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# Organizational Learning and Green Innovation: Does Environmental Proactivity Matter?

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**Abstract:** Emerging economies face the challenge of striking a balance between development and the environment. To adapt to the changes, organizations must develop dynamic capabilities for green innovation and corporate sustainability. Based on a resource-based view integrated with contingency and stakeholder theories, this study examines how strategic contingency makes differences in the transformation between learning and performance resources through innovation efforts. Oriented toward external and internal stakeholders, respectively, learning resources comprise absorptive capacity and transformative capability, innovation efforts include green product innovation and green process innovation, and performance resources contain green image and competitive advantage. Depicting their mediating relationships moderated by environmental proactivity, the research model is supported by survey observations collected from over 300 organizations in China. Environmentally proactive organizations are found to have more balanced dynamic capability development than those that are more reactive. To optimize green innovation, therefore, organizations need to embrace an ecological strategy and engage employees in learning.

**Keywords:** dynamic capability development; resource transformation; organizational learning; green innovation; corporate sustainability; environmental proactivity; moderated mediation

## 1. Introduction

Compared with mature economies, emerging markets face a bigger challenge to strike a balance between development and the environment. As the biggest developing country, for instance, China encounters many ecological issues that threaten people's health and wellbeing, and environmental incidents like smog, water pollution, and soil contamination appear in news media frequently. Enterprises that produce pollution in daily activities bear the social responsibility to mitigate waste and emissions. In the long run, environmental investments pay off in terms of efficiency improvement and consumption reduction, leading to better operational and economic performances [1]. As a win–win solution for both society and industry, therefore, sustainable development imposes a new requirement on enterprises compared with the traditional profit-seeking driver [2].

To survive in the changing business environment, enterprises must develop dynamic capabilities that integrate all kinds of resources for adequate and timely adaptation [3]. With respect to sustainable development, such capabilities allow organizations to carry out green innovation effectively [4,5]. By utilizing various organizational resources in innovative manners, enterprises may reach both financial and ecological goals [6,7]. Compared with other technical innovations, green innovation is more comprehensive and involves many aspects of daily operations in addition to manufacturing,

such as a paperless office, teleconferencing, and electronic workflow [8]. Such activities are not only conducive to environmental protection but also beneficial to the organizations themselves in terms of enhanced performance and reputation [9,10].

Nevertheless, there is a big disparity among enterprises in terms of environmental consciousness and many are still hesitant to take the sustainability initiative due to concerns such as implementation cost and business disruption [11]. Decision-makers in those organizations are not convinced of whether green innovation really pays off, as there is not a definite conclusion from empirical results [12–14]. Thus, this study attempts to address the question of why similar green innovation measures may yield different outcomes for different organizations.

Separately, researchers find organizational strategy and learning capability make differences in innovation performances, but few investigate their interplay on green innovation in which proactive responsiveness is required to deal with inherent uncertainties [15,16]. Based on a resource-based view integrated with contingency and stakeholder theories, this study develops and tests a research model of moderated mediation to examine the different roles that organizational learning and ecological strategy play. Empirical evidence may convince enterprises to become more proactive in developing dynamic capabilities for green innovation.

## 2. Research Background

At the corporate level, green innovation refers to the significant improvement in products/services and related business processes to reduce consumption and emissions [17]. The effort contains two general dimensions, respectively, green product innovation and green process innovation. Green product innovation deals with the design, development, and delivery of environmentally friendly products/services, and green process innovation pertains to the reduction of consumption and emissions in business processes [18]. From both aspects, green innovation mitigates environmental impacts and enhances operational efficiencies [19].

Among various theoretical lenses, the resource-based view provides a general framework to conceptualize green innovation as the process through which an enterprise cultivates and utilizes different resources for corporate sustainability [17,20,21]. In a knowledge-based society, the most valuable resource for business prosperity and social advancement is knowledge [22]. Organizational learning capability is identified as a critical success factor for organizational innovation, leading to the concept of the "learning organization" [23]. There are generally two dimensions of organizational learning capability, namely, absorptive capability and transformative capability [24]. Absorptive capacity deals with the evaluation and use of external knowledge by an organization to solve its business problems [25]. Transformative capability pertains to the utilization of internal knowledge to inspire innovation through constant research and development [26].

Together, the two aspects of organizational learning capability largely determine how well employees (including managers), the primary internal stakeholders, absorb and apply knowledge in green innovation [27,28]. Based on the resource-based view and stakeholder theory, therefore, this study views absorptive capability and transformative capability as the fundamental resources for active employee participation that is critical for green innovation [29]. In addition to internal stakeholders, the stakeholder theory considers external stakeholders, such as suppliers, customers, government, and society, for their interests in and influences on an enterprise [30]. Concerning how well an organization learns from its own experiences and external stakeholders (e.g., suppliers), learning capability is essential for the development of other resources more directly related to business success, especially corporate image and competitive advantage [31–33].

Corporate image pertains to the positive/negative impression an organization gives to its external stakeholders in terms of certain characteristics [34]. Accordingly, a green image is the perceived environmental commitment and performance of an organization by the general public, government, customers, suppliers, and so on [35]. It is commonly evaluated in terms of corporate reputation in fulfilling the social responsibility to reduce environmental impacts from business operations [36,37].

As an outcome of green innovation efforts, a green image is a resource vital to business success, such as building customer loyalty [38–40]. Another outcome is competitive advantage, which refers to the areas that an enterprise does better than its competitors to create value [41]. To achieve such a status, enterprises may pursue low-cost and differentiation strategies, both of which require organizational innovation from inside based on employee participation [42,43].

How well organizations utilize various resources for sustainable development is contingent upon corporate environmental strategy [44]. When internal and external stakeholders of an organization are environmentally proactive, they are likely to push forward strategic planning on mobilizing every resource available for green innovation [45,46]. Concerning how active an organization is strategically engaged in green innovation, environmental proactivity makes a difference in corporate sustainability [47,48]. Compared with organizations that are merely reactive to legal requirements, those proactive on ecological issues spend more resources on green innovation and motivate employees to participate in it, leading to better performances [49,50]. When researchers predict firm performances directly with proactive environment strategies, however, results are somewhat mixed [7,51,52]. From the perspective of contingency theory, environmental proactivity is not a simple predictor but a moderator of the causal relationships among other variables, as it constitutes an essential condition of green innovation [53,54].

## 3. Research Model

For long-term business success, enterprises develop dynamic capabilities by integrating different kinds of resources [55]. Through green innovation, enterprises continuously acquire and transform resources for sustainable development [56]. Such efforts bridge the gap between two types of organizational resources: absorptive capability and transformative capability on one side and a green image and competitive advantage on the other. Furthermore, the strengths of such relationships depend on the strategic contingency of environmental proactivity [57,58]. The resource-based view integrated with stakeholder and contingency theories leads to a research model of moderated mediation, as shown in Figure 1.

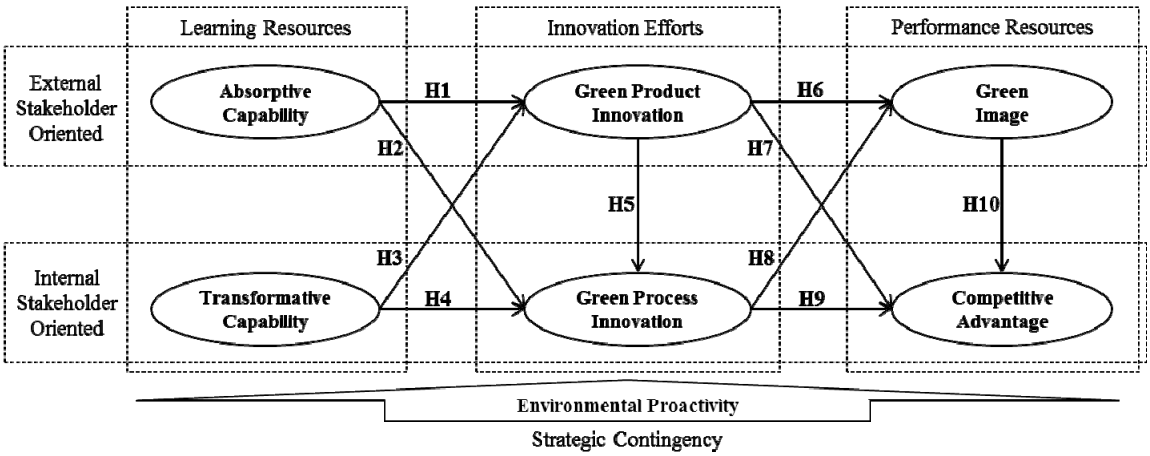


**Figure 1.** Research model of dynamic capability development for green innovation.

In this model, green product innovation and green process innovation mediate the effects of absorptive capability and transformative capability on green image and competitive advantage. Among them, absorptive capability, product innovation, and green image are external stakeholder oriented, whereas transformative capability, process innovation, and competitive advantage are internal stakeholder oriented. Making differences in resource utilization and transformation, environmental proactivity is likely to moderate the aforementioned relationships [59,60].

Organizational learning capability is closely related to organizational innovation in terms of existing knowledge acquirement and new knowledge creation [61]. Through market development

and technology investment, an enterprise may absorb and transform knowledge for product and process innovation [62]. In the context of green innovation, organizational learning capability is found critical for ecological product/service delivery and relevant business process re-engineering [63–65]. Through employee involvement, an organization's abilities to absorb and transform environmental knowledge are likely to have positive impacts on its green product innovation and subsequent green process innovation [66]. The external-stakeholder-oriented green product innovation may play the role of a partial mediator, as it largely drives the internal-stakeholder-oriented green process innovation [67,68].

**Hypothesis 1 (H1).** *Absorptive capacity has a positive effect on green product innovation.*

**Hypothesis 2 (H2).** *Absorptive capacity has a positive effect on green process innovation.*

**Hypothesis 3 (H3).** *Transformation ability has a positive effect on green product innovation.*

**Hypothesis 4 (H4).** *Transformation ability has a positive effect on green process innovation.*

**Hypothesis 5 (H5).** *Green product innovation has a positive effect on green process innovation.*

By reducing energy consumption and waste emissions, green innovation leads to the general public's recognition of an enterprise's ecological effort [69]. The introduction of green products differentiates an enterprise from its competitors and boosts its corporate image, which is critical for brand marketability [18]. In addition, green innovation enhances corporate reputation through the fulfillment of corporate social responsibility [67]. Being eco-innovative, an enterprise may discover new opportunities to serve people in need of green products/services, which enhances its green image [70]. The reduction of waste and emissions in manufacturing and logistics from green process innovation also benefits corporate image in the long run [71,72].

**Hypothesis 6 (H6).** *Green product innovation has a positive effect on green image.*

**Hypothesis 7 (H7).** *Green process innovation has a positive effect on green image.*

From the resource-based view, enterprises gain a competitive advantage from core resources and capabilities [73]. Green innovation enables an organization to have a scarce, inimitable, and irreplaceable strategic asset by providing environmentally friendly products [74]. The stakeholder theory also stresses the importance of business process re-engineering to corporate survivability and success [75]. From both the product and process aspects, therefore, green innovation helps companies gain a competitive advantage.

**Hypothesis 8 (H8).** *Green product innovation has a positive effect on competitive advantage.*

**Hypothesis 9 (H9).** *Green process innovation has a positive effect on competitive advantage.*

As an aggregate of customer evaluation and opinion, corporate image has an imperative implication for competitive advantage [76,77]. By integrating environmental considerations into product design and the manufacturing process, an enterprise is likely to gain a leading position in the emerging green product market [73] and establish a green image from the fulfillment of social responsibilities to key stakeholders [78]. Customers who recognize an enterprise's ecological effort prefer its products/services to others' [74], and this trend becomes more obvious as the public is increasingly aware of environmental issues [79]. Therefore, a corporate green image is found to have a positive relationship with competitive advantage [80].

**Hypothesis 10 (H10).** *Green image has a positive effect on competitive advantage.*

The hypothesized relationships may be stronger or weaker depending on how well organizational strategies reflect stakeholders' environmental awareness and activeness [75,81,82]. An enterprise that pursues a pro-environment strategy is likely to motivate its employees to evaluate the ecological impacts of daily operations and find out ways to improve product designs and business processes [83]. Whether an organization initiates green innovation largely depends on how proactive it is toward sustainable development and environmental protection [44]. Furthermore, an environmentally proactive strategy encourages and guides the participation of employees and other stakeholders in green innovation, which is indispensable to positive sustainability performances [47]. Therefore, environmental proactivity serves as a moderator, and the hypothesized relationships may be stronger for proactive than reactive organizations.

## 4. Methodology

To test the research model, an organizational survey was conducted to collect the observations on the variables. The Appendix A lists all the measurement items used in the questionnaire. Regarding the two dimensions of organizational learning capability, absorptive capacity was measured with items adapted from Guo's [84] and Cohen's [25] studies, and transformative capability measures were adapted from Hsu's [24]. The green innovation scale by Chen [18] was adapted to assess green product innovation and green process innovation. The measurement of green image was based on the instrument by Chen [70]. Competitive advantage was assessed using the scale adapted from Chang [67]. Unlike the unidimensional constructs above, environmental proactivity comprises multiple dimensions, which were measured with the items adapted from Bowen et al.'s [49] and Liu et al.'s [53] studies.

In China, green innovation is a relatively new phenomenon that demands organizational learning due to environmental regulation and competitive pressure. This study distributed the questionnaire to the representatives of 500 organizations randomly selected on the basis of the mailing lists provided by the chambers of commerce in the major cities in China. There were 347 returned questionnaires, among which 321 were complete and valid, leading to an effective response rate of 63.9%. There was a good mixture of private, state-owned, public, foreign/joint, and collective enterprises from almost 30% to just over 13%, respectively. The industry distribution of participating enterprises was relatively even, with 10–20% from each of the following: manufacturing, energy, construction, logistics, IT, and service. A little bit more than half of them were small and medium enterprises of fewer than 1000 employees.

For the variables in the hypothesized relationships, the common method bias (CMB) on their responses was assessed to rule out overwhelming spurious covariation from the survey methodology. First, the Harman's one-factor test based on exploratory factor analysis (EFA) showed that the first unrotated factor of all measures explained less than half of total variance, whereas all the factors with eigenvalues over one accounted for over three-fourths, and therefore construct-specific variance exceeded common method variance [85]. Based on confirmatory factor analysis, the unmeasured latent method construct (ULMC) technique further compared the method-only, trait-only, and trait-and-method models [86,87]. When all the measurement items were loaded onto a single factor (i.e., method-only model) rather than their own constructs (i.e., trait-only model), model fit deteriorated noticeably ($\chi^2$ from 321.016 to 2615.755, and $\chi^2/df$ from 1.354 to 10.38). The inclusion of both trait and method influences (i.e., trait-and-method model) did not improve but weakened model fit ($\chi^2$ from 321.016 to 391.064, and $\chi^2/df$ from 1.354 to 1.664), further dismissing the CMB concern.

As the variables in the hypothesized relationships are unidimensional/reflective latent constructs, covariance-based structural equation modeling (SEM) is the appropriate statistical technique. This study followed the recommended two-step approach of model estimation: the measurement model for construct validation first, and then the structural model for hypothesis testing. In the first step, a confirmatory factor analysis (CFA) was conducted on the measurement model

in which constructs were correlated with each other. With the support of construct validity, the next step estimated the structural model depicting hypothesized relationships with regression paths. Furthermore, a *k*-means cluster analysis on environmental proactivity dimensions classified participating organizations into proactive and reactive groups. A multigroup analysis further compared structural model estimates between two groups.

## 5. Results

The fit indices obtained from CFA on the measurement model supported overall goodness of fit ($\chi^2/df$ = 1.688 < 5, NNFI = 0.970 > 0.9, CFI = 0.974 > 0.9, RMSEA = 0.046 < 0.08). In addition to the overall assessment, Table 1 reports specific results about construct validity. As expected, the average response of each construct was positive (i.e., mean above the neutral point of 3 in the 5-point Likert scale used in the questionnaire) with reasonable variability (i.e., standard deviation between 0.7 and 0.9). The reliability coefficients were all above 0.7, indicating acceptable internal consistency of responses. The average variance extracted (AVE) were above 0.5 (i.e., square root value above 0.7), which supported convergent validity. Meanwhile, the largest construct correlation was 0.65, below the smallest squared root of AVE, which supported discriminant validity.

**Table 1.** Construct response patterns.

| Variable | Mean (SD) | α | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|---|
| 1. Absorptive capability | 3.63 (0.88) | 0.91 | **0.84** | | | | | |
| 2. Transformative capability | 3.98 (0.83) | 0.88 | 0.44 | **0.81** | | | | |
| 3. Green product innovation | 4.13 (0.84) | 0.93 | 0.40 | 0.51 | **0.88** | | | |
| 4. Green process innovation | 4.21 (0.75) | 0.90 | 0.41 | 0.52 | 0.57 | **0.84** | | |
| 5. Green image | 4.05 (0.79) | 0.93 | 0.53 | 0.65 | 0.65 | 0.62 | **0.87** | |
| 6. Competitive advantage | 4.15 (0.70) | 0.92 | 0.36 | 0.56 | 0.59 | 0.57 | 0.61 | **0.86** |

Note: SD—standard deviation; α—Chronbach's alpha; Bolded on the diagonal of the correlation matrix are the square roots of AVEs.

The validated measurement model laid a foundation for structure model testing. As shown in Figure 2, all the hypothesized relationships turned out to be significant, and the coefficients of determination (*R*-squared) for endogenous variables were relatively large (i.e., around 40–60% of variance was explained). The results confirmed the importance of organizational learning to green innovation efforts that led to firm performances. The two aspects of organizational learning capability were moderately correlated with each other. Compared with absorptive capability, transformative capability had somewhat bigger impacts on both the product and process aspects of green innovation. In addition, green process innovation partially mediated the effect of green product innovation on performance resources, with green image as the partial mediator for competitive advantage. The resource transformation driven by the interplay between external and internal stakeholders explains their critical roles in dynamic capability development for green innovation [88].

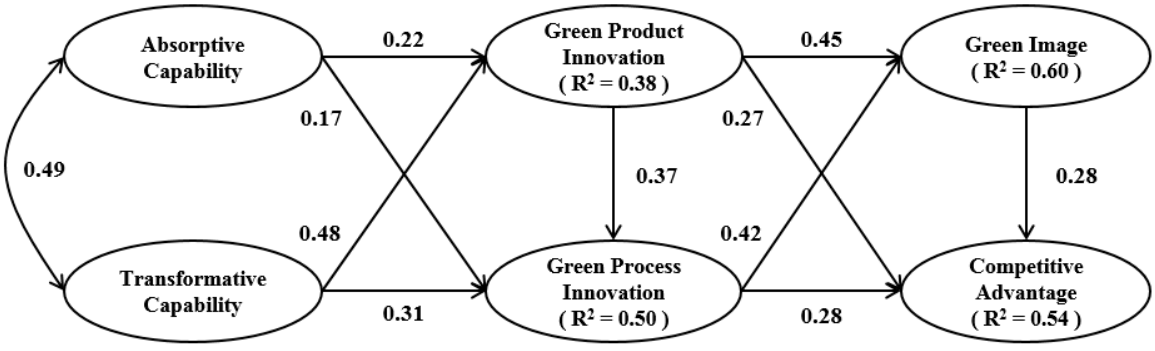


**Figure 2.** Structural model estimates. Note: All estimates were significant at the 0.01 level.

The *k*-means cluster analysis on the six dimensions of environmental proactivity divided the participating organizations into two groups: 224 relatively proactive and 97 relatively reactive in green strategy. Table 2 reports the cluster centers indicating the means of environmental proactivity dimensions in each group. The average difference scored 1.41 out of the 5-point Likert scale, which was quite salient. In the reactive group, the responses to environmental proactivity questions varied around the neutral point of 3 (i.e., "neither agree nor disagree"), whereas the proactive group saw mostly 4 (i.e., "agree") or 5 (i.e., "strongly agree"). The two levels of environmental proactivity reflect the different green strategies that participating organizations actually had.

**Table 2.** Environmental proactivity cluster centers.

| Dimension | Proactive (*n* = 224) | Reactive (*n* = 97) |
|---|---|---|
| 1. Environmental awareness | 4.51 | 3.38 |
| 2. Managerial priority | 4.59 | 3.09 |
| 3. Legal compliance | 4.65 | 3.09 |
| 4. Core value | 4.66 | 3.19 |
| 5. Top management support | 4.63 | 3.36 |
| 6. Leading status | 4.55 | 3.01 |

Based on the grouping variable derived from the cluster analysis, a multigroup analysis was conducted on the same structural model between two subsamples at different levels of environmental proactivity. Model estimates reported in Table 3 varied noticeably between two groups on the majority of paths. In the proactive group, all the relationships remained significant. In the reactive group, the correlation between absorptive capability and transformative capability became insignificant. Only the transformative capability predicted green innovation efforts, of which the process aspect affected performance resources. Meanwhile, green product innovation largely dictated green process innovation, and a green image did not convert to competitive advantage. On the other hand, proactive organizations exhibited balanced development of absorptive and transformative capabilities, parallel engagement in green product innovation and green process innovation, and a strong reputation–competitiveness relationship.

**Table 3.** Multigroup analysis.

| Relationship | Proactive | Reactive | Difference |
|---|---|---|---|
| Absorptive capability↔Transformation capability | 0.46 ** | 0.13 | 0.33 ** |
| H1. Absorptive capability→Green product innovation | 0.25 ** | −0.02 | 0.27 ** |
| H2. Absorptive capability→Green process innovation | 0.23 ** | 0.09 | 0.14 * |
| H3. Transformation capability→Green product innovation | 0.33 ** | 0.33 ** | 0.00 |
| H4. Transformation capability→Green process innovation | 0.25 ** | 0.35 ** | −0.10 |
| H5. Green product innovation→Green process innovation | 0.20 ** | 0.51 ** | −0.31 ** |
| H6. Green product innovation→Green image | 0.40 ** | 0.17 | 0.23 ** |
| H7. Green product innovation→Competitive advantage | 0.22 ** | 0.13 | 0.09 |
| H8. Green process innovation→ Green image | 0.41 ** | 0.31 * | 0.10 |
| H9. Green process innovation→Competitive advantage | 0.19 * | 0.47 ** | −0.28 ** |
| H10. Green image→Competitive advantage | 0.24 ** | 0.10 | 0.14 * |

Note: *—significant at 0.05 level; **—significant at 0.01 level.

## 6. Discussions

The findings of this study reveal the different roles that organizational learning and strategic disposition play in dynamic capability development for green innovation. As learning resources, absorptive capability and transformative capability directly affect how effectively employees carry out green product innovation and green process innovation, which then influence performance resources including green image and competitive advantage. Reflecting the ecological beliefs of external and

internal stakeholders upon whom resource utilization is contingent, environmental proactivity serves as the moderator that makes differences in the mediated relationships. Based on the resource-based view integrated with stakeholder and contingency theories, such moderated mediation captures how organizational learning and ecological strategy interact with each other, shaping green innovation dynamic capabilities. This provides a theoretical explanation to the question of why organizations taking similar green innovation measures may see very different outcomes.

The inclusion of learning capability and environmental proactivity helps clarify the mixed results in the effects of green innovation on firm performances from previous studies. For reactive organizations, green product innovation does not enhance performance resources much. This is probably due to the underdevelopment of absorptive capability from the lack of strategic commitment. On the other hand, proactive organizations exhibit a more balanced development of absorptive capability and transformative capability, which impacts both green product innovation and green process innovation, leading to a positive green image and competitive advantages. For an organization to fully benefit from green innovation, therefore, it is recommended to have a proactive strategy for sustainable development to motivate employees to absorb new knowledge and engage in ecological efforts.

The findings supplement the existing literature with new insights on dynamic capability development for green innovation [4,89]. Researchers have recognized the key role that absorptive capability plays in enterprise innovation [25]. Organizations with strong absorptive capability can keep up with the trend in the outside world and use the latest technologies to meet new demands. Transformative capability is also important, but most enterprises have developed such a capability through knowledge application to solve problems in daily operations. The main challenge for organizations, therefore, remains how to develop absorptive capability in a more balanced way with transformative capability. The findings suggest that it is essential for organizations to adopt environmentally proactive strategies that help them develop absorptive capability for effective innovation efforts. Moreover, organizations may establish platforms (e.g., enterprise social media) for external and internal stakeholders to communicate and work with each other for co-innovation [90]. In this way, the external-stakeholder-oriented activities of absorptive learning, product innovation, and green image can inform and drive the internal-stakeholder-oriented activities of transformative learning, process innovation, and competitive advantage.

## 7. Conclusions

Based on the integral resource-based view supplemented with stakeholder and contingency mechanisms, this study examines the roles that organizational learning and environmental proactivity play in dynamic capability development for green innovation. With survey observations, it tests a research model depicting that green innovation efforts transform learning resources into performance resources at two levels oriented toward external and internal stakeholders. The results support the moderated mediation that captures the interplay between organizational learning and environmental proactivity that leads to different green innovation outcomes.

This study has limitations that point to future directions of research. The main limitation is that the observations were collected from a single country. China is known as the world's factory, and sustainable development represents both a challenge and an opportunity for every enterprise, making it relatively easy to collect meaningful responses. Nevertheless, the specific findings (e.g., the strength of the relationship between green product innovation and green process innovation) may not be generalizable to other countries, especially those of different cultures. In addition, this study does not take the interaction between enterprise characteristics (e.g., organizational structures) and green innovation into account. Therefore, future studies may consider such country- and enterprise-level factors in theory development, research design, and data collection.

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**Conflicts of Interest:** The authors declare no conflict of interest.

## Appendix A. Measurement Items

### Absorptive Capability

1. Our company can quickly absorb, master, and utilize green equipment and production processes acquired from outside.
2. Our company is good at acquiring and utilizing external green technology and knowledge.
3. Our company closely monitors green technology development trends.
4. Our company has a strong green technology integration capability.

### Transformative Capability

1. Our company actively integrates extant green knowledge with internal operations.
2. Our company frequently applies green knowledge to a specific problem or task.
3. Our company effectively categorizes green knowledge for future use.
4. Our company flexibly utilizes green knowledge to cope with a turbulent environment.

### Green Product Innovation

1. Our company chooses product materials that produce the least amount of pollution.
2. Our company chooses product materials that consume the least amount of energy and resources.
3. Our company minimizes hazardous material use in products.
4. Our company circumspectly deliberates product recycling, reuse, and decomposition.

### Green Process Innovation

1. Our company figures out ways to reduce waste and emission.
2. Our company recycles waste and treats hazardous emission by all means.
3. Our company conserves resources (e.g., water, electricity) in business activities.
4. Our company effectively utilizes materials in business activities.

### Green Image

1. Our company is regarded as a benchmark of environmental management.
2. Our company's reputation on environmental management is stable.
3. Our company is trustworthy about environmental management.
4. Our company is dependable about environmental management.

### Competitive Advantage

1. The quality of our company's products/services is better than that of the competitors'.
2. Our company is more capable of R&D than the competitors.
3. Our company has better managerial capability than the competitors.
4. It is hard for the competitors to take our company's place in the market.

**Environmental proactivity**

*Environmental awareness*: Our company promotes environmental awareness in every area.
*Managerial priority*: Our company gives high managerial priority to environmental issues.
*Legal compliance*: Our company always attempts to go beyond basic legal compliance on environmental issues.
*Core value*: Protecting the environment is a core value of our company.
*Top management support*: Our company's top management commits to sustainable development.
*Leading status*: Our company leads the industry on sustainable development.

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