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Industrialization Paradox: Manufacturing Growth and Women's Financial Independence in NTT

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ABSTRACT
This study examines whether manufacturing growth in East Nusa Tenggara (NTT) Province, Indonesia, translates into greater financial independence for women, particularly women who weave ikat cloth. This study is motivated by the observation that NTT's manufacturing GRDP continues to grow while women weavers remain dispersed, informal, and disconnected from that growth. To the best of the author's knowledge, this relationship has received limited attention in NTT, and whether women's own labor force participation reliably improves their financial wellbeing has not previously been tested against common annual shocks; prior quantitative work operates mainly at the cross-country or national level, while NTT-specific evidence on ikat weaving remains qualitative. This study contributes region-specific empirical evidence by testing the industrialization paradox using a panel approach that extends beyond a standard one-way fixed-effects model to a two-way specification controlling for region and year effects. Using panel data from 21 regencies and 1 city in NTT over 2019-2023, this study estimates the relationship between manufacturing GRDP growth, female labor force participation, micro and small enterprises, and gender development and women's per capita expenditure, used as a proxy for financial independence. Once common annual shocks are accounted for, none of these factors, including women's own labor force participation, retains a meaningful association with their financial independence. This points to a deeper industrialization paradox in NTT, where women weavers' wellbeing appears to be shaped by informal, household-level, and shock-driven dynamics that standard indicators fail to capture, with implications for designing more targeted, weaving-specific interventions rather than relying on aggregate industrial growth alone.

Keywords*: development economics, industrialization paradox, ikat weaving, women's financial independence, panel data regression*

INTRODUCTION

In the development economics literature, a clear distinction exists between economic growth and economic development. Drawing on Amartya Sen's capability approach as outlined in Economic Development (Todaro & Smith, 2011), economic growth cannot be viewed as an end in itself, but rather as a means to expand the quality of life and freedoms enjoyed by people. This view aligns with Dudley Seers' argument in the same book, which asserts that even a doubling of per-capita income cannot be called development if poverty, inequality, and unemployment worsen (Todaro & Smith, 2011). The phenomenon whereby economic growth does not automatically translate into improved welfare for vulnerable groups is not new in the empirical literature; a study in India, for instance, found that rising women's education attainment has in fact coincided with a decline in their labor force participation, a paradox showing that macro

indicators such as growth and education do not automatically translate into real economic engagement for women (Chatterjee, Sonalde, & Vanneman, 2018).

Similarly, cross-country evidence shows that macroeconomic gains from closing gender gaps materialize only when growth is accompanied by deliberate institutional reform rather than assumed automatically (IMF, 2017), and studies on land inheritance rights find that gendered barriers to asset ownership can keep women locked out of paid non-agricultural work even amid economic growth (Kocabıçak & Dildar, 2025).

This theoretical framework becomes highly relevant when examined in the economic context of East Nusa Tenggara (NTT) Province, which is administratively divided into 21 regencies and 1 city. In many NTT households, women hold the status of homemakers (IRT) whose domestic work managing the household, children, and daily family needs carries no wage value. To cover the family's economic needs, women then rely on additional activities outside this domestic work, one of the most distinctive and culturally rooted of which in NTT is traditional ikat weaving. Weaving a single ikat cloth by traditional methods can take 3 to 6 months, depending on the complexity of the motif and the natural dyeing techniques used. This activity is one of the primary channels through which NTT women seek supplementary household income, as found among women weavers in Nggorea (Sulaiman & Anita, 2020), on the Sumba plateau (Dewi, Ayunda, Andalas, & Lede, 2024), and in Sikka Maumere, Flores, where weaving shifted from a purely traditional practice in the 1960s to a significant income-generating activity by the 1970s onward, with earnings used to build houses and finance children's schooling, and where women make up the large majority of the weaving workforce (Dentis, 2024)

However, weaving activity is fundamentally embedded in the informal sector, which is generally characterized by vulnerable employment status, minimal social protection, and unstable income (Soputan & Kerebungu, 2020). Studies on women's home-based industries in East Java further show that without adequate marketing networks and access to capital, women's economic potential in home-based enterprises struggles to grow beyond a subsistence scale (Susanti & Mas'udah, 2017). Related evidence on Indonesian women traders in the informal sector similarly finds that the amount of working capital and labor employed, rather than mere participation in a business, is what determines their income (Asakdiyah, 2015). At the national level, research shows that women's economic empowerment is positively correlated with regional GRDP. However, women still face structural barriers, low levels of formal job skills, limited education, and socio-cultural obstacles that push them more heavily into the informal sector than men (Firmansyah & Sihaloho, 2021). A recent ethnographic study of women weavers in Bomari Village, Ngada Regency, similarly finds that women turn to weaving both for internal reasons, such as preserving ancestral heritage and helping their husbands meet daily needs, and for external reasons, including scarce rural job opportunities, education levels that do not meet formal labor market requirements, and plantation income that is insufficient to cover household expenses (Suwito & Aliffiati, 2025).

This phenomenon gives rise to a fundamental economic paradox in NTT: on one hand, the province's manufacturing industry GRDP continues to record aggregate growth, yet this growth tends to be spatially concentrated in regions with a larger existing industrial base such as Kupang City, consistent with the general pattern found in studies of manufacturing GRDP growth across

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Indonesian regions, which show that manufacturing sector growth is spatially interdependent and tends to cluster rather than spread evenly (Azis, et al., 2026). Meanwhile, NTT itself remains one of the provinces with the highest poverty rates in Indonesia, with persistent inter-regional development inequality remaining an unresolved structural challenge (Nalle, Sengkoen, Seran, & Aulia, 2023). On the other hand, women weavers across the other 21 regencies of NTT run their enterprises independently and in a dispersed manner, without access to a market integrated with this industrial growth center.

Based on the foregoing, this study aims to empirically evaluate whether manufacturing GRDP growth in NTT Province contributes to improved women's financial independence, while also accounting for the role of women's FLFPR, the development of the number of micro and small enterprises (including home-based weaving and craft businesses), and the Gender Development Index as control variables. Using a panel data regression approach at the regency/city level for the 2019–2023 period, this study seeks to unpack further why the extensive participation of women in NTT's informal economic sector, particularly ikat weaving, does not necessarily correspond with aggregate industrial growth achievements, a phenomenon referred to in this study as the industrialization paradox.

This study offers novelty on three fronts. First, to the best of the author's knowledge, no prior study has quantitatively tested the relationship between manufacturing GRDP growth and women's financial independence using regency/city-level panel data specifically within NTT; existing quantitative evidence on women's economic rights and growth operates at a broader geographic scale. For example, one study uses cross-country panel data (Naveed, Ahmad, Nas, & Zhuparova, 2023), while another uses panel data from all 34 provinces of Indonesia between 2014 and 2018 (Firmansyah & Sihaloho, 2021). This study bridges that gap by quantitatively testing, at the sub-provincial scale, a relationship that prior work has only described qualitatively. Second, this study explicitly grounds a macroeconomic panel model in the specific, culturally embedded livelihood of ikat weaving, rather than treating NTT women's informal economic activity as an undifferentiated category, allowing the statistical results to be interpreted against the concrete realities of a 3-6-month production cycle and a home-based, family-labor production structure. Third, methodologically, this study goes beyond a standard one-way Fixed Effect Model by testing and adopting a two-way specification that controls for common annual shocks; this reveals that even Female Labor Force Participation Rate, the variable most often assumed to benefit from women's own agency directly, does not retain a robust association with women's expenditure once shocks such as the COVID-19 pandemic are accounted for a nuance that cross-country or single-period studies in the existing literature are not designed to detect.

RESEARCH METHODS

This study uses panel data combining time-series and cross-sectional data from 21 regencies and 1 city in East Nusa Tenggara Province. The primary data on GRDP by industry and other macroeconomic indicators were obtained from the official publications of the NTT Provincial Statistics Agency (BPS).

The study is limited to 2019-2023, as data on the Number of Micro and Small Industrial Enterprises by Regency/City from BPS NTT Province were not yet available for 2024 when this research was conducted. This restriction was

applied so that all variables share the same year coverage (a balanced panel), resulting in a total of N=110 observations (22 regions × 5 years). To analyze the determinants of welfare in elastic terms, this study employs a double-log model, in which the dependent variable and several key independent variables are taken in natural logarithms (Ln), allowing the regression coefficients to be interpreted directly as elasticities (Gujarati, 2003).
The mathematical model used is as follows:

$$ln(Women's_Expenditure)_{it} = \beta_0 + \beta_1 ln(Manufacturing_GRDP)_{it} + \beta_2(FLFPR)_{it} + \beta_3 ln(MSE)_{it} + \beta_4(GDI)_{it} + u_{it} \ldots\ldots\ldots 1)$$

The Ln_MSE variable covers the number of micro and small industrial enterprises in each regency/city, including women-based home weaving and craft businesses, the central focus of this study. The best estimation model among the Common Effect Model (Pooled OLS), Fixed Effect Model (FEM), and Random Effect Model (REM) was selected through the Chow and Hausman test. A multicollinearity test (VIF) was also conducted to confirm that no high correlation exists among the independent variables.

Table 1. The Summary Statistic of each Variable

Variable	Definition	Unit
Ln_Expenditure	Natural Logarithm of average per capita women's expenditure (proxy for financial independence)	IDR (Ln)
Ln_GRDP	Natural Logarithm of Manufacturing Industry GRDP	IDR Million (Ln)
FLFPR	Female Labor Force Participation Rate	Percent (%)
Ln_MSE	Natural Logarithm of the number of micro and small industrial enterprises	Unit (Ln)
GDI	Gender Development Index	Percent (0–100)

Source: Badan Pusat Statistik (BPS)

Average per-capita women's expenditure is used in this study as the proxy for women's financial independence for three main reasons. First, expenditure reflects realized purchasing power and material living standards that a household or individual can actually command and consume rather than nominal income, which is a standard justification for using expenditure-based welfare measures in Indonesian regional economic analysis, particularly where income is difficult to observe directly. Second, this proxy is especially appropriate for the population at the center of this study: women engaged in informal, home-based weaving work typically receive irregular, cash-based, and undocumented earnings that are difficult to isolate from overall household income through standard labor force surveys, whereas expenditure data captures the downstream welfare outcome of that income regardless of its source or regularity. Third, using expenditure rather than income avoids the risk of conflating a woman's labor market status (already captured separately by the FLFPR variable in this model) with her financial wellbeing, allowing the model to test whether labor force participation actually translates into improved material welfare rather than assuming the two are equivalent by construction.

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An initial one-way (entity) Fixed Effect Model, controlling only for time-invariant differences across regions, was first estimated as a baseline. However, because the 2019-2023 period includes the COVID-19 pandemic shock, which affected all regions simultaneously (as reflected in Figure 1), a two-way FEM incorporating both region and year fixed effects was adopted as the final model of this study, to account for common annual shocks that a one-way specification would otherwise leave uncontrolled. The joint significance of the year fixed effects was formally tested via an F-test comparing the one-way and two-way specifications. In addition, a Breusch-Pagan test was conducted to check for heteroskedasticity, and a Wooldridge test for serial correlation in panel data was conducted to check for first-order autocorrelation in the idiosyncratic errors.

RESULT AND DISCUSSION

GRDP and Women's Expenditure Trend

Figure 1 presents the index trend of manufacturing industry GRDP and women's expenditure in NTT during 2019- 2023 (2019=100). The two indices do not always move together: in 2020-2021, the women's expenditure index rose sharply even as the manufacturing GRDP index remained below its 2019 level due to the pandemic, before converging again by 2023. This asynchronous pattern is an early indication of the industrialization paradox, suggesting that NTT women's income sources, including weaving, are not fully dependent on the dynamics of the formal manufacturing industry.

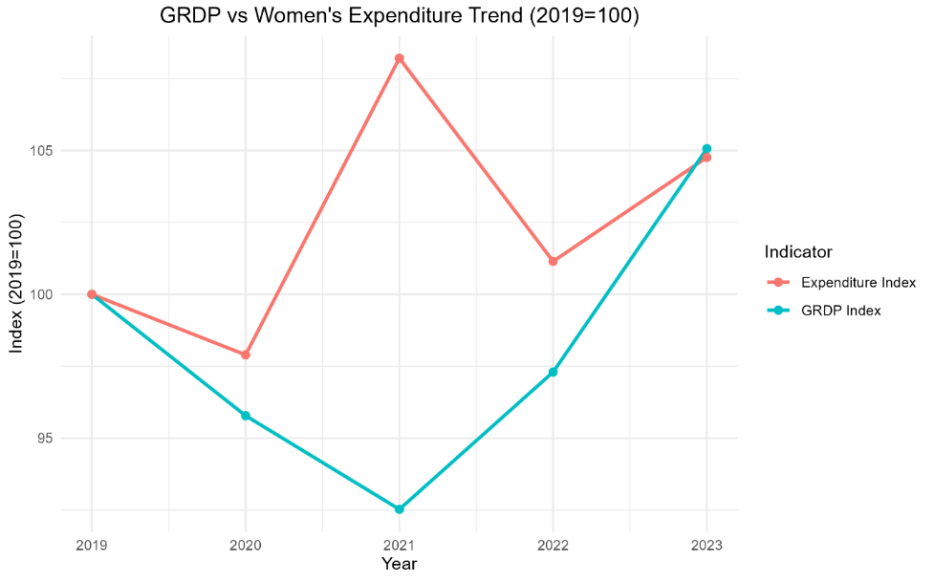


Figure 1. Trend of Manufacturing GRDP Index VS Women's Expenditure Index NTT, 2019=100
(Source: BPS NTT Province, processed)

Descriptive Statistics

Table 2 presents the descriptive statistics of all variables used in this study over 2019-2023.

Table 2. Operational Definition of Variables

Variable	N	Mean	Std. Dev	Min	Max
FLFPR (%)	110	65.19	7.18	45.35	78.30
GDI	110	92.73	3.76	84.08	99.04
No of Micro & Small Enterprises	110	6,601.31	5,614.36	654	31,209
Women's Expenditure (IDR)	110	7,055.17	1,878.70	4,456	13,218
Manufacturing GRDP (IDR Million)	110	40,252.33	51,250.73	2,362.80	274,608.90

Source: Panel Data 2019-2023, processed

Model Selection

The Chow test yields an F-value of 29.14 (df1=21, df2=84) with < 0.001, indicating that the Fixed Effect Model (FEM) is preferred over Pooled OLS. The Hausman test further produces a χ^2 value of 11.164 (df=4) with p=0.025, indicating that FEM is also more appropriate than the Random Effect Model (REM). Both tests support a Fixed Effect specification over Pooled OLS or REM.

Table 3. Model Selection Test Results

Test	Statistic	p-value	Conclusion
Chow (Pooled vs FEM)	F = 29.14 (df1=21, df2=84)	< 0.001	FEM is preferred over pooled OLS
Hausman (FEM vs REM)	$\chi^2 = 11.164$ (df=4)	0.025	FEM is more appropriate than REM

Source: R Studio output, processed

The multicollinearity test (VIF) shows all values well below the 5 threshold, indicating no serious multicollinearity among the independent variables.

Table 4. Multicollinearity Test Result (VIF)

Variable	VIF
Ln_GRDP	1.433
FLFPR	1.153
Ln_MSE	1.252
GDI	1.093

Source: R Studio output, processed

Robustness Checks: Year Fixed Effects and Diagnostic Tests

Because the 2019-2023 period spans the COVID-19 pandemic shock, which plausibly affected all regions simultaneously (Figure 1), this study tested whether adding year fixed effects to the one-way FEM materially changes the results. An F-test comparing the one-way and two-way FEM specifications shows that the year fixed effects are jointly significant (F=15.664, df1=4, df2=80, p<0.001), indicating that common annual shocks explain a meaningful share of the variation in women's expenditure that a one-way model would otherwise leave unaccounted for. A studentized Breusch-Pagan test indicates the presence of

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heteroskedasticity (BP=41.564, df=25, p=0.020), and a Wooldridge test for serial correlation in panel data finds significant evidence of first-order autocorrelation in the idiosyncratic errors (F=18.236, df1=1, df2=86, p<0.001). Both diagnostics indicate that classical OLS-based standard errors are likely understated, and that robust and/or clustered standard errors should be used when interpreting the precision of these estimates.

Table 5. Robustness and Diagnostic Tests Result

Test	Statistic	p-value	Conclusion
Year FE joint significance (F-test)	F = 15.664 (df1=4, df2=80)	1.66e-09	Year fixed effects are jointly significant
Breusch-Pagan (heteroscedasticity)	BP = 41.564 (df=25)	0.020	Heteroskedasticity present
Wooldridge (serial correlation)	F = 18.236 (df=1, df2=86)	5.01e-05	Serial correlation present

Fixed Effect Model Estimation Result

Given the significant year effects detected above, this study adopts the two-way FEM (region and year fixed effects) as its final model, presented in Table 6 alongside the one-way FEM for comparison. In the one-way FEM, only FLFPR shows a statistically significant positive association with Ln_Women's Expenditure (coefficient = 0.00309; p=0.028). However, once year fixed effects are added in the two-way FEM, this association is no longer statistically significant (coefficient = 0.00053; p=0.726), and none of the four variables Ln_GRDP (p=0.758), FLFPR (p=0.726), Ln_MSE (p=0.896), or GDI (p=0.166) shows a statistically significant association with women's expenditure. As with any observational panel regression, these results should be interpreted as statistical associations rather than strictly causal effects; given the heteroskedasticity detected above, robust standard errors are also recommended for any further analysis.

Table 6. Fixed Effect Model Estimation Result

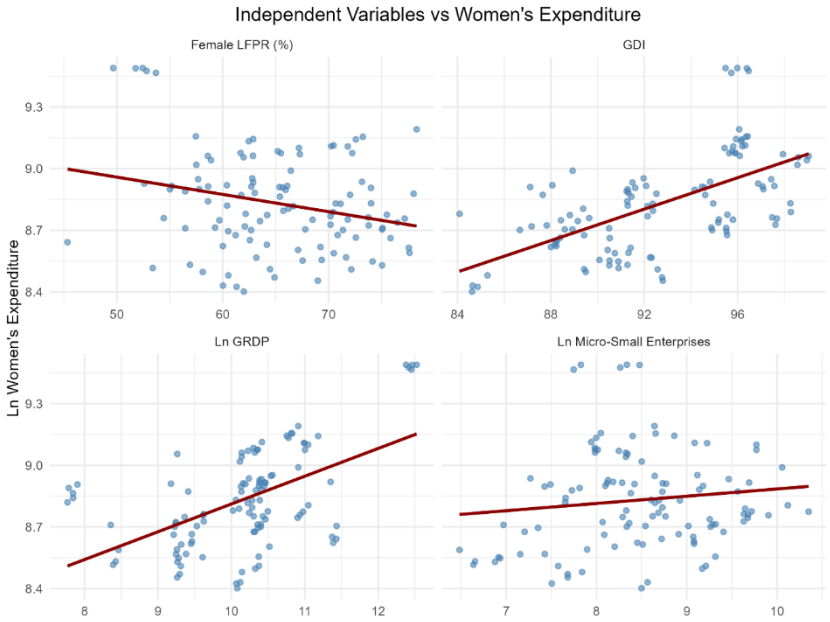
Variable	One-way FEM (region only)	Two-way FEM (region + year)
Ln_GRDP	-0.0160 (0.0443)	-0.0109 (0.0353)
FLFPR	0.00309** (0.00138)	0.00053 (0.00151)
Ln_MSE	0.0033 (0,0161)	-0.0017 (0,0128)
GDI	-0.0296 (0.0200)	-0.0281 (0.0201)
Observation	110	110
R^2	0.00771	0.0338
Adjusted R^2	-0.198	-0.317
F statistic	1.755 (df =4;84), p=0.146	0.699 (df =4;80), p=0.595

*Note: figures in parentheses are standard errors ** significant at a = 5%. The two-way FEM is the final model adopted in this study.*
Source: R Studio output, processed

Relationship between Variables and Women's Expenditure

Figure 2 displays scatter plots of the relationship between the four independent variables and Ln_Women's Expenditure, pooling all region-year observations. The FLFPR panel shows a highly heterogeneous spread of points.

At the same time, a simple trend line across the pooled data slopes gently upward; this raw pooled association does not hold once region and year fixed



effects are accounted for in the two-way FEM reported below. The Ln_MSE panel shows an even more scattered distribution with a nearly flat trend line, consistent with more micro and small enterprises in a region not proportionally raising women's expenditure.

Figure 2. Relationship between Ln_GRDP, FLFPR, Ln_MSE, GDI, and Ln_Women's Expenditure.

(Source: Panel Data 2019-2023, processed)

Why The Industrialization Paradox Occurs in NTT

Once common annual shocks are accounted for through year fixed effects, none of the four determinants tested, including FLFPR, which appeared significant in the one-way specification, show a robust, statistically significant association with women's financial independence in NTT. This pattern is explored through four complementary perspectives.

Growth vs. Development: Growth is no Guarantee of Development

The insignificance of Manufacturing GRDP reaffirms the foundational argument that growth and development are not the same thing. A rising GRDP figure is a quantitative measure of aggregate output; it does not automatically guarantee development genuinely felt by women, most of whose economic activity falls outside formal manufacturing, as recorded in GRDP (Todaro & Smith, 2011). This is not unique to NTT; research in India documents a similar paradox, where improved macro indicators such as women's education have coincided with declining female labor force participation (Chatterjee, Sonalde, & Vanneman, 2018). Notably, in this study, even FLFPR itself, initially the one variable that appeared to matter, loses its significance once common annual shocks are controlled for, suggesting that its apparent association in the simpler model may have reflected a shared time trend (such as the pandemic-era shift in economic activity) rather than a stable underlying relationship.

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The Informal Sector Trap

It is worth noting that Ln_MSE is a general proxy for the total number of registered micro and small industrial enterprises in a regency, rather than a variable that specifically isolates weaving businesses; official BPS data at this level of disaggregation are not available. With that caveat in mind, Ln_MSE shows no significant association with women's expenditure in either specification, plausibly because NTT's weaving industry generally operates on a micro, informal scale: carried out at home, without formal business records, with sales cycled directly into daily household needs (survival) rather than accumulated as wealth. This is consistent with findings among women weavers in Nggorea Village, where weaving began as a way to fill spare time and later became a pillar of family income (Sulaiman & Anita, 2020). Moreover, among Sumba women weavers, who treat weaving as an economic agency sustaining family and community resilience (Dewi, Ayunda, Andalas, & Lede, 2024). Because a single ikat cloth takes 3-6 months to weave, weaving income is small and inconsistent when measured at the regency level, and without sustained marketing networks and mentorship, this potential struggles to grow beyond subsistence (Susanti & Mas'udah, 2017). This gap between market value and producer income is echoed in a recent account of East Sumba's weaving communities, where woven cloths command high market prices while the weavers who produce them capture little of that added value, constrained by difficulty accessing natural dyeing materials and non-mechanical weaving tools (Shabrina, 2022)

Regional Inequality

Manufacturing activity recorded as large in NTT's GRDP is likely concentrated in regions with a more advanced industrial base, such as Kupang City, consistent with the general pattern of manufacturing GRDP growth in Indonesia clustering spatially rather than spreading evenly (Azis et al., 2026). Meanwhile, women weavers are dispersed across NTT's other 21 regencies without access to a market integrated with this growth center, consistent with NTT's broader inter-regional development inequality (Nalle, Sengkoen, Seran, & Aulia, 2023).

Shock Sensitivity

The joint significance of the year fixed effects ($p<0.001$) points to a fourth, more structural explanation: women's expenditure in NTT appears to be driven substantially by common annual shocks most plausibly the COVID-19 pandemic period visible in Figure 1 rather than by any of the four structural or macroeconomic variables examined in this study. This is consistent with the informal, home-based, and largely undocumented nature of weaving-based income, which likely responds more to short-term shocks in demand, mobility, and household coping strategies than to slower-moving structural indicators such as GRDP or GDI. Direct evidence from NTT's ikat-weaving creative economy during the COVID-19 pandemic supports this reading: qualitative research on weaving business units across NTT identifies declining income and loss of work opportunities as the two most immediate pandemic challenges faced by weavers, alongside pressure to innovate products and adopt new technology. The relatively low within R^2 of the two-way model (0.034) further confirms that most of the variation in women's expenditure lies outside these four variables altogether, reinforcing that the industrialization paradox in NTT runs deeper than a single missing determinant; it reflects a broader disconnect between the indicators

typically used to track economic progress and the lived economic reality of women weavers.

CONCLUSION

This study evaluates the relationship between manufacturing GRDP growth, women's FLFPR, the number of micro and small enterprises, and GDI on women's financial independence in NTT Province during 2019 - 2023, using a two-way Fixed Effect Model (region and year) on panel data from 22 regions (N=110). Once common annual shocks are controlled for, none of the four variables tested shows a statistically significant association with women's expenditure, including FLFPR, which had appeared significant in a simpler one-way specification. This pattern points to a deeper industrialization paradox in NTT, explained by the distinction between growth and development, the informal-sector trap that makes ikat weaving a survival economy rather than a vehicle for wealth accumulation, regional inequality between the industrial growth center and dispersed women weavers across NTT's 21 regencies, and the sensitivity of women's economic outcomes to common annual shocks such as the COVID-19 pandemic rather than to slower-moving structural indicators.

Local governments should redirect part of their policy focus toward more targeted interventions for women weavers: (1) strengthening access to business capital, training in more efficient production techniques, and market access beyond home regions; (2) building supply chains and marketing platform connecting weaving centers across the 21 regencies with growth hubs such a Kupang City; and (3) sustained mentorship programs, rather than one off assistance, given the long production time (3-6 months per cloth) and working capital required throughout the process. This is consistent with ongoing community-based interventions, such as the Pahikung Weaving School in East Sumba, which brings together women weavers from multiple villages to strengthen technical skills and local cultural knowledge. However, weavers there similarly report unresolved barriers to accessing raw materials and to market reach. Given the sensitivity of women's expenditure to common shocks, policies should also build shock-responsive safety nets such as emergency working-capital access or flexible microcredit that can be activated during crisis periods, rather than relying solely on interventions designed around stable, structural conditions.

This study has several limitations. First, the relatively low within R^2 indicates the four variables tested do not explain most of the variation in women's expenditure, so future research should consider additional micro-household-level variables, such as weaving hours worked or the selling price of woven cloth by regency. Second, the study period is limited to 2023 due to the limited availability of micro and small enterprise data from BPS NTT Province; further research is encouraged to update the analysis once data for subsequent years become available, ideally allowing the pandemic-era shock to be more precisely isolated from longer-run trends. Third, the Ln_MSE variable is a general proxy for all micro and small industrial enterprises rather than weaving businesses specifically, as disaggregated BPS data at that level are not available; future studies could seek more targeted data sources, such as village-level cooperative or UMKM registries. Fourth, both heteroskedasticity (Breusch-Pagan test,

p=0.020) and first-order serial correlation (Wooldridge test, p<0.001) were detected in the idiosyncratic errors, so future work should employ standard errors that are robust to both, such as clustered or Driscoll-Kraay standard errors, as the standard errors reported in this study likely understate the true uncertainty around these estimates; the associations reported here should in any case be interpreted as correlational rather than strictly causal, consistent with the nature of observational panel data. Finally, future research may consider a mixed-methods approach combining quantitative panel data with qualitative studies at the household or weaving-community level, to capture the dynamics of the ikat-weaving economy and its sensitivity to shocks that are not fully reflected in official statistics.

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