

Effect of Environmental Responsible Human Resource Management Practice on Manufacturing Enterprise Green Technology Innovation and Organizational Effectiveness

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ABSTRACT

This study uses the human resource management (HRM) practice and ability, motivation, and opportunities (AMO) theory and corporate social and environmental responsibility, to explore the effects of environmental responsible human resource management practice (ER-HRM) on energy-intensive manufacturing's green technology innovation and organizational effectiveness. A self-completed questionnaire was administered to managers of energy-intensive manufacturing in the Lao PDR. The data was collected from 198 managers of energy-intensive manufacturing for analysis. We used structural equation modeling (SEM) by smart PLS 3.0 to test the hypotheses in this research. The findings have shown a strong direct and positive impact of the environmental ability, motivation, and opportunity of ER-HRM practice on green technology innovation and organizational effectiveness. The ability of ER-HRM practice has the highest influence on green technology innovation and organizational effectiveness. The findings also prove the partial mediation of green technology innovation links ER-HRM with organizational effectiveness. This research is expected to identify the influences of ER-HRM in energy-intensive manufacturing to achieve innovation and performance while reducing emissions.

Keywords HRM practice; Green Technology Innovation; Corporate Sustainability Management

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1. Introduction

The expansion of the industrial sectors has caused economic growth in various regions worldwide. Still, such growth has led to the deterioration of natural resources and the environment, causing environmental problems to become more and more severe (Lin and Tan 2017; Wurlod et al. 2018). Energy-intensive manufacturing uses large-scale buildings and equipment in production and consumes more energy than any other industry, with limited natural resources and more severe environmental concerns, energy savings, and emission reduction are two critical aims for industrial companies, particularly energy-intensive industries (Li et al. 2020). Reducing the energy intensity of manufacturing processes is a key goal of climate policy because it effectively minimizes carbon emissions.

In order to solve such problems, all sectors must be aware and take action to help them. The state of the environment has progressed in lockstep with the growth of the industrial economy. Furthermore, at this time, international environmental agreements have begun to play a role, and trade pressure has emerged, including the rising demand from the low carbon innovation market. Thus, entrepreneurs have to speed up to adapt to the changes and emphasize environmentally friendly production for sustainable production and consumption by creating environmentally friendly innovations.

Environmental sustainability has emerged as one of the largest and most important challenges in the past few decades. Governments and companies are becoming greatly worried about the natural environment's variety and preservation for upcoming generations. Consumers and employees have recently demanded that businesses increase their environmental responsibilities. As a result, corporate organizations are more pressure and encouraged to adopt environmentally friendly policies and procedures. Many firms attempt to build and adopt a systematic environmental management system to accomplish this expansion. Green technology innovation has been shown to reduce pollution and environmental harm while also promoting firm performance and green development (Li et al. 2020).

In order to meet the environmental economic aim and carbon emission target, companies have to take aggressive steps to create green technology innovation and enhance their green technology innovation performance following the global carbon reduction agreement. Earlier studies have shown that green technology innovation methods may provide several competitive benefits and improving business sustainability, environmental regulations and company's internal governance have a positive effect on green technology innovation (Zhao et al. 2021). Moreover, Green technology innovation will be the essential solution for the business sustainability of energy-intensive industry (Li et al. 2020). As a result, it is critical to comprehend what motivates green

technology innovation.

Environmental responsible human resource management is concerned about promoting low carbon green technology innovation and reducing materials and pollution, it is the whole organizational process that is related to the practices of HR, sustainability of the organization, leadership and employee behavior. Considering the carbon neutrality and carbon peak policy, organizations around the world have begun to implement such philosophies. Environmental HRM is the newest and most important. Mampra et al. (2013) have described environmental HRM practices to promote the efficiency and environmental use of resources within organizations and to raise employee morale, motivation and fulfillment. Some other scholars define environmental HRM practices as enhancing low carbon environmental innovation (Zoogah et al. 2011).

Environmental responsible - HRM improves green awareness among employees (Renwick et al. 2013), increase green creativity (Jia et al. 2018) and enhances the innovation performance of green organizations (Tang et al. 2018) and the environmental business performance (Guerci et al. 2016 and Zhou et al. 2018). These fields of research are still widely limited and require more experimental investigations, mainly when organizations are under growing shareholder pressure to adopt green management policies and practices. In addition, existing literature proposes that a company might consider engaging new employees based on their environmental knowledge, attitudes, and values (Singh et al. 2019; Renwick et al. 2013), via environmental recruitment approach and selection procedures ensure that future employees value and understand the organization's ecological attitudes and values (Jackson and Seo 2010) by inspiring future talent' green attitudes, values, and skill (Renwick et al. 2013). Likewise, green or environmental training (Teixeira et al. 2016 and Jabbour et al. 2016) represent essential green human resource management practices to promote better environmental performance.

Some previous research indicates that HRM affect innovation. And HRM practice influences corporate, product, and business innovation (Iménez 2008) and small firms with fewer employees in which HRM systems significantly drive innovation (De Winne et al. 2010). Moreover, HRM practices support staff involvement rather than adherence to corporate structure and policies (Verburg et al. 2007). In addition, Zhou et al. (2013) propose differential impact of engagement and cooperation-oriented HRM practices on organizational innovation. The former improves the capacity for inner innovation, and the latter stimulates innovation by creating and maintaining social connections with outside sources. Additionally, green technology innovation is a crucial policy for firm performance (Singh et al. 2019), and the company leverages it to achieve its green corporate objectives. Green technology innovation in green products and processes considerably decreases the company's adverse environmental effects and enhances the company's performance, and environmental performance helps promote employee job satisfaction and commitment and

reduces turnover (Li et al. 2021; Walsh and Sulkowski 2010).

Green technology innovation would be an effective option for corporate and industrial business sustainability. Environmentally responsible human resource management is the entire organizational process linked to HR practices, organizational sustainability, leadership, and employee behavior. According to Mampra et al. (2013) and Walsh and Sulkowski (2010), the application of HRM practices is referred to as environmental HRM, this will increase staff motivation, engagement, and happiness. Environmental HRM practices can inhibit pollution and ecological damage through green technology innovation, and it can also enhance corporate performance and bring many competitive advantages and better business sustainability. Previous research has indicated that environmental regulation and corporate governance influence green technology innovation. The manufacturing organizations which involve in creating environmental innovation can enhance economic and ecological sustainability (Li et al. 2020).

This study explores the direct effect of Environmentally responsible human resource management practice on green technology innovation and organizational effectiveness. Based on earlier literature, it is assumed ER-HRM practice has influenced green technology innovation. The supplementary objective of current research is to look into green technology innovation as a mediator in the relationship between ER-HRM practice and organizational effectiveness. This study is based on the AMO theory of abilities, motivation, and opportunities (Bos-Nehles et al. 2013) for a proper comprehension of the impact of ER-HRM on green technology innovation and eventually on organizational effectiveness. Our research also applies the CSR theory to explore the ER-HRM practice as an essential asset in driving green technology innovation and organizational effectiveness. This research also provides a deeper insight into the relationship between environmental responsible HRM, green technology innovation and organizational effectiveness in the energy-intensive manufacturing.

2. Literature Review

2.1. Environmental Responsible Human Resource Management Practice

Environmental responsible human resource management (ER-HRM) was regarded as the HRM component of environmental management (Budhwar et al. 2002). As a result, it would only be detected in the early phase of its development in terms of strategic managerial decisions and departmental human resource practice. Many other authors highlighted the importance of workers' proactive behaviors, attitudes, and dedication to environmental management (Guerci et al. 2016), as established and promoted by the ER-HRM practices are mainly examined within the perspective of AMO theory (ability, motivation, opportunity) (Renwick et al. 2013). According to

the AMO theory, performance is the result of the interaction between employees' aptitude or competencies to perform (ability), desire or willingness to perform (motivation), and chance or policy and procedures to perform via participation (opportunity) (Blumberg et al. 1982). The underlying premise of ER-HRM approaches is to discover and improve employees' green skills. Environmental performance rating system promotes environmental incentives; providing employees with the capacity to work with flexibility and freedom, autonomy, and decision-making participation to enhance employees' environmental behavior (Amrutha et al. 2020). According to commitment theory, individuals construct their sense of self belonging on their groups, such as their involvement in organization (Hogg et al.1987). According to this theory, employees who create an environmental identity at work would adopt environmental innovation, influencing their firms' environmental performance (Kim et al. 2019). The main functional HRM areas were performance management, training, development, learning, salary and incentives, and culture. HRM practices are examined in the context of an environmental vision. This was quickly followed by Cherian and Jacob (2013) examined the firm's actual adoption of environmental HR practices, whereas Renwick et al (2013) review was a preliminary attempt to (a) evaluate how HRM and EM are combined and (b) propose future prospects for the research.

Opatha et al. (2014) emphasizing the importance of conceptualizing and operationalizing the multiple components in the field of ER-HRM, emphasizing the importance of conceptualizing and operationalizing the multiple elements in the field of ER-HRM, the necessity to develop instruments to evaluate the usefulness of these approaches. According to a study by Ahmad et al. (2015), developed a variety of environmental practices that may be integrated into the creation of an ecologically friendly company. In contrast, Arulrajah et al. (2016) developed and improved on the work of Cherian et al. (2012), which consolidated the previously approved HRM environmentally friendly practices among companies. Renwick et al. (2013) emphasized the possible need to explore other areas related to ER-HRM practices, so validating the employee empowerment green approach to their research study. The notion behind this statement is that employees must be empowered to carry out their companies' environmental initiatives and that green employee empowerment must be considered as part of a bigger framework of environmental human resources. Renwick et al. (2016) began a literature review, established a new research agenda for ER-HRM, focusing on the practical consequences for professionals. They emphasized the reason previous ER-HRM research could benefit from the addition of national culture, a better understanding of environmental recruiting and employee satisfaction, and a better awareness of ecological recruiting and job satisfaction methods and techniques, and there is a stronger emphasis on the link between ER-HRM and financial and environmental performance.

ER-HRM dimensions are discussed in the literature (Renwick et al. 2013). They found that selecting, hiring, training, and developing environmental human resources were essential duties. Their findings also revealed an absence of comprehensive research in developing nations and Asia and the lack of a cross-cultural paradigm. Amrutha and Geetha complete review. They examined data from 1995 to 2019, confirming the scarcity of research in developing nations while pointing out that most studies were done in Europe and Asia. They constructed a model to study how ER-HRM practices promote organizational sustainability. Based on their findings, corporate social responsibility and context are connected with all three components. Despite the availability of relevant literature reviews and the ever-growing research devoted to ER-HRM, all of these studies agree on one thing: that theoretical, methodological, and empirical advances in the field of ER-HRM are still urgently needed. A factual analysis of the consequences is the next steps in deepening our understanding of ER-HRM. Previous reviews of the literature on ER-HRM have been conducted have emphasized the need to understand better the actual outcomes of implementing ER-HRM practices.

2.1.1 Dimensions of Environmental Responsible Human Resource Management

(1) Environmental job design and analysis

Job descriptions are aimed to describe a collection of skills, tasks, and responsibilities connected to environmental conservation in general (Renwick et al. 2008 and 2013). To assist and protect the environment, some organizations have incorporated as many environmental and societal functions, duties, and obligations as possible into each career. In certain firms, every position has at least one environmental responsibility or more than one green responsibilities.

To the maximum degree feasible, job descriptions for employees can include many requirements of the company's social, environmental, personal, and technological components. For example, environmental protection standards and the assigned role roles for environmental reporting and health and safety-related activities must be implemented. Additionally, some businesses rely on group work and inter-functional teams as work design skills to efficiently handle the company's environmental concerns. This is because environmental performance comprises of demands diverse teams. Many firms nowadays have created new positions to focus on the firm's environmental practices (Jabbour et al. 2010; Opatha et al. 2013).

(2) Environmental recruitment

Environmental talent management policies need environmental recruitment. Companies must hire and retain employees who actively support and care about the environment's long-term

viability (Renwick et al. 2013). Therefore, to entice a new generation of employees who are more concerned about the environment (Ehnert 2009). Enterprises should build a reputation based on the notion that such entities are ecologically friendly (Guerci et al. 2016). Effective personnel management is the primary driver of company efficiency and long-term environmental growth. This might help businesses to hire and keep top people while also enhancing productivity.

Furthermore, the literature suggests that the talent management system may be incorporated in all human resource management sub-functions. Consequently, the talent management scheme may be integrated into the hiring process, assisting in attracting and retaining qualified employees who will contribute to achieving corporate goals and sustainability. As a result, green targets are increasingly included in management job descriptions to identify potential talent for achieving company goals while protecting the environment. As a result, environmental goals are now being included in management position criteria to assess the potential staff base for future talent acquisition. As they continue to expand their skill competence system, several organizations are already incorporating environmental consciousness into the fundamental abilities requirement of employees.

There is substantial evidence that today's companies with strong environmental or sustainable development are considerably more likely to retain talent than recruiters who don't have a strong green culture. According to various surveys, many firms have lately begun to acknowledge that low carbon green job seekers, who make up a significant section of the population of skilled employees, consider environmental values when considering a job application. Consequently, such businesses have begun to use ecologically friendly methods of recruiting new employees. Furthermore, many companies have started to promote the term low carbon or green in order to portray a corporate reputation. As part of their human resources recruiting policy, several companies have begun to offer preference to environmental or green positions applicants throughout the recruitment process.

(3) Environmental selective staffing

Selective staffing is a crucial approach for attracting top personnel. Selective staffing is a method of finding the best candidate for a vacant position based on tight criteria. Management may use social media and computerized recruiting and selection to locate the most qualified candidates. The necessity of selected employment for the successful development of environmental management is highlighted in a literature review on environmental sustainability (Jabbour et al. 2016). For example, firms have already evaluated the environment as a consideration in the recruiting process. Corporates may consider recruiting individuals whose environmental ideals correspond with the company's.

(4) Environmental training

HRMP has been shown to predict training, empowerment, and incentives accurately. Employee training is critical in improving their job and behavioral abilities to properly manage client requests and issues. According to a recent study on environmental sustainability, training is one of the essential components in putting good environmental management into practice. Employees who get environmental training better understand the necessity of environmental protection and increased awareness of environmental issues, motivating them to submit green technology innovation.

Employees are given a tremendous incentive to demonstrate the company's commitment to environmental sustainability and the effective implementation of ER-HRM by include both organized and unstructured training. Employees that receive environmental training are more likely to focus on green technology innovation training likes reducing water and energy use, avoiding waste, and utilizing renewable and recycled materials. To practice this, both organized and unstructured training can be successful. It is worth noting that including employees in the development of environmental goals and strategies will lead to more successful execution of environmental management programs.

(5) Environmental performance management

Employee's environmental performance is the environmental performance of an employee's job in a company over a specific period. Employee green performance refers to an employee's quantitative and qualitative contributions to lowering the organization's harmful environmental effects and increasing the organization's positive environmental impacts over a certain period. This interpretation accurately reflects the relevant meaning of employee's green performance in the context of an enterprise. Opatha and Arulrajah (2014) conducted a brief study on green employee's performance. However, understanding and recognizing the importance of employee's environmental performance is not enough to completely describe and delineate the elements of green performance. In addition, a more thorough examination of the literature is necessary for two other areas. Initially, it is essential to figure out why companies need to track employee green performance, and whose employees' environmental performance needs to be followed. Second, to determine that enterprises must record environmental performance components of occupations to quantify employee environmental performance.

(6) Environmental reward

Rewarding employees for their environmental behavior is one sign of the ER-HRM (Luu et al. 2018). Renwick et al. (2013) explained how businesses that utilize environmental rewards, for

example, encourage employees to adopt environmentally friendly activities. Management expects workers to do great work with consumers due to employee empowerment, ensuring consumer satisfaction and successful recovery. Employees who are effective in this regard should be recognized and rewarded. The provision of monetary and non-monetary awards inside the firm sends a clear message to employees that PEBs are valued and recognized.

(7) Environmental employee relations

The evolution of environmental human resource management has affected employee relations and union organization management operations. Staff interactions and union engagement are critical to the success of the company's environmental HRM goals and strategies in the context of environmental HRM. To acquire the anticipated advocacy of unions for business green management initiatives, many companies have devised ways and acknowledged the union as a significant participant in environment HRM. HRM practice such as staff participation and engagement in environmental programs and issue-solving programs for environmental employee involvement and union business operations. Which of the following policies might be regarded company's environmental performance.

(8) Green empowerment

Empowerment is one of the HPWS indicators, which refers to the ability and autonomy to make decisions and agreements (Forrester et al. 2000). Employees would get the clearance they need to handle consumers expectations and issues by abandoning responsibility at different parts of the service delivery chain (Babakus et al. 2003). Employees may exercise empowerment if they participate in training sessions that cover how to utilize empowerment effectively to satisfy the requirements and expectations of clients and management. Employee commitment to PEBs is aided by environmental empowerment (Luu et al. 2018). In the case of Tariq et al. (2016). According to their ER-HRM evaluation, environmental empowerment stimulates employees to commit to environmentally responsible behaviors, therefore supporting the firm in gaining a strategic commercial advantage. The importance of green empowerment via ecologically responsible and servant-based leadership is emphasized. By enabling individuals, leadership management may encourage them to take the initiative and adopt environmentally activities.

Table 1. Outlines the most prevalent environmental human resource practices.

Dimensions	Practices
Environmental job design	<ul style="list-style-type: none"> - Incorporates a variety of tasks, duties, and responsibilities related to environmental conservation into all work done. - To the degree practicable, incorporates environmental, organizational, social, individual, and procedural criteria into position descriptions and individual qualifications. To successfully address the organization's environmental concerns, collaboration and transversal teams are used for post conception procedures. - Make the environmental component a part of the job description and a requirement. - Include environmental skills as a fundamental component of the job description. - Future jobs/positions should be designed and deployed to focus exclusively on an organization's environmental business management tasks.
Environmental recruitment	<ul style="list-style-type: none"> - Using environmental job positions to recruit environmental talent is a good idea. - Include environmental considerations in job descriptions and applicant profiles. - Examine the environmental awareness, assets, culture, values, and beliefs of candidates. - Including information about environmental initiatives in the recruiting process. - On the company's job webpages, provide information on the company's environmental efforts.
Environmental selective staffing	<ul style="list-style-type: none"> - As part of the evaluation criteria, applicants' environmental issues and concerns are considered. - Inquiring about the environment during an applicant's interview or qualification evaluation. - To fill a vacancy, look for people who have the necessary ecological consciousness. - Candidates who have committed to environmental sustainability in their personal field of action will be considered.
Environmental training	<ul style="list-style-type: none"> - Provide engineering workers with specialized training on issues such as better energy-efficient technologies, alternative goods, waste management, and process redesign. - Employee training sessions on environmental concerns, both general and sector-specific, should be provided to raise employee awareness of the environmental consequences of their company's actions. Provide training sessions that will equip you with the knowledge you will need to implement proactive measures. Develop and execute educational methods, such as staff gardening. - Provide everyone with the opportunity to learn about environmental management.
Environmental performance management	<ul style="list-style-type: none"> - Using environmental indicators in the performance management and assessment processes. - Establish environmental goals and obligations for employees and their supervisors. - Give staff constructive and positive feedback on green endeavors.
Environmental rewards	<ul style="list-style-type: none"> - Employees' green credentials should be rewarded. - Financial incentives should be offered to employees who do well in becoming green. - Provide non-monetary incentives for staff who do well in environmental stewardship. - Excellent Teams will be recognized for their improved environmental performance. - Give out rewards for exceptional environmental performance. - Provide incentives to encourage environmentally beneficial behaviors and attitudes, such as garbage disposal and recycling. Provide incentives for developing environmental skills.

Dimensions	Practices
Environmental employee relations	<ul style="list-style-type: none"> - Allowing the employee to participate in environmental awareness programs. - To resolve the company's environmental issues, participate in constructive dialogues. - Recognize the union as a significant participant in environmental management. - Allow unions to establish an environmental workplace agreement with management. - Environmental policies and initiatives are carried out by operational employees.
Environmental empowerment	<ul style="list-style-type: none"> - Encourage employees to take part in long-term environmental planning. - Management's unwavering support for partners on environmental concerns.

2.1.2 AMO theory and ER-HRM practices

Human resource management practices are the specific HR policies, procedures, processes, and practices that are really integrated in the firm or organizational unit (Gerhart et al. 2000). The overarching goal of environmental HRM practices is to improve the company's environmental performance. Environmental human resource management practice is a broad term that incorporates a wide range of policies practices. The ability–motivation–opportunity based on HR approaches, in other words, increase employee's talents, motivation, and opportunity, hence promoting green performance. The purpose of ER-HRM practices is environmental human resource management to increase environmental performance by boosting staff abilities. This includes attracting and developing staff with relevant environmental skills, encouraging employees to accomplish environmental goals through employee incentives, and educating employees about environmental issues and evaluating their performance. Including environmental problems and possibilities by sharing environmental ideas and working together to achieve environmental goals.

The AMO theory is used in our research to forecast the link between the variables: ER-HRM practices, green technology innovation, and organizational effectiveness. Prior studies have shown that HRM practices have a positive influence on employee and firm's performance. However, AMO theory has been utilized extensively in research to investigate HRM methods in terms of employees' ability, motivation, and opportunity in order to identify their work attitudes, behaviors, and performance (Sobaih et al. 2019) as well as their impact on business performance (Gerhart et al 2005). Few studies in the energy-intensive manufacturing were found after an extensive examination of recent research on ER-HRM practices and their link to or influence on green technology innovation and organizational success. Previous research has evaluated environmental HRM using either a single-dimensional measure of HRM practices in the context of employees or a multi-dimensional measure of HRM practices in terms of employees. The multi-dimensional scale includes measures for evaluating staff recruitment and selection, development and training, company performance management, awards, and engagement (Renwick et al. 2008).

Further research has extended the AMO theory to explore ER-HRM practices from a leadership perspective (Singh et al. 2020). Singh et al. (2020) evaluated the consequences of environmental HRM on green technology innovation. It is critical for leadership and corporate management to examine ER-HRM practices. This is because strong leadership performance HRM methods directly and substantially impact the abilities, opportunities, and motivation of employees and their performance (Sobaih et al. 2019). Thus, green technology innovation and environmental corporate performance (Singh et al. 2019). This research applies AMO theory to investigate how manager-owners' environmental ability, motivation, and opportunity influence firms' green technology innovation and organizational effectiveness. It also adopts the CSR theory to explore ER-HRM practice to attain green technology innovation and organizational effectiveness.

2.2. Green Technology Innovation

Technology innovation is the main driving force of economic growth. Technology innovation can be divided into environmental technological innovation and non-environmental technology innovation. Existing studies have explored the driving factors of technology innovation or environmental technology innovation from different perspectives. It is mainly divided into the theoretical perspectives of Schumpeter, institutional innovation and national innovation system, as well as the theoretical perspectives of enterprise management and consumer behavior decision-making. Green technology innovation can be understood as a combination of “green”, “technology” and “innovation”, related concepts such as “environmental innovation” and “ecological innovation”, etc. Green technology innovation of enterprises requires human and financial investment, and has the attributes of long research cycle and uncertain innovation results.

Green technology innovation refers to the development or production of new products and services, which is one of the possibilities for tackling environmental concerns for sustainable development (Chen 2002; Chen 2006; Ar 2012). Green technology innovation can help to address these environmental issues. Furthermore, it generates competitive advantages and enhances employee satisfaction (Li et al. 2020). Technology, management functions, product design, and manufacturing process elements are the categories of green technology innovations. During the product's life cycle evaluation, green technology innovations involve improving an existing product design to lessen the negative influence on the environment (Tseng et al. 2013). Green technology innovation is hardware and software innovation connected to green goods or processes, such as power-saving, recycling, reuse, pollution prevention, sustainable products, or organizational environmental management. Green technology innovation is used to increase

environmental protection performance in terms of achieving environmental protection criteria. Also, improvement of green technology innovation performance can promote environmental protection and sustainable socio-economic development. By investigating and cultivating the potential and capacity of manufacturing firms, as the focal part of this ecology, green technology innovation can be improved to have sustainable development. Today's business operations are characterized by technological advancements that create new business areas. Business competition is becoming more intense. Consumers have become aware of safety and friendliness with environmental and social responsibility. A business that can adjust the concept of business administration by focusing on running a business with social responsibility will have a greater chance of survival and sustainable growth (Tseng et al. 2013).

2.3 Organizational Effectiveness

Organizational effectiveness is a vital factor in the success of any business, and organizational effectiveness has been acknowledged as a technique for measuring productivity. The amount of organizational success in achieving organizational performance. It is the sum of the vital constituents' effectiveness (Manzoor et al. 2012; Manoharan 2019). Based on this Manoharan (2019) study, job satisfaction, organizational commitment, and turnover intention objectively measure organizational effectiveness. Job satisfaction measures how well expectations are met and how well actual rewards are met. Job satisfaction is defined as the fulfillment of desires based on aptitude, ability, assessment, and reward. The commitment as how much an individual feels a feeling of togetherness with the organization, and it can be stated as loyalty or allegiance to the organization (Allen et al. 1990). Turnover intention is an employee's intent to move their work; Staff turnover is critical, particularly in human resource management (Mobley 1979).

3. Hypothesis Development

3.1. Environmental Responsible Human Resource Management Practice and Green Technology Innovation

The company's CSR and the ability-motivation-opportunity (AMO) theory were used to research and examine the HRM-performance relationship in the context of the Lao PDR's energy-intensive manufacturing. According to HRM practice and strategy literature Singh et al. (2019), green technology innovation involves the creation of green products and practices, including the use of environmental design concepts, decreasing the use of raw materials in the manufacture and reduced pollution and the usage of water, power, and other sources. Previous

research has shown that HRM has a major influence on technological and procedural innovation. According to the AMO concept, ER-HRM practices ability through recruitment, selection, training and development, with motivation such as rewards, incentives, compensation, and opportunity like teamwork and empowerment contribute to the green technology innovation of the firm (Singh et. al 2019). We suggest that green training practices help achieve high capabilities of employees, and assessment within the performance managing mechanism enhances green technology innovation in manufacturing. In addition, some previous research indicates that HRM sets or systems affect innovation performance. And HRM practice influences organizational, product, and business innovation and small firms with fewer employees, which HRM systems significantly drive innovation (De Winne et al.2010). Moreover, Zhou et al. (2013) propose differential impact of engagement and cooperation-oriented HRM practices on organizational innovation. The former improves the capacity for inner innovation and the latter stimulates innovation by creating and maintaining social connections with outside sources.

Innovation in green products and processes considerably decreases the company's negative environmental effects, ER-HRM practice can enhances the company's performance including economic, and environmental performance via green technology innovation (Giudice et al. 2018). Additionally, green technology innovation is a key policy resource for environmental performance (Singh et al. 2019) and the company leverages it to achieve its green corporate objectives. According to resource dependence and CSR theory, we suggest that firms promote and develop the capacity will use ER-HRM methods to recruit, motivate, and give chances for environmental HR to capitalize on their strengths for green technology innovation the following:

Hypothesis 1: Environmental ability has a positive effect on green technology innovation.

Hypothesis 2: Environmental motivation has a positive effect on green technology innovation.

Hypothesis 3: Environmental opportunity has a positive effect on green technology innovation.

3.2. Green Technology Innovation as Mediating Role between ER-HRM and Organizational Effectiveness

Green technology innovation was identified as a source of workplace change. Employees are expected to work in new ways, with new tools and technology, and increased efficiency and production. Green technology innovation may provide many chances to decrease expenses and ultimately improve profit by avoiding pollution and reusing waste resources, contributing to long-term sustainability and enhancing corporate performance. According to Walsh and Sulkowski (2010), the individuals who work at a company has more environmental practices that increase job satisfaction and lower working stress levels. In the same way, the employee who works

in a firm with more significant green technology innovation feels like a part of a greater that will promote loyalty to the organization. When employees are happy with the activities and workplace provided by the firm, the turnover intention rate will decrease. We may infer from the preceding discussion that green technology innovation has a major impact on organizational effectiveness. We extended recent research by investigating green technology innovation as a mediator between ER-HRM and organizational effectiveness (Singh et al. 2020; Li et al. 2020; 2021). Many prior studies indicate that ER-HRM has a significant and noticeable impact on technology innovation. HRM Strategy has a strong influence on employee environmental awareness and job satisfaction. Analyzing the above research, we can conclude that green technology innovation would connect environmentally responsible HRM practices and organizational effectiveness.

Hypothesis 4: The green technology innovation would mediate the mechanism between environmental responsible human resource management practice and organizational effectiveness

3.3 Research Model

From the above discussion, the following research model is proposed:



Figure 1. Research Model

4. Methodology, Data Analysis and Results

4.1 Samplings

This paper's quantitative research was carried out to collect data and examine the direct effect of environmental responsible human resource management practice (RE-HRM) on green technology innovation and organizational effectiveness by using AMO theory (ability, motivation and opportunities). The study relies on a questionnaire as its primary tool, divided into two parts. The first section is the sample's characteristics such as gender, age, educational level, number of employees, type of employee, year of work, and the second part are answers of choice following the 5 Likert scale, where 1 = strongly disagree and 5 = strongly agree. The population of the present

study includes the energy-intensive manufacturing in Lao PDR. Based on the preceding explanation, this study selects the energy-intensive sector as research evidence due to energy-intensive manufacturing uses large-scale buildings and equipment in production and consumes more energy than any other industry. Participants were informed before the survey that the information gathered would be used solely for this research paper's analysis.

4.2. Measurements

Environmental Responsible Human Resource Management (ER-HRM).

We examined environmental responsible HRM in our present study utilizing three aspects linked to AMO theory: abilities, motivation, and opportunity. These items were used to assess environmental abilities (1) Provide engineering workers with training on environmental issues; (2) Only those with environmental ideals are hired; (3) The environmental staffing process is given a lot of attention; (4) All employee is required to complete environmental training; (5) The goal of environmental training is to develop employees' environmental knowledge and abilities; (6) Employees put environmental knowledge on the job. Environmental motivation was measured using four items (1) performance evaluation reports on environment efficiency; (2) Environmental events, duties, concerns, and policies are all included in performance evaluation; (3) Employees are rewarded for their efforts in environmental management; (4) Rewarding employees for developing environmental abilities. Environmental opportunities were measured based on 3 items (1) Employees are helping to make the company more environmentally sustainable; (2) Using collaboration to solve environmental problems; (3) During a team meeting, employees address environmental challenges.

Green Technology Innovation

The measurement of the performance of green product innovation contained four items: (1) the corporation selects product materials that emit the least amount of pollution; (2) the corporation selects product materials that utilize the least amount of energy and resources; (3) the corporation employs the fewest number of materials to construct the product; (4) corporation would carefully consider if the product is easy to recycle, reuse, and disintegrate. The measurement of the performance of green process innovation contained four items: (1) the company's production procedure efficiently eliminates the emission of dangerous chemicals or trash; (2) the company's production technique recycles trash and emissions, allowing them to be processed and re-used; (3) the company's production method consumes less water, electricity, coal, or oil; (4) the company's production technique decreases the utilization of raw resources.

Organizational Effectiveness

Among organizational effectiveness, the measurement questionnaire was composed of eight items to measure organizational effectiveness as follows; (1) the firm supplied cultural and environmental events to its employees; (2) the employee is happy with the income they are now earning; (3) the individual is comfortable with their present teamwork; (4) working at this organization has made me feel good; (5) happy to let others know that I am a member of this firm; (6) I have a deep emotional connection to this company; (7) I will not quit from this firm; (8) I will not leave this organization in the further.

4.3 Data Analysis and Result

4.3.1 Demographic Analysis

A total of 250 questionnaires were distributed to the owners-managers of these energy-intensive manufacturing in Lao PDR on a self-administered basis, leaving a sample of 198 questionnaires for analysis. Table 1 shows the respondent's demographic characteristics. According to the 198 samples collected, most respondents were males (83%). Most of them were aged between 41 and 50 (60%), and remaining (27 %) were between 31 and 40. Most of the respondents were Master's graduates (59%). The majority of the energy-intensive manufacturing owns between 40 and 60 employees (25%), whereas (62%) have more than 62 employees. Most of these employees were full-time (88%) while only 12% were temporarily employed and paid hourly. The majority of respondents worked between 5 and 15 years (63%).

Table 2. Demographic characteristics

Variables	Category	Frequency	Percentage (%)
Gender	Male	164	83
	Female	34	17
Age	Less than 30	12	6
	31- 40	53	27
	41- 50	119	60
	More than 50	14	7
Education	High school	5	3
	Bachelor	65	33
	Master	117	59
	Ph.D	11	5

Variables	Category	Frequency	Percentage (%)
Number of Staff	40 employees or less	26	13
	40-60	49	25
	more than 60 employees	123	62
Type of Staff	Salary staff	175	88
	Hourly staff	23	12
Years of Work	Less than 5 years	25	13
	5 to 15 years	125	63
	More than 15 years	48	24

4.3.2 Measurement Model

A reliability and validity examination of constructs is to see if the measures are accurate. The composite reliability (CR) and Cronbach's alpha (CA) were examined, with values above the 0.70 critical value level, indicating reliability. Moreover, the average variance extracted (AVE) for all constructs was more than 0.50 and the factor loading values for all constructs were greater than 0.70, both of which are good. In this study, we will utilize Cronbach's alpha values to examine the reliability of our variables' dimensions.

Smart PLS 3.0 was used in this investigation to compute the average variance extracted (AVE), composite reliability (CR), and factor loading. The results of the validity and reliability studies are shown in Table 3. The average variance extracted (AVE) of environmental ability is 0.796, environmental Motivation is 0.746, Environmental opportunity is 0.763, green product innovation is 0.736, green process innovation is 0.627, and organizational effectiveness is 0.787. The composite reliability (CR) of environmental Ability is 0.972, Environmental Motivation is 0.921, Environmental opportunity is 0.942, Green Product Innovation is 0.948, Green Process Innovation is 0.861 and organizational effectiveness is 0.913. All measurement elements have factor loadings ranging from 0.743 to 0.987.

A reliability study and a factor analysis were also carried out using Smart PLS 3. The outcome is presented in table 2. When compared to other dimensions, the Cronbach alpha for environmental ability has the greatest value where 0.899, environmental motivation is 0.853, environmental opportunity is 0.863, green product innovation is 0.896, green process innovation is 0.714 and organizational effectiveness is 0.881. The AVE and related CR values are more significant than 0.5-0.7 in the reliability test. Furthermore, all Cronbach's alpha values are larger than 0.7, indicating that dependability has been achieved.

Table 3. The result of validity and reliability analysis

Variables	Factor Loading	AVE	C.R	Cronbach alpha
<i>Environmental Ability</i>				
EA 1: Provide engineering workers with training on environmental issues	0.786			
EA 2: Only those with environmental ideals are hired	0.895			
EA 3: The environmental staffing process is given a lot of attention	0.919			
EA 4: All employee is required to complete environmental training	0.854	0.796	0.972	0.899
EA 5: The goal of environmental training is to develop employees' environmental knowledge and abilities	0.897			
EA 6: Employees put environmental knowledge on the job	0.769			
<i>Environmental Motivation</i>				
EM 1: Performance evaluation reports environment efficiency	0.889			
EM 2: Environmental events, duties, concerns, and policies are all included in performance evaluation	0.798			
EM 3: Employees are rewarded for their efforts in environmental management.	0.865	0.746	0.921	0.853
EM 4: Rewarding employees for developing environmental abilities	0.928			
<i>Environmental Opportunity</i>				
EOP 1: Employees are helping to make the company more environmentally sustainable	0.878			
EOP 2: Using collaboration to solve environmental problems	0.786	0.763	0.942	0.863
EOP 3: During a team meeting, employees address environmental challenges.	0.983			
<i>Green Product Innovation</i>				
GPDI 1: The corporation selects product materials that emit the least amount of pollution	0.985			
GPDI 2: Corporation selects product materials that utilize the least amount of energy and resources	0.897			
GPDI 3: The corporation employs the fewest number of materials to construct the product	0.987	0.736	0.948	0.896
GPDI 4: Corporation would carefully consider if the product is easy to recycle, reuse, and disintegrate.	0.864			
<i>Green Process Innovation</i>				
GPCI 1: The company's production procedure efficiently eliminates the emission of dangerous chemicals or trash	0.976	0.627	0.861	0.714

Variables	Factor Loading	AVE	C.R	Cronbach alpha
GPCI 2: The company's production technique recycles trash and emissions, allowing them to be processed and re-used	0.924			
GPCI 3: The company's production method consumes less water, electricity, coal, or oil	0.867			
GPCI 4: The company's production technique decreases the utilization of raw resources	0.857			
Organizational Effectiveness				
OE 1: The firm supplied cultural and environmental events to its employees	0.897			
OE 2: The employee is happy with the income he or she is now earning	0.975			
OE 3: The individual is comfortable with their present teamwork	0.913			
OE 4: Working at this organization has made me feel good	0.953	0.787	0.913	0.881
OE 5: Happy to let others know that a member of this firm	0.765			
OE 6: Have a deep emotional connection to this company	0.743			
OE 7: Will not quit this firm	0.789			
OE 8: Will not leave this organization in the further	0.926			

CR stands for composite reliability, while AVE is for extracted average variance.

4.3.3 Structural Model

We extend and employ structural equation modeling analysis using smart PLS 3.0 in this study to assess the causal link between each variable in energy intensive manufacturing. We employed the SEM to test the study hypothesis. Because it enables for the inspection and testing of both contemporaneous and sequential linkages while accounting for measurement error, SEM is an accurate technique for data analysis in this study.

Environmental ability has a significant positive relationship with green technology innovation where β equals 0.49, t-value 10.953 with p is less than 0.001, this indicates that hypothesis H1 is valid. At the same time, environmental motivation has a positive effect with green technology innovation 0.42, t-value 9.731 with p is less than 0.001, indicating that hypothesis H2 is positive. In this connection Environmental opportunity significant impact to green technology innovation where β equals 0.26, t-value 5.331 with p is less than 0.001, which mean that hypothesis H3 is supported. In this regard, SEM finding that there is significant positive of green technology innovation and organizational effectiveness where β equals 0.52, t-value 12.731 with p is less than 0.001.

Mediation effect testing also tests the environmental ability, motivation, and opportunity to organizational effectiveness. The results reveal that the direct influence of environmental ability on organizational effectiveness increased from β 0.38, t-value 8.953, and p less than 0.001 to environmental ability on green technology innovation where β equals 0.49, t-value 10.953 with p is less than 0.001. Likewise, environmental motivation's direct impact on organizational effectiveness rose from where β equals 0.27, t-value 5.684 with p is less than 0.001 to environmental motivation on green technology innovation where β equals 0.42, t-value 9.731 with p is less than 0.001. Eventually, the direct impact of environmental opportunities on organizational effectiveness where β equals 0.24, t-value 4.731 with p is less than 0.001 raised to a total impact of environmental opportunities on green technology innovation where β equals 0.26, t-value 5.331 with p is less than 0.001. These findings prove that green technology innovation mediates the mechanism between environmental responsible HRM (environmental ability, motivation, and opportunities) and organization effectiveness. This indicates that hypothesis H4 is valid.

Table 4. Research Structure Model

Hypothesis	β	t-Value	Hypothesis Result
Environmental Ability→ Green Technology Innovation	0.49 ^{***}	10.953	Accepted
Environmental Motivation → Green Technology Innovation	0.42 ^{***}	9.731	Accepted
Environmental Opportunity →Green Technology Innovation	0.26 ^{***}	5.331	Accepted
Green Technology Innovation→Organization Effectiveness	0.52 ^{***}	12.731	Accepted
ER HRM→Green Innovation→ Organizational Effectiveness	0.39 ^{***}	9.125	Accepted
Environmental Ability→ Organization Effectiveness	0.38 ^{***}	8.953	Accepted
Environmental Motivation→ Organization Effectiveness	0.27 ^{***}	5.684	Accepted
Environmental Opportunity → Organization Effectiveness	0.24 ^{***}	4.731	Accepted

5. Conclusions

This study examined the interplay between environmental responsible HRM and green technology innovation and the organizational effectiveness of energy-intensive manufacturing in the Lao PDR. Recent studies revealed that environmental responsible HRM practices, environmental ability, motivation, and opportunity positively and significantly impact green technology innovation and organizational effectiveness. This meant that these variables for managers in energy-intensive manufacturing, significantly and positively contribute to green technology innovation and organizational effectiveness in the workplace. The findings also

indicated that the direct impact of environmental responsible HRM on organizational effectiveness was less than the direct impact of green technology innovation. The manufacturing managers concurred that green technology innovation in their businesses has a meaningful and positive impact on the link between environmental responsible HRM and organizational effectiveness. This raised the genuine worth of green technology innovation in products and processes used in energy-intensive manufacturing. The methods of responsible human resource management (Environmental abilities, Motivation, and Opportunities) have a minor impact on green technology innovation and organizational effectiveness, implying that socially responsible HRM must be implemented as a multidisciplinary approach to improve green technology innovation and organizational effectiveness. According to our findings, ER-HRM strategies such as environmental recruiting, environmental training, environmental empowerment, and so on help the firm engage, retain, and encourage ecological talent inside the organization for better environmental sustainability performance. As a result of our findings, we believe that ER-HRM practices should be integrated into the firm's different corporate and social structures to guarantee market.

5.1 Theory Implications

Our research supports the further development of ER-HRM for understanding the drivers of green technology innovation and organizational effectiveness. Our study proposes and extends the AMO theory. We argue that organizations must develop and maintain environmental practices for training, motivating, and engaging environmentally conscious employees to improve green technology innovation and organizational effectiveness (Gerhart 2005). Thus, this research incorporates CSR and AMO theory and shows why and how ER-HRM practices promote green technology innovation and organizational effectiveness. Our findings also suggest that green technology innovation and ER-HRM practices affect organizational effectiveness. Therefore, we propose that ER-HRM practices via environmental recruitment, training, incentive-based performance, empowerment, and others support the organization in engaging, maintaining, and encouraging environmentally-conscious employees to engage in green technology innovation (Gerhart 2005). Our research provides several important insights for leaders and managers regarding bringing green technology innovation to market and exploiting it for greater organizational effectiveness to develop energy-intensive manufacturings.

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Author Contributions

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