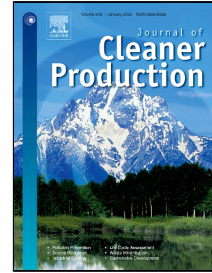


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# **Reinforcing green competitive advantage through green production, creativity and green brand image: Implications for cleaner production in China**

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## **Abstract**

The study explores the key reinforcing factors of green competitive advantage among equipment manufacturing enterprises in China. Primary data using a survey method has been collected from managers and customers of equipment manufacturing organizations. Covariance-based structural equation modeling (CBSEM) using SPSS 23.0 and AMOS 23.0 have been employed to estimate empirical findings. The results show that green brand image leads the process of reinforcing green competitive advantage. It has been seen that customer pressure, regulatory pressure and green creativity positively influence green production. However, the influence of customer pressure is higher, which provide an insight to the decision makers. Additionally, the work has indicated that although green production and green creativity directly have a positive role in reinforcing green competitive advantage. But, the role becomes stronger when it contributes toward green competitive advantage via green brand image. The study concludes that the role of customers is highly significant, they can play a vital role in reinforcing green competitive advantage for the enterprises and also they can influence firms to adopt green production. Similarly, the green awareness programs would be pivotal to create awareness among the general customers for persuading a business environment for cleaner production in the country.

**Keywords:** Innovation; competitive advantage; brand image; green production

## **1. Introduction**

The internal and external business environment of manufacturing firms has been significantly changed due to the rapid economic globalization. In order to adapt the changes of the market environment at a faster speed, reducing the operating cost and offering better products to customers, enterprises must emphasize upon innovation. At the same time, resources and environmental issues have become the primary dilemma faced by enterprises. The latest advancements show that a great deal of efforts is being made for environmental protection through

innovation (Cole & Grossman, 2018; Shu et. al., 2016). Zailani et al., (2015) argued that due to the excessive consumption of resources and increasingly prominent environmental problems, firms should implement green production to effectively reduce environmental risks and their negative consequences in the whole production process. The concept and practice of green production is getting great attention due to its focus on addressing environmental issues. Green production refers to the process of adding environmental concepts into product life cycle (Przychodzen & Przychodzen, 2015). Even though, the implementation of green production reduces waste and improve productivity in an all-round way (Tseng et. al., 2013). But, to what extent it can be useful in establishing a green image and improving core competitiveness is not explored yet.

Most of the previous research has focused on exploring the drivers of green production (Leal-Millan et. al., 2016). However, the study of Huang et al., (2016) criticized that still the results for the drivers of green production are ambiguous. Moreover, the resource-based theory highlight that resources and internal capabilities of an enterprise play an important role in its development and operation. The research of Zameer et al., (2018) highlighted that internal organizational factors significantly influence external factors. Demirel and Kesidou (2019) asserted that through rational allocation of resources for production and operation, R&D and innovation, firm can effectively improve its overall performance. If we look back in the landmark study of Hart (1995), it states that the competitive advantage theory is based upon the relation of firm with a natural environment. The study has indicated that the said relation is comprised of three interconnected parts, i) pollution prevention, ii) product stewardship and iii) sustainable development. Similarly, for thinking about sustainable environment and producing green products firm need capability of being creative. Although, creativity is widely studied in academic research, but the antecedent effect of green creativity to green production as a mediating factor, and its consequent effect on the green brand image and green competitive advantage has not got attention.

Furthermore, a great deal of efforts has been made to study green product management, and its determinants. But, still there are many shortcomings in exiting research. Such as, research on green production mainly emphasized on exploring the influencing factors of green production. Although, green production is a necessary condition for sustainable development of the organizations. But, the problem is that existing research merely focused on how green production improves a green

image of the organization. However, the ultimate output of the firms is its products, none of the study explored how green production can influence a green brand image, which may further influence green competitive advantage. Moreover, the mediating effect of the green brand image to the relationship between green production and green competitive advantages is also ignored. Although, Zhu et al., (2005, 2017) studies focused on China. But, their focus remained on supply chain management instead of competitive advantage. Therefore, it can be stated that existing research on competitive advantage mainly focused on a developed world, a country (China) known as a manufacturing hub of the world has not get attention in this regard.

Therefore, the study aims to introduce a novel analytical framework to bridge the aforesaid knowledge gaps. It considers the formation mechanism of firm green competitive advantage under the combined action of internal factors such as green production, green creativity and external factors such as a green brand image. Also, the mediating effect of the green brand image to the relationship between green production and green competitive advantages is being studied. Moreover, the study also explore the antecedent effect of green creativity to green production as a mediating factor, and its consequent effect on a green brand image and green competitive advantage. Practically, the study catch attention of practitioners to reinforce green competitive advantage through green production, green brand image and green creativity. The study used a comprehensive survey data that is collected through two kinds of surveys. One questionnaire designed to collect data from managers of equipment manufacturing companies and the second questionnaire used to collect data from customers of these companies. The comprehensive analysis of data from managers and customers provide practical insights to manufacturing sector companies and policy makers. Theoretically, the conclusions from study provide a basis for future research on reinforcing green competitive advantage through internal and external factors. Finally, the study provides a framework for decision makers in the government and firms to formulate relevant industrial policies for cleaner production and to promote green innovation practice in the country.

## **2. Literature review and research hypothesis**

In the recent past, there has been a great interest among scholars, practitioners, and even general public toward conserving the environment (Behnam et. al., 2018). Similarly, the great interest from stakeholders influenced the firms to adopt green production. Research has shown that green product doesn't mean zero pollution, but a product or the process that create least damage to the

environment is called green product (Junior et al., 2018). Correspondingly, the process opted to reduce environmental damages is called green production. The study of Agarwal and Helfat (2009) emphasized on strategic renewal from three aspects of product life cycle, manufacturing, usage and its disposal. Following the concept of Agarwal and Helfat (2009), organizations can reduce their environmental impact through green production. Similarly, organizations can use clean energy, recyclable materials and eliminate the sources of pollution.

Environmental friendly production and consumption are greatly influenced by the internal and external stakeholders that have environmental concerns with the product (Huang et. al., 2016; Biswas & Roy, 2015). It has been a great debate that how firms, government and consumers can play a role together to work for environmental sustainability (Yasmeen et al., 2019). The study of Bansal and Roth (2000) indicated that different levels of external pressure leads toward distinct organizational responses toward green production. According to Donaldson and Peterson (1995) the stakeholder theory given by Freeman (1984) explains that consumer needs and issues have a keen influence on firm's decisions and its operations to achieve their long term and short term goals. Consumer's need is important to understand for the proactive strategic environmental commitment based on environmental performance, organizational structure and competitive advantage of a company in the past (Hart, 1995).

The study of Zhu et al., (2017) indicated that the formal influence of customers through monitoring require organizations to cope with environmental challenges and implement green production and distribution strategies. Charan and Murty (2018) highlighted that external stakeholders significantly influence organizations to cope with environmental challenges while designing their production strategy. Huang et al. (2016) also suggests that green production strategy is influenced by customer's pressures. Their study only focused on measuring business performance of restaurant industry. But, green production is more important in other manufacturing industries such as equipment manufacturing industry. Further, they didn't studied green competitive advantage. Therefore, fresh study is required to explore how green competitive advantage can be reinforced through green production. Gualandris and Kalchschmidt (2014) highlighted that if a firm decides to not conform to the customer demand of green products, it will obviously lead to loss of market share which may lead to reduction in sales and profitability. However, their study only emphasized

on sustainable process management. The role of customer pressure in building sustainable products to gain competitive advantage was lacking in their study.

According to institutional theory, some external factors have a strong influence on the company's operations (Hirsch, 1975). Organizations work in a social system and its motivating factors are also based on the society in which it operates. These motivating factors are interconnected with each other (Laccobci and Hopkins 1992). The socio culture pressure forces the organization to make steps for the adoption of a green manufacturing system. In addition, resource based theory explains that resources are very important element for success of an organization. Traditionally, in the competitive markets, the actual performance of the product is based on its differentiation and creativity, according to phenomena of resource based theory, creativity and innovativeness are the main factors of developing new products or methods that can create product differentiation and help the organization to implement the differentiation strategy. So, it is creativity and innovation that helps the organization to create new opportunity, minimize the external and internal threats, increases the profit of the organization and reduce the manufacturing cost too. Accordingly, creativity is supposed to be a valuable resource for the organization. In the light of stakeholders' theory, institutional theory and resource based theory, it can be presumed that the role of institutions/regulatory bodies and other social stakeholders such as consumers will influence firms' decisions to opt green production. Additionally, the role of internal resources and capabilities in the form of creativity are also important for green production. Based upon the proceeding discussion following propositions have been developed.

**H<sub>1</sub>.** Regulatory pressure significantly influences firms to adopt green production.

**H<sub>2</sub>.** Customer pressure influences firms to adopt green production.

**H<sub>3</sub>.** Green creativity influences firms to adopt green production.

In response to adopting green production technologies, the role of corporate strategy and managerial capability is also important. The study of Helfat and Martin (2015) emphasized upon managerial capabilities of creating, extending and modifying the way in which firm make a living. Dai et al., (2017) stated that obtaining knowledge and seeking cooperation from experts with environmental skills will not only help to improve green product development, but also help to improve new product quality and productivity, shorten development cycles, and enhance the company's competitiveness. The core focus of their study remained on process innovation instead

of green production. In contrast, our study is designed to study the role of green production for reinforcing competitiveness. The traditional model of green production is based upon environmental protection and it promotes organizational sustainable development. But, the empirical evidence to justify the influence of green production on green competitive advantage is scant.

In addition, green production is more like an instrument to improve the environmental management practice process. Protecting the environment and creating awareness of green production through eco-labeling can improve an organization's competitiveness. According to resource based theory, if an organization has required resources and capabilities it will improve the innovation strengthen which would be a resource that contributes to the core competitiveness than the other way around. Green production assumes to be a competitive edge for the company, as many customers require ecofriendly product. It can be presumed that innovation leads the product toward a competitive edge. So, if a company is producing green products it is enhancing the innovating capability of the firm. Green production integrates the social responsibility with the core business of the enterprise. Similarly, opting green production satisfies the needs of green consumers (Ritter et al., 2015). According to Chen et al., (2006) green innovation can improve enterprise competitive advantage. Their study used only 200 sample size and used ANOVA instead of structural equation modeling. Further, their study only used green innovation and competitiveness and missed to study the role of antecedent factors such as green creativity, regulatory pressure and customer pressure. Moreover, Esty and Winston (2009) highlighted that smart companies use environmental strategies to shape competitive advantage. Ambec (2017) argued that green industrial policy can improve green competitive advantage. These studies emphasized on policy perspective. Whereas, the perspective of production and competitiveness is ignored. Therefore, new study is pivotal to explore how green production can enhance green competitive advantage. Based upon the proceeding discussions and arguments, the following proposition has been drawn.

**H<sub>4</sub>.** Green production can reinforce green competitive advantage.

The earlier research in the area of green business practices define green brand image as the environmental aspects associated with the product/brand (Bekk et al., 2016). The Kotler defined brand image as a set of ideas, beliefs and impression that a customer hold for certain product or

brand. Similarly, when environmental or green aspects are engaged in a product and then the belief and impression toward this product will be regarded as a green brand image. The concept green brand image can be divided into two components, one can be the functional and tangible component and the other one can be the psychological component. Both of these have equal importance. The perception of functional and psychological components is formed through the interaction of a consumer with product or brand. It is the experience of the customer which determines how they perceive a certain brand. Green brand image is the accumulation of firms green initiatives. According to Esmaeili et al., (2017) concerns over environmental issues has influenced the firms to produce more green products. Hanaysha et al., (2014) argued that opting green production can improve performance of automotive industry in Malaysia. However, they studied only one perspective i.e. passengers only. Whereas, our study is focused on equipment manufacturing industry of China and used two perspectives i.e. consumer and firm perspective. Wahyuni (2019) also found that green production is related to brand image. Their study is used in the context of Indonesia and based upon small sample size (i.e. 120 only). Business environment, social structure and government system in Indonesia and China is totally different (Akita, 2003; Cummings, 2008; Efferin & Hopper, 2007). Therefore, fresh evidence in the context of manufacturing sector of China is necessary. Further, they stated that green marketing is important as well as green production. In other words, companies need to emphasize on green marketing to shape a green image of their products. It can be presumed that green production will work as a reinforcing factor of a green brand image. Moreover, Zameer et al., (2019) argued that a consumer accumulates the knowledge from different sources to make a purchase decision. Kumar and Ghodeswar (2015) also stated that consumer knowledge of green production reinforce them to buy that product due to their environmental concerns.

The extent of green production and its supply refers to the degree of environmental concern of firm in the process of producing and supplying the products to the society. It aims to provide more green products to the society and minimize damage to the ecological environment. These practices are important to form a green brand image. Enterprises actively carry out green production and establish a green image, which can enhance the positive perception of the brand and it promotes the formation of competitive advantage of the enterprise. From a consumer perspective, the establishment of a green brand image is closely related to the development of green products. Green production is environmental responsibility behavior, and it is also an important means for



enterprises to establish a green image and follow to sustainable development (Famiyeh et. al., 2018). In summary, the green brand image reflects the green value orientation of the company. It shows to what extent company is taking the initiatives to produce green products and follow social responsibility. The green brand image can make the company the first choice for customers. Through building green brand image, a new offering under the umbrella of the same brand are easily accepted by the consumers, which enhance the competitive advantage of the firm. Based upon the aforementioned discussion, we have developed the following hypothesis:

**H<sub>5</sub>.** Green production can reinforce green brand image.

**H<sub>6</sub>.** Green brand image can reinforce green competitive advantage.

The discussion on the nexus of green production, green brand image and green competitive advantage suggest that the adaptation of green production in the organization will ultimately reinforce the firm competitive advantage. However, in order to explore the direct and indirect influence of green production on green competitive advantage, it is necessary to incorporate a third (mediating) variable. Green brand image can be the mediating variable in the relationship between green production and green competitive advantage. In other words, it can be stated that when firm adopt green production it will improve its image first before firm can gain competitive advantage. Such mechanism is recognized as direct and indirect effects (Preacher & Hayes, 2008). According to phenomena of resource based theory, creativity and innovativeness are the main factors of developing new products or methods that can create product differentiation and help the organization to implement the differentiation strategy. The study of Zehir et al (2015) emphasized that brand image is the outcome of firm differentiation strategy. Moreover, the differentiation strategy through resources and creativity work as a key pillar for creating value for customers and building strong brand image (Baroto et al., 2012). Similarly, this differentiation strategy helps the firms to differentiate their product from others which make them more competitive. Moreover, a theory of organization image management states that organizations attempt to create and maintain their image in the eyes of stakeholders. In this context, organizations adopt green production to create a sustainable brand image which can further strengthen their competitive advantage. Moreover, the study argues that green production will reinforce green brand image and green competitive advantage in H4 and H5. In addition, it has been postulated that green brand image reinforces green competitive advantage (H6). Thus, based on the arguments from the theory of organization image management and resource based view, it can be stated that green production

can not only influence green competitive advantage directly, but also it can effect indirectly via green brand image. Consequently, this study argues that green brand image mediates in the research framework and following hypothesis has been drawn.

**H<sub>6a</sub>.** Green brand image mediates the relationship among green production and green competitive advantage.

The development of green brand image requires the firm itself to integrate its resources and capabilities into a brand. In other words, the firm should further enhance its corporate brand strategy and engage employees and customers in planning and executing to bring new green products in the market. Zameer et al. (2018) asserted that internal and external resources are equally important. Firms should emphasize on engaging customers and employees because the engagement of internal and external stakeholders brings positive results into products. Jensen and Beckmann (2009) argued that strategic innovations through creativity play a vital role in creating a favorable image. Their study focused on strategic innovation instead of product innovation. Creativity is a way to change new ideas into reality. Generally, creativity is the ability to think in a different way. Similarly, in a context of green business, creativity can be defined as thinking about sustainable environment and producing green products. Resource based theory explains that resources are very important element for the success of an organization. If an organization has required resources and capabilities it will enrich the innovation strengthen which would be a resource that contributes to the core competitiveness than the other way around. Martin et al., (2015) explored the competitiveness of cities and found that adaptation of innovative strategies can play a significant role in gaining competitiveness. Ferreira et al., (2018) also found that creativity can reinforce the competitive advantage of the firms. However, their focus remained on strategic innovation instead of product innovation. Thus, it is necessary to integrate creativity into all decisions of the enterprise that will improve brand image on one end. And on the other end, it will contribute in reinforcing competitive advantage. Based on the proceeding discussion, the following propositions have been drawn:

**H<sub>7</sub>.** Green creativity can reinforce green competitive advantage.

**H<sub>8</sub>.** Green creativity can reinforce green brand image.

In order to explore the direct and indirect influence of green creativity on green competitive advantage, it is necessary to incorporate a third (mediating) variable. Green brand image can be the mediating variable in the relationship between green production and green competitive

advantage. In other words, it can be stated that when firm is capable of green creativity, it will improve its image first before firm can gain competitive advantage. Such mechanism is recognized as direct and indirect effects (Preacher & Hayes, 2008). The market positioning view (market based view) focus on developing firm new products and strategies according to market conditions. The view emphasizes on a product positioning to gain competitive advantage (Wang, 2014). Similarly, an effective brand positioning is pivotal to maximize brand value which is basically the antecedent factor of brand image (Park, 2009). Thus, it can be argued that there is some mechanism among creativity and competitiveness. As the core purpose of creativity is to build innovative products and strategies. In the light of market based view, the strategies and products are designed according to the market conditions. In this context, we can postulate that green creativity strengthens brand image which will improve green competitive advantage. In other words, green brand image play a role of mediator in the research framework. In addition, the study argues that green creativity will reinforce green brand image and green competitive advantage in H7 and H8. Also, it has been postulated that green brand image reinforces green competitive advantage (H6). Thus, based on the above arguments and in the light of market based view, it can be stated that green creativity can not only influence green competitive advantage directly, but also it can effect indirectly via green brand image. Consequently, this study argues that green brand image mediates in the research framework and following hypothesis has been drawn.

**H<sub>8a</sub>**. Green brand image mediates the relationship among green creativity and green competitive advantage.

Green creativity and green production have common objectives and rely on collective implementation practices (i.e. resources and capabilities). When a company develops a climate for creativity, it is also accumulating resources and capabilities those are required for firms to adopt green production practices. In other words, a firm which already has adopted green production, it will be easy to develop a climate for green creativity in the organization. According to the componential theory of creativity, the work environment influences creativity by influencing factors that contribute to creativity, which represent the fundamental source of organizational innovation (Amabile, 2012). Further, ambidexterity theory explains the process of dealing with conflicting demands at various levels of the organization (Bledow et al., 2009a, 2009b). Generally, it is divided into two levels, one is exploration level and the second is exploitation. Exploration level emphasizes on creating and managing new products through innovation (i.e. green

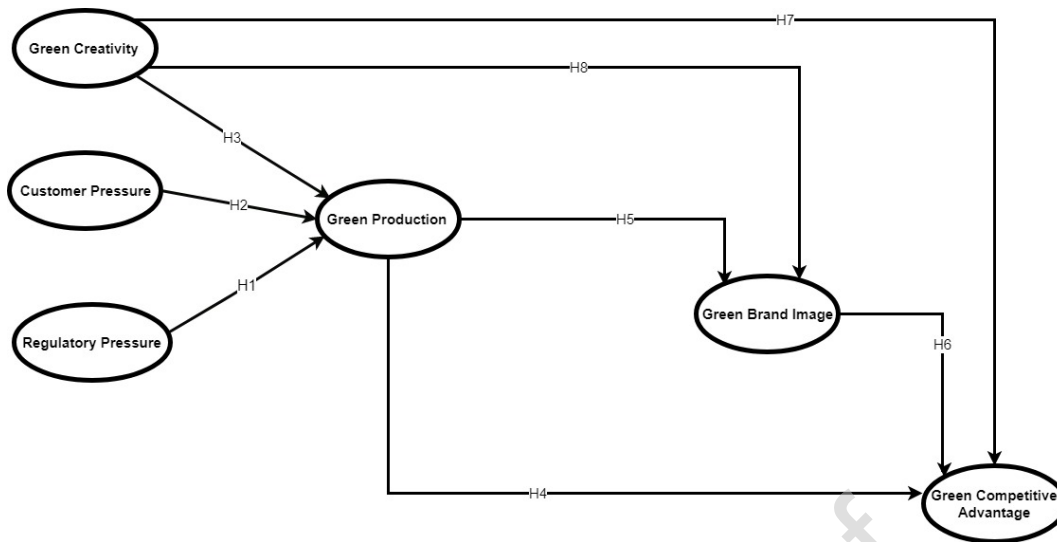
production). Whereas, exploitation focus on dissemination and execution. In other words, in the first phase of theory, it enables the firm to create new ideas and implement them in production process. In the second phase, organizations can exploit their efforts through distribution and marketing of products. Similarly, in the light of a componential theory of creativity and ambidexterity theory, it can be stated that based upon creativity organization would more likely to adopt green production which will likely to strengthen green brand image and enhance green competitive advantage at exploitation stage of ambidexterity theory. In addition, as discussed above, green production influence green brand image and green competitive advantage, and therefore, green production may work as a mechanism through which green creativity can reinforce green brand image and green competitive advantage. Consequently, green production could be mediating the relationship between green creativity and green brand image, also between green creativity and green competitive advantage. Therefore, following propositions have been drawn.

**H<sub>8b</sub>**. Green production mediates the relationship among green creativity and green brand image.

**H<sub>8c</sub>**. Green production mediates the relationship among green creativity and green competitive advantage.

### **3. Research Framework**

The study summarized the literature on green production, creativity, green brand image and green competitive advantage into a new research framework from the view of reinforcing green competitive advantage. Although, many studies in the past have explored the mechanism of improving competitive advantage, no research has explored the antecedent effect of green creativity to green production as a mediating factor, and its consequent effect on a green brand image and green competitive advantage. Moreover, the mediating effect of green brand image to the relationship between green production and green competitive advantages is also ignored. The study aims to fill the above research gap, and developed a novel framework. The study proposed eight hypothesis of direct effect and four other for indirect/mediation effects. The proposed framework is shown in fig.1.



*Fig.1: Research Framework*

## 4. Research Methodology

### 4.1 Measurement

To represent observable constructs for each latent construct, in this study, the widely used 5 point Likert scale has been employed. Among them, 1 represent ‘strongly disagree’ and 5 means ‘strongly agree’. Originally, all observable and latent constructs were developed in English. As the survey was being conducted among managers and customers of manufacturing enterprises in China. Therefore, to improve the level of understanding the survey questionnaire was translated into Chinese (a list of observable constructs is given in appendix 1). Academic experts who have command on speaking both English and Chinese have checked the translated version. It was ensured that no major discrepancies exist due to translation. After finalization, the survey instrument was distributed among participants.

### 4.2 Sampling and data collection

China is a manufacturing hub of the world. Due to large scale production, today China emits the highest carbon dioxide even greater than the United States. Environmentalists have consensus that the growing carbon emission has been creating environmental challenges. The Kyoto convention and general public awareness has urged Chinese legislators to introduce strict environmental systems to cope with environmental challenges. Similarly, the great consumer awareness and strict environmental challenges also stressed the equipment manufacturing sector organizations to gradually upgrade their production system to make it in line with recent environmental laws. Due to the greater pressure of new environmental laws on equipment manufacturing sector and its core

role in exports, this sector has been selected as a unit of analysis. Following the study of Zameer et al., (2018) the study used two types of questionnaires. First, a survey questionnaire (contains items for customer pressure, regulatory pressure, green creativity, green production and green competitive advantage) was designed to collect data from key persons across the distinguished equipment manufacturing firms such as first line, middle line and top line managers. It was confirmed that selected workforce has a sound knowledge about our study. Secondly, another survey instrument (contains items of green brand image) was used to collect data from the customers of same organizations. It was ensured that customers asked to fill a survey are repeated buyers of the same company and they have sound knowledge. To understand firms, environmental, competitive and innovation strategy, it was ensured that our survey instrument should incorporate a reasonable set of indicators to reflect all of these strategies.

Once the survey instruments have been finalized, two academic experts have evaluated these instruments. After the modification and incorporation of suggestions of experts, the survey instruments have been sent to about 35 employees and 35 customers for pilot testing. The results from pilot testing confirmed the reliability of the scale. The final questionnaire has been distributed among the managers and customers of the different equipment manufacturing organizations in China. The cluster of respondents have been used with the help of alumni, friends, personal references and social network. In order to ensure the integrity and confidentiality of the study, the anonymous filling-in method was adopted. It was ensured to the respondents that the information gathered from them will be utilized only for research purpose, and no individual information will be disclosed. In total, 1000 questionnaires were distributed among managers and a same number was distributed among the customers. A sum of 335 questionnaires were received from managers and 332 questionnaires were received from customers. After evaluation of the data for missing values and unengaged responses, some of the questionnaires were removed. Finally, a set of 320 questionnaires were utilized for final analysis. The final set of data consist of 320 managers and 320 customers' data. This final sample size is justifiable based upon the previous researches in the similar area. The study of Chu et al. (2019) utilized the sample of 165 respondents only, Wahyuni (2019) used data of 120 responses. Zhu et al., (2017) study in the supply chain context of China employed the data of 308 responses. Thus, it can be stated that sample size used in this study is reasonable for analysis.

### 4.3 Characteristics of the respondents

Demographic characteristics are presented in table 1 which show that participants of this study consist of managers and customers of equipment manufacturing sector enterprises. The demographic characteristics of managers show that more male manager (56.9%) than female managers (41.1%) responded the survey. The majority of employees' participants (35.2%) are classified in age group from 30-39 years, followed by 35% respondents in age group of 40-49 years. 22.2% respondents indicated that they belong to age group of 20-29 years. Education level of managers show that 53.4% hold undergraduate degree, followed by 40.6% who have a postgraduate education. The majority of managers (46.9%) are working as front line managers, followed by 37.2% middle level managers and 15.9% as top level managers. On average the data is collected from front line manager (46.9%). As our study is multiple perspective (i.e. customers and managers), therefore, it can be stated that front line managers play a role of the bridge among the company and customers. Based upon their role, it was anticipated that they have a clear knowledge about customers, companies' production and strategies relating to environmental performance.

The demographic profiling of customers indicates that 53.75% female and 46.25% male respondents. The majority of customers (55.9%) are categorized in age group from 30-39, 25% participants are categorized in the age group of 40-49, 15.3% participants of our study are in the age group of 20-29 and very few participants (3.8%) are in the age group 50 years and above. Detailed demographic information's are shown in the table 1.

**Table 1: Demographic Information**

|                          | <b>Employees</b> |         | <b>Customers</b> |         |
|--------------------------|------------------|---------|------------------|---------|
|                          | Frequency        | Percent | Frequency        | Percent |
| <b>Gender</b>            |                  |         |                  |         |
| Male                     | 182              | 56.9%   | 148              | 46.25%  |
| Female                   | 138              | 41.1%   | 192              | 53.75%  |
| <b>Age</b>               |                  |         |                  |         |
| 20-29 Years              | 71               | 22.2%   | 49               | 15.3%   |
| 30-39 Years              | 113              | 35.2%   | 179              | 55.9%   |
| 40-49 Years              | 112              | 35.0%   | 80               | 25%     |
| 50 Years and above       | 24               | 7.0%    | 12               | 3.8%    |
| <b>Education</b>         |                  |         |                  |         |
| High school and below    | 19               | 5.9%    | 19               | 5.9%    |
| Undergraduate            | 171              | 53.4%   | 179              | 55.9%   |
| Postgraduate             | 130              | 40.6%   | 122              | 38.1%   |
| <b>Job Level</b>         |                  |         |                  |         |
| Front line manager       | 150              | 46.9%   |                  |         |
| Middle level manager     | 119              | 37.2%   |                  |         |
| Top level management     | 51               | 15.9%   |                  |         |
| <b>Total Respondents</b> | 320              | 100%    | 320              | 100%    |

#### 4.4 Method of analysis

In order to examine the survey data and to test the proposed hypothesis, two steps method given by the Anderson and Gerbing (1988). At first, the reliability, discriminant and convergent validity has been measured to confirm that measurement constructs being used in the study are unidimensional and reliable. The study employs Covariance-based structural equation modeling (CBSEM) using SPSS 23.0 and AMOS 23.0. This technique is highly promising and it has a huge potential for SEM researches, especially in the area of business research (Hair et al., 2010). More specifically, this technique is more robust and it takes care of multicollinearity problems which makes results more valid and reliable. In the second step, the paper used a structural equation model to test hypothetical relationships. Following this, bootstrapping process (5000 resamples were used) to estimate the level of significance for indirect relationships.

## 5. Results and findings

### 5.1 Preliminary analysis and results from measurement model

As it has been stated in the previous part that all the constructs used in the survey instrument were taken from the previous studies. Therefore, it was necessary to check the psychometric properties and dimensionality of the constructs. Similarly, the study used SPSS and AMOS graphics to check Cronbach  $\alpha$  value, outer loadings and weights. Collectively, we obtained the data of six factors,



the data gathered from managers consist of five factors such as customer pressure, regulatory pressure, green creativity, green production and green competitive advantage. The data of another factor (green brand image) was obtained from customers of same organizations. As checking similarity or difference in the results of using manager data and customer data is not the focus of this study. Therefore, we followed the study of Zameer et al., (2018) and used six factors confirmatory factor analysis. Further, the study also examined the composite reliability (C.R), average variance extracted (AVE) to ensure the validity and reliability of constructs.

**Table 2: Factor Loadings of Constructs and Reliability Statistics**

| <b>Construct</b>                   | <b>Factor loadings (&gt;0.5)</b> | <b>Cronbach's <math>\alpha</math></b> | <b>Composite Reliability (&gt;0.7)</b> | <b>AVE (&gt;0.5)</b> |
|------------------------------------|----------------------------------|---------------------------------------|--|----------------------|
| <i>Regulatory Pressure</i>         |                                  | 0.908                                 | 0.909                                  | 0.716                |
| RP1                                | .86                              |                                       |  |                      |
| RP2                                | .90                              |                                       |  |                      |
| RP3                                | .85                              |                                       |  |                      |
| RP4                                | .76                              |                                       |  |                      |
| <i>Customer Pressure</i>           |                                  | 0.928                                 | 0.931                                  | 0.772                |
| CP1                                | .82                              |                                       |  |                      |
| CP2                                | .93                              |                                       |  |                      |
| CP3                                | .89                              |                                       |  |                      |
| CP4                                | .87                              |                                       |  |                      |
| <i>Green Production</i>            |                                  | 0.919                                 | 0.918                                  | 0.737                |
| GP1                                | .86                              |                                       |  |                      |
| GP2                                | .92                              |                                       |  |                      |
| GP3                                | .84                              |                                       |  |                      |
| GP4                                | .81                              |                                       |  |                      |
| <i>Green Creativity</i>            |                                  | 0.916                                 | 0.918                                  | 0.652                |
| GC1                                | .80                              |                                       |  |                      |
| GC2                                | .81                              |                                       |  |                      |
| GC3                                | .86                              |                                       |  |                      |
| GC4                                | .78                              |                                       |  |                      |
| GC5                                | .78                              |                                       |  |                      |
| GC6                                | .80                              |                                       |  |                      |
| <i>Green Competitive Advantage</i> |                                  | 0.944                                 | 0.945                                  | 0.812                |
| GCAD1                              | .88                              |                                       |  |                      |
| GCAD2                              | .91                              |                                       |  |                      |
| GCAD3                              | .91                              |                                       |  |                      |
| GCAD4                              | .90                              |                                       |  |                      |
| <i>Green Brand Image</i>           |                                  | 0.956                                 | 0.959                                  | 0.853                |
| GBI1                               | .89                              |                                       |  |                      |
| GBI2                               | .92                              |                                       |  |                      |
| GBI3                               | .93                              |                                       |  |                      |
| GBI4                               | .95                              |                                       |  |                      |

Note. All factor loadings are significant at:  $p < 0.001$ .

Source: Authors estimation based on CBSEM

First of all, the goodness of fit index of measurement model was analyzed. We examined CFI, GFI, RMR and RMSEA. The values are CFI is 0.908, GFI 0.87, RMR 0.045 and RMSEA is 0.053. The overall evaluation of the goodness of fit indexes of measurement model indicate that hypothesized model is fitted on observed data. Following this, indicator reliability was measured using factor loading. The study of Bagozzi & Yi, (1991) indicate that if the factor loadings are higher than 0.5, it means indicator reliability has been attained. Factors those have loadings value below 0.5 were removed. The results from the measurement model are shown in table 2 which represent that all remaining factors are correctly loaded. Further, it can be seen from table 2 that factor loading for all the constructs is above the minimum acceptable level which confirms the indicator reliability. Following this, internal consistency reliability was measured using composite reliability. According to Hair et al., (2010) the value of composite reliability higher than 0.70 is acceptable. The results of composite reliability and average variance extracted are also presented in the table 2. It can be seen that the value of composite reliability of all the constructs is greater than the minimum acceptable level of 0.70, it indicates that internal consistency of the constructs have been attained. For convergent validity, Hair et al. (2010) argued that average variance extracted should be higher than 0.50 for all latent constructs. Similarly, in this study convergent validity was measured using the average variance extracted method. The presented results in the table 2 indicate that the value of AVE for all constructs is above the minimum level of 0.50, which confirms the convergent validity. Moreover, the value of Cronbach's  $\alpha$  is higher than the 0.90 for all the constructs which confirms the overall reliability of the scale.

Once, the indicator reliability, internal consistency/reliability and convergent validity ascertained. One can move forward to the next step that is measuring discriminant validity. The study measured discriminant validity using Fornell and Larcker (1981) criterion. The results from Fornell and Larcker (1981) criterion are shown in table 3. The results has confirmed that the correlation among the constructs is not higher than the square root of the constructs' average variance extracted (AVE). Hence, the data satisfies the requirement of discriminant validity.

**Table 3: Fornell-Larcker Criterion: Discriminant validity**

|                             | Customer Pressure | Regulatory Pressure | Green Production | Green Brand Image | Green Creativity | Green Competitive Advantage |
|-----------------------------|-------------------|---------------------|------------------|-------------------|------------------|-----------------------------|
| Customer Pressure           | 0.879*            |                     |                  |                   |                  |                             |
| Regulatory Pressure         | 0.768             | 0.846*              |                  |                   |                  |                             |
| Green Production            | 0.815             | 0.751               | 0.859*           |                   |                  |                             |
| Green Brand Image           | 0.760             | 0.716               | 0.817            | 0.924*            |                  |                             |
| Green Creativity            | 0.795             | 0.776               | 0.792            | 0.803             | 0.808*           |                             |
| Green Competitive Advantage | 0.798             | 0.780               | 0.844            | 0.831             | 0.738            | 0.901*                      |

*Source: Authors estimation based on CBSEM*

To check the common method bias, the study employed Harman's one-factor test and marker variable mechanism. Initially, all factors have been added into principal components factor, by doing so, we found that no single factor accumulated for a threshold of 50% variance. Following this, the marker variable technique was used; common method variance was found (0.086) less than 10%. The results from both techniques confirm that no considerable common factor bias exists.

## 5.2 Structural model

Once reliability/internal consistencies and discriminant validity attained, the next step is to use structural model to test the proposed hypothesis. Prior to the discussion of the results for hypothesis testing, it is mandatory to test the appropriateness of structural model first. Similarly, different measures has been used to test the fit-criteria of structural model. In this study, CFI, GFI, NFI, TLI, RMR, RMSEA and CMIN/DF has been selected to evaluate the model goodness of fit. The model goodness of fit indexes are presented in the table 4. The evaluation suggests that RMR is less than 0.08 and RMSEA is also less than 0.06 which indicate the acceptable level of model specification. The value of CFI, GFI, TLI and NFI is above the acceptable threshold level, which indicate the acceptable level of goodness of fit for the model.

**Table 4: Goodness of fit evaluation indexes for structural model**

| Index   | Value measured | Cut-off Value | Benchmark Study                       | Decision   |
|---------|----------------|---------------|---------------------------------------|------------|
| CFI     | 0.98           | >0.90         | (Bentler, 1990)                       | Acceptable |
| GFI     | 0.97           | >0.80         | (Hu & Bentler, 1995)                  | Acceptable |
| NFI     | 0.98           | >0.90         | (Anderson & Gerbing, 1988)            | Acceptable |
| TLI     | 0.94           | >0.75         | (Sivo, Fan, Witta, & Willse, 2006)    | Acceptable |
| RMR     | 0.02           | <0.08         | (Byrne, 2013)                         | Acceptable |
| RMSEA   | 0.05           | <0.06         | (MacCallum, Browne, & Sugawara, 1996) | Acceptable |
| CMIN/DF | 2.417          | <5.0          |                                       | Acceptable |

*Source: Authors estimation using AMOS 23.0*

Figure 2 represent the structural model of the study. It shows standardized path coefficients ( $\beta$ ) along with R squared. These standardized path coefficients ( $\beta$ ) are a good basis for the hypothesis testing once the structural model fulfils the acceptable level of goodness of fit criteria.

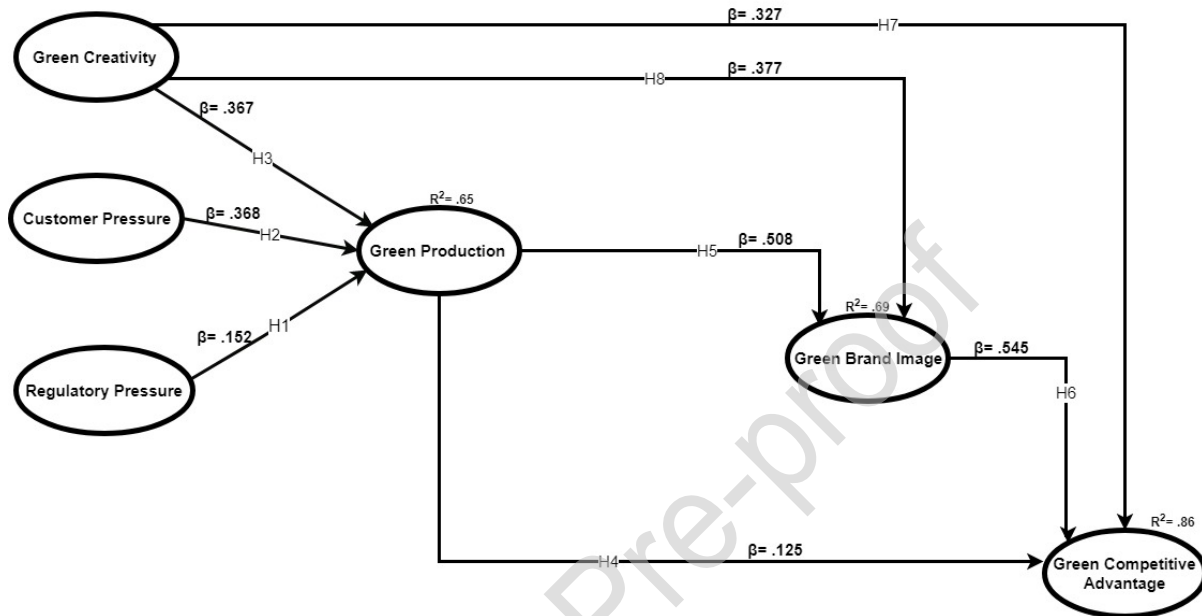


Figure 2: Structural Model (Source: Authors estimations using AMOS 23.0)

The value of R2 values ranged from 0.65 to 0.860, which shows that modeled variables represent 60% to 86% variance in their respective dependent variables. Collectively, all explanatory variables explain 86% variance in green competitive advantage. In summary, the discussion from the previous parts indicate that our measurement model fulfils reliability/internal consistencies of constructs and our measurement model meets the acceptable level of discriminant validity. Moreover, the structural model meets the goodness of fit criteria. Based upon the analysis, it is now safe and appropriate to move forward toward testing the proposed hypothesis based upon standardized path coefficients ( $\beta$ ) and p-values. Path coefficients will also be used as a reference to determine the strength of the effect.

### 5.3 Hypothesis testing

After the evaluation of model specification, the next step is to evaluate the causal relations to test hypothesis. In this study, twelve hypothesizes have been proposed. Eight out of them were used to indicate direct relations, whereas, the other four hypothesis were used to check indirect relationships. For estimating the indirect relations among the variables, scholars in business

management have great interest in exploring the role of mediating variable. To estimate a mediating factor, a large range of test has been introduced. The commonly used method for indirect estimates is the one that is introduced by Baron and Kenny (1986) and Sobel (1982) test. However, Mackinnon et al., (2002) and Biesanz et al., (2010) criticized that although these tests are widely used, but these have low power for measuring mediation effects comparing with modern techniques. Therefore, these methods are no more recommended. Biesanz et al. (2010) has introduced a partial posterior method and they argue that their suggested method has strong power for measuring mediation effects. However, this method is not widely adopted in academic research. Structural equation modeling is widely used method for survey research. Falk and Biesanz (2015) highlighted that partial posterior approach has been also used in the context of SEM. Thus, in this study, we adopted a structural equation modeling technique to measure direct and indirect relations among variables. For mediation analysis, we used a bootstrap method with 5000 bootstrap samples. Following this procedure, the core reinforcing factors for green competitive advantage can be established.

In this study, we used structural equation modeling using AMOS 23.0 to estimate the path coefficients ( $\beta$ ) and statistical significant (p-values). The summarized direct effects for hypothesis testing are presented in table 5. Path coefficients ( $\beta$ ), standard error, critical ratio and statistical significant (p-values) are reported. The path coefficients ( $\beta$ ) and p-value for the hypothesized path from regulatory pressure to green production are 0.152 and 0.003 respectively. The p-value is less than 0.05, which shows that results from the model for the impact of regulatory pressure on green production are statistically significant. Hence, hypothesis 1 is supported. The path coefficient ( $\beta$ ) and p-value for the hypothesized path from customer pressure to green production are 0.368 and 0.000 respectively. The p-value is less than 0.05, which shows that results from the inner model for the impact of customer pressure on green production are statistically significant. Hence, hypothesis 2 is also supported. The path coefficient ( $\beta$ ) and p-value for the hypothesized path from green creativity to green production are 0.367 and 0.000 respectively. The p-value is less than 0.05, which shows that results from the inner model for the impact of green creativity on green production are statistically significant. Hence, hypothesis 3 is supported.

Regulatory pressure, customer pressure and green creativity collectively explain 65% of variance in green production. However, if we look at the path coefficients, then we see that path coefficient of customer pressure and green production ( $\beta=0.368$ ) is higher than other paths, such as from

regulatory pressure to green production ( $\beta=0.152$ ) and green creativity to green production ( $\beta=0.367$ ). However, the path coefficient from customer pressure and green creativity to green production are almost similar. These results gives an insight that firms give more value to customer pressure followed by green creativity and then regulatory pressure at the time when firms are deciding to adopt green production. Fourth hypothesis was postulated to show to what extent green production can reinforce green competitive advantage. The results show that the path coefficients ( $\beta$ ) is 0.125 and p-value is 0.000. The p-value is less than 0.05, which shows that results from the inner model are statistically significant, which shows that green production reinforce green competitive advantage. Another hypothesis (H5) was postulated to show to what extent green production can reinforce green brand image. The results show that path coefficient ( $\beta$ ) is 0.508 and p-value is 0.000. The p-value is less than 0.05, which shows that results from the inner model are statistically significant, which shows that green production reinforce green brand image.

**Table 5: Standardized direct effects**

|    | Independent variable |   | Dependent Variable          | $\beta$ | S.E. | C.R.   | P    | Decision  |
|----|----------------------|---|-----------------------------|---------|------|--------|------|-----------|
| H1 | Regulatory Pressure  | → | Green Production            | .152    | .058 | 2.981  | .003 | Supported |
| H2 | Customer Pressure    | → | Green Production            | .368    | .059 | 6.840  | .000 | Supported |
| H3 | Green Creativity     | → | Green Production            | .367    | .054 | 6.933  | .000 | Supported |
| H4 | Green Production     | → | Green Competitive Advantage | .125    | .039 | 3.368  | .000 | Supported |
| H5 | Green Production     | → | Green Brand Image           | .508    | .052 | 10.751 | .000 | Supported |
| H6 | Green Brand Image    | → | Green Competitive Advantage | .545    | .036 | 14.513 | .000 | Supported |
| H7 | Green Creativity     | → | Green Competitive Advantage | .327    | .037 | 9.430  | .000 | Supported |
| H8 | Green Creativity     | → | Green Brand Image           | .377    | .053 | 7.973  | .000 | Supported |

*Source: author's estimation using AMOS 23.0*

The next hypothesis (H6) has been postulated to explore the role of green brand image in reinforcing green competitive advantage. The path coefficients ( $\beta$ ) is 0.545 and p-value is 0.000. The p-value is 0.000 which is lower than 0.05. Hence, hypothesis 6 is supported. It shows that green brand image reinforces green competitive advantage. We also checked the role of green creativity toward green competitive advantage. Hypothesis 7 was postulated in this regard. The estimated results show that the path coefficients ( $\beta$ ) is 0.327 and p-value is 0.000. The p-value is 0.000 which is lower than 0.05. Thus, hypothesis 7 is accepted. It shows that green creativity reinforces green competitive advantage. Another hypothesis (H8) used to examine the role of green creativity toward green brand image, the results are also signifying this hypothesis ( $\beta =0.377$ , p-value=0.000).

To explore the stronger role in reinforcing green competitive advantage, we have compared the estimated path coefficients. As the linkage of green production is checked with both i.e. green brand image and green competitive advantage, the path coefficients can give an indication that what can be the channels through which green competitive advantage can be reinforced. The comparison of the path coefficient indicates that the direct impact of green production on green competitive advantage is weaker comparing with its impact on green brand image (path coefficient for GP→GCAD= 0.125 and path coefficient for GP→GBI= 0.508). Now we have pitched a channel through which green production has more contribution. Further, the impact of green creativity on green production, green brand image and green competitive advantage have been explored. Similar to the previous discussion, the path coefficients for these estimated paths will give an indication of the stronger path. When we compared the path coefficients of these hypothesis (H3, H7, and H8). We found that the path coefficient of green creativity toward green brand image is stronger comparing with the other paths. It means that green creativity will intensely improve green brand image.

**Table 6: Indirect/Mediating effects**

|     | Independent variable | Mediating Variable | Dependent Variable | Estimate | S.E. | C.R.  | P    | Decision  |
|-----|----------------------|--------------------|--------------------|----------|------|-------|------|-----------|
| H6a | GP                   | GBI                | GCAD               | .292     | .063 | 4.635 | .002 | Supported |
| H8a | GC                   | GBI                | GCAD               | .221     | .057 | 3.877 | .001 | Supported |
| H8b | GC                   | GP                 | GBI                | .208     | .048 | 4.333 | .000 | Supported |
| H8c | GC                   | GP                 | GCAD               | .049     | .024 | 2.042 | .009 | Supported |

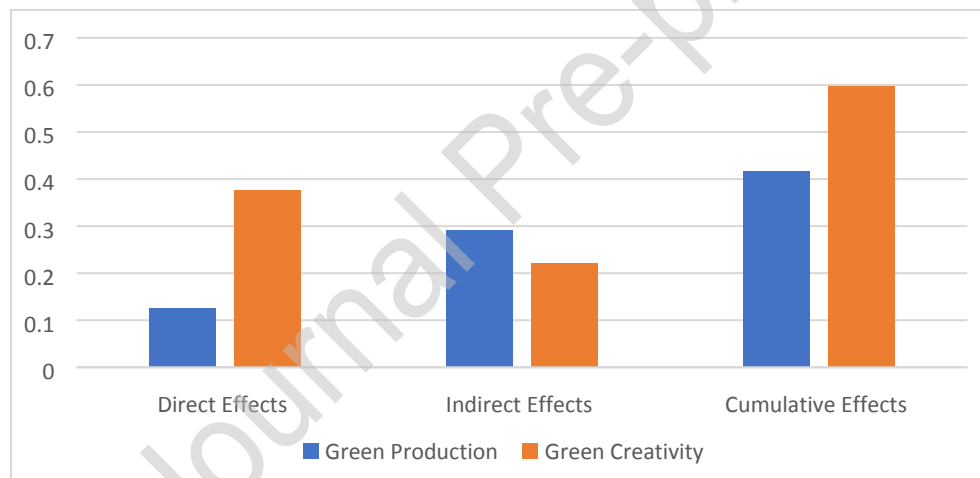
*Note: GP green production, GBI is green brand image, GC is green creativity and GCAD is green competitive advantage.*

*Source: author's estimation using AMOS 23.0*

To further validate our findings, four other hypothesis were drawn to test mediation effects. As we already discussed that green production reinforce green brand image, here it is important to explore the mediating role of green brand image in the impact of green production on green competitive advantage. Hypothesis 6a was developed in this regard. The results show that the path coefficient is 0.292 and p-value is 0.002. The p-value is lower than 0.05. Hence, hypothesis 6a is supported. In the previous discussion, it is indicated that green production has direct significant impact on green brand image and green competitive advantage. Therefore, it argued that green brand image partially mediates the relationship among green production and green competitive advantage. Another mediation hypothesis was drawn to check the mediating role of green brand image in the impact of green creativity on green competitive advantage. Hypothesis 8a was designed in this regard. The results indicate that the path coefficient is 0.221 and p-value is 0.001. The p-value is lower than 0.05. Thus, hypothesis 8a is validated. Because green creativity has direct significant impact on

green competitive advantage, therefore, it can be stated that green brand image also partially mediate the relationship among green creativity and green competitive advantage.

Furthermore, another hypothesis (H8b) used to examine the mediating role of green production in the impact of green creativity on green brand image, the results are signifying this hypothesis (path coefficient=0.208, p-value=0.000). Thus, green production partially mediate the relationship among green creativity and green brand image. As our core objective is to explore key factors for reinforcing green competitive advantage, therefore, the mediating role of green production in the impact of green creativity on green competitive advantage is also explored. Hypothesis 8c has been designed and tested in this regard. The results indicate that the path coefficient is 0.049 and p-value is 0.009. Although, path coefficient is too small, but the p-value is lower than 0.05. Therefore, hypothesis 8c is accepted. Because green creativity has direct significant impact on green competitive advantage, therefore, it can be stated that green production partially mediate the relationship among green creativity and green competitive advantage.



*Fig. 3: Effects on Green Competitive Advantage*

In this study, different routes have been designed to check how and to what extent latent constructs contribute in reinforcing green competitive advantage. The objective of this process was to pitch the key reinforcing factors of green competitive advantage. The direct, indirect and cumulative effect of green production and green creativity on green competitive advantage have been estimated. The graphical representation in figure 3 indicate that the direct effect of green creativity on green competitive advantage is higher comparing with green production. Whereas, the indirect effect of green creativity on green competitive advantage is lower comparing with green production. When we look at the cumulative effects of green creativity and green production on green competitive advantage, we see that cumulative effect of green creativity is higher. It gives a



guiding significance to the equipment manufacturing firms operating in China that only green production is not enough to gain competitive advantage. The role of green creativity is more important. On the other hand, if we look at the direct effects (H1-H8), we see that green brand image has the strongest effect on green competitive advantage. Green creativity and green production has a vital role in building green brand image. In summary, it can be stated that the effect accumulated from green production and green creativity is converted into green competitive advantage via green brand image. It shows that the power reinforced by green creativity and green production toward green brand image is being transformed into green competitive advantage.

## **6. Discussion and conclusion**

The continuous growth and production model in China has brought many environmental challenges. At present, China is among the highest carbon emitting countries in the world. However, to cope with environmental challenges the people's government of China is introducing strict environmental laws. Similarly, environmental laws along with pressure from consumers indicate that Chinese enterprises cannot continue to achieve high growth at the expense of environmental degradation. Therefore, firms operating in China need to change the mode of production. With the changing mode of production, every firm need to attain maximum competitive advantage. Thus, to this end, the study was aimed to explore how firm can gain competitive advantage and what factors are critical for opting green production.

The study found that regulatory pressure, customer pressure and green creativity reinforce the firms to adopt green production. Comparison of the results show that the pressure from customers influence more comparing with the regulatory pressure and green creativity. It means that customer's role is more critical for the firms in opting green production. It should be noted that the role of green creativity and customer pressure is almost similar. Although, many authors in the past studied the same context (e.g., environmental practices and Chinese firms). However, our study is different in nature. For example, Charan & Murty (2018) explored the influence of stakeholders' pressure on adaptation of sustainable business practices in India. Our study is different from them due to various reasons, first they used to study in India. Business environment, social structure and government system in India and China is totally different (De Haan, 2013; Huang & Tang, 2012; Kshetri & Dholakia, 2011; Singh & Gaur, 2009). Second, their sample size is only 98. Whereas, sample size in our study is more than 300. Third, their study remained limited to exploring the antecedent factors of sustainable business practices, their study don't cover how

sustainable practices can work as an antecedent factor for competitiveness. To bridge this, our study not only explored the role of customer and regulatory pressure toward green production, but we also measured how green production can stimulate firms' competitive advantage. Chu et al. (2019) explored the role of customer pressure in the context of third party logistic providers and argued that customer pressure is a key driver for green innovation. Their sample size is smaller (i.e. 165) than our study and they used regression method to test hypothesis. Whereas, our study is based on structural equation modeling technique. The role of green production is more important in production firms such as equipment manufacturers as compare to the logistic providers. In addition, exploring the role of green production as an antecedent factor of green brand image and green competitive advantage is pivotal, that is missed in the study of Chu et al. (2019). Therefore, our study is more comprehensive, it not only measure the role of customer pressure toward green production, but it also measure green production as an antecedent factor for the green brand image and green competitive advantage. Zhu et. al., (2005, 2017) explored the role of different pressures in the context of supply chain management perspective. Their studies mostly focused on regulatory pressures and green supply chain performance. However, the role of creativity as an antecedent factor for green production and green brand image was lacking in their studies. In contrast, our study focused on green creativity as an antecedent factor to green production and competitive advantage. Their studies used simple methods of analysis such as categorical and descriptive and regression analysis. Whereas, our study is based on structural equation modeling. Thus, it can be argued that our study used a comprehensive model and adds value to existing research. Moreover, the study of Huang et al., (2016) emphasized on service industry, and they explored the role of customer pressure in business performance perspective instead of the context of green production. Zameer et al. (2018) also used data of the banking sector and highlighted the role of customers for organization. They argued that customers are king, organizations need to address their requirement.

Further, it is seen that green production and green creativity improve green brand image. The findings are consistent with the study of Jensen and Beckmann (2009) who argued that strategic innovations through creativity play a vital role in creating a favorable image. Their study emphasized on developing the corporate brand image through strategic innovation and their study don't measure the role of green brand image toward green competitive advantage. In contrast, our study emphasized on green brand image of consumer brands and measured its role as an antecedent

factor for competitive advantage. Therefore, our study is different and it adds value to the existing literature. Hanaysha et. al., (2014) has found similar results that opting green product innovation can improve brand image of automotive industry in Malaysia, and, they studied only one perspective i.e. passengers only. Whereas, our study is focused on the equipment manufacturing industry of China using the data of customers and managers together. The exploration in the context of a different industry of manufacturing giant i.e. China adds significant value to existing research. Moreover, their study was only limited to green innovation and competitive advantage. However, our study extends the research framework by adding the antecedent role of green creativity toward green production. Following this, it has been explored how green production plays a role of the antecedent factor of competitive advantage.

Wahyuni (2019) also found that product innovation is related to brand image. Their study is used in the context of Indonesia and based upon small sample size (i.e. 120 only). Our study is different from them due to various reasons, first they used to study in Indonesia. Business environment, social structure and government system in Indonesia and China is totally different (Akita, 2003; Cummings, 2008; Efferin & Hopper, 2007). Second, their sample size is only 120. Whereas, sample size in our study is more than 300. Third, the studies only one firm i.e. Starbucks, in our study, a comprehensive set of data has been used from managers and customers of various equipment manufacturing firms. Fourth, they only measured the correlation among product innovation and brand image and don't explore the antecedent role of these factors for gaining competitive advantage. To add value to the existing understanding, our study not only measure the role of green production toward green brand image, but it also emphasize on how these factors can work as an antecedent factors of competitive advantage. Thus, it can be argued that our study is comprehensive and add value to the available literature. Zameer et al., (2019) suggested that the consumer accumulate the knowledge from different sources to make a purchase decision. Accordingly, our results are providing guiding significance to the firms to adopt green production to influence consumer purchase decision. Moreover, the critical evaluation has shown that influence of green production on green brand image is more powerful comparing with green creativity. Accordingly, it can be concluded that green production helps to enhance the green brand image, to cope with the complex and volatile market situation, and to achieve a strong grip of the market trend, and even establish industry standards in emerging markets, becoming a benchmark

brand. A good green brand image plays a significant role in the purchase decisions of consumers worldwide.

Moreover, it is found that green production reinforces green competitive advantage. It should be noted that green creativity has a significant impact on green production, which shows the strength gained from green creativity to green production is being transformed into green competitive advantage. Although, the study of Anning-Dorson (2018) indicate that innovation can lead to competitive advantage, but their analysis focused on the service sector instead of manufacturing sector. In our study, we emphasized on the equipment manufacturing sector. Further, they used data of India and Ghana, as we already discussed that system in China is totally different from those countries. Therefore, it was necessary to explore the way to improve green competitive advantage in the context of the manufacturing sector of China. Moreover, in the light of ambidexterity theory, the mechanism that can mediate the relationship between production and competitiveness was lacking in their study. Our study present a comprehensive model and incorporate the role of green brand image as a mediating factor. There, it can be argued that our study adds value to the literature on green production. Amarakoon et al., (2018) studied in the context of human resources innovation and competitive advantage. They also found that innovation in human resource practice can improve competitive advantage. Their focus was strategic innovation instead of product innovation through green production. Our study bridged the gap and focused on exploring the role of green production toward green competitive advantage. Esty and Winston (2009) highlighted in his book that smart companies use environmental strategies to shape competitive advantage. Ambec (2017) highlighted the role of policy makers, and stated that green industrial policy can improve green competitive advantage. Thus, in can be concluded that green production is like an instrument to improve the environmental management practice process. Protecting the environment and creating awareness of green production through eco-labeling can improve organization's competitiveness. Similarly, opting green production satisfies the need of green consumers (Ritter et al., 2015). Moreover, it can be argued that green production will not only directly reinforce green competitive advantage, but, the force of green creativity is being accumulated through green production to reinforce green competitive advantage.

The study further indicated that green creativity reinforces green competitive advantage. It means enterprises those think about the sustainable environment and produce green products gain more

competitive advantage. The study of Martin et al., (2015) in the context of creativity, clusters and competitive advantage of cities found that innovative and creative strategies can play a significant role in gaining competitiveness. Moreover, Ferreira et al., (2018) beliefs are similar to our findings that creativity can reinforce the competitive advantage. However, their focus remained on strategic innovation instead of product innovation. Because, green creativity in the context of green production and green competitive advantage is extremely important. Therefore, our study filled the gap and focused on exploring the role of green creativity toward green competitive advantage. Thus, it can be concluded that firms need to integrate creativity into all decisions of the enterprise that will improve brand image on the one end. On the other end, it will contribute toward reinforcing competitive advantage.

Finally, it is found that green brand image significantly improve green competitive advantage. The comparison of other reinforcing factors (i.e. green production and green creativity) show that green brand image is the strongest factor in reinforcing green competitive advantage. It can be concluded that green brand image is an important determinant for enterprises to form a competitive advantage. It should be noted that the effect accumulated from green creativity and green production is being transformed into green competitive advantage via green brand image. Thus, it can be stated that enterprises actively carry out green production and establish a green image, which can enhance the positive perception of the brand and it promotes the formation of competitive advantage. From the consumer perspective, the establishment of green brand image is closely related to the development of green products. Green production is an environmental responsibility behavior, and it is also an important means for enterprises to establish a green image and follow to sustainable development (Famiyeh et al., 2018). Green production helps to enhance the green brand image, which helps to cope with the complex and volatile market situation and to achieve a powerful grip of the market trend, and even establish industry standards in emerging markets, becoming a benchmark brand to gain competitive advantage.

### **7. Research implications to theory and practice**

The study offer several theoretical and practical implications. This paper makes in-depth analysis of green production and green competitive advantage. It explores the mechanism of that reinforce green competitive advantage. The study reveals that customer pressure is a triggering factor for firms to adopt green production. Thus, it adds value to the theory of green product innovation. Further, it was explored that to what extent green production reinforces green brand image and

green competitive advantage. It was seen that green production creates a favorable brand image that further reinforces green competitive advantage. It is an interesting finding of the mediating effect of brand image to the relationship between green production and green competitive advantages, the direct path between green production and green competitive advantage is statistically significant. It indicates an “imperfect mediating effect” of green brand image, and thus an endogenous force of green production to the green competitive advantage. It extends existing knowledge about how green production initiatives are transformed into green competitive advantage. Moreover, the role of green creativity in opting green production and building green brand image and green competitive advantage was estimated. Results have shown that green creativity also uses the same mechanism, i.e. green creativity improves brand image that further reinforces green competitive advantage. Hence, the study validates the theory of green innovation and clarifies the process of how enterprises can reinforce their green competitive advantage.

Along with theoretical implications, the study also offers several practical implications for decision makers. First, the influence of customer and regulatory pressure on green production gives a guiding insight to the policy makers. It is suggested that policy makers should emphasize on engaging customers as well as regulatory laws. As both have significant influence on firms in opting green production. On one end, policy makers can introduce strict environmental laws. On the other end, customer awareness programs and benefits such as tax rebates can be offered to encourage customers for playing their role in persuading firms to opt green production. Secondly, the study is helpful for enterprises, it highlighted that firms can gain competitive advantage through green brand image. But, for green brand image it is also indicated that firms need to reexamine their production activities to opt for green production. Thus, it is suggested to the manufacturing enterprises that instead of relying solely on the development model of production at environmental cost to promote economic growth, enterprises should incorporate environmental factors into all aspects of their product life cycle, provide environment friendly products, change from factor-driven to green innovation-driven and emphasize on the sustainable development of enterprises. In the process of product development and design, firms should try to incorporate recycling concepts and recyclable green materials. Also, firms should use eco-labeling to inform consumers about their green production initiatives. Moreover, firms can incorporate green concept in their corporate culture and marketing strategy to enhance the green image of brand to gain more competitive advantage. Finally, it is suggested that organizations should emphasize to strengthen

the cultivation of green creativity. As it is seen that green creativity is the basis of promoting green product innovation via green brand image. This kind of improvement of creativity is helpful for enterprises to continuously renew their technology and ability, and promote enterprises to continuously digest and absorb innovative resources. The stronger the green creativity, the more resources the organization has to convert ideas into visual innovative products, the better it can help the enterprise to establish a good impression to reinforce green brand image and green competitive advantage.

### **7.1. Implications for cleaner production/sustainability**

The summarized results of our investigation reveal that consumers have a significant role to influence firms to adopt green production. In other words, green production is a main pillar for cleaner production in the country. The current competitive environment show that customers are showing more interest in green products. Similarly, the demand and awareness toward green products is growing which posing new opportunities for cleaner production worldwide. Our study highlights the reasons behind the phenomena. The exploration indicates that green production and green creativity significantly improve green brand image. As green creativity make firms capable to think in a different way. Likewise, this study highlight that green creativity significantly influence green production which means that green creativity is posing a new thinking about sustainable environment and cleaner production. Cleaner production is useful for both the company and the customer. The study show that if a company is having a green innovative product, it can enhance the image of the company. Moreover, cleaner production through adopting green innovation also creates competitive advantage for the firm. If a company wants to sustain in the market it must have an element of differentiation that can attract the customer. Similarly, adopting green practices for cleaner production provides a point of differentiation for the company. Additionally, for the protection of a world we live in, it is important to adopt a defensive approach to environmental pollution.

The outcomes of this research has some concrete and academic implication for the business practitioners and policy makers in defining the best mechanism for developing the climate of cleaner production among producers, mainly in developing sustainable production in support of the green technology policy. Cleaner production is attaining significance within organizations and it is gradually becoming an imperative part of management decisions. Companies engage in cleaner production and green innovation not only increasing the productivity of the organization

and minimizing the waste of production, but also improving the image of organization and the quality of the product and thereby, increasing the competitiveness in the fast emerging worlds of competition. More specifically, results indicate that policy makers need to change their thinking from only emphasizing on regulatory pressure to engagement of general public and consumers. As study highlights the critical role of customers in firms' decisions regarding adoption of green production, therefore, policy makers should focus on creating awareness among general consumers and reinforce their role toward green production to create a climate for cleaner production in the country.

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## Appendix

|   |                            |
|---|----------------------------|
| <b>Regulatory pressure</b> (Huang et al., 2016).  | <b>监管压力</b>                |
| Emission standards drive our firm to take on green innovation activities  | 排放标准促使我们开展绿色创新活动           |
| Production technology standards drive our firm to take on green innovation activities                                     | 生产技术标准促使我们开展绿色创新活动         |
| Legal risks drive our firm to take on green innovation activities   | 法律风险促使我们开展绿色创新活动           |
| Government supervision drive our firm to take on green innovation activities  | 政府监督促使我们开展绿色创新活动           |
| Administrative penalties drive our firm to take on green innovation activities  | 行政处罚促使我们开展绿色创新活动           |
| <b>Customer pressure</b> (Huang et al., 2016).  | <b>客户压力</b>                |
| Increased awareness of environmental issues among our customers drive our firm to take on green innovation activities     | 客户对环境问题的认识不断提高促使我们开展绿色创新活动 |
| Customers' preferences for environmental friendly products drive our firm to take on green innovation activities          | 客户对环保产品的偏好促使我们开展绿色创新活动     |
| Customers' continuous attention to our firm' environmental behavior drive our firm to take on green innovation activities | 客户对公司环境行为的持续关注促使我们开展绿色创新活动 |
| Customers who seek green suppliers drive our firm to take on green innovation activities                                  | 寻求绿色供应商的客户推动我们开展绿色创新活动     |
| <b>Green production</b> (Chan et al., 2016).  | <b>绿色生产</b>                |
| Our company uses less or non-polluting/toxic materials that are environmentally friendly                                  | 我们公司使用较少或无污染/无毒的环保材料       |
| Our company uses materials that are easy to recycle, reuses, and decompose  | 我们公司使用易于回收、再利用和分解的材料       |
| Our company recovers company's end-of-life products and recycling   | 我们公司回收报废产品并加以再利用           |
| Our company uses eco-labeling   | 我们公司使用生态标签                 |
| <b>Green creativity</b> (Chen and Chang, 2013)  | <b>绿色创意</b>                |
| The members of the company suggest new ways to achieve environmental goals  | 公司成员提出了实现环境目标的新方法          |
| The members of the company propose new green ideas to improve environmental performance                                   | 公司成员提出了新的绿色理念，以改善环境绩效      |
| The members of the company promote and champion new green ideas to others   | 公司成员向其他人宣传和倡导新的绿色理念        |
| The members of the company develop adequate plans for the implementation of new green ideas                               | 公司成员为实施新绿色理念制定了充分的计划       |
| The members of the company would rethink new green ideas  | 公司成员将重新考虑新绿色理念             |

|  |                       |
|--|-----------------------|
| The members of the company would find out creative solutions to environmental problems | 公司成员将找到解决环境问题的创造性解决方案 |
|--|-----------------------|

|   |                                     |
|---|-------------------------------------|
| <b>Green Competitive Advantage</b> (Chen and Chang, 2013)   | <b>绿色竞争优势</b>                       |
| The company has the competitive advantage of low cost about environmental management or green innovation compared to its major competitors. | 与主要竞争对手相比，该公司在环境管理或绿色创新方面具有低成本竞争优势。 |
| The quality of the green products or services that the company offers is better than that of its major competitor's.                        | 该公司提供的绿色产品或服务的质量优于其主要竞争对手。          |
| The company is more capable of environmental R&D and green innovation than its major competitors.   | 与主要竞争对手相比，该公司更有能力进行环保研发和绿色创新。       |
| The company is more capable of environmental management than its major competitors.   | 该公司比其主要竞争对手更有能力进行环境管理。              |
| <b>Green Brand Image</b> (Chen, 2010)   | <b>绿色品牌形象</b>                       |
| The brand is regarded as the best benchmark of environmental commitments  | 该品牌被视为环保承诺的最佳标杆                     |
| The brand is professional about environmental reputation  | 该品牌在环保声誉方面很有口碑                      |
| The brand is successful about environmental performance   | 该品牌在环境绩效方面取得了成功                     |
| The brand is well established about environmental concern   | 该品牌在环境方面的关注度很高                      |
| The brand is trustworthy about environmental promises   | 该品牌的环保承诺值得信赖                        |

**Declaration of interests**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

Journal Pre-proof



**Highlights**

- Develops framework for reinforcing green competitive advantage.
- Comprehensive data from managers and customers have been analyzed.
- The role of customers in adopting green production is highlighted.
- Green brand image plays a role of partial mediator in the research framework.
- Provides policy suggestions and highlights implication for cleaner production.

Journal Pre-proof

