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Analysis of the Effect of Utilization of Science and Technology, Human Resources and Asset Land Management on Sustainable Optimization

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Abstract: Natural resources, especially land, are finite resources that constrain development. The limited availability of land in urban areas is disproportionate to the growing demand. This land is important for developing city infrastructure, such as office buildings, housing, education, health services, parks, and green open spaces, as well as other functions that support city infrastructure. The research was conducted as an effort to support government programs towards the optimization of sustainable cities by looking at the propositions of each variable. The product of this research helps the government optimize the development of sustainable cities. Testing with quantitative methods using partial least square data analysis utilizing Smart-PLS software. The results showed that the science and technology variable had an insignificant effect on the sustainable optimization of land assets in Malang City. However, the human resources variable and the asset land variable have a significant positive effect on the sustainable optimization of asset land in Malang City. The conclusion of this study shows that science and technology does not have a direct impact on the optimization of sustainable land assets in Malang City, but has a significant positive influence through the mediation of human resources. Therefore, researchers recommend improving science and technology in land asset management through improving the education and skills of human resources in the Malang City government.

Keywords: Science and technology; Human resources; Optimization; Land assets; Sustainable

Introduction

The concept of sustainable urban development is defined as urban development that emphasizes a balance between economic, socio-cultural and environmental aspects. Sustainable development means development that does not sacrifice the development needs of future generations, so that future development is based on the pillars: economic, social, and environmental (Joga, 2017). Global resource scarcity has become a major policy concern with forecasts of population increase, natural resource depletion and hunger (Scoones et al., 2019).To meet the two objectives of urban development, namely accommodating the growing urban population and conserving prime agricultural land, it is important to guide and shape future urban expansion in a more sustainable direction (Bren d'Amour et al., 2017). Malang city's population growth rate of 0.13% per year in 2020-2021 and a

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population density of 7667 km2 (Kota Malang dalam angka, 2022), requires land availability for balance. Cities around the world have incorporated sustainable development into their planning and are leading the charge in responding to the world's ecological crisis by "going green", The accessibility of urban green spaces is considered the key to urban sustainable progress (Du and Zhang, 2020). Trees can help cities and countries meet 15 of the 17 SDGs' sustainable development goals (Skof and Cavender, 2019). Land is the main asset in the agricultural sector and hence land policy is one of the key elements that determine whether the SDGs are achieved in developing countries or not (Mengesha et al., 2022). The Malang city government uses land assets given the high price of land in urban areas. The Law of the Republic of Indonesia number 26 of 2007 concerning Spatial Planning explicitly determines that the proportion of urban green space is at least 30% of the area. Because of this, the city government is obliged to optimize its asset land.

The asset sector of the Malang city government has several supporting applications in managing its assets, some of these applications are SIGMA (*Asset Management Geographic Information System*), SIPIPT (*Land Use Permit Management Information System*), SIMBADA (*Regional Property Management Information System*). However, in its management, only the SIMBADA application has been developed every year. The SIPIPIT and SIGMA applications have not experienced application development since 2019. The Malang City Government is very aggressive in inventorying and securing land assets in Malang city. Land and its resources are the backbone of most developing countries, land titling programs are seen as a strategy to achieve SDGs by increasing certainty of ownership and creating an enabling environment for land-related investments (Mengesha et al., 2022). The progress of the land asset titling program in Malang City Government is outlined in Figure 1

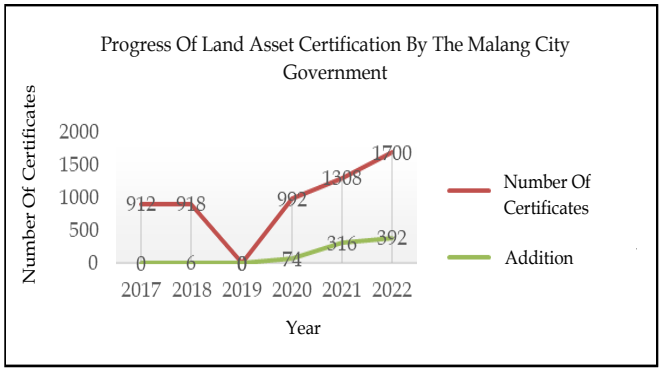

Figure 1. Land Asset Certification
Source: Regional Asset Finance Agency, 2022

Research states that to achieve a neutral state towards land degradation by 2030 requires the implementation of sustainable land management practices for the provision of sustainable ecosystem goods and services needed by the human population, to support this requires the development of systematic, robust and validated methods with the necessary science and technology approaches, whether in the form of satellite-based earth observation, or other types of technology needed (González-Roglich et al., 2019).The development of technology in managing natural resources should provide benefits for the welfare of the people, while still paying attention to balance and sustainability. The use of technology in efforts to utilize natural resources must be careful and precise so that the quality and sustainability of natural resources and the environment can be maintained, to support sustainable development (Soerjani et al., 2008). Smart cities are not "cities" plus "technology" but the use of smart solutions to solve city problems (Joga, 2017). The development of information and communication technology affects various lines of life, including the development of government systems (Habibie, 2019). The adoption of the latest technology by public agencies to make their government more innovative and smarter in various dimensions and specific functions of public management (Criado and Gil-Garcia, 2019). The results of the study prove that human resource competence affects the management of regional property and the quality of financial reports, while technology utilization only affects the quality of financial reports and has no effect on the management of regional property (Wahyuni et al., 2018). Along with the development of digital technology, mapping using UAVs currently has the potential to provide geospatial information with promising, effective, and efficient resolution (Junarto and Djurjani, 2020). Updating and evaluating changes in land use change, information regarding the location and existence of an object in an area plays an important role in decision making.

Human resources are the most valuable resource of any organization to remain competitive in the market (Rezaei et al., 2021). Sustainability will not be possible if development is only physically oriented, the most important thing is how to change the mindset and behavior of the community that is part of sustainable development efforts (Joga, 2017). Educational development is the key to the success of improving human resources and technological development because education plays a role in improving the quality of human resources (Widarni and Bawono, 2021). Humans strive to build low-carbon eco-friendly cities and popularize low-carbon eco-friendly buildings. "*Green*" building refers to the entire life cycle of a

building which includes maximizing resource conservation (energy, water, land, and materials), protecting the environment, reducing pollution, providing healthy, comfortable and efficient use of space for people and building harmony of nature and architecture (Bonenberg and Wei, 2015).

In order to achieve this goal, optimal management of natural resources is needed by using a scientific approach and increasing the skills of its human resources. The natural resources in question are government-owned land assets. There are several variable components that affect each other, each variable will be interdependent and will influence each other. These components are science and technology (science and technology), human resources, asset land as a natural resource and sustainable asset land optimization. These components are contained in Figure 2.

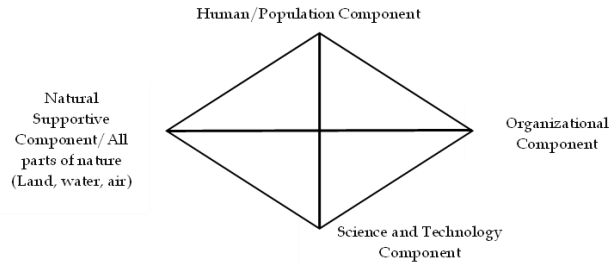

Figure 2. Interconnected Human Ecological Components
Source: Wardhana, 2004

This research is to analyze the relationship between several variables, namely the influence of science and technology, natural resources or asset land controlled by the Malang City government, and human resources in supporting the optimization of sustainable asset land. So that it can help the government in determining the direction of policy formulation towards the utilization of land assets for the development of sustainable facilities and infrastructure. Utilization and optimization of regional assets can increase or boost local revenue, therefore future asset management must aim to ensure the sustainable development of local government capacity (Arifuddin et al., 2019).

Method

The research method used is quantitative method. Data The research method used is quantitative method. Data analysis using the SEM-PLS method aims to test the predictive relationship between constructs by seeing if there is a relationship or influence between constructs (Ghozali and Kusumadewi, 2023). The advantage of the SEM-PLS method is that it tests latent variables so that it overcomes the shortcomings of other methods and allows testing the relationship of dependent variables in groups. Data collection is done by conducting primary and secondary data surveys. Primary data collection is done by distributing questionnaires through google forms and questionnaires. The research location is in Malang City, East Java Province. PLS-SEM does not require a large number of samples, at least recommended between 30 and 100 cases (Ghozali and Kusumadewi, 2023).

Respondents of this study using purposive sampling technique, the number of respondents consisted of 186 respondents. The questionnaire was distributed using google form and through direct distribution using a questionnaire questionnaire. The characteristics of respondents based on occupation show that respondents who work as State Civil Apparatus (ASN) are 76 respondents or 40.86% of the total number of respondents. Respondents who work as private workers were 18 respondents or 9.67% of the total number of respondents. Respondents who are entrepreneurs are 15 respondents or 8.06% of the total number of respondents. Respondents with other professions were 77 respondents or 41.39% of the total number of respondents. Determination of propositions between variables is carried out by quantitative analysis methods. The number of samples in a study using the SEM-PLS technique is 5 times the number of questionnaire indicators determined, the number of questionnaire indicators in this study were 19 indicators, so the number of samples that must be obtained is using the formula:

n= 5 x 19
n= 95 sampel

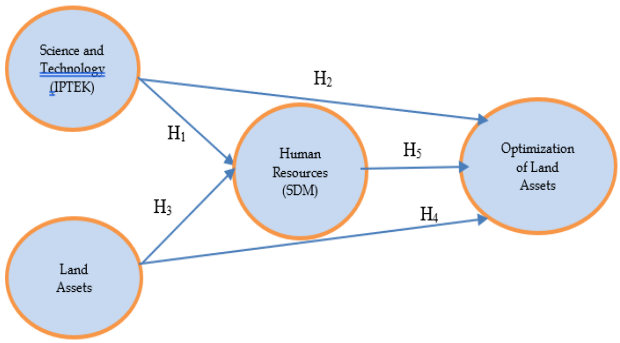

Figure 3. Conceptual Framework

Table 1. Relationship Between Variable

Hypothesis	Information
H1	It is suspected that the variable of science and technology influences the human resources variable.
H2	It is suspected that the variable of science and technology influences the sustainable land asset optimization variable.

Hypothesis	Information
H3	It is suspected that the land asset variable influences the human resources variable.
H4	It is suspected that the land asset variable influences the sustainable land asset optimization variable.
H5	It is suspected that the human resources variable influences the sustainable land asset optimization variable.

Result and Discussion

Result

Data Validity Test

Validity test is used to measure whether a questionnaire is valid or not (Ghozali, 2013). Validity test was carried out by testing 186 respondents based on the results of responses from 186 respondents who had been distributed, through a questionnaire that was filled in manually or via google form. How to test discriminant validity with reflexive indicators seen from the cross loading value of all indicators that have a loading value> 0.70 is considered valid (Ghozali and Kusumadewi, 2023). However, according to Chin, that for early stage research from the development of a measurement scale, a loading factor value of 0.5 - 0.6 is still considered sufficient (Susanto et al., 2020). The results of the validity test show the loading factor value> 0.5. Therefore, the indicators used in this study have achieved convergence validity.

Table 2. Loading Factor

	Cronbach`s alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
X1	0.863	0.865	0.902	0.649
X2	0.777	0.781	0.858	0.604
Y1	0.760	0.772	0.848	0.585
Y2	0.817	0.831	0.872	0.579

Source: Data Processed (2023)

Reliability Test

Reliability is actually a tool to measure a questionnaire which is an indicator of a variable or construct (Ghozali, 2013). Reliability occurs when the composite reliability value is greater than 0.7 and the Cronbach's alpha value is greater than 0.7 (Nadiah et al., 2017).This shows that the latent variables have good reliability, Table 3 shows that all latent variables used in this study have Cronbach's Alpha and Composite Reliability values> 0.7. So it can be interpreted that all latent variables are reliable

Table 3. Output Construction Reliability

	Cronbach`s alpha	Composite reliability(rho_c)
Science and Technology	0.863	0.902
Land Assets	0.777	0.858
Human Resources	0.760	0.848
Sustainable Land Asset Optimization	0.817	0.872

Source: Data Processed (2023)

R-squared is used to measure the level of variability of the independent variable on the dependent variable. By looking at the coefficient of determination shown through R-squared. From the table above, the value of R-Square is more than 0.5, indicating that the ability of the independent variables of science and land assets to influence the intervening variable of human resources and the dependent variable of sustainable optimization of land assets. The R-Square value of 0.637 means that the variability of the human resources construct can be explained by the variability of the constructs of science and technology and asset land by 63.7% while the rest is explained by other variables outside the model studied. The R-Square value of sustainable asset land optimization of 0.602 means that the variability of the constructs of science and technology and asset land is 60.2% while the rest can be explained by other variables outside the model studied. The greater the R-Square number produced, the greater the independent variable can explain the dependent variable so that the better the structural equation.

Table 4. R – Square Overview

	R-square	R-Square adjusted
YI	0.637	0.633
Y2	0.602	0.596

Source: Data Processed (2023)

Q – Square

Predictive relevance (Q2) in evaluating structural models to show the amount of predictive relevance possessed by a variable. The calculation is done using the formula $Q^2 = 1-(1-R_1^2)\ (1-R_2^2)$. The Q2 value that is closer to 1 means that the model is getting better. The Q2 values from the results of this study are:

Q2 = 1- (1-R12) (1-R22)
= 1- (1-0.637) (1-602)
= 1- (0.363) (0.398)
= 1- 0.144
= 0.855

Hypothesis Testing

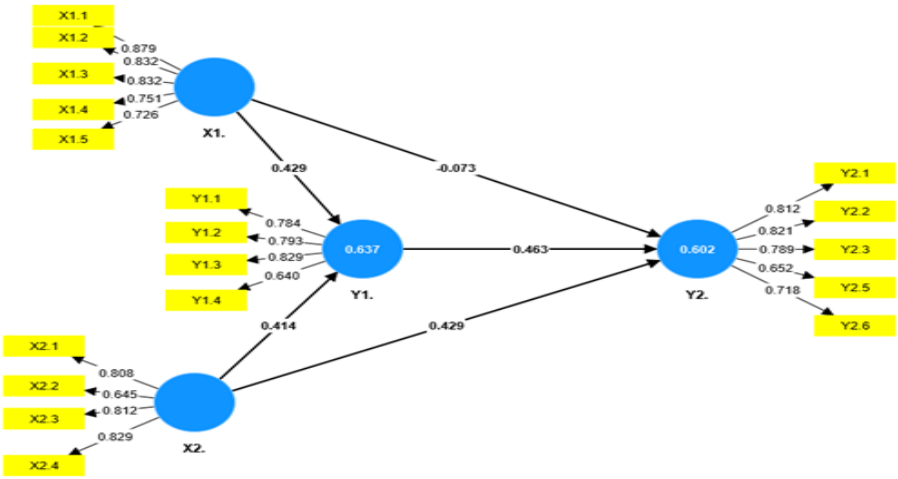

Figure 4. Hypothesis Testing

Table 5. Outside Loading

	Science and Technology (XI)	Land Assets (X2)	Human Resources (SDM) (Y1)	Sustainable Land Asset Optimization (Y2)
Mapping Technology GIS	0.879			
Applications Or Software	0.832			
Website-based Information Technology	0.832			
Mobile Applications	0.751			
Social Media	0.726			
Certified Land Assets		0.808		
Land Asset Security		0.645		
Land Asset Utilization		0.812		
Land Asset Inventory		0.829		
Policies/Regulations			0.784	
Qualified Civil Servants (ASN)			0.793	
Politics and Leadership			0.829	
Population Growth			0.640	
Economic Development				0.812
Availability of Clean Water				0.821
Availability of Infrastructure and Accessibility				0.789
Availability of Settlements				0.652
Availability of Green Open Spaces				0.718

This hypothesis is carried out to determine the effect between the exogenous latent variables of science and technology and natural resource asset land on the mediating or intervening variable, namely human resources and its effect on the endogenous latent variable, namely sustainable asset land optimization. Hypothesis testing is done by looking at the p-value. In general, the significance number is 0.01; 0.05 AND 0.1. Consideration of the use of numbers is based on the desired level of confidence (confidence interval). A number <0.01 means that the confidence level for obtaining the truth in research is 99%.

Path Coefficients – Mean, STDEV, T Values

Table 6. Path Coefficients

	Original sample (O)	Sample mean (M)	Standart deviation (STDEV)	T statistics (I0/STDEVI)	P values
X1. > Y1.	0.429	0.424	0.092	4.665	0.000
X1. > Y2.	-0.073	-0.073	0.079	0.921	0.357
X2. > Y1.	0.414	0.414	0.093	4.437	0.000
X2. > Y2.	0.429	0.421	0.097	4.415	0.000
Y1. > Y2.	0.463	0.468	0.092	5.034	0.000

1. The results of hypothesis testing of the independent variable science and technology (XI) on human resources (Y1) resulted in a P value of 0.000, which means that the science and technology variable has a significant effect on human resources and has a confidence level of 99% or hypothesis H1 is accepted.
   Hypothesis H1: Science and technology variables have a significant effect on human resources.
2. The results of hypothesis testing of the independent variable of science and technology (X1) on the optimization of sustainable asset land (Y2) resulted in a P value of 0.357, which means that hypothesis H2 is rejected or the relationship between the two is not significant.
   Hypothesis H2: The science and technology variable has an insignificant effect on the optimization of sustainable asset land.
3. The results of hypothesis testing of the independent variable asset land (X2) on human resources (Y1) resulted in a P value of 0.000, which means that the asset land variable has a significant effect on human resources and has a confidence level of 99% or hypothesis H3 is accepted.
   Hypothesis H3: The land asset variable has a significant effect on human resources.
4. The results of hypothesis testing of the independent variable land asset (X2) on sustainable land asset optimization (Y2) resulted in a P value of 0.000, which means that the land asset science variable has a significant effect on sustainable land asset optimization and has a confidence level of 99% or hypothesis H4 is accepted.
   Hypothesis H4: Asset land variables have a significant effect on sustainable asset land optimization.
5. The results of testing the hypothesis of intervening or mediating variables (Y1) on sustainable asset land optimization (Y2) resulted in a P value of 0.000, which means that the human resource variable has a significant effect on sustainable asset land optimization and has a confidence level of 99% or hypothesis H5 is accepted.
   Hypothesis H5: Human resource variables have a significant effect on the optimization of sustainable asset land.

The data can be seen in Table 7.

Table 7. Hypothesis Testing

Hypothesis	Variable	Original sample(o)	Sample mean(m)	Standart deviation	T statistic (Io/STDEV)	P values
H1	X1-> Y1	0.429	0.424	0.092	4.665	0.000
H2	X1-> Y2	-0.073	-0.073	0.079	0.921	0.357
H3	X2-> Y1	0.414	0.414	0.093	4.437	0.000
H4	X2-> Y2	0.429	0.421	0.097	4.415	0.000
H5	Y1-> Y2	0.463	0.468	0.092	5.034	0.000

Discussion

The results of hypothesis testing of the independent variable science and technology (XI) on human resources (Y1) resulted in a P value of 0.000, which means that the science and technology variable has a significant effect on human resources. This is in line with research which states that increasing human resources and technology is an important factor in efforts to increase economic growth in Indonesia (Widarni and Bawono, 2021). Furthermore, the increase in resources in

question is an increase in knowledge, mastery of technology, innovation, and the ability to develop technology to encourage technological development.

The results of testing the hypothesis of the independent variable of science and technology (X1) on the optimization of sustainable asset land (Y2) resulted in a P value of 0.357 which means that the hypothesis is rejected or the relationship between the two is not significant. The results of this analysis indicate that science and technology have an insignificant effect on the optimization of sustainable asset land. The utilization of information technology has no effect on the management of regional property (Sri Wahyuni et al., 2018). What is needed by industry today is those who have competence in the use of digital technology, the era of the industrial revolution 4.0 requires human resources that are in accordance with the latest technological developments (Rohida, 2018). This is not in line with the statement that in developed regions, people use and utilize science and technology more to process and manage existing natural resources (Wardhana, 2004). Although the existing natural carrying capacity is not good, but thanks to the intervention of science and technology, the results obtained by the community are better. The finding is that technological developments in this era of globalization can be utilized by the community and government to solve urban problems (Joga, 2017). Highlighting the technology that Singapore has adopted in improving food security given its limited natural resources, stating to increase its own food production and improve food security Singapore has implemented the use of technologies such as vertical farming and aquaponics in agriculture (Mok et al., 2020).

The results of hypothesis testing of the independent variable land assets (X2) on human resources (Y1) resulted in a P value of 0.000, which means that the land asset variable has a significant effect on human resources. This is in line with research which states that the occurrence of various natural resource damages and environmental pollution is triggered by natural resource utilization policies that are characterized by a centralized and sectoral approach (Jazuli, 2015). Population growth will be followed by the fulfillment of housing or settlements so that it will trigger land conversion (Prabowo and Bambang, 2020). Human resources affect natural resources, especially land, population growth, expansion of settlements, waste generated or policies generated by humans greatly affect environmental sustainability in Malang City.

The results of testing the hypothesis of the independent variable asset land (X2) on sustainable asset land optimization (Y2) resulted in a P value of 0.000, which means that the asset land science variable has a significant effect on sustainable asset land optimization. This is in line with research showing that the strategy that must be taken to optimize local government assets is to identify and inventory the value of assets and the potential of local government assets (Dewiyanti et al., 2022). The results of hypothesis testing of intervening or mediating variables, namely human resources (Y1) on sustainable asset land optimization (Y2), resulted in a P value of 0.000, which means that the human resource variable has a significant effect on sustainable asset land optimization. This is in accordance with research which states that the quality of human resources affects asset optimization (Arifuddin et al., 2019).

The concept of human resource management is seen as the importance of humans for development (Gomathy, 2022). Sustainability will not be possible if development is only physically oriented, the most important thing is how to change the mindset and behavior of the community which is part of sustainable development efforts (Joga, 2017). However, this contradicts research that states the quality of human resources has no significant effect on asset optimization (Nandoeng, 2023). The importance of governance, especially democratic participation and institutions for the achievement of SDGs, however, the provision of strong financial and human resources seems to be an important supporting factor in the journey towards sustainable development (Glass and Newig, 2019).

Strong financial and human resources seems to be an important enabling factor in the journey towards sustainable development (Glass and Newig, 2019).

Conclusion

From the research results, it is stated that only science and technology has an insignificant effect on the sustainable optimization of land assets. However, science and technology affect the optimization of land assets through the mediation of human resources. The results also show that the asset land variable affects directly or through human resources on the sustainable optimization of asset land. Therefore, the author recommends increasing the education and skills of human resources within the Malang City Government.

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Brawijaya University.

Author Contributions

Each author contributed in some way to the completion of the project, the lead author conceptualized the data collection, data analysis, manuscript writing and editing the lead and secondary authors decided on the questionnaire materials and data analysis in accordance with the research methods. All

authors contributed to the review process and acted as a sounding board on all aspects of the research.

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Conflicts of Interest
Regarding this research study, there is no conflict of interest

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