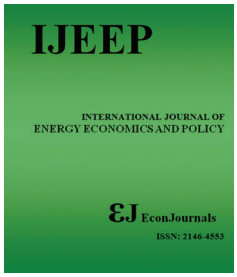

International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2024, 14(2), 632-641.

The Role of Economic Policies to Adopt Renewable Energy and Digital Technology on Business Decisions and HR Management in the Indonesian Mining Sector

Nalom Siagian

HKBP Nommensen University, Medan, Indonesia. *Email: nalom.siagian@uhn.ac.id

Received: 10 October 2023 **Accepted:** 02 February 2024 **DOI:** https://doi.org/10.32479/ijeep.15425

ABSTRACT

The problem formulation that arises from this research is how the direct and indirect effects of renewable energy adoption variables and digital technology adoption on business decisions of mining companies in Indonesia with HR management variables as intervening variables. The subjects of this research are leaders in mining companies in Indonesia totaling 390 business units, where the variables in this study are independent variables, namely the adoption of renewable energy and the adoption of digital technology, while the dependent variable is the business decisions of mining companies in Indonesia, and the intervening variable is the HR management variable, where data analysis uses path analysis using Amos 22 software. The research method carried out is to use a quantitative descriptive approach by using data analysis with the path analysis method, where the results of data processing with the path analysis method are carried out with the Amos 22 application. From the results of this study, the conclusions that exist, namely partially the variable adoption of renewable energy and the variable adoption of digital technology have a direct effect on the business decisions of mining companies in Indonesia. Renewable energy adoption variables partially also have a direct effect on HR management of mining companies in Indonesia, and HR management variables of mining companies in Indonesia have a direct effect on business decisions of mining companies in Indonesia. Simultaneously, the renewable energy adoption variable and the digital technology adoption variable indirectly affect the business decisions of mining companies in Indonesia through HR management as an intervening variable. With the process of adopting renewable energy and adopting digital technology, it will create changes to the business decision process carried out by the mining industry in Indonesia regarding HR management to become human resources capable of managing these changes, where the Government must carry out economic policies that support these changes, such as providing industrial incentives that are willing to change and adopt renewable energy and digital technology in order to compete and create products that are able to reduce the risk of climate change.

Keywords: Economic Policy of Renewable Energy Adoption, Economic Policy of Digital Technology, Human Resource Management, Business Decision
JEL Classifications: B22, F38, H21, G21, G32, G33

1. INTRODUCTION

Current economic activities are in dire need of good and significant breakthroughs, so a strong push is needed so that the breakthroughs that are carried out can be easily adapted in accordance with what is expected. One of the breakthroughs needed today is economic policy related to the adoption of renewable energy, as well as the adoption of digital technology, where economic policy by adopting renewable energy is carried out to anticipate the exhaustion of fossil energy, and reduce the increasing global warming due to increased carbon emissions (Kumar, 2017). Increased global warming will have an impact on increasing temperatures and changing temperatures which cause the emergence of various natural disasters that can no longer be predicted, such as landslides, flash floods, and environmental damage due to tidal floods that damage the environment and make high economic costs, so that

now in every country requires a fast and precise policy, so that there needs to be a change in the use of energy for factory activities, for motorized vehicle engines, and for other interests that are needed regarding the increase in existing energy sources, where this energy source can be said to be a renewal, where this policy needs to be well finalized so that existing policies can be useful and not harm the community (Parmentola et al., 2022).

Renewable energy policy can be seen from the provision of subsidies, both direct and indirect to renewable energy projects, such as solar panels, wind turbines, and hydroelectric power plants whose motion does not harm the community, so that it is low in carbon substances and can reduce the level of carbonization (Othman et al., 2022). Another policy is the provision of tax incentives for fossil energy conversion projects to renewable energy, where the resulting products are subject to tax incentives, which are intended to make these renewable energy products viable and reduce greater economic costs due to damage from global warming, so that it can be said that in the event of global warming and environmental damage, it will have a greater impact on the economy and make the costs incurred large towards environmental improvement, as well as reorganizing the environment that has been completely damaged (Adel, 2022). There is also a policy of providing tariffs to industries that cultivate renewable energy and sell renewable energy at favorable prices. Then there is also a policy of simplifying the necessary licenses so that later companies or industries are able to process mineral and mining products into renewable energy and can be sold at profitable and profitable prices, and can generate appropriate taxes for the State (Miglani et al., 2019).

There are also policies carried out in adopting the transformation of existing technology to digital technology, where technology that is still manual will make performance ineffective, even tends to be wasteful, to the detriment of an industry, where the adoption of the latest technology is needed, namely the process of adopting digital technology whose source comes from the transfer of technology that is currently developing, where the process of transferring this technology is carried out because the existing work is easy to do through digital access, and easy to use and carry out comprehensively (Esmaeilian et al., 2020). The adoption of digital technology is needed by the community so that later the existing technology can increase the growth and development of existing business activities such as e-commerce, as well as funding applications such as DANA, *online* trading applications, such as Shopee and Tokopedia, where the adoption of digital technology through digital commerce is needed to increase economic transactions, and increase household consumption which will boost economic growth (Park and Humphry, 2019).

(Yunus et al., 2023) The adoption of digital technology has the potential to significantly improve economic development, productivity and innovation. Some of the economic measures that can encourage the adoption of digital technology include improving digital infrastructure through massive investment in high-speed digital infrastructure, such as 5G and high-speed internet networks, to ensure fast and smooth collaboration (Anthony et al., 2019). To facilitate data protection, regulation and data protection are needed, where the Government can create a legal framework that regulates the handling and security of personal data so that consumers can feel safe when trading online, as well as adopt laws that support cybersecurity and protect consumers from the dangers of online trading fraud (Chiappetta Jabbour et al., 2020). In addition, the presence of the start-up industry by easing regulations further grows demand and supply, as well as consumption, where the Government can encourage the growth of start-ups by facilitating access to money, resources, and company incubators, as well as providing financial incentives for spending on research & development of digital technology and startup companies (Shih et al., 2018).

(Sinaga and Sitorus, 2023; Yunus et al., 2023). To create policies regarding the adoption of renewable energy and digital technology, it is necessary to manage human resources that are reliable and in accordance with their fields to be able to manage this, where with the management of human resources in order to use renewable energy properly, such as technical capabilities in handling power plants, as well as mining processing for renewable energy which will have an impact on reducing carbon emissions and preventing global warming (Bai et al., 2020). HR management can also be carried out through economic policies in the process of adopting digital technology, where human resources can be trained and developed to manage digital applications, and use them for positive purposes in the Government's efforts to encourage public consumption and drive the country's economy, so that this economic policy can achieve the goals that the Government will carry out (Jinil Persis et al., 2021).

With the increasing capabilities that can be developed in the process of adopting renewable energy and adopting digital technology, which will have an impact on how to process business decisions that will be carried out in the coming year, by estimating how much profit will be obtained in the coming year, as well as how many units of products will be produced and sold in the coming year (Rossi et al., 2019). With the better business decisions that will be carried out for the coming year, there will be an increasing understanding of human resources in optimizing the use of renewable energy, as well as the use of technology and digital applications to reap profits, and help the Government increase revenue (Clausen and Sörensen, 2022). Mining companies are one of the companies that can add value and profit to the country if managed properly, where mining companies are now concentrating on producing a variety of products to reduce carbon emissions and reduce global warming which is becoming increasingly real (Trencher et al., 2020). Mining companies can incorporate renewable energy into their operations, for example by using solar or wind power to run mining machinery. This can reduce their dependence on fossil fuels and reduce operating costs (Trencher et al, 2020).

Mining companies often have the technological know-how needed to build renewable energy projects and access to large tracts of land. They can build hydro, wind or solar power generation facilities on site and sell the energy to the grid or use it for their own activities (Unruh, 2018). To improve the effectiveness and sustainability of renewable energy technologies, mining companies can invest in

their research and development. Better energy storage techniques or processing technologies for renewable energy sources fall into this category (Leng et al., 2020). The use of renewable energy by mining businesses can help minimize the industry's negative impact on the environment, lower operational costs, and improve the company's reputation for sustainability. In addition, it can help them prepare for adjustments to energy laws and the increasing demand for green energy in the market (Woo et al., 2021). Digital technologies can be used by mining businesses to automate many of their processes. To improve effectiveness, safety and production, this includes the use of automated control systems, autonomous vehicles and mining equipment (Winans et al., 2017).

Artificial intelligence and machine learning can be used by mining businesses to predict equipment breakdowns, improve safety, and optimize production procedures (Barbeau et al., 2019). In addition, it can be applied to better mining planning. To improve research development for mining companies in the process of adopting renewable energy and adopting digital technology, qualified human resource development is needed, and requires something that can make human resources have the ability to use a series of tools for the process of adopting renewable energy and also adopting digital technology, such as running tubins and also using digital applications, where the development of human resource potential has not been maximized properly, thus disrupting business decisions, where management can make business decisions that will tend to harm it (Li et al., 2020). To get an overview and the reasons for the decline in the number of mining companies at this time can be seen in the Table 1.

From the table above, it can be concluded that the decreasing number of mining companies in the period 2018–2022 is due to the fact that there are still many leaders in mining companies who make wrong business decisions due to the application of energy adoption and digital technology adoption, as well as poor HR management in the mining company governance process in implementing the adoption process in both fields has not been properly optimized, so that many mining companies have gone out of business, resulting in decreased productivity of several mining companies.

2. LITERATURE REVIEW

2.1. Renewable Energy Adoption

To mitigate the effects of climate change and ensure the sustainability of energy resources, the application of renewable energy is essential (Li et al., 2022). This Economic Policy can help create a financial climate that encourages the development of the renewable energy industry, reduces dependence on fossil fuels, and lowers greenhouse gas emissions. In addition, the law can encourage the advancement of green technologies and open up new job prospects (Kouhizadeh et al., 2020). Several economic measures can be used to encourage the use of renewable energy, including those listed below:

1. Subsidies and financial incentives are carried out by providing direct financial assistance or tax reductions for renewable energy initiatives, such as those using solar cells, wind turbines, or hydroelectric facilities, Grants and low-interest loans to support the development and use of renewable technologies are also fiscal incentives, as are tax credits or tax exemptions for renewable energy consumers and producers.
2. Creating a renewable energy standard, which can be done by setting requirements for the percentage of renewable energy in a country's energy consumption and enacting laws that require energy providers to purchase and incorporate renewable energy into their portfolios.
3. Determination of favorable tariffs, which requires a purchasing mechanism that ensures that large energy suppliers will pay a fair price for renewable energy generation, as well as a feed-in tariff system that allows renewable energy producers to sell their excess energy to the grid.
4. Simplification of licenses, with faster and simpler regulation of renewable energy projects,
5. Education and training, which develops the renewable energy sector's workforce to provide workers with the skills needed to set up, operate and maintain renewable energy infrastructure.
6. Training and development, where investing in research and development of renewable energy technologies will increase productivity and cut costs (Sigala, 2020).
7. Indicators of renewable energy adoption by mining companies are:
8. Renewable electricity generation by calculating the amount of renewable electricity production capacity owned or operated by the mining corporation. The volume and type of renewable electricity generation, such as that generated by solar cells, wind turbines, or hydroelectric facilities, can be included in this list.
9. Renewable power proportion, where renewable energy consumption is compared to the company's overall energy consumption. This measures how much of the company's energy portfolio is made up of renewable sources.
10. Investment in renewable energy, which is the amount of money invested by mining companies in the creation and development of renewable energy initiatives.
11. Energy efficiency by measuring the improvement in energy efficiency caused by the use of renewable energy technologies in mining operations.
12. The use of energy monitoring technology is done by utilizing the latest energy monitoring and management technology to control energy use and see efficiency opportunities (Maulidia et al., 2019).

Table 1: Number of mining companies in Indonesia 2018–2022

Year	Number of Mining Companies in Indonesia (Business Units)
2018	515
2019	616
2020	518
2021	456
2022	390

Source: bps.go.id, 2022

2.2. Digital Technology Adoption

Digital technology adoption has the potential to significantly increase economic growth, productivity, and innovation (Andoni et al., 2019).

Mining companies can increase operational effectiveness, lower risks, and improve environmental sustainability by implementing digital technologies (Veskioja et al., 2022a). In addition, it enables companies to address issues unique to the mining sector, such as changing regulatory requirements and volatile commodity prices (Lee et al., 2018; Yildizbasi, 2021). Some of the main roles of mining corporations in utilizing digital technology are as follows:

1. Automation and operations automation, where mining companies can use digital technology to automate many of their processes. To improve effectiveness, safety and production, this includes the use of automated control systems, autonomous vehicles and mining equipment.
2. Data monitoring and analysis, where mining activities generate large amounts of data. They can collect, store, and analyze this data using digital technology to spot trends, streamline processes, and draw more informed conclusions.
3. Artificial intelligence and machine learning, where mining businesses can leverage artificial intelligence (AI) and machine learning to detect equipment failures, improve safety, and optimize production processes. In addition, it can be applied to better mining planning.
4. Digital energy management systems, where mining businesses can improve energy use and increase energy efficiency by using digital energy management systems. This may also require the use of sustainable energy sources in mining operations.
5. Partnerships with technology companies, where working with startups and technology companies can accelerate the adoption of digital technology by mining companies. They can collaborate to create unique solutions and seek technical innovations.
6. Supply chain transparency and resource tracking, where *blockchain* technology can be applied to the mining industry to improve supply chain transparency and resource tracking (Bonsu, 2020; Veskioja et al., 2022b; Yildizbasi, 2021).

Indicators of digital technology adoption in mining companies are:

1. Automation of the production process, where how the mining production process is automated, including whether or not autonomous vehicles, mining equipment, and control systems are used.
2. Document and business process digitization, where document and business process digitization refers to the extent to which the organization has replaced manual processes with electronic processes for document management, approvals, and reporting.
3. Utilize digital technologies, such as *blockchain*, to improve supply chain transparency in the mining industry.
4. Utilization of a digital energy management system, where to optimize energy use and save operational costs, a digital energy management system is used.
5. Alignment with digital transformation is the extent to which businesses have changed their corporate culture and strategy to accommodate digital transformation is known as alignment with digital transformation (Barbosa et al. 2019).

2.3. HR Management

The success of any organization depends on effective human resource (HR) management. It consists of a collection of procedures aimed at selecting, training, inspiring, retaining, and managing staff to achieve company goals (Bishoge et al., 2019). The growth, sustainability and success of an organization are all influenced by effective HR management. Moreover, it fosters a healthy work environment and encourages everyone to give their all. Technology can be leveraged to improve several aspects of HR management in the digital age, including performance management, employee training and development, and recruitment and selection (Schröder et al., 2020). Some important elements of HR management include the following:

1. Recruitment and selection by attracting qualified people to fill open jobs in the business is the goal of the recruitment process. The selection stage involves evaluating and selecting candidates based on specific standards appropriate for the open position.
2. Employee development is the teaching, training and development of staff members to enhance their talents, which can benefit both the individual and the company. Plans for career growth may also be included.
3. Performance Evaluation is a regular and impartial review of performance helps employees realize how well they are meeting their goals and serves as a foundation for future growth.
4. Employee well-being, understanding your employees' needs and well-being can help you support them when needed.
5. Career management can assist workers in making career plans and achieving their goals within the company (Newman, 2020).
6. Indicators of HR management in mining companies are as follows:
7. Employee turnover rate by calculating how often employees leave the company. A high turnover rate may indicate issues that need to be resolved regarding HR administration, workplace culture, or environmental factors.
8. Employee retention rate is the ability of a company to retain its personnel for a predetermined period of time measured by its retention rate. A high retention rate indicates that employees are happy and committed to the business.
9. The efficiency of the recruitment process is a measure of how quickly and successfully a company fills open positions. Long-term job openings can be prevented with effective strategies.
10. Evaluate employee performance through the use of performance reviews to measure how well employees contribute to company goals and how well they carry out career planning and development.
11. Employee safety and well-being by conducting an evaluation of employee safety levels and the steps taken to enforce them in a sometimes hazardous work environment (Onu et al., 2023).

2.4. Business Decision

The decision-making process relating to various operational, strategic, and tactical aspects of a company is referred to as business decisions. The success and expansion of an organization can be significantly affected by business decisions (Borowski, 2021). A deep understanding of the impact on the organization, careful analysis, and reliable and relevant information are the cornerstones of making good business decisions. Making the right choices can help a company achieve its goals and maintain its

competitiveness. An organization's productivity, reputation, and long-term profitability can be negatively impacted due to poor judgment (Situmeang et al., 2022). The following list includes some common business decisions made by organizations:

1. Strategic choices, which affect the long-term direction of the business and consider factors including product diversification, market expansion and significant financial investment. The company's mission and vision are influenced by this choice.
2. Tactical choices, which are more related to the implementation of strategies, such as pricing, supply chain management, and inventory management.
3. Operational decisions are choices that affect the way a business operates on a day-to-day basis. Examples include setting production schedules, allocating resources, and managing personnel.
4. Financial decisions include the choice of funding sources, cash flow management, investments, and financing. This includes deciding on funding strategies, creating budgets, and managing financial risks.
5. Decisions on agreements and partnerships include corporate mergers, acquisitions, and joint ventures with other organizations.
6. Crisis decisions, where decisions that must be taken in the event of an emergency or crisis that can jeopardize business continuity, are called crisis decisions (Bonilla et al., 2018).
7. Indicators of business decisions are as follows:
8. ROI (Return on Investment) compares the profit earned with the investment made to determine the profitability of a business choice. ROI can be used to evaluate effectiveness and return on investment.
9. Sales growth rate by tracking sales growth after the implementation of marketing decisions, pricing, or new products.
10. Customer satisfaction levels are determined when decisions are made regarding product quality, customer service levels, or the overall customer experience.
11. Operational efficiency by measuring the extent to which company decisions maximize the use of resources and operational processes to determine operational efficiency.
12. Financial sustainability by ensuring long-term financial considerations and corporate sustainability are taken into account when making business decisions (Ajwang and Nambiro, 2022).

2.5. Hypothesis

1. Renewable energy adoption has a direct effect on business decisions in the mining industry in Indonesia.
2. Digital technology adoption has a direct effect on business decisions in the mining industry in Indonesia.
3. Renewable energy adoption has a direct effect on human resource management in the mining industry in Indonesia.
4. Digital technology adoption has a direct effect on HR management in the mining industry in Indonesia.
5. HR management in the mining industry in Indonesia has a direct effect on business decisions in the mining industry in Indonesia.
6. Renewable energy adoption has an indirect effect on business decisions in the mining industry in Indonesia through HR management in the mining industry in Indonesia as an intervening variable.
7. Digital technology adoption has an indirect effect on business decisions in the mining industry in Indonesia through HR management in the mining industry.

3. RESEARCH METHODS

The research method used is to use a quantitative descriptive method using path analysis, where the results of data processing with the SEM method are carried out with the Amos 22 application (Bag et al., 2021) quantitative descriptive method with path analysis is a research strategy used to describe and examine how different research variables relate to each other in order to better understand and explain certain events. The population in this study were 390 mining companies in Indonesia in 2022, where the sampling method was carried out using the census method, where according to (Bag et al., 2021) the sampling method using the census method the sample taken is part of the existing population, so that the number of samples available is 390 mining companies in Indonesia. The data analysis carried out in this study is by conducting path analysis testing.

4. RESEARCH RESULTS

4.1. Results

4.1.1. Descriptive testing

4.1.1.1. Renewable energy adoption policy variables

The Table 2 for the renewable energy adoption variable question items most answered by respondents for question 1 was agreed as many as 171 respondents (43.85%), for question 2 the most respondents answered agreed as many as 172 respondents (44.10%), for question 3 many respondents answered agreed as many as 174 respondents (44.61%), and for question 4 respondents who answered agreed as many as 175 respondents (44.87%) and for respondent 5 the most respondents answered agreed as many as 176 respondents (47.13%).

4.1.1.2. Digital technology adoption variable

The Table 3 for the question items of the digital technology adoption variable that most respondents answered for question 1 was agreed as many as 172 respondents (44.10%), for question 2 the most respondents answered agreed as many as 174 respondents (44.61%), for question 3 many respondents answered agreed as many as 175 respondents (44.87%), and for question 4 respondents who answered agreed as many as 176 respondents (47.13%) and for respondent 5 the most respondents answered agreed as many as 171 respondents (43.85%).

4.1.1.3. HR management variables

The Table 4 for the question items of the HR management adoption variable that most respondents answered for question 1 was agreed as many as 171 respondents (43.85%), for question 2 the most respondents answered agreed as many as 175 respondents (44.87%), for question 3 many respondents answered agreed as many as 176 respondents (47.13%), and for question 4 respondents who answered agreed as many as 172 respondents (44.10%) and

Table 2: Descriptive analysis of renewable energy adoption variables

Question	Respondent Answer Score									
	SS (5)		S (4)		N (3)		TS (2)		STS (1)	
	F	%	F	%	F	%	F	%	F	%
Q1	140	35.90	171	43.85	55	14.10	24	6.15	-	-
Q2	144	36.92	172	44.10	57	14.61	17	4.36	-	-
Q3	142	36.41	174	44.61	56	14.35	18	4.61	-	-
Q4	143	35.75	175	44.87	54	13.84	18	4.61	-	-
Q5	145	37.18	176	47.13	58	14.87	11	2.82	-	-

Source: Processed with Primary Data, 2023

Table 3: Descriptive analysis of digital technology adoption variables

Question	Respondent Answer Score									
	SS (5)		S (4)		N (3)		TS (2)		STS (1)	
	F	%	F	%	F	%	F	%	F	%
Q1	144	36.92	172	44.10	57	14.61	17	4.36	-	-
Q2	142	36.41	174	44.61	56	14.35	18	4.61	-	-
Q3	143	35.75	175	44.87	54	13.84	18	4.61	-	-
Q4	145	37.18	176	47.13	58	14.87	11	2.82	-	-
Q5	147	37.69	171	43.85	53	13.59	19	4.87	-	-

Source: Processed with Primary Data, 2023

Table 4: Descriptive analysis of HR management variables

Question	Respondent Answer Score									
	SS (5)		S (4)		N (3)		TS (2)		STS (1)	
	F	%	F	%	F	%	F	%	F	%
Q1	147	37.69	171	43.85	53	13.59	19	4.87	-	-
Q2	143	35.75	175	44.87	54	13.84	18	4.61	-	-
Q3	145	37.18	176	47.13	58	14.87	11	2.82	-	-
Q4	144	36.92	172	44.10	57	14.61	17	4.36	-	-
Q5	143	35.75	175	44.87	54	13.84	18	4.61	-	-

Source: Processed with Primary Data, 2023

for respondent 5 the most respondents answered agreed as many as 175 respondents (44.87%).

4.1.1.4. Business decision variable

The Table 5 for the question items of the business decision variable that most respondents answered for question 1 was agreed as many as 176 respondents (47.13%), for question 2 the most respondents answered agreed as many as 171 respondents (43.85%), for question 3 many respondents answered agreed as many as 177 respondents (45.38%), and for question 4 respondents who answered agreed as many as 176 respondents (47.13%) and for respondent 5 the most respondents answered agreed as many as 174 respondents (44.61%).

4.1.2. Barley analysis

In reality, correlation analysis is a statistical method for determining how closely two or more variables are statistically related. Path analysis, on the other hand, is a more complex statistical technique that allows you to find cause-and-effect relationships between different model variables (Newman, 2020). The results of the correlation analysis are as follows:

According to the Table 6, it can be explained that if the adoption of renewable energy has been implemented properly, it will create good business decisions for mining companies in Indonesia. This can be seen from the estimated value of 0.644 which has a parallel and harmonious influence. The more implemented the adoption of digital technology, it will have an impact on the process of creating good and feasible business decisions for mining companies in Indonesia. This can be seen from the estimated value of 0.657 which has an influence that is in line and aligned. Increasing the adoption of renewable energy will have an impact on the HR management process, where renewable energy will be able to run if it is managed by HR that has good competence, where the estimated value is 0.734, which means that it has an influence that is in line and aligned. increasing the adoption of digital technology will actually reduce HR management, where the HR needed is HR that can apply digital technology in mining companies in Indonesia, where the estimated value is −0.756 which means that this value has an influence that is not in line and in the opposite direction. Good HR management will create good business decisions to continue to run a business in the mining industry well, where this HR management process can produce competent human resources who can become assets to better manage mining companies in Indonesia and can achieve predetermined goals. This is in accordance with the estimated value of 0.770, whose value has an influence that is in line and aligned.

4.1.3. Direct hypothesis testing

(Newman, 2020) states that direct hypothesis testing is A research technique known as "direct hypothesis testing" involves evaluating hypotheses through empirical data collection and statistical

Table 5: Descriptive analysis of business decision variables

Question	Respondent Answer Score									
	SS (5)		S (4)		N (3)		TS (2)		STS (1)	
	F	%	F	%	F	%	F	%	F	%
Q1	145	37.18	176	47.13	58	14.87	11	2.82	-	-
Q2	147	37.69	171	43.85	53	13.59	19	4.87	-	-
Q3	146	37.45	177	45.38	59	15.13	8	2.05	-	-
Q4	145	37.18	176	47.13	58	14.87	11	2.82	-	-
Q5	142	36.41	174	44.61	56	14.35	18	4.61	-	-

Source: Processed with Primary Data, 2023

Table 6: Correlation analysis

Correlation Between Variables	Estimation	Probability
Renewable Energy Adoption is a Business Decision	0.644	0.001
Digital Technology Adoption Business Decision	0.657	0.006
Renewable Energy Adoption HR Management	0.734	0.010
Adoption of Digital Technology HR Management	−0.756	0.111
HR Management Business Decisions	0.770	0.004

Source: Data Processing Results with Amos 22, 2023

analysis to determine whether the hypothesis is true or false. The direct hypothesis testing in this study are:

The Table 7 for the results of direct hypothesis testing shows that:

1. Renewable energy adoption variables have a direct effect on the business decisions of mining companies in Indonesia. This can be seen from the existing estimation value of 0.723 which is greater than the significance level of 0.05.
2. Digital technology adoption variables have a direct effect on the business decisions of mining companies in Indonesia. This can be seen from the existing estimation value of 0.774 which is greater than the significance level of 0.05.
3. The variable adoption of renewable energy has a direct effect on HR management in mining companies in Indonesia. This can be seen from the existing estimation value of 0.740 which is greater than the significance level of 0.05.
4. The variable adoption of digital technology has no direct effect on HR management in mining companies in Indonesia. This can be seen from the existing estimation value of −0.656 which is smaller than the significance level of 0.05.
5. HR management variables have a direct effect on the business decisions of mining companies in Indonesia. This can be seen from the existing estimation value of 0.735 which is greater than the significance level of 0.05.

4.1.4. Indirect hypothesis testing

According to (Newman, 2020) a statistical technique called indirect hypothesis testing, often referred to as "indirect analysis," is used to test the relationship between variables using intermediate or mediator variables. The results of indirect hypothesis testing are as follows:

According to the Table 8, it can be concluded that the variable adoption of renewable energy has an indirect effect on the business decision variables of mining companies in Indonesia through the HR management variable as an intervening variable, where this can be seen from the estimated value of 0.785 which is greater than the significance value of 0.05. For the digital technology adoption variable, it affects the business decisions of mining companies in Indonesia through the HR management variable as an intervening variable, where this can be seen from the estimated value of 0.825 which is greater than the significance value of 0.05.

Table 7: Direct hypothesis test

Influence between Variables	Estimation	Probability	R Square
Renewable Energy Adoption is a Business Decision	0.723	0.001	0.877
Digital Technology Adoption Business Decision	0.774	0.002	
Renewable Energy Adoption HR Management	0.740	0.012	
Adoption of Digital Technology HR Management	−0.656	0.006	
HR Management Business Decisions	0.735	0.000	

Source: Data Processing Results with Amos 22, 2023

Table 8: Indirect hypothesis testing

Influence between variables	Estimation	Probability	R Square
Renewable Energy Adoption Business Decision through HR management	0.785	0.000	0.873
Digital Technology Adoption Business Decisions through HR management	0.825	0.000	

Source: Data Processing Results with Amos 22, 2023

4.1.5. Godness of fit test

A statistical method called the Goodness of Fit test is used to assess how well a statistical model fits the data. The goal is to evaluate the statistical fit of the proposed model to the actual data (Newman, 2020). The results of the goodness of fit can be seen in the following table:

Based on the Table 9, it can be explained that the probability value of the goodness of fit test is 0.642, where this value can be said that the existing construct model shows that the existing model fit index is good, and does not show a probability >0.05.

Table 9: Godness of fit index

Godness of fit index	Cut-off value	Probability
Absolute Fit		
Prob. $\times^2$	Not significant (>0.05)	0.442
Df	0	1
$\times/Df^2$	≤5 <2	0.156
RMSEA	<1 <0.05 <0.01 0.05 ≤X ≤ 0.08	0.000
GFI	≥0.9	0.995
Incremental Fit		
AGFI	≥0.9	0.976
TLI	≥0.9	1.045
NFI	≥0.9	0.995
Parsimonious Fit		
PNFI	0-1.0	0.068
PGFI	0-1.0	0.051

Source: Data Processing Results with Amos 22, 2023

5. DISCUSSION AND CONCLUSION

The results state that the variable of renewable energy adoption has a direct effect on the business decisions of mining businesses in Indonesia. This is in accordance with research (Nandal et al., 2019) (Nandal et al., 2019) states that renewable energy that is adopted and must be carried out by mining companies will change business decisions and business targets by reducing costs consumed to adopt fossil energy into renewable energy.

The results also state that the digital technology adoption variable has a direct effect on the business decisions of mining businesses in Indonesia. This is in accordance with research (Kazancoglu et al., 2021) which states that the process of adopting digital technology in the production and marketing process of mining products will have an impact on changes in business decisions for cost efficiency.

According to the results of the study, the variable adoption of renewable energy has a direct effect on HR management in mining businesses in Indonesia. This is in line with research (Cho et al., 2019) which states that changes in renewable energy adoption can make the HR management process change towards increasing competence to manage and manage renewable energy, so that with increasing competence the company's focus will be on changing fossil energy to renewable energy.

The results also state that the variable of digital technology adoption does not have a direct effect on HR management in mining businesses in Indonesia, where according to (Fernando et al., 2021) (Fernando et al., 2021) technological changes to digital technology will reduce the number of human resources, so companies will add more costs in order to adopt these changes to train human resources who are still conventional to know and want to control the company with digital technology.

The results state that the HR management variable has a direct effect on the business decisions of mining businesses in Indonesia. This is in line with research (Park and Humphry, 2019) which states that HR management carried out by companies must pay attention to the latest internal and external conditions, if current conditions require adoption of digital applications, changes are needed in the process of developing HR capabilities and competencies in order to increase work productivity.

The results of the study describe that the renewable energy adoption variable has an indirect effect on the business decisions of mining businesses in Indonesia through the HR management variable as an intervening variable. This is in line with research (Marinakis et al., 2020) which states that the renewable energy adoption process makes companies have to review business decisions that were originally still run on fossil energy with the HR management planning process in order to be able to manage businesses with the latest systems using renewable energy to increase work productivity.

The results of the study describe that the digital technology adoption variable has an indirect effect on the business decisions of mining businesses in Indonesia through the HR management variable as an intervening variable. This is in line with research (Litvinenko, 2020) which states that the technology adoption process will have an impact on the company's decision to change the mindset of HR to be able to have different competencies than before and be able to utilize this digital technology to increase the productivity of HR work and also the company.

From the results of this study, the conclusions are that partially the renewable energy adoption variable and the digital technology adoption variable have a direct effect on the business decisions of mining companies in Indonesia. Renewable energy adoption variables partially also have a direct effect on HR management of mining companies in Indonesia, and HR management variables of mining companies in Indonesia have a direct effect on the business decisions of mining companies in Indonesia. Simultaneously, the renewable energy adoption variable and the digital technology adoption variable indirectly affect the business decisions of mining companies in Indonesia through HR management as an intervening variable.

REFERENCES

Adel, A. (2022), Future of industry 5.0 in society: Human-centric solutions, challenges and prospective research areas. Journal of Cloud Computing: Advanced, Systems and Applications, 11(1), 40.

Ajwang, S.O., Nambiro, A. (2022), Climate change adaptation and mitigation using information and communication technology. International Journal of Computing Sciences Research, 6, 1046-1063.

Andoni, M., Robu, V., Flynn, D., Abram, S., Geach, D., Jenkins, D., McCallum, P., Peacock, A. (2019), Blockchain technology in the energy sector: A systematic review of challenges and opportunities. Renewable and Sustainable Energy Reviews, 100, 143-174.

Anthony Jnr, B., Petersen, S.A., Ahlers, D., Krogstie, J. (2019), API deployment for big data management towards sustainable energy prosumption in smart cities-a layered architecture perspective. International Journal of Sustainable Energy, 39, 1-27.

Bag, S., Pretorius, J.H.C., Gupta, S., Dwivedi, Y.K. (2021), Role of institutional pressures and resources in the adoption of big data analytics powered artificial intelligence, sustainable manufacturing practices and circular economy capabilities. Journal of Technological Forecasting and Social Change, 163, 1-14.

Bai, C., Dallasega, P., Orzes, G., Sarkis, J. (2020), Industry 4.0

technologies assessment: A sustainability perspective. International Journal of Production Economics, 229, 107776.
Barbeau, K., Boileau, K., Sarr, F., Smith K. (2019), Path analysis in Mplus: A tutorial using a conceptual model of psychological and behavioral antecedents of bulimic symptoms in young adults. Journal of Quantitative Methods for Psychology, 15(1), 38-53.
Barbosa, N., Monteiro, R., Aparecida, E. (2019), Sustainable development goals in mining. Journal of Cleaner Production, 228, 509-520.
Bishoge, O.K., Zhang, L., Mushi, W.G. (2019), The potential renewable energy for sustainable development in Tanzania: A Review. Journal Clean Technologies, 1, 70-88.
Bonilla, S.H., Silva, H.R.O., da Silva, M.T., Gonçalves, R.F., Sacomano, J.B. (2018), Industry 4.0 and sustainability implications: A scenario-based analysis of the impacts and challenges. Sustainability, 10(10), 3740.
Bonsu, N.O. (2020), Towards a circular and low-carbon economy: Insights from the transition to electric vehicles and net zero economy. Journal of Cleaner Production, 256, 120659.
Borowski, P.F. (2021), Innovative processes in managing an enterprise from the energy and food sector in the era of industry 4.0. Processes, 9(2), 381.
Chiappetta Jabbour, C.J., De Camargo Fiorini, P., Wong, C.W.Y., Jugend, D., Lopes De Sousa Jabbour, A.B., Roman Pais Seles, B.M., Paula Pinheiro, M.A., Ribeiro da Silva, H.M. (2020), First-mover firms in the transition towards the sharing economy in metallic natural resource-intensive industries: Implications for the circular economy and emerging industry 4.0 technologies. Journal Resources Policy, 66, 101596.
Cho, Y.H, Shaygan, A., Daim, T.U. (2019), Energy technology adoption: The case of solar photovoltaic in the Pacific Northwest USA. Journal of Sustainable Energy Technologies and Assessments, 34, 187-199.
Clausen, E., Sörensen, A. (2022), Required and desired: Breakthroughs for future-proofing mineral and metal extraction. Journal Mineral Economics, 35, 521-537.
Esmaeilian, B., Sarkis, J., Lewis, K., Behdad, S. (2020), Blockchain for the future of sustainable supply chain management in Industry 4.0. Resources, Conservation and Recycling, 163, 105064.
Fernando, Y., Rozuar, N.H.M., Mergeresa, F. (2021), The blockchain-enabled technology and carbon performance: Insights from early adopters. Journal Technology in Society, 64, 101507.
Jinil Persis, D., Venkatesh, V.G., Sreedharan, V.R., Shi, Y., Sankaranarayanan, B. (2021), Modelling and analysing the impact of circular economy; Internet of things and ethical business practices in the VUCA world: Evidence from the food processing industry. Journal of Cleaner Production, 301, 126871.
Kazancoglu, Y., Sagnak, M., Mangla, S.K., Sezer, M.D., Pala, M.O. (2021), A fuzzy based hybrid decision framework to circularity in dairy supply chains through big data solutions. Journal of Technological Forecasting and Social Change, 170, 120927.
Kouhizadeh, M., Zhu, Q., Sarkis, J. (2020), Blockchain and the circular economy: Potential tensions and critical reflections from practice. Journal Production Planning and Control, 31, 1-17.
Kumar, A. (2017), A review of multi criteria decision making (MCDM) towards sustainable renewable energy development. Journal Renewable and Sustainable Energy Reviews, 69, 596-609.
Lee, M., Yun, J.J., Pyka, A., Won, D., Kodama, F., Schiuma, G., Park, H., Jeon, J., Park, K., Jung, K., Yan, M.R., Lee, S., Zhao, X. (2018), How to respond to the fourth industrial revolution, or the second information technology revolution? Dynamic new combinations between technology, market, and society through open innovation. Journal of Open Innovation: Technology, Market, and Complexity, 4(21), 1-24.
Leng, J., Ruan, G., Jiang, P., Xu, K., Liu, Q., Zhou, X., Liu, C. (2020), Blockchain-empowered sustainable manufacturing and product lifecycle management in industry 4.0: A survey. Journal Renewable and Sustainable Energy Reviews, 132, 110112.
Li, L. (2022), Reskilling and upskilling the future-ready workforce for industry 4.0 and beyond. Journal Information Systems Frontiers. Doi: 10.1007/s10796-022-10308-y.
Li, L., Msaad, H., Sun, H., Tan, M.X., Lu, Y., Lau, A.K.W. (2020), Green innovation and business sustainability: New evidence from energy intensive industry in China. International Journal of Environmental Research and Public Health, 17(21), 7826.
Litvinenko, V.S. (2020), Digital economy as a factor in the technological development of the mineral sector. Journal of Natural Resources Research, 29(3), 1521-1541.
Marinakis, V., Flamos, A., Stamtsis, G., Georgizas, I., Maniatis, Y., Doukas H. (2020), The efforts towards and challenges of greece's post-lignite era: The case of megalopolis. Sustainability, 12(24), 10575.
Maulidia, M., Dargusch, P., Ashworth, P., Ardiansyah, F. (2019), Rethinking renewable energy targets and electricity sector reform in Indonesia: A private sector perspective. Renewable and Sustainable Energy Reviews, 101, 231-247.
Miglani, A., Kumar, N., Chamola, V., Zeadally, S. (2019), Blockchain for internet of energy management: Review, solutions, and challenges. Journal Computer Communications, 151, 395-418.
Nandal, V., Kumar, R., Singh, S.K. (2019), Barriers identification and analysis of solar power implementation in Indian thermal power plants: An interpretative structural modeling approach. Journal Renewable and Sustainable Energy Reviews, 114, 109330.
Newman A.O.P. (2020), COVID, CITIES and CLIMATE: Historical precedents and potential transitions for the new economy. Journal Urban Science, 4(32), 32.
Onu, P., Pradhan, A., Mbohwa, C. (2023), The potential of industry 4.0 for renewable energy and materials development-the case of multinational energy companies. Heliyon, 9, e20547.
Othman, A., El Gazzar, S., Knez, M. (2022), Investigating the influences of smart port practices and technology employment on port sustainable performance: The Egypt case. Sustainability, 14, 14014.
Park, S., Humphry, J. (2019), Exclusion by design: Intersections of social, digital and data exclusion. Journal Information Communication and Society, 22(7), 934-953.
Parmentola, A., Petrillo, A., Tutore, I., De Felice, F. (2022), Is blockchain able to enhance environmental sustainability? A systematic review and research agenda from the perspective of Sustainable Development Goals (SDGs). Journal of Business Strategy and the Environment, 31, 194-217.
Rossi, E., Bertassini, A.C., dos Santos Ferreira, S., Neves do Amaral, W.A., Ometto, A.R. (2019), Circular economy indicators for organizations considering sustainability and business models: Plastic, textile and electro-electronic cases. Journal of Clenaer Productions,247, 119137.
Schröder, P., Lemille, A., Desmond, P. (2020), Making the circular economy work for human development. Journal Resources, Conservation and Recycling, 156, 104686.
Shih, C.F., Zhang, T., Li, J., Bai C. (2018), Powering the future with liquid sunshine. Joule, 2, 1925-1949.
Sigala, M. (2020), Tourism and COVID-19: Impacts and implications for advancing and resetting industry and research. Journal of Business Research,117, 312-321.
Situmeang, R., Mazancová, J., Roubík, H. (2022), Technological, economic, social and environmental barriers to adoption of small-scale biogas plants: The case of Indonesia. Energies, 15(14), 5105.
Trencher, G., Rinscheid, A., Duyganc M., Truong, N., Asuka J. (2020), Revisiting carbon lock-in in energy systems: Explaining the perpetuation of coal power in Japan. Energy Research and Social

Science, 69, 101770.
Unruh, G. (2018), Circular economy, 3D printing, and the biosphere rules. California Management Review, 60, 95-111.
Veskioja, K., Soe, R., & Kisel, E. (2022a). Implications of digitalization in facilitating socio-technical energy transitions in Europe Energy Research & Social Science Implications of digitalization in facilitating socio-technical energy transitions in Europe. Energy Research & Social Science, 91(September), 102720. https://doi.org/10.1016/j.erss.2022.102720
Veskioja, K., Soe, R. M., & Kisel, E. (2022b). Implications of digitalization in facilitating socio-technical energy transitions in Europe. Energy Research and Social Science, 91(September), 102720. https://doi.org/10.1016/j.erss.2022.102720
Winans, K., Kendall, A., Deng, H. (2017), The history and current applications of the circular economy concept. Journal Renewable and Sustainable Energy Reviews, 68, 825-833.
Woo, J., Fatima, R., Kibert, C.J., Newman, R.E., Tian, Y., Srinivasan, R.S. (2021), Applying blockchain technology for building energy performance measurement, reporting, and verification (MRV) and the carbon credit market: A review of the literature. Journal Building and Environment, 205, 108199.
Yildizbasi, A. (2021), Blockchain and renewable energy: Integration challenges in circular economy era. Renewable Energy, 176, 183-197.
Yunus, L., Iswandi, M., Baco, L., Zani, M., Limi, M.A., Sujono. (2023), How does sustainable energy system, creativity, and green finance affect environment efficiency and sustainable economic growth: Evidence from highest emitting economies. International Journal of Energy Economics and Policy, 13(1), 261-270.