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Article

The impact of strategic infrastructure development of Bali on the economic growth

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Abstract: Bali is the most famous tourist destination in the world, and this popularity has led to a significant rise in the island's economy. The rise in income has also driven an increase in demand for infrastructure. Moreover, the Bali regional competitiveness index, in the infrastructure pillar, shows a lower figure compared to the national level. So that the Bali Provincial Government focuses on building an infrastructure strategy. This research uses the Input-Output Table (IOT) model, namely the 2016 Bali Province IOT which will be released in 2021. This analysis was chosen because IOT assumes that one sector can be an input for other sectors, in terms of this this is the construction sector. With investment in strategic and monumental infrastructure marking the New Era of Bali, it will result in additional Gross Regional Domestic Product (GRDP) of IDR 18.7 trillion, or in other words Bali's GRDP will increase by 9.71% from the condition of no investment. This shows that infrastructure development is able to boost Bali's economy. Further research is needed to be able to qualitatively analyze development infrastructure strategies in Bali. Remembering that a qualitative approach is also important to be able to analyze in depth.

Keywords: economic growth; strategic infrastructure; input-output table (IOT)

1. Introduction

Bali Province is renowned as a world-famous tourism destination (Wijaya et al., 2020). The direction of Bali tourism so far has tended to be mass tourism, because it is believed to have a big impact on Bali's economy. It has been proven that over the last few decades, tourism has been a driving force for Bali's economy, reducing poverty, so that the Balinese people are very dependent on this industry (Budhi et al., 2022; Sutawa, 2021; Widiati et al., 2021). Apart from positive impacts, massive tourism development can also cause several problems (UNEP, 2009): 1) tourism development is not oriented on local economic growth; 2) the development of tourism is disregarding social norms, hindering the potential for building awareness and community capacity to maintain improved environmental quality in their area; 3) Tourism developments depend on ecosystem integrity; it is not integrated with an effort of conservation and carrying capacity principle application; 4) tourism developments do not include local people development and strengthen including its organization and destination management.

In an effort to reduce the negative impacts of the massive tourism industry, as well as to equalize development, the Bali Provincial Government is implementing a universal development plan for 2019–2023. Bali's development is carried out with the concept of a Planned Universal Development Pattern (Wirasuta, 2019) which takes place systematically, massively and dynamically at local, national and global

levels, namely development which is characterized by: First, being able to maintain/Genuine Bali; secondly, it can fulfill the needs, hopes and aspirations of Krama Bali in various aspects of life; and third, having sufficient readiness to anticipate/face the emergence of new problems and challenges that will have a positive or negative impact on conditions in the future to move towards the New Era of Bali, namely an era marked by a holistic new order of life for Krama Bali (Balinese Peopla and their way of life) (Government of Bali Province, 2022).

The Bali Development priority program as the implementation of the planned universal development pattern includes 5 (five) priority areas which are patterned and integrated throughout Bali, namely: 1) the areas of food, clothing and shelter; 2) health and education sectors; 3) the field of social security and employment; 4) the fields of customs, religion, traditions, arts and culture; 5) tourism sector. The Bali Provincial Government also includes supporting programs, namely the infrastructure development program to accelerate the realization of the Vision and Mission and is adjusted to cover the five priority areas of Bali's development.

The Bali Provincial Government also realizes that infrastructure achievements have an important role in shaping regional competitiveness. The results of the 2022 Regional Competitiveness Index (IDSD) measurements carried out by the National Research and Innovation Agency (BRIN), show that the IDSD of Bali Province (valued at 3.39) is above the National IDS (valued at 3.26). However, of the 12 pillars that form IDSD, there are 4 (four) pillars where the Bali Province IDSD score is below the national IDS score, namely the infrastructure pillar and macroeconomic stability pillar, labor market, and market size pillar (**Figure 1**).

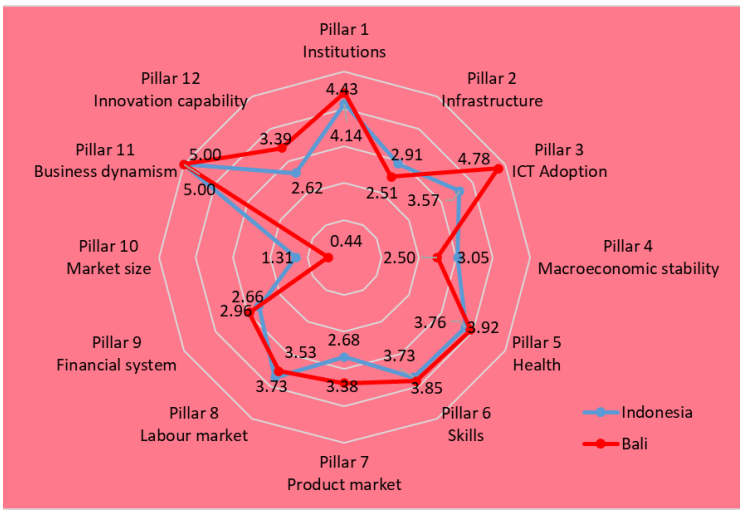

Figure 1. Scores of the 12 pillars forming the bali province and national competitiveness index for 2022 (National Research and Innovation Agency (BRIN), 2023).

Figure 1 shows that infrastructure development needs to be a priority in Bali. Therefore, the Bali Provincial Government continues to strive for strategic infrastructure development, both funding sourced from the Local Government Budget (APBD) and State Budget (APBN) (Anonymous, 2022). So it is important to analyze at a macro level the economic impact that can be provided if infrastructure

development is carried out. The aim of this research is to analyze the impact of Bali's New Era strategic and monumental infrastructure development on Bali's economy.

2. Materials and methods

2.1. Infrastructure and economics

Providing public infrastructure is one of the government's tasks (Setyari et al., 2022). Public infrastructure is defined as facilities, structures, networks, systems, plants, property, equipment, or physical assets – and the enterprises that employ them that provide public goods, or goods that meet a politically mandated, fundamental need that the market does not able to provide on its own (OECD, 2015). The demand for infrastructure is also influenced by economic activity and income levels. As demand increases, so does the need for infrastructure. The provision of infrastructure will encourage and have a positive impact on economic growth, both in urban and rural areas (Sun and Cui, 2018).

Several previous studies have been carried out regarding the impact of infrastructure on the economy. Various studies show that infrastructure has proven to have a significant impact on economic growth, including GDP per capita in (Beyzatlar et al., 2014; Ramadhan, 2019). Infrastructure that has been widely analyzed and proven to be important for economic acceleration is educational infrastructure, transportation infrastructure (roads), health infrastructure, including clean water infrastructure (Khanani et al., 2021; Munawaroh and Haryanto, 2021; Nawir et al., 2023; Nugroho et al., 2022; Setyari et al., 2022).

2.2. Input-Output (IO) Analysis Model

Input-Output Tables (IOT) are a statistical tool of economic analysis that allows measuring and describing productive relationships in one or several economies in a particular year, including linkages arising from trade (Lima and Banacloche, 2022). The Indonesian Input-Output (IO) table was compiled by Statistics of Indonesia (BPS) with the aim of presenting an overview of the reciprocal relationships and interconnections between activity units (sectors) in the Indonesian economy as a whole. The presentation form of the IO table is a matrix, where each row shows how the output of a sector is allocated to meet intermediate demand and final demand, while each column shows the use of intermediate inputs and primary inputs by a sector in its production process.

The IOT is a double-entry matrix that provides by columns the composition of gross value of production from the expenditure perspective, and by rows from the income perspective. It can be divided into three main matrices (**Figure 1**): The intermediate input matrix (*Z*), the final demand matrix (*y*) and the value-added matrix (GVA). The total output, Gross Value of Production (GVP) or total supply (total resources) is the sum by columns of *Z*, imports of intermediate inputs *ZM* (not to be confused with imports of final goods) and *GVA* by industrial sector, shown in the row 1 × Nvector, the total demand (total employment) by sector is the sum by rows of the sector, which includes the intermediate inputs and the final demand

offered by a column $N \times 1$ vector, fulfilling the accounting identity where total resources are equal to total employment. For the following calculations we will call x the $1 \times N$ vector of the GVP (Lima and Banacloche, 2022).

$$\sum_{j=1}^{3} x_{ij} + F_i = X_i; \text{for all i} = 1, 2, 3, \ldots \ldots$$

where: X_{ij} = output of i sector as input input of j sector; F_i = final demand of i sector; X_i = final output of i sector.

$$\sum_{j=1}^{3} x_{ij} + V_j = X_j; \text{for all i} = 1, 2, 3, \ldots \ldots$$

where: V_j = value added or primary input of j sector.

The Input Output table can provide information about goods and services transactions that occur between production activities in a particular economy in a particular time period. As presented in **Table 1**, through the presentation of the input structure, intermediate demand and output allocation, the Gross Value Added (GVA) of each production sector can also be identified. BPS classifies 52 production sectors in Table IO, where these 52 sectors have also been coordinated into 17 GDP-forming business sectors, so that analysis can be carried out using both types of industrial sectors.

Table 1. Simplified structure of a national symmetrical IOT (Lima and Banacloche, 2022).

		Sectors **1 2 3 … N**	**Final demand**			**Total employment**
			C	**FBC**	**e**	
Sectors i	1 2 3 … N	Intermediate demand: Intermediate inputs, intermediate consumption or use (Z)	y			Gross Value of production (GVP)
Imports		Imported intermediate inputs (Z^M)				
Value added (GVA)		Compensation of employees				
		Gross operating surplus				
		Taxes minus subsidies				
Total resources		Gross Value of Production (GVP)				

One of the benefits of IoT is to analyze sector contributions, for example to total output, added value, labor income, exports and imports. Just as investment supplies the capital stock needed to produce future output (Mendoza, 2023). From the results of this analysis, information can be obtained regarding the contribution of each sector to each of the problems studied (in this research it is the impact of the construction sector) (Cahyono and Sumargo, 2005). The last IO table released by BPS is the 2016 IO which was released in 2021.

3. Results and discussion

Before presenting the results of the data analysis, several strategic infrastructures that have been or will be built in Bali Province will first be explained. The next sub-section presents the results of the input-output analysis, and in the final

sub-section the forecasting of Bali's macroeconomic indicators is presented.

3.1. Strategic infrastructure marking a new era for Bali

Bali's infrastructure development referred to in this study includes several Balinese strategic and monumental infrastructure projects (**Table 2**). The data regarding the investment value of infrastructure projects in Bali comes from relevant agencies. In cases where the data is unavailable, estimates are made or various online sources.

Table 2. Infrastructure development plans and amount of development costs in Bali.

No	Types of infrastructure			Investment value (Billion Rp)	Location (Regency/City)	Quantity	unit
1	Development of Religious and Cultural Infrastructure	1.1	Construction of Protection of the Sacred Area of Pura Agung Besakih Temple	900	Karangasem	6800	Ha
		1.2	Development of the Bali Cultural Center Area (PKB)	2500	Klungkung	334	Ha
2	Development of Transportation Facilities; Construction of Sports Facilities; Development and Revitalization of Traditional Markets; Development of River Flood Control	2.1	Construction of the Singaraja-Mengwitani Shortcut Road	968.26	Buleleng–Badung	12.79	km
		2.2	Construction of the Sanur Triangle Port in Denpasar, Sampalan in Nusa Penida, and Bias Munjul in Nusa Ceningan, Klungkung	560	-	-	-
		-	Sanur Harbor	-	Denpasar	7400	m^2
		-	Sampalan Harbor	-	Klungkung	9000	m^2
		-	Bias Munjul Harbor	-	Klungkung	4920	m^2
		2.3	Development of Benoa Harbor into Bali Maritime Tourism Hub, Denpasar	6100	Denpasar	128	Ha
		2.4	Jagat Kerthi Bali Toll Road	24.6	Badung – Jembrana	96.84	km
3	Provision of Raw Water	3.1	Development of Captain I Wayan Dipta Stadium, Gianyar and 4 Support Soccer Fields	171	Gianyar	30000	m^2
4	Pembangunan dan Revitalisasi Pasar Rakyat	4.1	Construction of Sukawati Market Blocks A, B and C	167	Gianyar	19308	m^2
5	Pembangunan Pengendali Banjir Sungai	5.1	Construction of the Tukad Unda Artificial River (Normalization) in the Bali Cultural Center Area	363	Klungkung	230.92	km^2
6	Development of Information and Communication Technology Networks; Development of Religious and Cultural Infrastructure	6.1	Construction of dams to provide clean water	-	-	-	-
		-	Sidan Dam	1735	Badung, Gianyar, Bangli	82.7	Ha
		-	Tamblang Dam	793.8	Buleleng	79	Ha
7	Development of Transportation Facilities	7.1	Construction of Turyapada Tower KBS 6.0	500	Buleleng	115	M
		-	Total	14,782.66	-	-	-

3.2. Input-output analysis of Bali's strategic infrastructure

3.2.1. Backward linkage and forward linkage

Backward linkage or also known as dispersion power shows the magnitude of domestic output produced by all economic sectors which is caused by a 1 unit

increase in final demand from a particular sector. The higher the backward linkage of a sector means the higher the sector's ability to drive economic growth. The higher the dispersion power index (IBlj) of an economic sector, the greater the influence of that sector on the growth of other sectors, which also means that the linkage/dependence of that sector on other sectors is quite large.

Inter-sector linkages can also be seen from the large output produced by a sector as a result of an increase in final demand for all economic sectors. This inter-sector linkage is called forward linkage or the degree of sensitivity of a sector. The degree of sensitivity index (IFL_j) is a measure of the total impact on the output of a sector due to the use of that sector's output by other sectors as input. The higher the degree index value means the higher the sensitivity of the sector due to the growth of other sectors that use that sector for their production processes.

The linkage between sectors can be examined through the IBL_j and IFL_i values. The general rule for determining key sectors in the economy is to require that the IBL_j and IFL_i values must be greater than 1, and the IFL_i value must be greater than the IBL_j value.

Based on the IO Table for Bali Province, the position of each industrial sector (based on 52 industrial sectors) can be mapped into these quadrants. It is hoped that this can become a guideline for the economic development of a region.

Figure 2 shows that there are 10 industries included in quadrant I. The 10 industries in quadrant I have high forward linkage and backward linkage. Furthermore, there are 6 industries included in quadrant II, 20 industries in quadrant III and 16 industries in quadrant IV.

Quadrant II (FL Index >1 and Bl Index <1)	Quadrant I (FL Index >1 and BL Index >1)
I-01 Food Crop Agriculture I-04 Animal Husbandry I-11 Mining and Other Excavations I-32 Trade in Cars, Motorcycles and Their Repairs I-35 Ground Transportation I-43 Financial Intermediary Services Other Than Central Banks	I-17 Wood Industry, Goods from Wood and Cork and Woven Goods from Bamboo, Rattan, etc. I-28 Electricity I-33 Wholesale and Retail Trade, Not Cars and Motorcycles Air Force I-38 I-40 Provision of Accommodations I-41 Provision of Food and Drink I-42 Information and Communication Services I-47 Real Estate I-48 Corporate Services I-52 Other Services
I-02 Agriculture of Horticultural Crops, Annuals, Annual Horticulture, and Others I-03 Annual and Annual Plantations I-05 Agricultural and Hunting Services I-06 Forestry and Logging I-07 Fisheries I-08 Oil, Gas and Geothermal Mining I-09 Coal and Lignite Mining I-10 Metal Ore Mining I-12 Coal Industry and Oil and Gas Refineries I-14 Tobacco Processing Industry I-18 Paper and Paper Products Industry, Printing and Recording Media Reproduction I-20 Rubber Industry, Rubber and Plastic Products I-22 Basic Metal Industry I-23 Metal Goods Industry, Computers, Electronic Goods, Optics and Electrical Equipment I-24 YTDL Machinery and Equipment Industry I-34 Rail Freight I-44 Insurance and Pension Funds I-46 Financial Support Services I-50 Educational Services I-51 Health Services and Social Activities	I-13 Food and Beverage Industry I-15 Textile and Apparel Industry I-16 Leather, Leather Goods and Footwear Industry I-19 Chemical, Pharmaceutical and Traditional Medicine Industries i-21 Non-metallic Galvanized Goods Industry I-25 Transportation Equipment Industry I-26 Furniture Industry I-27 Other Processing Industries, Machinery and Equipment Repair and Installation Services I-29 Water Supply, Waste Management, Waste and Recycling I-31 Construction I-36 Sea Freight I-37 Lake River Transit and Crossing I-39 Warehousing and Transport, Postal and Courier Support Services I-45 Other Financial Services I-49 Government Administration, Defense and Mandatory Social Security
Quadrant III (FL Index <1 and BL Index <1)	Quadrant IV (FL Index <1 and BL Index >1)

Figure 2. Identification of leading industries in Bali province based on Table IO.

3.2.2. Bali construction sector multiplier

Multipliers are used to capture the direct and indirect impact of changes in output due to changes in final demand. In this study, the total effect is used which includes the effect of increasing output from economic sectors which are

components of direct input from the sector concerned (direct effect) and the effect of increasing output from other economic sectors (indirect effect).

The infrastructure development multiplier figures in the Bali Province I-O Table are shown by the construction sector (sector code 31), where it is more clearly known that:

- The output multiplier for the construction sector is 1.2828, meaning that if there is an increase in final demand for the construction sector by IDR 1 million, then output in all economic sectors will increase by IDR 1.282 million.
- The construction sector income multiplier is 0.3065, meaning that if there is an increase in final demand of IDR 1 million in the construction sector, it will increase household income in all economic sectors by IDR 306.5 thousand.
- The gross value added multiplier for the construction sector is 0.6208, meaning that if there is an increase in final demand of IDR 1 million in the construction sector, it will increase the gross value added in all economic sectors by IDR 620.8 thousand.

3.2.3. The impact of the total development of Bali's new era infrastructure on Bali's economic growth

Table 3. Impact of infrastructure development on Bali's economic growth in 10 main sectors (Based on classification of 52 industrial sectors).

No	Code	Sector description	Total of infrastructure			
			Before investment (Billion Rp)	After investment (Billion Rp)	Difference	Growth (%)
1	40	Provision of Accommodation	26,989.29	27,023.88	34.59	0.13
2	31	Construction	16,128.28	31,218.12	15,089.84	93.56
3	41	Provision of Food and Beverages	15,760.62	15,813.39	52.77	0.33
4	33	Wholesale and Retail Trade, Not Cars and Motorbikes	14,333.35	14,426.92	93.57	0.65
5	38	Air Freight	11,515.77	11,558.94	43.17	0.37
6	47	Real Estate	10,986.57	12,201.26	1214.69	11.06
7	42	Information and Communication Services	9959.17	10,004.55	45.38	0.46
8	43	Financial Intermediary Services Other Than Central Banks	8363.51	8549.92	186.41	2.23
9	50	Education Services	8193.06	8284.72	91.65	1.12
10	52	Other Services	7455.17	7576.83	121.66	1.63
		Sub Total	129,684.78	146,658.53	16,973.75	-
		Others	63,141.73	64,886.77	1745.09	-
		Total	192,826.51	211,545.30	18,718.84	9.71
		Growth Average of Sector	-	-	-	19.05

Economic growth is measured by looking at the GDP growth rate. GRDP is defined as the added value (value added) produced by all business units in a certain area, or is the final (net) amount of goods and services produced by the entire economy. Basically, Gross Added Value (NTB) (sector code 2090) in the input output table is Gross Regional Domestic Product (GRDP). GRDP is obtained by adding up sectoral added value with import sales taxes and import duties, so that there are several approaches to calculating, namely: production approach, income

approach and expenditure approach. In the input output table, the size of GRDP according to business field is shown by Gross Added Value (NTB).

The impact of strategic and monumental infrastructure development, symbolizing the New Era of Bali, on the island's economic growth is illustrated in **Table 3**. With an investment plan whose value is the total value of the strategic and monumental infrastructure development project marking the New Era of Bali, namely IDR 14,782.66 billion, it will generate additional GRDP of IDR 18,718.84 billion or in other words GRDP will increase by 9.71% from the condition of no investment. The economic sector that felt the biggest impact of the increase was the construction sector which experienced an increase of 93.56%, followed by the real estate sector of (11.06%). The average growth in the economic sector was 19.05% from the initial condition of no investment.

The impact of infrastructure development on the economy is shown by additional NTB (GRDP) and an increase in economic output. The impact of strategic and monumental infrastructure development marking the New Era of Bali on Bali's economy can be seen in **Table 4**.

Table 4. Impact of infrastructure development on Bali's economic growth in 10 main sectors (Based on classification of 52 industrial sectors).

Types of infrastructure projects			**Amount of Investment (Billion Rp)**	**Additional GVA (Billion Rp)**	**Economic growth (%)**
Development of Religious and Cultural Infrastructure	1.1	Construction of Protection of the Sacred Area of Pura Agung Besakih Temple	900.00	1139.64	0.59
	1.2	Development of the Bali Cultural Center Area (PKB)	2500.00	3165.68	1.64
Development of Transportation Facilities	2.1	Construction of the Singaraja-Mengwitani Shortcut Road	968.26	1226.08	0.64
	2.2	Construction of the Sanur Triangle Port in Denpasar, Sampalan in Nusa Penida, and Bias Munjul in Nusa Ceningan, Klungkung	560.00	709.11	0.37
	2.3	Development of Benoa Harbor into Bali Maritime Tourism Hub, Denpasar	6100.00	7724.25	4.01
	2.4	Jagat Kerthi Bali Toll Road	24.60	31.15	0.02
Construction of Sports Facilities	3.1	Development of Captain I Wayan Dipta Stadium, Gianyar and 4 Support Soccer Fields	171.00	216.53	0.11
Development and Revitalization of Traditional Markets	4.1	Construction of Sukawati Market Blocks A, B and C	167.00	211.47	0.11
Development of River Flood Control	5.1	Construction of the Tukad Unda Artificial River (Normalization) in the Bali Cultural Center Area	363.00	459.66	0.24
Provision of Raw Water	6.1	Construction of dams to provide clean water	-	-	0.00
	-	Sidan Dam	1735.00	2196.98	1.14
	-	Tamblang Dam	793.80	1005.17	0.52
Development of Information and Communication Technology Networks	7.1	Construction of Turyapada Tower KBS 6.0	500.00	633.14	0.33
	-	Total	14,782.66	18,718.84	9.71

Table 4 provides an explanation of the impact of strategic and monumental

infrastructure development marking the New Era of Bali on the Balinese economy. With an investment plan of IDR 14,782.66 billion invested in 12 types of infrastructure projects, it will have an impact on increasing economic growth by 9.71% from the condition without such investment. The largest contribution to economic growth came from the development of Benoa Harbor into the Bali Maritime Tourism Hub (BMTH) at 4.01%, the construction of the Bali Cultural Center at 1.64%, and the construction of the Sidan Dam at 1.14%.

4. Conclusion

The Bali Provincial Government is highly committed to the development of various infrastructure projects, particularly strategic and monumental infrastructure, which serves as a start of the New Era of Bali. Furthermore, prioritizing infrastructure development is essential to increase regional competitiveness. Despite several achievements in Bali's macroeconomic indicators, it is evident that the island's economic goals have to be realized.

There are 12 strategic and monumental infrastructures marking the New Era of Bali planned by the Bali Provincial Government with the support of the Central Government and Regency/City Governments in Bali, with a total value of IDR 14.7 trillion. With investment in strategic and monumental infrastructure marking the New Era of Bali, it will result in additional GRDP of IDR 18.7 trillion, or in other words Bali's GRDP will increase by 9.71% from the condition of no investment. The largest contribution to economic growth came from the development of Benoa Harbor into the Bali Maritime Tourism Hub (BMTH) at 4.01%, the construction of the Bali Cultural Center at 1.64%, and the construction of the Sidan Dam at 1.14%. So, according to statistical analysis, infrastructure development has been proven to have a positive impact on Bali's economy. Further research is necessary to conduct a qualitative analysis of strategic infrastructure development in Bali. It is crucial to focus on the importance of a qualitative approach for in-depth analysis.

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