

LABOR PRODUCTIVITY ANALYSIS IN EAST KALIMANTAN PROVINCE, INDONESIA USING THE MARVIN E. MUNDEL METHOD

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Abstract

Labor productivity is an important indicator for assessing how efficiently a region's human resources are used to generate economic output. East Kalimantan Province, whose economy still relies heavily on the mining sector while gradually transforming amid the relocation of the new national capital, faces the challenge of maintaining alignment between the growth of Gross Regional Domestic Product (GRDP) and labor absorption across sectors and regions. This study aims to measure the level and index of labor productivity in East Kalimantan Province during the 2022-2024 period, examined at the provincial level, across 17 business field categories, and across ten regencies/cities. The data used are secondary data on GRDP at constant prices and the number of workers published by the Badan Pusat Statistik (BPS). Productivity was calculated using the Mundel method, which compares productivity in the measurement period with that of the base period to produce a productivity index. The results show that the labor productivity index of East Kalimantan Province declined from 1.004 in 2023 to 0.992 in 2024. The sharpest decline occurred in the other services category and in Penajam Paser Utara Regency, while the financial and insurance services sector, real estate, and regencies such as Kutai Timur and Kutai Barat recorded an increase in the index. These findings indicate the need for particular attention to sectors and regions experiencing declining productivity so that regional economic growth remains sustainable and competitive.

Keywords: East Kalimantan, GRDP, Labor, Mundel Method, Productivity Index

1. INTRODUCTION

Regional economic growth cannot be separated from the workforce's capacity to convert available resources into productive output. Conceptually, productivity refers to the capability of an economic unit, whether an individual, an organization, or a region, to make efficient use of its resources in generating goods or services. Gross Regional Domestic Product (GRDP) is commonly used as the principal measure of economic growth, yet this figure alone does not fully reveal how efficiently the underlying workforce is being utilized. When GRDP grows faster than the increase in the number of workers, labor productivity can be said to have improved; conversely, an increase in the workforce that is not matched by a proportional rise in output will lower the level of productivity.

East Kalimantan is one of the provinces with the largest economic contribution on the island of Kalimantan, underpinned by mining and quarrying, manufacturing, and construction. In recent years the province has also become the site of the new national capital (Ibu Kota Nusantara/IKN), a development that has driven a shift of economic activity toward the construction and services sectors. Such structural change has the potential to alter the pattern of labor absorption across sectors and regencies/cities, making it essential to closely examine sector- and region-specific labor productivity so that regional development policy can be targeted more precisely.

Efforts to measure the efficiency of labor relative to output have been widely conducted at both the firm and regional levels. Suparno and Hamidah (2019) demonstrated that the Marvin E. Mundel method can be used to identify fluctuations in the productivity of a production unit from one period to the next by comparing the ratio of output to input in a measured period against a base period. A similar approach was applied by Manullang (2020), who combined the Mundel method

with the American Productivity Center (APC) approach to identify work units with low efficiency, and by Andrie et al. (2022), who measured the productivity of an operation-and-maintenance unit at a power plant using the same method. Gunawan et al. (2021) further showed that a Mundel-based productivity index can fluctuate between periods, serving as an early indicator of an imbalance between output and labor input, while Habibah and Herwanto (2022) used a partial-productivity approach for a comparable purpose, namely to identify declining productivity within a production division. At the macro level, Mahfuds and Yuliana (2022) found that inter-provincial labor productivity in Indonesia during 2015-2020 was influenced by structural factors such as the composition of economic sectors and the education level of the workforce, while Amelia et al. (2019) found that government expenditure and education level also contributed to inter-provincial labor productivity. Dirgantara and Santoso (2024), examining all Indonesian provinces over 2000-2022, showed that education and health positively affect labor productivity in the short run, whereas a higher share of non-productive population reduces it, although their study did not extend to a time-based productivity index at the regency/city level. Sari and Oktora (2021) added that the determinants of labor productivity may differ across regions depending on their sectoral structure, indicating that a regency/city level analysis remains necessary in addition to a provincial one.

Despite this body of research, an important empirical gap remains. Previous studies applying the Mundel method have predominantly focused on firms or operational units, whereas macro-level studies of Indonesian labor productivity have generally examined determinants across provinces rather than year-to-year productivity changes within sectors and regencies/cities. Consequently, the existing literature provides limited evidence on how productivity changes are distributed simultaneously across sectors and sub-provincial regions within a rapidly transforming economy. East Kalimantan provides a particularly relevant setting because its economic structure combines resource-based activities with expanding construction and service activities associated with the development of the new national capital. This study contributes to the literature in three ways. First, it extends the application of a productivity-index approach from organizational settings to a regional economy using official GRDP and employment data. Second, it provides a three-level comparison covering the province, 17 business-field categories, and ten regencies/cities. Third, rather than merely reporting aggregate productivity, it identifies the specific sectors and regions in which changes in output and labor absorption became increasingly aligned or misaligned during 2022–2024. Accordingly, this study aims to calculate labor productivity and its year-to-year index in East Kalimantan and to interpret the observed differences across sectors and regions as evidence for more targeted productivity-oriented policy.

2. RESEARCH METHOD

This is a quantitative descriptive study using official secondary data published by the Badan Pusat Statistik (BPS) of East Kalimantan Province for the 2022-2024 period (BPS, 2025). The data collected comprise GRDP at constant prices and the number of workers, each presented at three levels of observation: the province, the 17 business field categories, and the ten regencies/cities of East Kalimantan. The two datasets were matched by year and by unit of observation to support the productivity calculation.

2.1 Calculation of Productivity and the Productivity Index

Productivity was calculated by comparing output (GRDP) with input (the number of workers), as formulated in Equation (1).

$$\text{Productivity} = \text{GRDP} / \text{Number of Workers} \quad (1)$$

The productivity index was subsequently calculated using the Mundel method, which compares productivity in the measured period with productivity in the base period, as shown in Equation (2).

$$\text{Productivity Index} = \text{Productivity in the Measured Period} / \text{Productivity in the Base Period} \quad (2)$$

In this study, 2023 was treated as the measured period relative to a 2022 base period, while 2024 was treated as the measured period relative to a 2023 base period. A unit of observation is classified as productive when its productivity index is greater than or equal to one, and as less productive when the index falls below one.

2.2 Data Analysis

The resulting productivity and productivity-index figures were then analyzed descriptively to identify the business-field categories and regencies/cities that experienced an increase or a decrease in productivity from year to year. Comparisons across units of observation were used to determine which sectors or regions require further attention in efforts to improve labor efficiency in East Kalimantan Province.

3. RESULTS AND DISCUSSION

The results are presented and discussed in four stages. First, changes in GRDP and employment are described to establish the output and labor-input context. Second, the resulting labor-productivity levels are compared across sectors and regencies/cities. Third, the productivity indices are used to identify year-to-year improvements and declines. Finally, the sectoral and regional patterns are interpreted by examining whether changes in employment were matched by changes in economic output and by relating the findings to previous studies.

3.1 Gross Regional Domestic Product (GRDP)

GRDP at constant prices in East Kalimantan Province increased consistently every year during 2022-2024, as presented in Table 1.

Table 1. GRDP at constant prices of East Kalimantan Province, 2022-2024 (IDR million)

Year	2022	2023	2024
GRDP at Constant Prices	506,158,907.310	537,630,006.800	570,824,006.010

When disaggregated into the 17 business field categories, mining and quarrying consistently the largest contribution to GRDP, followed by manufacturing and construction, as shown in Table 2.

Table 2. GRDP at constant prices by 17 business fields in East Kalimantan Province, 2022-2024 (IDR million)

Code	Business Field	2022	2023	2024
A	Agriculture, Forestry, and Fishery	33,712,203.840	34,552,821.970	35,372,742.350
B	Mining and Quarrying	235,975,247.270	248,204,037.480	264,961,057.940
C	Manufacturing	99,643,369.950	104,339,854.380	104,606,598.940
D	Electricity and Gas Supply	337,249.730	391,372.090	455,591.330
E	Water Supply, Waste, and Recycling Management	278,099.110	299,358.750	322,446.660
F	Construction	39,881,289.770	46,190,192.330	52,471,789.060
G	Wholesale and Retail Trade, Car and Motorcycle Repair	30,131,630.110	32,195,960.850	34,955,106.110
H	Transportation and Warehousing	15,273,774.890	16,738,530.270	18,102,734.850
I	Accommodation and Food Service Activities	4,572,467.720	4,924,086.500	5,498,484.280
J	Information and Communication	9,682,239.350	10,348,222.910	11,168,903.580
K	Financial and Insurance Services	8,012,390.880	8,951,755.940	9,551,744.380
L	Real Estate	4,397,856.090	4,590,817.080	4,860,545.850
MN	Business Services	960,337.930	1,024,139.280	1,101,544.790
O	Public Administration, Defense, and Social Security	8,727,045.190	9,427,892.160	10,977,839.020
P	Education Services	7,679,667.320	8,051,038.580	8,482,454.300
Q	Health and Social Work Activities	4,042,804.050	4,321,486.230	4,535,653.650
RSTU	Other Services	2,851,225.110	3,078,440.000	3,398,769.150

At the regency/city level, Kutai Kartanegara and Kutai Timur recorded the highest GRDP, while Mahakam Ulu recorded the smallest GRDP throughout the observation period, as presented in Table 3.

Table 3. GRDP at constant prices by regency/city in East Kalimantan Province, 2022-2024 (IDR million)

No	Regency/City	2022	2023	2024
1	Samarinda	49,349,590	53,604,330	58,247,250
2	Balikpapan	91,142,160	97,060,150	100,191,740
3	Bontang	40,930,980	42,633,630	41,563,910
4	Kutai Kartanegara	128,798,430	135,406,050	143,009,770
5	Kutai Timur	97,173,420	104,663,190	114,943,000
6	Kutai Barat	22,536,420	23,848,650	25,654,270
7	Berau	29,940,840	31,570,050	33,868,490
8	Penajam Paser Utara	7,433,570	9,619,210	12,570,190
9	Paser	36,985,150	37,493,830	38,909,100
10	Mahakam Ulu	1,802,460	1,852,960	1,919,650
East Kalimantan		506,093,020	537,752,050	570,877,370

3.2 Number of Workers

The number of workers in East Kalimantan Province increased every year during 2022-2024, as presented in Table 4.

Table 4. Number of workers in East Kalimantan Province, 2022-2024 (persons)

Year	2022	2023	2024
Number of Workers	1,746.920	1,847.295	1,976.447

By business field, wholesale and retail trade together with agriculture, forestry, and fishery absorbed the largest number of workers, whereas electricity and gas supply absorbed the fewest, as presented in Table 5.

Table 5. Number of workers by 17 business fields in East Kalimantan Province, 2022-2024 (persons)

Code	Business Field	2022	2023	2024
A	Agriculture, Forestry, and Fishery	349,451	354,868	352,381
B	Mining and Quarrying	130,564	154,128	168,391
C	Manufacturing	131,400	124,353	138,773
D	Electricity and Gas Supply	7,544	6,290	7,166
E	Water Supply, Waste, and Recycling Management	9,333	7,291	8,367
F	Construction	105,395	118,658	147,736
G	Wholesale and Retail Trade, Car and Motorcycle Repair	350,429	364,685	383,988
H	Transportation and Warehousing	104,347	112,540	126,036
I	Accommodation and Food Service Activities	132,798	148,164	163,467
J	Information and Communication	10,973	10,466	13,651
K	Financial and Insurance Services	20,760	24,282	21,604
L	Real Estate	8,776	12,966	12,898
MN	Business Services	55,065	71,738	64,380
O	Public Administration, Defense, and Social Security	111,964	113,037	121,846
P	Education Services	100,599	65,486	118,148
Q	Health and Social Work Activities	42,318	27,319	40,837
RSTU	Other Services	75,204	40,114	86,778

At the regency/city level, Samarinda City and Kutai Kartanegara had the largest number of workers, while Mahakam Ulu had the fewest, as presented in Table 6.

Table 6. Number of workers by regency/city in East Kalimantan Province, 2022-2024 (persons)

No	Regency/City	2022	2023	2024
1	Samarinda	395,479	403,138	409,833
2	Balikpapan	306,793	322,469	343,968
3	Bontang	91,408	87,575	87,299
4	Kutai Kartanegara	356,841	356,298	376,150
5	Kutai Timur	190,015	216,253	223,226
6	Kutai Barat	76,242	90,163	91,606
7	Berau	108,163	123,154	126,670
8	Penajam Paser Utara	80,915	100,497	157,112
9	Paser	127,206	128,571	142,747
10	Mahakam Ulu	13,858	19,177	17,836
East Kalimantan		1,746,920	1,847,295	1,976,447

3.3 Labor Productivity

The result of Equation (1) shows that labor productivity in East Kalimantan Province remained relatively stable, in the range of IDR 288-291 million per worker per year during 2022-2024, peaking in 2023, as shown in Table 7.

Table 7. Labor productivity in East Kalimantan Province, 2022-2024 (IDR million/worker)

Year	2022	2023	2024
Labor Productivity	289.744	291.036	288.813

By business field, mining and quarrying recorded productivity far above the other sectors owing to its capital-intensive nature, generating high value added with a comparatively smaller workforce relative to its output, while business services recorded the lowest productivity, as shown in Table 8.

Table 8. Labor productivity by 17 business fields in East Kalimantan Province, 2022-2024 (IDR million/worker)

Code	Business Field	2022	2023	2024
A	Agriculture, Forestry, and Fishery	96.472	97.368	100.382
B	Mining and Quarrying	1,807.353	1,610.376	1,573.487
C	Manufacturing	758.321	839.062	753.796
D	Electricity and Gas Supply	44.704	62.221	63.577
E	Water Supply, Waste, and Recycling Management	29.797	41.059	38.538
F	Construction	378.398	389.272	355.173
G	Wholesale and Retail Trade, Car and Motorcycle Repair	85.985	88.284	91.032
H	Transportation and Warehousing	146.375	148.734	143.631
I	Accommodation and Food Service Activities	34.432	33.234	33.637
J	Information and Communication	882.369	988.747	818.175
K	Financial and Insurance Services	385.953	368.658	442.129
L	Real Estate	501.123	354.066	376.845
MN	Business Services	17.440	14.276	17.110
O	Public Administration, Defense, and Social Security	77.945	83.405	90.096
P	Education Services	76.339	122.943	71.795
Q	Health and Social Work Activities	95.534	158.186	111.067
RSTU	Other Services	37.913	76.742	39.166

At the regency/city level, Kutai Timur and Bontang consistently recorded the highest labor productivity, while Penajam Paser Utara and Samarinda ranked lowest, as shown in Table 9.

Table 9. Labor productivity by regency/city in East Kalimantan Province, 2022-2024 (IDR million/worker)

No	Regency/City	2022	2023	2024
1	Samarinda	124.784	132.968	142.124
2	Balikpapan	297.080	300.991	291.282
3	Bontang	447.783	486.824	476.110
4	Kutai Kartanegara	360.941	380.036	380.193
5	Kutai Timur	511.399	483.985	514.918
6	Kutai Barat	295.591	264.506	280.050
7	Berau	276.812	256.346	267.376
8	Penajam Paser Utara	91.869	95.716	80.008
9	Paser	290.750	291.620	272.574
10	Mahakam Ulu	130.066	96.624	107.628
East Kalimantan		289.706	291.102	288.840

3.4 Productivity Index

At the provincial level, the productivity index increased slightly from the 2022 base year to 1.004 in 2023, before declining to 0.992 in 2024. The 2024 value means that average output generated per worker was approximately 0.8% lower than in 2023. This decline occurred even though provincial GRDP continued to increase, because the number of workers increased more rapidly relative to output per worker. Thus, the result does not indicate an absolute contraction of the East Kalimantan economy; rather, it indicates a weakening in the efficiency with which additional labor was translated into additional output. This distinction is important because GRDP growth alone may mask a deterioration in labor productivity.

Table 10. Labor productivity index of East Kalimantan Province, 2023 and 2024

Year	2023	2024	Growth
Labor Productivity Index	1.004	0.992	-0.012

The sectoral results reveal that the provincial average conceals substantial differences among business fields. Nine of the 17 categories recorded an index below one in 2024. The largest deterioration occurred in other services, followed by education services and health and social work activities. These results indicate that, in these categories, the change in employment between 2023 and 2024 was not accompanied by a proportional increase in real output. For example, other services experienced a sharp increase in employment from 40,114 to 86,778 persons, whereas its GRDP increased from IDR 3,078,440 million to IDR 3,398,769 million. The resulting output per worker therefore fell substantially, producing an index of 0.510. A similar mechanism can be observed in education services and health and social work activities, where the increase in the workforce was considerably larger than the corresponding increase in output per worker.

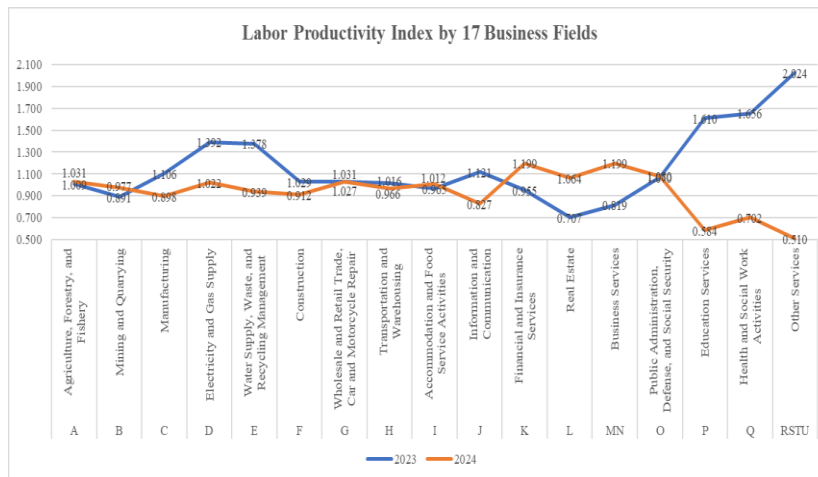
In contrast, financial and insurance services, real estate, and business services recorded clear improvements in 2024. In these categories, productivity increased because output growth was achieved with a relatively stable or smaller workforce. Financial and insurance services, for instance, increased its GRDP while employment declined from 24,282 to 21,604 persons, resulting in an index of 1.199. These contrasting patterns demonstrate that sectoral productivity cannot be inferred from output growth alone. The relationship between output and labor absorption must be considered simultaneously, which is precisely the information provided by the productivity index.

Table 11. Labor productivity index by 17 business fields in East Kalimantan Province, 2023 and 2024

Code	Business Field	2023	2024	Growth
A	Agriculture, Forestry, and Fishery	1.009	1.031	0.022
B	Mining and Quarrying	0.891	0.977	0.086
C	Manufacturing	1.106	0.898	-0.208

Table 11. Labor productivity index by 17 business fields in East Kalimantan Province, 2023 and 2024

Code	Business Field	2023	2024	Growth
D	Electricity and Gas Supply	1.392	1.022	-0.370
E	Water Supply, Waste, and Recycling Management	1.378	0.939	-0.439
F	Construction	1.029	0.912	-0.116
G	Wholesale and Retail Trade, Car and Motorcycle Repair	1.027	1.031	0.004
H	Transportation and Warehousing	1.016	0.966	-0.050
I	Accommodation and Food Service Activities	0.965	1.012	0.047
J	Information and Communication	1.121	0.827	-0.293
K	Financial and Insurance Services	0.955	1.199	0.244
L	Real Estate	0.707	1.064	0.358
MN	Business Services	0.819	1.199	0.380
O	Public Administration, Defense, and Social Security	1.070	1.080	0.010
P	Education Services	1.610	0.584	-1.027
Q	Health and Social Work Activities	1.656	0.702	-0.954
RSTU	Other Services	2.024	0.510	-1.514



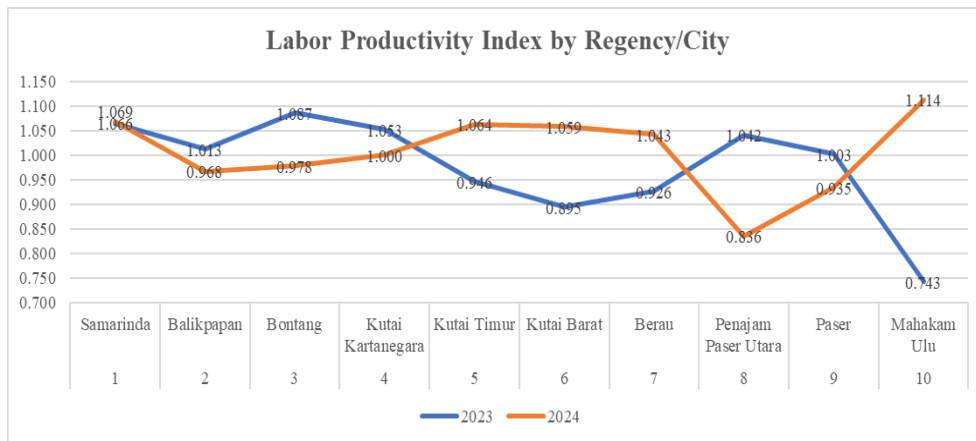
Picture 1. Labor productivity index by 17 business fields in East Kalimantan Province, 2023 and 2024

The regional results also show considerable heterogeneity. Penajam Paser Utara recorded the largest decline in 2024, with its productivity index falling to 0.836. The result can be understood from the relationship between rapid labor absorption and output growth: employment increased from 100,497 to 157,112 persons, while GRDP increased from IDR 9,619,210 million to IDR 12,570,190 million. Although both variables increased, output per worker declined because the expansion of employment was proportionally greater. This pattern is particularly relevant for a region experiencing major economic transformation, because rapid job creation does not automatically translate into higher labor productivity.

By contrast, Mahakam Ulu recorded the largest improvement, reaching an index of 1.114, followed by Kutai Barat and Kutai Timur. In these regions, the relationship between output and employment developed more favorably in 2024 than in the preceding year. Kutai Timur, for example, combined substantial GRDP growth with a more moderate increase in employment, allowing output per worker to rise. The comparison between Penajam Paser Utara and Kutai Timur therefore illustrates the central empirical finding of this study: regional economic expansion can generate very different productivity outcomes depending on how labor absorption evolves relative to output growth.

Table 12. Labor productivity index by regency/city in East Kalimantan Province, 2023 and 2024

No	Regency/City	2023	2024	Growth
1	Samarinda	1.066	1.069	0.003
2	Balikpapan	1.013	0.968	-0.045
3	Bontang	1.087	0.978	-0.109
4	Kutai Kartanegara	1.053	1.000	-0.052
5	Kutai Timur	0.946	1.064	0.118
6	Kutai Barat	0.895	1.059	0.164
7	Berau	0.926	1.043	0.117
8	Penajam Paser Utara	1.042	0.836	-0.206
9	Paser	1.003	0.935	-0.068
10	Mahakam Ulu	0.743	1.114	0.371
East Kalimantan		1.005	0.992	-0.013



Picture 2. Labor productivity index by regency/city in East Kalimantan Province, 2023 and 2024

Overall, the findings show that productivity changes in East Kalimantan were not uniform across sectors or regions. The provincial decline in 2024 was driven by a combination of contrasting sectoral and regional dynamics rather than by a common downward trend. This result is consistent with Sari and Oktora (2021), who emphasized that productivity is shaped by differences in regional and sectoral structures, and with Mahfuds and Yuliana (2022), who highlighted the importance of the relationship between labor-related factors and productivity. The present study adds a descriptive time-based perspective by showing where, within one province, changes in labor absorption were or were not accompanied by proportional changes in output.

From a policy perspective, the results should not be interpreted as evidence that employment growth itself is undesirable. Instead, those suggest that employment expansion should be accompanied by sufficient increases in value added. For sectors with declining indices, particularly other services, education, and health and social work, further investigation is needed to determine whether the decline reflects temporary labor-market adjustment, changes in employment classification, or more persistent inefficiencies. Similarly, the result for Penajam Paser Utara suggests that rapid structural transformation should be monitored not only through the number of jobs created but also through the productivity of those jobs. Conversely, sectors and regions with improving indices may provide useful cases for examining how output growth can be achieved without a disproportionate increase in labor input.

4. CONCLUSION

This study analyzed labor productivity in East Kalimantan Province during 2022–2024 using GRDP at constant prices and employment data, with year-to-year changes expressed through a productivity index based on the Marvin E. Mundel approach. The results show that the provincial productivity index increased slightly to 1.004 in 2023 but declined to 0.992 in 2024. Thus, although the provincial economy continued to grow in absolute terms, output per worker declined in 2024 because employment growth was not matched proportionally by output growth.

The sectoral analysis revealed substantial variation behind the provincial average. Nine of the 17 business-field categories recorded an index below one in 2024, with other services showing the lowest index (0.510), followed by education services and health and social work activities. In contrast, financial and insurance services, real estate, and business services showed improved productivity. At the regency/city level, Penajam Paser Utara recorded the lowest 2024 index (0.836) and the largest decline, whereas Mahakam Ulu recorded the largest improvement. These findings demonstrate the contribution of the study: a simultaneous productivity map at the provincial, sectoral, and regency/city levels that identifies where economic output and labor absorption became more or less aligned during a period of regional structural change.

5. Study Limitation and Recommendations

The findings should be interpreted subject to several limitations. First, the analysis uses aggregate secondary data, so it cannot identify firm-level, occupational, technological, educational, or institutional factors that may explain changes in productivity. Second, the Mundel-based index captures relative year-to-year changes and should not be interpreted as a complete measure of economic efficiency or causal performance. Third, the observation period is limited to 2022–2024; therefore, the results may reflect short-term adjustment rather than long-run productivity trends. Fourth, differences in sectoral and regional productivity may also be influenced by the structure and classification of employment and GRDP data, which cannot be fully examined using the available aggregate dataset.

Future research should extend the observation period and combine the present descriptive mapping with explanatory approaches, such as panel-data analysis, firm-level productivity analysis, or surveys of employers and workers. Such research could identify the specific factors underlying the observed misalignment between output growth and labor absorption. For policymakers, the present findings suggest that employment creation should be evaluated together with changes in value added per worker, particularly in sectors and regions where rapid labor absorption has been accompanied by declining productivity.

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