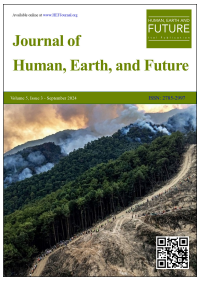
Available online at www.HEFJournal.org

ISSN: 2785-2997

Journal of
Human, Earth, and Future

Vol. 5, No. 3, September, 2024



Analyzing the Factors Influencing Green Job Participation and Income Effects Using National Labor Force Data

Devanto S. Pratomo [1*], Devi N. C. Ningsih [2], Adhi C. Fahadayna [3], Kukuh Arisetyawan [4], Muhammad S. Al Ayyubi [1], Christiayu Natalia [5], Dien A. N. Asrofi [1], Lustina F. Prastiwi [6]

[1] *Department of Economics, Faculty of Economics and Business, Brawijaya University, Malang, Indonesia.*

[2] *Department of Business Administration, Faculty of Administrative Sciences, Brawijaya University, Malang, Indonesia.*

[3] *Department of International Relations, Faculty of Social and Political Sciences, Brawijaya University, Malang, Indonesia.*

[4] *Department of Economics, Faculty of Economics and Business, Universitas Negeri Surabaya, Indonesia.*

[5] *Badan Pusat Statistik, Malang, Indonesia.*

[6] *Department of Development Economics, Faculty of Economics and Business, Universitas Negeri Malang, Malang, Indonesia.*

Received 09 June 2024; Revised 08 August 2024; Accepted 13 August 2024; Published 01 September 2024

Abstract

This study is focused on two main objectives: 1) to analyze the factors that influence the possibility of individuals working in the green job sector in Indonesia, and 2) to analyze the effects of green jobs on individuals' income. Using data from the National Labor Force Survey (SAKERNAS), the study employed (1) logistic regression to examine the factors that determine an individual's likelihood of getting a green job, (2) regression analyses based on Heckman selection bias correction to see the effects of green jobs on workers' income. The results show that the characteristics of green jobs in Indonesia are dominated by young and prime-age male workers with low education and experience, with no physical or mental health problems. From the welfare perspective, green workers tend to have higher income levels than those of workers employed in the non-green job sector. This research fills a significant gap, as studies on green jobs in Indonesia—particularly those focusing on wage levels—are scarce. Therefore, it is crucial to develop tailored policy strategies that address green job creation, benefiting both environmental quality and the labor market.

Keywords: Green Job; Sustainability; Income; Indonesia; Labor Force.

1. Introduction

Green jobs are increasingly recognized as the key in driving both environmental sustainability and socio-economic development. The International Labor Organization defines green jobs as employment opportunities that not only contribute to environmental preservation and restoration but also ensure decent work conditions, thereby enhancing the quality of life for workers [1]. In alignment with this statement, Consoli et al. (2016) [2] emphasized that green jobs are designed to mitigate the destructive effects of environmental degradation and unsustainable resource use, positioning them as essential to the broader agenda of sustainable development. Furthermore, from a business perspective, green jobs represent positions that focus on producing goods or delivering services that have positive environmental impacts,

* Corresponding author: devanto@ub.ac.id

http://dx.doi.org/10.28991/HEF-2024-05-03-014

such as reduced carbon footprints and improved energy efficiency [3]. These roles span various industries, from renewable energy to sustainable agriculture, highlighting the growing importance of integrating environmental considerations into economic activities [4, 5].

The significance of green jobs extends beyond merely creating employment opportunities; their true value lies in their capacity to safeguard the environment and foster long-term sustainability [6]. These jobs actively contribute to the reduction of pollution, the enhancement of workplace environments, and the promotion of healthier, more sustainable production processes. As a result, green jobs can lead to increased productivity by integrating eco-friendly practices into the workforce [7]. Furthermore, the expansion of green jobs is pivotal in addressing unemployment challenges, as they open up new sectors and generate sustainable employment opportunities that align with global environmental goals [5, 8].

In Indonesia, economic growth over the past two decades has largely been driven by environmentally unsustainable practices. Figure 1 presents a clear positive correlation that exists between economic growth and CO2 emissions during the past two decades, underscoring the trade-off between economic development and environmental quality. The continuous rise in CO2 emissions associated with industrial expansion and resource exploitation indicates that Indonesia is facing profound challenges in balancing economic progress with environmental sustainability. These trends not only threaten long-term environmental health but also highlight the urgent need for transformative approaches to resource management and production that align with Sustainable Development Goals (SDGs). Meanwhile, by adopting greener policies and promoting low-carbon technologies, Indonesia can work toward building a climate-resilient economy while preserving natural resources for future generations [9, 10].

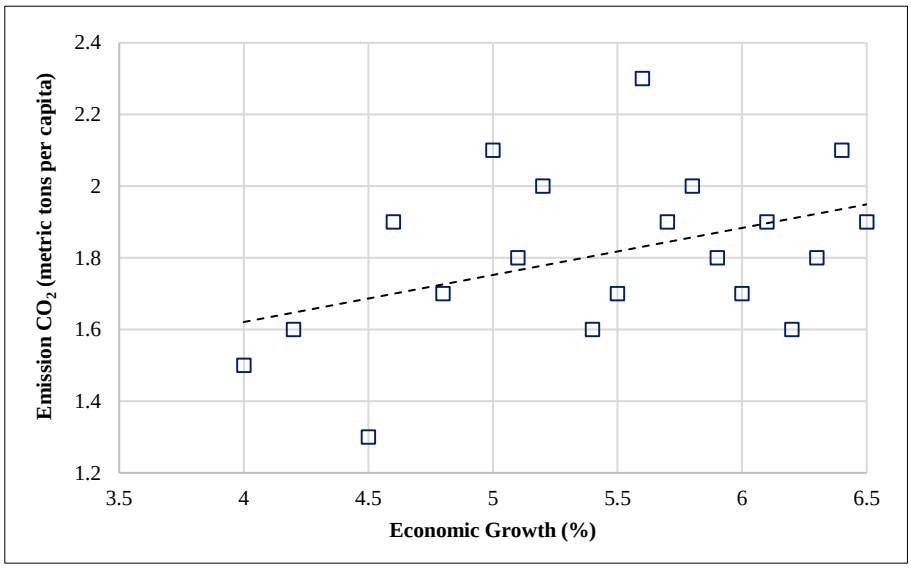


Figure 1. Correlation between Economic Growth and Carbon Emissions in Indonesia (2000-2018)

The development of green jobs presents a crucial pathway for Indonesia to achieve low-carbon, environmentally sustainable growth while ensuring social inclusivity. To realize this potential, it is imperative for the Indonesian government to adopt comprehensive policies that effectively balance economic advancement with environmental conservation and climate change mitigation. Recognizing the urgency of this challenge, Indonesia is committed to reducing its greenhouse gas (GHG) emissions by 29% by 2030, as articulated in its Nationally Determined Contribution (NDC) under the Paris Agreement. Expanding the green job sector should be the central pillar of these efforts, as it not only supports environmental goals but also fosters economic diversification and social equity. By investing in green jobs, Indonesia can drive sustainable development, create resilient industries, and reduce its dependency on carbon-intensive sectors [5].

Despite Indonesia's commitments to reducing greenhouse gas emissions and fostering sustainable development, the growth of green jobs remains significantly low. According to ILO (2013) [11], only 8.5% of the total workforce is engaged in environmentally friendly occupations, with a mere 3.8% classified as green jobs. This disparity highlights the gap between Indonesia's environmental aspirations and the actual development of its green job sector. The slow progress not only affects the country's ability to meet its climate goals but also deprives it the opportunity to stimulate economic growth through sustainable industries. To open up green employment opportunities, Indonesia must accelerate the adoption of green technologies, provide incentives for businesses to transition to sustainable practices, and invest in workforce reskilling initiatives to prepare workers for emerging green sectors [12]. These steps are essential for ensuring that green jobs not only contribute to environmental sustainability but also drive long-term economic growth and social inclusion.

A number of studies on the development of green jobs in Indonesia have been published; they highlight the gap between governmental commitments to reducing emissions and the actual progress in fostering a green economy. While the Indonesian government has pledged to cut emissions by 29% by 2030, only 3.8% of the total workforce is engaged in green jobs, reflecting painfully slow advancement in this sector [13]. Bowen & Kuralbayeva (2015) [8] pointed out that sectors such as renewable energy and waste management remain underdeveloped due to insufficient policy support and investment. Adams & Acheampong (2019) [10] argued that although renewable energy is crucial to driving green job growth, investment in the sector has been inadequate to meet the country's environmental and employment targets. These related studies emphasize the need for accelerated action to unlock the full potential of green jobs in Indonesia, especially from its workforce.

This study has two main objectives. Firstly, to analyze the factors that influence the possibility of individuals working in green jobs in Indonesia. Secondly, to analyze the effects of green jobs on workers' income generation. The analysis is aimed at explaining the differences in welfare between workers in the environmentally friendly sector and the workers in the conventional sector.

2. Literature Review

2.1. The Relationship between Green Jobs and Welfare

Studies that focus primarily on the relationship between Green Jobs and social welfare remain relatively sparse. However, a broader examination of environmentally friendly economic growth highlights its critical role in enhancing the quality of life for individuals and communities. Green growth encompasses an economy that prioritizes environmental sustainability by conserving natural resources, minimizing pollution, and reducing harmful emissions during production processes. It also emphasizes the creation of products and services that are not detrimental to the environment. According to the Organization for Economic Co-operation and Development (OECD) [14, 15], green growth initiatives in developing countries have the potential to foster poverty alleviation, stimulate economic growth, and enhance resilience against climate change and natural disasters. Furthermore, these initiatives can contribute to greater energy security and improved livelihoods for communities that rely on natural resources. In addition to these economic benefits, increased focus on the green economy can significantly mitigate environmental hazards and enhance public health. Improved health outcomes not only lead to a higher quality of life but also empower individuals to engage more productively in the workforce, ultimately benefiting the economy as a whole [16]. Thus, the pursuit of green economic policies aligns with broader developmental goals, fostering an ecosystem where both environmental sustainability and social welfare can thrive.

Figure 2 graphically illustrates the dire consequences of the failure to integrate green economy principles into societal economic activities [15, 16]. A lack of green frameworks can lead to excessive and unsustainable use of productive resources, ultimately degrading those resources. Over time, this degradation reduces the overall productivity of the labor force. As productivity declines, societal welfare is negatively impacted, with one of the major consequences being an increase in the poverty rate. Without environmentally sustainable practices, the depletion of resources leads to diminished long-term economic gains and undermines social welfare.

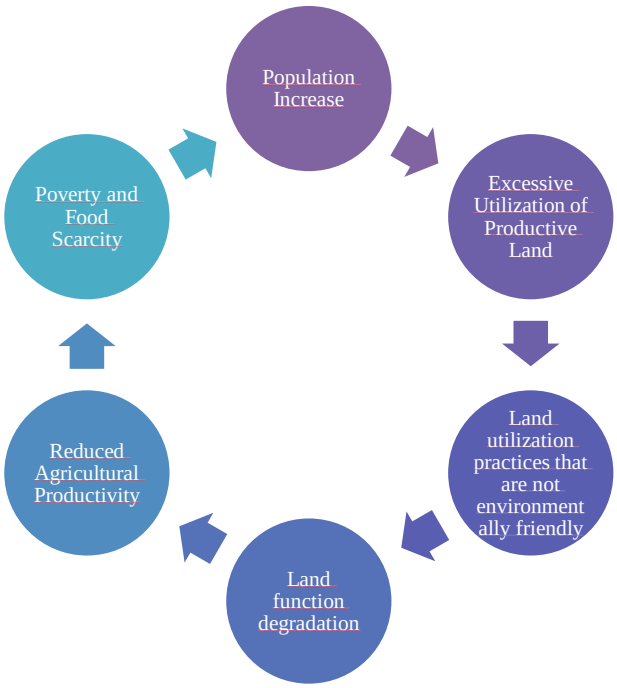


Figure 2. The importance of green economic growth

Nonetheless, the actual role of green growth in enhancing social welfare is not yet fully understood. Traditional economic metrics, such as Gross Domestic Product (GDP), may not accurately reflect the impacts of "green" policies, as indicated by Hallegatte et al. (2016) [17] and Schmalensee (2012) [18]. Environmental regulations, while necessary for promoting sustainable practices, can sometimes lead to short-term reductions in GDP if the anticipated efficiency gains from technological advancements fail to materialize. Furthermore, transitioning from conventional growth models to green growth models has significant implications for wealth distribution and income equity. As such, it is imperative for policymakers to critically evaluate the long-term effects of green initiatives on both economic performance and social equity, ensuring that the benefits of green growth are equitably shared across all segments of society.

2.2. Previous Studies

The growing concern over climate change and environmental sustainability has brought green jobs to the forefront of global development agendas. Defined broadly as employment that contributes to preserving or restoring environmental quality, green jobs are increasingly recognized not only as a pathway to environmental improvement but also as a means to promote economic growth and social well-being. In recent years, countries around the world have implemented policies aimed at fostering green economic transitions, with a particular emphasis on renewable energy, sustainable agriculture, and waste management. However, while the macroeconomic benefits of green job creation are well-documented, there remains a substantial gap in understanding the micro-level factors and mechanisms that influence green job growth, particularly in developing economies like Indonesia.

Despite the fact that the study of green jobs is a new contemporary issue in developmental economics, this study attempts to summarize several previous studies as a reference. The majority of previous studies discuss how to measure green jobs and distinguish them from other jobs. In addition, several studies also indirectly explain how green jobs derived from the concept of the green economy affect people's welfare. Consoli et al. (2016) [2] described an empirical analysis of the characteristics of green and non-green jobs to detect differences in skills and human capital. The results of the study revealed that green jobs use higher-level cognitive and interpersonal skills that are more intensive than non-green jobs. Green jobs also show higher levels of standard dimensions of human capital such as formal education, work experience, and on-the-job training. Bowen & Hancké (2019) [19] explained that greener growth has increased the educational requirements for green jobs faster than the qualifications needed in the economy as a whole. Therefore, education planning needs to be optimized in the momentum of the transition to a green economy.

Several other studies also discuss the driving factors of green job figures with more macro indicators. Lee (2017) [20] suggests that US state renewable energy regulatory policies tend to reduce policy uncertainty in energy and environmental markets, thereby encouraging the creation of green jobs. Lee & van der Hejiden (2019) find that higher education institutions are the main driving forces of green economic growth and, in particular, the development of green jobs. In addition, Lim et al. (2020) [22] found that the role of government, especially in investment activities and green economic recovery, can be essential in creating green jobs. Cecere & Mazzanti (2017) [23] used econometric analysis to assess the factors influencing green job creation in small and medium-sized companies in Europe. The results of the study found that innovations in environmentally friendly products and services are correlated with the creation of environmentally friendly jobs. In addition, the interaction between environmental management systems and product and service innovation also has a positive and significant effect on people's decision to engage in green jobs.

Furthermore, in their discussion on the role of green jobs in driving human development, Sulich et al. (2020) [24] presented an analysis of how green jobs can be used to address youth unemployment in Poland, the Czech Republic, and Belgium. Their research led to the conclusion that the existence of green economic development in spurring the creation of green jobs turns out to provide excellent job opportunities for young people who are hunting for their first job.

The preceding studies show a noticeable research gap concerning the specific driving forces behind the agenda for accelerating the provision of green jobs. This gap is especially apparent when the discussion shifts to a more micro-level context, especially in developing countries like Indonesia. While many existing studies focus on macroeconomic indicators and broader national policies that promote green job creation, there is a lack of in-depth analysis on individual factors that influence the development and sustainability of green employment opportunities at the community or enterprise level.

3. Research Methodology

3.1. Definition and Measurement of Green Jobs

The concept of "green jobs" is a highly debatable issue that has grown in popularity since the recent economic recession caused by the unprecedented COVID-19 pandemic. In other words, the labor market is increasingly aware of the need for environmental and sustainability issues. However, there is no general consensus on what constitutes a green job. OECD indicates that each country adopts a slightly different statistical definition of green jobs. However, in general, 'green' jobs can be considered jobs that are related to environmental goals and policies [14].

Some definitions of 'green' jobs focus on jobs and skills with an identifiable environmental focus, but most focus on jobs in specific industries or projects whose products are considered to be environmentally beneficial. Some products

that are considered environmentally beneficial, for example, feature renewable energy, environmental services, and/or jobs related to improving energy efficiency or developing low-carbon products [19]. Furthermore, Rutkowska-Podołowska et al. (2016) [25] explained the similar concept of green jobs: workplaces that contribute to preserving or restoring the environment in traditional sectors, such as manufacturing and construction, or in emerging sectors, such as renewable energy and energy efficiency.

The International Labor Organization (ILO) [1] and the United Nations Environmental Program (UNEP) (2008) [26] define green jobs as jobs in economic sectors that directly reduce negative environmental impacts, resulting in sustainable growth. Green jobs help reduce energy and raw material consumption, remove carbon from the economy, protect and restore ecosystem services and biodiversity, and minimize the production of waste and pollution. In addition, the ILO (2018) [1] emphasized that a job can be called green only if it is a decent job. The decent work aspect of green jobs is based on four strategic objectives: productive work; fair income opportunities; social protection and social security for workers and their families; and the right to participate in social dialogues.

Figures 2 and 3 present the concepts of green jobs according to the ILO and UNEP [27]. A 'green' job satisfies two requirements: it must support the environment and provide decent work. Many examples of jobs meet these two criteria, such as green architects, workers in the public transportation sector who are paid fairly, and workers in the solar energy sector. Meanwhile, types of work that are simply environmentally friendly or activities with good workability conditions but that do not meet decent work requirements cannot be categorized as green jobs. In the first case, for example, experience in the electronics recycling sector does not prioritize employee safety, and workers installing solar panels are underpaid. Furthermore, the second case usually involves chemical engineers and auto industry workers. The final case is where the work is categorized as neither feasible nor environmentally friendly. This is likely to be found in jobs that exploit nature, such as coal mining.

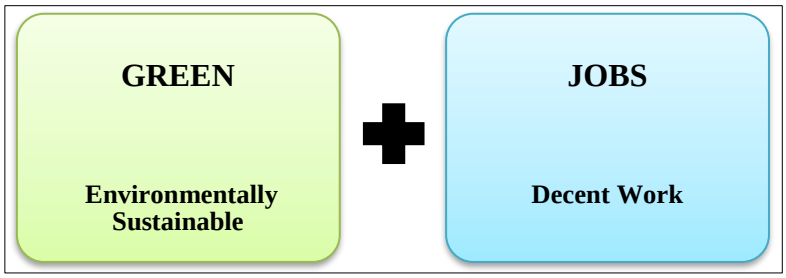


Figure 2. Definition of Green Jobs

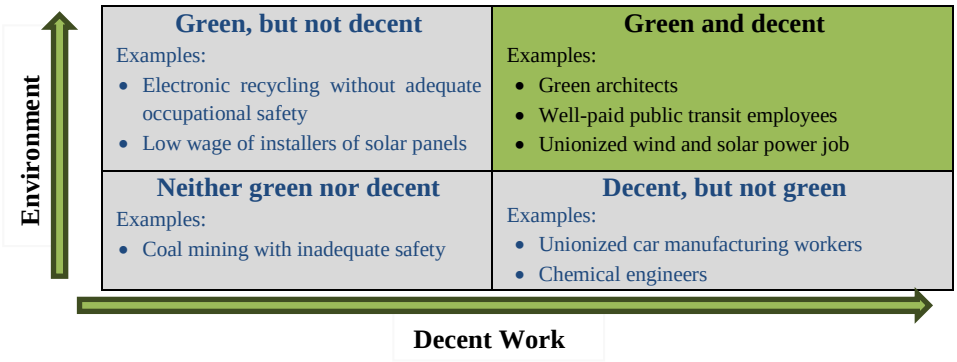


Figure 3. Green and Decent Work Framework

4. Research Method

The first objective of this study is to analyze the factors that influence the possibility of individuals becoming green workers. The method used is a logistic regression with the model as follows:

$$\text{GreenJob}_{ir} = \gamma_0 + \delta X_{ir} + \varepsilon_{ir} \quad (1)$$

where Green Job is binary, namely, 1 if the individual's job is one in which the individual is working in a job categorized as green job and 0 if it is not. The definition of green jobs used in this research refers to the International Labor Organization study on the "Green Jobs Mapping Study in Indonesia." According to this study, two key criteria determine whether a job can be categorized as a green job. First, the job must be situated within the green or environmentally friendly economy. Second, the job must meet the standard of decent work. To define employment within the green economy, the ILO (2018) [1] identified economic sectors that can be classified as environmentally friendly: agriculture, forestry, fisheries, mining and energy, manufacturing, construction, transportation, tourism. The determination of sectors included in the green economy is based on ILO's standards and further classified according to the Indonesian Standard Industrial Classification (KBLI) codes, as outlined in Table 1.

Table 1. Green Economic Sector

No	Sector	KBLI Code
1	Agriculture Sector	KBLI code 01111, 01112, 01121, 01122, 01125, 01131, 01132, 01115, 01134, 01135, 01223, 01300
2	Forestry and hunting Sector	KBLI code 02011, 02012, 02013, 02014, 02015, 02016, 02017, 02018, 02019, 02020, 02031, 02032, 02033, 02035, 02039, 02041, 02042, 02043, 02049
3	Fishery Sector	KBLI code 05011, 05014, 05031, 05032, 05041, 05042, 05043, 05044
4	Energy and Mining Sector	KBLI code 11102, 40101, 40102, 40103, 40104, 40201, 40202, 24119
5	Manufacturing Sector	KBLI code 15143, 15144, 15145, 15311, 15312, 15313, 15314, 15315, 15316, 15317, 17301, 17302, 17303, 17304, 17400, 20103, 20104, 20291, 20292, 20293, 20294, 20299, 36102, 22302, 24121, 24241, 24924, 26411, 35921, 35922, 31501, 37100, 37200
6	Construction Sector	KBLI code 45100-45219, 45221, 45222, 45224, 45225, 45312, 45314
7	Transportation Sector	KBLI code 60214, 60215, 61224, 61226, 60224, 60233, 60110, 60120, 60139, 61111- 61222
8	Tourism	KBLI code 55111, 55112, 55140, 55150, 63460, 63470, 92331, 92332, 92333, 92334, 92335, 92336, 92422, 92431, 93432, 93433, 80923

In addition to belonging to a green sector, the job must also meet the criteria of decent work. In this study, decent work is assessed based on whether workers have an employment contract, which ensures job security and formal working conditions. This approach reflects ILO's emphasis on equitable labor practices, where having a formal contract is a critical factor in providing adequate wages, ensuring safe working conditions, offering social security, and protecting workers' rights. Thus, a green job not only contributes to environmental sustainability but also ensures that workers benefit from fair and secure employment. This dual focus on environmental impact and labor standards ensures that green jobs contribute to both ecological preservation and improved social welfare

Table 2. Operational Definitions of the Variable

Variables	Definitions
Dependent Variables	
Green Jobs	0 = non-green worker* 1 = green worker
Income	numerical variable
Independent Variables	
Population Generation	0 = Boomer (born in 1946-1964) * 1 = Gen X (born in 1965-1980) 2 = Gen Y (born in 1981-1996) 3 = Gen Z (born in 1997-2012)
Gender	0 = female* 1= male
Residential Area	0 = rural* 1 = urban
Education	0 = graduated from elementary school and not attending school * 1 = graduate from junior high school 2 = graduated from senior high school 3 = graduated from university
Work Experience	0 = has no work experience* 1 = has work experience
Disabilities	0 = not experiencing disability* 1 = experiencing disability
Residential Island	0 = province in the eastern region of Indonesia* 1 = province on Java Island 2 = province on Sumatra Island 3 = province on Kalimantan Island 4 = province on Bali Island 5 = province on Sulawesi Island
Ln_Provincial Minimum Wage	Numerical variable
Ln_Environmental expenditure (t-1)	Numerical variable
Ln_Economic Growth	Numerical variable
Environmental Quality Index	Numerical variable

* Reference category

Furthermore, the second aim of this study is to estimate how welfare (as measured by income) differs between green workers and non-green workers. Estimates of Heckman's selection-biased correction was used to answer this question. In practice individuals might select themselves into their preferred work-status category, suggesting a potential sample-selection bias in the OLS estimator. Heckman's two-step model accounts for this potential bias by first estimating the probability of an individual working in a green job and then correcting for the selection in the income regression. This approach ensures that the estimated differences in income between green and non-green workers are not biased by unobserved factors that might influence both the choice of employment and income levels. The basic equation for the second objective is as follow:

$$\text{Income}_{ir} = \gamma_0 + \gamma_1 \text{Greenjob}_{ir} + \delta X_{ir} + \varepsilon_{ir} \quad (2)$$

where Income shows the worker's income level. Meanwhile, the vector X includes a range of control variables such as education level, work experience, age, and gender, which are essential to isolate the impact of green employment on income. These controls are particularly important because factors like education and experience are known to have a substantial effect on income levels and may differ systematically between green and non-green workers.

The main data used are primary data from the National Labor Force Survey (SAKERNAS) collected by the Central Statistics Agency (BPS) in 2016. Unfortunately, SAKERNAS's most recent dataset does not provide detailed employment information that is needed to identify green jobs. This study utilized the 2016 National Labor Force Survey (SAKERNAS) as the primary data source because it provides accurate and comprehensive microdata on Indonesian labor market, offering valuable insights into green jobs in Indonesia. This dataset's advantage lies in its ability to classify jobs using the two-digit of International Standard Industrial Classification (ISIC) or *Klasifikasi Baku Lapangan Usaha Indonesia (KBLI)* code, which serves as a solid foundation for identifying green jobs, while the two-digit classification offers a practical proxy with its ability to provide five-digit codes, which could provide a more detailed and precise categorization of green jobs. Despite this limitation, the 2016 SAKERNAS dataset remains one of the best available data sources for analyzing the determinants of green jobs and their welfare effects in the Indonesian context. Table 3 presents the descriptive statistics of the variables used in this study.

Table 3. Summary Statistics

Variables	Mean	Std. Dev.	Min	Max
Green workers	0.102073	0.302746	0	1
Income	14.0749	0.878459	9.21034	18.51143
Gen X	0.401071	0.490118	0	1
Gen Y	0.325649	0.46862	0	1
Gen Z	0.044201	0.205542	0	1
Male workers	0.596195	0.490662	0	1
Live in a city	0.451998	0.497693	0	1
Junior high school	0.171784	0.377194	0	1
Senior high School	0.256677	0.436802	0	1
University	0.114846	0.318837	0	1
Experience	0.431899	0.495343	0	1
Disabilities	0.00608	0.07774	0	1
Sumatra Island	0.283722	0.450806	0	1
Java Island	0.313777	0.46403	0	1
Bali Island	0.022164	0.147217	0	1
Sulawesi Island	0.131529	0.33798	0	1
Kalimantan Island	0.099927	0.299905	0	1
Ln minimum wage	14.4318	0.200169	13.98315	14.94691
ln environmental expenditure	24.54149	1.276659	22.51292	28.2932
Ln economic growth	5.49979	1.565549	-0.38	9.94
Environmental quality index	64.42314	8.622499	38.69	83.01

5. Results and Discussion

Table 3 presents the results of the logit estimates of green job determinants based on socio-demographic characteristics, regional characteristics and regional macro-economic conditions. As mentioned earlier, this study also estimates the determinants of green jobs separately between groups of male workers and female workers. The results indicate that workers from Generation X (born between 1965-1980) have a marginal effect of 0.0325, while Millennials

(Generation Y) show a higher marginal effect of 0.0473, and Generation Z has a marginal effect of 0.0160. These findings are consistent across both male and female models. They suggest that green jobs are more likely to be distributed among younger, productive-age workers compared to older generations, such as the Baby Boomers (born 1946-1964). This aligns with previous studies that highlight the young generation's heightened awareness of sustainable economic development, partly driven by green job opportunities [24, 28]. Additionally, green jobs often require new skills and technological adaptations, which younger workers, having grown up in the digital age, are more familiar with. This gives them a comparative advantage in accessing and engaging in green technologies and innovations [29].

Table 3 also shows that green jobs in Indonesia tend to be dominated by male workers. Male workers have a greater possibility of being green workers, with a marginal effect of 0.107. The gap between male workers and female workers in the labor market has become a crucial issue. Female workers tend to be tied to certain types of work that are vulnerable and insecure and are more likely to find jobs with low wages, low security and limited social mobility. Because of this existing gap, the opportunity for female workers to work in the green job sector is smaller. This study is in line with the findings of the ILO (2012) [14], which also found that many environmentally friendly jobs (green jobs) are expected to be concentrated in economic areas that have historically had limited representation of women. On the other hand, the study by Nhamo & Mukonza (2020) [30] highlighted opportunities for women in environmental sectors, showing that women have been empowered to take leadership roles in this field. The green economy, with a particular emphasis on the agricultural sector, is highlighted as a significant effort to empower both women and the youth.

Another factor that influences an individual's likelihood of obtaining a green job is their area of residence. Individuals who live in urban areas have a higher probability of obtaining green jobs than individuals who live in villages, with a marginal effect value of 0.0100. The same result is also found in the sample of male workers but is not significant for female workers. The high access to green jobs in urban areas cannot be separated from the infrastructure and needs in urban areas that can potentially create green jobs. In general, urban areas have better infrastructure to support the creation of green jobs, including better transportation systems, electricity and recycling facilities. These findings align with the study by Scholz & Fink (2022) [31]. Cities often function as the hubs of industries related to renewable energy, sustainable infrastructure, and environmental services, all of which offer a greater number of green job opportunities. Furthermore, urban governments frequently prioritize sustainable development, leading to more initiatives aimed at creating environmentally friendly employment opportunities. This emphasis on sustainability and advanced infrastructure makes cities fertile ground for the growth of green jobs.

In Indonesia, the largest potential provider of green jobs is the island of Sumatra, followed by Kalimantan, Java, Sulawesi and Bali. The differences in access to green jobs between islands of residence can basically depend on various aspects. One important aspect is the environmental challenges faced by each residence. The islands of Sumatra and Kalimantan are known for their alarming rate of deforestation, a low environmental quality index and relatively dangerous air quality [32]. Furthermore, green jobs in these regions often emerge in response to the degradation of natural resources. In Sumatra and Kalimantan, reforestation efforts, renewable energy projects, and sustainable land management initiatives are particularly relevant. The demand for these types of jobs grows as these islands work to mitigate environmental damage. In contrast, Java, with its denser urban population, might see more green job opportunities linked to sustainable infrastructure, energy efficiency, and waste management systems. Bali and Sulawesi, known for their reliance on tourism and agriculture, could benefit from the expansion of eco-tourism and sustainable farming practices. The differences in green job opportunities across the islands reflect the distinct environmental and economic priorities of each region, underscoring the importance of region-specific policies to promote sustainable employment.

The next factor that influences the possibility of an individual becoming a worker in the green job sector is education. Our research findings show that junior high school graduates tend to have a higher chance of obtaining a green job. On the other hand, this study finds that in general, the chances of college graduates obtaining green jobs tend to be lower. This finding is basically different from the general view that someone with a higher level of education tends to have better capacity and higher awareness in applying the concept of green work. Some green jobs, such as organic farming, can be undertaken by individuals with less education, so college graduates may be less suited for these types of jobs. This finding is in line with the research by McClure et al. (2017) [33], who also found that the chances of high school graduates or those with lower educational backgrounds to get green jobs were quite slender. However, contrasting results were presented by Consoli et al. (2016) [2] who indicate that, compared to non-green jobs, green jobs tend to exhibit higher levels of standard human capital dimensions, such as formal education, work experience, and on-the-job training.

Health has also a significant effect on an individual's chances of obtaining a green job. Individuals who have health problems tend to have a lower chance of working in the green job sector. These findings provide an indication that the green job sector in Indonesia is still not inclusive for people with disabilities. Only physically and mentally healthy people have wider access to enter the green job sector. Several previous studies explain that the low productivity of individuals with disabilities due to limited physical abilities is one of the causes of low access to the job market, including green jobs [33-36].

Table 3. Logit Regression of Green Job Determinants

Variables	All Models		Males		Females	
	Coefficient	M.E	Coefficient	M.E	Coefficient	M.E
Gen X	0.513***	0.0325	0.543***	0.0574	0.372***	0.00891
	(0.0343)		(0.0373)		(0.0881)	
Gen Y/Millennials	0.688***	0.0473	0.656***	0.0726	0.852***	0.0260
	(0.0357)		(0.0388)		(0.0918)	
Gen Z	0.279***	0.0160	0.229***	0.0214	0.578***	0.0153
	(0.0655)		(0.0714)		(0.165)	
Male Workers	1,444***	0.107				
	(0.0312)					
Live in City	0.136***	0.0100	0.171***	0.0204	-0.0465	-0.00142
	(0.0246)		(0.0268)		(0.0615)	
Junior high school	0.099***	0.00796	0.136***	0.0175	-0.150*	-0.00469
	(0.0320)		(0.0346)		(0.0858)	
Senior High School	0.00281	0.000217	-0.00101	-0.000124	-0.0192	-0.000638
	(0.0292)		(0.0316)		(0.0768)	
University	-0.613***	-0.0368	-0.673***	-0.0647	-0.483***	-0.0130
	(0.0481)		(0.0552)		(0.101)	
Experience	0.142***	0.0105	0.125***	0.0149	0.201***	0.00615
	(0.0238)		(0.0259)		(0.0593)	
Disabilities	-0.685***	-0.0506	-0.681***	-0.0812	-0.758	-0.0232
	(0.204)		(0.218)		(0.585)	
Java Island	0.543***	0.0328	0.452***	0.0461	1,186***	0.0250
	(0.0570)		(0.0616)		(0.163)	
Sumatra island	0.681***	0.0438	0.573***	0.0613	1,408***	0.0336
	(0.0479)		(0.0513)		(0.145)	
Kalimantan island	0.648***	0.0411	0.540***	0.0570	1,373***	0.0322
	(0.0577)		(0.0621)		(0.167)	
Bali Island	0.855***	0.0597	0.650***	0.0716	1,878***	0.0588
	(0.0821)		(0.0937)		(0.188)	
Sulawesi Island	0.517***	0.0308	0.496***	0.0514	0.736***	0.0121
	(0.0518)		(0.0549)		(0.166)	
Ln minimum wage	0.163**	0.0120	0.113	0.0134	0.354**	0.0108
	(0.0657)		(0.0720)		(0.162)	
Ln environmental expenditure	0.0236*	0.00174	0.0212	0.00253	0.0288	0.000880
	(0.0129)		(0.0142)		(0.0314)	
Ln Economic Growth	-0.058***	-0.00428	-0.0607***	-0.00725	-0.0470*	-0.00144
	(0.0093)		(0.0101)		(0.0250)	
Environmental Quality index	0.0056***	0.000414	0.00756***	0.000902	-0.00545	-0.000167
	(0.00202)		(0.00220)		(0.00522)	
Constant	-7,290***		-5.101***		-10.06***	
	(0.966)		(1,054)		(2,462)	
Observations	86,673	86,673	51,674	51,674	34,999	34,999

Note: Standard errors in parentheses: M.E = marginal effect; *** p<0.01, ** p<0.05, * p<0.1.

In addition to individual socio-demographic factors, regional macro-level characteristic influences the possibility of individuals obtaining green jobs. Firstly, there is a positive relationship between the minimum wage and an individual's likelihood of finding a green job. This result means that individuals who live in areas with a high minimum wage will

have a higher chance of obtaining green jobs. Correspondingly, increasing the regional minimum wage will increase the number of green jobs that are feasible from an income perspective; thus, the possibility of individuals becoming green workers will also be greater. Secondly, government spending on environmental functions has a positive effect on the likelihood of individuals obtaining green jobs. This finding is in line with previous research that also found that government investment in environmental aspects will encourage the creation of wider green jobs; thus, it can increase the possibility of individuals becoming green workers [20, 22].

Thirdly, this study finds that high economic growth actually reduces growth in green jobs. This result means that individuals who live in areas with high economic growth tend to have a lower probability of obtaining green jobs. These findings indicate a trade-off between economic growth and the availability of green jobs.

Fourthly, the environmental quality index variable has a positive and significant effect on the possibility of individuals obtaining green jobs. The finding suggests that regions with higher environmental quality index tend to offer more opportunities in green sectors, such as in the economic sectors related to renewable energy and sustainable agriculture. Improved environmental conditions may attract investments in green industries, thereby increasing job availability especially in green job activities. These findings underscore the importance of policies aimed at enhancing environmental quality as a key strategy for promoting green job creation, which benefits both environmental sustainability and the labor market.

Furthermore, this study estimates the determinants of green jobs based on the employment sector. The estimation results in Table 4 generally show the same pattern as the overall model in Table 3. In all sectors, except mining and construction, green jobs are dominated by prime age workers. Male workers have a greater likelihood of being employed in green jobs across most sectors, reflecting a persistent gender disparity in the labor market. Research conducted by UNEP supports this observation, showing that male workers dominate key sectors such as renewable energy, construction, and sustainable transportation [26, 37]. Similarly, García et al. (2019) [38] found that green job activities are overwhelmingly male-dominated, particularly in industries that require technical skills and physical labor. Further studies by Smith & Verde (2018) [39] revealed that addressing these gender disparities is essential for achieving a truly inclusive green economy, as diverse workforces tend to be more innovative and resilient.

Except in transportation and tourism, individuals who live in urban areas have a higher probability of obtaining green jobs than individuals who live in villages. Individuals who live in areas with a high minimum wage will have a higher chance of obtaining green jobs, particularly in agriculture, construction, and transportation sectors. Trade-off between economic growth and the availability of green jobs is found in agriculture, transportation, and tourism sectors.

These findings suggest that green job opportunities are shaped by both demographic and geographic factors, with significant implications for labor market policy. The concentration of green jobs among prime-age workers and males, especially in physically demanding sectors, points to potential barriers for women and older workers. This finding highlights the need for more inclusive green job strategies, especially for women and older workers. The urban-rural divide in green job accessibility underscores the importance of improving green infrastructure and investments in rural areas to ensure a more equitable distribution of job opportunities as in the urban area. Additionally, the positive correlation between higher minimum wages and green job availability in specific sectors suggests that wage policies can play a crucial role in promoting greener industries. However, the observed trade-offs between economic growth and green job availability in agriculture, transportation, and tourism sectors indicate that while these industries may benefit from economic expansion, they face challenges in adopting green practices without undermining job creation. These findings implicate the need for balanced policies that foster both economic growth and environmental sustainability.

The Heckman selection bias model results, supported by the OLS estimates, provide solid evidence that workers in green jobs tend to earn higher incomes compared to those doing non-green jobs. A study by Jackman & Moore (2021) [40] supported the findings of this research. They point out that green jobs not only contribute to environmental sustainability but also offer economic benefits in the form of higher wages. The income associated with green jobs could be attributed to several factors, including the demand for specialized skills, technological innovation, and government incentives that support sustainable industries. These jobs may require workers with specific qualifications or expertise in areas like renewable energy, waste management, and sustainable agriculture, which can justify a higher level of income. Furthermore, green job activities often benefit from governmental policies and subsidies aimed at promoting environmental goals, further elevating wage levels.

This income differential is consistent with prior studies, such as Jackman & Moore (2021) [40], which found that environmentally friendly jobs offer better financial compensation. As industries strive to adapt to uncompromising environmental regulations and increase in consumer demand for sustainable products, the skills required in green jobs are likely to become more valuable. This phenomenon leads to further wage growth in green job activities. Therefore, in the broader perspective, the higher incomes observed among green workers highlight the dual benefits of green jobs in enhancing economic welfare while advancing environmental sustainability.

Table 4. Determinants of Green Jobs by Sector

Variables	Agriculture	Forestry	Fishing	Mining	Industry	Construction	Transportation	Tourism
	Coefficient							
Gen X	0.536***	1,100**	0.437***	-0.438	0.447***	0.0418	0.305**	0.0866
	(-0.0558)	(-0.512)	(-0.155)	(-0.338)	(-0.0955)	(-0.089)	(-0.132)	(-0.174)
Gen Y/Millennials	0.792***	1,156**	0.685***	-0.19	0.631***	-0.0162	0.497***	0.472***
	(-0.0604)	(-0.526)	(-0.16)	(-0.336)	(-0.0972)	(-0.0937)	(-0.136)	(-0.173)
Gen Z	0.105	0.601	0.672**	-0.868	0.324**	0.0276	0.540*	0.435*
	(-0.126)	(-0.9)	(-0.265)	(-0.736)	(-0.154)	(-0.178)	(-0.276)	(-0.256)
Male workers	0.826***	-0.392	1,348***	-0.0158	1,386***	-0.317	0.442*	0.932***
	(-0.05)	(-0.401)	(-0.258)	(-0.309)	(-0.0657)	(-0.214)	(-0.245)	(-0.107)
Live in a city	0.455***	0.635*	1,029***	0.369*	-0.329***	0.169***	-0.118	-0.171
	(-0.0513)	(-0.334)	(-0.109)	(-0.199)	(-0.0603)	(-0.0629)	(-0.0866)	(-0.122)
Junior high school	0.0960*	0.351	0.608***	1,398***	0.0363	0.0527	0.266**	0.629***
	(-0.0566)	(-0.39)	(-0.135)	(-0.428)	(-0.0795)	(-0.0768)	(-0.111)	(-0.196)
Senior high school	0.318***	1,465***	0.288*	3,221***	0.101	0.498***	0.343***	1,608***
	(-0.057)	(-0.368)	(-0.157)	(-0.358)	(-0.0713)	(-0.0761)	(-0.1)	(-0.165)
University	0.845***	2,683***	-0.266	2,772***	0.16	1,806***	0.760***	2,913***
	(-0.134)	(-0.802)	(-0.497)	(-0.425)	(-0.139)	(-0.187)	(-0.197)	(-0.193)
Experience	0.328***	0.0184	0.137	-0.416**	-0.0385	0.0353	-0.106	-0.183*
	(-0.0433)	(-0.317)	(-0.113)	(-0.191)	(-0.0584)	(-0.0623)	(-0.0838)	(-0.108)
Disabilities	-0.892***		-0.622		-0.755	0.215	0.261	-0.558
	(-0.345)		(-0.795)		(-0.541)	(-0.573)	(-0.6)	(-1,085)
Java Island	1,544***	0.353	1,122***	1,093**	0.171	-0.729***	0.376**	-0.542**
	(-0.138)	(-0.709)	(-0.253)	(-0.44)	(-0.154)	(-0.137)	(-0.178)	(-0.263)
Sumatra Island	2,178***	0.0767	0.839***	-0.011	0.187	-0.295**	0.12	-1,192***
	(-0.121)	(-0.536)	(-0.19)	(-0.337)	(-0.144)	(-0.122)	(-0.146)	(-0.241)
Kalimantan Island	2,214***	0.7	0.0755	-0.343	0.898***	-0.0344	0.0623	-1,257***
	(-0.131)	(-0.544)	(-0.236)	(-0.39)	(-0.174)	(-0.147)	(-0.201)	(-0.3)
Bali Island	0.812***		0.297	2,925***	0.183	-1,323***	0.14	1,174***
	(-0.28)		(-0.55)	(-1,074)	(-0.203)	(-0.211)	(-0.35)	(-0.263)
Sulawesi Island	1,401***	-0.227	0.562***	0.456	-0.182	-0.408***	0.391**	-0.174
	(-0.131)	(-0.722)	(-0.186)	(-0.349)	(-0.162)	(-0.131)	(-0.159)	(-0.262)
Ln minimum wage	0.945***	-0.135	-0.372	-1,549***	0.233	1,011***	-0.427*	0.449
	(-0.157)	(-0.952)	(-0.345)	(-0.537)	(-0.148)	(-0.171)	(-0.226)	(-0.279)
Ln environmental expenditure	0.0353	0.0979	0.0924	-0.05	0.106***	0.0581*	-0.00922	-0.0311
	(-0.0226)	(-0.198)	(-0.06)	(-0.11)	(-0.0326)	(-0.0352)	(-0.0451)	(-0.0626)
Ln economic growth	-0.0905***	-0.138	-0.0332	0.0462	0.0409	0.00425	-0.0740**	-0.0956*
	(-0.0173)	(-0.0952)	(-0.0418)	(-0.0601)	(-0.0311)	(-0.0279)	(-0.0348)	(-0.049)
Environmental quality index	-0.00646	-0.0445*	0.0175*	-0.0163	0.0187***	0.0269***	0.0107	-0.00336
	(-0.00404)	(-0.0254)	(-0.00947)	(-0.0148)	(-0.00588)	(-0.00546)	(-0.00699)	(-0.00968)
Constant	-18.98***	0.0607	-1.879	20.32***	-10.08***	-17.53***	4.009	-7.927*
	(-2.378)	(-13.76)	(-4.839)	(-7.579)	(-2.349)	(-2.543)	(-3.297)	(-4.151)
Observations	30,846	550	2,206	1,497	8,362	4,887	3,140	3,839

Standard errors are in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

A gender-specific analysis of green workers reveals an interesting finding. Female green workers tend to earn higher incomes than their male counterparts. These findings challenge traditional wage patterns often observed in non-green sectors, where male workers usually earn more than female workers. One plausible explanation for this income disparity

could be that women in green jobs occupy more specialized or managerial roles that command higher pay, particularly in sectors that prioritize environmental sustainability and innovation. Additionally, companies may be prioritizing gender equity in sustainable industries, aligning with broader social trends toward diversity and inclusion in the workforce, especially in green job activities.

Furthermore, the estimation based on sectoral economic activities reveals that agriculture workers have the highest income levels. This trend is particularly notable because the agricultural sector, which is traditionally associated with lower wages, demonstrates a shift when focusing on green or sustainable practices. The higher wages for green workers in agriculture can be attributed to formal employment structures in this sector. As noted by Bolarinwa & Simatele (2023) [41], formal workers in agriculture who are likely involved in environmentally sustainable practices receive significantly higher wages than informal workers in this sector. This finding reflects a broader scope where formalization in traditionally informal sectors, combined with a focus on sustainability, not only strengthens job security but also leads to better financial compensation due to their higher level of wages. These findings stress the importance of promoting formal, sustainable employment in agriculture as a means of improving both environmental outcomes and workers' livelihoods, further supporting the case for policy initiatives that foster green job creation in the agricultural sector.

Table 5. Effect of Green Job Status on Individual Income

Dependent Variable	OLS	Heckman	Observations
Green Workers	0.164***	0.170***	50,988
	(0.00985)	(0.00987)	
Male Green Workers	0.152***	0.159***	32,650
	(0.0101)	(0.0101)	
Female Green Workers	0.195***	0.201***	18,338
	(0.0260)	(0.0260)	
Green Workers in Agriculture	0.340***	0.363***	8,764
	(0.0190)	(0.0190)	
Green Workers in Forestry	0.327***	0.260**	352
	(0.119)	(0.123)	
Green Workers in Fisheries	0.151***	0.139***	1,486
	(0.0411)	(0.0411)	
Green Workers in Mining and Energy	-0.0786	-0.131**	1,307
	(0.0647)	(0.0636)	
Green Workers in Manufacturing	0.135***	0.142***	6,201
	(0.0212)	(0.0212)	
Green Workers in Construction	0.110***	0.114***	4,328
	(0.0179)	(0.0178)	
Green Workers in Transportation	0.232***	0.230***	2,958
	(0.0273)	(0.0849)	
Green Workers in Tourism	-0.0493	-0.0449	2,064
	(0.0393)	(0.0392)	

Standard Error in parentheses: *** p<0.01, ** p<0.05, * p<0.1; Note: All of the regression analyses used control variables including generation, sex, residential area classification, education, working experience, disability, and island of residence.

6. Conclusion

This study analyzed the dynamics of green jobs in Indonesia, particularly their determinants and impact on income. The results show that characteristically, green jobs in Indonesia are dominated by young and prime-age male workers, those with low education and little work experience, and without physical or mental health problems. These results show that access to green jobs is generally unequal and not inclusive, especially for women workers or workers with disabilities. This study also found that in Indonesia, individuals have a higher chance of becoming green workers in areas with high levels of environmental damage. In addition, from a macro perspective, an increase in the minimum wage, effective environmental spending, and improved environmental quality can be a driving force for the growth of the green job sector. Within the context of workers' welfare, compared with groups of workers who have good social safety nets, green workers have higher income levels.

The findings of this study indicate the necessity to impose several policy measures to increase green job opportunities in Indonesia. First, targeted training programs should improve access for marginalized groups, such as women and individuals with disabilities. The government should also establish a robust minimum wage policy and promote

environmental spending. Local governments can incentivize eco-friendly businesses through tax holidays, invest in renewable energy projects, and implement education and training programs focused on green technologies to promote green jobs in more sustainable areas. Lastly, improving environmental quality and creating social safety nets for green workers will further support their financial stability and welfare.

7. Declarations

7.1. Author Contributions

Conceptualization, D.S.P., D.N.C.N., and A.C.F.; methodology, M.S.A. and C.N.; software, D.A.N.A.; validation, L.F.P. and K.A.; formal analysis, D.S.P. and M.S.A.; investigation, D.N.C.N. and A.C.F.; resources, D.S.P.; data curation, D.A.N.A. and L.F.P.; writing—original draft preparation, C.N., M.S.A., and D.A.N.A.; writing—review and editing, D.S.P., L.F.P., and K.A.; visualization, D.A.N.A.; supervision, D.S.P.; project administration, K.A.; funding acquisition, D.S.P. All authors have read and agreed to the published version of the manuscript.

7.2. Data Availability Statement

The main data used are primary data of National Labor Force Survey (SAKERNAS) collected and published by the Central Statistics Agency (BPS).

7.3. Funding

This study was funded in part by LPPM Universitas Brawijaya through Hibah Penelitian Strategis Inisiasi menuju CoE Tahun Anggaran 2023 (No: 989.7/UNI0.C20/2023).

7.4. Institutional Review Board Statement

Not applicable.

7.5. Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

7.6. Declaration of Competing Interest

The authors declare that there is no conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

8. References

[1] ILO. (2018). World Employment and Social Outlook: Greening with Jobs. International Labour Organization, Geneva, Switzerland.

[2] Consoli, D., Marin, G., Marzucchi, A., & Vona, F. (2016). Do green jobs differ from non-green jobs in terms of skills and human capital? Research Policy, 45(5), 1046–1060. doi:10.1016/j.respol.2016.02.007.

[3] Schanes, K., Giljum, S., & Hertwich, E. (2016). Low carbon lifestyles: A framework to structure consumption strategies and options to reduce carbon footprints. Journal of Cleaner Production, 139, 1033-1043. doi:10.1016/j.jclepro.2016.08.154.

[4] Maczulskij, T. (2024). How are green jobs created? A decomposition analysis. Economics Letters, 244. doi:10.1016/j.econlet.2024.111950.

[5] ILO. (2019). Skills for a Greener Future: A Global View. International Labor Organization, Geneva, Switzerland.

[6] Lehr, U., Lutz, C., & Edler, D. (2012). Green jobs? Economic impacts of renewable energy in Germany. Energy Policy, 47, 358–364. doi:10.1016/j.enpol.2012.04.076.

[7] Mansour, M. S., Hassan, K. H., & Bagheri, P. (2017). Shari'ah Perspective on Green Jobs and Environmental Ethics. Ethics, Policy and Environment, 20(1), 59–77. doi:10.1080/21550085.2017.1291829.

[8] Bowen, A., & Kuralbayeva, K. (2015). Looking for green jobs: the impact of green growth on employment. Grantham Research Institute Working Policy Report. London: London School of Economics and Political Science, 1-28.

[9] OECD. (2014). Towards Green Growth in Southeast Asia, OECD Green Growth Studies, OECD Publishing, Paris, France. doi:10.1787/9789264224100-en.

[10] Adams, S., & Acheampong, A. O. (2019). Reducing carbon emissions: The role of renewable energy and democracy. Journal of Cleaner Production, 240, 118245. doi:10.1016/j.jclepro.2019.118245.

[11] ILO. (2013). Green jobs mapping study in Indonesia: An overview based on existing research. International Labor Organization, Geneva, Switzerland.

[12] OECD. (2021). Career Guidance for Adults in a Changing World of Work, Getting Skills Right. OECD Publishing, Paris, France. doi:10.1787/9a94bfad-en.

[13] ILO. (2013). Sustainable development, decent work, and green jobs: Report V. International Labor Organization, Geneva, Switzerland.

[14] OECD. (2023). Job Creation and Local Economic Development 2023: Bridging the Great Green Divide. OECD Publishing, Paris, France. doi:10.1787/21db61c1-en.

[15] OECD. (2014). Greener Skills and Jobs, OECD Green Growth Studies, OECD Publishing, Paris, France. doi:10.1787/9789264208704-en.

[16] Jacob, K., Quitzow, R., & Baer, H. (2015). Green Jobs: Impacts of a Green Economy on Employment; Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH: Eschborn, Germany.

[17] Hallegatte, S., Fay, M., & Barbier, E. B. (2018). Poverty and climate change: Introduction. Environment and Development Economics, 23(3), 217-233. doi:10.1017/S1355770X18000141.

[18] Schmalensee, R. (2012). Evaluating policies to increase electricity generation from renewable energy. Review of Environmental Economics and Policy, 6(1), 45–64. doi:10.1093/reep/rer020.

[19] Bowen, A., & Hancké, B. (2019). The Social Dimensions of" Greening the Economy. European Commission, Brussels, Belgium.

[20] Lee, T. (2017). The effect of clean energy regulations and incentives on green jobs: panel analysis of the United States, 1998–2007. Natural Resources Forum, 41(3), 145–155. doi:10.1111/1477-8947.12125.

[21] Lee, T., & van der Heijden, J. (2019). Does the knowledge economy advance the green economy? An evaluation of green jobs in the 100 largest metropolitan regions in the United States. Energy and Environment, 30(1), 141–155. doi:10.1177/0958305X18787300.

[22] Lim, T., Guzman, T. S., & Bowen, W. M. (2020). Rhetoric and Reality: Jobs and the Energy Provisions of the American Recovery and Reinvestment Act. Energy Policy, 137, 111182. doi:10.1016/j.enpol.2019.111182.

[23] Cecere, G., & Mazzanti, M. (2017). Green jobs and eco-innovations in European SMEs. Resource and Energy Economics, 49, 86–98. doi:10.1016/j.reseneeco.2017.03.003.

[24] Sulich, A., Rutkowska, M., & Popławski. (2020). Green jobs, definitional issues, and the employment of young people: An analysis of three European Union countries. Journal of Environmental Management, 262, 110314. doi:10.1016/j.jenvman.2020.110314.

[25] Rutkowska-Podołowska, M., Sulich, A., & Szczygieł, N. (2016). Green jobs. Proceedings of the 3rd international conference on European integration: VŠB-Technical University of Ostrava, Ostrava, Czech Republic.

[26] UNEP. (2008). Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World. United Nations Environmental Program (UNEP), Washington, D.C., United States.

[27] Maclean, R., Jagannathan, S., & Panth, B. (2018). Education and Skills for Inclusive Growth, Green Jobs and the Greening of Economies in Asia: Case Study Summaries of India, Indonesia, Sri Lanka and Viet Nam. Technical and Vocational Education and Training: Springer Nature, Singapore. doi:10.1007/978-981-10-6559-0_1.

[28] Krajnc, D., Kovačič, D., Žunec, E., Brglez, K., & Kovačič Lukman, R. (2022). Youth Awareness and Attitudes towards a Circular Economy to Achieve the Green Deal Goals. Sustainability (Switzerland), 14(19), 12050. doi:10.3390/su141912050.

[29] Guerreschi, A., Piras, L., & Heck, F. (2023). Barriers to Efficient Knowledge Transfer for a Holistic Circular Economy: Insights towards Green Job Developments and Training for Young Professionals. Youth, 3(2), 553–578. doi:10.3390/youth3020038.

[30] Nhamo, G., & Mukonza, C. (2020). Opportunities for women in the green economy and environmental sectors. Sustainable Development, 28(4), 823–832. doi:10.1002/sd.2033.

[31] Scholz, W., & Fink, M. (2022). Green Jobs in Cities: Challenges and Opportunities in African and Asian Intermediary Cities. Discussion Paper (IDOS), 7, 1–66. doi:10.23661/dp7.2022.

[32] Global Forest Watch (2022). Forest Monitoring Designed for Action. Global Forest Watch (GFW), Washington, D.C., United States.

[33] McClure, L. A., LeBlanc, W. G., Fernandez, C. A., Fleming, L. E., Lee, D. J., Moore, K. J., & Caban-Martinez, A. J. (2017). Green collar workers: An emerging workforce in the environmental sector. Journal of Occupational and Environmental Medicine, 59(5), 440–445. doi:10.1097/JOM.0000000000000986.

[34] Pagan-Rodriguez, R. (2009). An empirical analysis on the incidence of part-time work among women with disabilities. Disability and Rehabilitation, 31(2), 73–83. doi:10.1080/09638280701774076.

[35] Birau, F. R., Dănăcică, D. E., & Spulbar, C. M. (2019). Social exclusion and labor market integration of people with disabilities. A case study for Romania. Sustainability (Switzerland), 11(18), 5014. doi:10.3390/su11185014.

[36] Lay-Raby, N., de la Fuente-Mella, H., & Lameles-Corvalán, O. (2021). Multinomial logistic regression to estimate and predict the job opportunities for people with disabilities in Chile. Information (Switzerland), 12(9), 356. doi:10.3390/info12090356.

[37] Mahajan, R., & Bandyopadhyay, K. R. (2021). Women entrepreneurship and sustainable development: select case studies from the sustainable energy sector. Journal of Enterprising Communities: People and Places in the Global Economy, 15(1), 42-75. doi:10.1108/JEC-11-2020-0184.

[38] Chabán-García, O., & Hidalgo-Capitán, A. L. (2023). Green economy and green jobs: A multisectoral analysis by means of Andalusia´s social accounting matrix. Revista de Estudios Regionales, 126(2), 122–148.

[39] Smith, A., & Verde, M. Gender equity in the green economy: Reducing barriers for women in green jobs. Journal of Sustainable Development, 11(4), 56–72. doi:10.5539/jsd.v11n4p56.

[40] Jackman, M., & Moore, W. (2021). Does it pay to be green? An exploratory analysis of wage differentials between green and non-green industries. Journal of Economics and Development, 23(3), 284–298. doi:10.1108/JED-08-2020-0099.

[41] Bolarinwa, S. T., & Simatele, M. (2024). Informality and the climate change-poverty nexus: empirical evidence from African countries. Journal of Environmental Economics and Policy, 13(1), 1–16. doi:10.1080/21606544.2023.2195684.