A STRUCTURAL EQUATION MODEL OF VARIABLES INFLUENCING ENVIRONMENTAL PERFORMANCE OF MANUFACTURING COMPANIES IN THAILAND

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIRMENTS FOR THE DEGREE OF PHILOSOPHY OF BUSINESS ADMINISTRATION IN INDUSTRIAL BUSINESS ADMINISTRATION

KING MONGKUT'S INSTITUTE OF TECHNOLOGY LADKRABANG

BUSINESS SCHOOL

KING MONGKUT'S INSTITUTE OF TECHNOLOGY LADKRABANG

2021

KMITL-2021-KBS-D-128-004

Dissertation Title	A Structural Equation Model of Variables Influencing Environmental Performance of Manufacturing Companies in Thailand
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Degree	Doctor of Philosophy
Programme	Industrial Business Administration (International Program)
Year	2021
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ABSTRACT

This study aims to examine the relationship between green human resource management practices, green culture, green innovation, and the environmental performance in the manufacturing companies in Thailand. To test the hypotheses, the data were collected from a sample of 300 respondents who responsible for the ISO 14000 system with at least five-years' experience, in a nation-wide manner of 28 business sectors, and examined using the structural equation modeling, based on a proposed conceptual model grounded in the resource-based view perspective (RVB) and the triple bottom line (TBL). The hypothesis testing revealed four significant correlations, Green human resource management practices have a positive impact on green culture and environmental performance. Green culture has a positive impact on green innovation, and green innovation has a positive impact on the environmental performance (at 0.05 Sig. Level). The model indicated the absolute fit indices, confirming the validity and reliability of the SEM analysis.

ACKNOWLEDGEMENTS

This dissertation is accomplished with the courtesy of Assistant Professor Dr. Nuttawut Rojniruttikul, my advisor at KMITL Business School, King Mongkut's Institute of Technology Ladkrabang (KMITL), for guiding, assisting, facilitating, and reviewing this research until completion, expertise and lecturers for auditing quality of research instruments and providing valuable recommendation, all respondents for contributing their information and devoting their time for this research questionnaires and in-depth interview and my wife for motivating me as always. I would like to express my deepest gratitude to your contribution and kindness and to all examiners who suggested revisions until this dissertation is satisfied.

Finally, I am highly grateful to my parents and my family for continuous supporting and encouraging me throughout my years of study. This accomplishment would not be achieved without them.

Jirachayut Wiroajchewan

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CHAPTER 1

INTRODUCTION

1.1 Background and Significance

Manufacturing has played a key strategic role at both organizational and national levels, especially creating competitive advantage, and improving performance. Due to the fact, technology has changed and evolved rapidly, demand's customers, market forces, and globalization caused the impact of violent industrial production (Popli, 2014). While many developing countries are interested in the investment from the developed countries, it is the development and introduction of modern technology in the economic development of the country and raises to become an industrialized country (Daily et al., 2012).

With the production process that does not care about the environment, it has become a national problem in many countries, to the regional and global levels. Like the topic of global warming, which is a widely debated cause, and the trend of rising global warming, to the phenomenon of climate variability. It affects people and the environment directly (Martinez-Fernandez, & Hinojosa, 2010). It is the driving force behind sustainable development and the development of organizations to become a green organization and "green" is used for a variety of actions (Sreesai, 2014).

At present, the green industry is one of the key strategies in the business of many companies. Green business is another way to help the business demonstrate its outstanding environmental stance among its competitors. On the other hand, green businesses mean the use and management of all resources to be used. Keeping within the environment, brings both benefits to the business and a good image for a well-managed community. Therefore, sustainable development is a concept that makes the industry become more and more active in the development of environmental policy and the operation in the factory to be sustainable (Mehta & Chugan, 2015).

For Thailand, following the ratification of the Johannesburg Declaration in 2002 and the Manila Declaration of 2009, the Ministry of Industry formulated a strategy for Thailand's

industrial development known as *The Green Industry Project.* Serving as a guideline for the management of factories or industries that utilize resources efficiently, recycling of the waste in the production process, pollution preventing by clean technology, including the production of environmentally friendly products. There is an exchange of waste that will be the raw material for other factories (Industrial Symbiosis) with emphasis on waste and recycling. Many organizations and industries have turned their attention to the implementation of the Environment Management System (EMS). Environmental management systems provide a framework for continuous improvement of the environment through effective management of the environmental impact of the organization included system improvements related to the performance (Jackson et al., 2012), enhancing teamwork (Jabbar et al., 2010), and organizational culture improvement (Jabbar et al., 2012).

A well-known environmental management system is Environmental Management System ISO 14000, established by the International Organization for Standardization (Kaur, 2011; Earnhart, 2013). EMS ISO 14000 has been recognized for its use by various organizations that are suitable and effective in developing an environmental management system (Johnstone et al., 2004; Jabbour et al., 2010). Moreover, there is increasing pressure from buyers in the Western countries demanding to improve environmental performance, which can translate to trade barriers for Thailand as the export-based economy as well (Parasnis, 2017).

ISO 14000 has become the international standard for designing and implementing an environmental management system. The standard is published by ISO (International Organization for Standardization), an international body that creates and distributes standards that are accepted worldwide. In a survey of ISO 14000 certification at the end of 2017, the number of companies that have implemented an ISO 14000 environmental management system shows a stable trend worldwide. Below are the results over the previous 6-year period.

There are many researchers found that organizations with social and environmental responsibility affect sustainable profitability (Darnall & Edwards, 2006; Hernadi, 2012; Farouk et al., 2012). This requires a high degree of interaction between environmental management and human resource management. This is consistent with the concept of green human resource management that involves Green policy; Environmental Health and Safety, Organizational Green Policies, and ISO 14000 as well (Yusoff et al. 2015). Organizations with better environmental performance will create a collective image and attracts the attention of highly qualified staff.

Increasingly popular environmental concepts will drive the company to improve its employees' ability to produce products that comply with stringent environmental regulations (Chen et al., 2012).

Moreover, green innovation has become one of the key strategic tools for sustainable development in the manufacturing industry (Chang, 2011). Implementing environmental management systems requires a green innovation factor (Weng et al., 2015). Organizations must consider the key drivers and what's already in their business (Routroy, 2009). If the company accepts green innovation actively, it can benefit from the differentiation and low cost, which can change the existing competition rules (Porter, 1981; Porter and van der Linde, 1995). Besides, environmental values incorporated into corporate culture affect the impact of the environmental strategy, both environmental and business performance (Moreton, Williamson, & Lynch-Wood, 2005; Chong, 2015). However, in practice the development of green organizations, there are also problems and barriers to implementation. The main problem is the lack of proper understanding of the principle of green organization of leaders and employees in the organization, driving the Green Policy Program, and obstacles in the implementation. Sustainable Green Organization requires a level of change of paradigm shift, with the cooperation and integration of operations, policies setting, and tools to support the operations, develop organizational sustainability for the benefit of society, economy, and environment (Sreesai, 2014).

1.2 Research Questions

Therefore, this study is interested in examining the internal factors on an organization's environmental performance of ISO 14000 certified manufacturing companies in Thailand. From the review of the theory and literature, this study has determined the factors affecting the environmental performance in this study; green human resource management practices, green innovation, and green culture. Green human resources management practices include top management support, recruitment and selection, training, performance appraisal, and rewards and compensation, that contributes to green innovation; product, process, management, and technology, and consistent with the green culture of the organization that contains with

leadership, communication, and employee empowerment. These factors will be able to drive the environmental performance to meet the objectives and goals of the organization efficiently.

1.3 Research Objectives

The main objectives of this study are;

1.3.1 To study direct, indirect, and combined influence of variables on the environmental performance of manufacturing companies in Thailand

1.3.2 To develop the structural equation model of variables affecting the environmental performance of manufacturing companies in Thailand

1.3.3 To check the consistency of the form, structure equation of variables that influence the environmental performance of manufacturing companies in Thailand developed with empirical data

1.4 Research Hypotheses

From studying various related variables, the researcher, therefore, hypothesize the research are as follows:

Hypothesis 1: Green human resource management practices have a positive impact on green culture

Hypothesis 2: Green human resource management practices have a positive impact on environmental performance

Hypothesis 3: Green human resource management practices have a positive impact on green innovation

Hypothesis 4: Green culture has a positive impact on green innovation

Hypothesis 5: Green culture has a positive impact on environmental performance

Hypothesis 6: Green innovation has a positive impact on environmental performance

1.5 Research Conceptual Framework

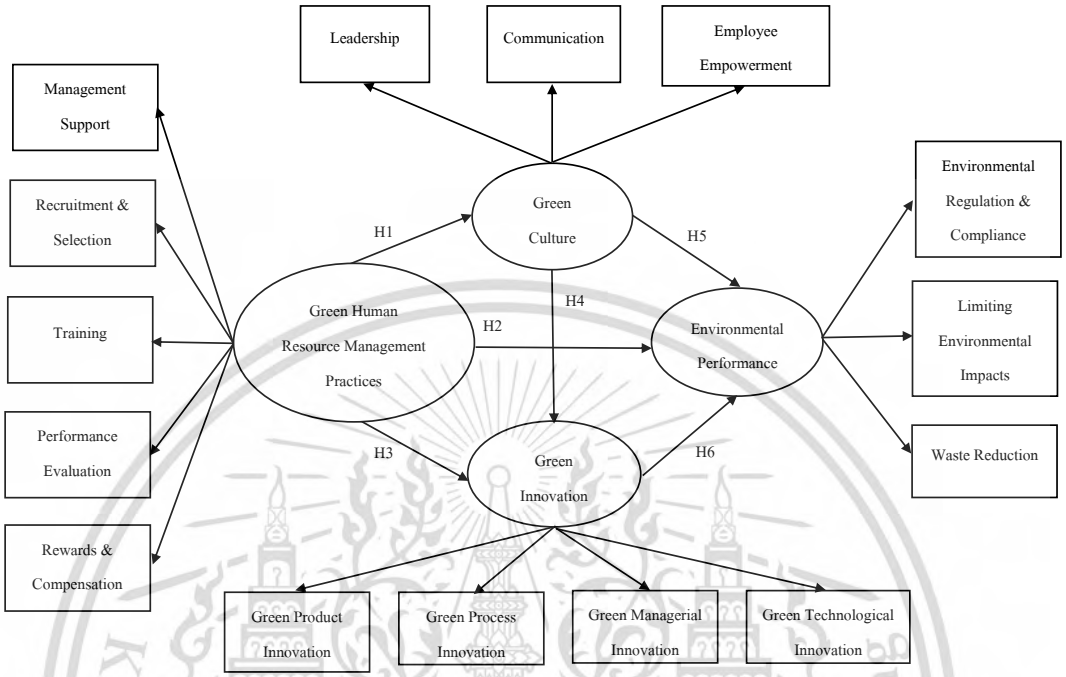


Figure 1.1 The Conceptual Model

1.6 Research Benefits

The expected benefits from this study are as follows:

1. For administrative, the benefit of executives or managers at all levels in determining the vision, mission, policy, consistency of the structure of the factors, and strategic planning of environmental management to create an environmental performance of manufacturing companies in Thailand.

2. For academics, the benefit, know the factors that have a direct and indirect influence and combined influence of variables on the environmental performance of manufacturing companies in Thailand, research and development in industrial management, environmental management, and those who are interested can continue to use the information to the study, develop academic and related professions.

1.7 Research Scope

To achieve the objectives of this research on "A Structural Equation Model of Variables Influencing Environmental Performance of Manufacturing Companies in Thailand", the researcher has set the scope of research as follows:

1.7.1 Content scope

This research is a specific study on "A Structural Equation Model of Variables Influencing Environmental Performance of Manufacturing Companies in Thailand", that consisting of

1. The overview of the green industry of Thailand
2. The concepts and theories of the resource-based view perspectives
3. The concepts and theories of the triple bottom line
4. The concepts and theories of the green human resource management practices
5. The concepts and theories of the green culture
6. The concepts and theories of the green innovation
7. The concepts and theories of the environmental performance of the organization

1.7.2 Population scope

The population used in this research is manufacturing companies that have received ISO 14000 environmental management system certification from the database of the Thai Industrial Standards Institute, Ministry of Industry, Thailand.

1.7.3 Variable scope

The researcher determined the variables used in the study, which includes Endogenous Latent Variables, Mediator/Intervening Variables, and Exogeneous Latent Variable as follows:

1.7.3.1 Endogenous Latent Variable is the environmental performance of manufacturing companies in Thailand consisting of 3 empirical variables or observed variables: Environmental Regulation Compliance, Limiting Environmental Impacts, and Waste Reduction.

1.7.3.2 Mediator/Intervening Variables are 2 variables: (1) Green Culture that consists of 4 empirical variables or observed variables: Leadership, Communication, and Employee empowerment and (2) Green Innovation that consists of 4 empirical variables or observed variables: Green Product Innovation, Green Process Innovation, Green Managerial Innovation, and Green Technological Innovation.

1.7.3.3 Exogeneous Latent Variable is green human resource management practices that consists of 5 empirical variables or observed variables: Management support, Recruitment & selection, Training, Performance evaluation, and Rewards & compensation.

1.7.4 Time boundary

The researcher conducted the research from December 2015 – October 2016 and collected data from September - October 2016.

1.7.5 Area scope

In this study, the researcher has determined the scope of the area used in the study is the certified ISO 14000 manufacturing companies in Thailand only.

1.8 Definition

1. ***Green Human Resource Management Practices*** - Policies, operations, and systems of human resource management for employees to understand environmental concepts and able to use internal resources of the organization sustainably, including the conservation of nature and the environment.

2. ***Management Support*** – Top management communicates the environmental policy, plan, and other pertinent information to employees.

3. ***Recruitment & Selection*** – The environmental policy in its recruitment and selection practices by collaborating the employers about greening in recruitment criteria and selection standards, stating the favorite of the business to recruit candidates who have competency and attitudes to contribute to company environmental administration

4. ***Training*** – A practice of knowledge, skills, and attitude that makes employees openness the need for environmental practices and develops a proactive attitude towards environmental topics for achieving environmental goals.

5. ***Performance Evaluation*** – The process of improving the capabilities of individuals and teams by encouraging employees to enhance their professional skills and environmental performance standards.

6. ***Rewards & Compensation*** – The use of environmental rewards and recognition and providing incentives to encourage environmentally-friendly activities and behaviors.

7. ***Green Innovation*** - The integration of all innovations that are different from competitors and reduce environmental impact, which leads to choices for better environmental development.

8. ***Green Product Innovation*** - Products that protect or promote the environment, which is due to energy conservation or efficient use of raw materials, reducing the use of toxins and waste, to the creation of new products that can be sold.

9. ***Green Process Innovation*** - Process of reducing environmental impact which saves energy, prevents pollution, and reuses of waste. There also are no production toxicities at present or add a new process.

10. ***Green Managerial Innovation*** - The organization's endeavor to incorporate green practices and objectives into its corporate strategy.

11. ***Green Technological Innovation*** - The behavior of creating environmentally-friendly new technology of product and process, pursuing economic growth benefits brought by technology innovation.

12. ***Green Culture*** - Defining shared values that are in line with the organization's needs, including the operation of environmentally friendly organizations.

13. ***Leadership***– Providing clear vision, inspiration, motivation to the employees and support employees' developmental needs towards the achievement of environmental goals of the organization.

14. ***Communication***– The action of communicating from management on green values within the organization that influence employees' behavior with regards to environmental performance.

15. ***Employee Empowerment***– The level of employee autonomy for making effective decisions involving situations and requirements that are beyond formative rules that improve the environmental awareness of employees.

16. ***Environmental Performance*** - Performance indicators of the implementation of the organization's environmental management plan that complies with rules or regulations to reduce the effects and toxic waste that will occur to the environment.

17. ***Environmental Regulation Compliance***– Conforming to environmental laws, regulations, standards, and other requirements such as site permits to operate.

18. ***Limiting Environmental Impacts*** - Reducing the negative impacts of production on the environment.

19. ***Waste Reduction*** - A set of processes and practices intended to reduce the amount of waste produced.

CHAPTER 2

LITERATURE REVIEW

The research on "A Structural Equation Model of Variables Influence Environmental Performance of Manufacturing Companies in Thailand", the related literature review contains the concepts, theories, and related research as follows;

2.1 The overview of the Green Industry of Thailand

2.2 The concepts and theories of the Resource-Based View Perspectives (RBV)

2.3 The concepts and theories of the Triple Bottom Line (TBL)

2.4 The concepts and theories of Green Human Resource Management Practices

2.5 The concepts and theories of Green Culture

2.6 The concepts and theories of Green Innovation

2.7 The concepts and theories of Environmental Performance

2.8 The literature review and research on the causal relationship of variables

2.9 The conceptual framework and hypothesis development

2.1 The overview of the Green Industry of Thailand

There are a few organizations that have specifically identified the term "green." The Ministry of Industry, for example, defines the Green industry as a manufacturing firm that commits to conducting business in an environmentally friendly and socially responsible manner to achieve sustainable growth by constantly developing and improving their production process and environmental management system. According to the United Nations Environment Program (UNEP), a green economy is one that improves human well-being and social equity while reducing environmental and ecological effects. As previously reported, a green factory consists of three components: the factory itself, the environment, and the society. As a result, companies who want to expand seasonally must think about the consequences for the environment and communities.

Some organizations that have clearly defined the green concept. For example, the Ministry of Industry defines the Green industry as the manufacturing firm that commits to conducting business in an environmentally friendly and socially responsible way to achieve sustainable growth by continuously developing and improving their production process and environmental management system. The United Nations Environment Program (UNEP) defines the green economy as an economy that results in improved human well-being and social equity, while reduces environmental and ecological impact (UNEP, 2020). As mentioned, a green factory concerns three elements, first the factory itself, second, the environment, and lastly the community (Green Industry in Thailand Towards Sustainable Growth.,2018). Thus, for the businesses that desire to grow seasonably, they need to consider the effects that might have on the environment and communities.

Over the last century, the issue of global warming has gotten worse. Many countries are now working to reduce the environmental effect, which is primarily caused by greenhouse gases generated by coal and fossil-fueled fuels, as well as deforestation, which disrupts natural balance. With the assistance of international organizations such as the United Nations Industrial Development Organization (UNIDO), which established Green Industry programs to assist developing countries in maintaining resource-efficient low-carbon growth while also creating new jobs and protecting the environment, developing countries have been able to sustain resource-efficient low-carbon growth while also creating new jobs and protecting the environment. By providing services and knowledge for more sustainable production, the programs also provide developed countries with access to cleaner technology and stronger enforcement of environmental agreements. The United States, as one of the world's most energy-intensive nations, has initiated the UCS Blueprint 2030, a national initiative (Reference suggested). The initiative aims to boost energy efficiency in residential, commercial, and industrial buildings. By 2030, the nation plans to turn away from fossil fuels and toward renewable energy. On the other side, the European Union (EU) has launched an initiative called EMC Factory that aims to reduce total resource usage while also generating revenue via technical advancements in the manufacturing process, as well as design and green factory management, this initiative focuses on improving energy and resource quality in the automotive, aerospace, and rail industries.

The global warming problem increases rapidly during the last century. Many countries are now working to reduce this environmental impact which over 90% caused by greenhouse

gases from coal and fossil-fueled energy as well as the deforestation that disrupt the balance of nature (Holli Riebeek., 2010). With the help from an international organization such as the United Nations Industrial Development Organization (UNIDO) who came up with the Green Industry initiatives to help developing countries to maintain resource-efficient low-carbon growth as well as creating new jobs while protecting the environment (United Nations Industrial Development Organization.,2010). The initiatives also provide developing countries with access to cleaner technologies and better implementation of environmental agreements by offering services and expertise for more sustainable manufacturing. The United States, one of the highest energies consumed countries, has launched a national initiative called the UCS Blueprint 2030 (R Cleetus., 2009). The plan is aimed to increase the energy efficiency in buildings for households, businesses, and factories. The country is also aiming to stop using fossil fuels by the year 2030 and move toward renewable energies. The European Union (EU) on the other hand, has launched an initiative called EMC Factory that aims to reduce the impacts on overall resource consumption but at the same time generating wealth and employment for economic growth (Environment and Economics - European Commission., 2012). This plan focuses on better energy and resource efficiency in the production of automotive, aerospace, and rail through technological improvement in the manufacturing process as well as design and green factory management.

Green factories necessitate a high degree of dedication. Manufacturers must possess the required skills and attitudes. In general, factories will follow the green factory definition in one of two ways. To begin, they should integrate their quality control system with environmental and safety policies across all supply chains. Second, they may apply for government-sponsored and funded programs, such as those run by the Ministry of Industry. Thailand has established a strategy to grow the manufacturing sector, following the Johannesburg Declaration in 2002 and the Manila Declaration in 2009.

Achieving green factories requires high level of commitment. Manufacturers need to have the right knowledge and attitude. In general factories can do one of these two ways to adopt the green factories concept. First, they can advance their quality management system with the environmental and safety policy throughout the supply chains. Second, they can seek supports and subsidized projects initiated by government sector such as the Ministry of Industry. Thailand, following the Johannesburg Declaration in 2002 and the Manila Declaration in 2009, has defined

a strategy to develop the manufacturing sector (Green Industry in Thailand Towards Sustainable Growth., 2018).

The Ministry of Industry launched a Green Industry project with the aim of serving as a model for green factories. Green commitment, green operation, green system, green culture, and green network were the five levels of the project. The project includes everything from raising environmental consciousness to introducing and certifying an environmental management scheme, as well as network expansion of best practices through supply chains. Environmental impact minimization, emissions control, resource efficiency, climate change reduction, and environmental conservation are also part of the project's guideline activities.

The Ministry of Industry created a Green Industry project that aimed to be the guideline for green factories. The project comprised of five levels; green commitment, green operation, green system, green culture, and green network (Green Industry in Thailand Towards Sustainable Growth., 2018). The project covers from creating the awareness of reducing the environmental impact, implementation, certifying the environment management system, to network extension of practice throughout the supply chains. The project guideline practices include the minimization of the environmental impact, the prevention of pollutions, resource efficiency, the reduction of climate change, and the protection and restoration of the eco-system.

China, which promotes renewable energy such as wind and solar power, is one of the UNEP's green economy initiative's success stories in a developing world. In 2005-2010, the Chinese government enacted renewable energy legislation that included a range of financial incentives and tax benefits. China has overtaken the United States as the world's largest producer of solar cells (PV), accounting for 45 percent of global production. China's energy industry generated 17 billion dollars in revenue in 2009. This strategy also contributes to the creation of over 1.5 million jobs (WWF Report, 2013).

One of the success stories according to UNEP’s green economy initiative in a developing country is China with the promotion of renewable energy such as wind power and solar power **(**UNEP, 2015**)**. The Chinese government has implemented renewable energy legislation in 2005-2010 offering a variety of financial incentives and tax privileges. China has become the biggest manufacturer of solar cells (PV) with a 45% market share of the world’s total output. In 2009, China’s revenue from the energy industry was at 17 billion dollars. This policy also helps to create more than 1.5 million jobs (G Emissions, 2017).

Manufacturers, workers, the economy, and the environment all benefit from green factory practices. The first and most important advantage is that it aids in the reduction of resource and energy use in the manufacturing process, lowering operating costs directly. Another advantage is that they often find opportunities to increase product and service efficiency. Manufacturers may also use the Green Industry logo for additional commercial value as a side effect. Employees profit as well because they operate in a cleaner and safer environment. For the city, the practice encourages more open communication between factories and residents, resulting in a stronger understanding and mutual benefit. Finally, it has the potential to aid in the preservation of natural resources for future generations.

Green factory practice has mutual benefit for all parties; manufacturers, employees, community, and the environment. The first and foremost benefit is that it helps to reduce the use of resources and energy in the production process, which directly lowers operating costs. Another benefit is that they often discover room for products and service quality improvements. The by-product benefit is that manufacturers can use the Green Industry mark for added commercial value as well. Employees also benefit from this by having a better and safer workplace. For the community, the practice fosters more open dialogue between factories and the community, thus creating a better understanding and a balanced benefit between the two. Finally, it can help preserve natural resources for the next generations.

The Ministry of Industry has been leading the charge toward green manufacturing by encouraging related industries to collaborate in the growth of the green industry and incorporating environmental initiatives into the ministry. There are currently 3,681 green factories certified: 1,619 factories at level 1, 870 factories at level 2, 1,162 factories at level 3, and 30 factories at level 4. Many more factories are undergoing inspection. (At the moment, no factory is rated as level 5.) By 2015, the Ministry of Industry hopes to raise the number of green factories to 70,000, or 50% of all factories. Even though the number of accredited factories is still small, the ministry is optimistic that the movement will encourage more manufacturers to join the program soon. Furthermore, with more factories accredited to the ISO I4000 standard, the ministry is positive about the program's potential performance.

The Ministry of Industry has been spearheading a move toward green manufacturing by encouraging related sectors to work together in the development of the green industry by integrating environmental projects within the ministry. Now, there are 3,681 factories certified for

green industry: 1,619 factories at level 1,870 factories at level 2,1,162 factories at level 3 and 30 factories at level 4 (TIR, 2018). Many more factories are under the assessment process. (Currently, there is no factory classified at level 5.) The Ministry of Industry aims to increase the number of green factories to 70,000, or 50% of the total factories by the year 2015 (TIR, 2018). Though the number of certified factories is still low, the ministry believes that the movement will drive more and more manufacturers to join the program in shortly. Also, with more factories certified ISO I4000 standard, the ministry is very optimistic about the success of the program in the coming future.

Table 2.1 Five Levels of Green Industry Development

Level 1	Green Commitment - Commitment demonstrated by policy, goals, and action plans to reduce environmental impacts, and effective organizational internal communication
Level 2	Green Activity - Activities in compliance with policy, goals and plans which have been set to reduce substantially environmental impacts as commitment states
Level 3	Green System - Systematic environmental management including follow-up, assessment, and revision aimed to continuous development as well as receiving a widely recognized award on environment and accreditations on a variety of environments
Level 4	Green Culture - Cooperation of employees in all levels of organization to implement a friendly environment in all aspects of business operation until it becomes a part of the organization culture
Level 5	Green Network - Demonstration of network extension throughout green demand chains by promotion business partners and allies entering accredited green industry process

Source: Ministry of Industry, 2018

Nevertheless, there are still obstacles on the road to green industries. The main problems are a lack of understanding of the green economy. Manufacturers often see green manufacturing as a no-return investment. In fact, studies from many internationally recognized organizations and the United Nations have confirmed the benefits and cost-savings from green manufacturing that would lead to sustainable growth. Other problems include regulations and incentive schemes such as an annual fee or tax exemption, which involve different government agencies' approval. Another challenge lies in the fact that some manufacturers still misunderstand the objective of the project, while some join the program only expecting the privilege rather than the benefits from realizing green operations.

2.2 The concepts and theories of the Resource-Based View Perspectives (RBV)

The conceptual framework on Resource-Based View of the Firm (RBV) is an important theory in enhancing our understanding of the outsourcing decision. In particular, the resource-based view can assist in the analysis of organizational capabilities, which can link outsourcing to organizational performance and in turn competitive advantage. It is possible to relate the resource-based view to analyzing the capabilities of an organization relative to competitors and suppliers in an outsourcing context. According to Barney (1999), a resource with the potential to create a competitive advantage must meet many criteria including value, rarity, imitability, and organization. Resources and capabilities are considered valuable if they allow an organization to both exploit opportunities and counter threats. Therefore, these resources should enable the organization to meet the factors critical to success in their business environment. The rarity criterion is related to the number of competitors that possess a valuable resource. Clearly, where some competitors possess a valuable resource then it is unlikely to be a source of competitive advantage and therefore is a suitable candidate for outsourcing. A valuable resource that is unique amongst both current and potential competitors is likely to be a source of competitive advantage. Valuable and rare resources can be a source of competitive advantage and should be performed internally and developed. The imitability criterion is concerned with considering the ease with which competitors can copy a valuable and rare resource possessed by an organization. In effect, this analysis is concerned with determining the sustainability of the competitive advantage in the

resource. Finally, Barney (1999) argues that a firm must be organized to exploit its resources and capabilities. The organization criterion includes some elements including the reporting structure, management control systems, and compensation policies. It is important to emphasize that even though a firm may possess a range of valuable, rare, and costly to imitate resources, an ineffective organization will prevent the full exploitation of these resources.

Many proponents of the resource-based view have argued that competitive advantage is created from resources and capabilities that are owned and controlled within a single organization. Therefore, resources that are internal to the organization drive competitive advantage. However, some scholars have extended the scope of the resource-based view to focus on resources that span the boundaries of the organization (Das and Teng, 2000) sometimes referred to as the 'extended resource-based view'. Proponents of this literature propose it as a means of understanding how firms can gain and sustain competitive advantage. For example, Dyer and Singh (1998) argue that organizations can combine resources in unique ways across organizational boundaries to obtain an advantage over their competitors. Firms can develop valuable resources by carefully managing relationships with external entities including suppliers, customers, government agencies, and universities. Therefore, a firm can gain and sustain a competitive advantage by accessing its key resources in a way that spans the boundaries of the firm. Research has suggested that there is the potential for productivity improvements in the value chain when organizations are willing to make relation-specific investments and combine resources in unique ways (Dyer, 1996). Organizations that make relation-specific investments can combine resources in unique ways to generate relational rents and gain a competitive advantage over organizations that are unable to do this.

The concept or theory of resource base also mentioned on the relationship between environmental management and competitive advantage is also an interesting issue. Whereas the best practice of environmental management through the company's resources and capabilities to help organizations protect the environment and reduce costs (Christmann, 2000), these are also used in determining the performance of the organization. Hart (1995) also describes relationships between the natural environment and the competitive advantage, three strategies have been proposed that are linked: pollution prevention, providing service or product care, and sustainable development. This is called the conceptual theory of the natural resource based of the organization.

2.3 The concepts and theories of the Triple Bottom Line (TBL)

The topic of sustainability and its essential concept, part of which is known as the Triple Bottom Line (TBL) (Kleindorfer et. al., 2005), has become a mainstream research topic of academics and practitioners. The sustainability concept expands its direction to measure the successful of business organizations with new criteria and values. Organizations are now refocusing their corporate activities to understand how they impact social, environmental, and economic dimensions under sustainability (Leppelt et. al., 2013). The concept of TBL was developed by Elkington (1997) who stressed the distinction of the economic and social dimensions of sustainability, which have been absorbed by the environmental dimension of sustainability. is an accounting framework with three parts: social, environmental (or ecological), and financial. Some organizations have adopted the TBL framework to evaluate their performance in a broader perspective to create greater business value. The environmental benefit comes from the recycling accomplished. In the private sector, a commitment to corporate social responsibility (CSR) implies an obligation to public reporting about the business' substantial impact for the better of the environment and people. Triple bottom line is one framework for reporting this material impact. This is distinct from the more limited changes required to deal only with ecological issues. The triple bottom line has also been extended to encompass four pillars, known as the quadruple bottom line (QBL). The fourth pillar denotes a future-oriented approach (future generations, intergenerational equity, etc.). It is a long-term outlook that sets sustainable development and sustainability concerns apart from previous social, environmental, and economic considerations. In the literature, this concept is also known as the notion 3P – people, profit, planet since its aim is for the action of business entities regarding the environment and the social sphere to be treated like financial results – and thus clearly settled regarding the performance in these spheres.

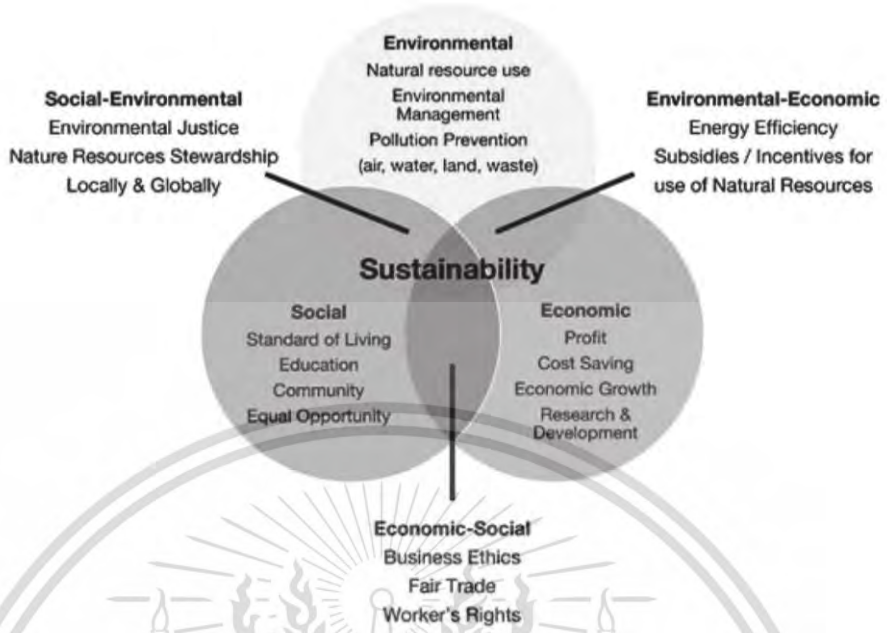


Figure 2.1 The Three S of Sustainability

Source: Clark & Richard, 2011

2.4 The concepts and theories of Green Human Resource Management Practices

In the last two decades, the mainstream nature of sustainability and environmental awareness pushed both practitioners and academics to address the issue of human resource management as a strategic tool for greening an organization and, in turn, economics and society at large (Benevene & Buonomo, 2020). The growing role of sustainable development and, above all, its ecological aspect, in the development of a modern company's competitive edge, leads to the popularization of the question of incorporating ecological practices into the area of human resource policy, referred to as Green Human Resource Management (GHRM).

GHRM practices are mostly analyzed in the light of the AMO (ability, motivation, opportunity) theory (Renwick et al., 2013) and the social identity theory (Hogg, Terry, White, 1995.; Abrams & Hogg, 1988.; Tajfel & Turner, 1979). According to the AMO theory, performance is a result of the interaction of employees' capacity to perform (ability), willingness to perform (motivation), and opportunity to perform through participation (opportunity)

(Blumberg & Pringle, 1982). Therefore, applying the AMO theory to GHRM practices implies identifying and developing employees' green competencies (Cabral & Lochan Dhar, 2019), creating a system of green performance appraisal and green rewards that generate green motivation; offering employees ways to operate with flexibility at work, autonomy, and participation in decision making, aimed at increasing employee green behaviors in the workplace (Amrutha & Geetha, 2020).

The social identity theory instead posits that subject develop their sense of who they are based on their belongingness to some specific groups, such as age group and gender organizational membership (Tajfel & Turner, 1979; Hogg & Turner, 1987). Thus, according to this theory, it is possible to assume that employees who develop a green identity at work (no matter whether they are directly involved or not in green practices) will endorse environmentally concerned behaviors which, in turn, will affect the environmental performance of their organizations in terms of sustainability (Kim, Kim, Choi, & Phetvaroon, 2019).

The researcher has studied the concepts, theories, and related research related to green human resource management. With researchers and scholars gave the meaning of Green human resource management for many people can be summarized in Table 2.2 as follows.

Table 2.2 Green Human Resource Management Practices Definition

Researcher/Academic	Green Human Resource Management Practices Definition
Aggarwal and Sharma, 2015	Tasked with environmental protection and saving the planet from man-made environmental disasters. GHRM is also an imperative undertaking for both the present and future generations and is also an emerging trend in the field of management. Moreover, GHRM functions as an integration mechanism between environmentally friendly practices and HR policies to attain sustainability and long-lasting organization, industry, and economic health. GHRM

Table 2.2 Green Human Resource Management Practices Definition (Cont.)

Researcher/Academic	Green Human Resource Management Practices Definition
	is also a tool to channel environmentally friendly products into corporate environmental programs successfully
Arulrajah et al., 2015	Activities including development of ongoing operation an maintenance systems that aims to create a green corporate employe It is the part of human resource management that deals with th transformation of ordinary employees to environmentally conscio employees. To achieve the organization's environmental goals and, i the end, it will produce a significant contribution to sustainab environmental development. This refers to the policies, proces program, and techniques for green human resource management tha business unit or organization were applied to reduce negativ environmental impacts, and the development of positiv environmental impacts from the operations of the organization
Ashraf et al., 2015	Scope of study of various human resources policies and practices that is used to ensure the efficient use of natural resources of a business and especially in contributing to our ecological commitment
Datta, 2015	The concept of implementing human resource management practices and policies that lead to the implementation of the best and sustainable benefits of various resources within the organization, including practices and policies that is operated by the human resource department in environmental conservation

From the study of many researchers and scholars who have given the meaning of green human resource management. The researcher, therefore, concluded that Green human resource management is policies, operations, and systems of human resource management for employees to understand environmental concepts and able to use internal resources of the organization sustainably, including the conservation of nature and the environment.

The researcher reviewed the research and literature on green human resource management variables. Many scholars and researchers have studied it can summarize the empirical variable or the observed variable as shown in Table 2.3.

Table 2.3 Green Human Resource Management Observed Variables

Researcher / Academic	Field of Study	Latent Variables	Observed Variables	Industry
AnuSingh and Shikha (2015)	The impact of Green Human Resource Management on environmental performance in factories using empirical evidence.	Green Human Resource Management	1. Management commitment 2. Employee training 3. Environmental activities	Manufacturing
Subramanian & Chong (2015)	Influence of GHRM practices on environmental performance using evidence from China's	Green Human Resource Management	1. Recruitment 2. Selection 3. Training 4. Performance evaluation 5. Rewards	Manufacturing

Table 2.3 Green Human Resource Management Observed Variables (Cont.)

Researcher / Academic	Field of Study	Latent Variables	Observed Variables	Industry
	manufacturing sector.			
Popli (2014)	GHRM practice education, perceptions, and implementation of industry in Nashik, India.	Green Human Resource Management	1. Recruitment 2. Training and assessment 3. Data recording 4. Activities, duties, & routines	Manufacturing
Jabbour et al. (2012)	The role of GHRM in Brazilian companies' environmental impact.	Green Human Resource Management	1. Personnel recruitment and selection 2. Training 3. Evaluation 4. Rewards 5. Benefits	Automotive
Becker (2011)	Leadership in Corporate Social Responsibility (CSR) and Sustainable Human Resource	Green Human Resource Management	1. Acquisition 2. Development 3. Employee management	Manufacturing

Table 2.3 Green Human Resource Management Observed Variables (Cont.)

Researcher / Academic	Field of Study	Latent Variables	Observed Variables	Industry
	Roles			
Kaur (2011)	The impact of human resource factors on the awareness of environmental performance on Malaysian corporate ISO 14001 environmental management systems.	Human resources	1. Executive commitment 2. Feedback and review 3. Delegation	Manufacturing
Nee (2011)	ISO14001 implementation factors in Malaysian SME Environmental Management Systems	Human capital resources	1. Commitment of top management 2. Training and Education 3. Delegation 4. Recognition and rewards	Small and medium enterprises
Ambika and Amrik S. (2004)	Success factors in the adoption and maintenance of Environmental	Implementation of the Environmental Management	1. Leadership and Support of Executives 2. Learning and	Manufacturing

Table 2.3 Green Human Resource Management Observed Variables (Cont.)

Researcher / Academic	Field of Study	Latent Variables	Observed Variables	Industry
	Management Systems.	System	training 3. Internal Audit 4. Sustainability	

Additionally, the researcher has prepared Table 2.4 to present a comparison overview of researchers' studies related to GHRM and their perceptions of which observed variables contribute to it.

Table 2.4 Green Human Resource Management Practices Dimensions Comparison

GHRM	Ashraf et al. (2015)	AnuSingh & Shikha (2015)	Bangwal & Tiwari (2015)	Jabbar & Abid (2015)	Subramanian & Chong (2015)
Management Support		✓			
Recruiting and Selection	✓		✓	✓	✓
Training	✓	✓	✓	✓	✓
Performance Appraisal	✓		✓		✓
Data Recording	✓		✓		
Reward and Compensation	✓		✓	✓	✓
Employee Empowerment		✓		✓	✓
Environmental Activities		✓		✓	
Labor Relations		✓			

Table 2.4 Green Human Resource Management Practices Dimensions Comparison (Cont.)

GHRM	Trivedi (2015)	Popli (2014)	Jabbour et al. (2012)	Daily et al., (2012)
Management Support	✓		✓	
Recruiting and Selection	✓	✓	✓	
Training	✓			✓
Performance Appraisal	✓	✓	✓	
Data Recording		✓		
Reward and Compensation	✓		✓	
Employee Empowerment			✓	✓
Environmental Activities		✓		
Labor Relations	✓		✓	

Table 2.4 Green Human Resource Management Practices Dimensions Comparison (Cont.)

GHRM	Grolleau et al. (2012)	Jabbour et al. (2012)	Nee (2011)	Jabbar et al., (2010)	Sarkaris et al., (2010)
Management Commitment			✓		
Recruiting and Selection	✓			✓	
Training		✓	✓	✓	✓
Performance Evaluation		✓	✓	✓	
Data Recording			✓		
Reward and Compensation			✓	✓	
Employee Empowerment			✓		
Environmental Activities			✓	✓	
Labor Relations	✓		✓	✓	

Table 2.4 Green Human Resource Management Practices Dimensions Comparison (Cont.)

GHRM	Brekke & Nybord (2008)	Unnikrishnan & Hedge (2007)	Daily et al., (2007)	Ambika & Amrik S. (2004)
Management Commitment			✓	✓
Recruiting and Selection	✓			
Training		✓	✓	✓
Performance Evaluation				✓
Data Recording			✓	
Reward and Compensation			✓	
Employee Empowerment	✓			
Environmental Activities	✓			✓
Labor Relations	✓			✓

The researcher has studied the research and related literature of the empirical variables or the observed variables of green human resource management. With many researchers and scholars, the researcher has studied the empirical or observed variables used to measure green human resource management and synthesized it out of 5 empirical variables or observed variables (Ashraf et al., 2015; AnuSingh and Shikha, 2015; Popli, 2014; Jabbour et al., 2012; Daily et al., 2012; Grolleau et al., 2012; Nee, 2011& Becker, 2011; Kaur, 2011 Jabbar et al., 2010; Sarkaris et al., 2010; Brekke & Nybord, 2008; Unnikrishnan & Hedge, 2007; Daily et al., 2007; Govindarajulu & Daily, 2004; Ambika & Amrik S., 2004; Frank, 2003; Dye & Chinander, 2001; Ramus, 2002; Forman & Jorgensen, 2001; Denton, 1999; Bauer & Aiman-Smith, 1996; Dechant & Altman, 1994; Taylor et al., 1992), including management support, recruitment & selection, training, performance evaluation, and rewards & compensation.

2.1.1 Management Support

The researcher studied the research related to the empirical or observed variable of the management support. Research and many scholars gave the meaning of the management support as shown in Table 2.5.

Table 2.5 Management Support Definitions

Researcher / Academic	Management Support Definitions
AnuSingh and Shikha, 2015	Responsibility for setting the vision or corporate environmental policy
Jabbar and Abid, 2015	Creating human power by stimulating the human mind. From energizing the mind which is the source of bringing green thinking into action
Aggarwal & Sharma, 2015	All tasks and duties involved in developing, pursuing, and creating a system at making the human resource of an organization environment aware of their private and professional lives
Renwick et al., 2013	HRM practices aimed at environmental and ecological influence of the firms and it is linked with firm environmental strategy and green behaviors of employees
Kaur, 2011	Fostering a strong culture in which employees are free to make environmental improvements without excessive managerial intervention, innovation promotion, and taking risks
Cramer and Roes, 2006	Giving personnel freedom to bring about constructive solutions to problems that arise to develop awareness and apply knowledge of the field into practice

From the study of many researchers and scholars those who have defined the meaning of management support. The researcher therefore concluded that Management support is defined as

vision, policy, culture, innovation, and environmental risk management at the organizational level, to give employees the freedom to manage and solve problems creatively.

2.1.2 Recruitment & Selection

The researcher has studied the research related to the empirical or the observed variable of the recruitment and selection. Many scholars gave the meaning of recruitment and selection as shown in Table 2.6.

Table 2.6 Recruitment & Selection Definitions

Researcher / Academic	Recruitment & Selection Definitions
Opatha and Arulrajah., 2014	Using environmental criteria in recruiting issues and communicating employers' concerns about the environment through a recruiting commitment
Bangwal and Tiwari., 2015	The process of recruiting new talent which realizes the process of sustainable development, system related to and familiar with conservation and sustainable environmental terminology
Jabbar and Abid., 2015	The process of hiring an environmentally aware, paperless candidate, such as job applications, can be done through the website, or job interviews by phone or online

From the study of many researchers and scholars who have given the meaning of recruitment & selection. The researcher, therefore, concluded that recruitment & selection refers to the process of recruiting competent candidates with environmental awareness. Sustainable development process and understand conservation and environmental protection.

2.1.3 Training

The researcher has studied the research related to the empirical or observed variable of training. Researcher and many scholars have given the meaning of the training as in Table 2.7 as follows.

Table 2.7 Training Definitions

Researcher / Academic	Training Definitions
Ahmed, 2015	A practice of knowledge, skills, and attitude that makes employees openness the need for environmental practices, and develops a proactive attitude towards environmental topics for achieving environmental goals
Opatha and Arulrajah., 2014	Providing accurate knowledge and skills about the environment to each employee through tailored environmental training courses. Including analysis of training needs to identify the need for environmental training
Daily et al., 2012	A systematic process of helping employees have the knowledge, attitudes, and skills to achieve the environmental management goals set by top management
Rothenberg., 2003	Making employees aware of the need to control the environment Increasing the ability to adapt to change and develop a proactive attitude towards environmental problems

From the study of many researchers and scholars who have given the meaning of training, the researcher concluded that training refers to the process of providing employees with systematic learning of skills, knowledge, attitudes, and competencies related to environmental work. Including changes in the future to enable employees to work efficiently and achieve organizational objectives in environmental management.

2.1.4 Performance Evaluation

The researcher has studied the research related to the empirical or observed variable, namely performance evaluation. Many researchers and scholars gave the meaning of performance evaluation as shown in Table 2.8 as follows.

Table 2.8 Performance Evaluation Definitions

Researcher / Academic	Performance Evaluation Definitions
Sumittra, 2018	The process of improving capabilities of individuals and teams by encouraging employees to enhance their professional skills and environmental performance standards that help to achieve the organizational goal in a better way
Opatha and Arulrajah., 2014	Evaluation of employee performance based on environmental criteria and includes a separate component for environmental advancement from interviews to provide feedback on performance
Bangwal and Tiwari., 2015	Corporate policy and environmental responsibility by integrating environmental management into the performance management system to improve the quality and values of environmental performance

From the study of many researchers and scholars who have given the meaning of performance evaluation. The researcher, therefore, concluded that performance evaluation refers to a systematic process of comparing environmental performance with established environmental standards within the time limit to comply with and achieve the organization's environmental objectives.

2.1.5 Rewards & Compensation

The researcher has studied the research related to the empirical or observed variable of the reward and compensation. Many researchers and scholars gave the meaning of rewards and compensation as shown in Table 2.9.

Table 2.9 Rewards & Compensation Definitions

Researcher / Academic	Rewards and Compensation Definitions
Opatha and Arulrajah., 2014	Providing employees with financial compensation for sound environmental performance and providing non-financial incentives to employees, including recognition and pride for their environmental performance
Sumittra, 2018	A practicing reward system for improving performance by offering employees a benefits package that rewards employees for green performance, the use of environmental rewards and recognition, and providing incentives to encourage environmentally friendly activities and behaviors
Daily et al., 2007	Recognition and reward for the contributions of employees in their contribution to environmental goals. Able to motivate and increase employees' commitment to environmental responsibility This can help companies and employees improve their environmental performance
Daily and Huang., 2001	Continuously reinforcing the motivation and commitment of our employees to take on environmental responsibility

From the study of many researchers and scholars who have given the meaning of rewards and compensation. The researcher, therefore, concluded that rewards and compensation refer to benefits that are both monetary. That is not money and other benefits that the organization pays to

employees according to the compensation system to incentivize employees to be responsible and to be more environmentally friendly which is linked with the performance of the employees as well.

2.1.6 Green Human Resource Management Model Summary

From the review of concepts, theories, literature, and related research of green human resource management, which consists of empirical or observed variables with many researchers and scholars have studied. This can be summarized in 6 variables: 1) Management Support, 2) Recruitment & Selection, 3) Training, 4) Performance Evaluation, and 5) Rewards & Compensation. The study model can be summarized in Figure 2.2.

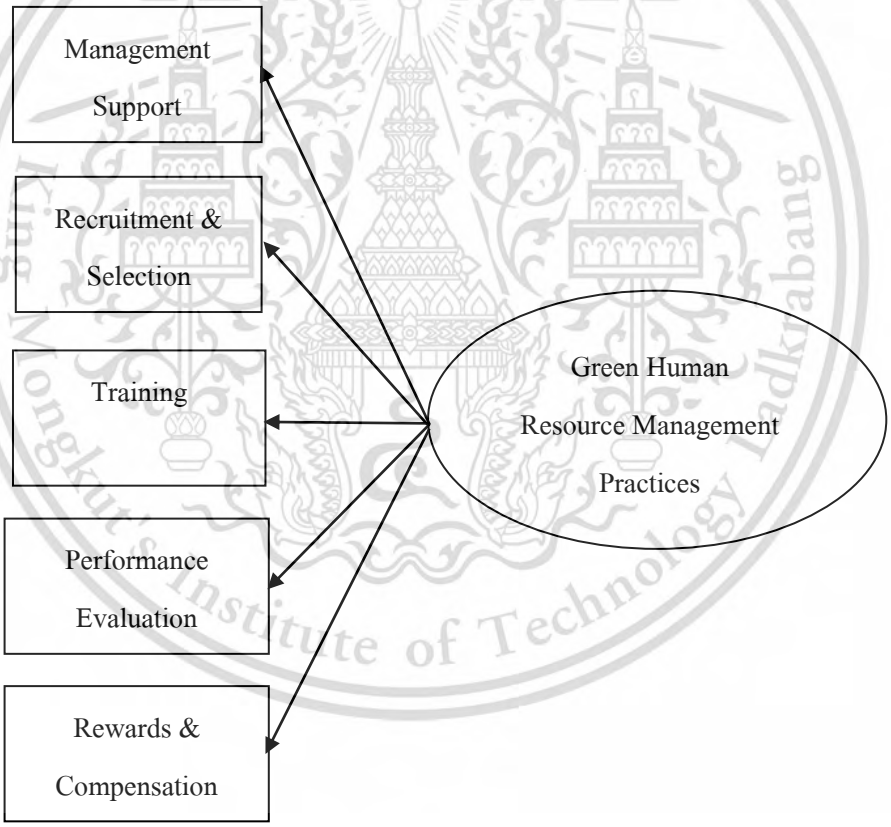


Figure 2.2 Green Human Resource Management Model Observed Variables

2.5 The concepts and theories of Green Culture

The terms for describing the concept of a green organizational culture have been diversified, including eco-friendly culture, environment-friendly culture, sustainability-oriented culture, etc., which is mainly based on extending organizational culture to a green oriented context. For instance, (Norton et al., 2015) defined a pro-environmental organizational culture as they extended (Schein's., 1990) organizational culture definition to meet the practical and perceptual criteria of working on business with the premise in environment conservation and protection.

The green culture concept is mostly concerned with realizing and obtaining the ecological balance (Mohezara et al., 2016). It involves both environment and people hence the need to carry out green culture since it promotes ecological development and sustainable economic growth based on politics, science, and aesthetics (Galpin et al., 2015). Through globalization, different economies have shared the benefits of undertaking green tendencies and incorporating such practices in their organizational culture. Most of the organizations are restructuring their cultures to accommodate new factors on issues such as environmental ones, behavior, and attitude related to environmental problems (Firoz and Abinakad, 2016; Liu, X., & Lin, K. L.,2020).

Hart (1995) shows organizational resource has a pivotal role in developing successful environmental strategies, and one of the resources that may support competitive advantage and green performance is organizational green culture (OGC) (Banerjee, 2002). Culture here refers to a shared system of beliefs, values, ideas, and attitudes that shape organizational behavior. Organizational culture can be developed by a managerial team to disseminate a set of values to guide corporate goals (Gao, 2017). Accordingly, we consider organizational green culture (OGC) whose values the firm has internalized throughout the organization and which are typically codified in a mission statement for all employees and managers (Stone et al., 2004). organizational green culture (OGC) may thus lead employees to accept green innovation as a fundamental value of the organization and to feel more involved in environmental issues.

The researcher has studied the concepts, theories, and related research related to green culture. With researchers and scholars gave the meaning of green culture for many people can be summarized in Table 2.10 as follows.

Table 2.10 Green Culture Definitions

Researcher / Academic	Green Culture Definitions
Liu & Lin, 2020	A set of collectively shared beliefs, values, perspectives, norms, and even practices, which guides organizational members to behave properly toward the external environment during economic business processes
Chang, 2015	Shared beliefs, values, norms, symbols, and social stereotype about organizational environment management and shapes the standard behaviors expected from the individuals
Fraj et al., 2011	What the Company holds within the values of internal environmental conservation throughout the organization
Wehr., 2011	Methods of understanding general group practice which has components of the ecosystem that affect sustainability
Harris and Crane., 2002	The formulation of assumptions, values, symbols, and things established by the organization that reflects either the wishes or needs of the company to operate in the environment properly
Office of Green Industry Promotion and Development., 2013	Cooperation of employees at all organizational levels will motivate personnel to implement friendly environmental policies in their business operations until it becomes a part of their organization culture

The study of many researchers and scholars has given the meaning of green culture. The researcher, therefore, concluded that a green culture is shared values that are in line with the organization's needs, including the operation of environmentally friendly organizations.

The researcher reviewed the research and literature on green culture variables. Many scholars and researchers have studied, and it can summarize the empirical variable, or the observed variables as shown in Table 2.11.

Table 2.11 Green Culture Observed Variables

Researcher/ Academic	Subject of Study	Latent Variables	Observed Variables	Economic Sector
Yang et al.,2016	Green information systems, green culture, and green innovation effectiveness	Green Culture	1.Adaptation 2. Consistency 3. Participation 4. Mission	Production
Subramanian & Chong., 2015	Turkish company research	Green Culture	1. Leadership 2. Information reliability 3. Employee participation 4. Employee empowerment	Production
Al-bahussin & El-garaihy., 2013	Influence of green culture and human resource practices on Chinese manufacturing environmental performance	Corporate Culture	1. Official culture 2. Innovation Culture 3. Support culture	Industrial
Olson., 2008	How unique organizational culture leapfrogs innovation through countries	Green Culture	1. Practice as an example. 2. Training 3. Installing the right tools	Industrial

Table 2.11 Green Culture Observed Variables (Cont.)

Researcher/ Academic	Subject of Study	Latent Variables	Observed Variables	Economic Sector
			4. Measuring and reporting performance 5.Create accountability together 6. Formulation of a communication plan and management change	
Harris & Crane, 2002	Creating a 'Green' Strategy at the Enterprise Level	Green Culture	1. Belief in performance 2. The main culture of the industry 3. Organizational barriers 4. Cultural fragmentation 5. Symbolic events 6. Business choice philosophy 7. Anti-personnel change	

The researcher has studied the research and related literature of the empirical variables or the observed variables of green culture. With many researchers and scholars, the researcher has studied the empirical or observed variables used to measure green culture, synthesized, and compare dimensions and elements of green culture of many researchers and scholars. Those mentioned in Table 2.12.

Table 2.12 Green Culture Dimensions Comparison

Green Culture	Roscoe, Subramanian, Jabbour, & Chong, 2019	Yang et al., 2016	Al-bahussin & El-garaihy., 2013	Olson., 2008
Adaptability		✓		
Consistency		✓		
Involvement	✓	✓		
Mission		✓		
Role model				✓
Training				✓
Appropriate instrument installation				✓
Measurement and reporting				✓

Table 2.12 Green Culture Dimensions Comparison (Cont.)

Green Culture	Roscoe, Subramanian, Jabbour, & Chong, 2019	Yang et al., 2016	Al-bahussin & El-garaihy., 2013	Olson., 2008
Mutual ownership				✓
Communication	✓			✓
Leadership	✓		✓	
Employee empowerment	✓		✓	

2.2.1 Leadership

After a review of the literature and theory, the author would like to define a definition of leadership as entailing an individual's ability to formulate policies and goals which drive and improve an organization's ability for vision and long-term sustainable development as can be seen in Table 2.13.

Table 2.13 Leadership Definitions

Researcher/ Academic	Leadership Definitions
Roscoe, et al., 2019	A proactive stance on environmental issues has been shown to help staff better understand environmental issues and gives employees the ability to implement positive environmental solutions

Table 2.13 Leadership Definitions (Cont.)

Researcher/ Academic	Leadership Definitions
Dubey et al., 2015	Setting environmental policies and goals to provide resources, training, and encourage improvement which involves defining action with a long-term vision driven by change according to customer needs which is compared with internal management control
Egri and Herman., 2000	The ability to influence individuals and drive organizations to achieve a vision of sustainable development of the ecosystem in the long term
Lloyd C. Harris., 2002	Behave in a sustainable manner, organizational actions will need to go beyond technical fixes and embrace new environmentally responsible values

The study of many researchers and scholars has given the meaning of leadership. The researcher, therefore, concluded that a leadership is providing clear vision, inspiration, motivation to the employees and support employees' developmental needs towards the achievement of environmental goals of the organization.

2.2.2 Communication

From the study of many researchers and scholars who have given the meaning of communication, the researchers concluded that communication refers to various forms of communication. Between the organization and stakeholders, both internal and external which involves implementing an environmental strategy, environmental activities environmental impact, and environmental performance results of the organization. The researcher has studied research related to the empirical variable or observed variable, the communication. Many scholars have given the meaning of communication as in Table 2.14 as follows.

Table 2.14 Communication Definitions

Researcher/ Academic	Communication Definitions
Roscoe, et al., 2019	Credible proenvironmental messages (message credibility) from senior management encourage environmentally conscious employees to act in an environmentally responsible manner
Jabbour, 2015	The various forms of interaction between organizations and their stakeholders concerning environmental performance
Uusi-Rauva and Nurkka., 2010	Internal communication formats within the organization, this will affect the participation of employees in implementing the organization's environmental strategy
Montabon et al., 2007	Various communication with stakeholders (shareholders, employees, customers, suppliers, and society) on the environmental impact of the company and/ the company's environmental efforts or activities to determine how well it is performing
Zutshi and Sohal.,2004	Two-way communication between the organization and its internal and external stakeholders is a fundamental element for the implementation and maintenance of a successful environmental management system

The study of many researchers and scholars has given the meaning of green culture communication. The researcher, therefore, concluded that a communication is the action of communicating from management on green values within the organization that influence employees' behavior with regards to environmental performance.

2.2.3 Employee Empowerment

From the study of many researchers and scholars who have given the meaning of Employee empowerment. The researcher, therefore, concluded that Employee empowerment

means encouraging employees to share, take responsibility in decision-making and act in managing, and fostering environmental creativity. The researcher studied the research related to the empirical variable or the observation variable, namely employee participation. Many scholars gave the meaning of Employee empowerment as shown in Table 2.15.

Table 2.15 Employee Empowerment Definitions

Researcher / Academic	Employee Empowerment Definitions
Jabbar and Abid., 2015	Encouraging employees to make decisions and act in promoting environmental initiatives
Ahuja., 2015	Encouraging employees to delegate responsibilities to other employees. It depends on the knowledge of the team on the causes of waste and the reduction of those waste
Srinivasan & Kurey, 2014	The level of employee autonomy for making effective decisions involving situations and requirements that are beyond formative rules
Zutshi and Sohal., 2004	Employees are involved in the environmental management system to achieve environmental goals. Employees are involved in environmental management decisions related to their job and are encouraged to provide feedback

The study of many researchers and scholars has given the meaning of employee empowerment. The researcher, therefore, concluded that a employee empowerment is the level of employee autonomy for making effective decisions involving situations and requirements that are beyond formative rules that improve the environmental awareness of employees.

2.2.4 Green Culture Model Summary

From the review of concepts, theories, literature, and related research which consists of an apparent variable or an observed variable. Many researchers and scholars have studied, and

this can be summarized in 3 variables: leadership, communication, and employee empowerment. The study model can be summarized as shown in Figure 2.3 as follows.

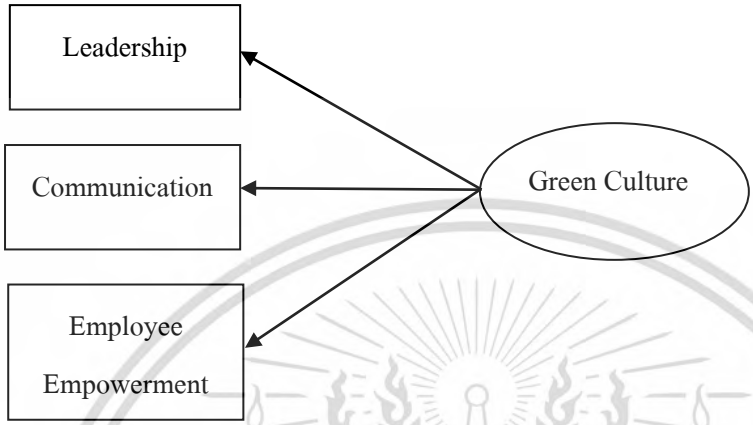


Figure 2.3 Green Culture Model Observed Variables

2.6 The concepts and theories of Green Innovation

Green innovation development is a very popular and innovative development approach for companies who want to show care to the environment and society. Many Thai companies have adopted the concept of green sustainability through "Green Innovation" from the driving force of the business that wants to create or change the direction of business operations to sustainability. Using the concept of conservation of natural resources and the environment to make the business in parallel with society and the environment sustainably. Making industrial businesses that may have been known as a waste user of natural resources or creating a product or service that after its expiration date becomes toxic waste or destroying the environment. Both turn to be leaders in social and environmental responsibility to avoid negative images or attitudes that will arise with the enterprise. Halila and Rundquist (2 0 1 1) have concluded the term green innovation (Eco-Innovation) is a word that has the same meaning as the phrases environmental Innovation, green Innovation, or sustainable innovation, which are ideas that lead to a sustainable environment through ecosystem improvement.

Therefore, Green innovation will lead to the creation of environmentally friendly greener products, non-toxic products manufactured from natural materials instead of materials that are harmful to humans, and the environment will guide the development of future commercial innovations. Green innovation will be the best way to reduce environmental pollution. Improving the organization's environmental performance and adherence to laws and regulations but organizations need to act in a leadership manner rather than a follower (Seman, et al., 2012).

From relevant literature reviews, it was found that there are 2 important theories and related to white innovation as follows.

1. *Innovation Economics Theory* consists of technology innovation driven by technology development and market demand factors. Empirical evidence also suggests that the two are related (Pavitt, 1984). Green innovation in mind Efficient new eco-friendly technology can happen under technological pressure factors. While the environmentally friendly product or image can occur under the pull factor of the market (Cleff & Renning, 2000).

2. *Environmental Economics Theory* from environmental problems and external factors. Making environmental regulations and policies Regulation push and pull are identified as the best driving factor for green innovation (Cleff & Renning, 2000) such as taxes and trading licenses. It is identified as the most dynamic effective environmental policy tool (Fischer et al., 1998).

Researchers have studied concepts, theories, and related research related to green innovation. Scholars gave the meaning of the green innovations can be summarized in Table 2.16 as follows.

Table 2.16 Green Innovation Definitions

Researcher/Academic	Green Innovation Definitions
Antonio Leal-Millán., 2017	All type of innovations that contribute to the creation of key products, services, or processes to reduce the harm, impact, and deterioration of the environment while optimizes the use of natural resources
Triguero et al., 2013	The implementation of several management activities aimed at reducing environmental impact

Table 2.16 Green Innovation Definitions (Cont.)

Researcher/Academic	Green Innovation Definitions
Seman et al., 2012	New methods, ideas, products, processes, or services that differentiate themselves from competitors and reduce adverse environmental impacts
Carrillo-Hermosilla et al., 2010	Reducing the environmental impact caused by consumption and production activities Whether this is a major motivation for development or transmission or not
Oltra and Saint Jean., 2009	New or modified processes, operations, systems, and products which is beneficial for the environment and responsible for environmental sustainability
OECD., 2009	Creating or inventing new products and services or the development of the original for the better clearly, including the production process, marketing method, organizational structure changes or changes in the way business work. This may be something that may or may not be intentional to happen that will lead to the development of the environment better than the alternatives that are currently
Bernauer et al., 2006	Incorporating all innovations with an environmental benefit, regardless of whether such benefits are the primary objective of innovation
Chen et al.,2006	Hardware and software innovations in connection with a product or process includes technological innovations related to energy saving, pollution prevention, and recycling of waste, green product design or management of the corporate environment

Table 2.16 Green Innovation Definitions (Cont.)

Researcher/Academic	Green Innovation Definitions
Kemp and Arundel.,1998	New or modified processes, techniques, systems, and products to avoid or reduce environmental hazards
Hemmelskamp., 1996	Innovation aimed at reducing negative environmental impacts which arises from the manufacturing process (Process innovation) and products (product innovation)

The study of many researchers and scholars has given the meaning of green innovation. The researcher, therefore, concluded that a green innovation is the integration of all innovations that are different from competitors and reduce environmental impact, which leads to choices for better environmental development.

2.3.1 Green Product Innovation

The researcher has studied the research related to the empirical or observed variable, the green product innovation. Many researchers and scholars gave the meaning of green product innovation as shown in Table 2.17 as follows

Table 2.17 Green Product Innovation Definitions

Researcher / Academic	Green Product Innovation Definitions
Antonio Leal-Millán., 2017	Green innovation comprises all type of innovations that contribute to the creation of key products, services, or processes to reduce the harm, impact, and deterioration of the environment at the same that optimizes the use of natural resources. Such type of innovation develops a critical role these days because it channels an appropriate use of the natural resources to improve the human well-being. Moreover, the creation and incorporation of changes in products and production processes could contribute to sustainable

Table 2.17 Green Product Innovation Definitions (Cont.)

Researcher / Academic	Green Product Innovation Definitions
	development. Innovation develops a critical role these days because it channels an appropriate use of the natural resources to improve the human well-being. Moreover, the creation and incorporation of changes in products and production processes could contribute to sustainable development
Oltra and Saint Jean, 2009	As innovations that consist of new or modified processes, practices, systems, and products which benefit the environment and so contribute to environmental sustainability
Andersen, 2008	As innovations which can attract green rents on the market. The concept is closely related to competitiveness and makes no claim on the "greenness" of various innovations. The focus of eco-innovation research should be on the degree to which environmental issues are becoming integrated into the economic process

The study of many researchers and scholars has given the meaning of green product innovation. The researcher, therefore, concluded that a green product innovation is products that protect or promote the environment, which is due to energy conservation or efficient use of raw materials, reducing the use of toxins and waste, to the creation of new products that can be sold.

2.3.2 Green Process Innovation

The researcher has studied the research related to the empirical or observed variable of the green process innovation. Many researchers and scholars gave the meaning of green process innovation as shown in Table 2.18.

Table 2.18 Green Process Innovation Definitions

Researcher / Academic	Green Process Innovation Definitions
Chen, Lai et al., 2006	Define green innovation "as 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"
Kemp and Pearson., 2007	The innovation object may be a product, process, service, or method (e.g., business model) and that an innovation should satisfy a user`s need or solve a problem and therefore be competitive on the market. Concerning the environmental aspect all cited definitions agree that the innovation should have a reduced negative impact (i.e., lower negative externalities)

The study of many researchers and scholars has given the meaning of green process innovation. The researcher, therefore, concluded that a green process innovation is process of reducing environmental impact which saves energy, prevents pollution, and reuses of waste. There also are no production toxicities at present or add a new process.

2.3.3 Green Managerial Innovation

The researcher has studied the research related to the empirical or observed variable of the green managerial innovation. Many researchers and scholars gave the meaning of green managerial innovation as shown in Table 2.19.

Table 2.19 Green Managerial Innovation Definitions

Researcher / Academic	Green Managerial Innovation Definitions
Chengli Shu., 2019	Green management enhances innovation performance to a greater extent than financial performance. This research provides an

Table 2.19 Green Managerial Innovation Definitions (Cont.)

Researcher / Academic	Green Managerial Innovation Definitions
	integrative framework illustrating how firm-level factors and institutional environments influence green decisions and proposes that green management may impact firm performance measures in distinctive ways
Arundel and Kemp, 2009	A new concept of great importance to business and policy makers. It is about innovations with lower environmental impact than relevant alternatives. The innovations may be technological or non-technological (organizational, institutional, or marketing-based). Eco-innovations can be motivated by economic or environmental considerations. The former includes objectives to reduce resource, pollution control, or waste management costs, or to sell into the world market for eco-products

The study of many researchers and scholars has given the meaning of green managerial innovation. The researcher, therefore, concluded that a green managerial innovation is the organization's endeavor to incorporate green practices and objectives into its corporate strategy.

2.3.4 Green Technological Innovation

The researcher has studied the research related to the empirical or observed variable of the green technological innovation. Many researchers and scholars gave the meaning of green technological innovation as shown in Table 2.20.

Table 2.20 Green Technological Innovation Definitions

Researcher / Academic	Green Technological Innovation Definitions
Kenton, W., 2020	A type of technology that is considered environmentally friendly

Table 2.20 Green Technological Innovation Definitions (Cont.)

Researcher / Academic	Green Technological Innovation Definitions
	based on its production process or its supply chain. Green tech–which is an abbreviation of "green technology"–can also refer to clean energy production; clean energy production is the use of alternative fuels and technologies that are less harmful to the environment than fossil fuels
Cainelli G., 2015	To fundamentally solve the environmental issues caused by coal mining, great breakthroughs have been made by using green mining technology. It is in this industry that green process innovation is highly appreciated
Tseng et al., 2013	Information on a comprehensive material saving plan and the management of documentation and information

The study of many researchers and scholars has given the meaning of green technological innovation. The researcher, therefore, concluded that a green technological innovation is the behavior of creating environmentally friendly new technology of product and process, pursuing economic growth benefits brought by technology innovation.

2.3.5 Green Innovation Model Summary

From the review of concepts, theories, literature, and related research which consists of an apparent variable or an observed variable. Many researchers and scholars have studied, and this can be summarized in 4 variables: green product innovation, green process innovation, green managerial innovation, and green technological innovation. The study model can be summarized as shown in Figure 2.4.

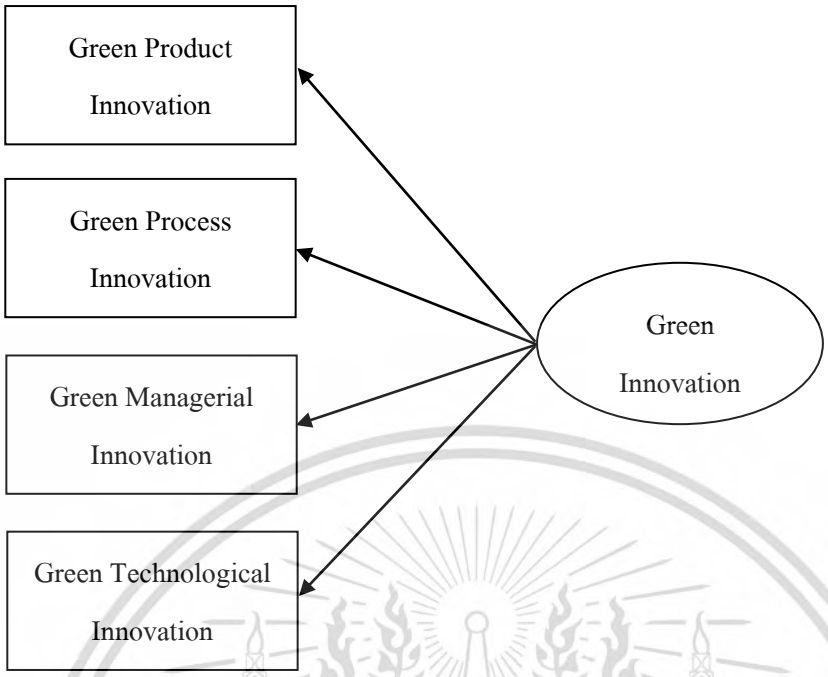


Figure 2.4 Green Innovation Model Observed Variables

2.7 The concepts and theories of Environmental Performance

Environmental performance is now an important measure of an organization's success not only at the regional level but also at the international level. The International Organization for Standardization (ISO) has put forward the environmental performance assessment. (Environmental Performance Evaluation - EPE) is a recommendation standard in the environmental management standards system.

When businesses around the world conform to the same standards, management techniques, business processes and production controls, quality, products, and services all become standardised, The International Organisation for Standardisation (ISO) is the largest accepted publisher and of standards in the world. These standards are critical for regulating business practices, manufacturing, and quality, there are 10 ISO standards as follows;

1. ISO 9000 - Quality Management
2. ISO / IEC 27000 - Information Security Management Systems
3. ISO 14000 – Environmental Management
4. ISO 31000: 2018 - Risk Management

5. ISO 50001: 2018 - Energy Management
6. ISO 26000: 2010 -Social Responsibility
7. ISO 28000: 2007 –Specifications for Security Management Systems for the Supply Chain
8. ISO 37001: 2016 Anti-Bribery Management Systems
9. ISO 45001 – Occupational Health and Safety
10. ISO 22000 –Food Management Systems

This research is interested in examining the internal factors on an organization's environmental performance, so the researcher has selected ISO 14000 certified manufacturing companies to study in this research. ISO 14000 – Environmental Management is a family of standards that provides the necessary tools and guidelines for companies to manage their environmental responsibilities. These standards use tools such as audits, communications, life-cycle analysis, and environmental challenges. This standard can be used by any organisation regardless of the industry.

The benefits of an environmental performance assessment include:

1. Improve the environment quality
2. Improve organizational efficiency and increase profit.
3. Assist in the management of expenses / production costs.
4. It helps to ensure proper use of resources.
5. Help to understand the environmental impact
6. Demonstrate compliance with the law
7. Is the basis for improving the environmental management system. (Environmental Management System - EMS) that is the organization
8. It is a supporting information to reward employees.
9. Improve relationships with customers and communities.
10. Increase awareness of the organization and
11. Support the performance comparison process. (Benchmarking)

Clearly the benefits of ISO 14000 certification are many: gaining marketplace and shareholder advantages, insurance hedging, reduced costs, other financial benefits, and achieving higher productivity. There are a few underlying potential benefits of the ISO 14001 certification (D'Souza, 2004):

- ISO 14000 helps firms to implement their commitment to environmental excellence, helps avoid multiple registrations, inspections, certifications, labels and conflicting requirements, and removes the need for certain regulatory “command and control” initiatives.
- ISO 14000 should facilitate international trade and remove trade barriers.
- These systems can also assist companies in targeting green consumers. By showing their support for environmental protection issues through their marketing of green products, organizations can pursue a distinctive way of competing.

Environmental index (Environmental Indicators) can be divided into two broad categories:

1. Environment Index Environmental Condition Indicators (ECIs) provide information about the environment. This helps the organization to know the impact or opportunity that the organization will have an environmental impact because of its operations. Makes it possible to plan and evaluate the performance.

2. Environmental Performance Indicators (EPIs) represent numerical measurements both financial and non-financial, which outlines critical information about environmental impact, compliance with regulations Relationships with stakeholders, and systems involved in the organization (Veleva and Ellenbecker, 2000; Ilinitch et al., 1998; Dye & Chinander, 2001). The Environmental Performance Indicator also deals with measurements of interactions between business and the environment (Olsthoorn et al., 2001), which approximates the effectiveness and efficiency of environmental actions. Establish a measure (Neely et al., 1995) where the indicator can act as a representative or a delegate of the organizational phenomenon (Ijiri, 1975). The Environmental Performance Inicator is divided into two groups: Management Performance Indicators (MPIs) and Operational Performance Indicators (OPIs).

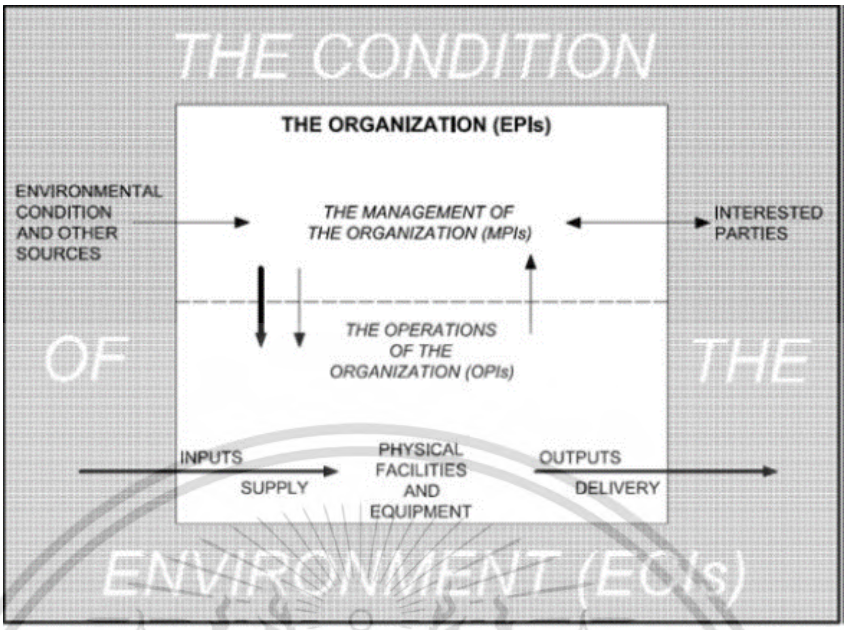


Figure 2.5 The Relationship between EPIs (MPIs & OPIs) and ECIs

Source: Ministry of Industry, 2010

3. Management Indices (MPIs) are indexes that are relevant to information that show the ability and effort of an organization to manage an organization to improve its environmental performance, such as legal compliance training. Raw material changes to improve production efficiency, waste utilization, costs of environmental management and product improvement to reduce environmental impact, etc.

4. Operational Indices (OPIs) are indicators that provide information on an organization's environmental performance. OPIs correlate with an organization's environmental problems such as raw material consumption. Energy and activity Enterprise service Utilities and machinery, including design, operation, and maintenance. The generation of waste from the activities of the organization, the relationship between Inputs-Outputs.

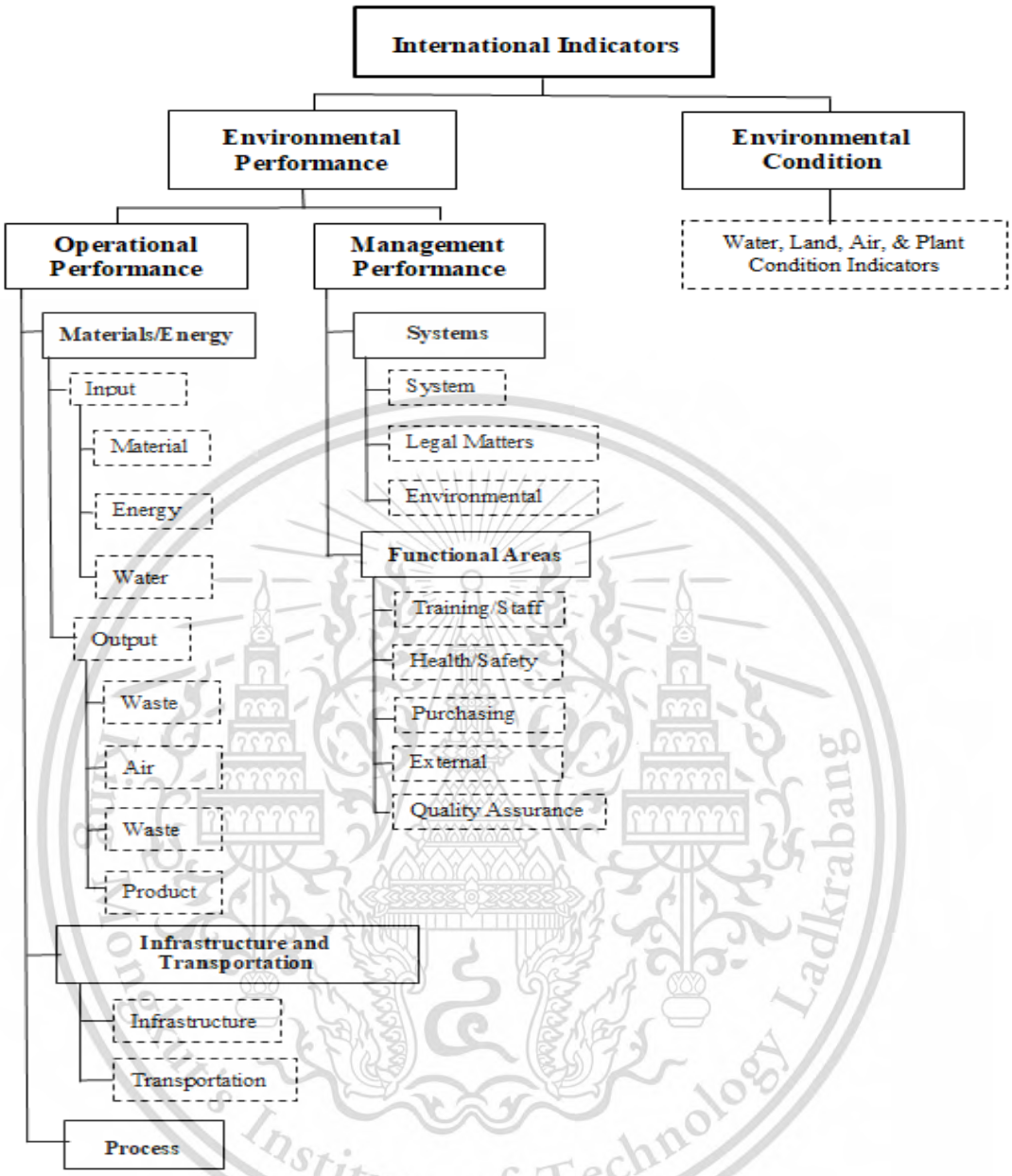


Figure 2.6 Environmental Index (Environmental Indicators)

Source: Husgafvel, R. & Pajunen, N. & Dahl, O. & Heiskanen, K. & Ekroos, A. & Virtanen, K., 2019

Type of environmental index is classified as follows

1) 1.1 Absolute indicators are indices that focus on real operational values, whereas 1.2 Relative indicators are also divided into two forms: Quotas, often used in

comparisons or proportions. The ratios are used to indicate the relationship between the absolute index and the unit of operation associated with that index.

2) Corporate, site or process indicators: 2.1 process indicators will be appropriate for departments that need indexes as a planning tool, control, and monitoring of performance and 2.2 site indicator and corporate indicator used to monitor performance related to environmental management and provide information to communicate in the organization

3) Quantity and cost related indicators are often related to the quantity that is physically measured. But nowadays, organizations tend to pay attention to environmental costs. It also has an index of expenses.

4) Aggregated is an index formed of the same type of information, but from each source. This can be collected and expressed in aggregate values, for example, tons of pollutants released from the entire production process each year, including pollutants released from various parts of the production.

5) Weighted is an index that is adjusted to add importance to weight. This is because each index has a different significance.

The researcher has studied the concepts, theories, and related research related to the environmental performance of the organization. With researchers and scholars gave the meaning of environmental performance of the organization for many people can be summarized in Table 2.21.

Table 2.21 Environmental Performance Definitions

Researcher / Academic	Environmental Performance Definitions
Paillé et al., 2014	The commitment of firms to protect the environment and to demonstrate measurable operational parameters that are within the prescribed limits of environmental care
Chan, 2005	Organizational initiatives to meet and exceed societal expectations vis-à-vis the natural environment
Stanwick, P.A. & Stanwick, S., 1998	The level of polluting emissions caused by that company

The study of many researchers and scholars has given the meaning of environmental performance. The researcher, therefore, concluded that an environmental performance is performance indicators of the implementation of the organization's environmental management plan that complies with rules or regulations to reduce the effects and toxic waste that will occur to the environment.

2.4.1 Environmental Regulation Compliance

The researcher has studied the research related to the empirical or observed variable of the environmental regulation compliance. Many researchers and scholars gave the meaning of environmental regulations compliance as shown in Table 2.22.

Table 2.22 Environmental Regulation Compliance Definitions

Researcher / Academic	Environmental Regulation Compliance Definitions
Denise Vu Broady, Holly A. Roland., 2011	To environmental laws, regulations, standards, and other requirements such as site permits to operate. In recent years, environmental concerns have led to a significant increase in the number and scope of compliance imperatives across all global regulatory environments. Being closely related, environmental concerns and compliance activities are increasingly being aligned with corporate performance goals and being integrated to some extent to avoid conflicts, wasteful overlaps, and gaps
Anabela Botelho, 2013	behavior and enforce environmental regulations. The regulated firms, on the other hand, must be informed about the legal limits imposed on them and subsequently, they must be able to comply with those limits. Using a questionnaire on the pulp and paper industry in Portugal we found that firm's decision to comply with environmental regulations is strongly influenced by firms' information on their legal obligations and that this effect is

Table 2.22 Environmental Regulation Compliance Definitions (Cont.)

Researcher / Academic	Environmental Regulation Compliance Definitions
	stronger for smaller firms
Paillé, Chen, Boiral, & Jin, 2014	This International Standard helps an organization achieve the intended outcomes of its environmental management system, which provide value for the environment, the organization itself and interested parties. Consistent with the organization's environmental policy, the intended outcomes of an environmental management system

The study of many researchers and scholars has given the meaning of compliance with environmental regulations. The researcher, therefore, concluded that a compliance with environmental regulations is conforming to environmental laws, regulations, standards, and other requirements such as site permits to operate.

2.4.2 Limiting Environmental Impacts

The researcher has studied the research related to the empirical or observed variable of the limiting environmental impacts. Many researchers and scholars gave the meaning of limiting environmental impacts as shown in Table 2.23.

Table 2.23 Limiting Environmental Impacts Definitions

Researcher / Academic	Limiting Environmental Impacts Definitions
Wendling, Z. A.,2020	EPI indicators provide a way to spot problems, set targets, track trends, understand outcomes, and identify best policy practices. Good data and fact-based analysis can also help government officials refine their policy agendas, facilitate communications with key stakeholders, and maximize the return on environmental investments

Table 2.23 Limiting Environmental Impacts Definitions (Cont.)

Researcher / Academic	Limiting Environmental Impacts Definitions
	The EPI offers a powerful policy tool in support of efforts to meet the targets of the UN Sustainable Development Goals and to move society toward a sustainable future
Fei-Baffoe et al., 2013	Helping companies identify and manage the risks and impacts of environmental issues, as well as related expenses
Montabon et al., 2007	Measurement level of proactive methods to reduce waste in principle and/clean up waste prior to production

The study of many researchers and scholars has given the meaning of limiting environmental impacts. The researcher, therefore, concluded that a limiting environmental impact is reducing the negative impacts of production on the environment.

2.4.3 Waste Reduction

The researcher has studied the research related to the empirical or observed variable of the waste reduction. Many researchers and scholars gave the meaning of waste reduction as shown in Table 2.24.

Table 2.24 Waste Reduction Definitions

Researcher / Academic	Waste Reduction Definitions
Roscoe, et al., 2019	Significant % reduction of waste (solids, liquids, gaseous …)
Chan, 2005	Actions taken before waste is generated to either reduce or completely prevent the generation of waste. The combined efforts of waste prevention, reuse, composting, and recycling practices

Table 2.24 Waste Reduction Definitions (Cont.)

Researcher / Academic	Waste Reduction Definitions
Business Guide for Reducing Solid Waste, 1993	All actions to reduce the number and/or toxicity of waste that needs to be disposed conversation to avoid confusion

The study of many researchers and scholars has given the meaning of waste reduction. The researcher, therefore, concluded that a waste reduction is a set of processes and practices intended to reduce the amount of waste produced.

2.4.4 Environmental Performance Model Summary

From the review of concepts, theories, literature, and related research which consists of an apparent variable or an observed variable. Many researchers and scholars have studied, and this can be summarized in 3 variables: environmental regulation compliance, limiting environmental impacts, and waste reduction. The study model can be summarized as shown in Figure 2.7 as follows.

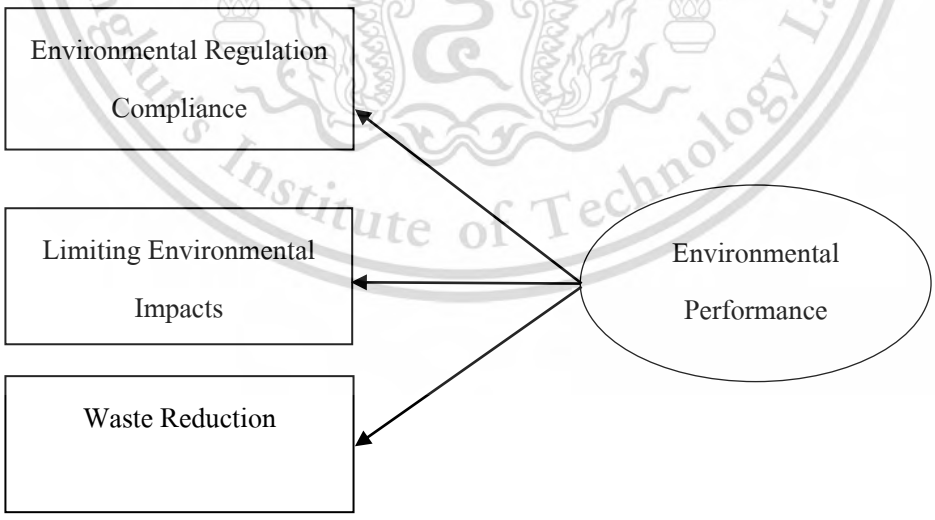


Figure 2.7 Environmental Performance Model Observed Variables

2.8 The literature review and research on the causal relationship of variables

Influence of Green Human Resource Management Practices on Green Culture

Jabbour & Santos (2008), Jabbour et al., (2010), and Subramanian & Chong (2015) has found the positive impact on green human resource management practices (GHRMP) and promote the firm's environmental performance.

A study by Attaianese (2012) found that employees trained and incentivised to engage in proenvironmental activities ultimately helped to develop and promote a green culture throughout the firm.

Roscoe et al. (2019) has conducted a large-scale survey of 204 employees at Chinese manufacturing firms and found that pro-environmental HRM practices including hiring, training, appraisal, and incentivisation support the development of the enablers of green organisational culture.

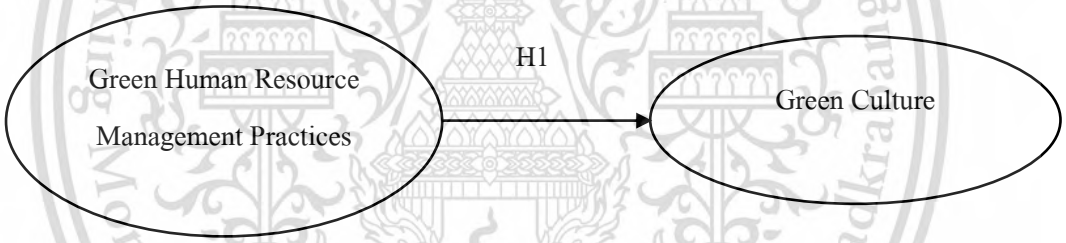


Figure 2.8 Influence of Green Human Resource Management Practices on Green Culture

Influence of Green Human Resource Management Practices on Environmental Performance

The study of Renwick et al., (2013) & Rani et al., (2014) have found about the importance and implementation of GHRM practices. Green human resource practices can be implemented in an organization through green recruitment, training and development, performance management and appraisal, compensation, pay and reward, and employment relation.

AnuSingh & Shikhathe (2015) has studied on the relationship between green human resource factors pertaining to environmental issues and organizational environmental performance as perceived by the organization's employees through human resource factors and

found that these factors have positively relationship on environmental performance is measured in ISO 14001 certified manufacturing organizations.

Jermsittiparsert, et al. (2019) found and suggested the Green HR practices positively influence environmental performance at Indonesian manufacturing industry. The study of Yusoff, et al. (2020) revealed that green HRM practices (green recruitment and selection, green training and development, and green compensation) have a meaningful relationship with environmental performance in Malaysia's hotel industry.

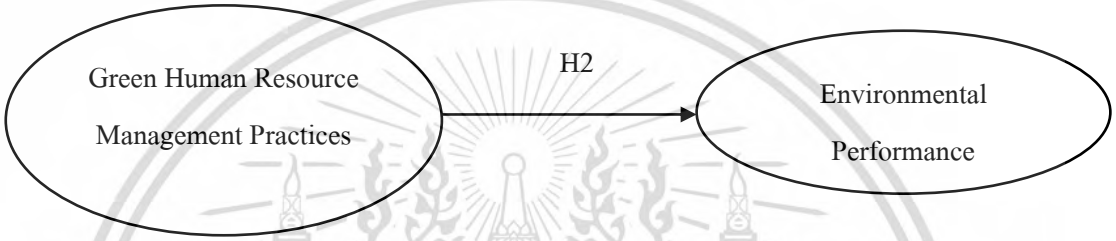


Figure 2.9 Influence of Green Human Resource Management Practices on Environmental Performance

Influence of Green Human Resource Management Practices on Green Innovation

The study from Jiménez-Jiménez & Sanz-Valle (2008) using structural equations modelling with data collected from 173 Spanish firms, this study analyses them, and findings show that innovation contributes positively to business performance and that human resource management enhances innovation.

A study of Singh et al. (2020) has examined the impact of GHRM on green innovation in small and medium enterprises (SMEs) and the results showed that the adoption of GHRM practices, particularly green ability, opportunity, and motivation, promoted SMEs' capability for products, services and procedures innovation.

Song et al. (2020) study on the effects of green human resource management and managerial environmental concern on green innovation, from 143 firms in China, and found that GHRM can positively influence green innovation, and green human capital mediated the link between GHRM and green innovation.

Sepahvand, et al. (2020) found that green human resource management measures in waste processing companies have a positive and significant effect on green innovation both directly.

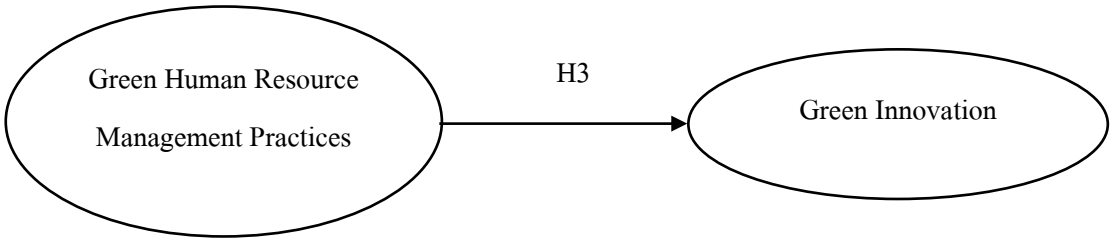


Figure 2.10 Influence of Green Human Resource Management Practices on Green Innovation

Influence of Green Culture on Environmental Performance

Lin & Ho (2011) reported positive relationship between management support and adopting green practice in Chinese logistic firms, which will ultimately improve environmental performance.

Sugita and Takahashi (2015) found that organizational culture comprises different aspects that play different roles in environmental management or sustainability management, and organizations need to cultivate green culture to guide employee behaviour in different aspects of their collective effort. Based on a case study of nine companies in various industries.

Wirtenberg (2014) analysed how they defined, developed, and integrated sustainability into organizational culture and strategy as well as employees' mentality, and gave a practical guidance on how organizations build green culture by taking advantage of their unique capabilities, knowledge, and purposes to cater to both long-term sustainability goal and short-term profitability requirement.

A study by Kassar et al. (2019) on the impact of green innovation and environmental performance in the Middle East and North Africa, where a direct, positive, and significant impact was observed with green products and environmental performance.

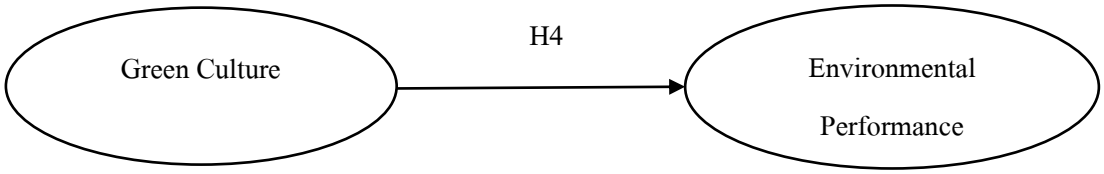


Figure 2.11 Influence of Green Culture on Environmental Performance

Influence of Green Culture on Green Innovation

O'Regan and Ghobadian (2005) proposed that innovation is driven by a company's culture, leadership and strategic planning. They also found that a high level of innovation in firms resulted from a better-defined culture than with firms having less innovation.

Fok et al. (2012) studied the relationships among individuals' green orientation, employee perceptions of organizational commitment to the green movement, and organizational culture. Employees in organizations of which culture is aligned with the green movement are likely to participate in sustainability effort and enhance relevant organizational performance and positive environmental impact.

Chen et al. (2012) found a positive relationship between green organizational culture and green innovation in the manufacturing industry.

Similarly, Chang (2015) found positive relationships between two variables in the manufacturing industry. The results from the study of Gürlek & Tuna (2017) indicate that green organizational culture has a positive effect on green innovation and competitive advantage. Accordingly, green organizational culture is an important determinant for green innovation and competitive advantage. In addition, green innovation acted as a full mediator of the effects of green organizational culture on competitive advantage. Specifically, green organizational culture predicted green innovation, which in turn predicted competitive advantage.

Figure 2.12 Influence of Green Culture on Green Innovation

Influence of Green Innovation on Environmental Performance

Eiadat et. al., (2008) findings that green innovation strategy and company's positive green performance are positively linked and should consequently continue to search for win-win solutions to their environmental problems.

Chiou, et al. (2011) conducted the research across 124 companies from eight industry sectors in Taiwan and found that greening the supplier through green innovation (green product,

green process, and grren managerial innovation) contributes significant benefits to the environmental performance and competitive advantage of the firm.

Conding & Habidin (2012) has study on the structural analysis of green innovation (GI) and green performance (GP) in Malaysian Automotive Industry and found a positive and direct significant relationship between GI and GP.

Tseng et al. (2013) proposes to evaluate green innovation practices with a particular focus on the managerial, process, product and technology innovation aspects in Taiwanese printed circuit board manufacturing firms. They found that green innovation practices have improved the organization environmental performance.

Results of the study of Küçükoglu & Pınar (2015), on 500 companies of Istanbul Chamber of Industry's record, states that green innovation activities (green product and green process innovation) have significant effect on a company's environmental performance and competitive advantage. Especially, green process innovation explains changes on environmental performance and competitive advantage. According to the survey results of Küçükoglu & Pinar (2016) from companies operating in Turkey, it was manifested that factor s directing companies to sustainability having a positive relationship with green organizational culture and green innovation.

Figure 2.13 Influence of Green Innovation on Environmental Performance

2.9 The conceptual framework and hypothesis development

2.9.1 Research Variables

The variables used by the researcher in this research, the researcher has studied, collected, and reviewed ideas, theories, literature, and various research works. This can be summarized as the variables used in the study as follows

2.9.1.1 Exogenous Latent Variables

2.9.1.1.1 Green Human Resource Management Practices

Green Human Research Management Practices consisted of five observed variables;

1. Management Support
2. Recruitment & selection
3. Training
4. Performance evaluation
5. Rewards & compensation

2.9.1.2 Mediator/Intervening Variable

2.9.1.2.1 Green Culture

Green Culture consisted of three observed variables;

1. Leadership
2. Communication
3. Employee empowerment.

2.9.1.2.2 Green Innovation

Green Culture consisted of four observed variables;

1. Green product innovation
2. Green process innovation
3. Green managerial innovation
4. Green technological innovation

2.9.2 Initial hypothesis development

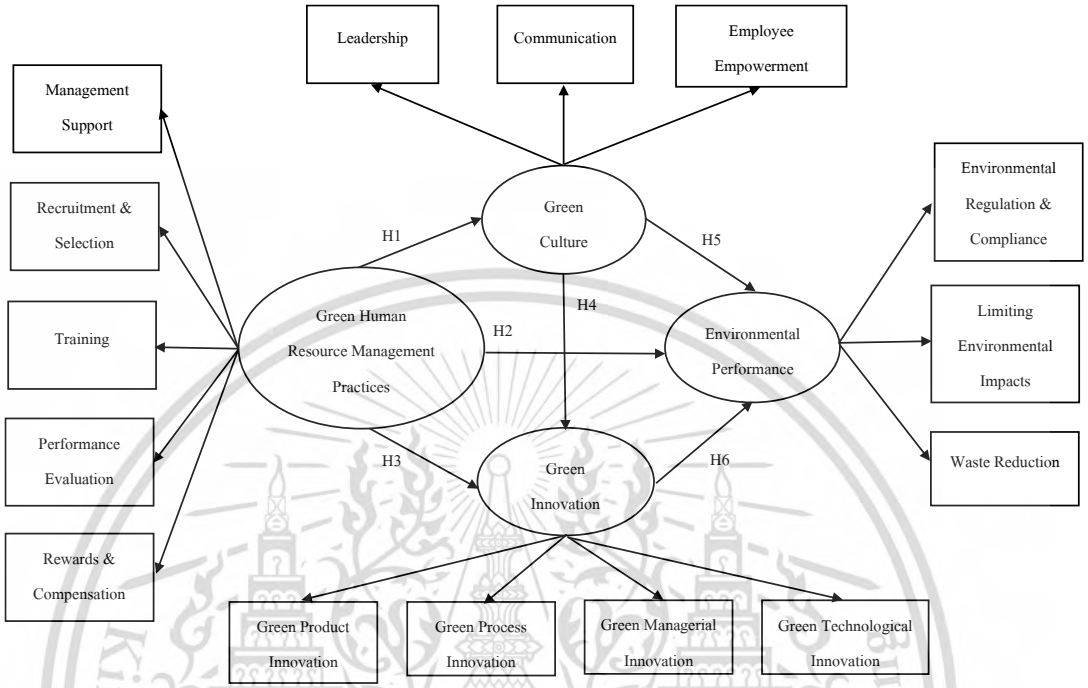


Figure 2.14 Initial Conceptual Framework

H1: Green human resource management practices have a positive impact on green culture

H2: Green human resource management practices have a positive impact on environmental performance

H3: Green human resource management practices have a positive impact on green innovation

H4: Green culture has a positive impact on green innovation

H5: Green culture has a positive impact on environmental performance

H6: Green innovation has a positive impact on environmental performance

CHAPTER 3

RESEARCH METHODOLOGY

This study on “A Structural Equation Model of Variables Influencing Environment Performance of Manufacturing Companies in Thailand” have the main objectives of this study are; to study direct, indirect and combined influence of variables on the environmental performance of manufacturing companies in Thailand, to develop the structural equation model of variables affecting the environmental performance of manufacturing companies in Thailand, and to check the consistency of the form, structure equation of variables that influence the environmental performance of manufacturing companies in Thailand. This research is quantitative research by collecting data using questionnaires with empirical data and designing the research methodology that comprises of details as follows.

3.1 Research Design

3.2 Ethics Clearance

3.3 Research Variables

3.4 Population and Samples

3.5 Research Method

3.6 Data Collection

3.7 Instrument quality inspection results

3.8 Statistical Data Analysis

3.1 Research Design

This research is the quantitative research method, by studying and researching from secondary sources such as books, journals, related research and using the method of data collection with primary data. to find answers about concepts from the factories, population and collect them to analyze the data by using the Structural Equation Model: SEM.

3.2 Ethics Clearance

Ethics approval for the study was obtained from King Mongkut's Institute of Technology Ladkrabang Human Ethics Committee before consultation with experts relating to the questionnaire's design (Pimdee, 2020).

3.3 Research Variables

The variables used by the researcher in this research, the researcher has studied, collected, and reviewed ideas, theories, literature, and various research works. This can be summarized as the variables used in the study as follows

3.3.1. Exogenous Latent Variables

3.3.1.1 Green Human Resource Management Practices

Green Human Research Management Practices consisted of five observed variables including management support, recruitment & selection, training, performance evaluation, and rewards & compensation.

3.3.2 Mediator/Intervening Variable

3.3.2.1 Green Culture

Green Culture consisted of three observed variables including leadership, communication, and employee empowerment.

3.3.2.2 Green Innovation

Green Culture consisted of four observed variables including green product innovation, green process innovation, green managerial innovation, and green technological innovation.

3.3.3 Endogenous Latent Variables

3.3.3.1 Environmental Performance

Environment Performance consisted of three observed variables including environmental regulation compliance, limiting environmental impacts, and waste reduction.

3.4 Population and Sample

This population for use in the study's structural equation modeling of variables potentially affecting Thai industrial factory environmental performance consisted of 666 ISO 14000 certified industrial plants which were had 895 persons involved in environmental performance related roles (Thai Industrial Standards Institute, 2016). Moreover, everyone has a minimum of five years' work experience in their capacity as EP officials in Thai ISO 14000 certified manufacturing companies.

3.4.1 Sample Size Determination

Sample size for the study was determined from theory in which various scholars have suggested that sample sizes from 200 - 400 individuals depending on model complexity and the number of variables (Hair et al., 2016). Sekaran and Bougie (2010) have also added that a sample size is the subset of a population required to ensure that sufficiently enough information is available in which a conclusion can be drawn.

Furthermore & Loehlin. (1992) has recommended that in a CFA, sample sizes should contain at least 200 individuals, which is supported by Monte Carlo simulation results in which CFA models were best suited for sample sizes $\geq$ 200 individuals. However, (Jackson., 2001) has suggested that in a CFA, the sample size should range from 200–400, and the magnitude of the loadings should have standardized values $\geq$ of 0.60. Prior studies have also suggested that the statistical power and precision of CFA and SEM parameter estimates are influenced by the sample size (Brown, 2015; Kyriazos, 2018). This is consistent with other often-cited research from (Kline., 2015 and Markus 2012) which have also stated that the typical sample size in studies where structural equation modeling is used is about 200 cases.

Authors such as (Steven, 1996) have used ratios for the number of independent parameters required to the number of questionnaires needed, with 20:1 frequently used. This is

consistent with research findings from (Schumacker and Lomax., 2010; Hair et al., 2016) which suggested that suitable sample sizes should be 10–20 individuals per research variable, with abnormal curve suggesting the need for an increase in size. Therefore, to maintain stringent standards for the survey, a sample target of 300 was determined which was set after the final questionnaire audit's completion (Kyriazos, 2018) (Table 3.3). This also allowed for non-response errors (Millar & Dillman, 2012) and low response rates (Pielsticker & Hiebl, 2020).

3.5 Research Method

3.5.1 Quantitative Research Method

Quantitative Research is to determine the population and sample for this research, and then create the tools and verify the quality of the tools. The tools were used to find the IOC value by 5 experts. The tools were improved and then put into practice with 30 samples and then used to find the reliability. Reliability was measured from the Cronbach Alpha coefficient, and the instrument was then used to collect data with real samples. And then analyze the quantitative data until obtaining the Final Model.

Quantitative research by studying from secondary sources such as books, journals, related research, and using questionnaires survey to obtain data of ISO 14000 certified companies, then collecting them for analysis using statistical analysis and Structural Equation Model (SEM).

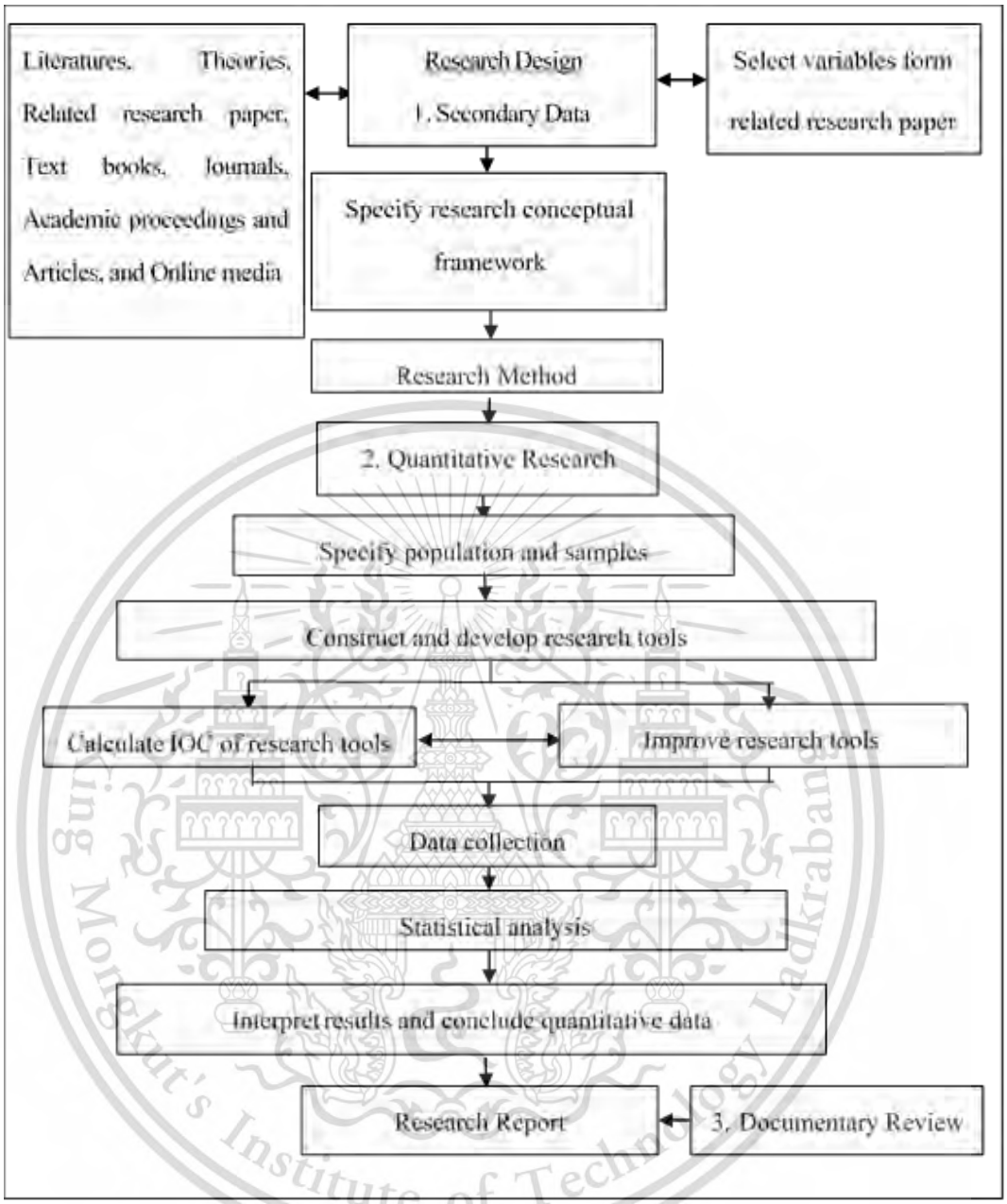


Figure 3.1 Research procedures

Subject research on "Structural equation models of variables that influence the environmental performance of industrial factories in Thailand" The research tools are as follows.

Questionaire

The researcher used questionnaires as a tool for data collection. Afterward the data were analyzed and built a 7 -point Likert Scale questionnaire. It is an adaptation of some existing

scholars' gauges. Including collecting or compiling messages related to the study issues which has been obtained from relevant literature reviews.

Steps for creating research tools

1. The researcher has collected data from the concept and theory. Research work involved the construction of questionnaires.

2. Data collection from concept, theory, and related research to know the relationship between variables. Then developed into a query structure.

3. Prepare a questionnaire according to the structure that the researcher has studied and bring it to 5 relevant experts from both academics and managers involved in an ISO 14000 certified industrial facility to verify the IOC confidence value. To verify consistency between the research questionnaire compared to the research objective that the researcher has determined and consistent with the research problem. The values obtained must be between 0.5–1, the larger the Cronbach's Alpha, the better is the consistency in the measurement (Vogt, 1999). If a value is less than 0.5, the question should be revised to reflect the objective to be measured.

4. Performing improvement of the questionnaire according to recommendations

5. The questionnaire has been updated according to expert advice, experiment with 30 samples before the actual use. To make sure each question is clear Is it the same story or is it the same direction in question or not.

6. The results obtained from all 30 questionnaires were examined for confidence (Reliability) of Cronbach's alpha.

7. The questionnaires obtained from the test are used to improve. The original questionnaire to be used for further data collection.

Building the gauge

This research instrument was a questionnaire used as a tool for the quantitative research. The researcher brought the tools from many places. Based on the conceptual framework and related literature reviews. To analyze the content accuracy (Validity Test) as shown in Table 3.1.

Table 3.1 Measurement Scale Development

Latent Variable	**Manifest/ Observed Variables**	**Developing research questions**	**Total Items**
Green Human Resource Management Practices	Management Support, Recruitment & Selection, Training, Performance Evaluation, and Rewards & Compensation	Al-bahussin & El-garaihy, 2013; AnuSingh & Shikha, 2015; Becker. 2011; Chen et al., 2015; Kaur, 2011; Lisi, 2015; Jabbour et al., 2012; Popli, 2014; Roscoe, et al., 2019; Tung, Baird & Schoch, 2014	28
Green Culture	Leadership, Communications, and Employee Empowerment	Al-bahussin & El-garaihy, 2013; Chen et al., 2015; Cheremisinoff & Haddadin, 2006; Curkovic et al., 2005; Dubey et al., 2015; Forbes Insights, 2014; Kaur, 2011; Lin & Ho 2008; Roscoe, et al., 2019; Montabon 2007; Sammalisto & Brorson, 2008; Srinivasan & Kurey, 2004; Zutshi & Sohal, 2004	22

Table 3.1 Measurement Scale Development (Cont.)

Latent Variable	**Manifest/ Observed Variables**	**Developing research questions**	**Total Items**
Green Innovation	Green Product Innovation, Green Process Innovation, Green Technological Innovation, and Green Managerial Innovation	Alhadid and Abu-Rumman 2014; Ar 2012; Kuei et al., 2012; Kucukoglu and Pinar 2015; Kuei et al., 2012; Lin and Ho 2008; Montabon, 2007; Tseng et al., 2012; Van den Berg et al., 2013; Yang et al. 2016	28
Environmental Performance	Environmental Regulation Compliance, Limiting Environmental Impacts, and Waste Reduction	Antonioli, Mancinelli & Mazzanti, 2013; Chen et al., 2015; Clarkson et al. 2008; Conding and Habidin, 2012; Dubey, Gunasekaran & Ali, 2015; Jabbour et al., 2012; Kaur, 2011; Lisi, 2015; Melnyk et al., 2003; Paille´ et al., 2014; Roscoe, et al., 2019; Tung, Baird & Schoch, 2014; Van den Berg et al. 2013; Weng et al. 2015; Yang et al. 2016; Zhu et al. 2010	15

3.6 Data Collection

Sampling and data collection procedures

The population of the study was a responsible employee with at least five years of experienced in ISO 14000 in Thai manufacturing companies. After reviewing the list of companies that registered ISO 14000, by taking out of the duplicate companies in more than one sector and the companies that have no production line, in Thai Industrial Standard Institute (TISI), the number of registered companies down from 889 to 398.

Sample collection commenced in September – October 2016. Sampling was used by a responsible employee with at least five years of experienced in ISO 14000 in the company. The respondent's demographic characteristic is shown in Table 2. To determine the sample size in this study, 10-20 times of the variable, (Jöreskog, & Sörbom, 1999; Hair et al., 2010), so the 300 certified ISO 14000 manufacturing companies were sufficient, from totally 398 companies or equals 75.37%, and divided into 28 sectors, from totally 54 sectors or equals to 51.85%.

3.7 Instrument quality inspection results

3.7.1 Results of checking for content validity

In this study, the quality of questionnaires was tested by determining the validity of the questionnaire. The content of the questionnaire (Content Validity) by 5 experts to check on the consistency between the developed questionnaire and the doctrinal content with computational techniques, Criteria index value (IOC).

3.7.2 User Response Scale

The researcher selected the gauges to create questionnaires as a 7-level estimating scale, with the scoring criteria 1-7 as follows:

The "7" points refer to strongly agree that the manufacturing company has done and carried out the activities

The "6" score refers to agree that the manufacturing company has done and carried out the activities

The "5" score refers to somewhat agree that the manufacturing company has done and carried out the activities

The "4" score refers to no opinion that the manufacturing company has done and carried out the activities

The "3" score refers to somewhat disagree that the manufacturing company has done and carried out the activities

The "2" score refers to disagree that the manufacturing company has done and carried out the activities

The "1" score refers to strongly disagree that the manufacturing company has done and carried out the activities

Interpretation of the mean of the variables obtained from the gauge of the above manner. There are criteria for finding the intersection of the layers. According to the principle of the classification method as follows:

$$\text{Interval} = \frac{(\text{Highest score - the lowest score.})}{\text{Total Levels}} \quad (3.1)$$

$$= \frac{(7\text{-}1)}{7}$$

$$= 0.85$$

From the calculation it was found that each spacing equal to 0.85 is therefore used as a basis for evaluating the variables in Table 3.2

The questionnaire and measures

Questionnaire research designing is an outline that is used to generate answers to research problems and is an arrangement of conditions for data collection and analysis. The questionnaire was divided into three parts, with Part 1 consisting of the correspondent's general and personal information, while Part 2 consists of 93 items concerning the organizational antecedents to the corporate environmental performance, with utilized a 7-point Likert scale (1 = Strongly Disagree to 7 = Strobngly Agree) (Table 3.2) , and Part 3 is the correspondent's

suggestion. Part 2 was divided into four parts with green human resource management practices consisting of 28 questions, green innovation consisting of 28 questions, green culture consisting of 22 questions, and environmental performance consisting of 15 questions.

Table 3.2 Likert Scale Questionnaire

Mean range	Interpretation
06.11-07.00	Strongly Agree
05.26-06.10	Agree
04.45-05.25	Somewhat Agree
03.56-04.44	No opinion
02.71-03.55	Somewhat Disagree
01.86-02.70	Disagree
01.00-01.85	Straongly Disagree

The validation of the questionnaires was conducted to enhance the quality of the data collection in two stages: First, the content validity was reviewed by 5 relevant experts from both academics and managers to determine the relevancy and validity of the questions, including latent variables, are

1. Mr. Suraya Popongwiwat, Engineering Manager, Somboon Malleable Iron Industrial Co., Ltd.

2. Mr. Jatuporn Sangchan, Information Management Manager, CPRAM Co., Ltd.

3. Mr. Korkoiat Charaswashirakool, Operational Excellence (Lean) Manager, Bayer Thai Co., Ltd.

4. Dr. Arporn Puvitayaphan, Deputy MD and Research and Development Institute Director. Thai Skill Plus Co., Ltd.

5. Dr. Supharuk Aticomsuwan, Human and Community Development Department, Faculty of Education and Development Sciences, Kasetsart University

The Index of Item-Objective Congruence (IOC) (Rovinelli, 1977) showed IOC values ranging from 0.60-1.00 for questions, concurring with the objectives of the evaluation. Second,

the reliability was estimated using Cronbach's alpha, resulting in values ranging from 0.7 or greater (Cronbach, 1951) for variables and from 0.953-0.965 for the 4 latent variables, confirming the reliability of the questionnaires.

Table 3.3 Results of measurement validation

Variables	**No. of items**	**Cronbach's Alpha**
Management Support	8	.946
Recruitment & Selection	3	.870
Training	4	.892
Performance Evaluation	8	.953
Rewards & Compensation	5	.909
Green Human Resource Management Practices	**28**	**.953**
Leadership	6	.961
Communications	6	.954
Employee Empowerment	10	.971
Green Culture	**22**	**.965**
Green Product Innovation	9	.939
Green Process Innovation	8	.953
Green Technological Innovation	7	.950
Green Managerial Innovation	4	.917
Green Innovation	**28**	**.953**
Environmental Regulation Compliance	5	.954
Limiting Environmental Impacts	5	.960

Table 3.3 Results of measurement validation (Cont.)

Variables	**No. of items**	**Cronbach's Alpha**
Waste Reduction	5	.961
Environmental Performance	**15**	**.959**
All items	**93**	**.969**

3.8 Statistical Data Analysis

Analysis of the model was conducted at two main parts. First, for descriptive analysis, statistical means, standard deviation, and inferential statistics were calculated for all variables (Table 4.3). Second, AMOS 21 has been chosen as one of the most popular research software for structural equation modeling analysis. Business research in recent years has shown a greater dependency on structural equation modeling as one of the best mainstream methods to analyze topics of business management field (Sarstedt, Ringle, Smith, Reams, & Hair, 2014). The structural model was initially tested using all possible paths among the variables. Following the elimination of insignificant paths, the model then was tested and analyzed in terms of the remaining paths. The goodness-of-fit measurement was used to measure the level of harmony of functions.

The study of forms, relationships, structures of variables, by using the program to analyze is AMOS 21 to help construct a structural equation model or structural analysis of causal relationships between variables, correlation research analyzed by advanced statistics, and a form of relationship between variables.

Table 3.4 Statistical values involved in evaluating the consistency of the conceptual framework with empirical data

Related statistics	Symbol	Objective	Statistical values that show that the conceptual framework is consistent with the empirical data
Chi-square	χ^2	To test the null hypothesis which is a conceptual framework that is consistent with empirical data	Ns. (p>.05)
Relative Chi-square	χ^2 /df	To prove that the conceptual framework is consistent with the empirical data	χ^2 /df < 2.00
Nested Chi-square	-	To compare other conceptual frameworks to determine which conceptual frameworks are More consistent with empirical data	χ2 (p <.05) and which conceptual framework less Nested χ2 is more consistent with the empirical data
Goodness of Fit Index	GFI	To measure the degree of harmony that fits between 0-1.00	>.90
Normal Fit Index	NFI	Relative Correspondence Scorecard	>.90
Standardized Root Mean square Residual	Standardized RMR	To inform the error of the conceptual framework in the root form of the remainder's square mean in standardized form with a	<.05

Table 3.4 Statistical values involved in evaluating the consistency of the conceptual framework with empirical data (Cont.)

Related statistics	**Symbol**	**Objective**	**Statistical values that show that the conceptual framework is consistent with the empirical data**
		value between 0-100	
Root Mean Square Error of Approximation	RMSEA	To inform the error of the conceptual framework, the root form of the mean square of the approximate error is between 0-100	<.05

Source: Wheaton et al., 1977; Joreskog & Sorbom, 1989; Bentler, 1990, Browne & Cudeck, 1993; Hair et al., 1999

CHAPTER 4

ANALYSIS AND FINDINGS

This research study on the direct, indirect, and combined influence of variables on the environmental performance of manufacturing companies in Thailand, develop the structural equation model of variables affecting the environmental performance of manufacturing companies in Thailand and check the consistency of the form, structure equation of variables that influence the environmental performance of manufacturing companies in Thailand that developed with the empirical data.

The results of the data analysis are presented in 5 parts as follows

4.1 Symbols and acronyms used in the data analysis

4.2 Results of descriptive statistics

4.3 Confirmation analysis results

4.4 Structural equation model analysis results

4.5 Hypothesis test results

This study presents the results of empirical analysis of the sample are the confidence and accuracy of the information, results of descriptive data, hypothesis test results, confirmation analysis results, the results of testing, structural equations model and conclusions, as well as the influence and consistency of each variable in the research concept framework, the following essence are

4.1 Symbols and acronyms used in the data analysis

To achieve a consistent understanding of presentation and interpretation of the analysis results. Researcher data has defined the symbols and abbreviations used in data analysis as follows:

Abbreviations used to represent variables

Exogenous Latent Variables are:

Green Human Resource Management (GHRM) are measured from five observed variables:

GHRMM	-	Management support
GHRMR	-	Recruitment & selection
GHRMT	-	Training
GHRMP	-	Performance evaluation
GHRMC	-	Rewards & compensation

Mediator/Intervening Variables

Green Culture (GC)

GC consisted of three observed variables:

GCL	-	Leadership
GCC	-	Communication
GCE	-	Employee empowerment

Green Innovation (GI)

GI consisted of four observed variables:

GIPT	-	Green product innovation
GIPS	-	Green process innovation
GIM	-	Green managerial innovation
GIT	-	Green technological innovation

Endogenous Latent Variables

Environmental Performance (EP)

EP consisted of three observed variables:

EPR	-	Environmental regulation compliance
EPI	-	Limiting environmental impacts
EPW	-	Waste reduction

Symbols and acronyms used to represent statistics

$\overline{X}$	-	Mean
S.D.	-	Standard deviation
SKEW	-	Skewness
KUR	-	Kurtosis
r	-	Pearson's product moment correlation coefficient
R^2	-	Squared multiple correlation
χ^2	-	Chi – square
df	-	Degree of freedom
p-value	-	Statistical significance level
λ	-	Factor loading
B	-	Standard solution
SE	-	Standard error
t	-	t test statistic
F	-	F test statistic
***	-	Statistical significance at the level of 0.001 ($p<0.001$)
**	-	Statistical significance at the level of 0.01 ($p<0.01$)
*	-	Statistical significance at the level of 0.05 ($p<0.05$)
GFI	-	Goodness of fit index
AGFI	-	Adjusted goodness of fit index
CFI	-	Comparative fit index
RMSEA	-	Root mean square error of approximation

4.2 Results of descriptive statistics

The details of general data of the sample and basic statistic of various variables for this research are as follows;

4.2.1 General data analysis results

Table 4.1 Respondents' Demographic Characteristics (n=300)

Demographic Profile	Category	Frequency	Rate (%)
Gender	Male	218	72.67
	Female	82	27.33
Age	< 30 years old	32	10.66
	> 30 – 40 years old	122	40.66
	> 40 – 50 years old	83	27.66
	> 50 – 60 years old	62	20.66
	> 60 years old	1	0.33
Years of experience	> 5 – 15 years	209	69.66
	> 15 – 25 years	42	14.00
	> 25 – 35 years	48	16.00
	> 35 – 45 years	1	0.33
No. of employees	1-50	17	5.67
	51-200	58	19.33
	> 200	225	75
Education	Vocational Degree	5	1.66
	Bachelor's Degree	163	54.34
	Graduate Degree	132	44.00
Nature of Business	Thai shares < 50%	32	10.67
	Thai shares > 50%	268	89.33

4.2.2 Correlation Coefficient Results

Analysis of the model was conducted at two levels. First, for descriptive analysis, statistical means, standard deviation, and inferential statistics were calculated for all variables (as seen in Table 4.2). Second, AMOS 21 was chosen as it is one of the most popular research tools for structural equation modeling (SEM) analysis. Business research in recent years has shown a

greater dependency on structural equation modeling (SEM) as one of the best mainstream methods to analyze topics of the business management field (Sarstedt, Ringle, Smith, Reams, & Hair, 2014). The structural model was initially tested using all possible paths among the variables. Following the elimination of insignificant paths, the model then was tested and analyzed in terms of the remaining paths. The goodness-of-fit (GIF) measurement was used to measure the level of harmony of functions Table 4.3. Finally Table 4.4 shows the results from the correlation coefficient analysis between the latent variables (below the diagonal in bold), the reliability of the latent variables (ρc) and the average variance extracted (AVE).

Table 4.2 The Correlation Coefficients between latent variable, their reliability, and their AVE values

Latent Variables	GHRM	GC	GI	EP
GHRM	**1.00**			
GC	0.038	**1.00**		
GI	0.172	0.317	**1.00**	
EP	0.490	0.457	0.406	**1.00**
ρc (Construct Reliability)	0.8545	0.7836	0.8093	0.782
ρv (AVE)	0.5411	0.5472	0.5155	0.5450
$\sqrt{}$AVE	0.7356	0.7397	0.718	0.7382

Note: All values have a Sig. $\leq$ 0.01, AVE = average variance extracted

Table 4.3 shows the descriptive statistics for the critical success factors on Environmental Performance.

Table 4.3 Descriptive Statistics for the Study's Observed Variables for Environmental Performance

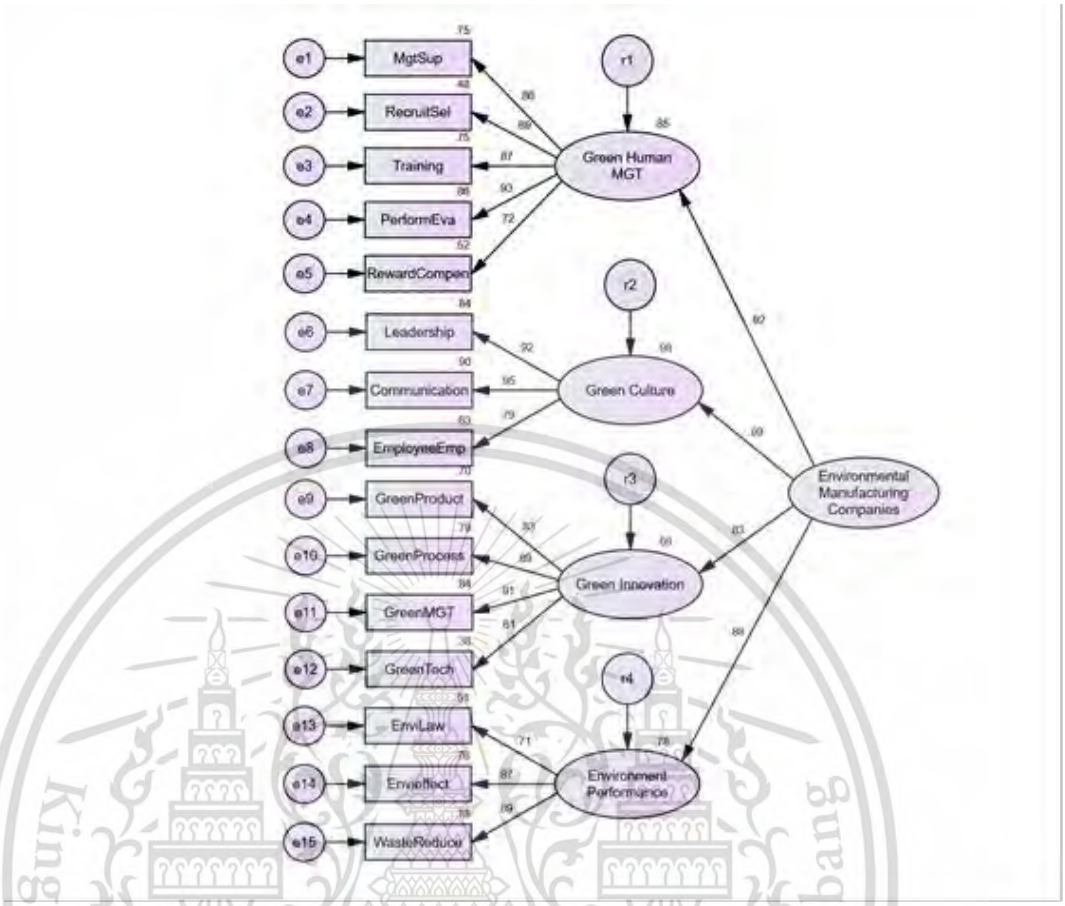
Variables	Mean	Interp.	S.D.	Min.	Max.	Skewness	Kurtosis
			GHRM				
GHRMM	5.6733	Agree	.83940	2.75	7.00	-.447	-.103
GHRMR	5.7367	Agree	.85426	3.67	7.00	-.418	-.365
GHRMT	5.6867	Agree	.87045	2.00	7.00	-.501	.322
GHRMP	5.6979	Agree	.87673	2.75	7.00	-.512	-.282
GHRMC	5.7413	Agree	.80219	3.40	7.00	-.398	-.416
			GI				
GIPT	5.5515	Agree	.84709	2.00	6.89	-.616	.655
GIPS	5.4879	Agree	.90394	2.88	7.00	-.144	-.494
GIM	5.5390	Agree	.93450	2.71	7.00	-.382	-.530
GIT	5.5700	Agree	.91696	3.25	7.00	-.175	-.744
			GC				
GCL	5.6306	Agree	1.06335	2.17	7.00	-.502	-.534
GCC	5.6283	Agree	.98054	2.83	7.00	-.361	-.634
GCE	5.5633	Agree	1.01057	2.90	7.00	-.436	-.588
			EP				
EPR	5.4313	Agree	1.12221	2.40	7.00	-.503	-.610
EPI	5.3273	Agree	1.17996	2.00	7.00	-.310	-.717
EPW	5.4073	Agree	1.16943	1.40	7.00	-.532	-.271

4.3 Confirmation analysis results

This research would like to present the results of the second confirmatory factor analysis of the variables in the conceptual framework. The latent variables and observed variables can be

analyzed one by one. The objective is to determine the regression weight of each question by the factor that is important to the component when it has a critical ratio, which means the Z-value is > 1.96 and the p-value < 0.05. The factor weight of those observed variables was not significantly at the 0.05 level (p-value < 0.05) (Vanichbuncha, K., 2013). And determine the suitability of the measurement model of each latent variable with the model concordance statistic. according to the specified criteria, such as CMIN/df, AGFI, GFI, CFI, IFI, NFI and RMSEA. The use of the p-value of Chi-square (χ^2) to measure model consistency is limited. The Chi-square (χ^2) is more valuable when the sample size is large and when there are many latent variables and there is a chance to reject H_0. Therefore, when the model rejects H_0, consider the value χ^2/df, which should be less than 3.00 (Bollen, 1989; Kline, 2005). The researcher was able to infer the coherence of the model from the CMIN/df, AGFI, GFI, CFI, IFI and RMSEA instead of Chi-square(χ^2) (Vanichbuncha, K., 2013) with the following;

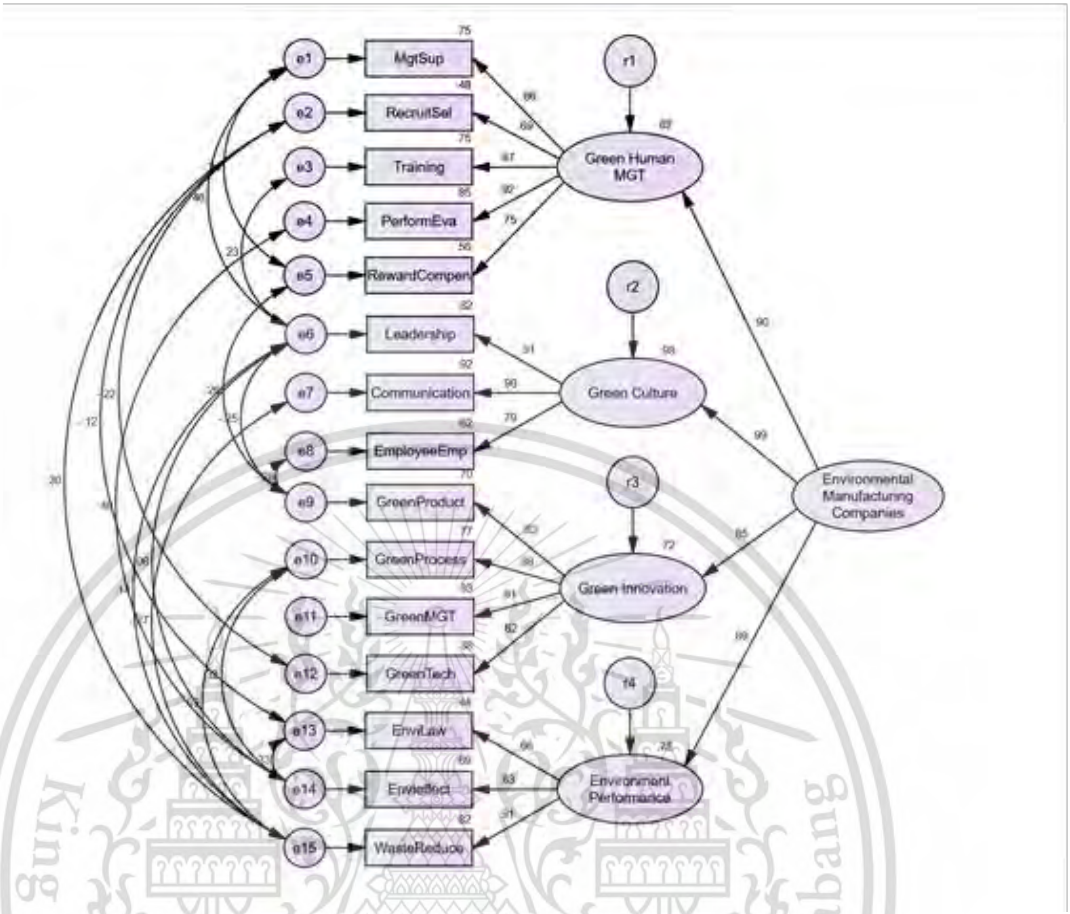
The second confirmatory factor analysis of the environmental performance of manufacturing companies**,** it consists of four observed variables; (1) Green Human Resource Management Practices including Management Support, Recruitment & Selection, Training, Performance Evaluation, and Reward & Compensation. (2) Green Culture including Leadership, Communication, and Employee Empowerment. (3) Green Innovation including Green Product Innovation, Green Process Innovation, Green Management Innovation, and Green Technological Innovation. (4) Environmental Performance including Environmental Regulation Compliance, Limiting Environmental Impacts, and Waste Reduction. (Figure 4.1, Table 4.4-4.13)



Chi-square=225.101, df=86, p-value=.000, Chi-square/df=2.617,

CFI=.936, GFI=.849, AGFI=.790, RFI=.879, NFI=.901, RMSEA=.101

Figure 4.1 Confirmatory factor analysis of Measurement Model Before Modification



Chi-square=73.858, df=70, p-value=.353, Chi-square/df=1.055

CFI=.998, GFI=.945, AGFI=.906, RFI=.951, NFI=.968, RMSEA=.019

Figure 4.2 Confirmatory factor analysis of Measurement Model After Modification

Table 4.4 The model consistency statistics before and after modification of measurement model

Congruence Index	Criteria used to consider	Before modification	After modification
Relative Chi-Square (χ^2/df)	< 3.00	2.617	1.055
GFI	> 0.90	0.849	0.945
CFI	> 0.90	0.936	0.998
IFI	> 0.90	0.936	0.998
AGFI	> 0.90	0.790	0.906

Table 4.4 The model consistency statistics before and after modification of measurement model (Cont.)

Congruence Index	Criteria used to consider	Before modification	After modification
RMSEA	< 0.05	0.101	0.019

The analysis results according to Table 4.4 found that the Goodness of – Fit Index (GFI) of confirmatory factor and empirical data of environmental manufacturing, some of them are not within the specified criteria. Considering that the value (χ^2/df) is 1.055, which should be less than 3, it shows that the confirmatory factor model is not qualified. Therefore, consider a model that is harmonious with the empirical data to obtain a model with truly statistically significant parameters and modify the new model based on theoretical reasoning for the modification index value (MI). When the model is harmonized, the values are within the specified criteria. It can be determined from (χ^2/df) equal to 1.055, which is less than 3 satisfying the specified criteria. By obtaining statistical values to measure the conformity of the model as follows: CMIN/df=1 .055, GFI=0.945, CFI=0.998, IFI=0.998, AGFI=0.906, RMSEA=0.019 and *p*-value of Chi-square = 0.353.

Table 4.5 Statistical value confirmatory factor analysis of measurement model

Sector		Variable	Regression weight	S.E.	C.R.	*p*-value
Green Human MGT	<---	Environmental Performance	0.904			
Green Culture	<---	Environmental Performance	0.990	0.089	15.192	***
Green Innovation	<---	Environmental Performance	0.847	0.128	10.208	***
Environment Performance	<---	Environmental Perfroamnce	0.885	0.098	8.071	***
MgtSup	<---	Green Human MGT	0.865			
RecruitSel	<---	Green Human MGT	0.694	0.096	10.394	***
Training	<---	Green Human MGT	0.866	0.065	14.775	***
PerformEva	<---	Green Human MGT	0.923	0.058	16.783	***

Table 4.5 Statistical value confirmatory factor analysis of measurement model (Cont.)

Sector		Variable	Regression weight	S.E.	C.R.	*p*-value
RewardCompen	<---	Green Human MGT	0.751	0.104	10.534	***
Leadership	<---	Green Culture	0.905			
Communication	<---	Green Culture	0.959	0.049	21.391	***
EmployeeEmp	<---	Green Culture	0.789	0.052	13.547	***
GreenProduct	<---	Green Innovation	0.835			
GreenProcess	<---	Green Innovation	0.876	0.055	14.060	***
GreenMGT	<---	Green Innovation	0.911	0.065	14.919	***
GreenTech	<---	Green Innovation	0.616	0.118	8.504	***
EnviLaw	<---	Environmental Performance	0.662			
Envieffect	<---	Environmental Performance	0.833	0.088	10.863	***
WasteReduce	<---	Environmental Performance	0.908	0.141	9.287	***

Remark: *** $p < 0.001$

From Figure 4.1 and Table 4.5 found that regression weight of variables used to measure latent variables for environmental manufacturing in between 0.616 –0.990 and regression weight of all variables is C.R. (Critical Ratio) > 1.96. It's can be concluded that all observe variables have a regression weight not equal to zero by statistical significance at the 0.05 (p-value < 0.05). Show that those variables are important indicators of regression weight in each of sectors by sector of Green Human Management Practices in between 0.694 – 0.923, sector of Green Culture in between 0.789-0.959, sector of Green Innovation in between 0.616-0.911, and sector of Environment Performance in between 0.662 – 0.908. In addition, regression weight of all questions has statistical significance at the 0.001 (p-value < 0.001) that found the variables is important indicators to indicate the factors of sector. By consider about regression weight of 4 sector of variables that found all questions is important indicators for element by C.R. (Critical Ratio) > 1.96. In conclusion, all question has a regression weight not equal to zero by statistical significance at the 0.05 (p-value < 0.05).

Latent variable of Environmental manufacturing has regression weight of variable have highest latent variable is Green Culture, next is Green Human Resource Management Practices.

Green Human Resource Management Practices have regression weight of sector have highest variable is Performance Evaluation, followed by Training.

Green Culture have regression weight of sector have highest variable is Communication, followed by Leadership.

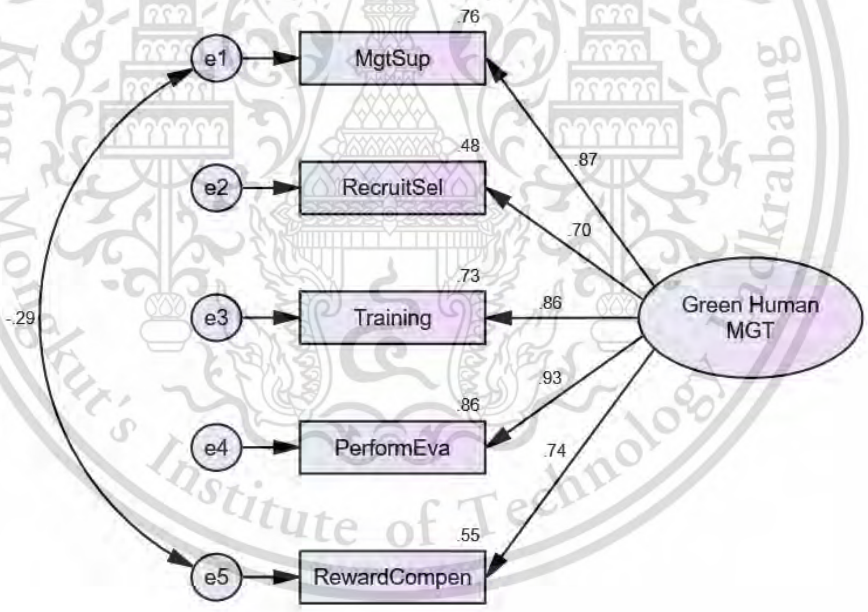
Green Innovation have regression weight of sector have highest variable is Green Managerial Innovation, followed by Green Process Innovation.

Environmental Performance have regression weight of sector have highest variable is Waste Reduction, next is Limiting Environmental Impacts.

Confirmatory factor analysis Green Human Management Practices

Table 4.6 The model consistency statistics before and after modification of the Green Human Resource Management Practices Model

Congruence Index	Criteria used to consider	Before modification	After modification
Relative Chi-Square (χ^2/df)	< 3.00	2.505	1.109
GFI	> 0.90	0.970	0.989
CFI	> 0.90	0.986	0.999
IFI	> 0.90	0.986	0.999
AGFI	> 0.90	0.910	0.958
RMSEA	< 0.05	0.097	0.026



Chi-square=4.437, df=4, p-value=.350, Chi-square/df=1.109,

CFI=.999, G4.437FI=.989, AGFI=.958, IFI=.999, RMSEA=.026

Figure 4.3 Confirmatory factor analysis of Green Human Management Practices Model After Modification

The first confirmatory factor analysis of the variable of Green Human Resource Management Practices that consist of 5 factors including Management Support, Recruitment & Selection, Training, Performance Evaluation and Reward & Compensation.

The analysis results according to Table 4.7 found that the Goodness of – Fit Index (GFI) of confirmatory factor and empirical data of Green Human Management Resource Management Practices, some of them are not within the specified criteria. Considering that the value (x^2/df) is 2.505, which should be less than 3, it shows that the confirmatory factor model is not qualified. Therefore, consider a model that is harmonious with the empirical data to obtain a model with truly statistically significant parameters and modify the new model based on theoretical reasoning for the modification index value (MI). When the model is harmonized, the values are within the specified criteria. It can be determined from (x^2/df) equal to 1.109, which is less than 3 satisfying the specified criteria. By obtaining statistical values to measure the conformity of the model as follows: CMIN/df=1.109, GFI=0 .9 89, CFI=0 .9 9 9, IFI=0 .9 9 9, AGFI=0 .9 58, RMSEA=0.026 and p-value of Chi-square = 0.350.

From Figure 4.3 and Table 4.7 found that regression weight of variables used to measure latent variables for Green Human Management Practices in between 0.695 –0.928 and regression weight of all variables is C.R. (Critical Ratio) > 1.96. It's can be concluded that all observe variables have a regression weight not equal to zero by statistical significance at the 0.05 (p-value < 0 .0 5). This show that those variables are important indicators of regression weight in latent variable of Green Human Management Practices that indicate by observed variables by following;

Latent variable of Green Human Management Practices has regression weight of variable have highest latent variable is Performance Evaluation, has a regression weight about 0.928. Next is Management Support, has a regression weight about 0.856, and Recruitment & Selection has a regression weight about 0.695 by sequence.

Table 4.7 Statistical value confirmatory factor analysis of Green Human Management Practices

Sector		Variable	Regression weight	S.E.	C.R.	*p*-value
MgtSup	<---	Green Human MGT	0.874			
RecruitSel	<---	Green Human MGT	0.695	0.097	10.278	***
Training	<---	Green Human MGT	0.856	0.065	14.465	***
PerformEva	<---	Green Human MGT	0.928	0.058	16.649	***
RewardCompen	<---	Green Human MGT	0.739	0.105	10.024	***

Remark: *** $p < 0.001$

Confirmatory factor analysis of Green Culture

Table 4.8 The model consistency statistics before the Green Culture with No Modification

Congruence Index	Criteria used to consider	Results
Relative Chi-Square (χ^2/df)	< 3.00	0.142
GFI	> 0.90	0.999
CFI	> 0.90	1.000
IFI	> 0.90	1.002
AGFI	> 0.90	0.996
RMSEA	< 0.05	0.000

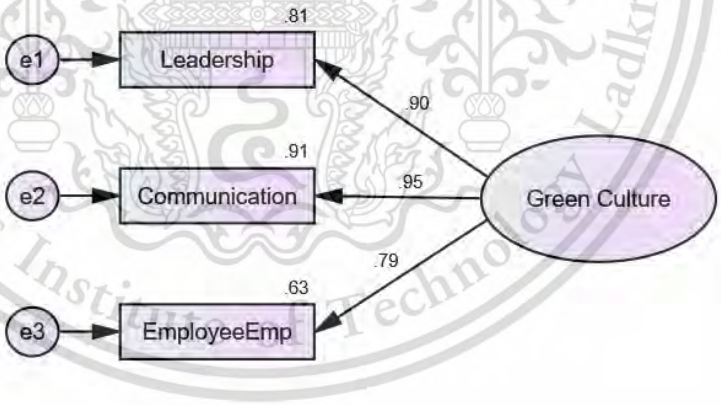
The first confirmatory factor analysis of the variable of Green Culture that consist of 3 factors including Leadership, Communication, and Employee Empowerment.

The analysis results according to Table 4.10 and Figure 4.4 found that the Goodness of – Fit Index (GFI) of confirmatory factor and empirical data of Green Culture, some of them are not within the specified criteria. Considering that the value (χ^2/df) is 0.142, which should be less than 3, it shows that the confirmatory factor model is not qualified. Therefore, consider a model that is harmonious with the empirical data to obtain a model with truly statistically significant parameters and adjust the new model based on theoretical reasoning for the modification index value (MI). When the model is harmonized, the values are within the specified criteria. It can be

determined from (χ^2/df) equal to 1.109, which is less than 3 satisfying the specified criteria. By obtaining statistical values to measure the conformity of the model as follows: CMIN/df=0.142, GFI=0.999, CFI=1.000, IFI=1.002, AGFI=0.996, RMSEA=0.036 and p-value of Chi-square = 0.760. By consider a model that is harmonious with the empirical data and not to adjust the new model.

This found that regression weight of variables used to measure latent variables for Green Culture in between 0.792 –0.953 and regression weight of all variables is C.R. (Critical Ratio) > 1.96. It's can be concluded that all observe variables have a regression weight not equal to zero by statistical significance at the 0.05 (p-value < 0.05). Show that those variables are important indicators of regression weight in latent variable of Green Culture that indicate by observed variables as follows;

Latent variable of Green Culture has regression weight of variable have highest latent variable is Communication, has a regression weight about 0.953. Next is Leadership, has a regression weight about 0.900, and Employee Empowerment has a regression weight about 0.792 by sequence.



Chi-square=.142, df=1, p-value=.706, Chi-square/df=.142,

CFI=1.000, GFI=.999, AGFI=.996, IFI=1.002, RMSEA=.000

Figure 4.4 Confirmatory factor analysis of Green Culture Model with No Modification

Table 4.9 Statistical value confirmatory factor analysis of Green Culture

Sector		Variable	Regression weight	S.E.	C.R.	p-value
Leadership	<---	Green Culture	0.900			
Communication	<---	Green Culture	0.953	0.052	20.083	***
EmployeeEmp	<---	Green Culture	0.792	0.052	13.954	***

Remark: *** p< 0.001

Confirmatory factor analysis of Green Innovation

Table 4.10 The model consistency statistics before and after modification of the Green Innovation

Congruence Index	Criteria used to consider	Before modification	After modification
Relative Chi-Square (χ^2/df)	< 3.00	2.474	1.052
GFI	> 0.90	0.985	0.997
CFI	> 0.90	0.993	1.000
IFI	> 0.90	0.993	1.000
AGFI	> 0.90	0.925	0.967
RMSEA	< 0.05	0.096	0.018

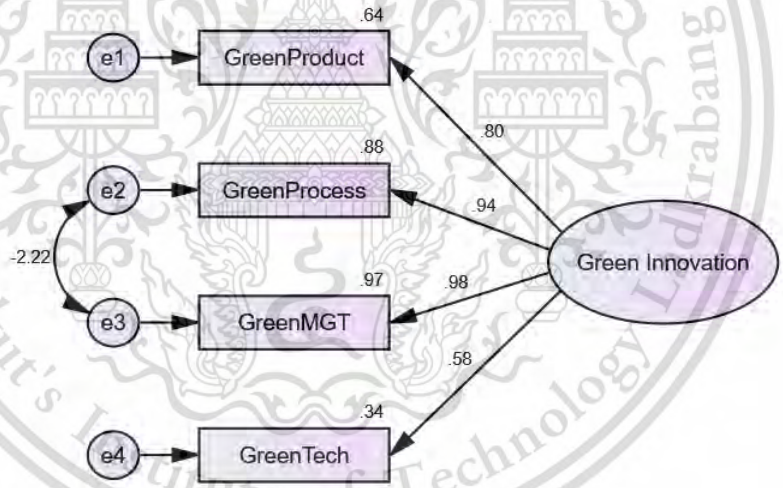
The first confirmatory factor analysis of the variable of Green Innovation that consist of 4 factors including Green Product, Green Process, Greengate and Greentech.

The analysis results according to Table 4.10 found that the Goodness of – Fit Index (GFI) of confirmatory factor and empirical data of Green Innovation, some of them are not within the specified criteria. Considering that the value (χ^2/df) is 2.474, which should be less than 3, it shows that the confirmatory factor model is not qualified. Therefore, consider a model that is harmonious with the empirical data to obtain a model with truly statistically significant parameters and adjust the new model based on theoretical reasoning for the modification index value (MI). When the model is harmonized, the values are within the specified criteria. It can be determined from (χ^2/df) equal to 1.052, which is less than 3 satisfying the specified criteria. By obtaining statistical values to measure the conformity of the model as follows: CMIN/df=0.052,

GFI=0.997, CFI=1.000, IFI=1.000, AGFI=0.967, RMSEA=0.018 and p-value of Chi-square = 0.305.

From Figure 4.5, it can be found that regression weight of variables used to measure latent variables for Green Innovation in between 0.581 –0.984 and regression weight of all variables is C.R. (Critical Ratio) > 1.96. It's can be concluded that all observed variables have a regression weight not equal to zero by statistical significance at the 0.05 (p-value < 0.05). Show that those variables are important indicators of regression weight in latent variable of Green Innovation that indicate by observed variables as follows;

Latent variable of Green Innovation has regression weight of variable have highest latent variable is Green Managerial Innovation has a regression weight about 0.984. Next is Green Process Innovation has a regression weight about 0.800, and Green Technological Innovation has a regression weight about 0.581 by sequence.



Chi-square=1.052, df=1, p-value=.305, Chi-square/df=1.052,

CFI=1.000, GFI=.997, AGFI=.967, IFI=1.000, RMSEA=.018

Figure 4.5 Confirmatory factor analysis of Green Innovation Model After Modification

Table 4.11 Statistical value confirmatory factor analysis of Green Innovation

Sector		Variable	Regression weight	S.E.	C.R.	*p*-value
GreenProduct	<---	Green Innovation	0.800			
GreenProcess	<---	Green Innovation	0.941	0.092	9.420	***
GreenMGT	<---	Green Innovation	0.984	0.111	9.813	***
GreenTech	<---	Green Innovation	0.581	0.120	8.088	***

Remark: *** $p < 0.001$

Confirmatory factor analysis of Environmental Performance

Table 4.12 The model consistency statistics of the Environmental Performance with No Modification

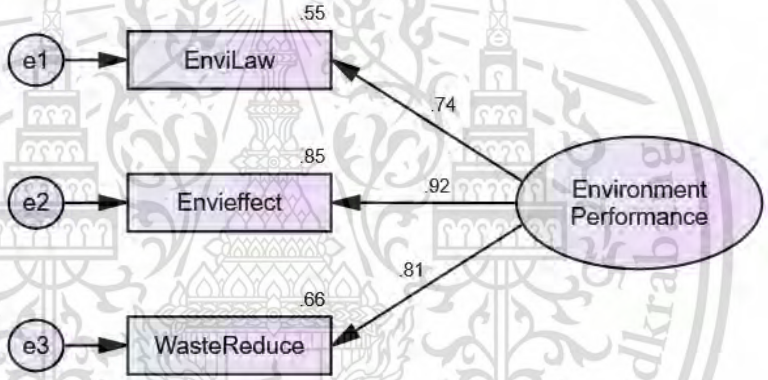
Congruence Index	Criteria used to consider	Results
Relative Chi-Square (χ^2/df)	< 3.00	0.123
GFI	> 0.90	0.999
CFI	> 0.90	1.000
IFI	> 0.90	1.004
AGFI	> 0.90	0.997
RMSEA	< 0.05	0.000

The first confirmatory factor analysis of the variable of Environmental Performance that consist of 4 factors including Environmental Regulation Compliance, Limiting Environmental Impacts and Waste Reduction.

This can be found that the Goodness of – Fit Index (GFI) of confirmatory factor and empirical data of Environmental Performance, some of them are not within the specified criteria. Considering that the value (χ^2/df) is 0.123, which should be less than 3, it shows that the confirmatory factor model is not qualified. By obtaining statistical values to measure the conformity of the model as follows: CMIN/df=0.123, GFI=0.999, CFI=1.000, IFI=1.004, AGFI=0.997, RMSEA=0.036 and p-value of Chi-square = 0.726. By consider a model that is harmonious with the empirical data and not to modify the new model.

It found that regression weight of variables used to measure latent variables for Green Performance in between 0.743 –0.922 and regression weight of all variables is C.R. (Critical Ratio) > 1.96. It's can be concluded that all observed variables have a regression weight not equal to zero by statistical significance at the 0.05 (p-value < 0 . 0 5) . Show that those variables are important indicators of regression weight in latent variable of Environmental Performance that indicate by observed variables as follows;

Latent variable of Environmental Performance has regression weight of variable have highest latent variable is Limiting Environmental Impacts has a regression weight about 0.922. Next is Environmental Regulation Compliance has a regression weight about 0.812, and Waste Reduction has a regression weight about 0.743 by sequence.



Chi-square=.123, df=1, p-value=.726, Chi-square/df=.123,
CFI=1.000, GFI=.999, AGFI=.997, IFI=1.004, RMSEA=.000

Figure 4.6 Confirmatory factor analysis of Environmental Performance with No Modification

Table 4.13 Statistical value confirmatory factor analysis of Environmental Performance

Sector		Variable	Regression weight	S.E.	C.R.	*p*-value
EnviLaw	<---	Environment Performance	0.743			
Envieffect	<---	Environment	0.922	0.065	14.793	***

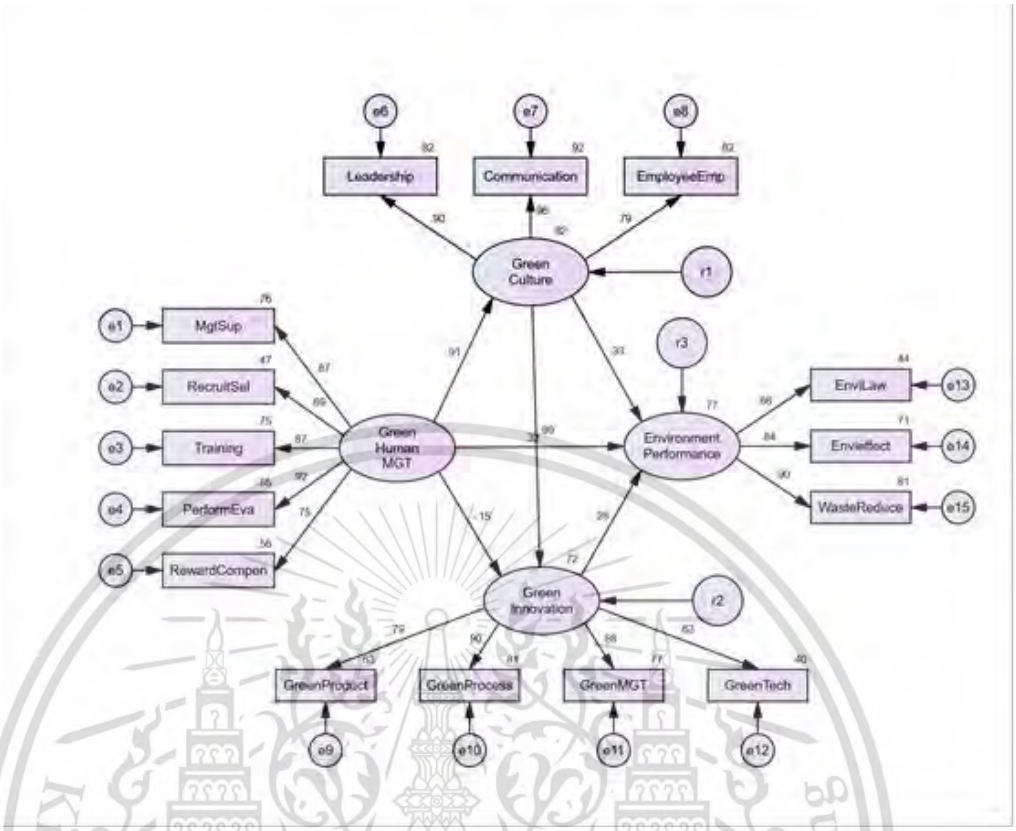
Table 4.13 Statistical value confirmatory factor analysis of Environmental Performance (Cont.)

Sector		Variable	Regression weight	S.E.	C.R.	*p*-value
		Performance				
WasteReduce	<---	Environment Performance	0.812	0.083	12.758	***

Remark: *** $p < 0.001$

4.4 Strutural Equation Model Analysis Results

The SEM results of the hypothesis tests revealed six significant correlations, including H1 (Green Human Resource Management Practices and Green Culture), H2 (Green Human Resource Management Practices and Environmental Performance), H3 (Green Human Resource Management Practices and Green Innovation), H4 (Green Culture and Green Innovation), H5 (Green Culture and Environmental Performance) and H6 (Green Innovation and Environmental Performance) were found in Table 4.14 cand Figure 4.7.



Chi-square=57.598, df=65, p-value=.731, Chi-square/df=.886,

CFI=1.000, GFI=.957, AGFI=.920, RFI=.959, NFI=.975,

RMSEA=.000, RMR=.033

Figure 4.7 Final Model

4.5 Hypotheses testing results

4.5.1 Hypotheses Test results

The hypotheses testing results are shown in Table 4.14 and Figure 4.8. The four conceptualized hypotheses were accepted. Hair et al. (2009) also added that construct validity could be judged acceptable when t-values $\geq$ 1.96, with Sharma (1996) adding that when standardized factor loading $\geq$ 0.60, further validity can be ascertained.

Table 4.14 Summary of the Hypotheses Test results

Hypotheses	Coef.	t-test	*p*-value	Hypothesis supported
Hypothesis 1: Green human resource management practices have a positive impact on the green culture	0.907	15.938	***	Yes
Hypothesis 2: Green human resource management practices have a positive impact on the environmental performance	0.322	2.216	0.027*	Yes
Hypothesis 3: Green human resource management practices have a positive impact on the green innovation	-0.155	-.949	0.342	No
Hypothesis 4: Green culture has a positive impact on green innovation	0.987	5.608	***	Yes
Hypothesis 5: Green culture has a positive impact on environmental performance	0.328	1.634	0.102	No
Hypothesis 6: Green innovation has a positive impact on the environmental performance	0.280	2.241	***	Yes

Note. * $p < 0.05$, *** = $p < 0.001$ is significant

4.5.2 The Goodness-of-Fit Analysis

A Goodness-of-Fit analysis to determine how well the model fits with the data uses convergent validity (CV) to assure that the expected relationships between the constructs exist. Hooper et al. (2008) have stated that CV includes GFI, CFI, RMSEA, and the chi-square/df statistic. Discriminant validity (DV) is also recommended in the GoF assessment (Henseler et al., 2014). Furthermore, it is recommended that the Chi-square (χ^2) value of $p \geq 0.05$ be met (this model's value = 88.45), and the relative Chi-square (χ^2/df) of ≤ 2.00 be achieved (this model's

value = 0.349) (Tabachnick & Fidell, 2007). Moreover, testing for the goodness-of-fit (GFI) value added support to the model's hypotheses were in support of the model's empirical data as the model's GFI=0.92 (Schumacker & Lomax, 2010). Values for the adjusted goodness-of-fit (AGFI) can also range from zero to one, and it is generally accepted that values $\geq$ 0.90, further support a well-fitting model (Hooper et al., 2008). Therefore, all the values were found to be within their acceptable parameters, suggesting support for the validity of the model and the hypotheses from GoF test.

Table 4.15 Goodness-of-Fit Criteria, Supporting Theory, and Results

Index Criteria	Criteria	Supporting Theory	Results
χ^2	*p*-value > 0.05	(Hooper et al., 2008)	0.988
χ^2/df	*p*-value $\geq$ 0.05	(Tabachnick & Fidell, 2007)	0.349
CMIN/ df	$\leq$ 2.00	(Tabachnick & Fidell, 2007)	1.053
RMSEA	$\leq$ 0.05	(Hooper et al., 2008)	0.013
GFI	$\geq$ 0.90	(Schumacker & Lomax, 2010)	0.957
AGFI	$\geq$ 0.90	(Hooper et al., 2008)	0.962
CFI	$\geq$ 0.90	(Schumacker & Lomax, 2010)	0.997
NFI	$\geq$ 0.90	(Schumacker & Lomax, 2010)	0.946

Table 4.16 The analysis of Direct Effect, Indirect Effect, and Total Effects

Antecedents	Consequences								
	GC			GI			EP		
	DE	IE	TE	DE	IE	TE	DE	IE	TE
GHRM	0.907***	-	0.907***	-0.155	0.895***	0.740***	0.322***	0.505	0.827
GC	-	-	-	0.987***	-	0.987***	.328	0.277	0.605
GI	-	-	-	-	-	-	0.280***	-	0.280***

Note. * $p < 0.05$, *** = $p < 0.001$ is significant, DE = direct effect, TE = total effect, IE = indirect effect

As can be seen from Table 4.16, considering the total effect, environmental performance has statistically significant at .05. green human resource management practices, green culture, and green innovation influenced by 0.827, 0.605, and 0.280 respectively. This can be seen that Thai manufacturing companies have paid attention green human resource management practices, by focusing on performance evaluation, management support, training, and other related human resource management practices, will have a total impact in green culture; communication, leadership, and employee empowerment. This study found that good leadership will increase an impact of the environmental performance. It also has an increase the total impact in green innovation (green process innovation, green managerial innovation, green product innovation, and green technological innovation) at the same time.

For the direct effect of environmental performance, the study found that it has a statistically significant at .05. Green human resource management practices, green culture, and green influenced by 0.907, -0.155, and 0.322 respectively. Having noted that Thai manufacturing companies also focus on green human resource management practices than green innovation and green culture and equipped with human resource development will result directly in the environmental performance of Thai manufacturing companies.

CHAPTER 5

DISCUSSION AND CONCLUSION

The main objectives of this study are; 1) To study direct, indirect and combined influence of variables on the environmental performance of manufacturing companies in Thailand 2) To develop the structural equation model of variables affecting the environmental performance of manufacturing companies in Thailand and 3) To check the consistency of the form, structure equation of variables that influence the environmental performance of manufacturing companies in Thailand developed with empirical data. The population for use in the study's structural equation modeling of variables potentially affecting Thai manufacturing companies' environmental performance consisted of 666 ISO 14000 certified manaufacturing companies which were had 895 persons involved in environmental performance related roles (Thai Industrial Standards Institute, 2016). To determine the sample size in this study, by using simple random sampling, 300 certified ISO 14000 manufacturing companies were sufficient, from totally 398 companies or equals 75.37%.

This research is the quantitative research method, by studying and researching from secondary sources such as books, journals, related research and using the method of data collection with primary data. to find answers about concepts from the factories, population and collect them to analyze the data by using the Structural Equation Model: SEM.

The second stage, Quantitative Research, is to determine the population and sample for this research, and then create the tools and verify the quality of the tools. The tools were used to find the IOC value by 5 experts. The tools were improved and then put into practice with 30 samples and then used to find the reliability. Reliability was measured from the Cronbach Alpha coefficient, and the instrument was then used to collect data with real samples, and then analyze the quantitative data until obtaining the Final Model.

Quantitative research (Quantitative Research) by studying from secondary sources such as books, journals, related research, and using questionnaires to collect data (Questionnaire) to obtain conceptual answers from manufacturing companies and collect them for analysis using statistical analysis and Structural Equation Model (SEM).

Exogenous Latent Variables

1. Green Human Resource Management Practices

Green Human Research Management Practices consisted of five observed variables including management support, recruitment & selection, training, performance evaluation, and rewards & compensation.

2. Mediator/Intervening Variables

2.1 Green Culture

Green Culture consisted of three observed variables including leadership, communication, and employee empowerment.

2.2 Green Innovation

Green Innovation consisted of four observed variables including green product innovation, green process innovation, green managerial innovation, and green technological innovation.

Analysis of the model was conducted at two levels. First, for descriptive analysis, statistical means, standard deviation, and inferential statistics were calculated for all variables. Second, AMOS 21 has been chosen as one of the most popular research for structural equation modeling analysis. Business research in recent years has shown a greater dependency on structural equation modeling as one of the best mainstream methods to analyze topics of business management field.

The SEM results of the hypothesis tests revealed six significant correlations, including H1 (Green Human Resource Management Practices and Green Culture), H2 (Green Human Resource Management Practices and Environmental Performance), H3 (Green Human Resource Management Practices and Green Innovation), H4 (Green Culture and Green Innovation), H5 (Green Culture and Environmental Performance) and H6 (Green Innovation and Environmental Performance) were accepted.

This chapter are presented in the following topics;

5.1 Discussion

5.2 Conclusion

5.3 Implication and Recommendations

5.4 Recommendations for future research

5.1 Discussion

The analytical SEM results revealed that four research hypotheses were accepted. The hypothesis H1 was supported, this result confirmed the findings in the previous research (Mandip, 2012; Jabbar et al., 2012; Daily et al., 2012; Cherian and Jacob, 2012) have shown that HR functions will become the driver of green culture within the organization by aligning its practices and policies with sustainability goals reflecting an environmental performance focus.

Hypothesis H2 was supported, as Green Human Resource Management Practices has a positive impact on Environmental Performance. This result confirmed the finding in the study of Guerci, Longoni, and Luzzini (2015) , based on a multirespondent survey in which the respondents were Human Resource Managers and Supply Chain Managers operating in Italy. Moreover, the numerous studies have investigated how proenvironmental HRM activities improve the environmental performance of the firm (Arda, Bayraktar, & Tatoglu, 2018; Daily et al., 2012; Jabbour & Santos, 2008). The finding from previous research from Roscoe, Subramanian, Jabbour, & Chong, (2019) in a large-scale survey of 204 employees at Chinese manufacturing firms, suggest that proenvironmental HRM practices including hiring, training, appraisal, and incentivization support the development of environmental performance.

Hypothesis H3 has no positive influence of green human resource management practices on green innovation. Several past studies suggest that HRM positively and significantly influences technological and product innovation (Wei et al., 2011; Jiménez-Jiménez and SanzValle, 2008; Verburg et al., 2007). At the same time, Seeck & Diehl (2017) in a review of the past studies on the HRM-Innovation note that as compared with product and technological innovation, the HRM does not have strong influence on administrative and process innovation (Seeck and Diehl, 2017).

Green culture has a positive impact on green innovation (H4). Supporting this result is the findings from previous research from Yang et al., (2017) over 300 organizations in China and found that green culture has positive direct impacts on green innovation effectiveness, and on the survey was carried in companies operating in Turkey which were listed among Istanbul Chamber of Industry (ICI) Top 500 companies for last 3 years successively and have ISO 14000 Environmental Management Certificate, it was manifested that factors directing companies to

sustainability having a positive relationship with green organizational culture and green innovation (Küçükoğlu & Pınar, 2018).

Green culture has no positive impact on environmental performance (H5), corresponding to previous research on an evaluation of environmental sustainability performance via attitudes, social responsibility, and culture: a mediated analysis, by using a cross-sectional data collection method, 185 respondents from Malaysian G7 construction firms participated in this research (Ajibike, et al., 2021). There is not a statistically significant positive effect between company culture and environmental sustainability performance. Construction firms are not obliged to be socially responsible through investment environmental, social responsibility activities. This could be due to unconformity with regulations that require them to expend on activities related to social responsibility and secure legitimacy from various stakeholders (Ahmad & Tower, 2011).

Finally, green innovation has a positive impact on environmental performance (H6), this result confirmed the finding from previous research conducted in eight industry sectors in Taiwan (Chiou et al., 2011) and survey research 500 companies in Turkey (Küçükoğlu & Pınar, 2015). prominent result of this study is that greening the supplier through green innovation contributes significant benefits to the environmental performance and competitive advantage of the firm. Many previous studies also suggest that environmental performance depends upon the quality of environment-friendly products, green process and product innovation, and incorporation of ecological sustainability matters into business operations and product development (Oliva et al., 2019; Chen et al., 2015; Dubey et al., 2015; Darnall et al., 2008).

Moreover, the study determined that green human resource management practices have the highest impact on environmental performance, compared to green culture and green innovation, respectively. Given that environmental performance implementation in Thai industries in the early stages, green human resource management practices, green culture, and green innovation was initially developed and implemented strategies to achieve the organization's target and goal.

5.2 Conclusion

The purpose of this research was to analyze the role of human resource management in the development of organizational capabilities and its influence on the manufacturing companies'

environmental performance from a resource-based view and triple bottom line. The study developed a conceptual model on green human resource management practices with green culture, green innovation, and environmental performance. The proposed model is unique and first of its kind to integrate green human resource management practices with green culture and green innovation for organizations to achieve their targeted environmental performance. This study has tested the model, by using the survey data from certified ISO 14000 manufacturing companies in Thailand. The study has shown that leadership, communication, and employees' empowerment can create the green culture and green innovation in the organization and positively influences organizations' environmental performance. Moreover, the critical role of green human resource management practices has also been identified. The empirical findings in this study provide an understanding of influencing factors and how to implement successful environmental performance in the organizations with the support of green human resource management practices and green innovation. The key challenge in front of HR professionals is to understand the scope and depth of green HRM in transforming their organizations as green entities. This effort ultimately leads to the better environmental performance of the organization. To create, practice and maintain environmental related innovative behaviors of employees coupled with the right attitude of greening, green HRM practices are critical. The study extends our knowledge to the Thai manufacturing companies, which is considered a major research gap between developed and developing countries and different contexts. Few limitations of this study are the study in specific business sectors in Thailand that will provide different findings and results. Moreover, although in this initial study the external factors have not been borne in mind, we are aware of their influence on the firm's environmental performance. For this reason, we suggest not only carrying out further investigations attempting to measure the comparative and complementary influence of internal and external factors on the firm's environmental performance, but also conducting empirical studies such as Green HRM practices in the manufacturing or service organizations (particularly the organizations that are polluting environment). Furthermore, this study merely examines the perceived environmental performance in the organization, so further research is needed for better understanding the impact of these integrated green factors.

5.3 Implications and Recommendations

Policy recommendations

1. The act on development promotion should be enforced by the public sector. Top management has to fully support, commit and treat the organization's environmental performance as a priority issue, such as allocating adequate resources (money, manpower, etc.) and following up employee's' suggestion for improvement on environmental performance. Furthermore, the trainings should be organized to educate the stakeholders in the industry, entrepreneurs, executives, and operators to raise their awareness of the value of eco-friendly production processes and knowledge is given about the correct production process especially innovative technology from scholars who specialize in studying, researching innovations to achieve eco-friendly production covering the entire industry. Besides, it is ready to support the global market to produce eco-friendly products including setting regulations to have environmental academics in each factory to give clear and precise knowledge on the environment to provide information on the pollution management that occurs in production closely.

2. Companies facing global competition and maintaining the environmental performance require green human resource management practices, seeing the role of green human resource management practices, which is very important for the company.

3. Companies forge the partnerships to support corporate green innovation and performance by both involving the community regarding the management and processing of recycle waste, and collaborating with formal and non-formal educational institutions by socialiazation of green strategies, among others, through green innovation, In recruiting new employees, as one activity from green human resource management practices, companies can use talent scouting system where one indicators is an understanding of green innovation and performance.

4. Government agencies involved in environmental control should support and promote a clear award process system, such as a tax reduction policy for manufacturing companies with an eco-friendly production process to stimulate the change in the production process to be aware of the environment, but also. Additionally, to seriously transform into an eco-friendly dyeing factory and strictly enforcement of environmental laws and regulations. There is a system of surveys and checks continuously from the government to achieve sustainability in the change.

Recommendations for implications

1. This study focused on exploring the environmental performance of manufacturing companies in Thailand only. Therefore, the conceptual framework should be studied with other operations as each industry has different contexts.

2. The findings of this research could be used as a research guideline and as information for government agencies, private sectors, business organizations, entrepreneurs and suggest carrying out further investigations attempting to measure the comparative and complementary influence of internal and external factors on the firm's environmental performance. Furthermore, this study merely examines the perceived environmental performance in the organization, so further research is needed for better understanding the impact of these integrated green factors.

3. Interested scholars could use models to measure the equation of environmental performance in industrial factories. It could be applied to various business groups such as trade, manufacturing, and service business and could study additional variables that may influence your competitiveness and entrepreneurial success.

5.4 Recommendations for future research

1. Other facilitators, drivers, and factors contributing to the success of the environmental performance in the industrial enterprises of Thailand in the age of 4.0 and more should be investigated in the future studies.

2. For scholars could be able to apply structural equations in empirical research, comparative studies should be conducted between business groups by type of business such as trade, manufacturing, and service or divided according to the size of the business such as small, medium, and large businesses across different settings, both at the local and international levels.

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APPENDIX

APPENDIX

QUESTIONAIRE

TOPIC: A STRUCTURAL EQUATION MODEL OF VARIABLES INFLUENCE ENVIRONMENTAL PERFORMANCE IN MANUFACTURING COMPANIES IN THAILAND

EXPLANATION:

This questionnaire prepared for the purpose of a PhD research study in Doctor of Philosophy in Industrial Business Administration (International Program), KMITL Business School, King Mongkut's Institute of Technology Ladkrabang. This questionnaire consists of 102 questions divided into 7 parts as follows;

Part 1 Basic information of respondents	5 Items
Part 2 Information of the operation of the organization of the respondents	3 Items
Part 3 Information on Green Human Resource Management	28 Items
Part 4 Information on Green Innovation	28 Items
Part 5 Information on Green Culture	22 Items
Part 6 Information on Environmental Performance	15 Items
Part 7 Other suggestions	1 Item

Part 1 Basic information of respondents

Explanation: Please mark √ into the box that corresponds to your information or fill in the blanks that match your actual situation.

1. Current position: .....

2. Gender: ☐ Male ☐ Female

3. Age:

☐ Below 30 ☐ 30-40 ☐ 40-50

☐ 50-60 ☐ More than 60

4. No. of work years' experience in this company .....

5. Education:

☐ Below Bachelor's Degree ☐ Bachelor's Degree

☐ Master's Degree ☐ Doctoral Degree

Part 2 Information of the operation of the organization of the respondents

6. No. of total employee Thai ..... % Foreigner ..... %

☐ 1-50 ☐ 51-200 ☐ More than 200

7. Business type: Your company is organized into an industrial field.

☐ Paper and paper products ☐ Stone cutting

☐ Recycling ☐ Food Production, processing, and preservation

☐ Gas production / distribution ☐ Other productions

☐ Metal casting ☐ Glass and glass products

☐ Sporting goods ☐ Computers and related activities

☐ Machinery and equipment ☐ Office equipment / Accounting

☐ Beverage ☐ Apparel

☐ Jewelry ☐ Electrical tools and equipment

☐ Medical tools and equipment ☐ Inspection Instrument

☐ Furniture ☐ Cement / Concrete / Asbestos

☐ Other chemical products ☐ Ceramics

☐ Dairy products ☐ Petroleum products

☐ Products obtained from milling, starches, and instant feed

☐ Plastic ☐ Rubber

☐ Metal ☐ Other food productions

☐ Wood and wood products ☐ Precious metal

☐ Automotive, transportation equipment, and maintenance

☐ Basic chemicals ☐ Garment

☐ Publications and Printing ☐ Artificial fiber

☐ Iron / steel ☐ Others

8. Characteristics of Business Operation

☐ Less than 50% of Thai shareholder ☐ More than 50% of Thai shareholder

Additional explanation

The following text is a message about the level of work and activities in your company. Would like to know your opinion in each message, by a rating from 1 to 7

"7" – Strongly agree that the manufacturing company has done and carried out the activities

" 6" - Agree that the manufacturing company has done and carried out the activities

"5" - Somewhat agree that the manufacturing company has done and carried out

the activities

"4" – No opinion that the manufacturing company has done and carried out the activities

"3" - Somewhat disagree that the manufacturing company has done and carried out the activities

" 2" - Disagree that the manufacturing company has done and carried out the activities

" 1" - Strongly disagree that the manufacturing company has done and carried out the activities

Part 3 Information on Green Human Resource Management

Explanation: Please answer the questionnaire by marking √ best matches your opinion which is divided into 7 levels as follows;

Green Human Resource Management Practices - Policies, operations, and systems of human resource management for employees to understand environmental concepts and able to use internal resources of the organization sustainably, including the conservation of nature and the environment

Question	Strongly Disagree						Stronly Agree
	1	2	3	4	5	6	7
Management Support							
9. Top management treats environmental performance as a priority issue							
10. Top management allocates adequate resources (money, manpower etc.) to environmental performance efforts							
11. Top management support staff in terms of environmental operation							
12. Top management follows up suggestions for improvement on environmental performance							
13. Top management frequently communicates the organization's environmental goals to employees							
14. Top management is committed to environmental performance							

Question	Strongly Disagree						Stronly Agree
	1	2	3	4	5	6	7
15. The organization's environmental performance receive full support from top management							
16. The organization's environmental strategies are driven by the top management							
Recruitment & Selection							
17. The company is recruiting employees, regardless of their environmental skills, knowledge, and attitudes of the applicant							
18. The company interview by using environmental questions in the new employee selection process							
19. The company uses information technology to recruit and select the employees effectively							
Training							
20. Environmental training is considered as an important investment							
21. Environmental training is a priority							
22. The company has conducted the environmental training programs continuously							

Question	Strongly Disagree						Strongly Agree
	1	2	3	4	5	6	7
23. The company provides training or seminars continuously to educate the stakeholders about the environment							
Performance Evaluation							
24. The supervisors have a conversation with the staff. To regularly assess the progress of the environmental performance							
25. The company has evaluated its performance on both quantitative (numerical) and qualitative (abstract) to ensure that employees progress or participate in the implementation of environmental targets							
26. The company provides sufficient information about what employees are expected of environmental operations							
27. The company regularly monitors and monitors the progress of environmental performance							
28. The results of environmental inspections are communicated to employees to be used to determine the extent of environmental improvement							

Question	Strongly Disagree						Strongly Agree
	1	2	3	4	5	6	7
29. The supervisors regularly provide feedback on the environmental performance							
30. The company has specified the environmental performance indicators (Green Practice) for each employee							
31. The company always evaluates the environmental performance of its employees by the established standards							
Reward & Compensation							
32. The company is rewarding employees and team that gives the advice to improve the company's environmental operations							
33. The supervisors praised the employees for their work in improving the environmental performance							
34. The company offers a bonus or other monetary reward to employees who can work towards environmental goals							
35. The company provides a monetary reward for improving environmental performance							
36. The company has set penalties for employees who do not comply with environmental policies and regulations							

Part 4 Information on Green Innovation

Explanation: Please answer the questionnaire by marking √ best matches your opinion which is divided into 7 levels as follows;

Green Innovation - The integration of all innovations that are different from competitors and reduce environmental impact, which leads to choices for better environmental development

Question	Strongly Disagree						Strongly Agree
	1	2	3	4	5	6	7
Green Product Innovation							
37. The company uses environmentally friendly materials in the production of products							
38. The company has improved and designed environmentally friendly packaging such as using less paper or plastic							
39. The company is taking advantage of expired products by going through the recycling process (Recycle)							
40. The company has studied technical, economic, and commercial feasibility to develop environmentally friendly products							
41. The company measures the number of innovative products for the environment							
42. The company pays attention to green product development to make the package easier to use							

Question	Strongly Disagree						Strongly Agree
	1	2	3	4	5	6	7
43. The company pays attention to green product development to make product discovery easier							
44. The company pays attention to green product development to easily decompose the product material							
45. The company pays attention to the use of natural materials as components for green products							
Green Process Innovation							
46. The company uses clean technology to save and prevent pollution in various fields such as energy, water, and waste etc.							
47. The company sends an internal auditor to assess the supplier's environmental performance							
48. The company has a process design which supports research and innovation development							
49. The company has a lower unit cost of green products than those of its competitors							
50. The company is recycling and reusing of materials							
51. The company has always modernized the							

Question	Strongly Disagree						Strongly Agree
	1	2	3	4	5	6	7
production process to prevent the occurrence of environmental impact							
52. The company has modernized the production process to meet the standards of regulations and environmental laws							
53. The company uses technological innovation in the production process to save energy							
Green Managerial Innovation							
54. The company has redesigned the implementation and management process to ensure environmental management will be carried out efficiently							
55. The company has designed and improved products or services to comply with new environmental regulations							
56. Management are using modern management systems to manage green innovation regularly							
57. Management regularly gather information on trends in green innovation							
58. Management are actively involved in green innovation activities							
59. The company has a high investment in							

Question	Strongly Disagree						Strongly Agree
	1	2	3	4	5	6	7
research and development of green innovation							
60. Management provide experience sharing between various departments, involved in the issue of green innovation							
Green Technological Innovation							
61. The company has invested in environmental equipment and technology							
62. The company has a system to help advise and transfer environmental technology							
63. The company uses advanced environmental production technology such as clean technology, biological treatment. (Bioremediation) or bio factory (Bio factory) etc.							
64. The company has managed environmental documents and data using technology systematically							

Part 5 Information on Green Culture

Explanation: Please answer the questionnaire by marking √ best matches your opinion which is divided into 7 levels as follows;

Green Culture - Defining shared values that are in line with the organization's needs, including the operation of environmentally friendly organizations

Question	Strongly Disagree						Strongly Agree
	1	2	3	4	5	6	7
Leadership							
65. Management has joint planning to make all employees understand the importance of environmental preservation							
66. The management has a clear policy to stimulate environmental awareness in all areas							
67. Management have shown that environmental conservation is a very important activity of the company							
68. Management have shown that environmental conservation is an important corporate culture of the company							
69. Management to assist staff, if you encounter problems in environmental management							
70. Management must think and act in a review of progress in environmental operations							

Question	Strongly Disagree						Strongly Agree
	1	2	3	4	5	6	7
Communication							
71. Management regularly provide news about green innovation to employees							
72. Management communicate to employees about environmental information							
73. The company provides accurate information regarding environmental knowledge to employees							
74. The company gives importance to the education of the environment and how to apply it to the employees							
75. Employees are easy to share knowledge with colleagues about the environment							
76. Employees share opinions and suggestions regarding to the environmental management in the form of networking and creating networks within the company							
Employee Empowerment							
77. Employees can openly and freely express their opinions on the environment without fear of punishment							
78. Employees have the power to make independent decisions for issues related to							

Question	Strongly Disagree						Strongly Agree
	1	2	3	4	5	6	7
the environment							
79. Employees cooperate well in complying with environmental regulations							
80. Employees do not receive any penalties if comments or suggestions for improvement of the environment are not successful							
81. Employees work as a team to solve environmental management problems regularly							
82. The company regularly works as a cross-functional team in matters of environment							
83. Management has introduced a recommendation system, to encourage employees to give suggestions, to improve environmental performance							
84. In environmental operations, employees are free to talk directly about concerns with management or supervisors							
85. Most staff recommendations are used in environmental operations							
86. Management allow employees to solve necessary environmental problems on their own							

Part 6 Information on Environmental Performance

Explanation: Please answer the questionnaire by marking √ best matches your opinion which is divided into 7 levels as follows;

Environmental Performance - Performance indicators of the implementation of the organization's environmental management plan that complies with rules or regulations to reduce the effects and toxic waste that will occur to the environment

Question	Strongly Disagree						Strongly Agree
	1	2	3	4	5	6	7
Compliance with environmental regulations							
87. The company has strict compliance with environmental laws and regulations							
88. The company has improved various environmental complaints continuously							
89. The company has reduced fines and expenses to compensate for environmental-related damages							
90. The number of accidents or incidents affecting the environment of the company has reduced							
91. The company has a focus on environmental performance for the company's reputation							
Limiting environmental impacts							
92. The company has limited the environmental impact not to exceed the laws and regulations							

Question	Strongly Disagree						Strongly Agree
	1	2	3	4	5	6	7
93. The company can reduce the time it takes to deal with events that affect the environment less							
94. Companies can prevent and reduce environmental crises such as leaks that affect the environment							
95. The company has reduced the environmental risk of accidents, spreading, and releasing waste							
96. The company has established partnerships with network partners to reduce the impact on the environment							
Waste reduction							
97. The company has reduced the amount of waste and the release of harmful waste from operations							
98. The company has purchased less raw materials, chemicals, and waste parts							
99. The company has provided equipment and environmental facilities adequately to reduce various waste in the production process							
100. Reduced material costs which arise from the use of efficient materials							

Question	Strongly Disagree						Strongly Agree
	1	2	3	4	5	6	7
101. The company uses fewer production resources such as water, electricity, gas, or oil							

Part 7 Other suggestions

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Thank you

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