B.: Green Behavior, KN&AW1: Green Knowledge Awareness, MOT: Motivation.

Table 4. Heterotrait-Monotrait Ratio (HTMT).

Indicator	Behavioral Intentions	Environmental Consciousness	Green Behavior	Green Knowledge Awareness	Motivation
Behavioral Intentions					
Environmental Consciousness	0.54				
Green Behavior	0.42	0.56			
Green Knowledge Awareness	0.50	0.55	0.47		
Motivation	0.26	0.45	0.50	0.23	

4.3. Structural Model Estimation

Structural models represent the relationship between latent variables and quantify their strength and significance. Structural model estimation involves several criteria, such as the Coefficient of Determination (R2), Effect Size (f2), Path Coefficients, and Level of Significance (*p*-Value). This study evaluated the direct effects of green knowledge and awareness on behavioral intentions, motivation, and environmental consciousness. We also calculated the direct effects of behavioral intentions, motivation, and environmental consciousness on green behavior. Lastly, we determined the mediating effect of behavioral intentions, motivation, and environmental consciousness between green knowledge and awareness and green behavior. The values for the proposed relationships were evaluated at a 95% confidence interval.

The coefficient of determination (R2) of the framework was 0.21, indicating that the predictor variables explain 21% of the variance in the endogenous variable. It should be noted that researchers have found it difficult to establish a threshold for the coefficient of determination since the value of R2 is highly dependent on the complexity of the model being studied. However, ref. [90] indicated the value of R2 above the thresholds of 0.19, 0.33, and 0.67 as weak, moderate, and substantial. In addition, the effect size of the constructs was assessed using f2. The results indicated that all the independent variables had a small effect on the corresponding dependent variables, except for green knowledge and awareness, which had a medium effect (See Table 5).

Table 5. Path Coefficients of Structural Model.

Indicators	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	*p* Value	R2	f2	Hypothesis Support
Behavioral Intentions -> Green Behavior	0.14	0.14	0.06	2.44	0.01	0.21	0.02	Accepted
Environmental consciousness -> Green Behavior	0.28	0.29	0.07	3.87	0.00		0.08	Accepted
Green Knowledge Awareness -> Behavioral Intentions	0.29	0.30	0.06	4.90	0.00		0.09	Accepted
Green Knowledge Awareness -> Environmental Consciousness	0.36	0.37	0.05	7.19	0.00		0.15	Accepted
Green Knowledge Awareness -> Motivation	0.13	0.14	0.06	2.01	0.04		0.02	Accepted
Motivation -> Green Behavior	0.21	0.21	0.06	3.25	0.00		0.05	Accepted
Green Knowledge Awareness -> Behavioral Intentions -> Green Behavior	0.04	0.04	0.02	2.04	0.04			Accepted
Green Knowledge Awareness -> Environmental Consciousness -> Green Behavior	0.10	0.11	0.03	3.13	0.00			Accepted
Green Knowledge Awareness -> Motivation -> Green Behavior	0.03	0.03	0.02	1.54	0.13			Rejected

It was observed in the current study that there was a positive influence of green knowledge and awareness on behavioral intentions, environmental consciousness, and motivation, as evidenced by the path coefficients. In addition, behavioral intentions, motivation, and environmental consciousness were found to affect green behavior positively. Moreover, the mediating effects also positively influenced the dependent variable (See Table 5). The influences were further tested for significance using the bootstrapping technique. This criterion requires a *p*-value of 0.05 or lower for an effect to be considered significant. Based on this, the evaluated relationships were significant, except for the mediation relationship proposed by motivation between green knowledge awareness and green behavior (See Table 5).

5. Discussion

Identifying factors that drive green behavior has recently attracted attention [5]. This is because organizations and their employees significantly impact the environment [4]. This study investigated the direct effect of environmental knowledge and awareness on green

behavior and the mediating roles of behavioral intentions, motivation, and environmental consciousness that influence it.

5.1. Analysis of Hypotheses

According to the H1 analysis, an individual's understanding and recognition of environmental issues can influence their actions towards being more environmentally conscious. Thus, H1 of the study has found support and RO1 of the study is met. As individuals within an organization become more informed and aware of these issues, their actions will likely align with promoting environmentally friendly practices. Many studies have found that individuals with greater environmental knowledge exhibit more green behavior. For instance, research shows that knowledge of the environment and awareness of sustainability greatly influence green behavior [92]. Other studies have examined the impact of environmental awareness on green behavior and found that greater knowledge and awareness positively influence green behavior in the workplace [93–95]. People with a high level of environmental knowledge are more likely to have a deeper concern for the environment, form positive attitudes towards environmental protection, increase behavioral intention, and act environmentally sustainably, which leads to more green behavior and a more sustainable environment. The results of this current study are consistent with these previous studies [96].

The H2 analysis suggests that environmental knowledge and awareness play a role in determining green behavior by shaping an individual's intentions. Thus, H2 has found support and RO2 of the study is achieved. As individuals gain a better understanding of environmental issues and become more aware of their impact, their intentions to act in an environmentally friendly manner may increase. This, in turn, can result in the adoption of green behavior. Some previous studies support these findings and demonstrate that behavioral intention impacts green behavior [69]. For example, the positive correlation between green behavior and behavioral intention suggests that individuals who face fewer financial constraints are more likely to express their intent to adopt eco-friendly behaviors and eventually engage in environmental practices [97]. Other researchers have also identified green behavior as a significant determinant of behavioral intention [98]. Green behavior represents an individual's ability and opportunity to engage in a behavior. It is also determined by their perceptions of how internal and external factors affect their ability to engage in the behavior [99]. Specifically, when environmental knowledge and awareness are increased, employees' intentions to adopt and exhibit green behavior in the organization are also likely to rise, as supported by other studies [8,45].

The H3 analysis does not support the idea that environmental knowledge and awareness play a role in determining green behavior by affecting individual's motivation. Thus, H3 has not found support. In previous studies as well, some researchers note that motivation does not always directly translate into green behaviors [46]. The findings of this study show that motivation does not mediate the relationship between employees' knowledge and awareness and their green behavior. With the results indicating that motivation does not mediate the relationship between environmental knowledge and awareness and green behavior, the study has provided understanding in relation to RO3 and hence RO3 is achieved.

The results of H4 show that environmental knowledge and awareness can impact green behavior by affecting an individual's level of environmental consciousness. Thus, H4 has found support and RO4 of the study is met. Specifically, as individuals become more informed and aware of environmental issues, their level of environmental consciousness may also increase, which can lead to the adoption of green behavior. These results align with previous studies which found that employees with low levels of environmental consciousness do not fully comprehend the significance of environmental issues. Thus, they are less likely to engage in green behavior, even if they possess knowledge and awareness of these issues. On the other hand, employees with a high level of environmental consciousness are more likely to engage in green behavior than those with lower envi-

ronmental consciousness [23]. This study offers empirical evidence that a high level of environmental consciousness strengthens the relationship between employee perceptions and pro-environmental behavior, supporting previous research findings [100].

This study, along with previous research, suggests that the level of support for green behavior among employees in an organization plays a significant role in determining the overall level of green behavior within the organization. While there is a significant amount of literature on the factors that influence an individual's pro-environmental behavior at home, there is a lack of research on employees' participation in pro-environmental behavior in the workplace. Furthermore, the mediating roles of employees' green behavior intentions, motivation, and environmental consciousness in the relationship between their green knowledge and awareness and the company's green behavior are significant. Employees' knowledge and awareness can be enhanced through various means, such as offering rewards, tax exemptions, profit sharing, and non-monetary rewards, such as recognition [101].

5.2. Managerial Implications

The adoption of green behavior is significantly influenced by environmental knowledge and awareness, as recent research indicates. Conversely, the absence of knowledge and awareness can hinder the adoption of green behavior [68]. Organizations can encourage green behavior at multiple levels by enhancing their employees' knowledge and awareness of green practices [102]. When an organization starts implementing environmentally friendly practices, it creates an environment where employees are more likely to adopt and display green behaviors [103]. Organizational support is also important in encouraging green behavior because employees are more likely to engage in eco-friendly practices when adequately facilitated by the organization [104]. To ensure that employees understand the significance and effects of their actions on the environment, organizations should encourage them to be more aware of their environmental impact. One effective method is to provide yearly reports on the organization's green initiatives and efforts to reduce environmental impact [6].

Along with training programs, organizations should also establish codes of conduct for eco-friendly behaviors to recognize and reward employees who exhibit such behaviors. Research has shown that organizational culture is crucial in implementing sustainable practices across the board [105]. To establish a green culture within an organization, managers should share their green beliefs and practices with employees to familiarize them with the organization's environmental initiatives [106]. Additionally, management should take on a mentorship role and lead by example regarding eco-friendly behavior. The organization's policies, activities, and language also play a crucial role in shaping its culture, and employee awareness of these considerations can motivate them to adopt green behaviors [5].

Leadership is key to motivating employees to participate in organizational change initiatives. Therefore, it is crucial to train leaders and top managers who are environmentally aware of increasing employee commitment to environmental programs [107]. As managers' ecological awareness increases, so does their commitment to eco-friendly behaviors, and employees are more likely to comply with environmental regulations. One managerial practice that can increase employee commitment to green behavior is establishing a system of motivation, recognition, and rewards. Additionally, external rewards can encourage employees to achieve environmental goals and engage in eco-friendly activities.

Research has shown that employees are more likely to exhibit eco-friendly behavior when it becomes a habit [45]. However, studies on employee involvement in pro-environmental programs have yielded conflicting results [108]. Some studies suggest that employees appreciate working for environmentally friendly companies and find it more satisfying. In contrast, others indicate that introducing environmental programs can cause resistance due to employees' unwillingness to change their usual operations [45]. One way to address this issue is for organizations to consider an individual's environmental knowledge and awareness and their willingness to act on environmental issues during the

hiring process. By considering these factors during job interviews, organizations can select individuals with a positive attitude toward environmental concerns and who are more likely to engage in green behavior. This can help align employees with the organization's objectives and policies. Additionally, offering incentives to employees can reduce resistance and promote a more positive attitude toward adopting green behaviors.

Overall, this research highlights the importance of environmental knowledge and awareness, behavioral intention, motivation, and environmental consciousness in achieving green behavior. Some practical steps organizations can take include implementing energy-efficient practices, recycling products, using resources efficiently, and incorporating renewable energy sources.

6. Conclusions

The success of any sustainable environmental strategy depends on the willingness of employees to take voluntary and spontaneous actions toward environmental conservation in the workplace. This study conducted a survey on 150 construction firms located across multiple regions of Pakistan to explore the connection between green knowledge, awareness, intention, motivation, and environmental consciousness. As an outcome of 121 responses collected from top managers of the surveyed firms the study found that enhanced knowledge and awareness of environmental issues can significantly increase employees' intention to engage in eco-friendly behaviors, such as conserving energy, reducing waste, and recycling. This highlights the importance of effectively communicating the importance of green initiatives to employees to instill a pro-environmental mindset. Therefore, organizations should aim to promote eco-friendly behavior through education, motivation, and recognition programs.

The current study has some limitations that should be addressed in future research. The sample size only included management employees, so it is recommended to replicate the study with a larger sample and in different settings. In addition, the study did not consider all possible factors that may affect the relationship between knowledge, awareness, and behavior, such as green shared vision, commitment, and responsible leadership. Furthermore, the study focused on a specific set of organizations, and it is suggested that future research should include larger organizations and examine the factors at the intra-organizational level. Investigating the factors impacting environmentally friendly behavior in both developed and developing countries in future research would also be valuable.

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