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# Studying the Joint Effects of Perceived Service Quality, Perceived Benefits, and Environmental Concerns in Sustainable Travel Behavior: Extending the TPB

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**Abstract:** The importance of the sustainability concept has gained increasing attention from scholars and practitioners. In this context, the aim of this study was to examine the determinants of intention to continue to use the new Metro in Qatar, which is considered a sustainable mode of travel. Therefore, in this paper, a special attention was paid to certain variables, such as environmental concern, perceived quality, and perceived benefits. A quantitative method approach was employed, in which data were collected based on self-administered questionnaires. A total of 1334 Qatar residents responded to the survey questionnaire, and Structural Equation Modeling (SEM) was used for hypothesis testing. The results confirmed the direct effects of perceived behavioral control, social influence, and attitudes on the intention of residents to continue to use the Metro network in their travel. Moreover, perceived behavioral control was found to play a mediating role, enhancing the indirect relationship between perceived benefits and intention to continue to use the Metro network. More importantly, environmental concerns significantly and positively affected the attitudes and perceived behavioral control of travelers; furthermore, these variables presented a mediated influence—through service quality—on the intention to continue to use the Metro network. This study enriched the sustainability behavior literature by examining the influences of crucial factors. Thus, this study is considered of great value for policy-makers who hope to maximize the awareness level of environmental sustainability among the population, in order to encourage them to embrace changes in their lifestyle towards becoming more environmentally responsible.

**Keywords:** environmental concern; sustainable transportation; social influence; service quality; Metro; perceived benefits



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## 1. Introduction

At present, it is more important than ever to make sustainable conduct a requirement in all facets of life. Humanity is currently on the verge of a global disaster brought on by climate change, which is expected to have a large and noticeable impact on every nation in the world. These changes will have a huge influence on the lives of individuals, in addition to natural ecosystems [1]. Moreover, as the traditional modes of travel are considered to contribute to the worsening of climate change, air pollution, and global warming, future transportation systems must become more sustainable. However, there are many factors affecting the choice of a sustainable transportation mode. For instance, driving a personal vehicle has a significant influence on fuel use and excessive carbon emissions [2,3].

This urgent situation calls for actions to be taken to minimize climate change [4] in various aspects, such as energy and resource conservation, dietary changes, waste reduction, and a fundamentally low-carbon lifestyle, involving the consumption of eco-sustainable products, employee green behaviors, sustainable traveling behaviors, green creativity and innovation, and green manufacturing practices [5–12]. Ref. [1], indicated that behavioral

changes and technical innovations are interventions that can help to tackle the catastrophic consequences of climate change. Moreover, using fewer cars is one way to battle climate change. Therefore, governments should promote the use of metros, car sharing, public transportation, and other environmentally beneficial modes of transportation. For instance, Ref. [12] conducted a study among 181 participants who voluntarily enrolled in a travel intervention program to reduce the use of cars and confirmed that self-efficacy, social support, and satisfaction significantly influenced the change in travel behavior. Moreover, they believe that there exist additional driving forces that can inspire people to shift toward the use of more environmentally friendly traveling methods, instead of cars. Therefore, it is clear that there is an urgent need to further investigate this phenomenon from different angles, not only emphasized in the aforementioned studies, but also by decision-makers and environmental rights groups.

Qatar's economy is heavily dependent on hydrocarbons (QDB, 2018). However, the Qatar Metro network is expected to contribute immensely to achieving Qatar's National Vision 2030, which calls for a diversified, pluralistic, and knowledge-based economic system by the year 2030. Furthermore, it is believed that the Qatar Metro will offer extraordinary support to the vision by not only driving organic socio-economic growth following an eco-friendly approach, but also supporting the vision through a network consisting of high-quality infrastructure. In Qatar, the Metro network has been planned and routed such that residents have access to the most current public transportation facilities available. In the GCC countries, public transportation is not very popular or often used. Ref. [13] indicated that there are significant challenges associated with designing a transportation system that competes with personal transportation and noted that public transportation in GCC countries is generally not very popular or widely used. A number of other key barriers have been identified in the literature, including gender expectations and attitudes, along with views regarding the use of public transportation in a hot, humid climate [14].

As a more sustainable transportation system is introduced, it is important to encourage people to display eco-friendly environmental behaviors, thus embracing sustainable traveling behaviors. This process necessitates a thorough understanding of people's mode of choice and how they react to anticipated changes in the transportation system. The notion of a sustainable transportation system is based on striking a balance between environmental, economic, and social development concerns; however, it is necessary to establish if (and to what degree) a new transportation system will be able to meet and exceed travelers' expectations. Moreover, regarding the change in traveling habits towards becoming environmentally friendly, the behavioral intentions of travelers, with respect to continued use of the new sustainable transportation system, are among the measures of success.

Most previous studies have generally focused on examining the usage intention and have paid less attention to sustaining such behaviors by examining the variable of continued usage intention [15]. Hence, this study attempted to fill this gap by examining the intention to continue to use the Qatar Metro as a sustainable means of travel. It has been argued, by [16], that the idea of "continue to use" is one of the most-essential post-adoption behaviors and is a crucial and fundamental sign of user loyalty [16].

Moreover, a previous study [17] attempted to examine the most significant factors impacting the transportation behavior of 441 university students in Trondheim. They found that psychological factors, such as attitude and priorities, contributed less to sustainable transportation behavior, while situational factors, such as the location of the campus and the distance of travel, were more influential. As there was insufficient information to capture the full impact, there is still room for further investigation of other determinants of sustainable traveling behavior, as they failed to capture the full impact [17]. Furthermore, it has been recommended that other factors, such as the environmental and health benefits of active transportation, can play an important role in the introduction of this mode of transportation. This claim was emphasized by [18]. During their study, students of the Roma Tre University were asked regarding their traveling patterns, such that they could promote more sustainable travel behavior among them. In addition, Ref. [19]

conducted a systematic review of 158 studies, in order to examine the travel behaviors associated with the adoption of sustainable transportation modes, regardless of which mode of transportation is used. As a result of their review, it was concluded that subjective factors were very crucial in determining transportation outcomes in the majority of the reviewed studies. As metros are considered an environmentally friendly and sustainable mode of travel, the present study was conducted to address these concerns by considering the impact of environmental concerns—as well as other factors—in an effort to gain a deeper understanding of the intention to continue to follow sustainable travel habits.

Another important motivation of this study was to extend the Theory of Planned Behavior (TPB) in the context of sustainable travel behavior. According to the study conducted by [20], although TPB has a wide range of application in understanding the attitudes and behaviors of people in various aspects, few studies have utilized it to analyze sustainable travel behavior. For this reason, we utilized TPB as a foundation and extended it by linking it to other theories such as the Norm Activation Theory (NAT), the New Ecological Paradigm (NEP), and the Value Belief Norm (VBN).

Finally, even though sustainable traveling modes are gradually attracting increased attention in academia [17,21–27], due to its importance in facing the issue of climate changes, most of the studies in this context have focused on developed countries, while neglecting developing countries. Therefore, this study is among the few studies that attempts to examine some critical factors that may significantly impact the intention to continue using sustainable traveling modes, particularly in the context of the MENA region.

Thus, taking the above into consideration, we aimed to identify the determinants of the Intention to Continue to use the metro (IC) among Qatar's residents (as travelers). These determinants included Environmental Concern (EC), Service Quality (SQ), Perceived Benefits (PB), Perceived Behavioral Control (PBC), Social Influence (SN), and Attitude towards metro transportation (AT).

## 2. Theory and Hypothesis Development

Various studies in the literature have predominantly concentrated on the challenge of selecting an attractive public transport system and changing behavior in connection to its acceptance as a viable alternative to personal transport [28–31]. In the present study, we aimed to identify specific motivational factors that are considered to be major contributors towards pro-environmental intentions to continue to use or behaviors and how general and specific values, attitudes, beliefs, and norms can be transformed or shaped into environmental policy measures [32–35]. Furthermore, we also attempted to evaluate the willingness of travelers to continue to use the Metro. It is also widely believed that such intentions are somewhat associated with subsequent behavioral preferences [29,36]. The Theory of Planned Behavior (TPB) [37], the Norm Activation Theory (NAT) [38], the New Ecological Paradigm (NEP) [39–42], and the Value-Belief-Norm (VBN) theory put forward by [43] serve as the theoretical foundation for this study, as discussed below.

Ref. [44] defined intention as “a measure of the strength of one's intention to perform a specific behavior” (p. 288). It has been noted, by [45], that the investigation of public transportation behavioral intention has been growing in importance, in order to improve the use of public transportation and encourage sustainable economic development. Several researchers have paid great attention to behavioral intention in many sectors, such as education, healthcare, and tourism and hotels [46–48].

Many theories, such as the TPB, NAT, NEP, and VBN, have been used in the literature to elaborate on environmentally friendly behavior. Environmental concern is defined as a person's consciousness of environmental issues and motivation to resolve them [24,49,50], where environmentally friendly transportation refers to a sustainable transport mode. The TPB states that attitudes toward that behavior, social influence, and perceived behavioral control all have an impact on behavior [37,51]. The NAT was proposed [38,52] to explain the psychological process towards the creation of the attitude towards pro-social and pro-environmental behaviors, such as green alternative transportation modes. It proposes three

variables for the prediction of behavior, namely (i) Personal Norm (PN) or moral obligation, (ii) Awareness of Consequences (AC), and (iii) Ascription of Responsibility (AR), which denotes the feeling of responsibility for negative behavioral consequences on society and the environment. The NEP was conceptualized [39–42] in response to the issue regarding the detrimental effects of human activities on the fragile biosphere. Similarly, the VBN theory was postulated by [43], who focused on several values related to environmental behaviors, such as self-regard and self-sacrifice toward other humans, the environment, and the planet, which all play a role in driving pro-environmental human behaviors.

Thus, in this study, we integrated the TPB, NAT, NEP, and VBN theories to explain the ecological behavior represented by the intention to continue to use the Metro as a pro-environmental mode of transportation.

### *2.1. Relationships between Environmental Concern and Service Quality and Perceived Benefits*

At present, there is a need to behave in a pro-environmental manner more than ever, due to the impact of the misbehavior of humanity in many aspects, such as increased pollution, wasted resources, and carbon emissions. As a consequence, climate change is a topic of concern for researchers and practitioners alike. Such environmental consciousness is reflected in the increasing number of consumers engaged in pro-environmental behaviors. As a result, consumers with environmental concerns tend to perceive green products to be of high quality and, consequently, tend to prefer eco-friendly products and services over non-green ones [53–55]. In a study carried out by [56], based on data collected from 351 Indian consumers, it was revealed that environmental concern is among the most-vital drivers of green purchasing behavior. Furthermore, individual users perceived superior levels of environmental concern and the value of products and services that serve to maintain environmentally friendly surroundings, which were viewed to be more appealing and of higher quality than other products [57].

Another study, conducted by [26], attempted to investigate the impact of environmental concern on the individual intention to use electric and autonomous vehicles in China. They found that environmental concern significantly influenced the green perceived usefulness, ease of use, and intention to use electric and autonomous vehicles. In this sense, environmental concerns have a strong influence on how people think about the world and how they behave; for example, if a person reports having a high level of environmental concern, he/she will likely pay closer attention to every part of his/her conduct or even his/her perception of things. Therefore, environmental friendliness has become a more necessary aspect of products and services and is a vital dimension of quality measurement [58]. Thus, we propose the subsequent hypotheses:

**Hypothesis 1.** *EC is positively related to SQ.*

**Hypothesis 2.** *EC is positively related to PB.*

### *2.2. Relationships between Perceived Benefits, Service Quality, Perceived Behavioral Control, and Social Influence*

As the environmental awareness of consumers grows, they have become more inclined toward pro-environment products and services, as well as more adaptable to green behaviors [59]. As a result, consumers who care about the environment assess the value of goods and services based on their environmental friendliness. Hence, before acting, they weigh the environmental costs and advantages of their anticipated purchase behavior [60]. The benefits of environmentally friendly products and services to customers are not only utilitarian benefits, but can be seen as psychological benefits, such as providing good feelings; safety benefits, in terms of air quality and resource preservation; self-expressive benefits; as well as positive social/societal impacts and the conservation of natural fauna and flora [61]. These perceived benefits have direct impacts on the perceived quality of eco-friendly products and services and also provide potential customers controlling power over the factors needed to shape their environmentally friendly behaviors.



The more an individual knows about the advantages of engaging in pro-environment behaviors, the greater the probability that he/she will develop an intention towards green purchasing behavior [54]. Therefore, consumers prefer to use public transportation to reap certain benefits, such as cost savings, reduced traffic, and reduced air pollution due to the overuse of cars. In addition, the use of public transportation, such as rail transportation, is seen to keep the environment healthy for future generations [62]. In summary, perceived benefits are amongst the main drivers of consumer intentions to be inclined towards using public transportation and other eco-friendly alternatives. Ref. [63] claimed that individual, contextual, and social forces are more crucial factors in influencing the perceived behavioral control of individuals. Therefore, it is anticipated that perceived benefits will boost an individual's perception of control over the resources required to engage in pro-environment behaviors [55,64]. Considering the above, we propose the subsequent hypotheses:

**Hypothesis 3.** *PB is positively related to SQ.*

**Hypothesis 4.** *PB is positively related to PBC.*

**Hypothesis 5.** *PB is positively related to SN.*

### *2.3. Relationships among Service Quality, Perceived Behavioral Control, and Attitudes*

A well-known definition of service quality is the customer's evaluation of the entire performance of a service provider [65,66]. Similarly, service quality refers to the achievement of the provision or fulfillment of consumer expectations [67,68]. In general, the quality of public transportation services (e.g., railways), reflects the ability of the company to identify the requirements of customers and to design the service to satisfy those requirements [69]. Ref. [70] identified four distinct viewpoints on the service quality of public transportation: target service quality, provided service quality, perceived service quality, and sought service quality. These perspectives include views from both the service provider and the customer. They were described as follows: target service quality refers to the standard that the service provider intends to meet; delivered service quality, the standard that was actually met; perceived service quality, the standard that the customer perceived as meeting the delivered service standard; sought service quality, the standard that the customer either implicitly or explicitly requires. Moreover, Ref. [70] developed six indicators to measure the service quality of public transportation indicators, which are availability, accessibility, information, time indicators, comfort, and security. In another study by [66], they proposed several dimensions for the measurement of service quality, including: (i) tangibles—the physical facilities, equipment used, and appearance of employees; (ii) reliability—providing accurate services; (iii) responsiveness—the rapid response of employees to customer requests; (iv) assurance—the courteous behavior of employees; (v) empathy—understanding the problems of customers and behaving in their best interests. Thus, if a service provider addresses these dimensions better than its competitors, its customer base will remain loyal and spread positive word-of-mouth [66,71–73]. Accordingly, services that do not meet the needs and expectations of customers are less likely to be re-purchased or recommended to others [66,74,75]. This suggests that service quality, in general (and for rail transportation, in particular), is a crucial factor of use continuity [76]. Moreover, in the literature related to behavior, Ref. [51] asserted that a behavior is determined by the attitude one has towards the action, social influences from friends and family, and the control one has over the means essential to achieve that action. It has also been argued, by [77,78], that the beliefs that one has about the behavioral consequences on one's self or on the environment are a significant determinant of behavior. Environmental considerations are, therefore, considered to be a decisive factor in the shaping of cognitive processes relating to the purchase of products and services [79].

With regard to railway transportation, many factors may influence the perceived service quality, such as lower congestion and short time of travel to destinations, punctuality,

good coverage, safety, availability of schedule information, comfortability, environmental friendliness, and family- and special-needs-friendly transportation services [80,81]. These quality aspects are powerful factors in determining the attitudes of individuals who choose rail over other modes of transport. Nevertheless, with the variety of transportation options available, green individuals tend to favor environmentally friendly modes. Consequently, we hypothesize the following:

**Hypothesis 6.** *SQ is positively related to PBC.*

**Hypothesis 7.** *SQ is positively related to AT.*

#### 2.4. Relationships between Perceived Behavioral Control and Social Influence

According to the TPB, one of the key factors influencing behavior is perceived behavioral control, which is defined as an individual's ability to engage in a specific activity or to control the resources required for that activity [51]. As a result, if a railway user perceives high service quality, they may have a good perception. Although service quality is important to railway users, other factors, such as time, traffic, and environmental safety, are also important. As a result, the customer will spread word-of-mouth regarding their positive experiences, encouraging their relatives and friends to use the railway transportation system [73,82]. Thus, we propose the subsequent hypothesis:

**Hypothesis 8.** *PBC is positively related to SN.*

#### 2.5. Relationships between Social Influence, Perceived Behavioral, and Attitude

In the TPB, attitude is considered to be the most-powerful factor influencing behavior. This implies, however, that attitudes (positive or negative) toward a particular behavior strengthen or weaken behavioral intentions [51]. As has been argued previously [83], the most crucial aspects of attitudes, with regard to environmentally friendly behaviors, are importance and convenience. While the degree of environmental concern reflects attitudes related to the importance of environmentally friendly behaviors, an individual's judgment of the time and effort required to engage in eco-friendly behaviors reflects his/her attitude related to convenience. It has been confirmed that inconvenience might outweigh importance, leading to a direct negative impact on environmentally friendly behaviors [53,84]. As a result, simply recognizing the significance of a particular pro-environmental behavior may be insufficient, if it is found to be inconvenient. Consumers are becoming more environmentally conscious as the level of environmental issues and problems rises. One of the main factors contributing to air pollution, noise, and traffic jams in many countries is the increasing use of private automobiles [85]. As railways are expected to offer high-quality services, comprehensive coverage of locations, less travelling time, and less cost, individuals may feel a stronger control over the resources required to use this sustainable mode of transportation. In view of the NAT, people are more inclined to adopt pro-social behaviors (altruistic behaviors) in the greater interest of society. In the same context, the use of rail transportation (as a behavior) is a pro-social and pro-environment behavior, reflecting the individual's social and environmental values [86,87]. Moreover, it has been made clear that frequent travelers who take public transportation can reduce traffic and pollution in cities [88]. Refs. [88,89] found that social norms had a substantial impact on the intention to use public transportation and that recent travelers who have used it are more motivated to do so in the future. Thus, we propose the subsequent hypotheses:

**Hypothesis 9.** *SN is positively related to AT.*

**Hypothesis 10.** *PBC is positively related to AT.*

## 2.6. Relationships between Attitudes, Social Influence, Perceived Behavioral Control, and Intention to Continue to Use Behavior

According to the TPB [37,51,90], belief intentions are crucial in determining behavior, which are determined by attitudes toward the action, social influences or subjective norms, and perceived behavioral control. Therefore, in this study, individual attitudes refer to how positively or negatively one evaluates the idea of using railways as a mode of transportation. Social influence or subjective norms, as a variable, refer to the social pressure exercised by important individuals on a person towards adopting green behavior, which, in this case, refers to the use of railway transportation instead of a private car. Ref. [86] indicated that the TPB has been extensively used to illustrate numerous transportation and sustainable traveling behaviors, for example using private car, bus, public transport, and bicycling, on the one hand, and environmental support and eco-friendly behaviors, on the other. Furthermore, the TPB constructs are important predictors of pro-environmental behavior and have a positive significant impact on it, as has been confirmed by previous studies [36,82,85,86,91]. Thus, we propose the subsequent hypotheses:

**Hypothesis 11.** *AT is positively related to IC.*

**Hypothesis 12.** *SN is positively related to IC.*

**Hypothesis 13.** *PBC is positively related to IC.*

## 2.7. Mediating Role of Service Quality

There has been a growing body of research addressing social, cultural, and psychological factors affecting the use of eco-friendly modes of transportation [36,82,85,87,91]. Despite the convenience of using a private car, consumers are becoming more environmentally sensitive and, therefore, have developed attitudes towards the use of transportation that has a less negative influence on the environment, such as railways and public transportation [82,87]. In view of the NAT, NEP, and VBN theories, it is supposed that consumers tend to engage in pro-environmental behaviors due to their concern for society and the environment [38,52,92,93]. Therefore, the values and environmental concern that one possesses are significant factors when judging the quality of the transportation services, which affects the attitudes towards accepting these services [94–96].

Moreover, due to the importance of environmental concern among consumers, it is important to evaluate the perception of service quality [36,85,87]. Thus, it has been confirmed that, when customers perceive services while considering environmental matters and fulfill their quality expectations, they will most likely opt to purchase that service [81,97]. In addition, prior research in public transportation has attempted to determine if service quality matters in influencing traveler behavior to use public transportation and how that can lead to boosting their intention to continue using public transportation modes. For instance, Refs. [98–100], revealed that the traveler's intention to using public transportation depends on his/her impression of the quality of the service provided by the public transportation. Therefore, we propose the subsequent hypothesis:

**Hypothesis 14.** *SQ mediates the relationship between EC and AT.*

**Hypothesis 15.** *SQ mediates the relationship between EC and PBC.*

## 2.8. Mediating Role of Attitudes and Perceived Behavioral Control

The TPB theory is commonly used to explain why individuals behave in certain manners, according to the widely held belief that attitudes, subjective norms, and a sense of behavioral control all play a role in such behaviors. Nevertheless, the model may not be the only factor influencing intentions and behaviors, as there are other factors to be considered such as values and self-identity, moral standards, and ecological considerations [101,102].

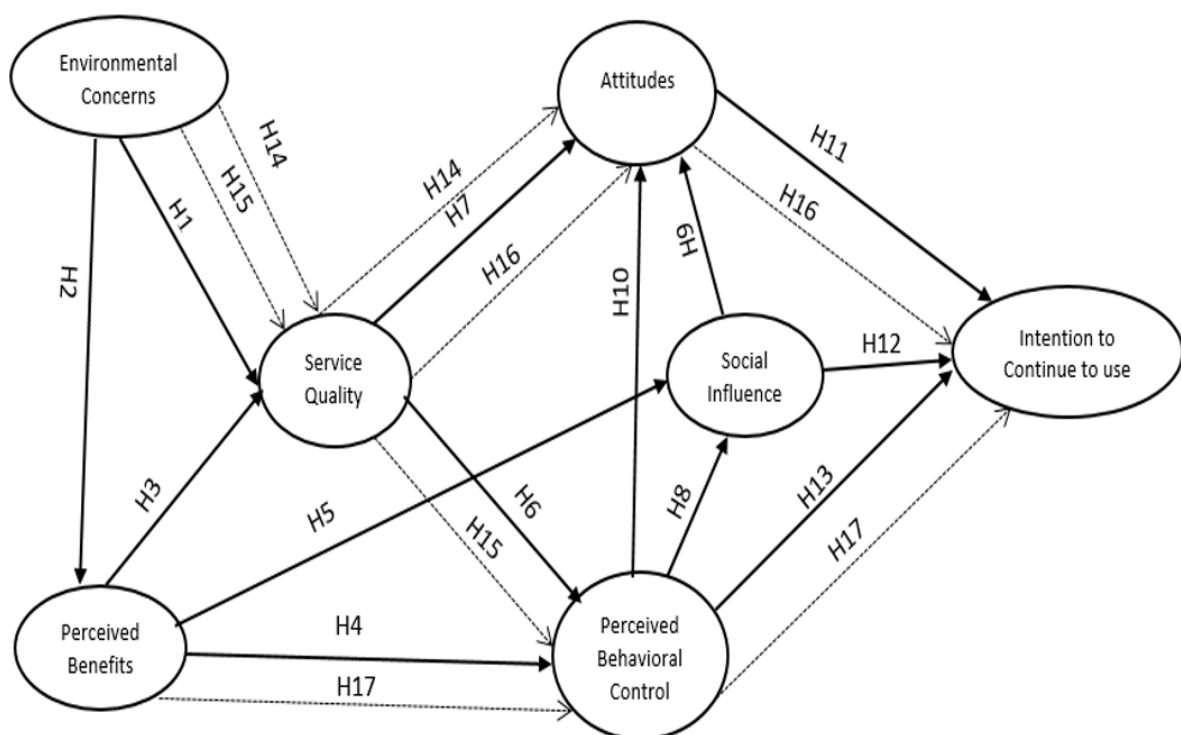


Thus, it is critical to determine which variables may be employed to expand the TPB, NAT, NEP, and VBN, in order to contribute more to explaining the pro-environmental behavioral intention to continue to use. In the railway transportation context, whatever the perceived quality of the service or the expected social and environmental benefits gained by choosing to use them, consumers would not intend to use unless they have a positive attitude and they perceive the ease of using such a mode of transportation [85,103,104]. Consequently, we propose the subsequent hypotheses:

**Hypothesis 16.** *AT mediates the relationship between SQ and IC.*

**Hypothesis 17.** *PBC mediates the relationship between PB and IC.*

Based on the theoretical foundation and the hypotheses development arguments, the research model of the study is depicted in Figure 1 below



Notes: Direct: ——— Mediated: - - - - -

**Figure 1.** Research model.

### 3. Methods

#### 3.1. Participants and Procedures

This study was conducted based on a quantitative online survey questionnaire research design, involving a cross-sectional sample of travelers who use the Qatar Metro, the new travelling system. As there was no sampling frame, we followed a convenience sampling technique, which is commonly used in behavioral studies [105]. The data were collected from 1334 participants, where the research assistants targeted travelers at various Metro stations. The determination of the sample size of this study was based on the number of parameters to be estimated as recommended by [106–108]. Since the SEM-AMOS frequently employs this technique, 20-times the number of indicators were used, and we maximized the number to prevent any data bias. The survey was in both English and Arabic, and the instructions for translating questionnaires suggested by [109] were followed, in order to ensure its reliability and consistency. Content validity was established by sending the

survey to five academics and ten from the target population. Then, it was developed further accordingly, before distribution to the target population. After collecting the data, different tests were performed to check the common method bias, such as Harman's single-factor test [110] and the collinearity Variance Inflation Factor (VIF) test [111]. All tests indicated that the data were free of any common method bias.

### 3.2. Measurements

The survey questionnaire comprised two parts: the first collected the background variables of the participants, while the second focused on the model constructs. The constructs included intention to continue to use the metro, service quality, environmental concern, social influence, attitudes, perceived behavioral control, and perceived benefits. The measurement of all constructs was based on a five-point Likert scale, where 1 denoted strongly disagree to 5 denoted strongly agree. The measurement items for the constructs were adapted from previous studies, accordingly: 4 items to measure continued intention to use the metro [51,112], 10 items to measure service quality [113,114], 5 items to measure environmental concerns [93], 4 items to measure social influence [115], 4 items to measure attitudes towards rail transportation [112], 4 items to measure perceived behavioral control [112], and 6 items to measure perceived benefits [116,117]. Therefore, due to low loading and cross-loading, some of the items were deleted where the remaining number of items was 28 items.

### 3.3. Statistical Analysis Techniques

A Structural Equation Modeling (SEM) approach was employed using the AMOS software, in order to assess the study's model. Prior to evaluating the structural model and conducting hypothesis testing, we confirmed the validity of the measurements and their reliability, in accordance with the standards in the structural equation modeling literature [118].

## 4. Results

### 4.1. Sampling Profile

The participants were requested to provide some background information, including gender, age, car ownership, education, income, and purpose of travel, as detailed in Table 1.

**Table 1.** Sampling profile.

Variable	Category	Frequency	Percent %
Gender	Female	403	30.2
	Male	931	69.8
Age	Less than or equal 25	778	58.3
	More than 25	556	41.7
Car Ownership	Have a car	898	67.3
	Don't have a car	436	32.7
Education	Secondary	331	24.8
	Diploma	207	15.5
	Bachelor	679	50.9
	Postgraduate	117	8.8
Income	Less than 10,000	744	55.8
	More than 10,000	590	44.2
Travel Purpose	Work	354	26.5
	Study	472	35.4
	Social	147	11.0
	Pleasure	361	27.1
Total		1334	100.0

#### 4.2. Measurement Model Analysis

Several tests were performed to confirm the construct, content, discriminant, and convergent validity, as well as to confirm the goodness-of-fit of the model. In detail, to confirm the construct validity and discriminant validity, we followed the criteria suggested by [119]. First, Confirmatory Factor Analysis (CFA) was conducted, in order to check that each item was loaded in its respective constructs. This was clarified by [120], who asserted that the constructs in the model may be correlated, but should still be distinct from each other. This clearly means that the shared variance amongst the items comprising the same construct should be higher than the other items of other constructs. This result was confirmed in our case. Then, we ran further tests, in order to check the factor loading, Composite Reliability (CR), and Average Variance Extracted (AVE). The finding revealed that all items were highly loaded in their respective constructs, but some items were eliminated because of low and cross-loading issues. Specifically, the factor loading was in an acceptable range (between 0.706 and 0.930; see Table 2) and met the criteria given by [119,121]. Moreover, as revealed in Table 2, the AVE values were higher in their respective constructs, demonstrating that the variance shared by items belonging to the same construct was greater than the variance shared by items belonging to different constructs in the model. As shown in Table 3, these findings thus support the discriminant validity of the measurement model.

**Table 2.** Convergent analysis results.

Construct	Items	Factor Loadings	Composite Reliability (CR)	Average Variance Extracted (AVE)			
Service Quality	SQ1	0.706	0.911	0.594			
	SQ4	0.818					
	SQ5	0.789					
	SQ6	0.780					
	SQ7	0.803					
	SQ8	0.745					
	SQ9	0.746					
	Environmental concerns	EC4			0.722	0.836	0.561
		EC3			0.763		
EC2		0.797					
EC1		0.711					
Perceived benefits	PB6	0.864	0.881	0.787			
	PB5	0.910					
	PB4	0.837					
	PB3	0.857					
	PB2	0.787					
Social influence	SN1	0.904	0.930	0.815			
	SN2	0.934					
	SN3	0.870					
Attitude	AT1	0.777	0.844	0.643			
	AT2	0.842					
	AT3	0.785					
Perceived behavioral control	PBC3	0.762	0.854	0.662			
	PBC2	0.832					
	PBC1	0.844					
Intention to continue to use the metro	CI2	0.910	0.900	0.750			
	CI3	0.868					
	CI4	0.817					

**Table 3.** Discriminant analysis results.

Construct	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) IC	<b>0.866</b>						
(2) SQ	0.386	<b>0.770</b>					
(3) EC	0.194	0.532	<b>0.749</b>				
(4) SN	0.756	0.330	0.124	<b>0.903</b>			
(5) AT	0.810	0.419	0.184	0.765	<b>0.802</b>		
(6) PBC	0.755	0.393	0.222	0.751	0.764	<b>0.813</b>	
(7) PB	0.282	0.590	0.484	0.311	0.331	0.384	<b>0.852</b>

In the same way, content validity was also confirmed through the above tests, as suggested previously [121,122]. From the result of CFA, it can be seen that all the items were highly loaded in their respective constructs, compared with other constructs. Moreover, to further confirm the construct validity, convergent validity was assessed by performing several test, as has been suggested by [121,123]. This was conducted based on the assessment of factor loading, Composite Reliability (CR), and Average Variance Extracted (AVE). As illustrated in Table 2, the findings indicated that all items were reported to have high factor loadings (i.e., greater than 0.7), indicating good validity, as suggested by [124]. In detail, the factor-loading ranges for each construct were as follows: service quality from 0.706 to 0.818, environmental concerns from 0.711 to 0.797, perceived benefits from 0.787 to 0.910, social influence from 0.870 to 0.934, attitude from 0.777 to 0.842, perceived behavioral control from 0.762 to 0.844, and intention to continue to use the Metro from 0.817 to 0.910.

Moreover, the CR values ranged from 0.836–0.930, exceeding the suggested value of 0.7 proposed by [119,121]. In particular, the CR values reported for each construct were as follows: service quality 0.911, environmental concerns 0.836, perceived benefits 0.881, social influence 0.930, attitude 0.844, perceived behavioral control 0.854, and intention to continue to use the Metro 0.900.

Finally, the AVE values were reported in the range between 0.561 and 0.815, above the cutoff value of 0.5 introduced by [125]. The AVE values for each concept were, in more precise terms, as follows: service quality 0.594, environmental concerns 0.561, perceived benefits 0.787, social influence 0.815, attitude 0.643, perceived behavioral control 0.662, and intention to continue to use the Metro 0.750. In summary, the model had adequate levels of convergent and construct validity.

Finally, we tested the goodness-of-fit indicators. For this purpose, several measures were utilized. The measurement model's normed  $\chi^2$  was 2.699, lower than the intended value of 3.0 recommended by [123]. Furthermore, the Comparative Fit Index (CFI) was further calculated to confirm the model fit, following the cutoff value of 0.95 suggested by [123]. Our findings confirmed that the reported value was 0.976, and the non-normed fit index was 0.973, thus confirming that the model in this study had a good fit to the data. The Root-Mean-Squared Error of Approximation (RMSEA) is another indicator that was calculated, for which the appropriate value should be less than 0.05 [126]. Our finding met this criterion, with a reported value of 0.038.

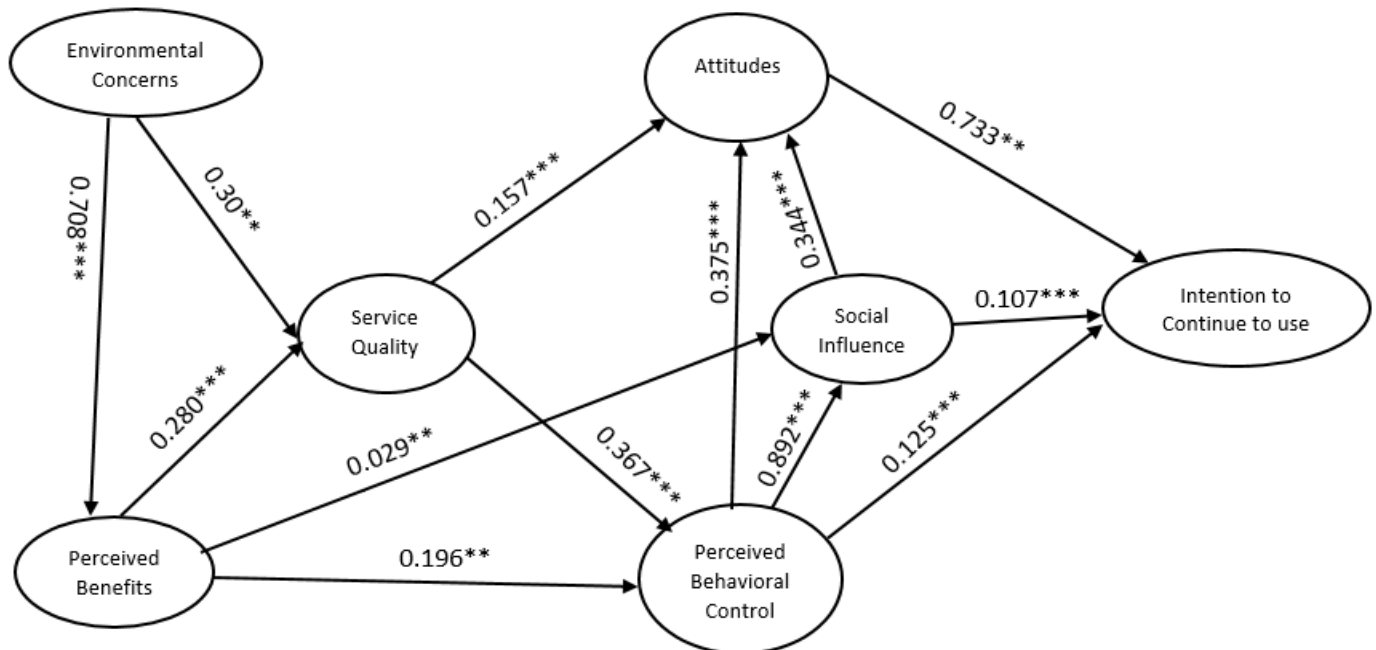
In summary, the measurement model obtained great results, in terms of validity and reliability, as well as having confirmed goodness-of-fit. Therefore, it was considered to be adequate to confirm the anticipated hypotheses. We detail the structural model analysis in the subsequent section.

#### 4.3. Structural Model Analysis

The model goodness-of-fit is a crucial part in examining a structural model and is a prerequisite for hypothesis testing; thus, we followed the instructions and the cutoff value given by experts in the SEM field [123,126,127]. In particular, the results indicated that the normed  $\chi^2$  should be less than 3.0, where our finding confirmed a reported value of 2.983. Moreover, the GFI, TLI, and CFI should all be higher than 0.90, where our findings surpassed this cutoff, with respective values of 0.949, 0.973, and 0.976. Similarly, the RMSEA

met the criterion (less than 0.05), with a reported value of 0.039. Hence, it was concluded that the model had a good fit and met all of the requirements, and the following step was to test the hypothesis relationships.

As the goodness of the structural model was confirmed, the hypothesized relations were tested. The results for the links among the constructs are demonstrated in Figure 2.



**Figure 2.** Path model results. Notes: Fit values  $\chi^2 = 999.429$ ;  $ratio = 2.983$ ;  $p$ -value = 0.000;  $GFI = 0.949$ ;  $CFI = 0.976$ ;  $TLI = 0.973$ ;  $RMSEA = 0.039$ . \*\*\*  $p < 0.001$ ; \*\*  $p < 0.01$ .

As illustrated in Table 4 and Figure 2, the direct relationships between EC and SQ ( $\beta = 0.300$ ,  $t = 9.944$ ,  $p < 0.001$ ) and EC and PB ( $\beta = 0.708$ ,  $t = 11.118$ ,  $p < 0.001$ ) were both significant and positive. Thereby,  $H_1$  and  $H_2$  were supported. Likewise, the direct relationships between PB and SQ and PB and PBC were both positive and significant ( $\beta = 0.280$ ,  $t = 13.966$ ,  $p < 0.001$ ;  $\beta = 0.196$ ,  $t = 6.118$ ,  $p < 0.001$ , respectively). In this way,  $H_3$  and  $H_4$  were confirmed. However, hypothesis  $H_5$  was rejected, as no significant association between PB and SN was found. Moreover, SQ was found to be a crucial factor, having significant impacts on PBC and AT ( $\beta = 0.367$ ,  $t = 7.173$ ,  $p < 0.001$ ;  $\beta = 0.157$ ,  $t = 11.129$ ,  $p < 0.001$ , respectively). Thus,  $H_6$  and  $H_7$  were confirmed. In the same way, the results confirmed  $H_8$ ,  $H_{10}$ , and  $H_{13}$ , as significant relationships between PBC and SN, AT, and IC were observed ( $\beta = 0.892$ ,  $t = 23.507$ ,  $p < 0.001$ ;  $\beta = 0.375$ ,  $t = 9.277$ ,  $p < 0.001$ ;  $\beta = 0.125$ ,  $t = 3.117$ ,  $p < 0.01$ , respectively). In terms of  $H_9$  and  $H_{12}$ , which indicated the relationships between SN and AT and IC, respectively, the results revealed that social influence had a significant impact on both of these variables ( $\beta = 0.344$ ,  $t = 5.052$ ,  $p < 0.001$ ;  $\beta = 0.107$ ,  $t = 3.455$ ,  $p < 0.001$ , respectively). Thus, these hypotheses were confirmed, providing significant input in terms of the applicability of the TPB-theory-based modeling in different cultures, settings, and contexts. The conclusion regarding assessing the direct relationships indicated that the relationship between AT and IC was also significant ( $\beta = 0.733$ ,  $t = 13.476$ ,  $p = 0.001$ ).



**Table 4.** Hypothesis testing results.

Hyp. No.	Hypothesis	Standardized Path Coefficient	Standard Error	t-Value	p-Value	Decision
H <sub>1</sub>	EC → SQ	0.30	0.03	9.944	0.000	confirmed
H <sub>2</sub>	EC → PB	0.708	0.047	11.118	0.000	confirmed
H <sub>3</sub>	PB → SQ	0.280	0.02	13.966	0.000	confirmed
H <sub>4</sub>	PB → PBC	0.196	0.032	6.118	0.000	confirmed
H <sub>5</sub>	PB → SN	0.029	0.025	1.152	0.249	Not confirmed
H <sub>6</sub>	SQ → PBC	0.367	0.051	7.173	0.000	confirmed
H <sub>7</sub>	SQ → AT	0.157	0.031	11.129	0.000	confirmed
H <sub>8</sub>	PBC → SN	0.892	0.038	23.507	0.000	confirmed
H <sub>9</sub>	SN → AT	0.344	0.031	5.052	0.000	confirmed
H <sub>10</sub>	PBC → AT	0.375	0.040	9.277	0.000	confirmed
H <sub>11</sub>	AT → CI	0.733	0.054	13.476	0.000	confirmed
H <sub>12</sub>	SN → CI	0.107	0.031	3.455	0.000	confirmed
H <sub>13</sub>	PBC → CI	0.125	0.04	3.117	0.002	confirmed

#### Analysis of the Mediation Effects

This study's primary objective was also to examine the mediating effects of certain variables, in order to assess their indirect effects on the intention to use metro transportation. More specifically, the mediating effects of SQ between EC and PBC and AT were ascertained. Moreover, the mediating role of AT in the relation between SQ and IC was also examined. Similarly, we examined the relation amidst PB and IC, in terms of the mediating role of PBC. To statistically examine the mediating effects in SEM, we followed the steps illustrated by [128] and employed bootstrapping, as has been suggested by Hayes and Preacher [129]. As illustrated in Table 5, the findings revealed that SQ played a full mediating role between EC and AT ( $a \times b = 0.050$ ; 95% CI: 0.030–0.080). Therefore, H<sub>14</sub> was confirmed, as zero was not included in the 95% confidence interval. Likewise, SQ was found to play a mediating role in the relationship between EC and PBC ( $a \times b = 0.119$ ; 95% CI: 0.082–0.173). Thereby, H<sub>15</sub> was confirmed. In terms of the mediating role of AT between SQ and IC, the results supported this relationship ( $a \times b = 0.120$ ; 95% CI: 0.069–0.175). Therefore, H<sub>16</sub> was confirmed.

**Table 5.** Mediation analysis results.

Hyp. No.	Hypothesized Relationship	Indirect Path Coefficient (a × b)	Lower Bound 90% CI	Upper Bound 90% CI	Decision	Direct Path Coefficient (c')	Lower Bound 90% CI	Upper Bound 90% CI	Decision	Mediation Results
H <sub>14</sub>	EC → SQ → AT	0.05	0.030	0.080	Significant Indirect Effect	−0.016	−0.078	−0.04	Significant direct Effect	Competitive Partial Mediation
H <sub>15</sub>	EC → SQ → PBC	0.119	0.082	0.173	Significant Indirect Effect	−0.071	−0.168	0.016	Insignificant direct Effect	Full Mediation
H <sub>16</sub>	SQ → AT → CI	0.120	0.069	0.175	Significant Indirect Effect	0.057	−0.001	0.119	Insignificant direct Effect	Full Mediation
H <sub>17</sub>	PB → PBC → CI	0.030	0.011	0.056	Significant Indirect Effect	−0.062	−0.094	−0.026	Significant direct Effect	Competitive Partial Mediation

Another aim was to examine the mediating role of PBC between PB and IC, as indicated in H<sub>17</sub>, and the hypothesis was supported ( $a \times b = 0.030$ ; 95% CI: 0.011–0.056).

As a result, these findings indicate the substantial contribution and significance of this study, as we determined the direct and indirect relationships between the most-important elements influencing the intention to continue to use metro transportation.

## 5. Discussion

The primary purpose of this study was to examine the influence of environmental concern and other factors in affecting individual intention to continue to use a sustainable traveling option. Sustainable transport has arisen as a critical scholarly debate, which is intrinsically tied to societal and environmental well-being. However, it is highly concerning that the current traffic and transportation patterns in many emerging countries lack social and environmental standards. As a result, the citizens of these nations are exposed to risks associated with the mode of transportation in different aspects. Therefore, the significance of how different variables interact, in relation to the pro-environmental conduct of potential travelers in the context of a developing country, was revealed through the empirical findings presented in the current study.

The statistical findings of this study were used to determine the nature of the relationships between environmental concern, service quality, perceived benefits, perceived behavioral control, social influence, attitude towards metro transportation, and intention to continue to use the Qatar Metro.

The findings demonstrated a significant relationship between environmental concern and perceived benefit; therefore, it is in line with the results of earlier studies. For example, a study in a similar context was conducted by [24] who found that environmental concern had a significant relationship with perceived value. Another study [26] found that environmental concern has a significant relationship with green perceived usefulness. Moreover, the findings revealed that environmental concern influences a traveler's expectations regarding service quality. Thus, it can be inferred that eco-friendly transportation is perceived as a superior quality service, as compared to less eco-friendly modes of transportation. As expectations regarding service quality predominantly serve as determinants of perceived behavioral control, attitudes, and intentions [130,131], it is unlikely that a service provider will furnish unrealistic expectations. The results also confirmed that the perceived quality is determined by the benefits perceived by the customer, in the case of using the Qatar Metro. As consumers are becoming more environmentally friendly, their appreciation of the long-term benefits related to the use of eco-friendly transportation means is increasing. Similarly, our findings confirmed the positive link between perceived benefits and service quality, in line with previous studies [27,132].

Moreover, the results obtained in this study confirmed the positive impact of perceived benefits on attitudes toward sustainable traveling behaviors, consistent with the findings of past research, such as that of [133]. These findings support previous research conducted in different contexts [134,135], as well as reinforce the link between perceived values and attitudes.

Furthermore, the results support the significant impact of perceived benefits on social influence, thus supporting the finding of the previous study conducted by [136] who observed that perceived values have a positive and significant influence on interpersonal behavior in the context of buying intention. Therefore, the perceived value (economic, social, and/or environmental) of a product or a service generates social norms or influences, along with the self-confidence in and capability of performing that behavior, which can be considered as shifting power towards adopting sustainable traveling behaviors.

Similarly, the relation between service quality and perceived behavioral control was confirmed by our findings, extending the previous study of [20]. Moreover, in many studies and in different contexts, it has been confirmed that service quality is one of the most-crucial factors influencing the attitude of individuals. In the same line, the results of our study support the relationship between service quality and attitudes toward sustainable travelling behaviors, in agreement with the previous studies [20,21,137], in which it has been reported that service quality has a positive and significant influence on attitude. Thus, in order to promote the optimistic attitudes of metro users, they must appreciate the values delivered to them by the Qatar Metro, such as fast, secure, reliable, and economically competitive transportation services. When the expectations of travelers are not adequately met, their positive attitudes and intention to continue to use the Metro

service will deteriorate. Interestingly, we examined the relationship between attitude and intention to continue to use the metro transportation modes, and our findings supported the above relationship. Despite the established importance of attitude in individual behaviors, few studies have examined its effect in the context of sustainable travelling behavior. Thus, the findings of this study enrich the literature on sustainable travelling behaviors by highlighting the significant impact of attitude on determining the individual intention to continue to use it. By looking at this relation in a different context, it was obvious that attitude usually plays an important role in individual behavior, as found both here and by others [1,23,25,132,138–141].

Another major factor is social influence, which has grown significantly in importance in predicting individual behaviors in many contexts. It might be due to the increasing variety of channels that can convey and spread impacts. Therefore, it was very interesting to take this factor into consideration, in order to examine its influence on the intention to continue to use the Metro, which is considered a sustainable travelling mode. The results revealed that social influence had a significant impact on the intention to continue to use the Metro, consistent with prior findings [12,15,141–144], where social influence was found to have a significant effect on individual intention behavior. Thus, as the findings emphasized the significant impact of social influence on intention to continue to use the Metro, there is a dire need to organize public service campaigns in order to generate positive word-of-mouth regarding continuing to use the Metro, as eco-friendly public transportation.

Perceived behavioral control refers to a person's assessment of his/her own effectiveness and perceived controllability in engaging in a behavior [51,145]. It is, therefore, broadly considered one of the most-important elements affecting individual behaviors [22,25,141,146]. Thus, in this study, we found that perceived behavioral control was significantly associated with the intention to continue to use the Metro. As anticipated, this finding was consistent with earlier studies [25,140,141,147].

Furthermore, service quality, perceived behavioral control, and attitudes towards the Qatar Metro were identified as potential mediators between predictors and criteria variables, thus signifying the importance of achieving service quality benchmarks, building confidence in the new Metro system, and developing positive attitudes towards its use. As service quality is a matter for the user and has a direct impact on the individual attitude toward certain behaviors—as has been confirmed earlier by a variety of studies [21,137]—it is, therefore, expected to enhance the relationship between environmental concern and attitude toward sustainable travelling behavior. Our findings confirmed this assumption and found that service quality plays a mediating role in the relationship between environmental concerns and traveler attitudes. Similarly, another study has found that service quality plays a moderating role in the relationship between customer attitude toward the environment and his/her green product purchasing behaviors [32].

In summary, it is therefore clear that factors such as environmental concern, perceived behavior control, service quality, perceived benefits, social influence, and attitude (e.g., toward the Qatar Metro) have significant roles in shifting the transportation style of travelers toward environmentally friendly forms of transportation. Therefore, in order to guarantee the vigor of civic life, business, and the government, efficient, eco-friendly, and socially sustainable transportation services are fundamentally important.

### 5.1. Theoretical Contributions

In terms of the theoretical contributions, this study extends the scope of the TPB [37], NAT [38], NEP [39–42], and VBN [43] by ascertaining the relationships among the selected variables related to pro-environmental behaviors in the transportation industry. Contextually, it is believed that this study is among the few pioneer studies that have attempted to explore the psycho-social factors that shape the travelers' intention to continue to use the Metro as a travel mode in Qatar. Importantly, this study extends the TPB by examining and confirming the joint effects of some variables, such as service quality, perceived benefits,

and environmental concern, on the TPB variables towards the intention to continue using the Qatar Metro, as an eco-friendly mode of transportation.

### 5.2. Managerial Contributions

In terms of managerial contribution, this study has significant practical implications by offering a guidance on how to encourage sustainable travelling behavior. First, this study is of a high practical relevance to transportation companies and travel agents, who must keep a close eye on the requirements and developments in tourism and transportation markets, including travel mode choices and new transportation alternatives. Second, it recommends some policy measures to be enhanced for promoting a green and sustainable built environment, as well as the promotion of green tourism in Qatar. For example, critical issues such as the identification of profitable routes and services, the standardization of prices, the provision of the interoperability of transit modes, reservation and payment systems, and socio-cultural barriers should be effectively addressed, in order to encourage the traveler's intention to continue to use the Metro. Furthermore, hosting the World Cup Qatar 2022 has given the Qatar Rail Company a great chance to promote the use of the Metro locally and internationally, but it still needs to ensure that by promoting it more in the national and international media. Third, it provides guidance on how to maximize the environmental concerns among travelers to lead them to change the travelling behavior in a more sustainable way, as well as to help in shifting the travelling behavior towards public transportation. Fourth, this study could help the decision-makers at Qatar Rail Company on how to provide transit-oriented development around rail/metro stations to offer more state-of-the-art retail facilities.

In conclusion, to become an international service hub, it would be highly beneficial to build and advance an integrated transportation system that is equipped with world-class facilities and that is consistent with socio-economic development, energy conservation, and environmental preservation goals. Therefore, a well-designed and well-executed transportation system and infrastructure helps Qatar strengthen its economical, sociocultural, educational, and other welfare ties with society, ultimately leading Qatar towards achieving societal, economic, and environmental sustainability.

### 5.3. Limitations and Future Research Agenda

This study provides substantial value both theoretically and practically, in terms of the proposed model developed and/or the methodology used to analyze it. However, as with other studies, there were limitations to this study that must be considered by researchers when attempting to interpret or generalize the findings. As it stands, one limitation of the study is the fact that it focused on certain variables to determine the intention to continue using the Qatar Metro. Therefore, future researchers may derive various topics of interest from the present study, for example identifying other sociological or psychological factors that are strongly linked with intention to continue to use eco-friendly transportation modes. Additionally, a future study can look into how demographic and socioeconomic factors affect people's intentions to continue using the Metro, where they may have a big impact. Moreover, this study ignored the non-use of public transportation in favor of concentrating on the intention to continue using the Metro, which is a form of public transportation. This makes it a great venue for future research to examine the determinants of using and not using public transportation. Since we concentrated on the Metro as a sustainable mode of transportation, it is recommended for future research to look at other sustainable modes as well, such as electronic vehicles, shared cars, using public transportation rather than private vehicles, bicycles, and more.

As a result of its design, the study had another limitation, as cross-sectional data and self-reporting were used in this study to assess customer attitudes, PBC, social influence, service quality, environmental concerns, and their intention to continue using Qatar Metro services. As self-reporting could be misleading and unreliable, other measurements (e.g., based on secondary data related to the frequency of travel by the Metro) could be utilized.

Moreover, longitudinal studies may be more reliable in reflecting the long-term behavior of the customers, and so, future studies may consider the use of other research designs.

Furthermore, the researchers could not generalize the results of this study, regarding the hypothesized model, as the study was conducted in one country and we considered only one mode of transportation. In the future, this study could be extended to cross-country and cross-transportation mode contexts, in order to validate the results and gain deeper theoretical insight. Moreover, future researchers can design studies to measure the satisfaction of clients and propose recommendations for improvement. Similarly, future researchers can further investigate from various perspectives, such as cost–benefit analysis, transportation lifestyle, tourism development, engineering and construction, and so on. Thus, this study offers a wide scope of research directions for future academics and practitioners.

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