

Human Resource Application Development in Transportation For A Clean-Emission Green Economy Transition

Diena Noviarini^{1*}, Eko Arif Syaefudin², Ryna Parlina³, Fildzah Shabrina⁴, Akhmad Yamani⁵, Adnan Kasofi⁶

^{1,2,3,4,5,6} Business Digital (Faculty of Economic and Business), State University of Jakarta, Jakarta, Indonesia

^{1st} diena_1601@yahoo.com, ^{2nd} dienanovi18@gmail.com, ^{3rd} wisudatn@gmail.com, ^{4th} fildzah.shabrina@unj.ac.id, ^{5th} offistar90@gmail.com, ^{6th} adnan.unj@gmail.com

¹ <https://orcid.org/0000-0002-9597-4427>, ² <https://orcid.org/0009-0009-0003-9742>, ⁴ <https://orcid.org/0009-0001-2781-646X>, ⁶ <https://orcid.org/0009-0003-0118-5668>

*Corresponding Author: diena_1601@yahoo.com

Abstract: — This applied product research program activity involves the implementation of the development and utilization of future human resource application systems in the transportation sector using solar panels and energy dashboards for the transition to a clean green economy. This research introduces the concept of a green economy to improve people's welfare by promoting human resources that use green energy resources efficiently and sustainably to reduce carbon emissions and pollution caused by economic activities. The concept of a green economy emphasizes the efficiency of energy resource utilization through modern technological innovations using alternative energy resources such as solar panels in addition to fossil energy resources. The green economy mission movement in Indonesia can improve human resources capable of facing global economic environmental challenges using Green Human Resources applications that are integrated with the green economy system by utilizing a series of information technologies including the internet of things platform, Big Data, Cloud Computing and artificial intelligence to process and transform data into an efficient and convenient information system for users. To introduce and familiarize this information technology system using various devices such as smartphones and personal computers to future entrepreneurs of solar panel and green panel systems, it is hoped that it can improve the conditions and capabilities of entrepreneurs to become profitable businesses in terms of costs and technological efficiency as required by stakeholders in the global green economy environment as a way to win the global green economy competition.

Keywords: — green economy, welfare, resources, application, technology

1. Introduction

Indonesia is among the countries that have set a net-zero emissions target since the COVID-19 pandemic crisis [1]. Despite the COVID-19 pandemic crisis in Indonesia, it has not dampened ambitious climate change action. Based on data from September 2021, 52 parties representing 63 countries contributing 54.2% of global greenhouse gas (GHG) emissions are targeting net-zero energy emissions, including their own emissions, including the European Union, Brazil, China, Japan, and South Korea [1]. Pressure from the World Bank, the International Monetary Fund (IMF), the World Bank Organization, the International Monetary Fund (IMF), the Organization for Economic Cooperation and Development (OECD), and the United Nations (UN) has made green investment in the economic recovery from COVID-19 a priority to build back better. Indonesia holds a crucial role as the G20 Presidency in 2022, ensuring its commitment to net-zero emissions demonstrates strong leadership in addressing climate change and encourages other countries to do the same, including by financing climate change through a green economy.

A green economy is an economic concept that aims to improve public welfare and promote social justice, while minimizing negative impacts on the environment [2]. In Indonesia, a green economy plays a crucial role in driving



economic growth by emphasizing sustainability, resource efficiency, and technological innovation. With a green economy, Indonesia can achieve stable and inclusive economic growth while addressing the global environmental challenge of net-zero emissions [2].

The concept of a green economy contributes significantly to driving innovation in transportation technology, creating jobs, improving sustainability, and attracting investment in applied research. The investment in the green economy, with jobs requiring expertise to conserve or restore the environment, whether in traditional sectors such as manufacturing and construction or in emerging green sectors such as renewable energy and energy efficiency, has made Green Human Resources a new trend in recent years due to the need for various green industrial sectors [3]. Research results indicate that there are no regulations in Indonesia that specifically and regulate the development of green human resources and their application [3]. In this zero-emission research, the existing problem formulation is the development of human resources who master the application of Green Human Resources towards a clean green economy transition in the transportation sector as a key driver, ensuring that human capital can design, implement, and maintain low-carbon emission solutions. In Europe, the green human resources trend, inextricably linked to the development of new and renewable energy (NRE), is projected to create up to 4 million jobs by 2050 [3].

2. THEORITICAL BACKGROUND

The energy sector, which is transitioning to clean energy, requires a green human resources workforce skilled in green technology. Consequently, Indonesia is currently preparing to transition from conventional energy to renewable energy, with a target of 23% by 2025, although Indonesia has yet to reach 1% [3].

To achieve this target, Indonesia needs to develop competent human resources (HR) in the renewable energy sector [3]. The transition from conventional energy to renewable energy in Indonesia is impacting the development of the green human resources sector, particularly in terms of job creation [3]. The number of renewable energy jobs in Indonesia is projected to increase by 0.63 million in 2023, 0.74 million in 2030, and 1.07 million in 2050 [3]. However, a major challenge remains the lack of skilled green human resources in the green economy sector. Current training is not aligned with technological developments in the green human resources sector. Human resource development in the green economy for the transition to a net-zero emissions economy consists of several categories, which represent novelties in this research:

1. Shifting Skill Requirements (Green Skills Transformation), one of the most significant of which is the transition from conventional skills to green and zero-emission skills. Organizations in the green economy increasingly demand competencies such as:

- a. Renewable energy management
- b. Carbon accounting and life cycle assessment
- c. Sustainable production and eco-design
- d. Environmental data analysis and reporting

This transition requires human resources (HR) systems to redesign training, up skilling, and skills development programs to support zero-emission goals.

2. Integrating Sustainability into HR Strategy Human resource development is no longer separate from environmental strategy. HR now:

- a. Aligns learning objectives with zero-emission and climate targets
- b. Embeds sustainability values into leadership development
- c. Supports organizational culture shifts toward low-carbon behaviors

This phenomenon reflects the role of HR as a strategic driver of green transformation, not just a supporting function.

3. Growth of Green Research and Innovation

Competencies Zero-emission research requires interdisciplinary human capital, combining:

- a. Engineering and environmental science
- b. Economics and policy analysis

c. Digital technologies (artificial intelligence (AI), big data, smart grid)

Human resource development supports this by fostering:

- a. Research collaboration skills
- b. Innovation and systems thinking
- c. Continuous learning ecosystems

Universities, research institutions, and companies are increasingly investing in developing green research and development (R&D) talent.

4. The Emergence of Green Jobs and Just Transition Concerns

The green economy is creating new jobs while simultaneously transforming or eliminating carbon-intensive jobs. This leads to:

- a. Risks of labor displacement
- b. Demand for retraining of fossil-fueled transport workers
- c. Emphasis on a “just transition”

Human resource development plays a crucial role in ensuring equitable access to green jobs and preventing social inequalities during the zero-emission transition.

5. Digitalization Supports Zero-Emission Human Capital Development Digital tools enable more environmentally friendly HR practices, including:

- a. Online training reduces travel emissions
- b. Data analytics tracks skills gaps in sustainability
- c. AI supports personalized green learning pathways

This phenomenon links digital transformation to environmental performance, reinforcing zero-emission goals.

6. Human Capital Measurement and Accountability for Emission Reduction Organizations are increasingly measuring:

- a. The carbon impact of workforce activities
- b. The effectiveness of sustainability training
- c. The contribution of human capital to emissions reduction

HR research is now exploring metrics that link learning outcomes to environmental performance, strengthening evidence-based zero-emission strategies.

7. Policy-Driven and Global Alignment of Human Capital Development International climate policies influence HR by:

- a. Requiring sustainability competencies
- b. Encouraging green certifications and standards
- c. Promoting cross-border green knowledge transfer

HR is adapting to a global green human capital framework that supports a net-zero green economy.

3. METHODOLOGY

Digital technologies increasingly support sustainable HR practices by enabling distance learning, reducing training-related emissions, and facilitating data-driven skills assessment [4]. Furthermore, organizations are developing metrics to evaluate the contribution of human capital development to environmental performance, including emissions reduction outcomes [4]. This shift toward measurement and accountability strengthens the empirical foundation of Human Resource Development (HRD) research in the zero-emission context. The

development of HRD applications in the transportation sector for a clean, green economy transition is described through a five-year roadmap of previous and future research, as outlined in the roadmap (fig.1).

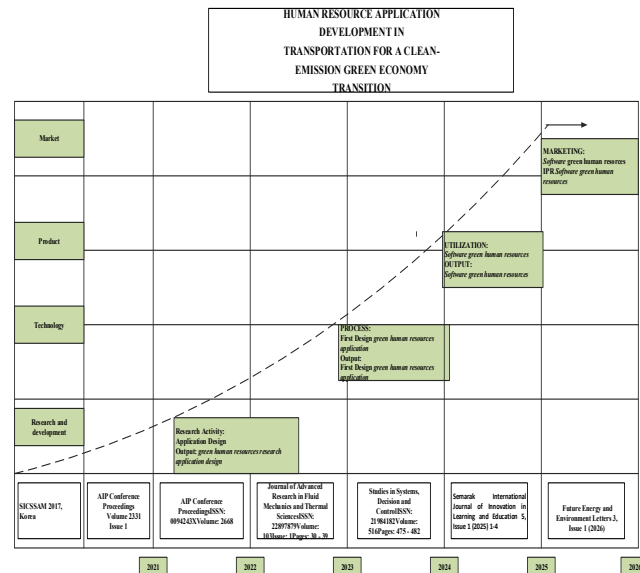


Fig.1 Green Transportation Transition Road Map

Analysis is the methodology used by the author in this research. The steps in a systematic literature review as a research flowchart are as follows (fig.2): (1) Formulating the problem, identifying re-search questions to direct the literature search, and the focus of the analysis. (2) Collecting data by re-viewing all scientific works, journals, and other sources relevant to the title of this activity. (3) Evaluating the feasibility of the data used to verify the accuracy of the data used in the literature review. (4) Analyzing and interpreting relevant data, (5) A commonly used tools describe and combine organizational or business problems in terms of examining the problems faced by the work unit [5]. The design method is used by using hardware specifications, software, brain ware servers, and clients to design a software design prototype that can solve problems faced by Indonesian and foreign communities [6]. Then the data analysis used is to change the rows of collected data into meaningful facts and ideas to be understood both qualitatively and quantitatively [7].



Fig.2. Flowchart diagram of Human Resources Application in the Transportation Sector for a Clean Green Economy Transition

The methodology for research partners can refer to the research roadmap and flowchart diagrams that describe the future of the green transportation transition application. This community service is action research carried out by the chairman, lecturer members, student members, and partner members so that it is expected to provide information to stakeholders (legislative members, regional government officials, officials of the Ministry of Transportation, officials of the Ministry of Transportation, community leaders, journalists, investors) regarding the benefits of the green transportation transition application.

4. RESULT

The design of applications at the Ministry of Transportation uses the steps that must be taken in designing a system model. According to Jones et al (2006), there are steps that must be taken, namely investigating system needs by interviewing, analyze data, designing, testing and implementing [8].

Interviews and secondary data interviews are stages for collecting data from various relevant and accountable sources of information [8]. The results of searching for data sources that can be used for the green transportation transition application are collected into a review conducted by researchers. In the early stages of software development, in this case system design, including the green transportation transition application. In this stage, user needs are determined for the application functions to be developed. In addition, at this early stage, the technical operations of the application, the platform used, and the software and hardware to be used will also be explained [9]. The system analysis and design stage includes identifying problems, understanding how the existing system works, analyze the system and making a report on the analysis results [9].

The design stage is carried out by creating a navigation structure, program flow, and application display (fig. 3). Then the testing stage for the application that has been created is tested with programming so that the results can be improved for the application.

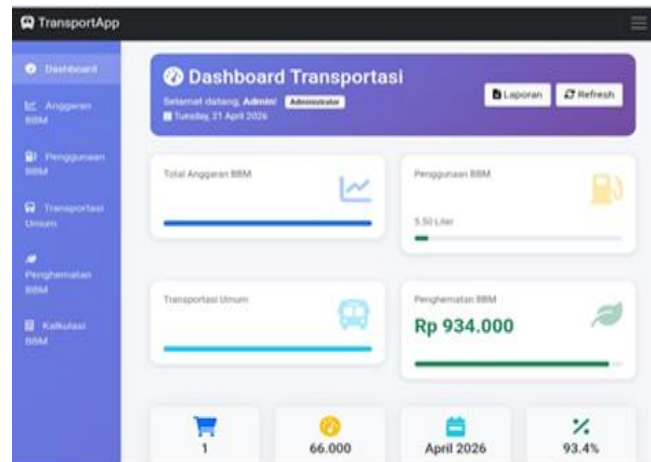


Fig.3. Main Dashboard of Human Resources Application in the Transportation Sector for a Clean Green Economy Transition

The system implementation stage is the last stage in this study (fig. 4). If the testing stages are successful, the first researcher will install the application on the smartphone device that has been provided [9]. Then the implementation is carried out in the form of training for users in this case, palm oil plantation stakeholders, including UNJ students. The maintenance and development stage of the green transportation transition application is carried out if there are problematic features and functions of the application.

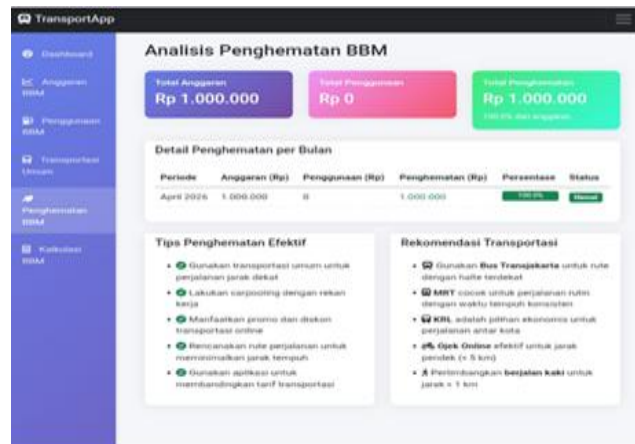


Fig.4. Analysis of Human Resources Application in the Transportation Sector for a Clean Green Economy

5. CONCLUSION

The stages of compiling articles and publications are mandatory results that must be carried out in this study of research. The publication of scientific papers will later be documented and published as part of the research's results in reputable and accredited online journals, Sinta1st and/or Scopus Indexes. The application system as the research's result (fig.3) has also been registered as an intellectual property right in the Ministry of Intellectual of Property Rights of Indonesia respectively.

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