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The Analysis And Design Stages In Model Development Of Green Training Planning Management In Indonesia

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ABSTRACT

The implementation of green jobs workforce training planning management, which was supported by a web-based information system, can provide innovative practice in institutional management activities. With early environmental scanning, training institutions can effectively predict future programs and move towards optimized management as a first step in adapting to the demands of renewable training. This study involves research and development that produces a web-based media product design through the development of a workforce training planning management model for cross-sector green jobs, to support the planning activities of (1) Green training beneficiaries, (2) Green training programs. This research used two ADDIE stages: (1) analysis and (2) design. The aim was to produce an analysis and a design summary. The development process involved two designs: (1) conceptual model design of green trainee planning management, (2) conceptual model design of green training program curriculum planning management. The research was conducted at private training institutions partnered with the Indonesian government in Jakarta. It is hoped that this research will result in interesting findings for the body of knowledge and contribute to industry and society. It will also assist workforce training providers in carrying out their planning management functions, creating a roadmap for effective training plans and implementation actions.

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1. INTRODUCTION

Green Jobs are decent jobs that contribute to environmental conservation (ILO, 2013), offer adequate wages, safe working conditions, and sustainable career opportunities, with specific tasks and skills in implementing environmentally friendly decision-making processes (BAPPENAS, 2023), producing environmentally friendly products and services through the process of sustainability principles. Green Skills are transversal skills (ETF, 2022), covering knowledge, abilities, and values and attitudes needed to support sustainability with (1) technical knowledge, (2) expertise, and (3) the ability to use effective technology to facilitate environmentally friendly decision-making processes (UNCC, 2023), through the use of information technology, digitalization and communication (Hamid et al, 2019).

In Indonesia, job opportunities requiring green skills according to PPN/Bappenas are 1.8 million - 4.4 million until 2030, and the demand for green talent per year is predicted to be around 250-650 thousand, PPN/Bappenas added that until 2045 there will be 15.3 million new jobs for the green economy sector at Indonesia's Green Jobs Conference in 2023. So, the transition to a green economy will create new jobs and the need for new skill profiles, qualifications and training frameworks (UNIDO, 2022).

In fact, there are still challenges in developing green training governance, green jobs, green skills in Indonesia, namely (1) the need for a system for developing green workforce competencies with high green skills, (2) there is a gap between the availability and accessibility of data and information about green jobs and limited green skills (3) there is low awareness and understanding of green jobs due to limited access to the knowledge, (4) the need for close stakeholder involvement to ensure that the governance of green training development effectively meets the need of the industrial and workforce (BAPPENAS, 2023).

Training and competency development activities for the workforce have been proven to improve the quality of the workforce, however, the actual rollout in institutions still faces governance constraints because of limited needs analysis and development identification, along with issues in optimally allocating resources to build the best organization. Therefore, a reliable information and data are needed in governance (UNESCO, 2007), where the training management information system can provide reliable, relevant, and appropriate data for training institution managers (UNESCO, 2004), and improve the quality of the training management system to keep up with the changing of times.

Management is a series of processes or stages to achieve expected goals (New World University, 2024:7). Planning management includes clear objectives, guaranteed accountability, and institutional guarantees with the aim of establishing clear goals and strategies for the organization (Luo et al., 2023). The goal of management in training planning is to transform "inputs" into "outputs," resulting in trained beneficiaries, increased knowledge and skills, and newly sustainable attitudes, values, and culture (Mara & Thomson, 2021:76). Therefore, the implementation of green workforce training planning management in Indonesia supported by a web-based information system can provide practical innovation in training management activities. By an early environmental scanning, institutions can effectively predict future programs and move towards optimized management as the first step in adapting to the demands of renewable training.

Research related to training governance has provided practical findings on the need for green human resource management, namely green reward, green education and development, green performance evaluation, green discipline, green employment, green

safety and health, green selection, and green career design management (Alavi & Aghakhani, 2021). Other finding state that consolidates efforts between the government, employment sectors, training providers, and international development partners are significant for the recognition of green skills in sustainable industries (Lamichhane & Neupane, 2022). At the institutional level, information-based management contributes to the coherence of guidance coordination and validation to facilitate the two-way flow of information (Mouratoglou & Villalba-Garcia, 2022:7). The development of an effective education and training information system model can provide benefits such as (1) a "Decision Support System" to assist decision-makers, (2) an "Early Warning System" to predict problems, and (3) a "Recommendation System" to propose realistic and effective actions (Skittou et al, 2021). By utilizing information systems, monitoring and managing the quality of education and training programs work effectively and efficiently (Logachev et al, 2021), a decision support system model for education and training management based on clustering analysis is significant (Peng & Pei, 2022).

While there is extensive research on training governance, little in-depth work has been done on managing the planning and instruction for a multi-industry 'green' workforce. Consequently, this specific area remains underdeveloped and lacks a systematic framework. So the questions of this research are (1) What are the stages of analysis and design of the development of a cross-sector green workforce planning management model in Indonesia?, (2) What is the summary of the analysis and design of the development of a cross-sector green workforce planning management model in Indonesia?, (3) What is the conceptual model design of the development of a cross-sector green workforce training planning management model in Indonesia?.

2. METHODS

The type of research used is Research and Development (R&D) which is an industry-based development because the research findings are made for designing new products or procedures (Gall, Gall, & Borg, 2003:569). This research uses the ADDIE model approach, by implementing two initial stages, namely: (1) the analysis stage, (2) the design stage. With the aim of producing an analysis summary and a design summary. This research was conducted at a private partner institution of the Government of the Republic of Indonesia in Jakarta which has provided a distance training program for the workforce to improve work competencies through the Republic of Indonesia government project from 2020 to 2024. This research was conducted from May 2025-September 2025 at the Arsikei Consulting (A.C.) institution in Jakarta.

The purpose of (1) the analysis stage is to identify the gap's causes and validate them, determine instructional objectives, confirm the intended beneficiaries, identify resources and develop a project plan, the final result is the summary of the analysis (Branch, 2009:18). At this stage there is an analysis of the needs of the organization and beneficiaries carried out through group forum discussions, structured interviews, observations, as well as documentation reviews and the searching of primary and secondary data. Literature and field studies are to produce a factual model, while the needs analysis is to produce a model design. Literature and field studies establish the factual model while needs analysis generates the required the design model. The purpose of the (2) design stages is to verify the expected performance, plan appropriate test methods, compile performance objectives, plan test strategies, and the results obtained from this stage are a design summary (Branch, 2009:18). This phase of research will produce: : (1) conceptual model design of green training beneficiaries, (2) conceptual model design of green training programs.

3. RESULTS AND DISCUSSION

a. Analysis Stages

The analysis stages in this study were conducted through a previous review of relevant research literature, structured interviews, observations, and electronic documentation reviews to validate the context, needs, and gaps in order to determine instructional objectives and identify resources. As a data analysis technique, literature review was used as a reference for researchers to conduct their research, through Publish or Perish application, Google Scholar, and Scopus were used to produce meta-analyses, and electronic databases such as ScienceDirect, MDPI, Springer, and others. The keyword analysis was: Education and Training - Skilled Workforce - Green Skills - Green Jobs - Management. Indexed articles from 2020-2025 form a conceptual framework providing a holistic approach to understand the concept of green workforce training management.

The benefits of green governance related to the sustainability of the Economy, Social, Governance (ESG) side are (1) green management utilizes an innovation to achieve sustainability, social, and competitive advantage (Yassin et al, 2025), the important role of green practices can improve management performance in organizations, (2) there is an influence of human resources and green management on the organization's sustainable results (Ndiango et al, 2024), (3) green recruitment has a positive connection and a significant influence on workforce performance (Titin et al, 2024), (4) there is a significant connection between green resource management, green behavior, green commitment, and sustainable organizational performance (Le & Tham, 2024).

The benefits of green knowledge related to the sustainability of the Economy, Social, Governance (ESG) side (1) sharing green knowledge positively modernize the relationship between green human resource management and green innovation (Makumbe, 2024), (2) green human resource management and green innovation with green awareness share knowledge as significant mediator mechanisms, tacit knowledge is applied to identify sustainability, empowering those sustainability steps (Alavi & Aghakhani, 2021).

The advantages of green training related to the sustainability of the Economy, Social, Governance (ESG) perspective are (1) green training and development significantly influence environmentally friendly behavior, which substantially increases organizational commitment (Purba et al, 2024), (2) the role of green training in increasing green intellectual capital encourages better operational efficiency and sustainability in the context of the global economy (Chuyen, 2024), (3) green training improves operational efficiency, resource use, and environmental performance (Barakat et al, 2023), (4) green training practices are a powerful tool to increase workforce awareness of achieving sustainable development goals (Moradeke, 2021), (5) sustainable skills development significantly increase workforce awareness of achieving development goals (Fapohunda et al, 2022), (6) environmentally friendly training is needed in environmentally friendly human resource management practices (Murdiono & Bovanantoo, 2024), (7) green training is positively related to workforce career growth (Xie et al, 2020).

The advantages of green skills related to the sustainability of the Economy, Social, Governance (ESG) side (1) local assets and resources, including human resources, with a green skills-based approach strengthen resilience skills (Mininni & Hiteva, 2023), (2) green skills practices achieve sustainable development goals in the manufacturing sector (Le & Tham, D.H, 2024), (3) knowledge, moral principles, and attitudes to support the environment or green skills are needed to create and support sustainable social,

economic, and environmental outcomes in business, industry, and society (Pirzada, 2023), (4) transferable skills or soft skills are core green skills needed at all levels compared to technical skills or hard skills (Strachan et al, 2022).

Green workforce training governance opportunities (1) demand for environmentally friendly solutions creates the need to identify green skills (Nikoloski, 2024), (2) green technology culture at all levels of education can be achieved through the creation of green curricula (Pirzada, 2023), (3) a clean energy-based economy plays a role in the creation of various skills, upgrading and retraining of the workforce (Mininni & Hiteva, 2023), (4) increases efforts, attention and investment to ensure environmental sustainability in products and services (Shamzzuzoha et al, 2022), (5) there are joint efforts among the government, companies, the employment sector, and training providers, as well as international development partners, to institutionalize the recognition of green skills. (Lamichhane & Neupane, 2022), (6) promoting green skills requires a transdisciplinary knowledge base and a holistic and integrated understanding of the environment, society, economy and culture (Bishnoi & Rai, 2022), (7) the exponential growth of digitalization and the increasing need for sustainability in the manufacturing industry, the development of a multi-skilled workforce (Akyazi, 2022).

Green workforce training governance gaps (1) minimal adjustment of technical and vocational training content for green skills (Manyati et al, 2024), (2) skills development systems do not produce sufficient numbers of workers with environmentally friendly knowledge, skills and abilities to carry out green jobs (Napathorn, 2022), (3) skills gaps in micro, small and medium enterprises that must be managed (Bishnoi & Rai, 2022), (4) there is an impact of skills and labor market transformation with significant reconfiguration of labor markets and new skills (Thake, 2024), (5) the lack of availability of qualified and sustainable labor in the forestry sector and the recruitment of its labor (Šporčić, 2023), (6) blue economy labor in the port sector is required to promote green culture (Tsoutsos et al, 2025).

The documentation review was conducted through electronic documentation review of the webinar activity: "Go Green Get Skilled: Responding to Green Jobs Opportunities", Coordinating Ministry for Economic Affairs of the Republic of Indonesia in 2024, which was attended by partner institutions. The webinar activity resource persons were the Executive Director of Kartu Prakerja Program Management [N1], Kartu Prakerja Public Sector Economic Development Manager [N2], Director of Manpower, Ministry of National Development Planning/Bappenas [N3], Representative from Koasi Indonesia [N4], Representative from PT Nestle Indonesia [N5].

[N1] stated that: there is a significant impact on the expansion of green job opportunities in Indonesia which is in line with the need for green talent with a focus on five industrial function areas in Indonesia. [N2] stated that: (1) there are significant challenges in Indonesia for the workforce group because the formal educational background of the workforce is low, and the access to the workforce training provided is still minimal, (2) the role of training institutions is significant for workforce ability to adapt the needs of sustainable work, by identifying those new needs in the industry from the labor market and research procurement, (3) the industrial sector in Indonesia has integrated sustainability from upstream to downstream in the business process model, carried out with the upstream sourcing process to the downstream marketing process, and business processes as value, (4) several examples of sustainable practices are environmentally friendly interior design by ensuring minimal energy use with a solar panel technology, meanwhile, in the tourism sector, we can prioritize eco-tourism, which has the potential to boost local economic sustainability by focusing on the preservation of environmental tourism sites, and in other sectors, designers transform to green

processes by adopting the use of eco-friendly textile coloring materials. [N3] stated that: the Green Jobs Occupation Map in the KKNI by BAPPENAS has been compiled to map the types of positions or occupations or professions for job seekers, job providers and education and training providers. [N4] stated that: (1) four out of five young people in Indonesia already have a critical view of the climate crisis, (2) creating green employment involves promoting green mindsets, behaviors, and skills among the workforce, aligning with Indonesia's objective to raise annual economic growth to between 5% and 7%, [N5] states that: (1) sustainability is the current organizational value, and it works as a framework of thinking, environmental is interpreted as the tactical capability of sustainable business operations, both in terms of resource management and efficient use of energy in the business cycle in the organization, while social is interpreted as diversity and inclusion in line with sustainable human resources that do not differentiate between race and gender but prioritize the ability of the workforce for their work abilities and new skills, while governance is understood as a system that applies the understanding of sustainability to the actual products and services produced, (2) the workforce is the company's front line for a culture of sustainability, can be implemented in the process of sustainable communication, sustainable governance in line with the world's and Indonesia's targets for SDGs through a net zero carbon roadmap, (3) sustainable collaboration is a new era that must be carried out continuously as a sustainable action harmoniously between all stakeholders, namely government, companies, and NGOs.

Further needs analysis validating the gap between actual and ideal governance was conducted through: (1) structured interviews and (2) field observations. In-depth interviews were conducted to collect data and information in face-to-face or online activities. In-depth interviews' informants were management, training heads, and facilitators at Arsikei Consulting (A.C.) Jakarta as a training institution partner of the Coordinating Ministry for Economic Affairs. Interviews were recorded and transcribed, then analyzed using thematic content analysis. The coding process is conducted organically from the understanding through the recognition of interview themes, in accordance with the interview guidelines.

A.C. Institution, has met the licensing requirements for operating in the fields of private education, management and banking education, and private language education. Since 2020, A.C. Institution has been a part of the Kartu Prakerja Program's ecosystem and has provided various types of training according to the needs and interests of trainees under the collaboration of platform partners for work competency development training relevant to occupations in Indonesia. The training carried out at the A.C. Institution uses a digital platform remotely with a mixed method aimed at workers in the occupations of administrative, service business and sales staffs. The informants in the interview were [N1] Operational Director, [N2] Academic Manager, [N3] Facilitator, [N4] Facilitator, [N5] Facilitator, [N6] Facilitator, [N7] Facilitator, where the informant's higher education is bachelor's degree 1 with a percentage of 72% and bachelor's degree 2 with a percentage of 28%, and has had 10-20 years of work experience in the field of education and training in Indonesia.

The interview findings related to training activities that have been carried out for the workforce in the institution are, [N1] stated that the training that has been carried out is a competency improvement program aimed at supporting trainees to improve their skills and knowledge, both technically and non-technically, as a process of self-development of the workforce, [N2] the program accessed through a digital platform provided is distance learning with a combination of synchronous and asynchronous learning targeting workforce across all regions in Indonesia, [N3] the program is designed for the

development of human resource competencies, aiming at the targeted occupation, [N4] the program is for the workforce and MSMEs in Indonesia, [N5] the program related to the introduction of competency units includes elements, performance criteria, for the workforce to understand industry standards and preparation of the necessary work evidence, [N6] competency-based training develops specific and measurable skills that are directly related to occupational performance, [N7] the program is designed in accordance with the objectives of the project provider, namely the Government of the Republic of Indonesia, starting with designing a curriculum relevant to the competencies of the targeted workforce and its evaluation.

The interview findings related to the need for appropriate management functions for sustainable training are [N1] the need for a management system that allows institutions to effectively track and ensure compliance with all established policies and procedures, so the institutions can foster a culture of continuous learning that drives organizational success, [N2] integrated training management is needed to support the sustainability of institutions by planning, organizing and evaluating resources continuously, focusing on training customers with a continuous improvement, [N3] to anticipate constantly changing digital technology, hybrid management is needed so that activities from planning through to evaluation can be properly accommodated in line with the times, [N4] strategic management is needed based on the quality of each management function, starting from planning, supervision, implementation, control that combines integrated human and material resources for sustainable management, [N5] integrating data and information for the development and the analysis of training institution management, [N6] the need for adaptive management that utilizes feedback to continuously improve strategies so that institutions can make the right decisions, [N7] the need for a management system that applies an appropriate input, process and output approach, as input in the form of industry needs, processes in the form of design and implementation, while the output in the form of graduates who are ready to work, to support a sustainable economy that has a positive impact in society.

Interview findings related to the need for a management information system to support sustainable training governance are [N1] the need for an integrated and centralized system, not only to accommodate training but also to be useful for the growth of the institution, and simplify the operational activities of the institution, [N2] the need to provide access to resources and support the training process, integrate operational needs into superior competitiveness for the institution, facilitate the simplification of training governance through data-based analysis, [N3] the need to analyze data on administrative and academic operations in one centralized system, [N4] for holistic governance control in the institution, can help with planning both tactically and strategically within the short, medium and long term, [N5] to optimize educational data, and increase efficiency in management, [N6] to access data and make decisions, and can assist monitor operations, [N7] the need for its implementation of governance aspects to help future planning.

Interview findings related to the role of training institutions in supporting sustainability of the circular economy and the need for a future green workforce, are [N1] institutions have a significant role related to the implementation of sustainable training in Indonesia, [N2] institutions can anticipate superior systems that can bridge the skills needed in the industry, [N3] institutions can contribute in organizing training programs and developing green competencies that are synergistic collaborations between the government, institutions and DUDIKA, [N4] institutions can play a role in initiating green skills campaigns, collaborating with the government and appropriate industries related to holistic support, [N5] the strategic role of institutions in preparing the workforce for

the green economic transition in Indonesia is one of the challenges for current institutional managers in filling the needs in the sustainable industry, [N6] institutions have a role in creating a productive and effective learning environment by guiding, motivating and providing feedback to potential green workers, [N7] institutions have a big role in supporting sustainability campaigns in Indonesia, by introducing knowledge of green practices to the workforce, through reskilling and upskilling programs.

Interview findings related to training needs analysis are [N1] training needs analysis is used to determine which training is the right solution to address existing skills gaps, [N2] is carried out by setting goals and objectives, identifying the needs of beneficiaries, [N3] is planned and implemented to obtain a number of data or information about the conditions and needs of potential trainees, [N4] to find knowledge and skills gaps of potential beneficiaries, identify problems and needs, design needs assessments, conduct analysis and feedback, activities are carried out through surveys, group discussions, interviews and observations, [N5] begins with identifying skills gaps, continues with training planning and implementation, and ends with evaluation and feedback and development, [N6] is needed when there is a gap between expected performance and current performance, the gap is due to a lack of skills or knowledge, [N7] initial assessment in the form of a needs survey with potential trainees, employers, industry partners, the results are used to develop a targeted program to cover the existing skills gaps.

Observations of training program activities were conducted through electronic channel recording searches, with the observation aspects are: (1) facilitators, (2) facilities and infrastructure, (3) program implementation. The findings of observations of facilitators at the institution showed that the facilitators (1) mastered the class with adult learning theory or andragogy, (2) two-way-interaction with participants, (3) mastered the material and communicated fluently, (4) displayed information in presentation slides, (5) paid attention to grammar and voice intonation, (6) provided reinforcement and feedback on the learning outcomes of trainees during the learning process, (7) asked questions to encourage connections between prior knowledge and the topics to be studied, (8) explained basic competencies or learning objectives, (9) delivered conclusions at the end of the training session. The findings of observations on facilities and infrastructure at the institution were (1) the training was an integrated program where there was a combination of asynchronous and synchronous learning, (2) the applications used by trainees could be accessed on various digital devices, such as laptops, computers, and cell phones, (3) high-quality audio-visual and electronic learning materials and media.

Therefore, the needs analysis in this study not only provides a factual overview but also serves as a strong foundation for developing a green workforce training planning management model. A summary of the analysis stages, namely the literature review and field study, resulted in a factual model, while the needs analysis and factual model resulted in a model design.

b. Design Stage

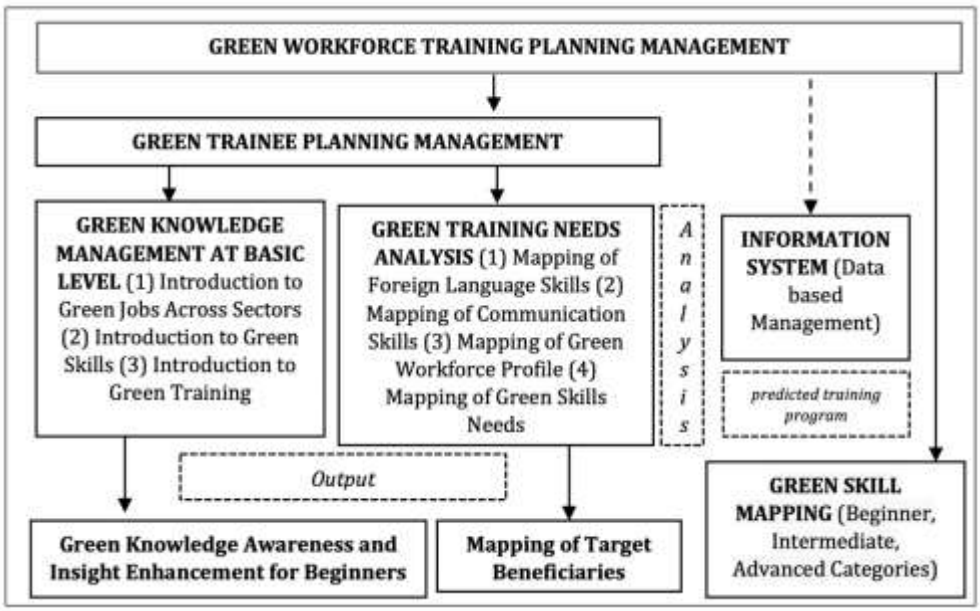
The rationale for developing a green workforce training management model is built upon the establishment of green jobs as a national priority program to encourage increased green jobs, productivity, and economic competitiveness, as outlined in Indonesia's RPJMN (2025-2029) through Presidential Regulation No. 12 of 2025. The "Indonesian Green Workforce Development Roadmap" was launched by the Ministry of National Development Planning/Bappenas in 2025 as a guide for preparing a skilled and inclusive green workforce in Indonesia. Therefore, a collaborative action plan involving

the roles of the Ministry, education and training providers, DUDIKA, associations, and other development partners in Indonesia is needed.

A sustainable planning begins with its planning steps from upstream to downstream, Green Training Management System is a web-based system product design to support cross-sector green skilled workforce training planning management activities presented as an innovative solution for private institutions that organize workforce training as partners of the Republic of Indonesia government, which is an integrated management system to support the planning of green trainees, trainee facilitators, training programs.

The development of the model in this study is built on a number of assumptions that (1) the workforce has diversity based on differences in occupational roles and functions in Indonesia, where the workforce has differences in formal and higher education, skills, certifications, as well as work experience and domestic and international career goals, (2) there is an expansion of green job opportunities in Indonesia in line with the need for green talent by integrating sustainability from upstream to downstream processes, (3) a web-based digital integrated training management system will increase the efficiency of green training planning governance so that the objectives are achieved through analysis with the selection of predicted opportunities to produce appropriate green program designs, (4) information systems can bridge the workforce as job seekers with the industry as employers, (5) knowledge management is a means of sharing sustainable green knowledge, (6) training needs analysis is not only focused on individual level analysis but also displays alignment with the overall organizational strategy

Figure 1. Hypothetical Model Design of Green Trainee Planning Management

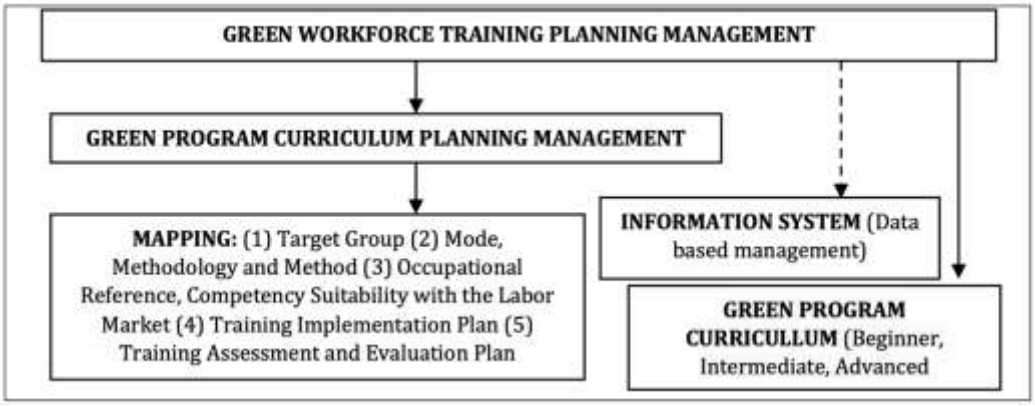


The design of a hypothetical model of green trainee planning management is based on (1) Green knowledge management which significantly influences the organizational sustainability (Al-Faouri, 2023), with the goal of sustainable development across manufacturing and service industry sectors (Alioune, 2024), has dimensions of green knowledge acquisition, sharing, storage, application, and green knowledge creation (Yua et al, 2022), which offers a multifaceted approach while promoting environmental sustainability, (2) Green training needs analysis can develop targeted programs where identification is needed to address workforce competency gaps (Chang & Lu, 2025), proven not only to focus on individual level analysis but also to display alignment with organizational strategy (Nunes et al, 2025), and can be used consistently for targeted continuous professional development, and the gaps between knowledge and practice, so

it can translate knowledge into action, which is an integral part that influences training effectiveness (Al-Mamun et al, 2021).

Green skills need mapping involves a comprehensive framework that outlines the specific green job competencies required for different job positions or across sectors. Competencies in green work required in the Green Training Management System-ESF are based on the classification of green skills (PPN/BAPPENAS et al, 2020), namely (1) Awareness and respect for the environment for sustainable development, (2) Adaptability and transferability skills in implementing environmentally friendly technology, (3) Teamwork skills to work collectively, (4) Communication and negotiation skills to promote change, (5) Entrepreneurial skills to capture opportunities in low-carbon technology, environmental mitigation and adaptation, (6) Occupational safety & health skills, (7) Analytical thinking skills to interpret and understand changes and the steps required, (8) Coordination and management skills including a holistic and interdisciplinary approach, (9) Innovation skills to identify opportunities and develop new strategies to respond to green challenges, (10) Marketing skills to promote environmentally friendly products and services, (11) Consulting skills to provide green solutions, (12) Information technology skills to provide green solutions, (13) Foreign language skills for global work ecosystem, (14) Strategic and leadership skills for sustainable development.

Figure 2. Hypothetical Model Design of Green Training Program Curriculum Planning Management



The design of a hypothetical model for green program curriculum planning management is based on (1) lifelong learning on the development of sustainable practices that will reduce its environmental impact while meeting labor market needs (Jayaprakash, 2024), (2) green jobs require skills and qualifications that are tailored to cross-disciplinary contexts so that the adaptation of sustainability training processes occurs (Basterra et al, 2023), (3) green skills facilitate a top-tier workforce in environmental challenges and opportunities (ACET, 2015).

4. CONCLUSION

The Green Training Management System guides planning for green training participants focusing on green talent mapping to categorize participants into beginner, intermediate, and advanced levels. The necessary data and information for this mapping include (1) foreign language skills (2) communication skills (3) green workforce profiles, (4) green skill needs. planning the green training program curriculum is designed to produce a comprehensive green training program design, which is informed by the following data and information (1) target groups of participants (2) modes, methodologies, and methods for program delivery, (3) occupational references and

competency suitability for the labor market, (4) learning implementation plans for the training program, (5) assessment and evaluation strategies for the program.

Therefore, this research is expected to provide benefits both theoretically and practically. Theoretically, it is expected to provide new insights into the development of management function theory in training planning, particularly for green workforce training, supported by the implementation of a web-based management system to increase efficiency and effectiveness and grow in the readiness of fulfilling the demands of renewable training.

Practically, it is expected to assist institutions in carrying out planning management function activities to create a roadmap for implementing green training programs, for the achievement of green training plan results, and appropriate implementation in actions. Meanwhile, for trainees, it is hoped to help prospective training beneficiaries, especially skilled workers, in eliminating the gap of knowledge regarding jobs, green skills, and green training, so with this increased awareness and green promotion, a superior future workforce ecosystem and a green ecosystem mapping will be created.

Future research can focus on the development, implementation, and evaluation stages to complete all research stages. At the development stage, feasibility tests can be conducted by media and information technology experts, language and communication experts, and training management practitioners, followed by system user trials and test instrument. At the implementation stage; group field trials can be conducted to produce a final design model. Moreover, the evaluation stage serves as the final review and catalyst within this final stage of development research where data will be obtained regarding the evaluation of system use to measure how well the system achieved its intended development objectives.

5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

6. REFERENCES

ACET. (2015). Kuala Lumpur Declaration on TVET for a Sustainable Future adopted. Asia-Pacific Conference on Education and Training (ACET). Retrieved from: https://unevoc.unesco.org/

Akyazi, T., del Val, P., Goti, A., and Oyarbide, A. (2022). Identifying Future Skill Requirements of the Job Profiles for a Sustainable European Manufacturing Industry 4.0. *Recycling,* 7(3), 32. Doi: 10.3390/recycling7030032

Al-Faouri, A.H. (2023). Green knowledge management and technology for organizational sustainability: The mediating role of knowledge-based leadership. *Cogent Business & Management, Taylor & Francis Journals,* 10(3), 2262694-226. Doi:10.1080/23311975.2023.2262694

Al-Mamun, A., and Seamer, M. (2021). Board of director attributes and CSR engagement in emerging economy firms: Evidence from across Asia. *Emerging Markets Review*, 46, 100749. Doi: 10.1016/j.ememar.2020.100749

Alavi, S. and Aghakhani, H. (2023), Identifying The Effect Of Green Human Resource Management Practices On Lean-Agile (LEAGILE) and prioritizing its practices. *International Journal of Productivity and Performance Management*. 72(03), 599-624. Doi: 10.1108/IJPPM-05-2020-0232

Alavi, S. and Aghakhani, H. (2023), Identifying The Effect Of Green Human Resource Management Practices On Lean-Agile (LEAGILE) and prioritizing its practices.

International Journal of Productivity and Performance Management, 72(03), 599-624. Doi: 10.1108/IJPPM-05-2020-0232

Alharbi, B. F. M. (2025). Project Management Green Commitment in PMI, Saudi Arabia: How Green Intellectual Capital, Green HRM, Green Training and Innovativeness Influence Project Performance. *Journal of Ecohumanism,* 4(1), 4397. Doi: 10.62754/joe.v4i1.6332

Alioune, A. (2024). The Impact of Green Knowledge Management on Sustainable Development Goals and Green Innovation in French Economic Firms: A Structural Analysis. *Croatian Regional Development Journal,* 5(02). Doi: 10.2478/crdj-2024-0011

BAPPENAS, World Bank Group, and Australian Government. (2020). Indonesia's Occupational Tasks and Skills, Tasks and Skills Profiles. Retrieved from: https://pubdocs.worldbank.org/

BAPPENAS. (2023). The Development Of Green Jobs Roadmap In Indonesia. Innovation and Investment for Inclusive Sustainable Development (ISED) - Project Phase II. Jakarta: GIZ, Kementerian PPN/BAPPENAS. Retrieved from: www.ilo.org

Barakat, B., Milhem, M., Naji, G.M.A., Alzoraiki, M., Muda, H.B., Ateeq, A., and Abro, Z. (2023). Assessing the Impact of Green Training on Sustainable Business Advantage: Exploring the Mediating Role of Green Supply Chain Practices. *Sustainability,* (15)14144. Doi: 10.3390/su151914144

Basterra E, L., Naidoo M, Calvacanti D. (2023). Social Protection In Global Crises: A Gap Between Evidence And Action. *BMJ Glob Health.* Doi:10.1136/ bmjgh-2023-013980

Bishnoi, T. and Rai, D.K. (2022). Case Study: India. The Role of the Skill Council for Green Jobs (SCGJ) in Recognising Green Skills and Upskilling Workers in Micro, Small and Medium Enterprises. In: Pavlova, M., Singh, M. (eds) Recognizing Green Skills Through Non-formal Learning. Education for Sustainability, vol 5. Springer, Singapore. Doi: 10.1007/978-981-19-2072-1_7

Branch, R.M. (2009). Instructional Design: The ADDIE Approach. New York: Springer Science Business Media. Doi: 10.1007/978-0-387-09506-6

Chang, J.-C., and Lu, H.-Q. (2025). Competency and Training Needs for Net-Zero Sustainability Management Personnel. *Sustainability,* 17(7), 3244. Doi:10.3390/su17073244

Chuyen, D. T. (2024). Impact Model Of Green Training On Business Performance. *PEOPLE: International Journal of Social Sciences.* 490–498. Doi: 10.20319/icssh.2024.490498

ETF. (2022). ETF Policy Briefing: Skilling For The Green Transition. European Training Foundation. Retrieved from: www.etf.europa.eu

Fapohunda, T.M., Genty, K.I., Jayeoba, F.I., and Olanipekun, L.O. (2022). Green Training and Development Practices on Environmental Sustainability: Evidence from WAMPO Plc. *ESCAE Journal of Management and Security Studies (EJMSS).* 02(01). Doi: 10.48112/jemss.v1i2.212

Gall, M.D., Gall, J.P., and Borg, W.R. (2003). Educational Research An Introduction, Seventh Edition. Boston: Pearson Education Inc.

Hamid, M. Z. A. , Hassan, A. , Nordin, M. S., Kamin, Y. , Atan, N. A. , and Suhairom, N. (2019). Generic Green Skills in Teaching and Learning: Meaning and Implementation. *Universal Journal of Educational Research,* 7(12A),121-126. Doi: 10.13189/ujer.2019.071915.

ILO. (2013). Green jobs becoming a reality Progress and outlook 2013. Geneva: International Labour Organization. Retrieved from: www.webapps.ilo.org

Jayaprakash, S. A/P. (2024). Greening TVET for Sustainable Development: A Path to a More Sustainable Future. *International Journal Of Academic Research In Progressive Education And Development.* 13(01). Doi: 10.6007/IJARPED/v13-i1/20877

Lamichhane, R., and Neupane, M.S. (2022). Case Study: Nepal. The Inclusion of Green Competences in the Recognition of Prior Learning. In: Pavlova, M., Singh, M. (eds) Recognizing Green Skills Through Non-formal Learning. *Education for Sustainability,* 5, Springer Singapore. Doi:10.1007/978-981-19-2072-1_10

Le, T.T. and Tham, D.H. (2024). Nexus Of Green Human Resource Management And Sustainable Corporate Performance: The Mediating Roles Of Green Behavior And Green Commitment. *Journal of Trade Science.* 12(02), 100-116. Doi: 10.1108/JTS-11-2023-0028

Logachev, M.S., Orekhovskaya, N.A., Seregina, T.N., Shishov, S. and Volvak, S.F. (2021). Information System for Monitoring and Managing the Quality of Educational Programs. *J. Open Innov. Technol. Mark. Complex,* 7(93). Doi: 10.3390/joitmc7010093

Luo, X., Liu, Z., Tian, J., Wang, Y. and Liu, H. (2023). PDCA-Based Management of Corporate Research Integrity and Ethics. *ICEMED- AEBMR*, 254, 89–94. Doi: 10.2991/978-94-6463-224-8_13

Makumbe, W. (2024). Green Human Resources Management and Green Performance: A Mediation–Moderation Mechanism for Green Innovation and Green Knowledge Sharing. *Journal Sustainability.* 16(24), 10849. Doi: 10.3390/su162410849

Manyati,T.K., Kalima, B.G., Owolabi, T., and Mutsau, M. (2024). Exploring The Potential For Enhancing Green Skills Training, Innovation And Sustainable Livelihoods In Informal Spaces Of Harare, Zimbabwe: Identifying Gaps And Opportunities. IIMBG Journal of Sustainable Business and Innovation. *IIMBG Journal of Sustainable Business and Innovation.* 2(01),60-79. Doi:10.1108/IJSBI-06-2023-0036

Mara, D and Thomson, M.M. (2021). Theoretical And Practical Approaches To Non-Formal Education: Interdisciplinary Examinations into Various Instructional Models. USA: BrownWalker Press-Universal Publishers Inc.

Mouratoglou, N. and Villalba-Garcia, E. (2022). Bridging Lifelong Guidance And Validation Of Non-Formal And Informal Learning Through ICT 0perationalization. *Luxembourg: Publications Office of the European Union.* Cedefop working paper; No 8. Retrieved Doi:10.2801/692674

Murdiono, J. and Bovanantoo, R. (2024). Green Training in Green Human Resources Management: A Study on PT Celebes Railway Indonesia. *LIB PRO.* 44(3). Doi: 10.48165/bapas.2024.44.2.1

Napathorn, C. (2022). The development of green skills across firms in the institutional context of Thailand. *Asia-Pacific Journal of Business Administration.* 14(04), 539-572. Doi:10.1108/APJBA-10-2020-0370

New World University. (2024). Principles of Management. Saylor Foundation. Retrieved from: www.saylor.org

Nikoloski, D. (2024). Identifying Green Skills Gaps Through Labor Market Intelligence. *Journal of Infrastructure Policy and Development.* 8 (6). Doi:10.24294/jipd.v8i6.4868

Nunes, J., Silva, P. D., Andrade, L. P., Gaspar, P. D., Cuce, P. M., Cuce, E., and Yilmaz, Y. N. (2025). Correction: Nunes et al. Energy Efficiency in Portuguese Traditional Cheese Industries: A Comprehensive Case Study. *Energies,* 18(17), 4735. Doi: 10.3390/en1817473

Peng, Y., Pei, C., and Zheng, Y. (2020). A cross-sectional survey of knowledge, attitude and practice associated with COVID-19 among undergraduate students in China. *BMC Public Health,* 20, 1292. Doi: 10.1186/s12889-020-09392-z

Pirzada, G., Naz, M. ., and Jamil, M. (2023). Incorporating Green Skills in Vocational Education & Training in Pakistan: The Educators' Perspectives. *Journal of Social Sciences Review,* 3(1), 42–52. Doi: 10.54183/jssr.v3i1.121

Purba, S. D., Wiranatha, H. D., and Sulistyaningsih, E. (2024). Increasing Commitment Through The Effect Of Green Training And Development And Green Behavior In State-Owned Bank Employees. *Binus Business Review.* 15(3), 261–270. Doi: 10.21512/bbr.v15i3.11229

Shamzzuzoha, A., Cisneros Chavira, P., Kekäle, T., Kuusniemi,H., and Jovanovski, B. (2022). Identified Necessary Skills To Establish A Center Of Excellence In Vocational Education For Green Innovation. Cleaner *Environmental Systems.* Doi: 10.1016/j.cesys.2022.100100

Skittou, M., Merrouchi, M. and Gadi, T. (2021). A Model of an Integrated Educational Management Information System to Support Educational Planning and Decision Making: A Moroccan Case. *WITS,* Proceedings of the 6th International Conference on Wireless Technologies, Embedded, and Intelligent Systems. Doi: 10.1007/978-981-33-6893-4_16

Šporčić, M. (2023). The Challenge Of Recruiting Forestry Workforce In Europe And Worldwide. *Sumarski List.* 147 (5), 239-250. Doi.10.31298/sl.147.5-6.4

Strachan, S., Greig, A. and Jones, A. (2023). Going Green Post COVID-19: Employer Perspectives on Skills Needs. *Sage Journals.* 37(06). Doi:10.1177/026909422311516

Thake, A.M. (2024). Greening Our Economy for A Sustainable Future. 163-175. Doi.10.1016/B978-0-443-23603-7.00013-3

Titin, Florid, M. I., Natsir, I., Kalalo, R. R., Elmas, M. S. H., and Telaumbanua, E. (2024). Can Green Recruitment Affect Employee Performance if Moderated Green Training based on the SDG?. *Journal of Lifestyle and SDGs Review*. 4(2), e01827. Doi: 10.47172/2965-730X.SDGsReview.v4.n02.pe01827

Tsoutsos, T., Skarakis, N., and Tournaki, S. (2025). Developing a Qualified Workforce for Greener Ports. In: McNally, C., Carroll, P., Martinez-Pastor, B., Ghosh, B., Efthymiou, M., Valantasis-Kanellos, N. (eds) Transport Transitions: Advancing Sustainable and Inclusive Mobility. *TRAconference.* Lecture Notes in Mobility. Springer, Cham. Doi: 10.1007/978-3-031-85578-8_108

UNCC. (2023). Why Are Green Skills Important for Youth?. Department for International Development. United Nations Climate Change. Retrieved from: www.unfccc.int

UNESCO. (2005). NFE-MIS Handbook Developing a subnational Non-Formal Education Management Information System. France: Literacy and Non-Formal Education Section Division of Basic Education UNESCO. United Nations Educational, Scientific and Cultural Organization. Retrieved from: www.unesdoc.unesco.org

UNESCO. (2007). Non-Formal Education Management Information System. United Nations Educational, Scientific and Cultural Organization. France: United Nations Educational, Scientific and Cultural Organization-UNESDOC. Retrieved from: www.unesdoc.unesco.org

UNINDO. (2022). What are green skills?. United Nations Industrial Development Organization. Retrieved from: www.unido.org

Xie, X., Zhu, Q., and Qi, G. (2020). How can green training promote employee career growth?. *Journal of Cleaner Production*, 259. Doi:10.1016/j.jclepro.2020.120818.

Yassin, N.S., Akel, D.T., and Mohamed Abd-Rabou, H. (2025). Green Management Training Program And Its Effect On Staff Nurses' Organizational Citizenship Behavior. *BMC Nursing,* 24(01). Doi: 10.1186/s12912-025-03203-9

Yua, E., Raymond-Yakoubian, J., Daniel, R.A, and Behe, C. (2022). A framework for co-production of knowledge in the context of Arctic research. *Ecology and Society,* 27(1):34. Doi: 10.5751/ES-12960-270134