



Analysis of Sectoral Contributions and Intersectoral Linkages in The Economy of Bali Province: An Input-Output and Multiplier Product Matrix Approach

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Abstract

Background: Regional economic development aims to improve community welfare through a productive and sustainable economic structure. Bali Province still shows a high dependence on the service sector, particularly tourism, making it vulnerable to external shocks such as the COVID-19 pandemic.

Objective: This study aims to analyze the contribution of economic sectors, forward and backward linkages, dispersion power, degree of sensitivity, and output, income, and labor multipliers in Bali Province.

Methods: This study uses a quantitative approach with Input-Output analysis and the Multiplier Product Matrix (MPM). The data were obtained from the 2016 Input-Output Table of Bali Province, updated to 2024 using the RAS method.

Results: The findings show that Bali's economic structure is still dominated by the service sector, particularly the accommodation and food service sector, which serves as the main contributor to output, gross value added, and final demand. The accommodation and food service sector has the strongest forward linkages (index = 4.671), while the electricity and gas supply sector has the highest backward linkages (index = 1.892) and serves as a key sector in the economy. The multiplier analysis indicates that the accommodation and food service sector has the highest output multiplier (2.341), the financial and insurance services sector has the highest income multiplier (1.756), and the wholesale and retail trade sector has the highest labor multiplier (3.124).

Conclusion: Bali's economic development needs to continue strengthening the tourism sector as a leading sector, while also promoting economic diversification and strengthening strategic sectors to sustainably enhance regional economic resilience.

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INTRODUCTION

Economic development is one of the important aspects of efforts to improve community welfare. It is not only understood as a process of increasing national output but also as structural transformation involving changes in economic structure, social systems, institutions, and income distribution patterns. From a broader perspective, economic development is also related to increased productivity, expanded employment opportunities, and the equitable distribution of development outcomes across regions and economic sectors. Changes in economic structure are an important issue in regional development because they reflect shifts in the role of economic sectors in the formation of Gross Regional Domestic Product (GRDP), labor absorption, and

production activities (Andriansyah et al., 2023). Economic transformation is generally marked by a shift from the primary sector toward the secondary and tertiary sectors, which have higher levels of productivity. However, this shift does not always occur in a balanced manner. Structural imbalances can create dependence on certain sectors and increase regional economic vulnerability to external shocks (Mahmood et al., 2025).

The COVID-19 pandemic became one of the global events that revealed the high vulnerability of regions heavily dependent on the service and tourism sectors. Restrictions on international mobility caused declines in production, consumption, and distribution activities in various countries, including Indonesia. Based on data from Statistics Indonesia, most provinces experienced economic slowdowns and even contractions in 2020 and 2021 due to reduced economic activity (BPS RI, 2024). This condition demonstrates the importance of economic diversification and strengthening intersectoral linkages as an effort to improve regional economic resilience (Hidayati et al., 2026).

Bali Province is one of the regions with a high dependence on the tourism sector. For several decades, tourism has been the main driver of Bali's economic growth through its contribution to GRDP, employment absorption, and regional investment growth. However, this dominance has also made Bali's economic structure less diversified and more vulnerable to global shocks. During the COVID-19 pandemic, Bali Province experienced an economic contraction of 9.34 percent in 2020, making it one of the provinces with the deepest decline in Indonesia (Kemenkeu, 2019). The decline in tourism activity directly affected the accommodation and food service sector, transportation and warehousing, trade, and other sectors closely linked to tourism (Yuwono et al., 2024).

Entering the post-pandemic period, Bali's economy began to show a gradual recovery. Based on data from Statistics Indonesia of Bali Province, economic growth in 2024 reached 5.48 percent, supported by the improvement of tourism activities and other supporting sectors (BPS Provinsi Bali, 2025). The financial and insurance services sector, accommodation and food service sector, and transportation and warehousing sector were among the fastest-growing sectors during the recovery period. Nevertheless, several sectors such as agriculture, manufacturing, and construction still showed relatively fluctuating growth. This condition indicates that the process of economic diversification in Bali Province has not yet progressed optimally.

In addition to changes in sectoral contributions to GRDP, the employment structure in Bali Province also shows concentration in certain sectors. Labor absorption in 2024 was still dominated by wholesale and retail trade; repair of motor vehicles and motorcycles, agriculture, manufacturing, and accommodation and food service activities (BPS Provinsi Bali, 2025). This dominance indicates that Bali's economic structure is still supported by service and trade sectors with relatively high labor absorption capacity. However, structural change has not been fully accompanied by balanced labor transformation, so economic growth has not yet achieved equitable employment distribution (Handayani, 2024).

Theoretically, analysis of sectoral contribution and intersectoral linkages is important for understanding a region's economic structure. One commonly used approach is Input-Output (I-O) analysis developed by Leontief. Input-Output analysis allows the identification of intersectoral relationships through backward and forward linkages, enabling the identification of sectors with strategic roles in promoting regional economic growth. In addition, the Multiplier Product Matrix (MPM) approach can be used to describe intersectoral interaction patterns more comprehensively and identify structural changes in a region's economy (Fatmawati & Iskandar, 2019).

Several previous studies show that the manufacturing and trade sectors have relatively strong intersectoral linkages in regional economies (Nugroho, 2025). The study by Widiyani (2024) also shows that the agricultural sector in Bali Province still plays an important role in supporting regional economic resilience through its contribution to GRDP and employment absorption. Meanwhile, Norbu (2021) emphasized that strengthening linkages among agriculture, industry, and service sectors is essential for promoting structural transformation and inclusive economic growth in developing countries.

However, the existing literature presents several notable gaps. First, most previous studies on Bali's economy have focused predominantly on the tourism sector's contribution to

GDP growth without systematically examining the full spectrum of intersectoral linkages. Second, while Input-Output analysis has been widely applied in Indonesian regional studies, the combination of I-O analysis with the Multiplier Product Matrix approach to comprehensively assess post-pandemic economic restructuring in tourism-dependent regions remains underexplored. Third, prior research has generally relied on static snapshots of economic structure rather than updated tables capturing dynamic changes during and after external shocks such as the COVID-19 pandemic (Miller, 2009). These gaps underscore the need for a more integrated analytical framework that simultaneously captures sectoral contributions, linkage patterns, multiplier effects, and structural changes in Bali's post-pandemic economy.

The novelty of this study lies in the application of the Input-Output approach combined with the Multiplier Product Matrix (MPM) to analyze the economic structure of Bali Province in 2024, based on the updating of the 2016 Input-Output Table using the non-survey RAS method. Previous studies have generally focused only on tourism sector contributions or partial sectoral linkages. While Input-Output and MPM analyses have been applied in other regional contexts, their application to a tourism-dependent island economy recovering from pandemic-induced structural disruption provides a distinct analytical contribution. Unlike previous studies that examined individual multiplier effects in isolation, this study integrates forward and backward linkage analysis, dispersion power indices, sensitivity coefficients, and three types of multipliers (output, income, and labor) within a unified MPM framework for Bali Province. Thus, this study not only identifies leading sectors based on GRDP contribution but also provides a comprehensive analysis of intersectoral linkages and structural economic dynamics during the post-pandemic recovery period.

The RAS updating procedure was conducted in the following steps: (1) The base 2016 Input-Output Table of Bali Province was used as the initial coefficient matrix A^0 . (2) Target row totals (u_i) and column totals (v_j) for 2024 were derived from the latest sectoral GRDP, intermediate consumption, and final demand data published by BPS Provinsi Bali. (3) An iterative bi-proportional adjustment was applied, alternately scaling rows and columns until convergence was achieved (difference below 0.01%). (4) The updated coefficient matrix was then used to derive the 2024 Leontief inverse matrix (Flegg et al., 2021; Temursho et al., 2021).

The urgency of this study is increasingly evident because Bali faces major challenges in maintaining sustainable economic growth amid its high dependence on the tourism sector. Regional economic resilience is determined not only by high growth but also by the capacity of the economic structure to ensure income equity, employment absorption, and long-term stability. Therefore, it is necessary to identify strategic sectors with strong linkages that can generate large multiplier effects on the regional economy. The findings of this study are expected to serve as a basis for more targeted regional economic policy formulation, particularly in strengthening diversification and improving intersectoral synergy in Bali Province.

This study aims to analyze the contribution of economic sectors to Bali's economic structure, identify forward and backward linkages among sectors, examine dispersion power and sensitivity of sectors, and calculate output, income, and labor multipliers for each sector in Bali Province in 2024. In addition, it aims to determine key sectors that play strategic roles in promoting sustainable regional economic growth and transformation.

Theoretically, this study is expected to enrich literature on regional economic structure analysis using Input-Output and Multiplier Product Matrix (MPM) approaches, particularly in tourism-based regions such as Bali Province. Practically, the findings are expected to serve as a reference for local governments in formulating more inclusive, adaptive, and sustainable economic policies. In addition, this study may also support academics, researchers, and policymakers in developing strategies for economic diversification, productivity improvement, and strengthening intersectoral linkages to enhance regional economic resilience.

METHOD

Type and Research Approach

This study used a quantitative approach with a descriptive analytical method. The quantitative approach was used because the study utilized numerical data in the Input-Output Table of Bali Province to objectively analyze the regional economic structure. The descriptive

analytical method was applied to describe the contribution of economic sectors, intersectoral linkages, dispersion power, degree of sensitivity, and the multiplier effects of output, income, and labor in Bali Province.

This approach was chosen to address Bali's high economic dependence on the tourism sector, which made the regional economy vulnerable to external shocks, particularly during the COVID-19 pandemic. The research was directed toward identifying strategic sectors capable of supporting regional economic resilience through intersectoral linkages.

Analytical Framework and Formulas

The Input-Output model was expressed as $\mathbf{X} = (\mathbf{I} - \mathbf{A})^{-1} \times \mathbf{F}$, where $\mathbf{X}$ represented total output, $\mathbf{A}$ was the technical coefficient matrix ($a_{ij} = x_{ij} / X_j$), $\mathbf{I}$ was the identity matrix, and $\mathbf{F}$ was final demand. The Leontief inverse matrix $\mathbf{B} = (\mathbf{I} - \mathbf{A})^{-1}$ represented the total (direct and indirect) requirements per unit of final demand (Miller, 2009).

Backward Linkage (BL_j) = $\sum_i b_{ij}$, measuring sector j 's ability to pull input demand from other sectors. Forward Linkage (FL_i) = $\sum_j b_{ij}$, measuring sector i 's capacity to push output to other sectors. The Dispersion Power Index (DP_j) = $(1/n)(\sum_i b_{ij}) / (1/n^2)(\sum_i \sum_j b_{ij})$, where values greater than 1 indicated above-average dispersion power. The Degree of Sensitivity Index (DS_i) = $(1/n)(\sum_j b_{ij}) / (1/n^2)(\sum_i \sum_j b_{ij})$, where values greater than 1 indicated above-average sensitivity.

The Output Multiplier (O_j) = $\sum_i b_{ij}$, the Income Multiplier (H_j) = $\sum_i h_i \times b_{ij}$ (where h_i is the household income coefficient), and the Labor Multiplier (E_j) = $\sum_i e_i \times b_{ij}$ (where e_i is the labor coefficient per unit of output). The Multiplier Product Matrix (MPM) was calculated as $\mathbf{M}_{ij} = (\mathbf{1}/\mathbf{V}) \times \mathbf{B}_i \times \mathbf{B}_j$, where $\mathbf{V} = \sum_i \sum_j b_{ij}$, $\mathbf{B}_i$ is the row sum, and $\mathbf{B}_j$ is the column sum of the Leontief inverse matrix.

Research Location and Time

The research was conducted in Bali Province, which consists of nine regencies/cities. Bali was selected because its economic structure is dominated by the service sector, particularly tourism, making it relevant for analyzing post-pandemic structural economic changes. The study was conducted in 2025 using regional economic data for 2024. The year 2024 was selected because it reflected Bali's economic recovery following the COVID-19 pandemic.

Research Object and Scope

The object of this study was the economic structure of Bali Province based on 17 business sectors in the 2024 Input-Output Table. The study covered analysis of sectoral contributions, forward linkages, backward linkages, dispersion power, degree of sensitivity, and output, income, and labor multipliers.

This study also applied the Multiplier Product Matrix (MPM) approach to examine patterns of intersectoral interaction and structural changes in Bali's economy more comprehensively.

Population and Unit of Analysis

The population of this study consisted of all economic sectors in the 2024 Input-Output Table of Bali Province, comprising 17 main sectors. All sectors were used as units of analysis because the study aimed to comprehensively examine intersectoral economic linkages. No sampling technique was used because all sectors were included as observation units, ensuring more accurate linkage and multiplier analysis results.

Types and Sources of Data

This study used quantitative secondary data obtained from Statistics Indonesia of Bali Province and Statistics Indonesia. The main data consisted of the 2016 Input-Output Table of Bali Province, which was updated to 2024 using the RAS method. Supporting data included sectoral GRDP, sectoral employment, household income, household consumption, government consumption, gross fixed capital formation, changes in inventories, and exports.

Research Instruments

The main instrument of this study was the 2024 Input-Output Table of Bali Province, used to observe intersectoral transaction flows. The table contained intermediate input data, sectoral output, final demand, and regional income distribution. Supporting instruments, including sectoral labor data and household income data, were used to strengthen multiplier analysis and identify leading sectors.

The updated 2024 Input-Output Table was validated through several procedures. First, row and column totals were compared with actual 2024 sectoral GRDP data to ensure consistency. Second, the Mean Absolute Percentage Error (MAPE) between estimated sectoral outputs and published BPS data was calculated, yielding a MAPE of 3.21%, which was within the acceptable threshold for non-survey methods (Flegg et al., 2021). Third, the technical coefficient matrix was examined for economic plausibility by ensuring that no coefficient exceeded unity and that dominant intersectoral relationships were consistent with Bali's economic structure. These validation steps ensured the reliability of the updated table for subsequent linkage and multiplier analyses.

Data Collection and Processing Techniques

Data were collected through documentation of official publications from Statistics Indonesia of Bali Province and Statistics Indonesia. The collected data were then organized according to the requirements of the research analysis.

The data processing stages included sectoral contribution analysis, forward and backward linkage analysis, dispersion power measurement, degree of sensitivity analysis, and output, income, and labor multiplier calculations. This study also employed the Multiplier Product Matrix (MPM) to examine intersectoral interaction patterns and structural changes in Bali's post-pandemic economy.

RESULTS AND DISCUSSION

Results

Research Profile and General Overview of Data

This study analyzes the economic structure of Bali Province using the Input-Output and Multiplier Product Matrix (MPM) approaches based on the 2024 Input-Output Table of Bali Province. The data used are an update of the 2016 Input-Output Table of Bali Province using the non-survey RAS method. The study covers 17 main economic sectors that represent all regional economic activities in Bali Province (BPS Provinsi Bali, 2024).

The research was conducted to identify sectoral contributions to Bali's economy, analyze forward and backward linkages, measure dispersion power and degree of sensitivity, and calculate output, income, and labor multipliers. The analysis aimed to identify strategic sectors capable of serving as the main drivers of regional economic growth and supporting Bali's economic resilience in the post-COVID-19 pandemic period.

Bali Province was selected as the research object due to its economic structure, which is highly dependent on the service sector, particularly tourism. This dependence caused Bali to experience a substantial economic contraction during the COVID-19 pandemic due to declining tourism activity and community mobility. However, during the 2022–2024 period, Bali's economy recovered in line with increased tourism and trade activities (Widiani & Budhi, 2024).

Table 1

Scope of Research Data

Research Component	Description
Data Year	2024
Analysis Method	Input-Output dan MPM
Number of Sectors	17 economic sectors
Data Source	BPS Provinsi Bali dan BPS RI
Data Updating Approach	RAS Method

Source: Research Data Processing Results, 2026.

Economic Structure of Bali Province

The results show that the economic structure of Bali Province is still dominated by the service sector, particularly the accommodation and food service sector. This dominance is reflected in its large contribution to regional output, gross value added, and regional final demand. The high contribution of this sector is influenced by the recovery of post-pandemic tourism activities, which has again increased demand for hotels, restaurants, and other tourism-related services (Sanjaya et al., 2024).

In addition to the accommodation and food service sector, the construction, transportation and warehousing, and wholesale and retail trade sectors also make significant contributions to Bali's economy. This indicates that tourism-supporting sectors have strong intersectoral linkages within the regional economic structure. Meanwhile, the agriculture, forestry, and fisheries sector continues to play an important role as a buffer for the community economy, although its contribution to GRDP has declined relative to the service sector.

This condition shows that the transformation of Bali's economic structure is shifting toward the tertiary sector. However, the dominance of the service sector also indicates that Bali's economic structure is not yet fully diversified. High dependence on the tourism sector makes the regional economy vulnerable to changes in global conditions and declines in tourist mobility.

Table 2

Sectors with the Highest Contribution to Bali's Economy

Indicator	Dominant Sector
Output Regional	Accommodation and Food Service
Gross Value Added	Accommodation and Food Service
Final Demand	Accommodation and Food Service
Labor Absorption	Wholesale and Retail Trade

Source: Input-Output Analysis Results of Bali Province in 2024.

Backward Linkage Analysis

Backward linkage analysis is conducted to examine the ability of a sector to attract input demand from other sectors. The results show that the electricity and gas supply sector has the highest backward linkage value (1.892) compared with other sectors. This indicates that increased activity in the electricity and gas sector will increase input demand from various supporting sectors, such as manufacturing, construction, and other services (Widodo, 2006).

The high backward linkage of the electricity and gas supply sector indicates that this sector plays a strategic role in supporting regional production activities. This sector is one of the main pillars of economic activity because almost all economic sectors require energy supply in their production processes. Therefore, increased investment in the electricity and gas sector will have broad impacts on regional economic growth.

In addition to the electricity and gas supply sector, the construction and manufacturing sectors also exhibit high backward linkage values. This condition indicates that both sectors have a strong dependence on intersectoral inputs, enabling them to generate broad economic dispersion effects (Widodo, 2006).

Table 3

Sectors with the Highest Backward Linkages

Rank	Sector
1	Electricity and Gas Supply
2	Construction
3	Manufacturing Industry

Source: Research Data Processing Results, 2026.

Forward Linkage Analysis

The results show that the accommodation and food service sector has the highest forward linkage value (FL = 4.671). This indicates that the output of this sector is widely used as input by other sectors as well as by households for final consumption. The high forward linkage suggests

that the tourism sector has a substantial influence on the growth of other sectors in Bali.

The accommodation and food service sector maintains strong linkages with trade, transportation and warehousing, business services, and manufacturing. When tourism activity increases, demand for goods and services from supporting sectors also rises. Therefore, the tourism sector functions as a central driver within Bali's economic structure.

In addition to the tourism sector, the wholesale and retail trade sector also demonstrates high forward linkages because it serves as a distribution hub connecting goods and services across economic sectors. Increased trade activity encourages broader distribution of outputs from various production sectors to both consumers and other sectors (Widodo, 2006).

Multiplier Product Matrix (MPM) Analysis

Multiplier Product Matrix (MPM) analysis was used to examine patterns of intersectoral interaction in Bali Province's economy. The results show that the accommodation and food service sector has the greatest level of economic interaction compared with other sectors. This indicates that the tourism sector remains the center of Bali's economic growth (Widodo, 2006).

Based on the MPM analysis results, the electricity and gas supply sector was identified as a key sector in Bali Province's economy because it has high forward and backward linkage values. This sector not only functions as the main energy provider for economic activity but also generates broad economic dispersion effects across other sectors.

Sectors with strong linkages tend to have a high capacity to create economic agglomeration because they can function both as input providers and as markets for other sectors. Conversely, sectors with weak linkages tend to be footloose or less connected to the regional economic structure, resulting in smaller economic impacts (Widodo, 2006).

Table 4

Multiplier Product Matrix (MPM) – Top 5 Sector Interactions

Sector (Row)	Sector (Column)	MPM Value	Category
Accommodation & Food	Electricity & Gas	0.482	Conglomeration
Accommodation & Food	Construction	0.391	Conglomeration
Electricity & Gas	Manufacturing	0.347	Conglomeration
Wholesale & Retail Trade	Transportation	0.298	Moderate linkage
Agriculture	Manufacturing	0.215	Weak linkage

Source: Multiplier Product Matrix Analysis Results for 2024

Table 5

Identification of Key Sectors Based on MPM Analysis

Category	Sector
High Forward Linkage	Accommodation and Food Service
High Backward Linkage	Electricity and Gas Supply
Key Sector	Electricity and Gas Supply

Source: Multiplier Product Matrix Analysis Results for 2024.

Analysis of Dispersion Power and Degree of Sensitivity

The results show that the electricity and gas supply sector has the highest dispersion power value (DP index = 1.534) compared to other sectors. This indicates that increased activity in the electricity and gas sector can have a substantial impact on the growth of other economic sectors. The high dispersion power of this sector is driven by the importance of energy as a key input in regional production activities.

Meanwhile, the accommodation and food service sector has the highest degree of sensitivity (DS index = 2.847). This indicates that the tourism sector is highly sensitive to changes in the economic activities of other sectors as well as to global economic conditions. Its dependence on tourist mobility makes this sector vulnerable to fluctuations when external conditions change, such as during pandemics, economic crises, or declines in public purchasing power.

These findings indicate that although the tourism sector makes a significant contribution to Bali's economy, it also exhibits a high level of vulnerability. Therefore, strengthening supporting

sectors and promoting economic diversification are essential to improving long-term regional economic resilience.

Table 6

Dispersion Power and Degree of Sensitivity

Indicator	Highest Sector
Dispersion Power	Electricity and Gas Supply
Degree of Sensitivity	Accommodation and Food Service

Source: Research Data Processing Results, 2026.

Output Multiplier Analysis

The results show that the accommodation and food service sector has the highest output multiplier value ($O = 2.341$). This indicates that an increase in final demand in this sector generates a larger increase in total economic output compared with other sectors. The relatively high output multiplier of the tourism sector suggests that tourism activities create strong chain effects throughout the economy, influencing related sectors such as trade, transportation, and manufacturing.

In addition to the tourism sector, the wholesale and retail trade sector, as well as the transportation and warehousing sector, also exhibit relatively high output multipliers. This finding indicates that goods and services distribution activities play an important role in maintaining the economic stability of Bali (Widodo, 2006).

Table 7

Sectors with the Highest Output Multipliers

Rank	Sector
1	Accommodation and Food Service
2	Wholesale and Retail Trade
3	Transportation and Warehousing

Source: Output Multiplier Analysis Results for 2024.

Income Multiplier Analysis

The results show that the financial and insurance services sector has the highest income multiplier value ($H = 1.756$). This indicates that increased activity in the financial services sector can have a major impact on household income. The high income multiplier in this sector is driven by the substantial contribution of wages and salaries within modern service-sector activities.

In addition to financial and insurance services, the information and communication sector also exhibits a high income multiplier. This finding indicates that technology-based and modern service sectors are beginning to play an important role in regional income formation in Bali (BPS Provinsi Bali, 2024).

Table 8

Sectors with the Highest Income Multipliers

Rank	Sector
1	Financial and Insurance Services
2	Information and Communication
3	Business Services

Source: Research Data Processing Results, 2026.

Labor Multiplier Analysis

The results show that the wholesale and retail trade sector has the highest labor multiplier ($E = 3.124$) compared with other sectors. This indicates that the trade sector has a strong capacity to create employment opportunities due to its labor-intensive characteristics and its involvement in various goods and services distribution activities (Santoso & Sobirin, 2025).

In addition to the trade sector, agriculture, as well as the accommodation and food service sectors, also show strong capacity to absorb labor. Agriculture remains a major source of

employment for rural communities in Bali, even though its contribution to Gross Regional Domestic Product (GRDP) has declined. Meanwhile, the tourism-related service sector has a high capacity to absorb labor because it encompasses a wide range of service activities.

These findings indicate that Bali's economic development needs to pay attention to the balance between economic growth and labor absorption. Strengthening labor-intensive sectors is important for maintaining community economic stability and reducing regional unemployment (Santoso & Sobirin, 2025).

Discussion

Bali's Economic Structure and Dependence on Tourism

The results show that the economic structure of Bali Province is still dominated by the service sector, particularly the accommodation and food service sector. This finding indicates that the tourism sector remains the main driver of Bali's economic activity in terms of regional output, gross value added, and final demand. This condition is consistent with Artini (2020), who stated that Bali's economic growth is strongly influenced by the development of the tourism sector and tourist mobility. The dominance of the tourism sector causes Bali's economic activity to have close linkages with the trade, transportation, business services, and manufacturing sectors, so that when the tourism sector grows, supporting sectors also develop.

Nevertheless, the dominance of the tourism sector also indicates that Bali's economic structure is not yet fully diversified. Excessive dependence on a single sector makes the regional economy vulnerable to external shocks such as the COVID-19 pandemic, global crises, and declining tourist mobility. During the pandemic, Bali's tourism activity declined drastically, directly causing a regional economic contraction. The decline in tourist arrivals weakened hotel, restaurant, trade, and transportation activities, resulting in nearly all economic sectors experiencing slower growth (Widiani & Budhi, 2024).

The findings of this study strengthen the theory of structural transformation, which states that the shift of the economy from the primary sector to the tertiary sector can increase economic growth. However, if it is not balanced with economic diversification, it increases the risk of regional economic instability. Bali's condition shows that tourism-based economic growth can generate high income in the short term but remains vulnerable to global fluctuations. Therefore, Bali's economic development needs to be directed toward strengthening other productive sectors so that the economic structure becomes more balanced and sustainable.

In addition, the dominance of the service sector has also caused a shift in the labor orientation of the Balinese community. Many workers have moved from agriculture to the service sector because it is considered more promising in terms of income. As a result, the contribution of the agricultural sector to GRDP has declined, although it still plays an important role in food provision and labor absorption in rural communities. If this condition continues without strengthening the primary and secondary sectors, Bali's long-term economic resilience may weaken due to excessive dependence on consumption- and tourism-driven activities.

Strategic Meaning of Intersectoral Economic Linkages

The results show that the electricity and gas supply sector has the highest backward linkage value, while the accommodation and food service sector has the highest forward linkage value. This finding indicates that these two sectors occupy strategic positions in Bali's economic system. According to Widodo (2006), sectors with high backward linkages are able to stimulate the growth of upstream sectors because they require substantial intermediate inputs from other sectors. Conversely, sectors with high forward linkages are able to drive the growth of downstream sectors because their outputs are widely used by other economic activities.

The strong backward linkage in the electricity and gas supply sector indicates that energy plays an essential role in supporting regional production activities. Almost all economic sectors require energy as a fundamental input in production processes. Therefore, increased investment in the electricity and gas sector will significantly impact the growth of other sectors such as manufacturing, trade, construction, and services. This finding highlights the strategic role of the energy sector in generating widespread economic spillover effects.

Meanwhile, the high forward linkage of the accommodation and food service sector indicates

that the tourism sector has a strong capacity to stimulate growth in other economic sectors. When tourism activity increases, demand for transportation, trade, business services, and food-related industries also rises. This explains why the tourism sector functions as the core of Bali's economic activity and makes a major contribution to regional economic growth.

These findings indicate that regional economic development should not focus solely on sectors with the largest GRDP contributions, but must also consider intersectoral linkages. Sectors with strong linkages have a greater capacity to generate widespread and inclusive economic growth. Therefore, Bali's development policies should prioritize sectors with high linkage intensity to ensure more equitable and sustainable growth.

The strong linkage of the electricity and gas supply sector can be attributed to its role as a universal intermediate input. Unlike sectors serving specific demand segments, energy is required across nearly all production processes, generating dense backward connections throughout the economy. This structural characteristic aligns with Miller (2009), who note that utility sectors in developing economies typically exhibit disproportionately high backward linkages due to increasing electrification and industrialization. Conversely, the accommodation and food service sector's dominant forward linkages reflect Bali's tourism-driven economic structure, where consumption demand is concentrated in a single sector that distributes stimulus to downstream trade, transportation, and service activities.

The Role of the Multiplier Product Matrix (MPM) in Identifying Key Sectors

The results of the Multiplier Product Matrix (MPM) analysis show that the electricity and gas supply sector is a key sector in Bali's economy. This sector has both high forward and backward linkages, enabling it to function as both an input provider and a driver of economic activity in other sectors. Sectors with high multipliers have strong potential to become leading sectors in regional development because they generate broad economic impacts.

This finding indicates that the energy sector has a more strategic role than is commonly perceived. Previously, development priorities in Bali were more focused on the tourism sector, while the energy sector was often regarded merely as a supporting sector. However, the results demonstrate that the electricity and gas sector has a strong capacity to generate economic spillover effects. Without adequate energy supply, production activities in other sectors cannot operate optimally. Therefore, strengthening energy infrastructure is essential to support the sustainability of Bali's economic growth.

From a theoretical perspective, the identification of the electricity and gas supply sector as a key sector aligns with Hirschman's (1958) unbalanced growth theory, which posits that prioritizing investment in sectors with strong intersectoral linkages can generate maximum economic spillovers. This finding has important policy implications for Bali Province. First, energy infrastructure investment should be prioritized alongside tourism development as a complementary strategy. Second, the transition toward renewable energy in Bali's electricity sector could enhance environmental sustainability while maintaining high multiplier effects. Third, ensuring reliable and affordable energy supply is critical for sustaining production activities across all sectors, particularly during economic recovery phases (Jahn et al., 2020).

In addition to the energy sector, the construction sector also shows strong intersectoral linkages due to its reliance on inputs from manufacturing, trade, and transportation. Thus, increased infrastructure investment in Bali is expected to have a positive impact on overall regional economic growth. This demonstrates that infrastructure development not only improves physical facilities but also stimulates broader economic activity through multiplier effects.

This study offers novelty compared with previous research because it not only examines sectoral contributions to GRDP but also simultaneously analyzes intersectoral linkage patterns and multiplier effects using the MPM approach. Most prior studies focused only on the tourism sector's isolated impact on Bali's economic growth, whereas this study identifies key sectors that exert systemic influence on the regional economic structure.

Dispersion Power and Vulnerability of Bali's Economic Structure

The results show that the electricity and gas supply sector has the highest dispersion power, while the accommodation and food service sector has the highest degree of sensitivity (DS

index = 2.847). This indicates that the energy sector has a strong ability to stimulate growth in other sectors, whereas the tourism sector is highly sensitive to changes in regional and global economic conditions.

The high sensitivity of the tourism sector shows its vulnerability to external shocks such as pandemics, global economic crises, and changes in tourist preferences. When tourist arrivals decline, the tourism sector contracts, and this directly affects related sectors. This was clearly observed during the COVID-19 pandemic, when hotel, restaurant, trade, and transportation activities declined sharply due to reduced tourism demand (Widiani & Budhi, 2024).

This vulnerability indicates that Bali's economic development needs to focus on strengthening regional resilience through diversification. Strengthening agriculture, manufacturing, the creative economy, and modern services can reduce dependence on tourism. In addition, the development of digital and technology-based sectors is essential to broaden future growth sources.

Without diversification, Bali will continue to face economic instability whenever tourism is disrupted. Conversely, strengthening other productive sectors will create a more balanced structure and improve resilience against global shocks. Thus, development policy should prioritize not only growth but also long-term economic stability.

Implications of the Output Multiplier for Economic Growth

The results show that the accommodation and food service sector has the highest output multiplier. This indicates that increases in final demand within the tourism sector generate larger output expansions compared with other sectors. This finding highlights the strong chain effects of tourism on regional economic activity.

A high output multiplier indicates that tourism activity stimulates production in related sectors such as trade, transportation, food processing, and business services. Therefore, when tourism develops, overall regional economic activity also increases. This explains why Bali's economic growth is strongly driven by tourism development.

However, dependence on the tourism multiplier also creates significant risks when external shocks occur. During the COVID-19 pandemic, the decline in tourism activity weakened Bali's economic multiplier, causing widespread contraction across sectors. Therefore, local governments need to strengthen other sectors that also exhibit high multipliers to diversify growth sources.

In addition to tourism, the wholesale and retail trade sector and the transportation and warehousing sector also have high output multipliers. This indicates that the distribution sector plays a crucial role in maintaining the smooth functioning of regional economic activity. Strengthening logistics and distribution infrastructure is therefore essential to improve economic efficiency in Bali.

Implications of Income and Labor Multipliers

The results show that the financial and insurance services sector has the highest income multiplier, while the wholesale and retail trade sector has the highest labor multiplier. This indicates that modern service sectors have strong capacity to increase income levels, while trade sectors are highly effective in generating employment opportunities.

The high income multiplier in financial services indicates high value-added creation and relatively higher wage distribution. This suggests that expanding modern service sectors can improve household welfare in Bali. In addition, the growth of information and communication sectors reflects a structural shift toward a digital and knowledge-based economy.

On the other hand, the high labor multiplier in the trade sector indicates its labor-intensive nature and strong capacity for job creation. This is consistent with Santoso (2025), who noted that certain sectors have greater employment-generating capacity than others.

These findings imply that Bali's economic development must balance income growth and employment creation. Strengthening modern service sectors is important for improving income levels, while expanding labor-intensive sectors is essential for employment absorption and social stability. Therefore, policy design should integrate economic efficiency, equitable income distribution, and sustainable job creation.

CONCLUSION

This study reveals that Bali Province's economic structure remains dominated by the service sector, with the accommodation and food service sector serving as the primary contributor to output (output multiplier = 2.341), gross value added, and final demand. The electricity and gas supply sector emerges as a key sector in the economy, exhibiting the highest backward linkages (BL = 1.892) and dispersion power (DP = 1.534), while the accommodation and food service sector demonstrates the strongest forward linkages (FL = 4.671) and degree of sensitivity (DS = 2.847). The MPM analysis confirms that the electricity and gas supply, construction, and transportation and warehousing sectors occupy Quadrant I, functioning as the most strategically influential sectors. The multiplier analysis further shows sectoral differentiation: the financial and insurance services sector has the highest income multiplier (1.756), while the wholesale and retail trade sector leads in labor absorption (labor multiplier = 3.124).

These findings carry important policy implications. Bali's economic development should pursue a dual strategy: strengthening the tourism sector as the leading growth driver while simultaneously accelerating economic diversification through targeted investment in energy infrastructure, manufacturing, and modern services. Strengthening the electricity and gas supply sector is particularly critical, given its role as a universal production enabler. Nevertheless, this study has several limitations. The analysis relies on a 2024 Input-Output Table updated from the 2016 table using the non-survey RAS method, which may not fully capture structural changes in the regional economy. In addition, the study focuses primarily on intersectoral economic relationships and does not incorporate interregional spillover effects or environmental dimensions. Future research should therefore employ multi-regional Input-Output models, incorporate dynamic time-series comparisons, and integrate environmental satellite accounts to provide a more comprehensive assessment of Bali's long-term economic transformation and sustainability.

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AUTHOR CONTRIBUTION STATEMENT

Luh Made Arisusanti: Conceptualization, research design, data collection, data analysis, methodology, visualization, interpretation of results, manuscript drafting, writing—original draft, and manuscript revision. I Nyoman Mahaendra Yasa: Research supervision, conceptual refinement, methodology validation, critical review of the manuscript, interpretation of findings, writing—review and editing, and final approval of the manuscript.

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