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Enhancing individuals' engagement in marine recreational sport activities: from an institutional perspective

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Introduction: Encouraging consumer participation in marine recreational sport activities is recognized as a key strategy for boosting both local and regional economies. However, compared to other traditional outdoor activities, participation rates in marine recreation remain relatively low. Two major barriers to participation are consumers' concerns about whether marine recreational sport activities are interesting and suitable for themselves, which can be summarized into product quality uncertainty and product fit uncertainty.

Methods: To address this issue, this paper, grounded in institutional theory, investigates how different institutional environments influence consumers' product certainty and their behavioral engagement in marine recreational sport activities—an area previously underexplored in the literature.

Results and discussions: By collecting 292 survey responses and utilizing ordinary least squares (OLS) regression analysis, we found that both product quality certainty and product fit certainty have a significant positive effect on consumers' behavioral engagement. Additionally, both the regulatory-normative and cognitive institutional environments were shown to significantly enhance consumers' product quality and fit certainty. Moreover, age was found to moderate these effects, with a positive influence on the relationship between the regulatory-normative environment and product certainty, while only affecting the relationship between the cognitive institutional environment and product fit certainty.

KEYWORDS

marine recreational sport activity, institutional theory, institutional environment, behavioral engagement, product fit certainty, product quality certainty

1 Introduction

Marine tourism initially encompasses recreational activities that involve traveling a considerable distance from one's place of residence, with the marine environment serving as the primary setting or focus. Over time, this concept has expanded beyond traditional beach-based activities to encompass a wide array of pursuits centered on the coast and sea (Carvache-Franco et al., 2020b). These activities include but are not limited to, scuba diving, snorkeling, windsurfing, jet skiing, fishing, sea kayaking, visits to fishing villages and marine parks, as well as motor yachting. The diversity of these activities, combined with their recreational appeal, has made marine-based leisure a popular option for individuals seeking to make the most of their free time, particularly for those residing far from coastal areas. Additionally, these activities have contributed significantly to both local and regional economies (Gomez et al., 2021; Li et al., 2024). According to recent reports, the market size of China's water and outdoor sports industry reached 574.205 billion yuan in 2022, reflecting a year-on-year growth of 13.19%. Notably, individuals aged 18 to 40 have shown a keen interest in water sports[1]. In 2023, the value added by the marine services sector amounted to 5,896.8 billion yuan, accounting for 4.7% of the nation's GDP and contributing an additional 0.3 percentage points to national economic growth[2]. With the growing popularity of outdoor sports, increasing public engagement in marine activities is crucial for bolstering the local tourism industry and fostering business growth.

However, compared to other traditional outdoor activities, participation in marine recreational sport activities remains relatively low. This can primarily be attributed to the demanding nature of marine sports. The lack of adequate infrastructure has resulted in a limited number of venues capable of providing high-quality marine sports experiences (Lin and Dong, 2021; Sharaan et al., 2022). Additionally, because marine recreational sport activities have only recently gained popularity, consumers often express concerns regarding their safety and suitability, which can be categorized into two types of uncertainties: product quality uncertainty and product fit uncertainty. For instance, consumers may experience a higher level of product quality uncertainty if they question whether a scuba diving instructor possesses the proper certifications or sufficient experience to ensure a safe and enjoyable experience. In contrast, beginners might face a higher level of product fit uncertainty if they worry about their ability to perform well during a surfing lesson, particularly if they lack prior experience with balance-based sports. If consumers perceive a lower level of product quality uncertainty, they are more likely to view marine recreational activities as both enjoyable and safe. This reduces their perceived risk and fosters greater trust in these activities, making them more inclined to seek opportunities to participate. Furthermore, when consumers believe they can perform well in marine recreational activities, their confidence

increases, alleviating perceived stress. At the same time, a lower level of product fit uncertainty enhances their willingness to try these activities, encouraging greater participation.

Addressing these uncertainties is essential for fostering the growth of marine recreational sport activities. In response, the government has begun enhancing relevant infrastructure and implementing policies aimed at reducing consumer uncertainties. According to institutional theory, institutions encompass formal regulations, informal practices, norms, standards, and roles that shape the behavior of organizations and individuals (Bruton et al., 2010). Thus, institutional environments may play a critical role in reducing consumer uncertainties. However, previous research on marine recreational sport activities has largely focused on identifying factors that influence consumer motivations and qualitatively assessing the impact of policy measures (Carvache-Franco et al., 2020; Qin et al., 2020; Jones and Chikwama, 2021). There remains a lack of clarity on how effective these policies are in reducing consumer uncertainties and increasing participation rates, as well as whether policies with different focuses yield distinct impacts.

Furthermore, consumers across different age groups are likely to exhibit distinct needs, desires, and preferences, which can lead to varied behaviors (Khan et al., 2019). Additionally, as consumers progress through different stages of their life cycle, their needs and responses to marketing initiatives tend to evolve (Khan et al., 2020; Rather and Hollebeek, 2021). Therefore, a key research objective of this paper is to investigate the moderating effect of age on the relationship between the institutional environment and consumers' certainty regarding product quality and product fit-an area that has not been extensively explored in prior studies. Accordingly, this study proposes the following three research questions:

RQ#1: How can product quality certainty and product fit certainty affect consumers' behavioral engagement in marine recreational sport activities?

RQ#2: How can institutional environments affect consumers' product quality certainty and product fit certainty in marine recreational sport activities?

RQ#3: How can consumers' age affect the relationship between institutional environment and their product quality certainty and product fit certainty in marine recreational sport activities?

To address the research questions, this paper begins by developing a theoretical framework to examine the impact of the institutional environment on consumer behavioral engagement, as well as the moderating effects of age. Data will be collected through Credamo, an online survey platform, and regression analysis will be employed to test the proposed hypotheses. Based on the findings, recommendations will be made to enhance consumer engagement in marine recreational sport activities.

This paper makes four significant contributions. Firstly, it enriches institutional theory by exploring the varied impacts of different government policies on consumer engagement in marine recreational sport activities, addressing a gap in prior research that has largely overlooked how specific policies influence consumer behavior in this context. Secondly, it extends the application of institutional theory by identifying the moderating role of age on the relationship between institutional environments and consumer

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engagement, shedding light on why the effectiveness of government policies differs among demographic groups. Thirdly, the study advances existing literature on consumer engagement by examining how product quality certainty and product fit certainty affect consumer behavior, a previously unexplored area in the context of marine recreation. Lastly, the findings offer practical insights for policymakers to design more effective strategies that boost consumer participation in marine recreational sport activities, contributing to economic development while also providing evidence for the need to tailor policies to different age groups to achieve optimal results.

The remainder of this article is organized as follows: Section 2 reviews the relevant literature and establishes the theoretical foundation; Section 3 outlines the hypotheses development and research model; Section 4 describes the data and research methodology; Section 5 presents the results; Section 6 provides the conclusions and discussions; Section 7 highlights the theoretical and practical contributions; and Section 8 offers suggestions for future research.

2 Literature review

2.1 Institutional theory

Institutional theory posits that the actions of organizations and individuals are shaped by their surrounding institutions, which are governed by established rules and norms (DiMaggio and Powell, 1983; Andoh-Baidoo et al., 2024). These institutions exert influence either explicitly through government-imposed laws and regulations or implicitly through culturally embedded social norms (Yang and Su, 2013; Shou et al., 2023b). This theoretical framework defines "institutions" as widely adopted practices, technologies, or social interaction rules, encompassing both formal elements like laws and regulations and informal elements such as customs, norms, and cultural values (Zhao et al., 2023). Currently, these elements are categorized into three pillars: the regulative, normative, and cognitive pillars (D'Andrade, 1984; Scott, 2014), just as shown in Table 1. These pillars generate three types of institutional pressures: coercive pressures stemming from regulatory policies, normative pressures based on shared values and accepted standards, and mimetic pressures driven by the emulation of successful entities in uncertain contexts (DiMaggio and Powell, 1983). Together, these pillars influence individual behaviors by shaping their cognitions, attitudes, and access to resources (Roth and Kostova, 2003).

In this paper, two distinct types of institutional environments are considered: the regulatory-normative institutional environment (RE) and the cognitive institutional environment (CE). The regulatory-normative environment refers to consumers' perceptions of government and social media support in encouraging participation in marine recreational sport activities, while the cognitive environment encompasses individuals' legal awareness, risk identification and management abilities, as well as their capacity to access relevant information (Zhao et al., 2023). The focus on the regulatory-normative environment stems from the limited influence of coercive pressures in this context. Due to the relatively short history of marine recreational sport activities compared to other sports, there has not yet been a substantial number of consumers actively engaging with government policies. Additionally, the smaller participant base makes it challenging for the government to accurately identify consumer needs, potentially leading to biased policy implementation (Sheng et al., 2018). Conversely, leveraging social media is seen as an effective strategy to boost consumer engagement (Annamalai et al., 2021). In the realm of sports, social media can facilitate the sharing of positive experiences and consumption memories, thereby prompting interactions and increasing user engagement (Vale and Fernandes, 2018). Social media content creators can also enhance content vividness, which positively influences consumer attitudes and click-through intentions (Lohtia et al., 2003; Fortin and Dholakia, 2005). Thus, utilizing both government initiatives and social media support to promote marine recreational sport activities appears to be a more effective strategy, underscoring the value of the regulatory-normative environment. On the other hand, compared to traditional outdoor activities, consumers tend to be less familiar with marine recreation, which may heighten their perception of associated risks. Therefore, incorporating the cognitive institutional environment is crucial to address these concerns.

2.2 Uncertainties in marine recreational sport activities

Decision-makers rely heavily on the information available to them. When this information pool is insufficient, they experience a sense of insecurity, often manifesting as uncertainty (Bar-Anan et al., 2009). Uncertainty is defined as "the extent to which a culture programs its members to feel either uncomfortable or comfortable in unstructured situations" (Hofstede, 2011). Individuals with high levels of uncertainty are more likely to have a strong emotional need

TABLE 1 Comparison between diverse pillars.

Pillar	Explanation	Examples
Regulative	Regulative pillar reflects coercion, monitoring, enforcement, and conformity to rules.	Laws, policies, and regulations
Normative	Normative pillar consists of social norms, values, beliefs, and assumptions about human nature and human behavior that are socially shared and carried by individuals.	Values and norms that are internalized by society.
Cognitive	Cognitive pillar stems from addressing generally "held beliefs and taken-for-granted assumptions that provide a framework for everyday routines, as well as the more specialized, explicit and codified knowledge and belief systems."	Symbols, codes, and rules that are constitutive of the nature of reality and experiences.

for clear, structured rules and tend to rely on written guidelines to reduce their uncertainty (Sarafan et al., 2020; Kim et al., 2021). In the context of this study, consumers' limited familiarity with marine recreational sport activities leads to significant information asymmetry. For organizations, it is challenging to fully convey the attributes and qualities of these activities, and there may be unforeseen issues that are difficult to identify or communicate (Dimoka et al., 2012). As a result, consumers may struggle to assess whether these activities are genuinely appealing, leading to concerns about product quality uncertainty (Chen et al., 2023).

In addition to product quality uncertainty, another critical dimension is product fit uncertainty, which refers to the misalignment between consumer preferences and the product itself (Hong and Pavlou, 2014). Unlike other outdoor recreational activities, engaging in marine sports often requires consumers to possess basic skills. For instance, when embarking on a fishing trip by boat, participants must ensure they can manage seasickness. However, opportunities to engage in these activities are relatively scarce for individuals who live far from coastal areas. Consequently, many people may not fully understand whether marine activities are suited to their interests and capabilities. They may also face challenges in knowing how to perform safely and effectively in these settings. Thus, to enhance consumer engagement in marine recreational sport activities, it is essential to increase both their product quality certainty and product fit certainty.

2.3 Behavioral engagement in marine recreational sport activities

Engagement refers to the level of attention, effort, participation, curiosity, interest, and passion that individuals display when involved in an activity (Chiu, 2021). It reflects the degree to which individuals invest in learning, their commitment to achieving goals, and their persistence and satisfaction in participating in activities (Marks, 2000; Fredricks et al., 2004). Although originally conceptualized in the educational field to measure student performance, the concept of engagement has since been broadened to encompass other domains. For instance, researchers such as Ghosh et al. (2020); Li et al. (2021), and Saks (2022) have applied it in the field of human resource management to assess employee job performance. Additionally, scholars like Tafesse and Wood (2021); Lim and Rasul (2022), and Blut et al. (2023) have utilized engagement in marketing to evaluate the effectiveness of strategic initiatives.

Engagement can be categorized into three distinct dimensions: emotional, cognitive, and behavioral. Emotional engagement refers to consumers' reactions toward peers, activities, and organizations, particularly involving specific emotions such as happiness, excitement, boredom, or anxiety (Fredricks et al., 2004). Those with high emotional engagement tend to feel comfortable, safe, and genuinely interested in the activities. Cognitive engagement is defined by the mental effort that consumers put into tasks, often using deep, self-regulated, and strategic approaches. Consumers with high cognitive engagement are more likely to invest effort in learning how to excel in the activities, demonstrating a commitment

to understanding and improving their performance. Lastly, behavioral engagement involves the actual participation and involvement in activities both within and outside of designated settings (Fredricks et al., 2004). Consumers who exhibit high levels of behavioral engagement are proactive, actively seek out opportunities, and take responsibility for their actions, showing a strong dedication to fully engaging in the activities.

In this paper, we focus on behavioral engagement as the primary measure of consumers' involvement in marine recreational sport activities for three key reasons. Firstly, unlike emotional and cognitive engagement, behavioral engagement reflects tangible actions such as participation and interaction, making it a more direct and practical indicator of consumer involvement. This approach ensures that the recommendations provided can lead to more immediate and impactful outcomes in promoting marine recreational sport activities. Secondly, previous studies have shown that emotional and cognitive engagement significantly influence behavioral engagement (Choi et al., 2024; Wang et al., 2025). While various strategies exist to enhance emotional and cognitive engagement, their ultimate purpose is to drive behavioral engagement, which underscores its central role in consumer participation. Finally, since emotional and cognitive engagement act as precursors to behavioral engagement, strategies designed to boost behavioral engagement inherently address these underlying factors. As such, this paper emphasizes behavioral engagement as the key metric for assessing and enhancing consumer involvement in marine recreational sport activities.

3 Hypotheses development

3.1 Product certainty and consumers' behavior engagement

In this paper, product quality certainty refers to consumers' confidence that marine recreational sport activities will be enjoyable. When consumers perceive a high level of product quality certainty, they develop greater trust in the services offered by marine recreational providers. This trust can foster positive emotions and interactions, making consumers more likely to actively seek advice from experts on how to improve their performance and better prepare for participation (Wongkitrungrueng and Assarut, 2018). Moreover, trust has been identified as a key factor influencing consumers' intention to revisit or continue engaging in activities (Guo et al., 2021). Therefore, when consumers are confident that the activities are both enjoyable, they are more inclined to participate repeatedly and deepen their engagement. Thus, we propose the following hypothesis:

H1a: Product quality certainty is positively associated with consumers' behavioral engagement.

On the other hand, product fit certainty relates to their belief in their own ability to perform well in these activities. When consumers perceive higher levels of product fit certainty, they are prone to believing that they are able to perform well in the activities and the service provided can well meet their requirement. This enables them to experience greater satisfaction with marine

recreational sport activities. Satisfied consumers tend to exhibit more positive attitudes towards these activities and are more inclined to engage deeply by interacting with other participants and seeking ways to improve their performance (Van Doorn et al., 2010; Hepola et al., 2020; Bitrian et al., 2021). Additionally, when consumers have a strong sense of certainty regarding the suitability of the activities, they perceive lower levels of risk, particularly in terms of physical and psychological safety. Perceived risk is a critical factor influencing engagement intentions (Natarajan et al., 2017), and consumers who perceive lower risks are more likely to show a positive intention to participate in activities (Xue et al., 2020). Based on this, we propose the following hypothesis:

H1b: Product fit certainty is positively associated with consumers' behavioral engagement.

3.2 Institutional environment and consumers' product certainty

In this paper, regulatory-normative environments refer to the regulations and guidelines established by organizations, such as governments and enterprises, to encourage consumer participation in marine recreational sport activities. Regulatory-normative environments help ensure the quality and safety of infrastructure by curbing merchants' illegal practices and conducting regular inspections. This fosters a safer environment for activities, thereby alleviating consumers' concerns about potential risks. Additionally, a supportive regulatory-normative environment enables enterprises to access both subsidy and non-subsidy policy supports, making it easier for them to secure resources (Bag et al., 2021; Liu and Wu, 2024). As a result, organizations can allocate more resources to upgrading equipment and enhancing the overall experience, which in turn increases consumers' confidence in the quality of these activities. Thus, we can propose the hypothesis:

H2a: Regulatory-normative environment is positively associated with consumers' product quality certainty.

Cognitive institutional environments, on the other hand, focus on policies aimed at reducing perceived risks for consumers. In a positive cognitive institutional environment, social media platforms are encouraged to disseminate information highlighting the benefits of marine recreational sport activities and essential safety skills. This can provide a large number of opportunities for consumers to learn how to protect themselves and better understand the value of participating in these activities. Access to more positive and informative content significantly boosts consumers' product quality certainty. Based on these considerations, we propose the following hypothesis:

H2b: Cognitive institutional environment is positively associated with consumers' product quality certainty.

Furthermore, in a supportive regulatory-normative environment, organizations can more easily access relevant information and resources, enabling them to design tailored activities that cater to consumers with diverse preferences and characteristics. This allows consumers to select marine recreational sport activities that align with their personal interests, thereby enhancing their product fit certainty (Mpungose, 2020). Thus, we can propose the hypothesis:

H3a: Regulatory-normative environment is positively associated with consumers' product fit certainty.

In a positive cognitive institutional environment, the widespread use of social media platforms facilitates communication between potential consumers and experienced participants. This exchange deepens consumers' understanding of the skills required for these activities, reducing uncertainty. As consumers become more familiar with marine recreational sport activities, they are better able to assess their own capabilities, thus increasing their confidence in their ability to perform well. Based on these insights, we propose the following hypothesis:

H3b: Cognitive institutional environment is positively associated with consumers' product fit certainty.

3.3 Moderating roles of age

Compared to younger generations, who typically use social media as their primary source of information, senior adults tend to rely more on formal regulations to assess the quality and safety of activities. Thus, in a supportive regulatory-normative environment, an increase in regulatory support for the marine recreational industry is likely to significantly boost trust among senior adults more than it would for younger individuals. Furthermore, while younger adults are generally more drawn to thrilling and adventurous activities, senior adults tend to prioritize ensuring that they possess adequate skills before participating. Thus, we can propose the following hypothesis:

H4a: Consumers' age positively moderates the effect of regulatory-normative environment on their product quality certainty.

Consequently, in a cognitive institutional environment, senior adults are more likely to benefit from the information shared on social media platforms, as it helps them gain the necessary knowledge and confidence. Adults who have greater trust in service quality and a deeper understanding of marine recreational sport activities are more likely to feel confident in the quality of these activities (Chong et al., 2022). Therefore, we propose that the cognitive institutional environments contribute more to enhancing product quality certainty for senior adults than for younger adults. The hypothesis is as follows:

H4b: Consumers' age positively moderates the effect of cognitive institutional environment on their product quality certainty.

Furthermore, while both younger and senior adults are encouraged to explore various marine recreational sport activities in a regulatory-normative environment, younger adults are generally more independent in forming their own opinions and are less inclined to strictly follow the guidance provided by organizations. In contrast, senior adults primarily rely on official channels for information, making them more likely to adhere to the recommendations offered by these organizations on how to perform well in their activities (Zhu et al., 2023). This tendency allows senior adults to acquire the necessary skills in advance, thereby enhancing their product fit certainty. Thus, we can propose the following hypothesis:

H5a: Consumers' age positively moderates the effect of regulatory-normative environment on their product fit certainty.

Additionally, because younger generations have more diverse avenues for learning how to participate in marine recreational sports activities, instructions and guidelines are often specifically tailored to meet the needs of senior adults. This targeted design allows senior adults to quickly familiarize themselves with the activities through clear and concise descriptions, significantly enhancing their product fit certainty. Furthermore, according to socioemotional selectivity theory, younger individuals prioritize future-oriented goals, such as knowledge acquisition, while older individuals focus on present-oriented goals, such as emotional meaning (Carstensen et al., 1999; Yue and Huang, 2024). Given that senior adults are more inclined to engage with training information shared on social media platforms, they are also more likely to gain emotional support from these platforms. This emotional reinforcement, combined with access to comprehensive training, boosts their confidence and belief in their ability to perform well in the activities. Based on these insights, we propose the following hypotheses:

H5b: Consumers' age positively moderates the effect of cognitive institutional environment on their product fit certainty.

The whole conceptual framework is shown in Figure 1.

4 Data

4.1 Data collection

After selecting construct measurements from previous studies and modifying them to better align with the context of this research, we sought feedback on their readability from three experts in consumer behavior. Additionally, recognizing that adults from different demographic backgrounds might interpret the content differently, we also had the questionnaire reviewed by five individuals from various age groups. The final questionnaire consists of five sections, with all constructs measured using a seven-point Likert scale (1 = strongly disagree, 7 = strongly agree). The first section gathers demographic information, such as age, gender, income, and education level. Given that some respondents might be unfamiliar with marine recreational

sport activities and related policy tools, the second section includes two screening questions: "Have you ever participated in marine recreational sport activities?" and "Are you familiar with the various types of policy tools?". Only the respondents both having participated in marine recreational sport activities and are familiar with the policy tools are considered useful. The remaining sections focus on collecting data on consumers' behavioral engagement, product-related certainty, and perceptions of the institutional environment. Details of the questionnaire structure are presented in Table 2. Data was collected via Credamo, a widely used data collection platform, yielding a total of 500 responses, of which 292 were valid, resulting in a usable response rate of 58.4%. The low response rate can be attributed to two main reasons. Firstly, unlike other outdoor recreational activities, marine activities require extensive public infrastructure and specialized equipment, which limits participation to a relatively small number of individuals. Secondly, the majority of consumers are unfamiliar with the policy tools associated with these activities, resulting in only a subset of respondents being considered relevant or useful for the study. The demographic breakdown of respondents is provided in Table 3: over 70% were female, 77% were aged below 45, and the majority held at least an undergraduate degree. Additionally, more than half of the respondents reported a monthly income of at least 8,000 yuan.

4.2 Validity and reliability tests

Since the measurement items were adapted from previous studies, confirmatory factor analysis (CFA) was conducted to assess the validity and reliability of the constructs. Firstly, Cronbach's alpha and composite reliability (CR) were calculated to evaluate construct reliability. As shown in Table 4, Cronbach's alpha values ranged from 0.722 to 0.898, exceeding the threshold of 0.7, while composite reliability values ranged from 0.844 to 0.936, also surpassing the 0.7 threshold, indicating strong reliability (Fornell and Larcker, 1981). Secondly, all factor loadings in this study were above the threshold of 0.7, and the average variance extracted (AVE) for all constructs ranged from 0.641 to 0.83, exceeding the recommended minimum of 0.5, thus supporting good convergent validity (Fornell and Larcker, 1981).
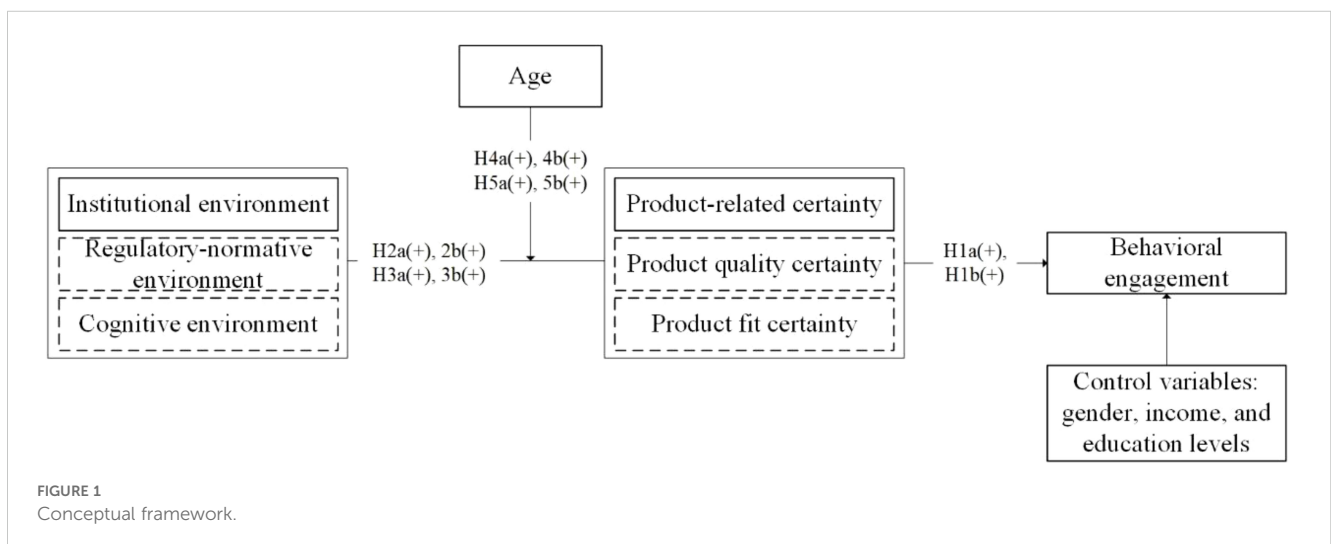

FIGURE 1
Conceptual framework.

TABLE 2 Construct and items.

Construct	Items	Description
Behavioral engagement (BE) (Akhtar et al., 2024)	BE 1	I pay a lot of attention to the cues of marine recreational sport activities.
	BE 2	I often get involved in the discussions of the marine recreational sport activities.
	BE 3	I often participate in the question-and-answer activities when it discusses about marine recreational sport activities.
Product quality certainty (PQC) (Hong and Pavlou, 2014)	PQC 1	I am sure that I would be relax in the marine recreational sport activities as introduced.
	PQC 2	I am sure that I would be interested in the marine recreational sport activities as introduced.
	PQC 3	I am sure that I would be enjoyable in the marine recreational sport activities as introduced.
	PQC 4	I am sure that I would have fun in the marine recreational sport activities as expected.
Product fit certainty (PFC) (Hong and Pavlou, 2014)	PFC 1	I am sure the marine recreational sport activities would match my requirements.
	PFC 2	I am certain that the marine recreational sport activities would match my tastes.
	PFC 3	I am sure that the marine recreational sport activities would fit my preference.
	PFC 4	I am sure that marine recreational sport activities with these characteristics is what I am looking for.
Regulatory-normative environment (RE) (Zhao et al., 2023)	RE 1	Government departments encourage individuals to take participate in marine recreational sport activities.
	RE 2	Government departments can give special support to individuals who want to take participate in marine recreational sport activities.
	RE 3	The government supports individuals who had failed to take participate in marine recreational sport activities.
	RE 4	The public can see individuals successfully taking participating in marine recreational sport activities.
Cognitive environment (CE) (Zhao et al., 2023)	CE 1	I know how to take participate in marine recreational sport activities and protect my selves.
	CE 2	I know how to identify risks when taking participate in marine recreational sport activities.
	CE 3	I know how to deal with risks when taking participate in marine recreational sport activities.
	CE 4	I know how to find information concerning marine recreational sport activities needed.

Thirdly, discriminant validity was assessed by comparing the square root of AVE for each construct with the inter-construct correlations, which met the required standards, as shown in Table 5. Additionally, exploratory factor analysis (EFA) was performed to further confirm convergent validity. As illustrated in Table 6, each item showed stronger correlations with its designated construct than with others, confirming satisfactory discriminant validity. Considering that several constructs had correlation coefficients exceeding the recommended threshold of 0.6, we further tested for potential multicollinearity. According to Mason and Perreault (1991), multicollinearity is a concern if the variance inflation factor (VIF) exceeds 3. The calculated VIF values in this study ranged from 1.393 to 2.565, indicating no issues with multicollinearity.

In addition to conducting validity and reliability tests, we also addressed common method bias (CMB) by following the procedure outlined by Podsakoff et al. (2003). At the beginning of the survey, respondents were informed that the data collected would be used solely for academic research and that their privacy would be strictly protected. This assurance encouraged respondents to express their opinions freely. Furthermore, to reduce the likelihood of

participants drawing causal inferences between constructs, the questionnaire was designed to distribute the various factors across different pages. Additionally, to assess potential multicollinearity among the variables, we calculated the Variance Inflation Factor (VIF). The results showed that the VIF values ranged from 1.393 to 2.823, well below the threshold of 3, indicating no significant multicollinearity concerns (Hair et al., 2006).

5 Results

After confirming the validity and reliability of the questionnaire data, ordinary least squares (OLS) regression models were employed to test the hypotheses. The study of each hypothesis involves three steps. First, the model's overall significance is tested to ensure the probability (F-statistic) is below the 5% threshold. Second, the significance of the independent variable is evaluated at the 5% level. If the independent variable is found to significantly affect the dependent variable, the third step is to determine whether this effect is positive by comparing the estimated coefficients to zero. The initial analysis focused on assessing

TABLE 3 Demographic information of respondents.

Variables	Category	Frequency (N=292)	Percent
Gender	Male	86	29.45%
	Female	206	70.55%
Age	Less than 35 years	127	43.49%
	36 to less than 45 years	102	34.93%
	46 to less than 55 years	18	6.16%
	More than 56 years	45	15.41%
Education levels	High school or below	22	7.53%
	Undergraduate	192	65.75%
	Postgraduate	78	26.71%
Income	Less than 5000 yuan	56	19.18%
	5001 to less than 8000 yuan	66	22.60%
	8001 to less than 15000 yuan	94	32.19%
	More than 15001	76	26.03%

the impact of product certainty on consumers' behavioral engagement. As indicated in Table 7, both product quality certainty (estimated coefficient = 1.1174, p < 0.001) and product fit certainty (estimated coefficient = 1.1749, p < 0.001) demonstrated a positive and significant influence on consumers' behavioral engagement, thereby supporting hypotheses H1a and H1b.

Next, this study investigated the impact of institutional environments on consumers' product quality certainty and product

TABLE 4 Assessment of reliability and convergent validity.

	Cronbach's Alpha	rho_A	Composite Reliability	AVE	Indicator	Factor loading
Behavioral engagement (BE)	0.898	0.9	0.936	0.83	BE 1	0.914
					BE 2	0.908
					BE 3	0.91
Product quality certainty (PQC)	0.732	0.732	0.848	0.651	PQC 1	0.803
					PQC 2	–
					PQC 3	0.811
					PQC 4	0.807
Product fit certainty (PFC)	0.722	0.723	0.844	0.643	PFC 1	0.802
					PFC 2	–
					PFC 3	0.805
					PFC 4	0.797
Regulatory-normative environment (RE)	0.774	0.776	0.869	0.689	RE 1	0.856
					RE 2	0.822
					RE 3	–
					RE 4	0.811
Cognitive environment (CE)	0.875	0.875	0.914	0.728	CE 1	0.865
					CE 2	0.855
					CE 3	0.874
					CE 4	0.816

TABLE 5 Correlations and the square roots of AVE.

	BE	PQC	PFC	RE	CE
BE	**0.911**				
PQC	0.649	**0.807**			
PFC	0.697	0.735	**0.802**		
RE	0.735	0.576	0.588	**0.83**	
CE	0.753	0.627	0.669	0.658	**0.853**

The values on the diagonal are the square roots of the AVEs. Values below the diagonal are the inter-construct correlations.

fit certainty. As shown in columns (1) and (2) of Table 8, both the regulatory-normative environment (estimated coefficient = 0.3967, p < 0.001) and the cognitive institutional environment (estimated coefficient = 0.4002, p < 0.001) had a positive and significant effect on consumers' product quality certainty, thereby supporting hypotheses H2a and H2b. Furthermore, columns (3) and (4) indicate that the regulatory-normative environment (estimated coefficient = 0.4108, p < 0.001) and the cognitive institutional environment (estimated coefficient = 0.4377, p < 0.001) also positively and significantly influenced consumers' product fit certainty, thus supporting hypotheses H3a and H3b.

This study further explored the moderating effect of age on the relationship between the institutional environment and consumers' product quality certainty. As shown in column (1) of Table 8, the interaction between the regulatory-normative environment and age had a positive and significant effect on consumers' product quality certainty (estimated coefficient = 0.1062, p < 0.001), thereby supporting hypothesis H4a. As illustrated in Figure 2, while adults aged over 46

exhibited lower product quality certainty compared to the younger age groups, an increase in the regulatory-normative environment led to a more substantial improvement in their product quality certainty. Conversely, as indicated in column (2) of Table 8, the interaction between the cognitive institutional environment and age did not show a significant effect on product quality certainty (estimated coefficient = 0.0585, n.s.), thus rejecting hypothesis H4b.

Additionally, column (3) of Table 9 indicates that the interaction between the regulatory-normative environment and age had a positive and significant effect on consumers' product fit certainty (estimated coefficient = 0.0691, p < 0.05), thereby supporting hypothesis H5a. As depicted in Figure 3, while adults aged over 46 had lower product fit certainty compared to the other age groups, an increase in the regulatory-normative environment reduced the disparity in product fit certainty across age groups. In contrast, column (4) reveals that the interaction between the cognitive institutional environment and age also positively and significantly influenced consumers' product fit certainty (estimated coefficient = 0.0704, p <

TABLE 6 Results of exploratory factor analysis.

	BE	PQC	PFC	RE	CE
BE 1	**0.914**	0.629	0.674	0.685	0.703
BE 2	**0.908**	0.589	0.609	0.649	0.676
BE 3	**0.91**	0.55	0.618	0.674	0.678
PQC 1	0.518	**0.803**	0.535	0.47	0.533
PQC 3	0.538	**0.811**	0.656	0.474	0.478
PQC 4	0.513	**0.807**	0.588	0.451	0.505
PFC 1	0.585	0.553	**0.802**	0.456	0.504
PFC 3	0.572	0.591	**0.805**	0.488	0.585
PFC 4	0.515	0.625	**0.797**	0.47	0.519
RE 1	0.642	0.511	0.491	**0.856**	0.574
RE 2	0.571	0.446	0.491	**0.822**	0.513
RE 4	0.617	0.476	0.482	**0.811**	0.551
CE 1	0.662	0.542	0.573	0.576	**0.865**
CE 2	0.652	0.542	0.543	0.555	**0.855**
CE 3	0.666	0.519	0.574	0.587	**0.874**
CE 4	0.59	0.534	0.592	0.527	**0.816**

Bold indicates that the variable is significantly more correlated with this set of items than it is with the other sets of items.

TABLE 7 Effect of product certainty on behavioral engagement.

	Behavioral engagement	
	(1)	(2)
Product quality certainty	1.1174***	
	(0.0864)	
Product fit certainty		1.1749***
		(0.0811)
Gender	0.1096	0.1276
	(0.1296)	(0.1239)
Education levels	0.0671	0.0401
	(0.1170)	(0.1118)
Income	0.2564***	0.2098***
	(0.0628)	(0.0606)
_Cons	-2.3401***	-2.3659***
	(0.5425)	(0.4939)
Number of obs.	292	292
R-squared	0.4584	0.5047
Prob>F	0.0000	0.0000

***: $p < 0.01$.

0.05), supporting hypothesis H6a. However, as shown in Figure 4, although a stronger cognitive institutional environment increased product fit certainty, it did not significantly narrow the differences between age groups.

6 Conclusion, discussions, and suggestions

6.1 Conclusion and discussion

The empirical results reveal that both product quality certainty and product fit certainty have a positive and significant impact on consumers' behavioral engagement. Furthermore, both the regulatory-normative environment and the cognitive institutional environment significantly enhance consumers' product quality and fit certainty. Additionally, age was found to positively moderate the effect of the regulatory-normative environment on consumers' product certainty, while it only moderated the impact of the cognitive institutional environment on consumers' product fit certainty.

There are three key reasons behind the insignificant effect of age on the relationship between the cognitive institutional environment and consumers' product fit certainty. Firstly, while older adults may have more experience in handling risks, they are still relatively unfamiliar with marine recreational sport activities. In contrast, information presented in regulatory-normative environments tends to be more detailed and specific, allowing older adults to draw on their past experiences to assess whether they can effectively participate in these activities. Secondly, the information channels in cognitive institutional environments are more diverse than those in regulatory-normative environments. For instance, younger individuals may access information through platforms like TikTok and WeChat, whereas older adults might rely on television news and community networks (Pirhonen et al., 2020; Al-Samarraie et al., 2022). Despite these differences, adults across age groups have ample

TABLE 8 Effect of institutional environment on consumers' product certainty.

	Product quality certainty		Product fit certainty	
	(1)	(2)	(3)	(4)
Regulatory-normative environment	0.3967***		0.4108***	
	(0.0366)		(0.0370)	
Cognitive institutional environment		0.4002***		0.4377***
		(0.0325)		(0.0317)
Gender	-0.0930	-0.0189	-0.1065	-0.0275
	(0.0746)	(0.0716)	(0.0754)	(0.0699)
Education levels	-0.0443	0.0362	-0.0190	0.0692
	(0.0673)	(0.0649)	(0.0680)	(0.0634)
Income	0.0887*	0.0616	0.1151**	0.0792*
	(0.0362)	(0.0351)	(0.0366)	(0.0343)
_Cons	3.6296***	3.4763***	3.3129***	3.0337***
	(0.2295)	(0.2190)	(0.2321)	(0.2137)
Number of obs.	292	292	292	292
R-squared	0.3493	0.4005	0.3770	0.4653
Prob>F	0.0000	0.0000	0.0000	0.0000

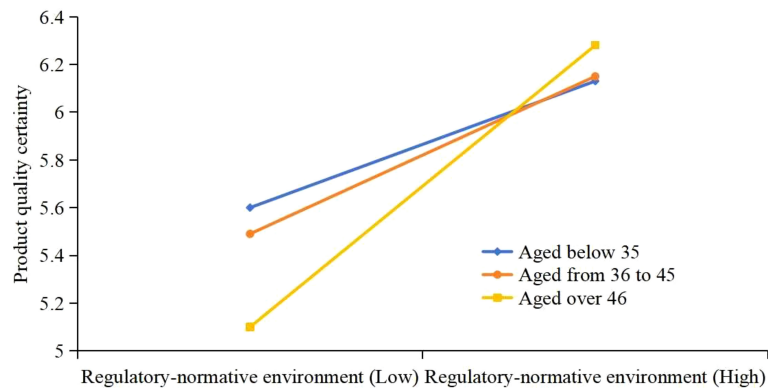*: $p < 0.5$, **: $p < 0.1$, ***: $p < 0.01$.

FIGURE 2
Moderating roles of age in the effect of regulatory-normative environment on consumers' product quality certainty.

opportunities to access relevant information, enabling them to assess their capability to engage in the activities, thus explaining the lack of a significant moderating effect of age. Thirdly, the variety and rapid evolution of marine recreational sport activities, combined with shifting consumer interests, mean that participants of all ages frequently need to learn new safety measures. This constant need to adapt can lead to cognitive overload, diminishing the moderating influence of age on product fit certainty.

TABLE 9 Moderating roles of age in the relationship between institutional environment and product certainty.

	Product quality certainty		Product fit certainty	
	(1)	(2)	(3)	(4)
Regulatory-normative environment * Age	0.1062***		0.0691*	
	(0.0319)		(0.0324)	
Cognitive institutional environment * Age		0.0585		0.0704*
		(0.0321)		(0.0311)
Age	-0.6233***	-0.3400	-0.4575*	-0.4515*
	(0.1834)	(0.1863)	(0.1865)	(0.1805)
Regulatory-normative environment	0.1902**		0.2808***	
	(0.0723)		(0.0735)	
Cognitive institutional environment		0.2968***		0.3146***
		(0.0653)		(0.0633)
Gender	-0.0756	-0.0087	-0.0980	-0.0170
	(0.0736)	(0.0717)	(0.0748)	(0.0695)
Education levels	-0.0763	0.0144	-0.0558	0.0301
	(0.0674)	(0.0665)	(0.0686)	(0.0644)
Income	0.1077**	0.0732	0.1483***	0.1108**
	(0.0382)	(0.0380)	(0.0389)	(0.0368)
_Cons	4.8376***	4.0834***	4.1558***	3.8215***
	(0.4226)	(0.3971)	(0.4297)	(0.3849)
Number of obs.	292	292	292	292
R-squared	0.3747	0.4075	0.3946	0.4790
Prob>F	0.0000	0.0000	0.0000	0.0000

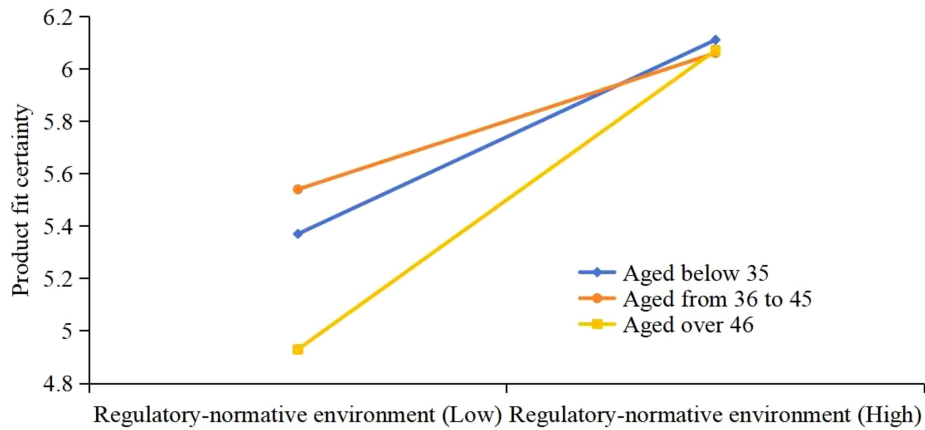*: $p < 0.5$, **: $p < 0.1$, ***: $p < 0.01$.

FIGURE 3
Moderating roles of age in the effect of regulatory-normative environment on consumers' product fit certainty.

6.2 Suggestions

In China, policymakers have implemented various policy tools to support the development of marine recreational sport activities, focusing on both the regulatory-normative environment and the cognitive institutional environment. These policy efforts can be categorized into three key areas for each environment. Firstly, within the regulatory-normative environment, the policies emphasize (1) continuing infrastructure development, (2) establishing regulatory frameworks, and (3) promoting industry growth. The regulatory frameworks are designed to ensure that all activities are conducted within a legal framework, while industry promotion includes both subsidy and non-subsidy incentives to support enterprises in developing marine recreation-related industries. Secondly, the cognitive institutional environment focuses on (1) safety information dissemination, (2) skills training for safety, and (3) emergency response exercises. Safety information sharing ensures that consumers are well-informed on how to minimize risks, while safety skills training and emergency drills aim to equip both individuals and organizations with the knowledge and capabilities

needed to effectively respond to potential hazards, thus reducing the impact of unforeseen events. The details are shown in Figure 5.

Based on the findings of this study, we propose the following five strategies to enhance the diffusion of marine recreational sport activities. The first is to expand public infrastructure developments. Governments should prioritize the construction of additional water sports centers, piers, and safety facilities that meet international standards. Improving public infrastructure not only ensures the quality and safety of marine recreational sport activities but also enhances consumers' product quality certainty, thereby encouraging greater participation. The second is to implement targeted subsidy policies to support industry growth. To boost consumers' product fit certainty, governments should introduce subsidy programs to support enterprises in adopting advanced technologies. By leveraging emerging technologies, businesses can better understand consumer needs and design tailored activities, ultimately increasing consumer engagement in marine recreation. The third is to promote safety education and skills training. Organizations, such as universities and community centers, should establish regular training programs and leverage online
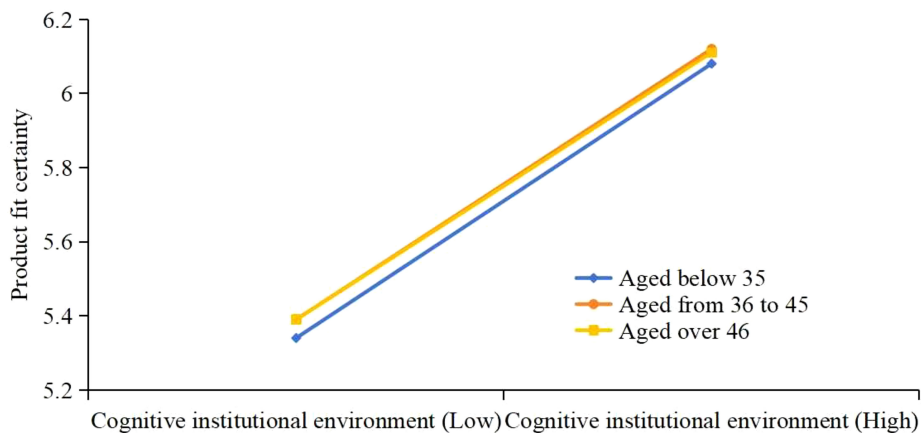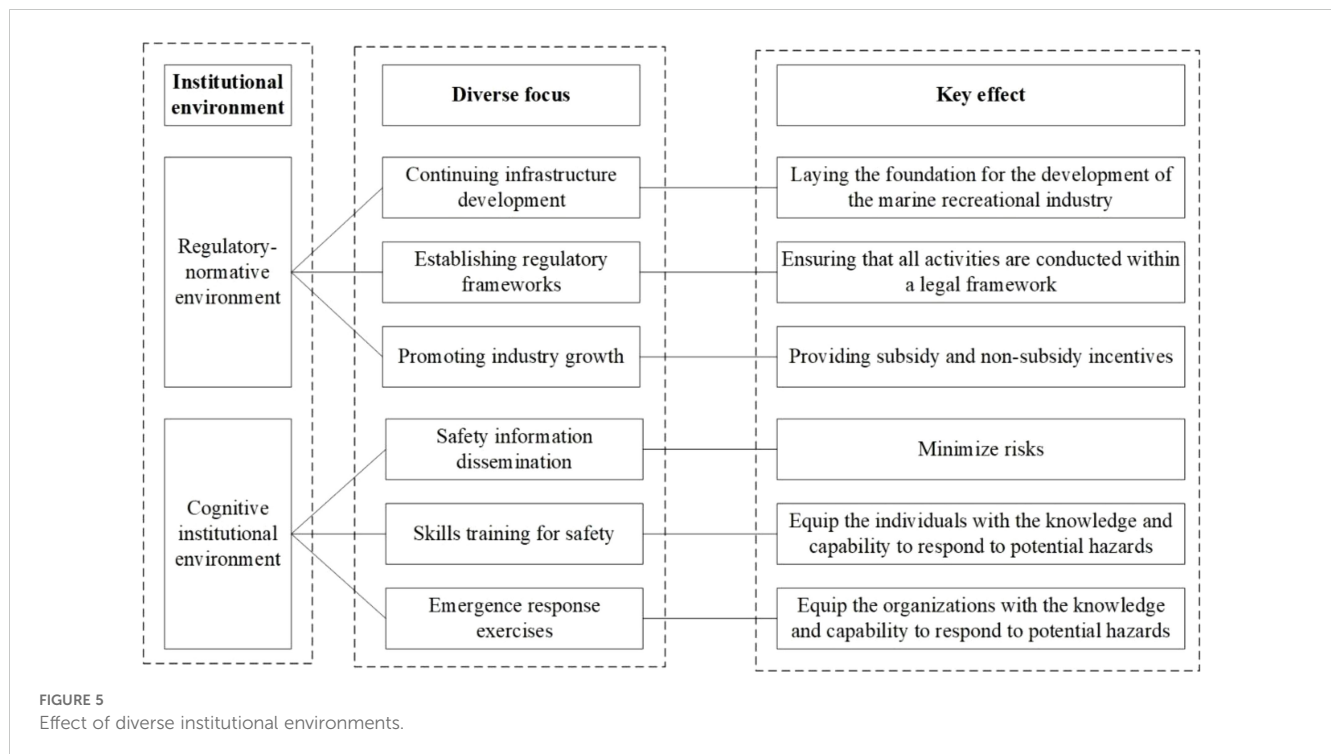

FIGURE 4
Moderating roles of age in the effect of cognitive institutional environment on consumers' product fit certainty.

FIGURE 5
Effect of diverse institutional environments.

platforms to disseminate safety knowledge. Equipping consumers with safety-related skills will boost their confidence in handling unexpected situations, thereby reducing concerns related to product quality certainty. The fourth is to diversify communication channels to reach different age groups. Given the varying preferences for information channels across age demographics, governments and businesses should integrate digital platforms (e.g., TikTok, WeChat) with traditional media (e.g., television, newspapers) to promote the benefits of participating in marine recreational sport activities and to communicate relevant regulations. This targeted approach can enhance awareness and engagement across diverse consumer segments. The final is to conduct regular emergence response exercises and publicize them. Organizations should continue to conduct regular emergency response exercises to improve their readiness for unforeseen events. Promoting these drills on social media can increase consumers' product quality certainty, thereby fostering a higher intention to engage in marine recreational sport activities.

7 Contributions

7.1 Theoretical contributions

This paper makes three key theoretical contributions. Firstly, it enriches institutional theory by examining how different types of institutional environments influence consumer engagement in marine recreational sport activities. While institutional theory traditionally asserts that institutional contexts shape individual behavior (Bruton et al., 2010), it has largely overlooked the distinct mechanisms through which various types of institutional

environments exert their effects. Previous studies primarily relied on qualitative analyses to evaluate the impact of policy measures in the context of marine recreational sport activities, without providing quantitative evidence (Carvache-Franco et al., 2020a; Qin et al., 2020; Jones and Chikwama, 2021). This paper addresses this gap by quantitatively assessing the influence of diverse institutional environments on consumer behavioral engagement, thus contributing to a more robust understanding of the field.

Secondly, the study extends the application of institutional theory by identifying the moderating effect of age on the relationship between institutional environments and consumer engagement. While earlier research has highlighted the significant impact of government policies on consumer behavior (Bruton et al., 2010), it has not fully explored how these effects vary across age groups. To bridge this gap, the paper investigates the differential effects of various policy tools on consumers of different age groups, providing insights into why individuals from distinct age cohorts perceive government support differently. This analysis sheds light on why identical policy measures may yield diverse behavioral outcomes among different demographic groups.

Thirdly, the study advances the consumer engagement literature by quantitatively investigating the impact of product quality certainty and product fit certainty on consumer behavior—an area previously underexplored in the context of marine recreation. Most prior research has focused on identifying factors that drive consumer motivation or qualitatively evaluating policy impacts, leaving a gap in understanding the quantitative effects of institutional environments. By exploring how institutional environments address product quality uncertainty and product fit uncertainty to enhance consumer behavioral engagement, this paper makes a significant contribution to bridging this gap in the literature.

7.2 Practical implications

This study offers three key practical implications. Firstly, the findings highlight the critical role of product quality certainty and product fit certainty in enhancing consumer behavioral engagement in marine recreational sport activities. This provides valuable insights for policymakers, suggesting that future regulations should prioritize strategies to boost consumers' confidence in both the quality of these activities and their own suitability for participation. Secondly, the study underscores the significant impact of institutional environments in reducing consumer uncertainties. By empirically examining the effects of regulatory-normative and cognitive institutional environments, this research offers concrete guidance for policy development. Policies that encourage active consumer participation in marine recreational sport activities, while simultaneously promoting self-protection measures, can effectively increase consumer confidence and engagement. Thirdly, the findings emphasize the importance of offering tailored support to consumers across different age groups. The empirical results show that age significantly moderates the relationship between institutional environments and product certainty, indicating the need for differentiated communication strategies that cater to the specific informational needs of various age demographics (Shou et al., 2023a).

8 Limitations and future work

This paper has two primary limitations. Firstly, the empirical data utilized is cross-sectional, which restricts the ability to capture the dynamic effects of institutional environments over time. To address this limitation, future research should consider conducting semi-structured interviews with a diverse sample of potential consumers to explore their evolving perceptions. Additionally, implementing a panel study with quarterly surveys over a two-year period would allow researchers to track changes in consumer perceptions and behaviors longitudinally. Secondly, this study does not account for the interactive effects of different types of government policies. Future work should adopt a multiple-case study approach to examine the specific focus areas of regulatory, normative, and cognitive policies. Collecting qualitative data through interviews with policymakers would further enrich the analysis by complementing quantitative findings. Comparative analyses could then be employed to identify patterns and interactions between these policy tools, offering a more comprehensive understanding of their combined impact.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

MS: Formal Analysis, Methodology, Writing – original draft. JX: Formal Analysis, Methodology, Writing – original draft.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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