

Article

# The Determinants of Green Radical and Incremental Innovation Performance: Green Shared Vision, Green Absorptive Capacity, and Green Organizational Ambidexterity

Yu-Shan Chen <sup>1,\*</sup>, Ching-Hsun Chang <sup>2</sup> and Yu-Hsien Lin <sup>1</sup>

<sup>1</sup> Department of Business Administration, National Taipei University, 151, University Rd., San Shia, New Taipei City 237, Taiwan; E-Mail: byrantpitt@hotmail.com

<sup>2</sup> Department of Business Administration, Tamkang University, 151, Yingzhuan Road, Tamsui, New Taipei City 25137, Taiwan; E-Mail: dr.chang.ch@gmail.com

\* Author to whom correspondence should be addressed; E-Mail: yushan@mail.ntpu.edu.tw or dr.chen.ys@gmail.com; Tel.: +886-286-741-111 (ext. 66681).

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**Abstract:** This study proposes a new concept, green organisational ambidexterity, that integrates green exploration learning and green exploitation learning simultaneously. Besides, this study argues that the antecedents of green organisational ambidexterity are green shared vision and green absorptive capacity and its consequents are green radical innovation performance and green incremental innovation performance. The results demonstrate that green exploration learning partially mediates the positive relationships between green radical innovation performance and its two antecedents—green shared vision and green absorptive capacity. In addition, this study indicates that green exploitation learning partially mediates the positive relationships between green incremental innovation performance and its two antecedents—green shared vision and green absorptive capacity. Hence, firms have to increase their green shared vision, green absorptive capacity, and green organisational ambidexterity to raise their green radical innovation performance and green incremental innovation performance.

**Keywords:** green radical innovation; green incremental innovation; green shared vision; green absorptive capacity; green organizational ambidexterity; green exploration learning; green exploitation learning; green innovation

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## 1. Introduction

The main purpose of this study is to develop a research framework to investigate the determinants of green radical and incremental innovation performance. Prior research has widely discussed the relevant issues about organisational ambidexterity which means an organisation pursues efficiency and flexibility simultaneously. However, there is no research exploring the issue of organisational ambidexterity about environmental management. This study proposes a new concept, “green organisational ambidexterity”, to explore its antecedents, consequents, and mediation effects to fill the first research gap. Besides, no study discusses shared vision about environmental management. We develop a novel construct, “green shared vision”, and investigate its positive influence on green organisational ambidexterity and green radical and incremental innovation performance to fill the second research gap. In addition, no research explores absorptive capacity about environmental management. We propose a novel construct, “green absorptive capacity”, and discuss its positive influence on green organisational ambidexterity and green radical and incremental innovation performance to fill the third research gap. We therefore propose three novel constructs—green organisational ambidexterity, green shared vision, and green absorptive capacity—and develop an integral framework to further discuss their relationships with green radical and incremental innovation performance to extend the research of green innovation.

Taiwan has become one of the world’s major factories in the electronics industry. More consumers are becoming more concerned about the environmental impact of their own purchases in the world [1,2]. Nowadays, Taiwanese electronics companies suffer from strict environmental regulations—Montreal Convention, Kyoto Protocol, Restriction of the Use of Certain Hazardous Substances (RoHS), and Waste Electronics and Electrical Equipment (WEEE), *etc.*—and the prevalent consumer environmentalism [3,4]. In addition to the efforts in economic development, Taiwanese manufacturing companies have already adopted a number of environmentally friendly strategies to respond to the green trends [5]. As a result, Taiwanese electronics companies are changing their business models to take advantage of the green opportunities by means of green innovation [3]. They are more willing to take an active role in finding solutions to global warming [6]. According to the perspective of stakeholder management, companies have to adopt environmental management to satisfy the green needs of key stakeholders, such as customers and environmental communities, who are becoming more environmentally friendly [7,8]. The competitive rules in the world have been changing, since environmental management would affect all facets of a firm’s operations [9,10]. It is necessary for firms to integrate sustainability philosophy with innovation in the environmental era [11–13]. Effective green innovation can help firms and our society accomplish environmental sustainability [14]. Besides, green innovation plays a crucial role for companies to respond to the green trends to obtain competitive advantage [3,15]. In the environmental era, green management can not only help companies overcome environmental challenges, but also stimulate them to undertake green innovation that could enhance their competitive advantages [6,16,17].

Organisational ambidexterity is defined as an organisation’s ability to be aligned and efficient in its current operations and simultaneously to be adaptive and flexible to changes in the environment [18]. March [19] argues that organisational ambidexterity is rooted in balancing exploratory and exploitative activities. Exploration involves radical innovation, effectiveness, discovery, creating new markets and

products, broad search, and revolutionary change [20]. In contrast, exploitation involves incremental innovation, efficiency, refinement, routinisation, local search, and evolutionary change [19,21]. Organisational learning perspective argues that firms position themselves in two search behaviours for problem-solving: exploitation and exploration [19,22], so Katila and Ahuja [20] demonstrate that organisational ambidexterity combining exploration and exploitation would positively affect corporate performance. The mindsets needed for exploration are totally different from those needed for exploitation [23,24]. Consequently, pursuit of both exploration and exploitation is a key driver to achieve organisational success [20,25,26]. Many firms assert environmental management is a wasteful and unnecessary investment, and are misled to believe that environmental management is an impediment to their profitability and growth. However, industrial pollution results from the inefficient use of resources [5]. Firms that pioneer in environmental management or green innovation could possess the first mover advantage that enables them not only to enjoy higher benefits for their green products but also to obtain competitive advantages [6,17]. Although “organisational ambidexterity” has become a hot issue in the fields of strategic management, organisational management, and knowledge management [27], no literature explores the issue of organisational ambidexterity in the field of environmental management. This study proposes a novel concept, “green organisational ambidexterity”, and refers to March [19] and Tushman and O'Reilly [26] to define it as “the ability to integrate and reconcile both exploratory and exploitative environmental activities”. Based on the theory of organisational ambidexterity, this study develops an original framework of green organisational ambidexterity to explore its antecedents, consequents, and mediation effects to meet the prevalent environmentalism nowadays.

When environmentalism is more popular in the market, green innovation becomes more prevalent [7]. “Green innovation” refers to “hardware or software innovation that is related to green products or processes, including the innovation in technologies that are involved in energy-saving, pollution-prevention, waste recycling, green product designs or corporate environmental management” [28]. Moreover, the diversity of eco-innovations could include several key dimensions: design, user, product service and governance [29]. All dimensions can play a significant role in the management of eco-innovation [29]. This study asserts that there are two types of green innovation: “green radical innovation” and “green incremental innovation”. Referring to the definition of Dewar and Dutton [30] and Subramaniam and Youndt [31], this research defines “green radical innovation” as ‘the fundamental or revolutionary changes in existing green products, services, or processes by means of environmental technology that departs from current environmental knowledge’. Besides, this study refers to the definition of Dewar and Dutton [30] and Subramaniam and Youndt [31], and defines “green incremental innovation” as “the minor improvements or simple adjustments in existing green products, services, or processes by means of environmental technology that reinforces, modifies, or extends current environmental knowledge”. Green innovation can not only make a differentiation strategy by satisfying environmental needs, but also reshape marketing rules in the market [28]. We argue that companies have to develop green organisational ambidexterity, green shared vision, and green absorptive capacity to increase green radical and incremental innovation performance.

Although prior literature has widely discussed the relevant issues about green innovation, none explores green radical and incremental innovation performance. Therefore, we would like to fill the research gap. We propose three novel constructs—green organisational ambidexterity, green shared

vision, and green absorptive capacity—and develop an integral framework to further discuss their relationships with green radical and incremental innovation performance. Green innovation is more important for companies under the context of environmentalism. We summarize the literature on organisational ambidexterity, absorptive capacity, shared vision, and green management into a new managerial framework of green innovation. Besides, we further undertake an empirical test to verify the relationships among green organisational ambidexterity, green shared vision, green absorptive capacity, and green radical and incremental innovation performance. We build up a research framework which can help companies raise their green radical and incremental innovation performance through its three determinants: green organisational ambidexterity, green shared vision, and green absorptive capacity.

## 2. Literature Review and Hypothesis Development

### 2.1. *The Influence of Green Shared Vision on Green Organisational Ambidexterity*

A shared vision embodies the collective goals and aspirations of senior team members that express the developmental path for an organisation's future [32,33]. Besides, a shared vision provides a common strategic direction which can override the adverse effects of divergent goals and conflicting perspectives about organisational ambidexterity [34]. By contrast, lack of a shared vision could lead to distrust and suspicion throughout the organisation, making it hard to pursue both of exploratory and exploitative activities. A shared vision contributes to resolving conflicts related to resource exchange and combination and to achieving organisational ambidexterity [35]. Hence, a shared vision in ambidextrous organisations motivates organisational members to generate opportunities by means of resource exchange and combination across exploratory and exploitative units [26,33,36].

When organisational members share a vision they are better able to pursue ambidexterity [35]. Organisational ambidexterity becomes a dynamic capability only if the firm's exploitation and exploration activities are strategically integrated [37]. Strategic integration requires a shared vision [18]. The creation of a shared vision is beneficial to build organisational ambidexterity [27]. The coordination of exploitation and exploration activities necessitates the presence of a shared vision [38]. A clear strategic vision which provides for a common identity is important for the facilitation of organisational ambidexterity [37]. Jansen, George, Van den Bosch and Volberda [35] indicate that a shared vision contributes to a collective understanding of how senior team members might integrate exploratory and exploitative activities.

Referring to March [19] and Tushman and O'Reilly [26], this study proposes a novel construct, "green organisational ambidexterity", and defines it as "the ability to integrate and reconcile both exploratory and exploitative environmental activities". Besides, this study argues that there are two parts in green organisational ambidexterity: "green exploration learning" and "green exploitation learning". Referring to March [19], this study defines "green exploration learning" as "the pursuit of new environmental knowledge" and "green exploitation learning" as "the improvement of existing environmental knowledge". Furthermore, this study proposes an original concept, "green shared vision", and refers to Larwood, Falbe, Kriger, and Miesing [32] to define it as "a clear and common strategic direction of collective environmental goals and aspirations that has been internalized by

members of an organization”. Tushman and O’Reilly [26] identify a shared vision as the key source of organisational ambidexterity. Thus, this study asserts that green shared vision of a firm positively affects its green organisational ambidexterity. This study argues that green organisational ambidexterity comprises two parts: green exploration learning and green exploitation learning, so this study implies the following hypotheses:

- *Hypothesis 1 (H1). Green shared vision is positively associated with green organisational ambidexterity.*
- *Hypothesis 1a (H1a). Green shared vision is positively associated with green exploration learning.*
- *Hypothesis 1b (H1b). Green shared vision is positively associated with green exploitation learning.*

## 2.2. The Influence of Green Absorptive Capacity on Green Organisational Ambidexterity

Absorptive capacity is the ability to acquire, assimilate, transform, and exploit knowledge [39,40]. A firm’s absorptive capacity not only focuses on the acquisition and assimilation of external knowledge, but also encompasses a firm’s ability to process knowledge internally. These two dynamics lead to the firm’s ability to explore new knowledge and exploit existing knowledge [41]. A firm’s absorptive capacity helps a firm to link external and internal knowledge and thereby benefit the development of organisational ambidexterity. Prior research affirms that firms with a higher level of absorptive capacity exhibit better organisational learning and organisational ambidexterity [42]. Absorptive capacity facilitates organisational ambidexterity by allowing a firm to effectively integrate external and internal sources of existing and new knowledge [40]. At this state, an effective integration of external and internal sources of known and new knowledge is useful for organisational ambidexterity [41].

Besides, a firm’s absorptive capacity can help companies build the effective spanning of organisational and technological boundaries [43]. This kind of knowledge recombination and integration is beneficial for organisational ambidexterity [41,44,45]. This study proposes an original construct, “green absorptive capacity”, and refers to [39] to define it as “the ability to acquire, assimilate, transform, and exploit environmental knowledge”. Absorptive capacity that enables firms in hypercompetitive context to value, assimilate, apply, explore, and exploit new knowledge within or outside the firms is positively related to organisational ambidexterity [41]. Hence, this study asserts that green absorptive capacity positively affects green organisational ambidexterity including green exploration learning and green exploitation learning and implies the following hypotheses:

- *Hypothesis 2 (H2). Green absorptive capacity is positively associated with green organisational ambidexterity.*
- *Hypothesis 2a (H2a). Green absorptive capacity is positively associated with green exploration learning.*
- *Hypothesis 2b (H2b). Green absorptive capacity is positively associated with green exploitation learning.*

## 2.3. The Influence of Green Organisational Ambidexterity on Green Innovation

Prior literature argues that a firm’s search for solutions has two organisational learning behaviours: exploitation and exploration [19]. Exploration involves radical innovation, discovery, learning by

doing, variance-increasing, and flexibility [20,46,47]. In contrast, exploitation involves incremental innovation, refinement, routinisation, variance-decreasing, and efficiency [19,21]. In this context, Tushman and O'Reilly [26] define ambidexterity as the ability to simultaneously pursue both incremental and radical innovation. Consequently, pursuit of both exploration and exploitation is one of the key determinants of innovation outcomes [20,26,48]. Companies often discover new technologies in the period of exploration, and then they continue to improve the performance of the technologies in the period of exploitation [49].

Tushman and Smith [50] argue that exploration is related to radical innovation and exploitation is related to incremental innovation. Prior research posits that the integration between exploratory and exploitative activities can enhance both of incremental and radical innovation [37,38,41]. Hence, organisational ambidexterity is positively associated with innovation outcomes [26,49]. Empirical evidence verifies firms that specialize in both exploitation and exploration are more likely to achieve excellent innovation performance [51]. Besides, Raisch and Birkinshaw [37] demonstrate that organisational ambidexterity is positively related to new product development performance. It is widely accepted that there is a positive relationship between organisational ambidexterity and innovative performance [49]. Thus, this study asserts that green organisational ambidexterity positively affects green innovation performance. Green organisational ambidexterity comprises two parts: green exploration learning and green exploitation learning. Besides, there are two types of green innovation: green radical and incremental innovation, so this study implies the following hypotheses:

- *Hypothesis 3 (H3). Green organisational ambidexterity is positively associated with green innovation performance.*
- *Hypothesis 3a (H3a). Green exploration learning is positively associated with green radical innovation performance.*
- *Hypothesis 3b (H3b). Green exploitation learning is positively associated with green incremental innovation performance.*

#### 2.4. The Influence of Green Shared Vision on Green Innovation

Vision can deliver common knowledge, insight, and foresight as well as image of a desired future state to members [52]. A shared vision can cause trust throughout the organisation, making it easy to identify, extract, and combine diverse skills, abilities, and perspectives to achieve organisational ambidexterity [26]. Thus, a shared vision could stimulate organisational members to find opportunities by means of resource exchange and combination across units [26,33,36]. In this sense, a shared vision contributes to achieving outstanding organisational performance [35].

Top managers can apply green shared vision to deliver a collective direction of strategic green objectives and missions to the members in the firm. The key to competitive advantage begins by defining and then communicating a clear, shared, and integrated vision [48]. A shared vision provides a common strategic direction which can motivate employees to contribute their efforts towards organisational goals such that the organisation has better performance [34]. Empirical results indicate that a shared vision is positively associated with a firm's ability to combine high levels of exploratory and exploitative innovations [37]. Hence, this study asserts green shared vision of a firm positively affects its green radical and incremental innovation performance and implies the following hypotheses:

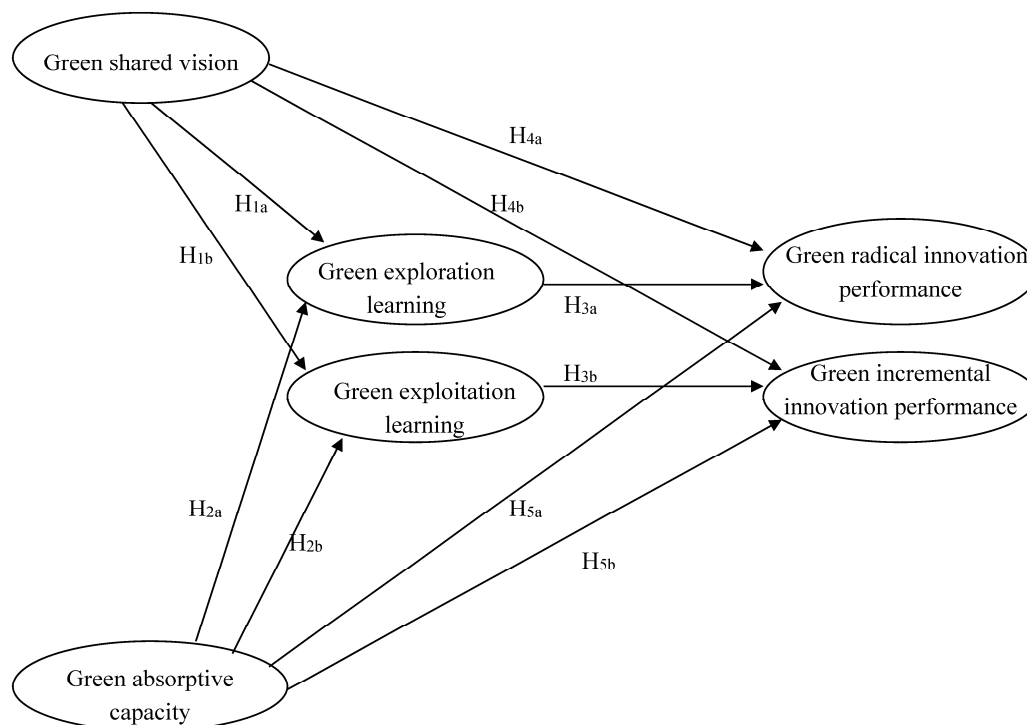
- *Hypothesis 4 (H4). Green shared vision is positively associated with green innovation performance.*
- *Hypothesis 4a (H4a). Green shared vision is positively associated with green radical innovation performance.*
- *Hypothesis 4b (H4b). Green shared vision is positively associated with green incremental innovation performance.*

## 2.5. The Influence of Green Absorptive Capacity on Green Innovation

If the environment is rapidly changing, companies have to establish absorptive capacity to acquire, assimilate, transform, and exploit knowledge [39]. Hence, companies should develop absorptive capacity to undertake knowledge management actively and obtain competitive advantages [53]. Successful innovation needs the integration between external knowledge and internal capability which can provide important ideas [44,54]. Absorptive capacity is the ability to enable companies to acquire and apply external knowledge as well as internal knowledge which have a positive effect on innovation [40,55]. Companies do not only need to create mechanisms to learn and exploit knowledge which can lead to innovation, but also require absorptive capacity to produce creative and innovative ideas [40,55]. Because an organisation's absorptive capacity relates to R&D resources, interaction mechanisms, and managerial processes [56], its absorptive capacity is critical to its innovative capabilities [39]. This study proposes a novel notion, "green absorptive capacity", and refers to [39] to define it as "the ability to acquire, assimilate, transform, and exploit environmental knowledge". Prior literature demonstrates that absorptive capacity is a critical driver of innovative capabilities and outcomes [39,40]. As a result, absorptive capacity is positively related to innovation performance [57]. Therefore, this study asserts that green absorptive capacity positively affects green radical and incremental innovation performance and implies the following hypotheses:

- *Hypothesis 5 (H5). Green absorptive capacity is positively associated with green innovation performance.*
- *Hypothesis 5a (H5a). Green absorptive capacity is positively associated with green radical innovation performance.*
- *Hypothesis 5b (H5b). Green absorptive capacity is positively associated with green incremental innovation performance.*

We argue that green shared vision and green absorptive capacity positively affect green radical and incremental innovation performance. In addition, we assert that the relationships between green radical and incremental innovation performance and the two drivers—green shared vision and green absorptive capacity—are partially mediated by green organisational ambidexterity that integrates green exploration learning and green exploitation learning simultaneously. The antecedents of the research framework are green shared vision and green absorptive capacity and the consequents are green radical innovation performance and green incremental innovation performance, while green exploration learning and green exploitation learning are two partial mediators. The research framework is shown in Figure 1.

**Figure 1.** Research framework.

### 3. Methodology and Measurement

#### 3.1. Data Collection and the Sample

We applied a questionnaire survey to verify the hypotheses in Taiwan's electronics industry. There are three reasons to select Taiwan's electronics industry as research object. First, Taiwan is the world's factory of the electronics industry. Taiwan's electronics companies face strict environmental regulations, such as Montreal Convention, Kyoto Protocol, Restriction of the Use of Certain Hazardous Substances in EEE (RoHS) Directive, Waste Electronics and Electrical Equipment (WEEE) Directive, Energy Using Product (EuP) Directive, and Integrated Product Policy (IPP) Directive, so that they undertake green innovation that can satisfy their customers' environmental desires [3]. It is interesting to explore the influences of green shared vision and green absorptive capacity on green radical and incremental innovation performance and to investigate the mediation effect of green organisational ambidexterity when environmental issues become a huge impact for them. Second, Taiwan's electronics industry is famous [28], so it is meaningful to explore green innovation of Taiwan's electronics industry. Third, Taiwan is a newly emerging manufacturing base in the world. It is remarkable to discuss how Taiwanese electronics companies enhance their green radical and incremental innovation performance via green shared vision, green absorptive capacity and green organisational ambidexterity in the environmental era. These specific characteristics in Taiwan's electronics industry can contribute to theoretical findings. The samples of the questionnaire survey were randomly selected from the "Business Directory of Taiwan". The respondents of the questionnaires are the managers of environmental, human resource management, and R&D departments in Taiwanese electronics companies. To heighten the valid survey response rate, the research assistants of this study called to each company sampled, explained the objectives of the study and the questionnaire contents,



and confirmed the names and job titles of the respondents prior to questionnaire mailing. The respondents were asked to return the completed questionnaires within two weeks via mail.

We referred to past literature to design the questionnaire items. Prior to mailing to the respondents, eight experts and scholars were asked to modify the questionnaire in the first pretest. Subsequently, the questionnaires were randomly mailed to ten Taiwanese electronics companies and the managers of environmental, human resource management, and R&D departments in the 10 Taiwanese electronics companies were asked to fill in the questionnaire and to identify the ambiguities in terms, meanings, and issues in the second pretest. High content validity is a necessary requisition for the questionnaire survey in this study. To avoid common method variance (CMV), the respondents of the different constructs in this study are different. The respondents of “green shared vision” and “green absorptive capacity” are managers of environmental departments; those of “green exploration learning” and “green exploitation learning” are managers of human resource management departments; and those of “green radical innovation performance” and “green incremental innovation performance” are managers of R&D departments. In addition, we refer to Nancarrow, Barce and Wright [58] to apply the three ways that include anonymity, promise of confidentiality, and asking to be honest to decrease socially desirable bias (SDB) in the questionnaire survey. Six hundred questionnaires were sent to the randomly selected companies. There are 202 valid questionnaires, and the effective response rate was 33.67%.

### 3.2. The Measurement of the Constructs

This study applies five-point Likert scale from 1 to 5 rating from strong disagreement to strong agreement to measure the questionnaire items. The measurements of the constructs are described in the following:

*Green shared vision.* This study refers to Jansen *et al.* [35] to measure “green shared vision” and its measure includes four items: (1) there is commonality of environmental goals in the company; (2) there is total agreement on the company’s strategic environmental direction; (3) all members in the company are committed to the environmental strategies of the company; and (4) the company’s employees are enthusiastic about the collective environmental mission of the company.

*Green absorptive capacity.* This study refers to Daghfous [40] and Lichtenthaler [59] to measure “green absorptive capacity” and its measure includes five items: (1) the organisational structure of the company has the ability to understand, analyse, and interpret information from external environmental knowledge; (2) the company can communicate environmental knowledge across its units; (3) the company has the ability to combine existing environmental knowledge with the newly acquired and assimilated environmental knowledge; (4) the company has the ability to recognize, value, and acquire external environmental knowledge that is critical to its operations; and (5) the company has the ability to successfully commercialize new external environmental knowledge.

*Green organisational ambidexterity.* This study refers to He and Wong [25] to measure “green organisational ambidexterity”. There are two parts in the measurement of green organisational ambidexterity: “green exploration learning” and “green exploitation learning”. The measurement of green exploration learning includes four items: (1) the company actively introduces new generation of green products, services, or processes; (2) the company actively develops new green products, services, or processes; (3) the company actively finds new green markets; and (4) the company

actively enters new green technology fields [25]. Besides, the measurement of green exploitation learning includes four items: (1) the company actively improves existing green products, services, or processes; (2) the company actively adjusts existing green products, services, or processes; (3) the company actively consolidates existing green markets; and (4) the company actively reinforces existing green technology fields.

*Green innovation performance.* This study asserts that there are two types of green innovation: “green radical innovation” and “green incremental innovation”. This study refers to Subramaniam and Youndt [31] to measure green radical innovation performance and its measure includes three items: (1) the company invents new generation of green innovation that makes a breakthrough in its green products, services, or processes; (2) the company devises new green innovation that fundamentally changes its green products, services, or processes; and (3) the company develops green innovation that departs from its existing environmental expertise or green technology. In addition, this study refers to Subramaniam and Youndt [31] to measure green incremental innovation performance and its measure includes three items: (1) the company improves its existing green innovation that makes a simple modification in its current green products, services, or processes; (2) the company adjusts its existing green innovation that makes a slight change in its current green products, services, or processes; and (3) the company reinforces its existing green innovation that slightly enhances its current environmental expertise or green technology.

## 4. Empirical Results

### 4.1. The Results of the Measurement Model

The means, standard deviations, and correlation matrix are shown in Table 1. The factor analysis of the six constructs is shown in Table 2. Every construct in this study can be classified into only one factor. We referred to prior research to design the questionnaire items. Before mailing to the respondents, we employed two pretests for the questionnaire revision. Therefore, the measurement of this study is acceptable in content validity. Besides, there are several measures to confirm the reliability and validity of the measurement. On one hand, one measure of the reliability is to examine the loadings of each constructs’ individual items. With respect to the quality of the measurement model, the loadings ( $\lambda$ ) of all items of the six constructs listed in Table 3 are significant. On the other hand, Cronbach’s  $\alpha$  is the other measure of the reliability. Table 3 lists Cronbach’s  $\alpha$  of the six constructs. In general, the minimum requirement of Cronbach’s  $\alpha$  coefficient is 0.7 [60]. In Table 3, the Cronbach’s  $\alpha$  coefficient of “green shared vision” is 0.842; that of “green absorptive capacity” is 0.870; that of “green exploration learning” is 0.812; that of “green exploitation learning” is 0.824; that of “green radical innovation performance” is 0.830; and that of “green incremental innovation performance” is 0.823. Because the Cronbach’s  $\alpha$  coefficients of all constructs are more than 0.7, the reliability of the measurement in this study is acceptable.

In addition, we apply Fornell and Larcker’s measure of average variance extracted (AVE) to evaluate the discriminant validity of the measurement [61]. The AVE measures the amount of variance captured by the construct through its items relative to the amount of variance due to the measurement error. To satisfy the requirement of the discriminant validity, the square root of a construct’s AVE

must be greater than the correlations between the construct and the other ones in the model. For example, the square roots of the AVEs for the two constructs—green absorptive capacity and green exploitation learning—are 0.860 and 0.865 in Table 3 which are more than the correlation, 0.365, between them in Table 1. It demonstrates that there is adequate discriminant validity between the two constructs. The square roots of all constructs' AVEs in Table 3 of this study are all more than the correlations among all constructs in Table 1. Therefore, the discriminant validity of the measurement in this study is acceptable. In addition, if the AVE of a construct is higher than 0.5, it means that the convergent validity of the construct is acceptable. In Table 3, the AVEs of the six constructs are 0.723, 0.740, 0.751, 0.749, 0.755, and 0.748, that are all higher than 0.5. It indicates that the convergent validity of the measurement is acceptable. Based on the above results, the reliability and validity of the measurement in this study are acceptable.

**Table 1.** Means, standard deviations and correlations of the constructs.

Constructs	Mean	S.D.	A.	B.	C.	D.	E.
A. Green shared vision	3.656	0.572					
B. Green absorptive capacity	3.579	0.561	0.349 *				
C. Green exploration learning	3.485	0.568	0.343 **	0.334 *			
D. Green exploitation learning	3.733	0.550	0.320 *	0.365 **	0.190 †		
E. Green radical innovation performance	3.489	0.568	0.317 *	0.328 *	0.369 *	0.084	
F. Green incremental innovation performance	3.714	0.575	0.323 **	0.335 *	0.139	0.372 *	0.168 †

Note: †  $p < 0.1$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ . S.D. is “standard deviation”.

**Table 2.** Factor analysis of this study.

Constructs	Number of Items	Number of factors	Accumulation percentage of explained variance
Green shared vision	4	1	62.3%
Green absorptive capacity	5	1	61.9%
Green exploration learning	4	1	60.1%
Green exploitation learning	4	1	61.5%
Green radical innovation performance	3	1	58.9%
Green incremental innovation performance	3	1	59.4%

**Table 3.** The items' loadings ( $\lambda$ ) and the constructs' cronbach's  $\alpha$  coefficients and average variance extracted (AVEs).

Constructs	Items	$\lambda$	Cronbach's $\alpha$	AVE	The square root of AVE
Green shared vision	GSV1	0.819	0.842	0.723	0.850
	GSV2	0.825 **			
	GSV3	0.839 **			
	GSV4	0.840 **			
Green absorptive capacity	GAC1	0.806	0.870	0.740	0.860
	GAC2	0.814 **			
	GAC3	0.830 **			
	GAC4	0.826 **			
	GAC5	0.837 **			

**Table 3.** *Cont.*

Constructs	Items	$\lambda$	Cronbach's $\alpha$	AVE	The square root of AVE
Green exploration learning	GER1	0.826	0.812	0.751	0.867
	GER2	0.837 **			
	GER3	0.825 **			
	GER4	0.842 **			
Green exploitation learning	GEI1	0.810	0.824	0.749	0.865
	GEI2	0.823 **			
	GEI3	0.838 **			
	GEI4	0.828 **			
Green radical innovation performance	GRI1	0.804	0.830	0.755	0.869
	GRI2	0.817 **			
	GRI3	0.825 **			
Green incremental innovation performance	GII1	0.808	0.823	0.748	0.865
	GII2	0.814 **			
	GII3	0.823 **			

Note: \*\*  $p < 0.01$ .

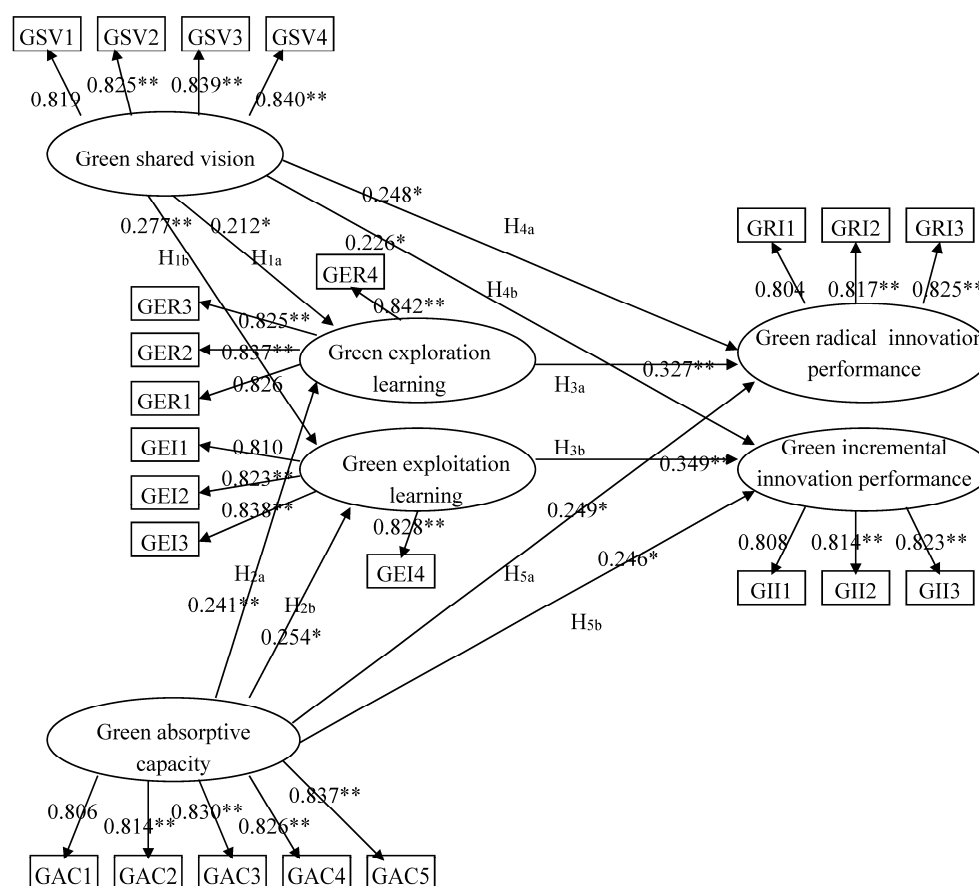
#### 4.2. The Results of the Structural Model

We utilize structural equation modeling (SEM) to verify the hypotheses and apply AMOS 17.0 to obtain the empirical results by means of maximum likelihood estimation (MLE). Table 4 shows the results of the structural model in this study. The overall fit measures of the full model in the SEM indicates that the fit of the model is acceptable (Degree of freedom = 220, Chi-square = 326.72, GFI = 0.902, RMSEA = 0.049, NFI = 0.903, CFI = 0.905). All of the paths estimated are significant, and all hypotheses are supported in this study. The residuals of the covariance are small and center near 0. The results of the full model in this study are shown in Figure 2. All ten paths estimated are significantly positive. Therefore, H<sub>1a</sub>, H<sub>1b</sub>, H<sub>2a</sub>, H<sub>2b</sub>, H<sub>3a</sub>, H<sub>3b</sub>, H<sub>4a</sub>, H<sub>4b</sub>, H<sub>5a</sub>, and H<sub>5b</sub> are all supported in this study. We find out that the increase of both green shared vision and green absorptive capacity can not only raise green exploration learning and green exploitation learning, but also enhance green radical innovation performance and green incremental innovation performance. We demonstrate that green shared vision and green absorptive capacity are two crucial drivers of green radical and incremental innovation performance. The results prove that green exploration learning partially mediates the positive relationships between green radical innovation performance and its two drivers—green shared vision and green absorptive capacity. In addition, the results verify that green exploitation learning partially mediates the positive relationships between green incremental innovation performance and its two drivers—green shared vision and green absorptive capacity. It means that green shared vision and green absorptive capacity can not only directly affect green radical innovation performance and green incremental innovation performance positively, but also indirectly affect them positively via green organisational ambidexterity. According to the above research results, we suggest that companies should raise their green shared vision, green absorptive capacity, and green organisational ambidexterity to enhance their green radical innovation performance and green incremental innovation performance to meet the environmental trends.

**Table 4.** Measures of Overall Model Fit.

Hypothesis	Proposed effect	Path coefficient	Results
H <sub>1a</sub>	+	0.212 *	H <sub>1a</sub> is supported
H <sub>1b</sub>	+	0.277 **	H <sub>1b</sub> is supported
H <sub>2a</sub>	+	0.241 *	H <sub>2a</sub> is supported
H <sub>2b</sub>	+	0.254 *	H <sub>2b</sub> is supported
H <sub>3a</sub>	+	0.327 **	H <sub>3a</sub> is supported
H <sub>3b</sub>	+	0.349 **	H <sub>3b</sub> is supported
H <sub>4a</sub>	+	0.248 *	H <sub>4a</sub> is supported
H <sub>4b</sub>	+	0.226 *	H <sub>4b</sub> is supported
H <sub>5a</sub>	+	0.249 *	H <sub>5a</sub> is supported
H <sub>5b</sub>	+	0.246 *	H <sub>5b</sub> is supported

Note: \*  $p < 0.05$ , \*\*  $p < 0.01$ .

**Figure 2.** The results of the full model.

Note: Degree of freedom = 220, Chi-square = 326.72, GFI = 0.902, RMSEA = 0.049, NFI = 0.903, CFI = 0.905, \*  $p < 0.05$ , \*\*  $p < 0.01$ .

Green exploitation and exploration learning activities are two fundamentally different learning activities between which firms divide their attention and resources. If firms' green exploitation and exploration learning activities are strategically integrated, green organisational ambidexterity can become a determinant of green radical and incremental innovation performance. Strategic integration between green exploitation and exploration learning activities requires green shared vision and green

absorptive capacity. Green shared vision and green absorptive capacity are two important requirements to generate green organisational ambidexterity. As key leaders in organisations, top managers are regarded as playing an important role in fostering green organisational ambidexterity, since they can help build up green shared vision and green absorptive capacity. Thus, companies can encourage top managers to develop environmental leadership. Top management team's leadership and effective management can facilitate the development of green shared vision and green absorptive capacity that positively relate to green organisational ambidexterity and green innovation performance. Moreover, companies can build up strategic human resource practices including the recruitment, selection, training, and career path management of organisational members as a way of stimulating the pursuit of green exploitation and exploration learning activities at the same time. Furthermore, establishing a supportive culture can stimulate organisational members to simultaneously pursue and integrate green exploitation and exploration learning activities which can further enhance green radical and incremental innovation performance.

## 5. Conclusions and Implications

Although previous research has highlighted the relevant issues about organisational ambidexterity, no research explores organisational ambidexterity about environmental management. This study proposes a new concept, "green organisational ambidexterity", that combines green exploration learning and green exploitation learning simultaneously. The main purpose of this study is to discuss the antecedents and consequents of green organisational ambidexterity and to explore its mediation effect in Taiwan's electronics industry. The literature is not conclusive on how to enhance green radical and incremental innovation performance in an integrated framework under the context of environmentalism. Thus, we provide an approach about shared vision and absorptive capacity to improve green radical and incremental innovation performance in the environmental era. Furthermore, we develop a research framework of green radical and incremental innovation performance to discuss its relationships with green shared vision, green absorptive capacity, and green organisational ambidexterity. The empirical results show that green shared vision and green absorptive capacity positively relate to green organisational ambidexterity, green radical innovation performance, and green incremental innovation performance. Besides, we find out that the positive relationships between green radical innovation performance and its two drivers—green shared vision and green absorptive capacity—are partially mediated by green exploration learning. In addition, we demonstrate that the positive relationships between green incremental innovation performance and its two drivers—green shared vision and green absorptive capacity—are partially mediated by green exploitation learning. All hypotheses proposed in this study are supported. Therefore, investing resources in the increase of green shared vision, green absorptive capacity, and green organisational ambidexterity is helpful to increase green radical and incremental innovation performance.

There are five academic contributions in this study. First, there is no research exploring the issue of organisational ambidexterity about environmental management. This study proposes a new concept, "green organisational ambidexterity", to explore its antecedents, consequents, and mediation effects to fill the research gap. Second, although prior literature has discussed the radical and incremental changes of eco-innovations [29,62–64], this study further explores the concept of green radical and

incremental innovation performance and develops a research framework to investigate the determinants of green radical and incremental innovation performance. Third, although previous research has widely explored the relevant issues about shared vision, none explores shared vision about environmental management. We propose a novel construct, “green shared vision”, and discuss its positive influence on green organisational ambidexterity and green radical and incremental innovation performance to fill the research gap. Fourth, no research discusses absorptive capacity about environmental management, though prior literature has widely explored the relevant issues about absorptive capacity. We propose a novel construct, “green absorptive capacity”, and discuss its positive influence on green organisational ambidexterity and green radical and incremental innovation performance to fill the research gap. Fifth, we integrate the concepts of shared vision, absorptive capacity, organisational ambidexterity, and green management to propose a research framework of green radical and incremental innovation performance to extend the research of green innovation.

There are four practical contributions in this study. First, we verify that the rise of green shared vision and green absorptive capacity can not only increase green organisational ambidexterity, but also raise green radical and incremental innovation performance. As a result, if companies would like to enhance their green radical and incremental innovation performance, they have to increase their green shared vision and green absorptive capacity. Second, if companies intend to improve their green radical and incremental innovation performance, they need to enhance their green organisational ambidexterity, since the research results indicate that green organisational ambidexterity has a significant mediation effect in this study. It means that green shared vision and green absorptive capacity can not only directly affect green radical innovation performance and green incremental innovation performance positively, but also indirectly affect them positively via green organisational ambidexterity. Third, in a more sophisticated context of innovation process, it is worth educating experienced leaders of green innovation projects to increase green shared vision, green absorptive capacity, and green organisational ambidexterity to raise green radical and incremental innovation performance. Fourth, because green innovation has become an effective differentiation and positioning strategy nowadays, firms should use green innovation to differentiate and to position their products to seize new green markets [65]. According to the results of this study, firms have to integrate green shared vision, green absorptive capacity, and green organisational ambidexterity into their long-term strategies to enhance their green radical innovation performance and green incremental innovation performance.

Leadership processes is a supporting factor when implementing green organisational ambidexterity. Effective mechanisms for linking and integrating green exploitation and exploration learning activities include top managers’ leadership and coordination. Hence, top managers must be capable of disseminating environmental information across as well as within organisations, thereby facilitating the reciprocal environmental information flows between green exploitation and exploration learning activities. Senior management teams should be able to embrace the paradox associated with jointly pursuing green exploitation and exploration learning activities as well as manage the environmental information processing and coordination demands. Hence, firms can encourage top managers to build up environmental leadership. When top managers share a green vision and build up green absorptive capacity, they are able to pursue green organisational ambidexterity which can further positively affect green radical innovation performance and green incremental innovation performance. Besides, the key to green competitive advantage begins by defining and communicating a shared, clear, and integrated

green vision. The shared green vision must be implemented through flexible strategic planning activities within the organisation to make sure every member can identify, extract, and digest common environmental goals. Additionally, team-based structures and human resource practices that emphasize innovation, teamwork, job enrichment, flexibility, and creativity are beneficial to support the simultaneous pursuit of green exploitation and exploration learning activities. In addition, a supportive culture is one key source of green organisational ambidexterity. Thus, companies can develop a supportive culture to motivate organisational members to undertake the coordination, integration, and synchronization of green exploitation and exploration learning activities that can further raise green radical and incremental innovation performance.

There are four limitations of this study. First, this study only focuses on the electronics industry. We did not collect data from other industries and compare with this study. Second, this paper only focuses on Taiwanese companies. We didn't collect data from other countries' companies and compare with this study. Third, we collected data by means of questionnaire survey, which can only provide cross-sectional data so that we cannot analyse the dynamic change of green shared vision, green absorptive capacity, green organisational ambidexterity, green radical innovation performance, and green incremental innovation performance from the longitudinal perspective. Fourth, we collected self-reported data by means of questionnaire survey. We didn't collect public secondary data and compare with this study.

There are four directions with respect to future research in the study. First, we focus on the electronics industry of Taiwan. Future research can focus on other industries and compare with this study. Second, we focus on Taiwanese companies. Future research can focus on other countries' companies and compare with this study. Third, we test the hypotheses by means of questionnaire survey, which only provides cross-sectional data so that we cannot demonstrate the dynamic change of green shared vision, green absorptive capacity, green organisational ambidexterity, green radical innovation performance, and green incremental innovation performance in the different stages. Therefore, future research can focus on the longitudinal study to investigate the differences of the empirical results in the different stages. Fourth, we collected self-reported data by means of questionnaire survey. Thus, future research can collect public secondary data and compare with this study. We hope that the research results are useful for managers, researchers, practitioners, and policy makers, and contribute to future research as reference.

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## **Author Contributions**

Yu-Shan Chen initiated the project and conceptualized the paper. Ching-Hsun Chang analysed the data and completed the paper in English. Yu-Hsien Lin made contributions in data collection and writing material.



## Conflicts of Interest

The authors declare no conflict of interest.

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