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How Do Perceived Regulations Influence Environmentally Sustainable Project Management? The Mediating Role of Commitment and Moderating Role of Triple Constraint

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Abstract: The notion of achieving environmental sustainability through project management has gradually attracted the attention of scholars in recent years. This study explores the influence mechanism of a project manager's perception of environmental regulations on their environmentally sustainable project management practice. Employing a combination of qualitative and quantitative research methods, this study firstly establishes a conceptual model of interviews with project managers, proposes hypotheses based on the conceptual model, and ultimately carries out hypothesis testing using the questionnaire data. The results show that (i) project managers' perceptions of environmental regulations can directly promote their environmentally sustainable project management practice; (ii) project managers' affective commitment to change plays a partial mediating role in the above relationship; and (iii) in the aforementioned mediation relationship, both cost and time constraints have a negative moderating effect. This study provides new evidence for institutional theory at the micro level and expands the theoretical research perspective in the field of project management. We suggest that construction companies incorporate environmental performance into the performance appraisal of project managers and strengthen green construction training for employees.

Keywords: project management; environmental regulations; project managers; affective commitment to change; triple constraints; sustainability

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1. Introduction

The sustainable development of the construction industry has always been a topic of general concern for scholars all over the world [1–5]. Globally, the construction industry consumes 40% of total energy and 16% of water resources, as well as producing 25% of greenhouse gas emissions and 30–40% of solid waste, which has caused a devastating impact on environmental sustainability [6]. Especially in developing countries that sacrifice the environment for rapid economic development, the construction industry is far from achieving sufficient sustainability [7–9]. As a representative of developing countries, China has witnessed the rapid expansion of its construction industry as urbanization has continued in recent years [10,11]. From 2016 to 2021, China's annual total emission of construction waste was about 1.55 to 2.4 billion tons, accounting for about 40% of urban waste. In 2020, construction energy consumption was 94.62 million tons of standard coal [12]. Construction dust was also recognized as one of the main "culprits" of smog weather [13].

Implementing environmentally sustainable project management (ESPM) during the construction phase of a project is an effective method to solve the above problems [14]. ESPM refers to a project management mode that aims to achieve the multiple goals of economic, social, and ecological benefits through the rational planning of human, material, and financial resources [15,16]. Specifically, ESPM sets eco-friendly development as a project objective. Its core difference from traditional project management is that ESPM

introduces green management ideas and applies the concept of sustainable development to guide engineering construction and project operation, minimizing the adverse effects of construction projects on the ecological environment and continuously improving the situation. A low level of ESPM practice is a common problem in developing countries. Solving this problem begins with project managers [9].

Project managers are the core of project management in the construction phase. They have the responsibility and ability to address issues with the environmental sustainability of a project [17,18]. Project managers are the primary responsible persons for the time/schedule, quality, cost, and environmental protection of construction projects [19]. They are regarded as the pivot point of achieving sustainable development [20], because they are externally affected by the government and other stakeholders but internally dominate the entire process of project management during the construction phase [6]. In recent years, sustainability has been recognized as a capability of project managers. Competent project managers should not only perform traditional project management roles, but also manage projects in the most efficient and effective manner in terms of environmental sustainability [21,22]. Thus, how to promote ESPM practice for project managers is a key issue to be solved urgently in the construction industries of developing countries.

At present, government-led environmental regulations are considered to be some of the most effective instruments to solve environmental problems in developing countries [5,23]. Environmental regulations refer to environmental policies aimed at reducing the impact of entities on the environment and creating conditions for entities to carry out technological and management innovation for environmental protection [24]. According to institutional theory, environmental regulations provide a tangible rule system and intangible institutional pressure. The effect of environmental regulations on ESPM is realized firstly by government supervision and secondly by affecting the leaders of companies and organizations [25]. Project managers' perception of environmental regulations largely affects their ESPM mindset and behavior [26]. Previous studies have explored the influencing factors of ESPM from the personal perspective of project managers based on the theory of planned behavior (TPB) [17,18]. However, the transition from traditional project management to ESPM is also undoubtedly an organizational change in addition to a personal change in the project manager [27]. Thus, neglecting to explore the ESPM practice of project managers from an organizational perspective represents a research gap in existing studies.

Furthermore, from an organizational perspective, the influencing mechanism of environmental regulations on ESPM remains to be clarified. In the study of organizational change, affective commitment to change plays a significant role as an important motivator of change [28,29]. In this case, whether project managers' affective commitment to change has a mediating effect on their perception of environmental regulations and ESPM practice is also worthy of exploration. In addition, the three traditional objectives of project management—cost, time, and quality objectives—may affect the decisions of a project manager, so their moderating roles should not be ignored [30,31]. The insufficient exploration of the influencing mechanism of environmental regulations in existing studies creates another research gap.

Based on the above gaps, our research questions are proposed:

RQ1. What is the relationship between project managers' perception of environmental regulations and their ESPM practice?

RQ2. Does project managers' affective commitment to change have a mediating effect on the above relationship?

RQ3. Do the triple constraints of traditional project management goals (cost, time, and quality) have a significant moderating effect on the above relationships?

To answer the above RQs, this study adopts grounded theory to analyze in-depth interviews with project managers and establishes a conceptual model. On this basis, using data taken from 129 questionnaires for project managers, the conceptual model is tested by regression analysis.

The remainder of this study is organized as follows: The Section 2 expounds the establishment of the conceptual model based on grounded theory. The Section 3 presents a theoretical analysis based on the conceptual model and proposes the hypotheses. The Section 4 introduces the methodology of this study. The Section 5 comprises the results and discussion. The Section 6 presents the conclusion of this paper, including the academic and practical contributions, limitations, and implications.

2. Conceptual Model Development

2.1. Developing Method

In order to identify the key factors in the impact mechanism of environmental regulations on professional managers, we conducted interviews with real project managers. Grounded theory was employed in this study to establish a conceptual model. To be specific, this study analyzed the text data obtained from in-depth interviews with project managers and then established a conceptual model of the relationship between project managers' perception of environmental regulations and their ESPM practice.

2.2. Qualitative Data Collection

In this study, the research data required were mainly collected from in-depth interviews with project managers of ongoing construction projects, the relevant literature, and news reports. First, we searched the keywords "environmental regulations", "environmental laws and regulations", "project manager", "sustainable project management", and "green construction" on the literature retrieval site "Google Scholar". By sorting the relevant literature retrieved, a preliminary theoretical cognition of the relationship between project managers' perception of environmental regulations and ESPM practice was established. Second, information collection and analysis was conducted for the written reports and video interviews available on various media platforms on green construction project management, where a perceptual understanding of this issue was obtained. Finally, in-depth semi-constructed interviews were conducted with project managers (including deputy project managers) of ongoing construction projects, and the conceptual model was established on this basis.

The project managers and deputy project managers of ongoing construction projects in different cities were selected as the interviewees for this study. In order to determine the interview outline, a pretest was conducted with the deputy project manager of the Beijing Daxing International Airport North Line Expressway Project (Langfang Section). The interview outline was finally settled after the modification of some special statements, explanations, and grammar. A total of eight managers or deputy managers of eight construction projects were interviewed. Subsequently, six interview records were randomly selected for category construction (three project managers and three deputy project managers), and the remaining two interview records were reserved for saturation testing. The basic information of these eight interviewees is given in Table 1.

2.3. Qualitative Data Analysis

2.3.1. Open Coding

Open coding was the first step in the processing of the raw data and was designed to conceptualize the interview data in this study. The software Nvivo-12 was utilized to code the in-depth interview text data of six interviewees. First, over 200 original statements were extracted from the interview records, and the initial concepts were formed based on the core content of these original statements. Then, categorization was applied to the concepts, during which the differences and similarities of these concepts were ascertained. Initial concepts with less than three repetitions and inconsistencies were excluded, and those with three or more occurrences and good consistency were retained, totaling 26 (A1–A26). Ultimately, the retained original concepts with similar content were merged according to the content consistency, and 12 categories were further summarized (B1–B12), as shown in Table 2, where "Party A" refers to the investor of the construction project.

Table 1. Basic information of interviewees.

No.	Project Name	Interviewee's Title	Interview Time
1	Beijing Daxing International Airport North Line Expressway (Langfang Section)	Project Manager	31 August 2019 20:10–20:55
2	Scegc Xi'an Liangjiatan International School Project	Project Manager	15 September 2019 09:47–10:12
3	Shanty Area Renovation Project of Kindergarten Residential District of China Railway First Survey and Design Institute	Project Manager	15 September 2019 17:15–17:42
4	Zhengzhou-Xi'an High-Speed Railway Xi'an North Station Building Construction Project	Deputy Project Manager	24 September 2019 21:30–22:00
5	Xi'an-Baoji High-Speed Railway Baoji South Station Building Construction Project	Deputy Project Manager	24 September 2019 16:00–16:30
6	Xi'an-Baoji High-Speed Railway Yangling Station Building Construction Project	Deputy Project Manager	4 November 2019 20:30–21:00
7	Functional Reconstruction and Restoration Project of Lanzhou Trade World of China Railway First Survey and Design Institute	Deputy Project Manager	5 November 2019 13:00–14:00
8	Jinlu Shangju Construction Project of Chonghuang Town, Gaoling District, Xi'an (Section II)	Project Manager	7 November 2019 8:30–9:00

Table 2. Initial concepts and categories formed by open coding.

No.	Examples of Original Statements	Initial Concept	Category
A1	…The environmental protection requirements for construction in Beijing are still quite high…	Environmental protection requirements	B1 Stringency of environmental regulations
A2	…In recent years, environmental protection has become increasingly strict and relevant authorities have frequently carried out inspections…	Frequency of inspections	
A3	…They order work stoppage at every turn, and we have suffered considerable loss…	Work stoppage due to pollution	B2 Severity of environmental punishment
A4	…Fines are quite heavy if we are caught for pollution…	Environmental fines	
A5	…The principal person in charge assumes a lifelong responsibility…	Responsibility of individuals	
A6	…Good performance in environmental protection will bring a good reputation for the enterprise…	Benefits of green management for enterprise	B3 Value of green management recognition
A7	…One who performs environmental protection well in the project for which one is responsible will also acquire an excellent resume…	Benefits of green management for individuals	
A8	…At present, reform is the general trend; we are all pushed by the times and the old way does not work…	Green change as an inevitable trend	B4 Support for green change
A9	…Young people are more receptive to the change of management method…	Acceptance of green management change	
A10	…Stop the idling of construction machinery…	Energy conservation	B5 Multi-pronged approaches to conservation
A11	…Recycled water for curing concrete…	Water conservation	
A12	…Try to implement reusable materials for construction consumables…	Material conservation	

Table 2. *Cont.*

No.	Examples of Original Statements	Initial Concept	Category
A13	…Conduct relevant training for workers so as to prevent pollution…	Pollution prevention	B6 Proactive prevention and control of pollution
A14	…Deal with pollution promptly in cases of polluting…	Pollution treatment	
A15	…Utilize construction machinery with lower noise…	Reduction of interference	
A16	…Many construction units are winning bids at a loss…	Limited budget	B7 Pressure of cost reduction
A17	…Employees are still looking forward to the bonus when the project is finished…	Demand for project bonus	B8 Pressure of profit increase
A18	…Enterprise also needs to make a profit from projects…	Demand for profit increase	
A19	…There will be a reward if we complete the project ahead of schedule…	Incentive for early completion	B9 Pressure of compressed project time
A20	…Sometimes when I am busy, this project is not finished yet, and the next one is scheduled for me…	Tight time linkage of projects	
A21	…An extra day spent on the construction site will lead to a significant increase in cost…	Cost increase resulting from project postponement	B10 Pressure of on-schedule completion
A22	…We would need to pay liquidated damages to Party A if the project were not finished on-schedule…	Exposure to default risk	
A23	…Despite no defect in project quality, you cannot do anything if project is denied…	Risk to project acceptance	B11 Pressure of quality acceptance
A24	…Some new materials and techniques are indeed advanced and eco-friendly, but the corresponding acceptance rules are still deficient…	Deficient acceptance rules	
A25	…Party A may be worried that there will be risks because if a problem occurs in the later operation period, Party A will take responsibility…	Risk aversion of Party A	B12 Pressure of Party A's recognition
A26	…Party A does not understand what they have not seen before, so they may feel doubtful about it…	Party A's doubt of quality	

2.3.2. Axial Coding

Axial coding was conducted to achieve the further coding analysis of the data based on the results of open coding with the aim of extracting core categories and summarizing their meanings. A total of six core categories were ultimately formed in this study. Their meanings and corresponding categories are presented in Table 3.

2.3.3. Selective Coding

Selective coding was used to sort relationships between core categories on the basis of axial coding, that is, to sort out the "storyline" of the influencing mechanisms of project managers' perception of environmental regulations on their ESPM practice.

Perceived environmental regulations may have both direct and indirect impacts on green construction project management practice. The interviews revealed that the interviewees did not make a clear distinction between the perception of different types of environmental regulations; in other words, whether they were command-and-control environmental regulations, market-based environmental regulations, or informal environmental regulations, the interviewees tended to consider them as comprehensive environmental pressure. This mentality manifested in the interviews as follows: "…Actually, it is related to the strictness of the first local policy. If it is implemented strictly, all relevant

policies will be implemented strictly, and vice versa…", and "…These environmental regulations sometimes do not act individually. For example, if residents made a complaint, the environmental protection authority would probably carry out an investigation and environmental punishment would be enacted upon the construction…". The direct impact of perceived environmental regulations on green construction project management practice was reflected by the interviewees as follows: "…It is without doubt that construction sites in regions with stricter regulations will perform better in environmental protection…", "…We are also not willing to be frequently reported on by residents; this is bad for our construction and development…", and "…The existing environmental policies require us to pay for environmental pollution; the more we pollute, the more money we pay…".

Table 3. Core categories and corresponding categories formed by axial coding.

Core Category	Meaning	Corresponding Category
Perceived environmental regulations	Project managers' perception of the stringency of environmental regulations and the severity of punishment.	B1 Stringency of environmental regulations B2 Severity of punishment
Affective commitment to change	The tendency of project managers' mindsets to change from an adherence to traditional construction project management to support of green construction project management based on the benefits of green construction project management.	B3 Recognition of the value of green management B4 Support for green change
ESPM practice	The ESPM practice of project managers, including eco-friendly construction techniques and construction machinery adopted in the project construction organization design, and the principle of four conservations and one protection practiced in construction management.	B5 Multi-pronged approaches to conservation B6 Proactive prevention and control of pollution
Cost constraints	The pressure of project funds faced by project managers during management.	B7 Pressure of cost reduction B8 Pressure of profit increase
Time constraints	The pressure of construction time faced by project managers during management.	B9 Pressure of compressed project time B10 Pressure of on-schedule completion
Quality constraints	The pressure of construction quality faced by project managers during management.	B11 Pressure of quality acceptance B12 Pressure of Party A's recognition

Second, project managers' affective commitment to change may play a mediating role. The interviews suggested that project managers' transition from traditional construction project management to green construction project management involves a transition from mindset change to behavior change. Moreover, ground change occurs in fully understanding the benefits brought about by green management, which is consistent with the view of organizational change research that affective commitment to change acts as a mediating variable. Examples of this mentality shown in the interviews include the following: "…Under such strict environmental inspections, I definitely want to perform environmental protection well during project management, which is favorable for both the enterprise and me personally…", "…Whether it is a complaint from residents or environmental fines made in inspections, it will affect my mind during work…", "…I can feel the government's determination to fully realize environmental protection, and I support green management because in the long term it is a good thing for the enterprise, for me personally, and even for society…", and "…The change in management mode is an overall change from mindset to behavior rather than an overnight thing…".

Third, cost constraints may play a negative moderating role in the relationship between perceived environmental regulations and affective commitment to change. From the

interviews, it can be observed that the significant influence of cost constraints on project managers primarily prevented their paradigm shifts, i.e., cost constraints had a negative moderating effect on the relationship between perceived environmental regulations and affective commitment to change. This influence was specifically embodied in the interviews as follows: "…Despite the fact that green management is a good thing, the payment of Party A is fixed, and green management would definitely add additional cost. In this case, the profits of the project would be cut down and we would suffer from a loss of bonuses. We have no desire to consider environmental protection once our vital interests are influenced…", and "…Cost is the biggest problem. Well, it is enough to meet the minimum requirements for environmental protection; we do not need to do better…".

Fourth, time and quality constraints may play a negative moderating role in the relationship between affective commitment to change and green construction project management practice. The interviews revealed that the influence of time and quality constraints on project managers is mainly reflected as an impediment to their behavior change, i.e., time and quality constraints have a negative moderating effect on the relationship between affective commitment to change and green construction project management practice. This effect manifests specifically in the interviews as follows: "…Personally, I am willing to manage the project in an eco-friendly way, yet sometimes it is a waste of time, and the time pressure is so great that I have to give up…", and "…We all want to contribute to the country's environmental protection, but actually it is impossible. Party A will be worried about the project quality if traditional techniques are not used during construction. It is still important to satisfy Party A…".

Based on the above, the relationship structure of the core categories is outlined in this study as follows: (1) perceived environmental regulations have a direct influence on ESPM practice; (2) affective commitment to change plays a mediating role; (3) cost constraints have a negative moderating effect on the relationship between perceived environmental regulations and affective commitment to change; and (4) time and quality constraints have a negative moderating effect on the relationship between affective commitment to change and ESPM practice.

2.3.4. Theoretical Saturation Test and Reliability Analysis

Core categories are saturated when the addition of new information coding no longer generates new theoretical understanding or surpasses original theoretical understanding, and there are no new impacts on the core categories. Theoretical saturation tests were conducted on the remaining two interview records, the results of which suggest that the conceptual density of the core categories had reached saturation. With no new core categories emerging and no other new important correlations found, it was determined that theoretical saturation was reached.

We used the method of triangulation to analyze the reliability of the research framework, that is, to code data from multiple angles and compare them. In addition to the researcher, we also invited two doctoral students majoring in economic management to participate in the coding and compared the coding results of the three people in pairs. The reliability of this study was 92.6%, and the reliability of the researchers was 91.5%. The reliability of both was more than 90%, which means their reliability was good.

2.4. Conceptual Model

According to the "storyline" constructed by selective coding, a conceptual model of the influencing mechanism of project managers' perception of environmental regulations on ESPM practice was established in this study, as shown in Figure 1. Theoretical support for the hypotheses of the variable relationships presented in Figure 1 is elaborated on in Section 4.

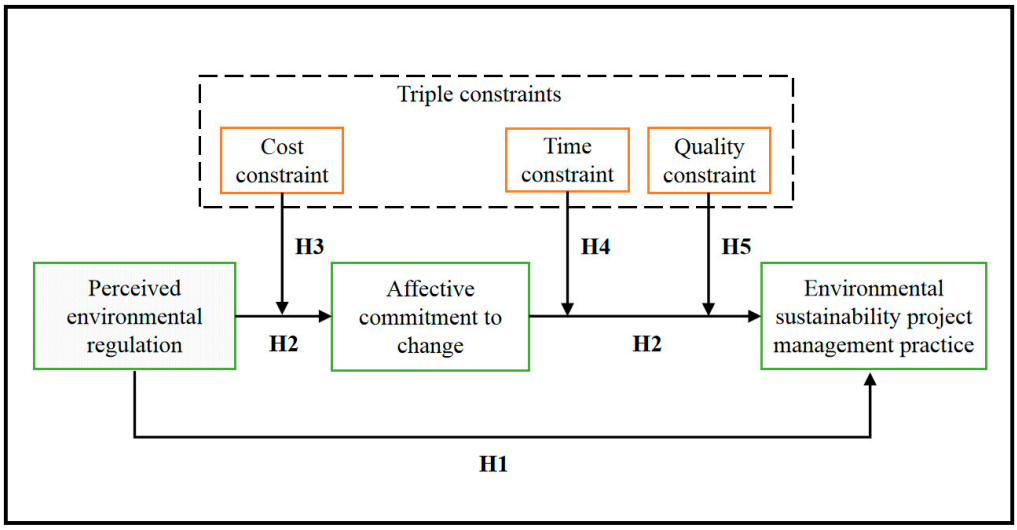

Figure 1. Conceptual model of this study.

3. Hypotheses Development

3.1. Direct Effect

In the construction industry, command-and-control regulations dominate environmental regulations [32]. Regulatory agencies established by the government penalize construction projects that exceed the specified emission thresholds permitted. Penalties include required rectification within a prescribed time limit; fines; sealing or detaining related materials or machinery and equipment; suspending the business for rectification; lowering qualification levels; revoking qualification certificates; etc. [33]. Thus, violating such regulations may bring losses or even the risk of a breach of contract to construction companies. In addition, China has established a complete credit system for the construction market. Information regarding government penalties for construction companies due to environmental issues is treated as "bad behavior records" and posted on relevant websites for 6 months to 3 years [34]. This not only seriously affects the credibility of construction companies but also negatively affects their future project contracts, especially public procurement projects that demand the strict credibility of companies [35]. In summary, regulation-related government fines and trade barriers impose pressure on project managers [36]. Thus, in order to avoid penalties and maintain the credibility of construction companies, project managers' perception of command-and-control regulations obliges them to implement ESPM.

For market-based regulations, since carbon trading policies are currently only implemented in a few pilot provinces in China, such regulations are more commonly reflected in the form of environmental protection taxes [37]. Construction companies need to pay environmental protection taxes according to the emissions of air pollutants, water pollutants, solid waste, and noise generated during the construction phase [38]. Project managers therefore feel taxing pressure through their perception of market-based regulations, with ESPM becoming a way that they may choose to reduce this flexible expenditure.

Informal environmental regulations are relatively well established in some developed countries and can even intervene in the decision-making processes of local governments [39]. In recent years, the Chinese government has also given increasing power to individuals or groups concerned with environmental protection [40]. Sometimes, construction projects adopt "greenwashing behaviors" to evade inspections by governmental regulatory agencies [6], but they cannot evade residents who observe the construction site in real time. Even though China's environmental protection organizations are still immature [24], complaints from residents can, to some extent, force construction projects to adopt environmental protection measures or even result in a suspension of work [38].

Thus, in order to reduce the risk of these situations, project managers are more willing to practice ESPM when under the pressure of informal regulations.

According to institutional theory, companies or organizations will comply with rules in order to achieve higher legitimacy [36]. As the first person responsible for project energy saving and environmental protection [19], project managers under the pressure of environmental regulations are responsible for implementing ESPM practices to reduce pollution emissions from construction projects. Additionally, as the top manager assigned by the construction company to the project [19], the project manager has the ability to implement ESPM to avoid adverse consequences caused by the violation of environmental regulations. Thus, the stronger the project manager's perception of environmental regulations, the more willing they are to practice ESPM. In summary, we propose the following hypothesis:

H1. *Project managers' perception of environmental regulations is positively correlated with their ESPM practice.*

3.2. Mediating Effect

The former section discussed the behavioral tendencies of project managers based on institutional theory; that is, institutional pressure caused by perceived environmental regulations can directly influence project managers to implement ESPM. Meanwhile, project managers' perception of environmental regulations can also improve their motivation to practice ESPM by enhancing their affective commitment to change. People with an affective commitment to change believe in the value of change, believe that change serves as an important objective of the organization, and regard change as an effective strategy [41]. Based on the above views, the relationship between project managers' perception of environmental regulations and their affective commitment to change through ESPM is explained by the two aspects detailed below.

First, when a construction project is regarded as an organization, maintaining a good relationship with government departments is one of the important goals of the organization. Perceived environmental regulations can strengthen project managers' belief in the value of ESPM in serving this goal so that they are ideologically inclined toward green changes to project management. Project managers usually hope to maintain a good relationship with the government in order to obtain government approval procedures more efficiently and to even obtain the opportunity to undertake government investment projects [26,42]. Environmental inspections represent one of the few opportunities where they may communicate with government departments. Construction projects implementing ESPM leave a good impression on government departments. The stronger their perception of environmental regulations, the more importance local governments will attach to environmental protection. Project managers operating under such governments are more aware of the effectiveness of ESPM in winning the government's favor. Thus, they show stronger affective commitment.

Second, when a construction industry green management system is regarded as an organization, reducing the environmental problems caused by the construction process is an important goal of the organization. Previous studies have shown that project managers usually have some environmental protection awareness but lack the confidence to improve the environment through their own power and ability [21]. Environmental regulations represent a government-led environmental tool. Perceived environmental regulations help project managers to realize that the effectiveness of reducing environmental pollution through project management is recognized by the government, which in turn enhances their affective commitment to ESPM.

The higher a project manager's affective commitment to change is, the more inclined they are to support ESPM with their mindset [28] and the more willing they are to move from traditional project management toward implementing ESPM. As the antecedent variable of change practices, affective commitment to change has been supported by many scholars. People with a high affective commitment to change can successfully cope with ongoing organizational change [43]. In addition, affective commitment to change is considered the key to successfully implementing customer relationship management [44]. Some

scholars have found that affective commitment to change can promote green public procurement behavior [28]. Similarly, the affective commitment to change of project managers can also promote their ESPM practice.

Based on the above discussion, it is clear that project managers' perception of environmental regulations can further promote their ESPM practice by enhancing their affective commitment to change. Moreover, the mediating effect of affective commitment to change has been verified by research in many fields. For example, the relationship between charismatic leadership, trust in top management, and employees' innovation implementation behavior is mediated by affective change commitment [45]. The mediating effect of affective change commitment on some motivators and green public procurement behavior has also been found [46]. Some scholars believe that personal trust and communication affect the success of change through affective commitment to change [29]. Thus, it is reasonable to take affective commitment to change as a mediating variable. In summary, it is believed that the relationship between project managers' perception of environmental regulations and ESPM is also mediated by affective commitment to change. Based on this, the following hypothesis is proposed:

H2. *The affective commitment to change of project managers mediates the positive relationship between perceived environmental regulations and ESPM practice.*

3.3. Moderating Effect

3.3.1. The Moderating Effect of Cost Constraints

The cost goal of a construction project is determined before the project starts, but there is certain flexibility at the disposal of its project manager within a reasonable range [47]. When this flexible range is larger, the cost constraint is weaker, and in turn when the flexible range is smaller, the cost constraint is stronger. From the interviews conducted in this study, we learned that project cost constraints mainly affect changes to the mindsets of project managers.

First, the promotive effect of perceived environmental regulations on affective commitment to change is weakened by project managers' consideration of cost saving. In addition to requiring more environmentally friendly management methods, some auxiliary materials or equipment, such as sewage purification equipment and dust screens, are also required for ESPM, which inevitably increase construction costs [9]. ESPM under strong cost constraints may lead to project overruns. In the current performance evaluation criteria of construction projects, cost performance is still given priority over environmental performance [47]. Thus, if project managers perceive strong environmental regulations while experiencing strong cost pressure, they may reduce their affective commitment to ESPM out of consideration for cost saving.

Second, due to the consideration of project bonuses, the promotive effect of project managers' perception of environmental regulations on their affective commitment to change is weakened. The interviewees stated that project bonuses accounted for a large portion of their income (usually more than 50%), and the sum of bonuses is directly proportional to project profits. In the case of strong cost constraints, ESPM implementation may decrease project profits, which, in turn, decreases the bonuses of project managers. Thus, even if project managers feel pressure from environmental regulations, out of consideration of their own income consisting of bonuses, they will be conservative in their affective commitment to ESPM. Considering the above two factors, we find that when project managers encounter strong cost constraints, the promotive effect of their perception of environmental regulations on affective commitment to change is weakened. On this basis, the following hypothesis is proposed:

H3. *Cost constraints negatively moderate the positive relationship between project managers' perception of environmental regulations and their affective commitment to change.*

3.3.2. The Moderating Effect of Time Constraints

Construction projects generally preset the construction time (schedule target) before commencement [31]. The more sufficient the construction time, the weaker the time constraints, and in turn the less sufficient the construction time, the stronger the time constraints. When time constraints are strong, the promoting effect of managers' affective commitment to change on ESPM practice is weakened because ESPM practice requires more time than traditional project management. Being a change, ESPM also represents an innovation [48]. The duration of ESPM may be lengthened because project managers lack ESPM knowledge and skills and because workers are unfamiliar with emission reduction rules or energy-saving equipment [21]. Time is not only related to project performance but is also related to breaches in construction contracts. Thus, even if a project manager has a strong affective commitment to ESPM, it is difficult to put ESPM into practice under the pressure of time constraints. This viewpoint was also supported by the interviewees. In summary, we propose the following hypothesis:

H4. *Time constraints negatively moderate the positive relationship between project managers' affective commitment to change and their ESPM practice.*

3.3.3. The Moderating Effect of Quality Constraints

The investor (Party A) and the construction company (Party B) specify the quality standards that a project should meet in the construction contract [30]. Some clients have a low quality requirement for their projects, namely meeting the national mandatory quality criteria. By contrast, some clients have a high quality requirement that even moves far beyond the national mandatory quality criteria [49]. In the latter case, project managers are affected by strong quality constraints.

The interviewees generally believed that, under strong quality constraints, the promotive effect of affective commitment to change on ESPM practice would be weakened due to the uncertainty regarding quality brought about by ESPM practice. ESPM is a relatively new model, meaning that advanced construction methods or new materials may be adopted [9]. New things are often accompanied by higher risk, so ESPM may increase the quality risk of projects [14]. Under strong quality constraints, managers must be more cautious about ESPM practice to guarantee the quality requirements, even if they are mentally inclined toward ESPM. Therefore, we propose the following hypothesis:

H5. *Quality constraints negatively moderate the positive relationship between project managers' affective commitment to change and their ESPM practice.*

4. Methodology

4.1. Sampling and Data Collection

Considering that the topic and observation unit of this study and Yuan et al. (2018) are similar, the data collection method of this study refers to the literature, that is, using the Likert five-level questionnaire to collect research data, with 1 to 5 indicating strong disagreement to strong agreement [22]. Since the research was undertaken in China, we performed a back translation of the questionnaire and revised items that were not accurately expressed [50]. The items were adapted based on previous studies [17,22,30,41,51,52]. In order to ensure respondents accurately understood the items, we explained the meaning of every variable before the questions were given. The detailed items are listed in Table 4.

We obtained data for testing the research model via a questionnaire survey for project managers. The survey was conducted in April 2021. Sichuan Province and Chongqing City were selected as the research areas because of the availability of data and the country's increasing interest in the ecology of the upper reaches of the Yangtze River. The sampling method was convenience sampling. In order to reduce social approval bias, the questionnaire ensured strict anonymity and required respondents to only provide partial background information (gender, age, time as a project manager, etc.). Respondents were

required to circle the answer with which their degree of agreement with the statement could be best described.

Table 4. Measurement of variables.

Variables	Items for Measurement
Perceived environmental regulation (*PER*)	*PER1*: The emission indicators for construction pollutants have a significant impact on the construction activities of the project. *PER2*: The discharge fee/environmental protection tax has a significant impact on the construction activities of the project. *PER3*: Residents' complaints have a significant impact on the construction activities of the project.
Affective commitment to change (*ACC*)	*ACC1*: I believe in the value of ESPM. *ACC2*: ESPM is a good strategy for the project and society as a whole. *ACC3*: I think that the environmental protection department is making a mistake by introducing ESPM. *ACC4*: ESPM serves an important purpose. *ACC5*: Things would be better without ESPM. ACC 6: ESPM is not necessary.
Environmentally sustainable project management practices (*ESPM*)	*ESPM1*: I attach great importance to energy conservation in the management of this project. *ESPM2*: I attach great importance to the control of pollutant emissions in the management of this project (water pollution, air pollution, solid waste pollution, and noise pollution). *ESPM3*: I attach great importance to the control of waste in the management of this project. *ESPM4*: I attach great importance to the recycling of materials in the management of this project. *ESPM5*: I attach great importance to ecological impact in the management of this project.
Cost constraints (*CC*)	*CC*: Cost constraints have a significant impact on the construction activities of this project.
Time constraints *(TC*)	*TC*: Time/schedule constraints have a significant impact on the construction activities of this project.
Quality constraints (*QC*)	*QC*: Quality constraints have a significant impact on the construction activities of this project.

We sent questionnaires to 215 project managers (including deputy managers) who had at least 1 year of project management experience and who were collectively working on 120 projects under construction. A total of 139 questionnaires were returned, with a response rate of 64.7%. In order to ensure the quality of the response results, we screened the returned questionnaires and eliminated those with careless answers. Finally, 129 valid questionnaires were obtained. Descriptive statistical analysis of each variable and the participants' demography are shown in Table 5.

4.2. Data Analysis

Next, we analyzed the reliability and validity of the questionnaire. The analysis process was taken from a previous study [53]. We used confirmatory factor analysis (CFA) to calculate the factor load of each variable item. The test results are presented in Tables 6 and 7. First, we examined the Cronbach's α value and composite reliability (CR) of each variable to check their reliability. In Table 6, the Cronbach's α value and CR of all the variables are shown to exceed 0.7, which indicates that the variables of this study had high reliability. Second, we calculated the average variance extraction (AVE). In Table 6, it is shown that the AVE of all the variables exceeds 0.5, which indicates that the variables had high convergent validity.

Table 5. Descriptive statistical analysis.

Variables	N	Max.	Min.	Mean	S.D.
Variables for study					
PER (perceived environmental regulation)	129	5.00	1.00	2.99	0.81
ACC (affective commitment to change)	129	5.00	1.00	3.09	0.90
ESPM (environmentally sustainable project management practices)	129	5.00	1.00	3.37	1.08
CC (cost constraints)	129	5.00	1.00	3.21	1.06
TC (time constraints)	129	5.00	1.00	3.45	0.96
QC (quality constraints)	129	5.00	1.00	2.89	0.98
Variables of participants' demography					
Gender (1 = male, 2 = female)	129	1.00	1.00	1.00	0.00
Age (years)	129	52.00	25.00	35.88	6.66
Working (years) [a]	129	12.00	1.00	3.65	3.05
EXP [b]	129	2.79	−1.40	0.00	1.00

Note: [a]: Respondents' time working as a project manager. [b]: Through exploratory factor analysis (EFA), *Age* and *Working* were combined into one factor. The factor score was the control variable *EXP*, which has been standardized.

Table 6. Results of confirmatory factor analysis and reliability and validity testing.

Variable	Std. Factor Loadings	t	Cronbach's α	CR	AVE
PER			0.821	0.823	0.609
PER1	0.729	fixed			
PER2	0.738	7.62 ***			
PER3	0.867	7.81 ***			
ACC			0.909	0.912	0.636
ACC1	0.712	fixed			
ACC2	0.659	7.25 ***			
ACC3	0.880	9.70 ***			
ACC4	0.855	9.27 ***			
ACC5	0.790	8.46 ***			
ACC6	0.864	9.16 ***			
ESPM			0.894	0.898	0.642
ESPM1	0.716	fixed			
ESPM2	0.801	8.84 ***			
ESPM3	0.911	9.86 ***			
ESPM4	0.844	9.24 ***			
ESPM5	0.715	7.73 ***			
CC	1.00	fixed	/	/	/
TC	1.00	fixed	/	/	/
QC	1.00	fixed	/	/	/

Note: *** = significant at 1% level. Model fit: Chi^2 = 146, df = 107, Chi^2/df = 1.36, CFI = 0.965, TLI = 0.956, RMSEA = 0.0531 (90% CI is [0.029, 0.074]).

Table 7. Correlation analysis and AVE results.

	1.	2.	3.	4.	5.	6.
1. *PER*	***0.780***					
2. *ACC*	0.268 ***	***0.797***				
3. *ESPM*	0.358 ***	0.475 ***	***0.801***			
4. *CC*	−0.159	−0.233 ***	−0.302 ***	/		
5. *TC*	−0.197 **	−0.086	−0.219 **	0.177 **	/	
6. *QC*	−0.221 **	−0.049	−0.120	0.192 **	0.289 ***	/

Note: *** = significant at 1% level; ** = significant at 5% level. The value on the diagonal is the square root of the AVE.

We then examined the correlation coefficient and the square root of the AVE among the variables. In Table 7, it is shown that all of the correlation coefficients do not exceed

the minimum of the square root of the AVE, which indicates that the variables had high discriminant validity. Finally, this study had a better fitting index compared with the measurement model, which indicates that the model is in good agreement with the data. (Chi^2 = 146, df = 107, Chi^2/df = 1.36, CFI = 0.965, TLI = 0.956, RMSEA = 0.0531 (90% confidence intervals (CIs) are [0.029, 0.074]). The above tests show that the validity and reliability of the variables in this study met the requirements for further analysis [26].

Since this study used a questionnaire to collect data, it was inevitably affected by common method bias (CMB). Two methods were used to detect CMB. First, we used Harman's one-factor method and exploratory factor analysis (EFA) based on principal component analysis (PCA). The explanatory amount of the first unrotated factor was 37.17%, which was 40% below the threshold. Second, we used the single-factor method. After adding all of the items to the same dimension, the model fitting index became significantly worse. At this time, the fitting indexes of the CFA model were Chi^2 = 569, df = 119, Chi^2/df = 4.782, CFI = 0.600, TLI = 0.543, and RMSEA = 0.171. In summary, CMB was not a serious problem in this study.

Referring to related studies on project management [54], this study used project managers' experience (EXP) as the control variable. Through EFA based on PCA, two variables were combined, namely the age of the respondents and their time working as a project manager, into one factor. The factor score was the control variable [55]. After analysis, the Initial Eigen of the first factor was 1.61, which explains 80.44% of the variance. The maximum value of EXP was 2.79, the minimum value was −1.39, the mean value was 0, and the standard deviation was 1.

5. Results and Discussion

5.1. Hypotheses Testing and Results

Based on the data collected from the questionnaire, and referring to the methodology of existing research [26,50,53], this study uses linear regression, which is the regression of a moderated mediation effect model, for hypothesis testing. In order to conduct the regression analysis, the SPSS-23 and PROCESS macros were used for data analysis [56]. We used linear regression to test our hypotheses. The SPSS-23 and PROCESS macros were used for data analysis [56]. The testing procedures included direct effect analysis, mediating effect analysis, and moderating effect analysis. The specific testing procedure and method were taken from a previous study [57]. This study used the OLS method to estimate the regression coefficient [50]. If the coefficient was at 10% or lower, the coefficient was significant. Moreover, to better test the mediating effect and moderating effect, the bootstrap analysis method with 5000 repeated samples was used and the CI level was set to 90%. The bias-corrected percentile method was adopted as the sampling method to estimate the coefficient of the interaction items. If 0 was not included between the lower and upper limits of the confidence intervals, the corresponding effect was significant.

Direct effect analysis and mediating effect analysis were first conducted. The regression results are shown in Tables 8 and 9. From Model 3 in Table 8, it is observed that the PER coefficient was significant and positive; moreover, from the direct effect in Table 9, it can be seen that the confidence interval did not exceed 0. This indicates that a positive direct effect was established, and **H1** is supported. From Model 3 in Table 6, it is observed that the ACC coefficient was significant and positive. In comparing Model 1 with Model 6, it is observed that the PER coefficient significantly decreased; moreover, with regard to the indirect effect, the confidence interval did not exceed 0. This indicates that a positive mediating effect was established, and **H2** is supported. The PER coefficient in Model 3 was also significant, so it represents a partially mediating effect.

Table 8. Direct and mediation analyses.

	Model 1		**Model 2**		**Model 3**	
	DV: *ESPM*		**DV: *ACC***		**DV: *ESPM***	
	b	**SE**	**b**	**SE**	**b**	**SE**
Constant	2.013 ***	0.341	2.247 ***	0.293	0.935 **	0.378
			Control variable			
EXP	−0.148	0.090	−0.087	0.078	−0.106	0.083
			Independent variable			
PER	0.456 ***	0.110	0.284 ***	0.095	0.320 ***	0.104
			Mediator			
ACC					0.480 ***	0.095
F for reg.	10.796 ***		5.565 ***		17.168 ***	
adj-R^2	0.133		0.067		0.275	

Note: *** = significant at 1% level; ** = significant at 5% level. SE = standard error.

Table 9. Direct and mediation analyses using BOOTSTRAP.

Mediation Model	**Effect**	**SE**	**90% Confidence Interval**	
			Lower	Upper
Total effect	0.456	0.110	0.274	0.639
Direct effect	0.319	0.104	0.147	0.493
Indirect effect	0.136	0.049	0.061	0.221

Note: Bootstrap = 5000 times, and confidence interval (CI) level was set to 90%. SE = standard error.

These analyses were followed by a moderating effect analysis. In the analysis process, some variables were centralized. There were three moderating variables in this study. According to the hypotheses, one moderating variable (CC) moderated the first stage of the mediating effect (PER → ACC) and the other two (TC and QC) moderated the second stage of the mediating effect (ACC → ESPM). We first analyzed the moderating effect of CC. The regression results are shown in Tables 10 and 11. From Model 4 in Table 10, it is observed that the PER*CC coefficient was significant and negative; moreover, from Table 11, it is observed that when CC increased, the effect of PER on ACC significantly decreased. This indicates that the negative moderating effect of CC was established, and **H3** is supported. The moderating effect is shown in Figure 2.

Table 10. Moderation analysis (*CC*'s moderating effect on *PER* → *ACC*).

DV: *ACC*	**Model 4 (Step 1)**		**Model 5 (Step 2)**		**Model 6 (Step 3)**		**Model 7 (Step 4)**	
	b	**SE**	**b**	**SE**	**b**	**SE**	**b**	**SE**
Constant	3.097 ***	0.079	3.097 ***	0.077	3.096 ***	0.075	3.060	0.072
				Control variable				
EXP	−0.112	0.079	−0.87	0.078	-0.093	0.076	−0.054	0.073
				Independent variable				
PER			0.284 ***	0.095	0.249 ***	0.094	0.216 **	0.090
				Moderator and interaction				
CC					−0.167 **	0.072	−0.134 *	0.069
*PER*CC*							−0.274 ***	0.072
F for the step	2.001		9.003 ***		5.428 **		14.514 ***	
R^2 change	0.016		0.066		0.038		0.092	
F for reg.	2.001		5.565 ***		5.650 ***		8.324 ***	
adj-R^2	0.008		0.067		0.098		0.186	

Note: *** = significant at 1% level; ** = significant at 5% level; * = significant at 10% level. SE = standard error.

Table 11. Moderation analysis using BOOTSTRAP (*CC* on *PER* → *ACC*).

Level of *CC*	Effect	SE	90% Confidence Interval	
	PER* on *ACC		**Lower**	**Upper**
−1 SD	0.512	0.113	0.324	0.698
Mean	0.217	0.089	0.068	0.366
+1 SD	−0.076	0.124	−0.281	0.129

Note: Bootstrap = 5000 times, and the confidence interval (CI) level was set to 90%. SE = standard error.

The analysis results of TC's and QC's moderating effects are listed in Tables 12 and 13. Similar to the above analysis of the moderating effect, TC had a negative moderating effect, but that of QC was not significant. Thus, H4 is supported but H5 is not supported. In addition, we created a moderating effect figure to better display the moderating effect. Since the moderating effect of QC was not significant, we only drew a moderating effect figure for TC, which is given in Figure 3.

Finally, we summarize the hypotheses and their testing results in Table 14.

Table 12. Moderation analysis (*TC's* and *QC*'s moderating effects on *ACC* → *ESPM*).

DV: *ESPM*	Model 8 (Step 1)		Model 9 (Step 2)		Model 10 (Step 3)		Model 11 (Step 4)	
	b	**SE**	**b**	**SE**	**b**	**SE**	**b**	**SE**
Constant	3.378 ***	0.095	3.377 ***	0.084	3.377 ***	0.083	3.366 ***	0.083
Control variable								
EXP	−0.188 *	0.095	−0.125	0.085	−0.113	0.085	−0.085	0.085
Independent variable								
ACC			0.555 ***	0.094	0.537 ***	0.094	0.458 ***	0.100
Moderator and interaction								
TC					−0.175 *	0.092	−0.156 *	0.091
QC					−0.063	0.089	−0.050	0.089
*ACC*TC*							−0.197 *	0.103
*ACC*QC*							0.043	0.108
F for the step	3.901 *		34.497 ***		2.692 *		2.218	
R^2 change	0.030		0.209		0.032		0.026	
F for reg.	3.901 *		19.714 ***		11.467 ***		8.534 ***	
adj-R^2	0.022		0.226		0.246		0.261	

Note: *** = significant at 1% level; * = significant at 10% level. SE = standard error.

Table 13. Moderation analysis using BOOTSTRAP (*TC* and *QC* on *ACC* → *ESPM*).

Level of *TC*	Level of *QC*	Effect	SE	90% Confidence Interval	
		ACC* on *ESPM		**Lower**	**Upper**
−1 SD	−1 SD	0.605	0.114	0.416	0.795
−1 SD	Mean	0.648	0.116	0.456	0.841
−1 SD	+1 SD	0.691	0.191	0.375	1.007
Mean	−1 SD	0.416	0.148	0.170	0.662
Mean	Mean	0.459	0.100	0.293	0.625
Mean	+1 SD	0.502	0.143	0.264	0.739
+1 SD	−1 SD	0.227	0.225	−0.146	0.599
+1 SD	Mean	0.269	0.269	0.001	0.538
+1 SD	+1 SD	0.313	0.312	0.054	0.571

Note: Bootstrap = 5000 times, and the confidence interval (CI) level was set to 90%. SE = standard error.

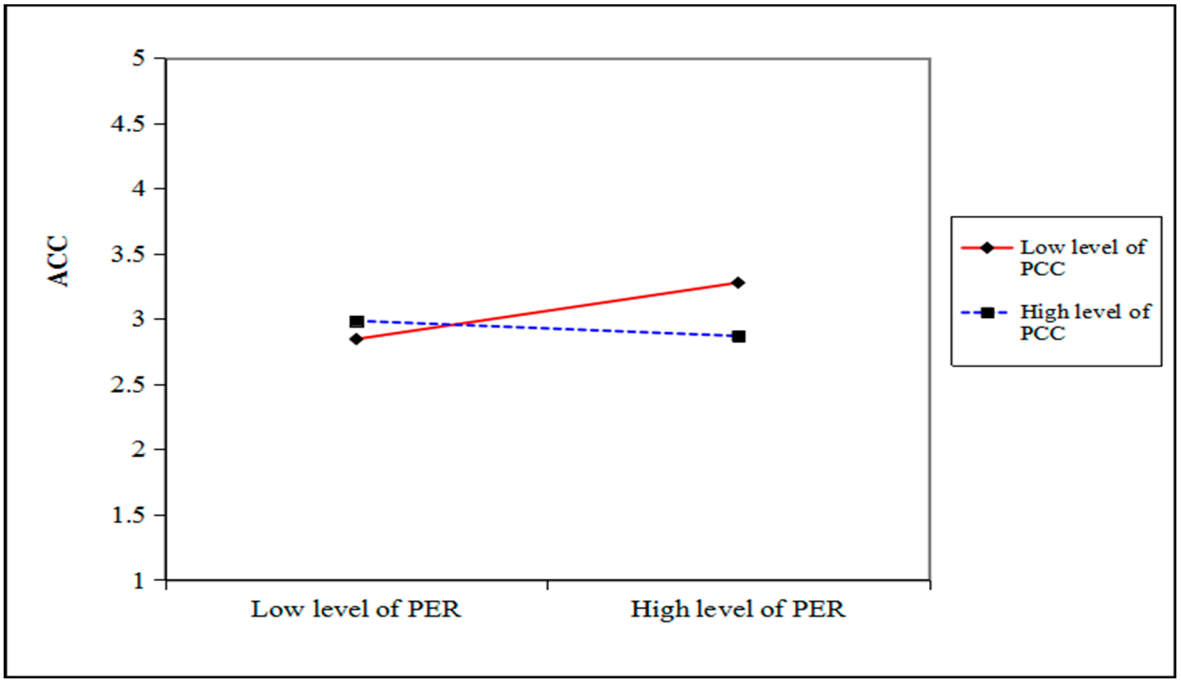

Figure 2. Moderating effect of *PCC* on the relationship between *PER* and *ACC*.

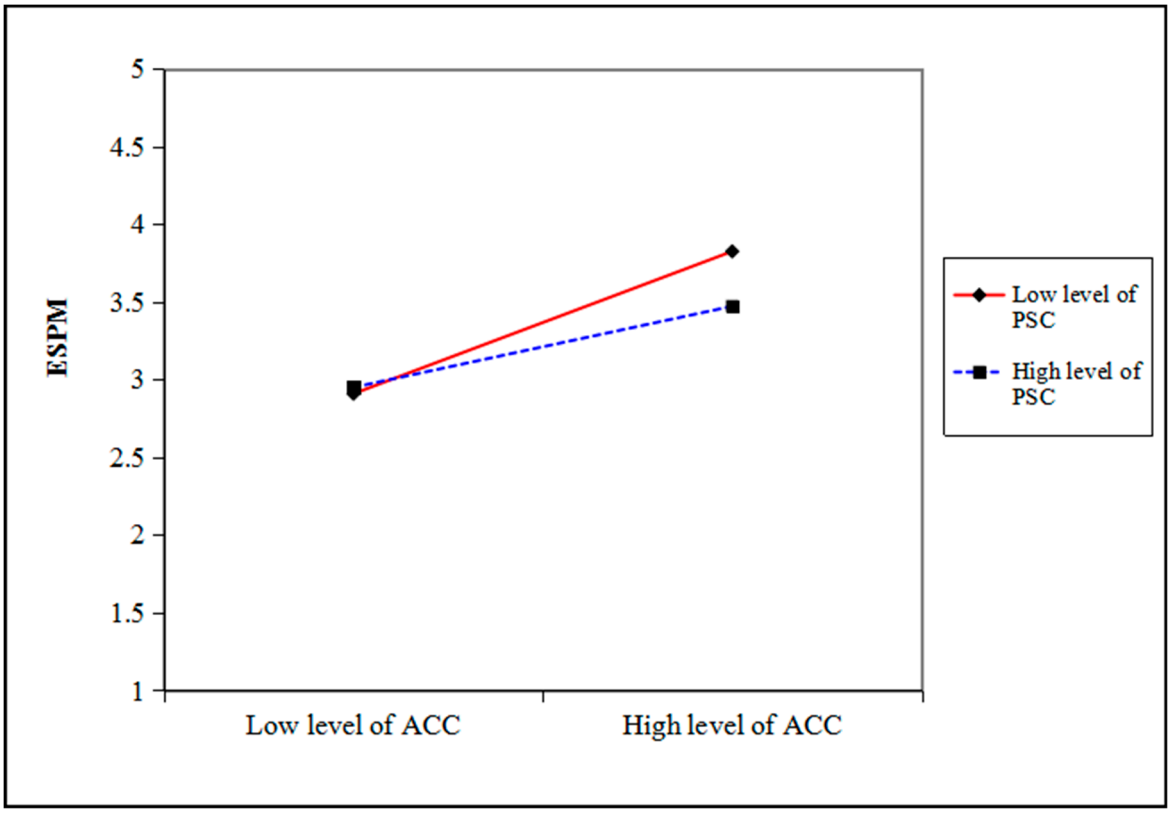

Figure 3. Moderating effect of *PSC* on the relationship between *ACC* and *ESPM*.

Table 14. Summary of hypotheses testing.

No.	Effect Type	Hypotheses	Supported?
H1	Direct effect	Project managers' perception of environmental regulations is positively correlated with their ESPM practice.	Supported
H2	Mediation effect	The affective commitment to change of project managers mediates the positive relationship between perceived environmental regulations and ESPM practice.	Supported
H3	Moderating effect (*PER* → *ACC*)	Cost constraints negatively moderate the positive relationship between project managers' perception of environmental regulations and their affective commitment to change.	Supported
H4	Moderating effect (*ACC* → *ESPM*)	Time constraints negatively moderate the positive relationship between project managers' affective commitment to change and their ESPM practice.	Supported
H5		Quality constraints negatively moderate the positive relationship between project managers' affective commitment to change and their ESPM practice.	Not supported

5.2. Discussion

The empirical results of this study show that perceived environmental regulation is positively correlated with ESPM, and this relationship is partially mediated by affective commitment to change. The following findings can be drawn from these results: First, the results again verify the previous view that government support is essential for ESPM implementation in developing countries [9,48]. Second, affective commitment to change as a common mediating variable in organizational change research [29,46] is also applicable to green changes in project management.

Third, the effectiveness of environmental regulations is extended to the construction industry and construction projects. In research on the industrial sector, environmental regulations have been recognized for their positive roles both in improving energy efficiency and green productivity and in promoting green technological innovations [58,59]. This study's results extend the conclusions of previous studies to the construction industry. Moreover, at the level of construction companies, environmental regulations are considered to promote the development of green technologies and techniques [51]. Taking project managers as the unit of observation, this study found that environmental regulations can promote the implementation of ESPM, extending the conclusions of previous studies at the project level.

According to the empirical results, cost constraints hinder the process of mindset change (affective commitment to change) in project managers, and time constraints hinder the process of behavior change (ESPM practice). The negative moderating effects of cost and time support the view that the high costs of green building materials and equipment as well as time pressure represent important challenges to implementing green construction [21]. Additionally, these results reveal that the cost issue in the construction phase is an obstacle to green construction [9], and the relationship between construction time and energy consumption needs to be carefully considered [31].

It is worth noting that the moderating effect of quality constraints was not statistically significant, and hypothesis H5 was not supported. This may be due to the uncompromising quality requirements of technical development in the construction industry. The quality of buildings is related to the lives and property safety of users. For this reason, new green technology innovation may lead to cost increases or construction period extensions; however, it does not reduce project quality and can even promote higher project quality [36], despite the fact that investors worry that green technology as an innovation may lead to increased quality risk. Qualified project managers should have relevant professional knowledge and understand that green technology does not conflict with quality [60]; thus, they will not be affected by quality pressure when considering whether to practice ESPM.

6. Conclusions

Based on the view of coercive isomorphic institutional pressure in institutional theory, this study linked environmental regulation with project management. Previous studies have found that environmental regulation has significant effects on some macro-environmental indicators. However, changes to environmental indicators result from the efforts of numerous micro-organizations. Thus, exploring the relationship between environmental regulation and the behavior of managers in organizations can help us to understand the micro-operation mechanism of environmental regulation.

Based on interviews with eight project managers of ongoing projects, a moderated mediation model was developed to explain the relationship between and the influencing mechanism of project managers' perception of environmental regulations and their ESPM practices. Subsequently, data collected through 126 questionnaires were used to test the conceptual model. The results show the following: (i) Project managers' perception of environmental regulations can directly promote their ESPM practice. (ii) Project managers' affective commitment to change has a partial mediating effect on the former relationship. (iii) Cost constraints have a negative moderating effect on the relationship between project managers' perception of environmental regulations and their commitment to change, and time constraints have a negative moderating effect on the relationship between project managers' affective commitment to change and their ESPM practice. **RQ1**, **RQ2**, and **RQ3,** proposed in this study, were answered.

6.1. Contributions and Implications

The academic contributions of this study are as follows:

(i). This study explored the relationship between environmental regulation and ESPM. Most previous studies focused on the impact of environmental regulation on macro-objective environmental indicators at the industry or regional level [37,58], and ignored the impact of micro-managers' behavior. This study took the project manager as the observation unit, expanding the research scope of the effectiveness of environmental regulation in the construction industry and providing new evidence for institutional theory at the micro level.

(ii). This study developed a moderated mediation model to explore the impact of the influencing mechanism of project managers' perception of environmental regulations on their ESPM practices. Most previous studies only explored the driving factors of project managers' ESPM practice at the personal level. This study developed a conceptual model with the classical variable in the field of organizational change as the mediating variable and the constraints of three project organizational goals as moderating variables, expanding the theoretical research perspective in the field of project management.

(iii). This study adopted a combination of qualitative and quantitative research methods in a new attempt to explore ESPM. Previous studies have repeatedly mentioned that the three objectives of project management affect the decisions of project managers [21,30]. However, it is difficult to clearly develop relationship hypotheses of the impact of these three constraints on ESPM by theoretical analysis alone. This study innovatively used a qualitative analysis method to analyze the interview results of real project managers and clarify the specific moderating role of "triple constraints", making up for the deficiency of quantitative studies in the development of theoretical relations.

Based on the empirical results, the implications of this study are as follows:

Policy-makers should urge environmental regulators to strengthen the supervision of the environment on construction sites, using methods such as introducing real-time monitoring equipment for pollutant emissions into construction projects [61]. In addition, the environmental protection tax system should be further improved. Tax management should be professionalized as soon as possible, and the list of taxable pollutants should be detailed to more effectively encourage the economic regulatory role of environmental protection taxes. These suggestions can enhance the deterrence of environmental regulations,

which would increase the institutional pressure felt by project managers and decrease the likelihood of risk-prone mindsets, prompting them to practice ESPM.

In addition to policy-makers, construction companies should also take measures to motivate project managers to implement ESPM. We suggest that construction companies should make environmental indicators the main assessment criteria of project manager performance and link these indicators with their bonuses. This would largely prevent managers from neglecting the environmental management of projects in order to lower costs and would encourage them to practice ESPM. Moreover, companies should hire experts in green construction to regularly train project managers and construction personnel. This should include training on green construction site management, green construction technology, the facilities and equipment of pollution treatment, and green building materials. Such training can greatly reduce the time costs caused by ESPM and decrease the time pressure on project managers in implementing ESPM.

6.2. Limitations and Further Research

Despite their utility, the findings of this study should nevertheless be considered with caution due to a number of limitations. First, this study used questionnaires to obtain data, and the empirical results obtained here need to be carefully considered when applied in practice. Second, the interviewees were mainly from projects currently under construction. There are many such projects under construction in China, but the sample size of this study was relatively small; thus, the research results perhaps cannot comprehensively reflect the views of all project managers. Third, this study only focused on China. Due to the social and economic differences between China and other developing countries, the conclusions of this study may not be fully applicable to other developing countries.

With respect to further research, scholars may consider the following: First, in addition to the influence of project managers, ESPM implementation can also be affected by other stakeholders; thus, their behaviors should also be studied. Second, the design phase of a construction project does not directly affect the environment, but it has a significant impact on the subsequent construction phase and in-service phase. The sustainable management of this phase is therefore also worth studying. Finally, a variety of complex factors during the construction phases of projects also affect the implementation of ESPM. Case studies may help us to understand these issues more deeply.

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