

COMPLEMENTARITY IN GREEN BUILDING IMPLEMENTATION DIY PROVINCE: I-O 2022 ANALYSIS TABLE

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Abstract – This study aims to test the effect of sectors that are able to complement the green building in influencing the regional economy in DIY. This study also adds elements of environmental externalities obtained from year to year and the average of DIY EQI change into the calculation of the Input-Output Table. The analytical tool used in this study is I-O analysis. In general, the result of this study indicate that the application of green building can be a hope for the Government in implementing pro-environmental economic growth. The researcher found that green building which adheres to the concept of weak complimentary theory will be appropriate when applied to the design of priority development cities for development purposes such as in construction and real estate sectors

Keywords: green building, environment, regional economy, Input-Output

for the increase in global carbon emissions because Europe experienced a mass energy shift by many countries including the Union countries to ensure the running of household and industrial activities in their countries. Various efforts have been made to maintain environmental sustainability by balancing the interests of economic development, especially infrastructure and housing, which significantly promote development and economic growth. The rapidly increasing implementation of green building has occurred in various regions, one of which is in ASEAN (Danusastro and Aryani, 2015)

I. INTRODUCTION

According to the International Energy Agency (2022), there has been a very significant increase in the amount of carbon emissions that occur globally where this increase is caused by energy burning activities and business activities which in 2022 will be 36.8 gigatonnes. The increase in carbon emission figures is the highest increase in world history, namely 0.5 gigatonnes from 2021.

The war that took place between Ukraine and Russia became one of the significant reasons

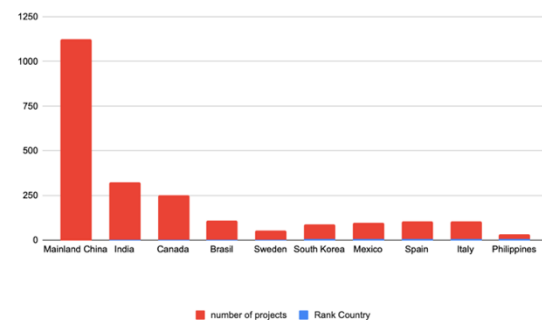


Figure 1.10 Countries and Number of LEED Certified Projects (units)
Source: USGBC (2022)

The seriousness of various countries in implementing green building has not yet entered a serious stage, because green building-based projects are still not dominant in development in various countries.

From the figure above, it can be seen that the number of projects with LEED certification in the 10 countries with the most LEED

certification is only 2,246 projects. The government's lack of attention in implementing Green Building needs to be increased in order to ensure economic growth that is also pro-environment and does not cause leakage due to climate change in the future.

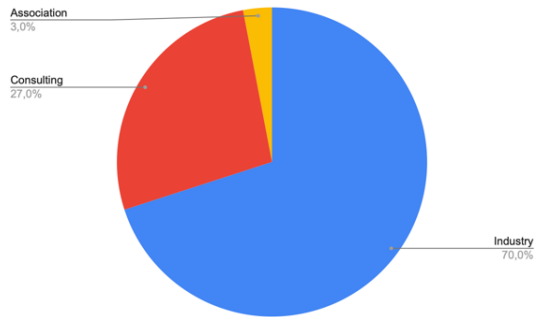


Figure 2. Number of Corporate Memberships in 2019-2020 (percent)
Source: Green Building Council Indonesia (2020)

The same thing also happened in Indonesia, from the corporate membership image compiled for 2019-2020 that green building awareness is still significantly dominated by the Association at 75%, this shows the government's lack of role in campaigning for the importance of implementing green building in Indonesia. Even from the picture above, the role of the consultant is only 7% where the consultant is usually the party needed to provide recommendations and provide awareness in the development stages of a project (Krupis, 2014).

Table 1.
Number of Green Building Certified Buildings in Indonesia (units)

Province	Certified Buildings
Jakarta	29
East Java	6
Central Java	4
Banten	3
Yogyakarta	1

Source: Green Building Council Indonesia (2023)

According to the Green Building Council Indonesia (2023), out of 34 provinces, only 5 provinces in Indonesia have green building

certification in Indonesia. Even the Special Region of Yogyakarta Province only has 1 building that has national green building certification, namely the New Yogyakarta International Airport. Seeing the various potentials that exist in the Yogyakarta, especially in the field of sustainability tourism, it will be the main impetus to be able to present sustainability development goals and sustainability growth to present a green ecosystem as a whole for development and economic growth in Yogyakarta.

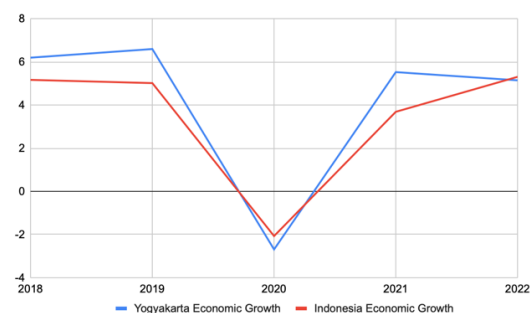


Figure 3. Yogyakarta and Indonesia Economic Growth (percent).
Source: Central Agency on Statistics (2023)

The momentum of the trend of economic growth in Yogyakarta in the last 5 years which has always been above national economic growth certainly shows that the Economy of the Special Region of Yogyakarta Province has proven to have resilience and competitiveness that can be improved and improved. However, the trend of economic growth that is growing above the national average is not accompanied by the trend in the environmental quality index in Yogyakarta because in the last 5 years the average growth of the environmental quality index in Yogyakarta has always been at below the average growth of the national environmental quality index (EQI).

The growth of the EQI in Yogyakarta, which is below the national growth average, is of course something that must be taken seriously, especially the seriousness of the Government in formulating environmentally-oriented economic development policies. The implementation of SDG-based development must be carried out in a comprehensive green ecosystem, not only implemented in a few

economic sectors. Therefore, the importance of implementing green building in Yogyakarta must be a concern of the Government to ensure that no leakage may occur in the future caused by environmental damage that is not serious to be anticipated and handled properly.

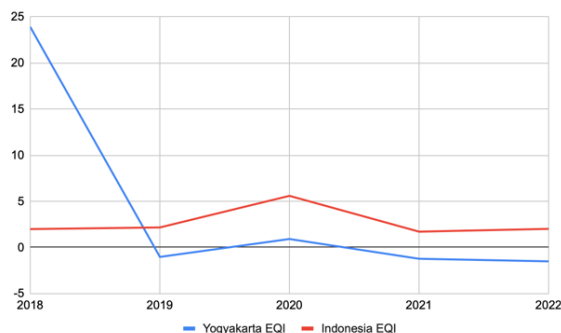


Figure 4. Yogyakarta and Indonesia EQI Growth (percent)
Source: The Ministry of Environment and Forestry (2023)

Research by Zaini et al (2022), this research was conducted on twelve plans for economic empowerment and environmental sustainability in Malaysia which showed that green buildings did not get support from the industrial world because of the high initial costs. This study formulates an economic model of green development using structural equation modeling to increase interest, especially the industrial world in green development. The model in this research becomes a strategy to minimize total costs and increase clients' investment in green buildings this also exists research by Dwaikat (2018), this research was conducted in Malaysia by paying attention to the concept of gree building based on factors related to building criteria. The concept of green building in this study aims to evaluate economic performance in terms of energy consumption and to study the inflation of energy prices associated with reduced energy consumption. The results of this study prove that the application of green building is able to save 71.1% of energy compared to the industrial baseline, namely saving 5756 kWh/m² which is equivalent to \$ 2,796,451 with an average energy increase of 1%, so these economic benefits are significantly related to the economic benefits

obtained. from the application of green building.

Similar research was also conducted by Danusastro et al (2015), research conducted in the Southeast Asia (ASEAN) region was carried out by developing assessments of Green Buildings that already existed and were compiled in each regional country. This research looks at the development of assessments on a national and international scale with the Green Mark and Green Building Index in rating certifications given by foreign reviewers to buildings in Jakarta. The results of this study prove that the application of green building in ASEAN countries influences business development, construction (contractors, consulting services, and construction management) related to the application of green building.

This research is also completed by Aisha et al (2018), this research was conducted in Jakarta which carries the concept of green estate in it. In this study, the growth of public awareness regarding green living is increasingly widespread, especially in the business world. Sustainability of development in green building is carried out by saving energy, providing sustainable public goods, providing alternative energy by involving citizen participation. This study uses qualitative and quantitative methods with housing secondary data in the REI directory book. The results of this study are the importance of mapping the types and scope of green estate in building brands, exploring developer strategies in green estate, and implementing green estate product branding strategies.

In other research, Riyanto (2021), this research was conducted in Indonesia by calculating the management of state assets which is carried out in a transparent and accountable manner. In this research it was carried out using statistical techniques by identifying the factors that influence the value of residential property, the source of information comes from primary data from the Directorate General of State Assets by looking at the perceptions and values of several factors. The results of this study are proven that the non-building structure variable group has more influence than the value in the building structure group. This study has

limitations with the limited use of respondents from government appraisers so that it does not describe the value perception of government appraisers at DJKN.

The various studies above are enhanced by research by Indryani (2022), this research was conducted in North Kalimantan Province with East Kalimantan Province which will become the New Capital City. This research uses the Input-Output tables from the Central Bureau of Statistics and this study is deepened by using the Interregional Input-Output (IRIO) tables which are used to see the economic region of North Kalimantan with other provinces. The results of the study show that the leading sectors in this province are the manufacturing and electricity industries and from a spatial perspective, East Kalimantan is the province that is affected when North Kalimantan is experiencing changes in final demand.

The high cost of a green building scheme, which is 3-5% of conventional development, will reduce the forward and backward linkages of implementing the scheme. The decline in output, GDP, and tax revenue is expected to occur in the implementation of the green building scheme, so an analysis is needed to see the impact of the regional economy in Yogyakarta equipped with a weak complimentary theory, due to the large number of development infrastructures that become public goods.

II. METHODS

In this study, the data used used secondary data, namely in the form of Input-Output tables for Yogyakarta, data on the Gross Regional Domestic Product (GRDP) of the Province of the Special Region of Yogyakarta which were focused on 2 sectors that had a direct relationship with green building, namely the construction and real estate sectors. plantations sourced from the Yogyakarta Central Agency on Statistics. Data sourced from the Central Agency on Statistics, namely the Standard Classification of Indonesian Business Fields

(SCIF) is used to classify the business sector sectors that contribute to this research.

This study also includes the environmental quality index (EQI) sourced from the Ministry of Environment and Forestry of the Republic of Indonesia as the main factor for considering environmental conditions from development activities.

According to Central Agency on Statistics (2010), the analysis tool in this study uses an analysis of the Input-Output table and is formulated as follows:

$$Z_i = M_i + X_i = \dots W_i + Y_i \dots\dots\dots (1)$$

(Supply) (Demand)

(I = 1,2,3,...)

The second equation will be derived in table I, namely:

$$X_j = \dots X_{ij} + V_j = U_j + V_j \dots\dots\dots (2)$$

(j = 1,2,3,...)

Therefore, equation (1) contains the balance between supply and demand (supply=demand) and equation (2) contains the balance between the quantity of production in each sector and the input prices of other sectors and added to the value added in the related sector. The method of using I-O as a projection tool in economic activity will go through the following stages (Central Agency on Statistics, 2010:27):

1. Break down the activities or sectors that have links with the sectors or activities to be projected through backward or forward linkages;
2. Look for the effect of projected activities through regional I-O tables and change them in the form of modified I-O tables with backward or forward linkage characteristics;
3. Projecting the impact of a development activity or sector as a whole either directly or indirectly in the I-O tables that have been made with the aim of observing the development of regional development policies and economic activities.

In this study, the I-O tables used are the results of updating throughout 2018-2022 due to limited data used in carrying out the RAS Partial Survey stages. This study also analyzes the 2030 scenario if the Special Region of Yogyakarta Province is consistent in carrying out green building in accordance with the existing consensus in which Indonesia has signed the Nationally Determined Contribution (NDC) in the Paris Agreement where there are many efforts in various fields that the country needs to do to support the reduction of carbon emissions.

This scenario also uses the environmental quality index (EQI) of the Special Province of Yogyakarta where there is an assumption that there are negative externalities that impact economic activity and guarantees an economy that is pro-environment, environmentally oriented, and in accordance with the SDGs.

III. RESULTS AND DISCUSSION

Based on the results of the analysis that has been carried out, it can be seen that if Yogyakarta Province implements green building until 2030, there will be an accelerated increase in output for the economic sectors as illustrated in Figure 5. This condition illustrates that in the long run there will be a balance between environmental output from conventional output and this must be encouraged to produce quality economic output in Yogyakarta.

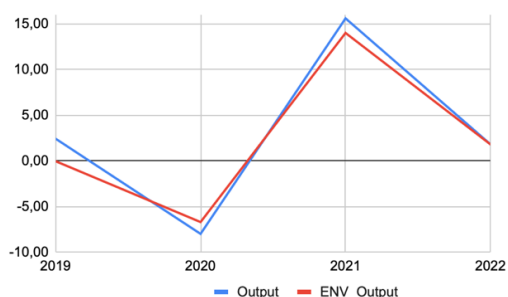


Figure 5. Projections of Conventional and Output Growth Environmentally (in percent)

A similar analysis also occurs in the GRDP growth of Yogyakarta, where there has been a significant increase in the implementation of the green building scheme. Calculations made by adjusting to environmental conditions prove that there is a potential increase in the GRDP of Yogyakarta in the future, and the aggregate demand between conventional GRDP and environmentally friendly GRDP will grow in a similar trend as shown in Figure 6.

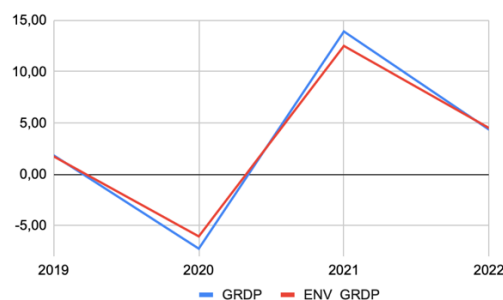


Figure 6. Projection of Conventional GRDP Growth and Environmentally Friendly (in percent)
Source: Data Processed

In the 17 sectors in the economy as well as the results of the 2 observational sectors that are related to the green building scheme, the results are obtained that there is a stretch in the economy and will significantly affect the economy in Yogyakarta. The results of this study are in line with the weak complimentary concept research conducted (Banzhaf, 2020).

The results of the forward linkage analysis carried out on the Input-Output tables that have been analyzed, in 2018-2021 the real estate and construction sector will become the dominant sector that drives the economy of Yogyakarta. In 2022 there will be changes in the driving sector that has forward linkages from the existing sectors in the Province of Yogyakarta where the government administration, defense and mandatory social security sectors as well as the information and communication sector are the main sectors that have added value to the economy as they are. in Table 2.

In the backward linkage analysis, from 2018-2021 the real estate sector has become the dominant sector with the spread of the economy to other sectors in the economy of

Yogyakarta. The construction sector will not become the dominant sector that has the power to spread the economy until 2030 in the application of the green building scenario and this will also occur in the real estate sector which in 2022 and 2030 will no longer be the dominant factor in the spread of the economy in other sectors where the agricultural sector, forestry and fisheries are the dominant sectors in the spread of the economy to other sectors in Yogyakarta by 1.38 in 2022 and 1.40 in 2030.

Table 2.

Results of Forward Linkage and Backward Linkage Analysis

SECTOR	YEAR	FLER	BLER
Construction	2018	2,34	2,27
	2019	2,35	2,28
	2020	2,57	2,41
	2021	2,53	2,37
	2022	3,91	2,73
	Est_2030	8,22	4,61
Green Construction	2018	2,43	2,31
	2019	2,36	2,28
	2020	2,59	2,42
	2021	2,53	2,37
	2022	3,98	2,77
	Est_2030	8,51	4,73
Real Estate	2018	17,57	1,35
	2019	17,55	1,35
	2020	17,46	1,36
	2021	17,51	1,34
	2022	2,75	2,33
	Est_2030	2,75	2,89
Green Real Estate	2018	17,46	1,34
	2019	17,55	1,35
	2020	17,46	1,36
	2021	17,51	1,34
	2022	2,75	2,34
	Est_2030	2,75	2,93

Source: Data processed.

Based on the results of the conventional output multiplier analysis and in the green building scenario, the results show that in 2018-2021 the education services sector is the main sector which is the main sector for the output multiplier in Yogyakarta, but these results have changed, namely in 2022 and 2030 where the procurement sector Electricity and gas are sectors that are output multipliers in the economy. In the multiplier results, only the real estate sector is significant as the main sector in the income multiplier in the economy of Yogyakarta in 2018-2021, which is consistent both in the conventional income

multiplier and in the green building scenario as shown in Table 3.

In 2022 and 2030 there will be a significant shift in the main sectors in the income multiplier, namely the agriculture, forestry and fisheries sectors which will become the main sectors which play a role in the income multiplier of 2.08 times in the economy of Yogyakarta.

Table 3.

Results of Analysis of Output Multiplier and Income Multiplier

SECTOR	YEAR	OUTPUT MULTIPLIER	INCOME MULTIPLIER
Construction	2018	0,22	0,19
	2019	0,22	0,19
	2020	0,08	0,15
	2021	0,20	0,17
	2022	0,36	0,47
	Est_2030	0,13	0,18
Green Construction	2018	0,21	0,18
	2019	0,22	0,19
	2020	0,08	0,15
	2021	0,20	0,17
	2022	0,08	0,15
	Est_2030	0,14	0,19
Real Estate	2018	0,00	5,51
	2019	0,00	5,54
	2020	0,00	5,52
	2021	0,00	5,82
	2022	0,28	1,19
	Est_2030	0,28	1,19
Green Real Estate	2018	0,01	5,75
	2019	0,01	5,54
	2020	0,08	0,15
	2021	0,01	5,54
	2022	0,28	1,19
	Est_2030	0,30	1,21

Source: Data Processed

On the results of the static economic impact, the results show that there has been a significant increase in the economy of Yogyakarta, where if consistently implementing the green building scenario there will be an increase in GRDP of IDR 1,069,348,051 (in million rupiah) and an increase in output of IDR 1,038,748 .059 (in million rupiah) until 2030. Therefore, if the green building scenario is properly encouraged by Yogyakarta there will be a significant acceleration of local output and GRDP.

In 2018, if the green building scenario is carried out there is an increase in GRDP of IDR 4,047,990 (in million rupiahs) and output of IDR 123,547,990 (in millions of rupiahs) then there is a loss of economic value because it does not implement this scenario whereas in 2019 if the green scenario building was

applied, there was a decrease in GRDP of -Rp. 1,734,686 (in million rupiahs) but there was an increase in output of Rp. 265,314 (in million rupiahs).

In the results of the dynamic economic impact analysis in 2020, there was an increase in GRDP of IDR 66,331,056 (in million rupiahs) and also an increase in output of IDR 66,331,056 (in millions of rupiahs) when implementing the green building scheme which was the year with the most significant increase from the previous year. In 2021, in the same trend there will be an increase in GRDP and output with the same value of IDR 377,432 (in million rupiahs)

The increase in GRDP in 2021 when applying the green building scenario still occurs, namely with an increase of IDR 9,809,820 (in million rupiahs) but there is a decrease in output of -Rp 190,172 (in millions of rupiahs) if this scenario is implemented. In the dynamic economic impact analysis carried out until 2030 by consistently and sustainably implementing the green building scenario, there is a potential increase in GRDP of IDR 57,859,640 (in million rupiah) and an increase in output of IDR 37,759,638 (in million rupiah) for Yogyakarta.

IV. CONCLUSION

Seeing the huge potential for economic value if the green building scenario is applied to Yogyakarta, the Regional Government's seriousness is needed to encourage green building policies. The amount of added value and the power of spreading the economy to other sectors in the economy of Yogyakarta is the main thing that becomes an urgency because it will have an impact on multi-sectoral growth.

The results of the multiplier of income and output which are also on an increasing trend are supporting and reinforcing reasons in the implementation of green building in Yogyakarta even though from the results of the dynamic economic impact analysis for 2018-2022 the results of GRDP and output are still

fluctuating but in the long term until 2030 there are potential economic value is very large and will greatly impact the economy.

Based on the results of this study, there are theoretical and practical implications as follows:

1. In theory, initially the green building scenario was thought to reduce economic surplus and this was proven in short-term observations, namely 2018-2022, but when implemented in the long term it will provide a very significant economic surplus to the economy.
2. In practice, the results of this study serve as policy recommendations for Yogyakarta to seriously encourage the green building sector so as not to lose economic growth momentum and prevent leakage that might occur in the future due to not paying attention to climate change factors in economic development.

This study certainly has limitations in model selection, data availability, and analysis stages. Static I-O tables certainly have limitations that must be completed with a more dynamic Computable General Equilibrium (CGE) analysis.

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