Green skill investment and green job productivity: the critical mediation of digital readiness

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Abstract

The transition toward a sustainable and green aconomy has increased the demand for green jobs that are supported by skilled and digitally ready human resources. In Indonesia, particulary in semi-urban areas such as Cirebon City, challenges related to environmental pressures, limited digital adoption, and workforce capability gaps remain significant. This study aims to examine the effect of green skill investment on green job labor productivity, with digital technology adoption readiness serving as a mediating variable. A quantitative survey approach was employed, collecting primary data from workers engaged in green job sectors, including environmental agencies, the departement of manpower, and waste management units in Cirebon City. Data were analyzed using a structural modelling approach to explore direct and mediated relationships among variables. The finding indicate that investment in green skills enchances labor productivity and strengthens workers' readiness to adopt digital technology. Digital Technology adoption readiness also plays an important role in translating green skills into productive work outcomes, highlighting the interconnected nature of green competencies and digital transformation. These results suggest that policies and training programs aimed at developing green jobs should integrate environmental skill development with digital readiness to support sustainable and inclusive workforce transformation.

Keywords: *green skills investment, green jobs, labor productivity, digital technology adoption, sustainable workforce.*

Introduction

ESG topics have gotten a lot of attention lately as key priorities for both global and national development plans. This focus makes sense since we're seeing economies transition to be more sustainable and industries restructure themselves. Indonesia confronts several significant challenges in this context, including the escalating impacts of climate change, social inequality, and suboptimal governance. These issues necessitate a transformation of economic and employment systems that prioritizes not only growth but also sustainability. A pivotal strategy extensively discussed in the literature is investment in green skills, which is regarded as instrumental in fostering the creation of green jobs while enhancing labor productivity through preparedness for digital technology transformation.

Numerous international studies underscore the critical role of green skills in facilitating the shift to a circular and low-carbon economy. For instance, Bozkurt & Stowell (2016) demonstrate that insufficient investment in green skills development can result in diminished labor productivity, particularly in nations reliant on traditional industries. This insight is corroborated by Bianchi et al. (2024), who argue that the success of the green transition is inseparable from the integration of green skills with digital competencies, as technological adoption is essential for bolstering the efficiency and sustainability of

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production processes. Consequently, the productivity of green jobs is influenced not solely by environmental considerations but also by the workforce's readiness to leverage digital technologies effectively.

In the Indonesian context, these challenges are further compounded in local and semi-urban industrial zones. Cirebon City, a hub for the textile industry and a port area, is undergoing rapid urbanization, leading to a 15% annual increase in carbon emissions from industrial waste (BPS, 2023). The fish processing and textile sectors in this region are under pressure to adhere to environmental regulations, notably Law No. 32 of 2009 on Environmental Protection and Management, which mandates more eco-friendly production practices. However, these pressures are intensified by deficiencies in human resource quality, particularly the inadequate digital skills needed for mitigating environmental impacts and optimizing technology-driven production processes.

The conditions experienced by MSMEs in Cirebon are not much different, where the use of digital technology is still very minimal. Data from BPS (2023) indicates that only approximately 25% of MSMEs have integrated digital technologies into their operations. This limited adoption risks impeding MSME productivity and competitiveness, especially amid the demands of a green economy. Moreover, Indonesia's digital adoption index, which lags behind the global average (WEF, 2024), coupled with disparities in access to digital education and training (UNESCO On & Terms, 2023), highlights structural barriers that could undermine the efficacy of green skills investments.

While prior research has affirmed the substantial role of green skills in augmenting labor productivity (Hair, 2019), studies specifically examining the mediating role of readiness to adopt digital technology in the relationship between green skills investment and green job productivity remain scarce, particularly within the context of local and semi-urban industries in Indonesia. This research gap warrants investigation, given the unique characteristics of regions like Cirebon City, which grapple with environmental pressures, constrained technology adoption, and the imperative for inclusive labor transformation. This study checks out the connection between green skills investment and how productive green jobs are, using Cirebon City's openness to digital technology as the middle factor that links them together. Theoretically, it aims to contribute to the advancement of ESG theory and Human Capital Theory within the framework of the local green economy, while practically providing a foundation for formulating sustainable and inclusive workforce training policies and labor regulations.

Literature Review

Human Capital Theory, by Becker (1975), sees knowledge, skills, health, and values as capital to be developed. Investing in these areas increases productivity and future economic returns. Education, training, and work experience are strategic investments, balancing current costs with higher future income. This study adopts and expands the framework of Human Capital Theory into two transformative contexts of the 21st century: the green economy and the digital revolution. This integration is achieved by positioning green skills and digital competencies as specific forms of high value human capital within the new economic paradigm. The sustainability dimension encompassing environmental, social, and governance (ESG) aspects provides a normative and operational orientation for skills investment, emphasizing the development of human capital that is not only productive but

also ecologically and socially responsible. Meanwhile, the digital transformation dimension highlights the complementary nature between conventional (or green) human capital and the ability to utilize new technologies, resulting in adaptive and highly competitive human capital.

This research tests Becker (1975) theory of investment and productivity within a model that examines the interaction between green skills investment, digital technology readiness, and productivity in sustainable (green) jobs. The independent variable (X) in this study is Green Skills Investment. This variable is grounded in Human Capital Theory within the context of the Green Economy, as proposed by Bozkurt & Stowell (2016) and Nurhasanah et al. (2022), and is further integrated with the ESG (Environmental, Social, and Governance) framework (Jorgji et al., 2024). According to this theoretical foundation, investment in green skills constitutes an essential plays an important role in pushing us toward better resource management and a circular economic model. Green skills are technically more specific than general sustainability competencies and are required for occupations that directly contribute to the mitigation of environmental impacts.

The Productivity of Labor in Green Jobs, which serves as the dependent variable (Y), represents the concept of return on investment derived from Human Capital Theory by Becker (1975) within the context of the green economy. Becker points out that the benefit of investing in human capital shows up in how it makes people better at their jobs and more capable overall. In the realm of green jobs, this productivity is defined multidimensionally, encompassing not only the efficiency of producing goods or services (output per unit of labor) but also the quality of output that minimizes environmental impact (ILO, 2017). Thus, this productivity integrates sustainability criteria, such as emission reduction, energy conservation, and waste recycling.

The variable Readiness to Adopt Digital Technology (Z) is regarded as a form of complementary human capital within the extension of Human Capital Theory (Becker, 1975). This theory indicates that productivity often emerges from the interaction of various types of skills. In the digital era, the economic value of green skills can be effect gets way bigger when employees can actually work with digital tech, stuff like IoT sensors that keep an eye on the environment, big data for efficiency analysis, or digital platforms for green supply chain management.

Research conducted by Bone, Gonz, et al. (2025) in the journal *Technological Forecasting & Social Change* indicates that for roles in the green jobs sector, employers have shifted to skill-based hiring to address labor shortages. This reinforces the thesis that investment in skills rather than formal degrees alone is critically important in this sector. Another study by Deal (2021) from the Energies journal points out that eco-friendly jobs and the skills needed for them play a major role in Europe's Green Deal and its plan for bouncing back economically, demonstrating that investment in green skills is a macro-policy strategy that supports economic welfare. Therefore, this theory is used to explain how Green Skills Investment can influence the Productivity of Green Jobs Labor in the context of sustainable industries in Cirebon City. Based on this insight, we propose the following hypothesis:

H 1: There is a positive and significant influence of Green Skills Investment (X) on the Productivity of Green Jobs Labor (Y).

Based on the extension of Human Capital Theory (Becker, 1975), the economic value of

an investment in human capital increases when it interacts with other complementary capabilities. In this context, Green Skills Investment (X) is viewed as a cognitive foundation that directly drives the Readiness to Adopt Digital Technology (Z). Employees with solid knowledge about environmental practices and efficient resource use tend to adapt better when companies introduce digital tools like IoT sensors, data analytics, or eco-friendly supply chain software . This occurs because green skills create an awareness of the need for technological solutions to address environmental challenges, thereby triggering the readiness to adopt them. This argument is strengthened by Setyaningrum (2023) findings, which demonstrate that green practices within organizations contribute positively to the development of digital capabilities. Looking at it from both angles the theory and what the numbers show there's a clear pattern here. The more Cirebon City invests in teaching green skills, the better workers get at adapting to digital technology.

H 2: There is a positive and significant influence of Green Skills Investment (X) on the Readiness to Adopt Digital Technology (Z).

Readiness to Adopt Digital Technology is not merely a supporting factor, but rather a mediating human capital variable that acts as a catalyst. This variable mediates the relationship between X and Y through two primary mechanisms: (1) accelerating and facilitating the application of green skills into work practices via digital tools; and (2) enhancing the accuracy, scalability, and innovation in the execution of green tasks, which ultimately drives productivity. For instance, research conducted by Setyaningrum (2023) in the *Journal of Industrial Engineering and Management* (a reputable journal with a focus on the Indonesian context) .shows that having digital skills actually acts as a bridge between Green HRM practices and how sustainable a business can be. This finding supports the key role of digital readiness in aligning sustainability practices with business performance, which is relevant to enhancing the Productivity of Green Jobs.

H 3: There is a positive and significant influence of the Readiness to Adopt Digital Technology (Z) on the Productivity of Green Jobs Labor (Y) in Cirebon City.

Referring to Becker (1975) postulate regarding the complementary nature of human capital, and reinforced by empirical evidence from Gajdos and Antczak (2024), Handayani et al. (2021), and Setyaningrum (2023), it can be asserted that the relationship between Green Skills Investment (X) and the Productivity of Green Jobs Labor (Y) is not entirely direct. A portion of this influence is transmitted through the strengthening of Readiness to Adopt Digital Technology (Z). In the absence of adequate digital readiness, the productive potential of green skills may only materialize suboptimally due to limitations in implementation tools and methods. Consequently, in Cirebon City, the presence of a workforce with a high level of digital readiness will strengthen and get the most out of investing in green skills so workers can be more productive in environmental jobs. The more prepared the workforce is to adopt digital technologies, the more effectively their green skills will generate work output that is not only abundant in quantity but also superior in sustainability quality.

H 4: The Readiness to Adopt Digital Technology (Z) significantly mediates the relationship between Green Skills Investment (X) and the Productivity of Green Jobs Labor (Y).
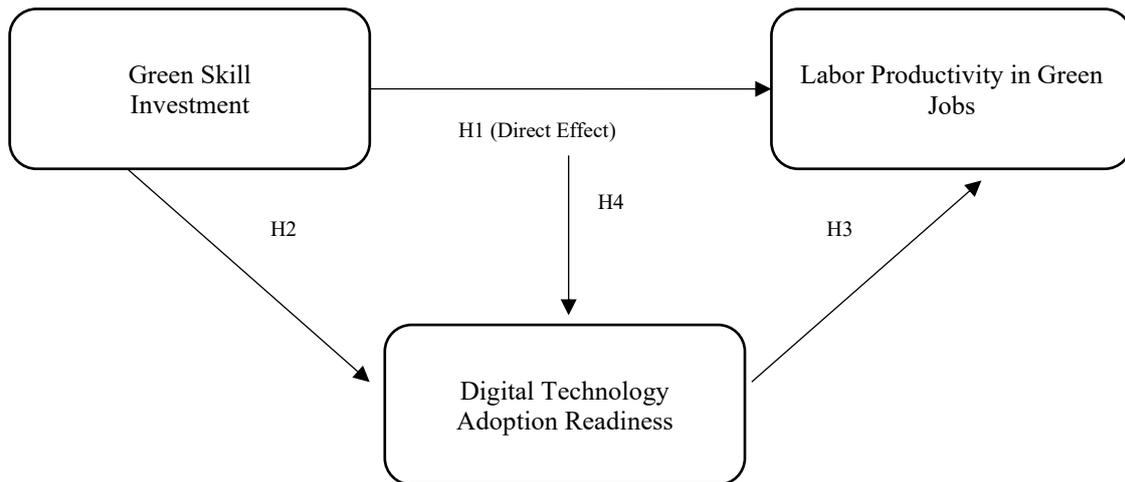
Figure 1. Research Framework

Methods

This study employs a survey methodology utilizing a quantitative approach, specifically designed to examine causal relationships among variables and the mediating role within the research framework. The quantitative methodology was selected due to its capacity for objective variable measurement and hypothesis testing, particularly the direct and indirect effects of Green Skills Investment on Green Job Productivity, with Readiness to Adopt Digital Technology serving as a mediating variable. The data employed herein consists of primary quantitative information collected directly from respondents, collect genuine data based on real-world situations. With 105 participants for this study, and handpicked them to make sure they properly reflected the population, ensuring that the data collected provides a robust foundation for analyzing the proposed relationships and mediating effects within the context of Cirebon City.

The data sources were derived from employees and individuals engaged in the green jobs sector in Cirebon City and its environs, encompassing government agencies such as the Environment Agency, the Department of Manpower, and industrial waste management entities. Data collection was conducted via the distribution of questionnaires, both directly (offline) and indirectly (online) through Google Forms. Questionnaires seemed like the best choice because help gather data from a bunch of respondents efficiently, and they help with facilitate the assessment of respondents' perceptions, knowledge, and readiness concerning the variables under investigation.

Sampling employed snowball sampling, a chain-referral technique that began by identifying an initial set of respondents (seeds) who met the research criteria. These initial respondents were then asked to identify and refer other potential participants from within their social networks (Biernacki & Waldorf, 1981) . The number of samples is determined using practical SEM guidelines, where each indicator must have at least five respondents (Hair, 2019). With a total of 21 indicators representing three research variables, the study utilized 105 respondents (21 X 5 = 105, according Hair (2019)), deemed sufficient to satisfy sample adequacy criteria for structural model analysis.

The Green Skill Investment variable was measured by adapting indicators of green knowledge comprehension, encompassing general knowledge, specific knowledge,

technical knowledge, managerial knowledge, as well as basic, managerial, operational technical, and social responsibility skills. The Green Jobs Labor Productivity variable was assessed through indicators such as the application of green skills in daily life and the work environment, enhancements in professional knowledge and skills, and institutional support for professional development. All indicators for both variables were evaluated using a five-point Likert scale with an ordinal measurement level. Meanwhile, the Digital Transformation Readiness variable was measured based on indicators including clarity of organizational goals, the use of cascading goals, the application of key performance indicators, the ability to analyze the external environment, and feedback collection mechanisms, employing an ordinal measurement scale aligned with the categories within each indicator.

Analyzing the data, with a multivariate statistical method using SEM (Structural Equation Modeling) or PLS (Partial Least Squares). Broke down the analysis into several steps. First, descriptive analysis to get a picture of who the respondents were. After that, checked if the constructs were valid by running a Confirmatory Factor Analysis (CFA), and also tested how reliable the instrument was using Cronbach's Alpha. Next, tested the structural model to see if it fit well. Finally, ran hypothesis tests to figure out both the direct and indirect relationships between the variables studying, including how Digital Transformation Readiness acts as a mediator.

Results and Discussion

For the analysis stage, we first checked whether the research instrument was suitable through validity and reliability tests. After that, we assessed whether the model used fit the existing data (goodness of fit). Moving forward, hypothesis testing to identify which variables actually influenced each other. The findings revealed, we discussed and related them to existing theories, including previous similar studies. The goal was to gain a comprehensive picture of the critical role of Green Skill Investment and Readiness to Adopt Digital Technology in increasing Green Job Productivity in Cirebon City.

The SmartPLS 4 results show that Green Skill Investment (X) indicators all meet the requirement, with loading factors above 0.7. The loading factor values in this variable range from 0.762 to 0.863. This indicates that each Green Skill Investment indicator makes a strong contribution in representing the construct being measured. The results show that all indicators under Green Skill Investment met the requirements for convergent validity, making them valid enough to continue with further testing.

For the Green Jobs Labor Productivity variable (Y), based on the test results, every indicator shows loading factor numbers that pass the standard requirements. For this variable, the loading factors fall between 0.716 and 0.876. What this basically means is that the indicators we picked do a good job at measuring the green jobs labor productivity, both in terms of work efficiency and output quality oriented towards sustainability. Therefore, all indicators in the Green Jobs Labor Productivity variable are declared valid and acceptable as a construct measurement tool.

In the Digital Technology Adoption Readiness (Z) variable, all indicators show loading factor values above 0.7 with a range of 0.700 to 0.930. These values reflect that the digital technology adoption readiness indicators have excellent strength in describing the construct under study. The high loading factor values for most indicators also indicate

consistency in measuring the digital readiness of the workforce in the context of green jobs.

Table 1. Validity Test Results for Each Indicator.

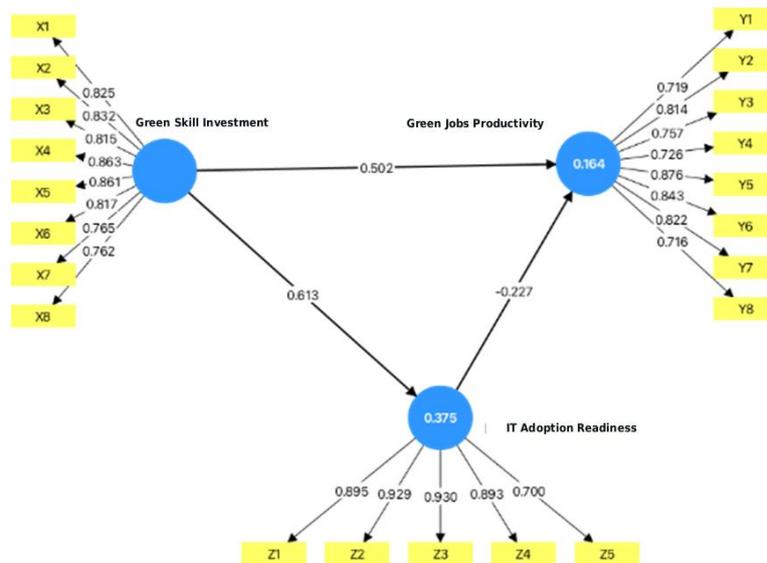| Code	Green Skill Investment (X)	Labor Productivity in Green Jobs (Y)	Digital Technology Adoption Readiness (Z)	Explanation
X1	0,825			Valid
X2	0,832			Valid
X3	0,815			Valid
X4	0,863			Valid
X5	0,861			Valid
X6	0,817			Valid
X7	0,765			Valid
X8	0,762			Valid
Y1		0,719		Valid
Y2		0,814		Valid
Y3		0,757		Valid
Y4		0,726		Valid
Y5		0,876		Valid
Y6		0,843		Valid
Y7		0,822		Valid
Y8		0,716		Valid
Z1			0,895	Valid
Z2			0,929	Valid
Z3			0,930	Valid
Z4			0,893	Valid
Z5			0,700	Valid

Figure 2. Convergence Test Results

Overall, the convergent validity test results show that all indicators in the three research variables, namely Green Skill Investment, Green Jobs Labor Productivity, and Digital Technology Adoption Readiness, have loading factor values above 0.7. From these results,

it can be concluded that all the indicators used are valid and meet the required convergent validity criteria. Therefore, these indicators can be used for subsequent analysis, such as when testing the structural model or the research hypothesis.

Table 2. Reliability Test Results

	Cronbach's Alpha	Composite Reliability	Composite Reliability	Explanation
Green Skill Investment (X)	0,929	0,933	0,942	Reliable
Labor Productivity in Green Jobs (Y)	0,919	0,923	0,941	Reliable
Digital Technology Adoption(Z)	0,914	0,949	0,928	Reliable

Based on Table 2, The data shows that all our variables have Cronbach's Alpha and Composite Reliability numbers at 0.7 or above. This confirms that each variable in our research is reliable, so that the instruments or questionnaires used are considered consistent and have a good level of reliability.

Table 3. Goodness of Fit Model Test Results (GoF)

Variable	Value Average Variance Extracted (AVE)
Green Skill Investment (X)	0,670
Labor Productivity in Green Jobs (Y)	0,763
Digital Technology Adoption (Z)	0,618
AVE	0,684

Based on Table 3, The data shows that each variable has a valid AVE value because its value is greater than or equal to 0.5. After calculation, the average AVE value above is 0.684, and there is an Adjusted R Square value is 0.527. Goodness of Fit (GoF) check if the research model actually works well in explaining how the variables connect with each other, I ran a Goodness of Fit (GoF) test. Basically, I calculated the GoF by looking at the Average Variance Extracted (AVE) score, which tells us how good the measurement model and the R^2 value, which represents the quality of the structural model. Thus, GoF provides a comprehensive picture of the suitability of the research model in terms of both construct validity and predictive ability. Based on the test results, an AVE value of 0.684 and an R^2 value of 0.527 were obtained. The GoF value of 0.42422 was then compared with the criteria proposed by Hasanuddin et al. (2024) a GoF score of 0.10 means the fit is small, 0.25 shows a medium fit, and 0.36 reflects a large fit. Since our study's GoF score went beyond 0.36, we can say the research model demonstrates a strong Goodness of Fit (large fit). This shows that our model works really well for both the measurement and structural parts. From this, we can see that the indicators we picked do a solid job of representing the latent variables. to be measured, and the relationship between variables in this model has a fairly significant influence in explaining the variables that are the final results.

The results revealed a strong connection between the variables we examined. When we looked at how Green Skill Investment relates to Green Jobs Labor Productivity, we found a path coefficient of 0.613, with a T-statistic of 6.994 and a p-value of 0.000. What this

basically means is that putting money into green skills training actually boosts how productive workers are in Cirebon's green jobs sector - and this effect is pretty substantial and statistically significant. These findings indicate that improving sustainability-based competencies and skills contributes directly to improving the performance and work output of workers.

Table 4. Bootstrapping Test Results

Hipotesis	Original Sample	T Statistic	P Values
X → Y	0,613	6,994	0,000
X → Z	0,502	4,373	0,005
Y → Z	0,613	6,994	0,000
X → Z → Y	0,363	2,472	0,013

Between investing in green skills and being ready to adopt digital tech, the findings were actually quite solid. Analysis result about a 0.502 path coefficient here, with a T-statistic hitting 4.373 and a p-value at 0.005. These figures demonstrate that investment in green skills training significantly impacts workers' readiness to use digital technology. These findings also reveal that when companies focus on developing green skills in their employees, the benefits are not only for environmental sustainability but also for making the workforce more prepared and capable of facing digital changes occurring in their workplace.

When tested for its influence, it turned out that Readiness to Adopt Digital Technology on Green Jobs Workforce Productivity had the following route coefficient of 0.613. Furthermore, the t-statistic was 6.994 with a p-value of 0.000. These results indicate that labor readiness to adopt digital technology has a positive and significant relationship with work productivity levels. This finding reflects that the use of digital technology supported by individual readiness can improve the effectiveness, efficiency, and quality of output in sustainability-based work.

Table 5. Summary of Hypothesis Testing

Hypothesis	Hypothesis Statement	Result
H1	There is a positive and significant influence between Green Skill Investment (X) and Green Jobs Labor Productivity (Y) in Cirebon City.	Supported
H2	There is a positive and significant influence between Green Skill Investment (X) and Digital Technology Adoption Readiness (Z) in Cirebon City	Supported
H3	There is a positive and significant influence between Digital Technology Adoption Readiness (Z) and Green Jobs Labor Productivity (Y) in Cirebon City	Supported
H4	Digital Technology Adoption Readiness (Z) significantly mediates the relationship between Green Skill Investment (X) and Green Jobs Labor Productivity (Y) in Cirebon City.	Supported

The indirect effect test shows that Digital Technology Adoption Readiness acts as a mediating variable in the relationship between Green Skill Investment and Green Job Labor Productivity. The analysis results show an indirect effect of 0.363, with a t-statistic of 2.472 and a p-value of 0.013. These findings indicate that green skills investment can increase worker productivity through another pathway, namely by increasing their readiness to adopt digital technology. These results indicate that the green skills possessed by workers become more effective in increasing productivity when supported by adequate digital readiness. Based on the overall test results, all hypotheses proposed in this study are not rejected. After a mediation analysis test was conducted to determine whether mediation in this study was full mediation or partial mediation. To conduct a mediation analysis properly, we've got to check out how the direct effects stack up against the indirect effects using a one-tailed test through bootstrapping. Based on what Table 6, here's the comparison between those direct and indirect effects:

Table 6. *Effects* and *Indirect Effects*

	Hypothesis	Path Coefficients	Mediation Role
Direct Effects	Green Skill Investment (X) → Labor Productivity in Green Jobs (Y)	Positive & Significant	*Partial Mediation*
Direct Effects	Green Skill Investment (X) → Digital Technology Adoption (Z)	Positive & Significant	
Direct Effects	Digital Technology Adoption (Z) → Labor Productivity in Green Jobs (Y)	Positive & Significant	
Indirect Effects	Green Skill Investment (X) →Digital Technology Adoption (Z) → Labor Productivity in Green Jobs (Y)	Positive & Significant	

Based on the data presented in Table 6, it can be inferred that, in the absence of the mediating variable Digital Technology Adoption Readiness (Z), Green Skill Investment (X) exerts a positive and significant influence on Green Job Labor Productivity (Y). The results indicate that green skill investments really help organizations prepare better for digital technology adoption. What's interesting is that this digital readiness then leads to higher productivity among workers in green jobs. Upon incorporating Digital Technology Adoption Readiness as a mediating variable, the indirect effect of Green Skill Investment on Green Job Labor Productivity remains positive and significant, with the direct effect also persisting as significant. The findings indicate that Digital Technology Adoption Readiness partially explains how Green Skill Investment leads to improved Green Job Labor Productivity.

The validity test outcomes reveal that all indicators across the Green Skill Investment (X), Green Job Labor Productivity (Y), and Digital Technology Adoption Readiness (Z) variables exhibit outer loading values surpassing the threshold of 0.70. These results indicate that each indicator effectively and consistently explains the underlying latent construct.

The reliability checks with Cronbach's Alpha and Composite Reliability showed figures of more than 0.70 for the three variables, so it can be concluded that the level of consistency is high. This implies that the instruments employed to assess green skill investment, readiness for digital technology adoption, and green job labor productivity reliably capture the empirical realities in Cirebon City. The AVE numbers are all above 0.50, which basically means the convergent validity checks out well for our research variables.

In summary, the goodness-of-fit test showed a value of 0.424, which means the structural model works well enough. So basically, we can use this model to explain how the different variables in our study are connected and affect each other. The findings of the hypothesis test indicate that Cirebon City's green job productivity is positively and significantly impacted by investments in green skills. The relatively high path coefficient value, supported by a significant test statistic, indicates that increased investment in green skills development is directly correlated with increased productivity among workers involved in the green job sector. This finding confirms that strengthening human resource capacity through environmentally-oriented skills is a key factor in promoting more effective and sustainable performance at work.

The study's conclusions are consistent with the Human Capital Theory within the framework of the green economy put out by Bozkurt & Stowell (2016), which views skills as a strategic asset in improving workforce performance and productivity. In the framework of the green economy, green skills not only reflect technical abilities, but also include knowledge, attitudes, and work practices that support environmental preservation and resource efficiency. Investment in training in waste management, energy efficiency, emission reduction, and environmentally friendly production practices enables workers to produce more efficient, higher quality output that meets sustainability standards. Conceptually, environmentally friendly skills play an important role in reducing environmental impact, ensuring decent working conditions, and encouraging the development of an ecologically sustainable, climate-resilient, and cleaner economy (Gričnik et al., 2023). These skills are needed in jobs that contribute to the preservation of biodiversity and ecosystems, reduction of energy use, as well as reducing waste and pollution. Thus, green skills are the main foundation for the creation of green jobs that are not only economically productive but also environmentally and socially responsible (Hüseynova et al., 2025).

The availability and caliber of green talents are critical to the corporate sector's shift to a low-carbon economy. This shift is strategically driven by the business sector, but the workforce's capacity to embrace and use eco-friendly skills will be a major factor in its success. Employers are urged to review existing business models, increase operational effectiveness, and build new sustainability-based markets and job possibilities as people actively acquire green skills. This directly raises worker productivity in the field of green jobs.

This data confirms the patterns that (Bone, González Ehlinger, et al., 2025), which show a significant shift in the green job sector towards skills-based recruitment and workforce development, rather than simply formal qualifications. Workers with relevant green skills are considered more adaptive to technological changes, environmental regulations, and sustainable job market demands, enabling them to produce more optimal performance.

This matches up by da Costa et al. (2025), in this whole green economy shift, workers

need to actually know stuff about environmental topics that's like one of the biggest things. Their research found what people learn in school doesn't really line up with what companies actually need when it comes to green skills, and shows that many companies have recognized the importance of green skills but have not yet fully prioritized them in their recruitment and internal training processes. This situation indicates that investment in green skills remains a challenge, as well as a strategic opportunity to increase the productivity of the green workforce.

In the context of Cirebon City, these findings reflect that investment in green skills is an important factor in increasing green job productivity, both in terms of quantity and quality of output. Workers equipped with environmentally friendly skills are able to contribute more effectively in supporting the region's green economic transition, while strengthening the competitiveness of the green job sector at the local level. Our results back up H1, showing that when invest in developing green skills, it actually makes a real difference in green job productivity.

The second hypothesis test shows that Green Skill Investment has a favorable and substantial impact on the readiness for digital technology adoption. This finding indicates that investment in green skills not only improves environmental technical competencies, but also strengthens the readiness of the workforce to accept and use digital technology. Theoretically, these results are in line with the Technology Acceptance Model and Diffusion of Innovation Theory approaches, which emphasize that an individual's readiness to adopt technology is influenced by their level of knowledge, experience, and perceived benefits. Green skills training integrated with the use of technology, such as sensor-based energy monitoring or digital waste management systems, encourages workers to become more familiar with digital technology as part of their daily work activities(Wang et al., 2023). Dynamic Capability Theory, which states that investment in skills development not only strengthens technical competencies but also the workforce's adaptive capabilities to technological innovation (see green skills as capital for technological adaptation) (Liang et al., 2025).

Research such as Elshifa et al. (2025), shows that green skills training significantly improves the digital readiness and competencies of the workforce, especially when combined with cross-sector collaboration. Digital technology adoption readiness is positively and significantly impacted by green skill investment. Green skill investment, through sustainability-based training and development, contributes directly to improving digital competencies, which in previous studies have been proven to be one of the main predictors of green digital technology adoption (Desmaryani et al., 2024). Furthermore, green skills investment can also be understood as part of institutional support, as it reflects an organization's commitment to providing training, facilities, and support systems for its workforce.

In addition, Mardiana (2025) study, Studies that combine TAM with TPACK also prove that digital skills play a significant role in increasing the use of environmentally conscious digital technology.These findings also expand on the results of Setyaningrum and Muafi (2023) research, which confirms that digital skills play an important role in supporting Green Human Resource Management practices. In the context of Cirebon City, investment in green skills has proven to serve as a gateway for the digital transformation of the workforce, especially in sectors that are adapting to the demands of sustainable industry

and digitalization simultaneously.

The results of the analysis show mbrace digital technology positively impacts the productivity of labor in green jobs, with the effect being statistically significant. This means that workers who are more digitally ready tend to show higher levels of productivity in green jobs. This finding supports the principle of a green economy that emphasizes resource efficiency through the use of technology. The use of digital technology, such as automation systems, the Internet of Things, or environmental monitoring applications, enables workers to work more accurately, quickly, and in accordance with sustainability standards. This is in line with the definition of green job productivity, which focuses not only on output but also on the resulting environmental impact. According to Human Capital theory (Becker, 1975), improvements in the skills, knowledge, and abilities of the workforce contribute directly to increased productivity. Digital technology is not only a tool, but also part of upskilling that increases the productivity value of individuals.

Gajdos & Antczak (2024) research implicitly shows that improved skills, including digital skills, contribute to more optimal work outcomes in the green sector. In the context of Indonesia, particularly the city of Cirebon, digital readiness is a distinguishing factor between workers who are able to productively take advantage of green job opportunities and workers who are still hampered by technological limitations.

A study by Kaltum et al. (2025) looked into how using cloud tech can boost productivity and help micro and small businesses stay sustainable in the long run. They also checked out other factors that play a role, like how engaged employees are, whether they're digitally literate enough, and if the organization is actually ready to make the switch. The results of the study show that the application of cloud technology does not have an optimal impact if it is not accompanied by the readiness of human resources and a supportive organizational environment. In other words, technology serves as an enabler, while the digital readiness of the workforce is a determining factor in its effective use. The findings reinforce the argument that readiness to adopt digital technology not only affects technical aspects of productivity, but also the capacity of workers to utilize technology effectively and sustainably. Although this study focuses on the micro and small sectors, its conceptual framework is relevant to the context of green jobs, where productivity is not solely measured by work output, but also by process efficiency, reduced environmental impact, and long-term sustainability.

The mediation test results show that Digital Technology Adoption Readiness significantly mediates the relationship between Green Skills Investment and Green Job Labor Productivity. The significant indirect effect value indicates that most of the impact of green skills investment on labor productivity occurs through increased digital readiness of workers. This finding reinforces the main argument that green skills do not automatically contribute to high productivity if they are not supported by adequate digital readiness and capabilities. The Technology-Organization-Environment (TOE) theoretical paradigm, which asserts that the success of technology adoption is determined by the characteristics of the technology, organizational conditions including human resource readiness, and external market and regulatory pressures thus making digital readiness an important factor in bridging skills with expected performance outcomes (Sapitri et al., 2025).

Another way to explain this is through TAM and the Diffusion of Innovation framework. It comes down to how users perceive the technology - if they see it as beneficial and not too

complicated, they're more likely to have a positive attitude toward it and ultimately impacting performance outcomes. In the context of the green workforce, readiness to adopt digital technology is not only about the availability of tools, but also about digital competence, psychological motivation, and the perceived usefulness of technology for green jobs themselves an aspect reinforced by research finding that digital competence and psychological readiness are significant in the adoption of environmentally friendly technology (Mardiana, 2025).

These mediating findings suggest that investment in technical-environmental skills will be more effective if accompanied by increased readiness to adopt technology as a mechanism that translates green competencies into measurable work productivity. Without technological readiness, investment in green skills will only result in theoretical competencies without real implementation in the field, creating dissonance between training policies and work realities a phenomenon previously identified in studies on skills and technology implementation (Azzahra et al., 2025).

In the local context of Cirebon City, these results provide a perspective that the transformation towards a green and digital economy must proceed in harmony. Digital technology adoption readiness is a crucial connecting mechanism (mediator) for the development of green skills to be realized as effective work productivity. This is in line with studies that highlight how workers' digital readiness mediates the relationship between human resource investments (e.g., training or digital leadership) and operational results or job performance.

Conclusion

This study concludes that green skill investment plays a central role in improving green job labor productivity in Cirebon City, both directly and through the readiness to adopt digital technology. Workers who possess stronger green-related knowledge and skills are better positioned to perform their tasks productively within sustainability oriented sectors. At the same time, digital technology adoption readiness emerges as an important mechanism that strengthens the effectiveness of green skills, enabling workers to translate environmental competencies into more efficient, accurate, and impactful work outcomes. These findings confirm that the development of human capital in green jobs cannot be separated from digital readiness, as both dimensions interact to support productivity in the transition toward a green and digital economy.

Despite its significant contribution, this research still has its shortcomings. Because it used a cross-sectional design, it cannot observe changes that occur within a skills, digital readiness, and productivity over time, focusing only on environmental jobs within one urban area could limit how can use these findings in other locations or work sectors. Future research is encouraged to apply longitudinal approaches to observe dynamic developments in green and digital competencies, expand the scope of analysis to different cities or national contexts, and incorporate additional variables such as organizational support, digital infrastructure, or green organizational culture to enrich the understanding of productivity drivers in green jobs.

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