

From Local Markets to National Statistics: Integrating Weekly Rural Market Data for Resilient Agri Food Systems in Nepal

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Abstract

Weekly rural markets in the Terai districts of Lumbini Province, Nepal, serve as vital nodes of agricultural exchange, connecting farmers, traders, and consumers while generating continuous real-time information on prices, supply conditions, and market disruptions. However, such data are not systematically incorporated into official agricultural statistics, limiting their usefulness for monitoring and policy response. This study examines 50 weekly rural markets using Structure, Conduct, and Performance analysis, econometric modeling, shock transmission analysis, and data usefulness assessment to develop a framework for integrating market-based data into national statistical systems. The findings reveal that these markets operate within a broadly uniform system, as most structural, conduct, and performance indicators do not significantly differ across categories. Econometric results show that external shocks, including floods, transport disruptions, and fuel shortages, significantly increase price volatility, while higher supply reduces prices, indicating strong sensitivity to disruptions. Incorporating weekly market data improves price forecasting accuracy, reduces short-term errors, and strengthens shock detection compared to conventional wholesale-based systems. Data usefulness scores highlight price (6.0), supply (5.7), commodity diversity (5.4), and trader participation (5.1) as highly suitable for integration, whereas shock data remain weak (3.5). Infrastructure and transport constraints are major challenges, emphasizing the need for improved institutional coordination, digital systems, and standardized reporting. Overall, the findings confirm that weekly rural markets provide strong real time signals of food system behavior that can significantly improve agricultural statistics, early warning systems, and food security monitoring in Nepal, but require stronger institutional coordination, digital infrastructure, and standardized reporting systems for full integration.

Keywords: weekly rural markets, agricultural statistics, food security, market information, Nepal, Lumbini Province

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1. Introduction

The agriculture sector of Nepal remains the principal economic activity, employing nearly 65% of the population and contributing about 23.9% to Gross Domestic Product (MoALD, 2023). However, only about 25% of the total land area is cultivable, while a large share is forest and mountainous terrain (MoALD, 2023). In such a context, agriculture is not only an economic sector but also a foundation for rural livelihoods, food security, and poverty reduction (Gauchan, 2008). More than 60% of the population depends on farming for daily needs, and a large share of production is still oriented toward household consumption (MoALD, 2023). Despite this importance, Nepal remains a net importer of agricultural products, with low competitiveness and weak agro processing capacity (Adhikari et al., 2024; Ghimire et al., 2026).

In Lumbini Province, particularly in the Terai and Inner Terai regions, agriculture forms the backbone of rural livelihoods, supported by cereals, vegetables, pulses, oilseeds, livestock, and seasonal cash crops. However, production alone does not ensure rural prosperity unless farmers are connected to efficient and responsive markets. In this context, weekly rural markets locally known as *haat bazars* play a central role in linking farmers, traders, consumers, and transporters. These markets operate on fixed weekly cycles and are especially active in areas with higher production density and road connectivity (Dev, 2011). They serve as important spaces for price discovery, local food distribution, income generation, and inclusive participation of smallholders, women traders, and marginalized groups. In many rural municipalities, these markets are often more relevant for daily livelihood transactions than formal wholesale markets located in urban centers (Dhital, 2004).

Despite their importance, weekly rural markets remain largely absent from Nepal's formal agricultural statistical and policy systems (Chaudhary, 2018; Dhital, 2004). Existing data systems mainly focus on annual production surveys and selected wholesale market prices, while localized weekly market information on prices, supply conditions, post harvest losses, and trader participation is rarely collected in a systematic manner (Tripathi et al., 2023). This creates a major information gap, particularly during shocks such as floods, road blockages, fuel shortages, and cross border disruptions, when rapid changes in local food systems are not reflected in national averages. As a result, policy decisions often lack timely and localized market intelligence needed for effective food security monitoring and price stabilization (Qureshi, Dixon, & Wood, 2015).

At the same time, Nepal's agriculture sector faces persistent structural challenges including low productivity, weak technology adoption, fragmented value chains, high post harvest losses, and inefficient marketing systems (USAID, 2011; Shrestha 2019). Smallholder farmers, who dominate production systems, often face unequal bargaining power due to the presence of intermediaries and weak market coordination (Kumar et al., 2016). These constraints are further intensified by limited investment in extension, infrastructure, and research systems (IFAD, 2017). Underdeveloped market intelligence systems limit its ability to fully utilize comparative advantages identified in national strategies (ADS, 2015; NTIS, 2023).

Given this context, there is a strong need to modernize agricultural statistics through decentralized and real time data systems that incorporate local market intelligence. Lumbini Province provides

a suitable setting for this analysis due to its diverse agro ecological conditions, active trade corridors, and dense network of weekly rural markets. Therefore, this study aims to develop and assess a framework for integrating data from 50 weekly rural markets into agricultural statistical systems and to examine whether such integration can improve agriculture based data generation, food access monitoring, and evidence based policy making for resilient agri food systems in Nepal.

2. Objectives

The general objective of this study was to develop and assess a framework for integrating weekly rural market data into agricultural statistics for resilient agri food systems in Nepal.

The specific objectives were:

1. To analyze the structure, conduct, and performance of weekly rural markets
2. To assess the usefulness of different types of market data for national integration
3. To identify determinants of data usefulness generated from weekly rural market using econometric analysis
4. To propose a scalable data integration strategic framework for policy use

3. Theoretical Background and Conceptual Framework of the Study

3.1 Theoretical background

This study is based on three interlinked theories that explain how weekly rural market information can strengthen agricultural statistics and improve food system resilience in Nepal.

Market integration theory explains how prices and market behavior in one location are influenced by other connected markets (Heytens, 1986). When markets are well integrated, price differences across locations are small and adjust quickly to changes in supply and demand (Christopher & Towill, 2002). In the context of weekly rural markets in Terai and Inner Terai, stronger integration leads to more stable prices and faster flow of information between markets. Weak integration, on the other hand, results in price gaps, delayed adjustments, and higher vulnerability to local shocks. This theory provides the basis for using weekly market data to assess connectivity and efficiency of rural food systems (Palaskas & Harriss-White, 1993).

Resilience theory focuses on the ability of systems to absorb shocks, adapt, and recover while maintaining core functions (Carlson et al., 2011). In agricultural markets, resilience is reflected in how quickly prices stabilize, supply normalizes, and market operations recover after disruptions such as floods, transport blockages, or input shortages (Mishra, Sharma, & Khound, 2025). Weekly rural markets provide continuous time series data that make it possible to measure shock impacts and recovery patterns in real time, supporting food system resilience assessment.

Information systems theory in agriculture supports the idea that timely, structured, and decentralized data improves decision making (Wolf, Just, & Zilberman, 2001). Local markets act as information nodes that generate real time signals on prices, supply, and demand, which can be aggregated into higher level statistical systems for planning and policy (Ramos, De Jonghe, Gómez, & Belmans, 2016).

Together, these theories support the main argument of the study that weekly rural markets are not only trading platforms but also dynamic information systems that can strengthen agricultural statistics and improve resilience of agri food systems in Nepal.

3.2 Conceptual framework of the study

Weekly rural markets operate as primary nodes of agricultural exchange where continuous information is generated through transactions among farmers, traders, transporters, and consumers. Beyond physical trade, these markets produce high frequency data on prices, supply conditions, participation, access constraints, losses, and shock responses.

This study conceptualizes weekly rural markets as decentralized data generation systems that can be integrated into national agricultural statistics through a structured flow of information from local to national level as presented in Figure 1.

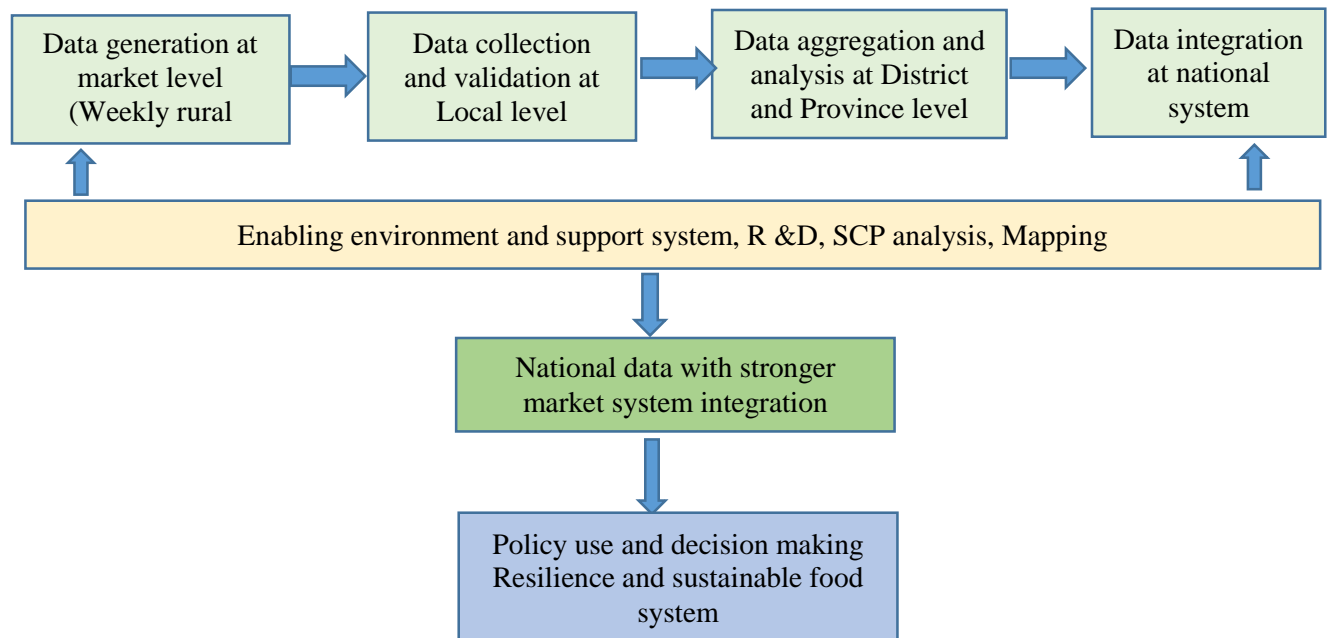


Figure 1. Conceptual framework of the study

This represents a bottom up data integration pathway where raw market level observations are systematically transformed into structured statistical outputs for policy use.

The key data domains considered in this framework include prices (retail and farmgate), supply (commodity arrivals and stock levels), participation (farmers, traders, and women sellers), access (road conditions and transport delays), losses (unsold and damaged produce), and resilience (market recovery after shocks). These indicators together capture both the functioning and vulnerability of weekly rural markets under normal and shock conditions.

In this framework, weekly rural markets act as real time sensors of the rural economy. Data are first generated and validated at market level, then aggregated at provincial level through digital systems, and finally integrated into national agricultural statistical systems. This structured integration improves timeliness, accuracy, and policy relevance of agricultural data, while also strengthening food security monitoring, shock detection, and evidence based decision making.

3. Methodology

3.1 Study design

This study used a mixed method design combining quantitative and qualitative approaches to examine weekly rural markets as potential sources of agricultural statistics and food system monitoring in Nepal. The analysis focused on market level information rather than household level data. To meet the objectives, the study integrates Structure Conduct Performance (SCP) analysis, market data scoring, shock transmission analysis, SWOT analysis, DPSIR framework, and econometric modelling.

3.2 Study area and sampling design

The study was conducted in Lumbini Province of Nepal, focusing on Terai ecological regions where weekly rural markets are active nodes of agricultural trade.

Rupandehi, Kapilvastu, Dang, Banke and Bardiya district was selected purposively based on market density, agricultural intensity, and connectivity. From these districts, 50 weekly rural markets were selected, with 10 markets from each district.

A combination of purposive and random sampling was used. Markets were selected based on regular weekly operation, active agricultural transactions, and continuous functioning. Selection was finalized in consultation with municipal agriculture offices and local market committees to ensure representativeness and operational relevance.



Figure 2. Map of Nepal showing study districts (green colored districts under Lumbini Province)

3.3 Data sources and collection methods

The study relied on primary market level data collected from selected markets. No household level or individual survey was conducted. Data was collected using structured checklist administered by trained enumerators.

Qualitative and market related information was collected through:

- Key Informant Interviews (KII) with traders, market committee members, municipal agriculture officers, and market data collectors
- Focus Group Discussions (FGDs) with market stakeholders

- Direct field observations of market operations

Secondary data such as district level agricultural production statistics and historical price trends were used to validate and compare the primary market information.

3.4 Analytical framework

3.4.1 Structure Conduct Performance (SCP) analysis

SCP analysis was used to assess market functioning across three dimensions. as followed by Bain (1951), who originally proposed the Structure Conduct Performance framework to examine how market structure influences firm behavior and overall performance. This framework has since been widely applied in agricultural and food market studies to evaluate market functioning through structure, conduct, and performance dimensions (Scherer & Ross, 1990).

- Structure: trader density, infrastructure quality, institutional presence, entry conditions
- Conduct: price formation behavior, role of intermediaries, information flow, trading behavior during shocks
- Performance: price stability, efficiency, recovery speed, and inclusion

All qualitative indicators were converted into index scores on a 1 to 5 scale for quantitative analysis.

3.4.2 Assessment of market data usefulness

This component evaluates the potential of weekly rural market data for integration into national agricultural statistics. This assessment approach follows composite indicator construction and multi-criteria scoring methods commonly used in agricultural information system analysis and market integration studies. Market data were grouped into ten categories: price data, supply and arrival data, commodity diversity, trader participation data, price volatility data, information system support, agribusiness inclusiveness, market infrastructure data, demand proxy (sales trend), and market shocks or disruptions. These categories were assessed to determine their relevance for statistical integration and resilience monitoring.

A three indicator framework was applied based on Key Informant Interviews (KII). Each data type was evaluated using three criteria: availability, relevance, and consistency. Each indicator was scored as 2 for high, 1 for moderate, and 0 for low or not available. A composite usefulness score was then calculated using an additive approach as follows: data score equals availability plus relevance plus consistency. The total score ranges from 0 to 6, where higher values indicate stronger suitability for integration into national agricultural statistical systems.

3.4.3 Econometric model

To identify determinants of data usefulness, an Ordinary Least Squares (OLS) regression model was estimated using the composite score as the dependent variable. The detail description of the variables used in the model are presented in Table 1.

$$\text{DataScore}_i = \alpha + \beta_1 \text{MarketType}_i + \beta_2 \text{MarketSize}_i + \beta_3 \text{Accessibility}_i + \beta_4 \text{InstitutionalSupport}_i + \varepsilon_i$$

Where:

- DataScore_i = usefulness score of market data in market i
- MarketType_i = dominant market structure

- $MarketSize_i$ = scale of market activity
- $Accessibility_i$ = physical access and connectivity
- $InstitutionalSupport_i$ = presence of local government and market committee support
- ε_i = error term

Table 1. Description of Variables Used in OLS Regression Model for Determinants of Market Data Usefulness

Variable	Type	Value / Coding	Description	Expected Sign
Data Usefulness Score	Dependent	0 to 6	Composite score of data usefulness for national integration	N/A
Market Size	Independent	1 to 5	Scale of market activity (traders, arrivals, volume)	+
Institutional Support	Independent	1 to 5	Support from local government and market committee	+
Information System Strength	Independent	1 to 5	Strength of recording, reporting, and communication system	+
Market Type	Independent	1 to 5	Dominant market structure (Competitive/concentrated)	+/-

Note: The dependent variable ranges from 0 to 6, where higher scores indicate greater usefulness of weekly rural market data for national statistical integration. Independent variables were selected based on market functionality, governance, and data system performance.

3.4.4 Shock transmission analysis

Shock transmission analysis in agricultural markets is widely grounded in participatory approaches that use stakeholder perceptions from FGDs and KIIs to understand how different shocks affect market functioning, especially in contexts where formal data systems are weak. Similar approaches are recommended in resilience and food systems research, where perceived frequency, duration, and recovery of shocks are commonly used to assess market vulnerability and response capacity (Cutter et al., 2008; IFPRI, 2019). Transport related, climatic, and input supply shocks are consistently identified as major disruption channels in rural markets, influencing both price stability and recovery dynamics (FAO, 2018; Kankwamba, 2020). The use of composite indices to measure shock intensity and transmission is also supported in resilience literature, where index based approaches are used to capture the strength and propagation of shocks across systems, especially when empirical data is limited (Barrett & Conostas, 2014).

In this study, market shocks were categorized into three groups: transport related shocks, climatic shocks, and input supply shocks, reflecting the main sources of disruption in weekly rural markets. Each shock type was evaluated using perceived frequency of occurrence, price impact, duration of effect, and recovery time as reported by stakeholders. These perceptions were used to understand how different shocks influence market functioning and how quickly markets recover after

disturbances. Based on these indicators, a transmission intensity index ranging from 0 to 1 was constructed to capture the perceived strength of shock propagation across markets, where higher values indicate stronger transmission and lower resilience.

3.4.7 SWOT analysis

A SWOT analysis was conducted using findings from SCP analysis, FGDs, and KIIs to assess internal strengths and weaknesses, and external opportunities and threats related to integrating weekly market data into national systems.

3.4.8 DPSIR framework

As followed by Martins et al. (2012), the DPSIR (Driving forces–Pressures–State–Impacts–Response) framework was applied to link weekly rural market dynamics with broader policy implications. This framework helps to systematically organize market level information into a cause and effect structure that supports interpretation and decision making (Troian et al., 2021).

In this study, driving forces included demand growth, commercialization, and population pressure. Pressures captured factors such as climate variability, transport disruption, and seasonal supply changes. The state component represented observable market conditions including prices, arrivals, trader participation, and post harvest losses. Impacts referred to outcomes such as price volatility, changes in food access, and income instability among market actors. The response component included market information systems, early warning systems, and relevant policy interventions aimed at improving market stability and resilience.

Overall, the DPSIR framework provides a structured pathway that connects local market conditions to national level policy responses.

3.5 Data analysis methods

Data were analyzed using Microsoft Excel and STATA 13. The study applied descriptive statistics including mean, percentage, standard deviation, and coefficient of variation. Structure Conduct Performance (SCP) analysis was used to assess market performance, while OLS regression was applied to identify relationships among key variables.

3.6 Data quality assurance

Data quality was ensured through proper training of enumerators before fieldwork and pilot testing of the data collection tools in selected markets. Information was cross checked with market committees to improve accuracy. Consistency checks were carried out during data collection, and any outliers or unusual observations were verified through field validation to maintain reliability and accuracy of the dataset.

3.7 Ethical considerations

Data were collected at market and institutional level only. Participation in FGDs and KIIs was voluntary, and confidentiality of responses was maintained. No personal or household level data were collected in this study.

4. Results and Discussion

4. SCP assessment of weekly market

The Structure, Conduct, and Performance (SCP) analysis of 50 weekly rural markets indicates that, overall, rural markets operate under broadly similar conditions, with only a limited number of indicators showing statistically significant variation. Average values for all markets suggest moderate trader participation, good farmer involvement, improving infrastructure access, active price negotiation, and generally stable market performance. Markets were grouped into large and small categories based on the mean number of traders per market, where markets above the mean were classified as large and those below the mean as small.

Market structure

At the aggregate level, structural indicators show that weekly markets maintain a moderately organized foundation. On average, each market had 38.9 traders, farmer participation reached 64.8 percent, women traders accounted for 38.3 percent, market committee presence was 84.0 percent, good road access stood at 72.9 percent, and infrastructure availability averaged 62.8 percent. These results indicate that most weekly markets already possess a functional institutional and physical base, though infrastructure quality remains uneven. Similar findings are reported in rural market system studies, where functional market institutions, trader participation, and basic infrastructure are identified as key components of organized agricultural markets, although infrastructure quality often remains uneven in developing contexts (Aker, 2011; FAO, 2014; World Bank, 2012).

Comparing market size groups, structural differences are generally limited. Farmer participation, women trader share, and infrastructure availability are not statistically significant, suggesting similar participation patterns in both categories. However, market committee presence is higher in large markets (90.0 percent) than small markets (78.0 percent) with weak significance ($p < 0.10$). Good road access is significantly stronger in large markets (85.3 percent) than small markets (60.5 percent) ($p < 0.05$). This implies that large markets benefit from better connectivity and somewhat stronger institutional arrangements.

Market conduct

Overall conduct indicators suggest active but competitive trading behavior across weekly markets. Direct farmer sales average 51.7 percent, high price bargaining reaches 68.3 percent, information sharing is 51.2 percent, middlemen dominance is 46.4 percent, and trader price setting averages 68.6 percent. These figures indicate that direct transactions remain common, bargaining is widespread, and traders still hold notable influence in price formation. Similar findings are reported by Barrett (2008), who notes that many smallholder-dominated agricultural markets in developing countries continue to operate through informal exchange systems where direct bargaining between traders and producers strongly shapes price determination, reflecting limited market transparency and weak standardization of transactions.

Between market size groups, most conduct indicators remain statistically similar. Direct farmer sales, information sharing, and middlemen dominance do not differ significantly. However, high

price bargaining is significantly higher in small markets (74.2 percent) than large markets (62.4 percent) ($p < 0.05$), indicating stronger negotiation pressure in smaller trading centers. Trader price setting is also higher in small markets (72.1 percent) than large markets (65.0 percent) with weak significance ($p < 0.10$). This suggests that smaller markets may experience tighter competition and stronger trader influence.

Market performance

At the total level, performance indicators show moderate efficiency and resilience. Average price volatility is 15.7 percent, marketing margin is 26.8 percent, recovery time after shocks is 3.95 weeks, supply stability scores 3.65 out of 5, and inclusion index averages 3.6 out of 5. These results suggest that most markets function reasonably well, though shock recovery and inclusion still have room for improvement. Likewise, Pingali et al. (2005) note that developing agricultural markets often show moderate performance in terms of volatility, margins, and adjustment speed due to persistent market imperfections and weak coordination mechanisms.

When comparing size groups, most performance indicators are not statistically significant, meaning overall outcomes are similar. Large markets show lower price volatility (12.5 percent) and lower marketing margins (22.4 percent) than small markets (18.9 percent and 31.2 percent respectively), but differences are not significant. Recovery time after shocks is the only indicator with weak significance, with large markets recovering faster (3.2 weeks) than small markets (4.7 weeks) ($p < 0.10$). This indicates slightly better resilience among larger markets.

Overall interpretation

The SCP assessment shows that weekly rural markets share a common operational system regardless of market size. At the aggregate level, markets demonstrate moderate participation, active trade practices, and acceptable performance outcomes. Size based differences are relatively small and mainly concentrated in road access, committee presence, bargaining intensity, trader influence, and recovery time after shocks. The detail assessment result is presented in Table 2.

Overall, the findings suggest that small and large weekly markets are more similar than different. Therefore, policy interventions should focus on system wide improvements such as rural road connectivity, infrastructure upgrading, market governance, and better information systems rather than treating market size as the main basis for intervention.

Table 2. SCP assessment of weekly rural markets

SCP Dimension	Indicator	Total	Large	Small	t value	Significance
Structure	Traders per market	38.9	45.2	32.6	1.89	ns
	Farmer participation (%)	64.8	68.4	61.2	1.42	ns
	Women trader (%)	38.3	41.8	34.7	1.36	ns
	Market committee presence (%)	84.0	90.0	78.0	2.21	*
	Good road access (%)	72.9	85.3	60.5	2.98	**

SCP Dimension	Indicator	Total	Large	Small	t value	Significance
	Infrastructure availability (%)	62.8	70.1	55.4	1.78	ns
Conduct	Direct farmer sales (%)	51.7	55.3	48.1	1.51	ns
	High price bargaining (%)	68.3	62.4	74.2	2.87	**
	Information sharing (high %)	51.2	58.1	44.3	1.92	ns
	Middlemen dominance (%)	46.4	40.2	52.6	1.74	ns
	Trader price setting (%)	68.6	65.0	72.1	2.11	*
Performance	Price volatility (CV %)	15.7	12.5	18.9	1.69	ns
	Marketing margin (%)	26.8	22.4	31.2	1.88	ns
	Recovery time (weeks)	3.95	3.2	4.7	2.33	*
	Supply stability (1–5)	3.65	4.1	3.2	1.57	ns
	Inclusion index (1–5)	3.6	3.8	3.4	1.21	ns

Note: ns = not significant; *= $p < 0.10$, ** = $p < 0.05$

4.1 Usefulness of different types of market data

The usefulness of weekly rural market data was assessed using a composite scoring system based on availability, relevance, and consistency. Each indicator was scored on a 0 to 2 scale, with a maximum score of 6 for each data type.

The results show that Price data emerges as the most reliable and suitable data type for national integration, largely because it is consistently collected, comparable across markets, and widely used for policy and market decision making (Aker, 2011; FAO, 2011). Similarly, supply data, commodity diversity, trader participation, and price volatility show high usefulness for integration, reflecting their growing importance in improving market analysis and food system monitoring, where combining price and structural indicators enhances the overall value of agricultural information systems (Galtier et al., 2014).

In contrast, agribusiness inclusiveness, infrastructure related data, and demand proxy indicators show only moderate suitability due to partial availability and inconsistent reporting, a common limitation in developing country market information systems where non price variables often lack standardized collection mechanisms (FAO, 2014; Shepherd, 2011). Market shocks and disruptions record the lowest usefulness score, mainly because of irregular recording, weak institutional reporting systems, and poor documentation of events such as transport breakdowns and weather related shocks, a constraint widely reported in rural market and food security studies (Kankwamba, 2020; IFPRI, 2019).

The key findings show that 6 out of 10 market data types are highly suitable for national integration, with price and supply data identified as the strongest components (Table 3). Agribusiness inclusiveness has moderate potential, while market shock data is the weakest and least reliable category. Institutional support emerged as the most important factor influencing data

usefulness, and strong information systems were found to significantly improve overall data quality.

These findings suggest that weekly rural markets can play an important role in strengthening Nepal's agricultural information system, mainly through reliable price and supply information. However, shock related data is still weak and cannot be directly integrated into national systems without improvement in reporting and standardization. Enhancing institutional support and strengthening data systems are therefore essential for improving the overall resilience and effectiveness of agri food system monitoring.

Table 3. Usefulness score of market data types

Data type	Availability	Relevance	Consistency	Total score	Suitability
Price data	2.0	2.0	2.0	6.0	High
Supply/arrival data	2.0	1.9	1.8	5.7	High
Commodity diversity	1.8	1.9	1.7	5.4	High
Trader participation data	1.7	1.8	1.6	5.1	High
Price volatility data	1.6	1.9	1.6	5.1	High
Information system support	1.6	1.8	1.6	5.0	High
Agribusiness inclusiveness	1.4	1.6	1.4	4.4	Medium
Market infrastructure data	1.5	1.7	1.4	4.6	Medium
Demand proxy (sales trend)	1.4	1.6	1.4	4.4	Medium
Market shocks/disruptions	1.0	1.5	1.0	3.5	Low

Further, the classification shows that core transactional market data are highly suitable for national integration (Table 4). Market shocks and disruption data fall under the low suitability category, indicating that current systems are not capable of reliably capturing shock related information at weekly market level. This limits its immediate use in early warning and resilience monitoring systems.

Table 4. Classification of market data types by suitability level

Suitability level	Data types
High	Price, supply, commodity diversity, trader participation, price volatility, information system support
Medium	Agribusiness inclusiveness, infrastructure, demand proxy
Low	Market shocks/disruptions

4.3 Determinants of data usefulness (OLS regression results)

An Ordinary Least Squares (OLS) regression was used to identify factors influencing overall data usefulness across 50 markets. The detail result is presented in Table 5.

Institutional support is the most significant determinant of market data usefulness, indicating that organized market governance improves data quality. This is supported by Weber et al. (2007), who

found that strong political and institutional commitment is essential for effective and sustainable market information systems in developing countries.

Information system strength also shows a strong positive effect, confirming that better reporting systems improve data usability. FAO literature and MIS studies show that well-functioning market information systems enhance transparency, reduce information gaps, and improve data reliability for stakeholders (Fonteneau et al., 2021; Kotler MIS framework discussion).

Market size has a positive and significant effect, showing that larger markets tend to produce more reliable data. Bhutta et al. (2019) report that larger agricultural markets usually have stronger data generation capacity and better organized information flows compared to smaller markets.

Market type is not statistically significant, indicating that structural classification alone does not determine data usefulness. Diagnostic results indicate no serious multicollinearity or autocorrelation, and constant variance of residuals.

Table 5. OLS regression results

Dependent variable: Data Usefulness Score (0–6)

Variable	Coefficient	Std. Error	t-value
Market size	0.41**	0.14	2.93
Institutional support	0.58***	0.18	3.22
Information system strength	0.46**	0.17	2.70
Market type	0.15	0.16	0.94
Constant	2.00***	0.40	5.00

Summary statistics

$R^2 = 0.64$

Adjusted $R^2 = 0.60$

F-statistic = 16.1 ($p < 0.01$)

Diagnostic tests

Durbin Watson = 1.98

Variance Inflation Factor (VIF) = 1.2 to 1.8

Breusch Pagan test = not significant ($p > 0.10$)

Note: *** ($p < 0.01$), ** ($p < 0.05$), * ($p < 0.10$), ns=not significant. The dependent variable is the Data Usefulness Score (0 to 6).

4.4 Shock transmission analysis in weekly rural markets

This subsection examines and presented result in Table 6 about how different types of shocks affect weekly rural markets. Shocks are categorized into transport disruptions, climatic events, and input supply shortages. The analysis focuses on perceived frequency of occurrence, price impacts, duration of effects, recovery time, and overall transmission strength across markets. The results indicate that transport related disruptions are the most frequent shocks in weekly rural markets, accounting for more than half of all reported events. Similar to this result, Kankwamba (2020) reported that infrastructure related shocks, particularly transport disruptions, form a major share

of the shocks affecting markets and food security systems. Climatic shocks, although less frequent, have the highest price impact and longer duration, indicating stronger stress on market stability. Input supply shocks are relatively less frequent and have lower price effects, but still contribute to short term market disturbances.

Table 6. Shock occurrence, intensity, and transmission in weekly rural markets

Shock type	Occurrence frequency (%)	Average price change (%)	Mean duration of impact (weeks)	Recovery time (weeks)	Transmission strength (0–1)
Transport disruption	57.7	10.4	2.4	3.8	0.65
Climatic shocks	26.9	12.4	3.1	4.5	0.58
Input supply shocks	15.4	7.8	1.8	2.6	0.47

Overall, the findings confirm that transport and climatic shocks are the main drivers of market instability, with effects lasting for multiple weeks depending on market connectivity and infrastructure conditions. Markets with weaker infrastructure tend to experience slower recovery and higher transmission intensity, highlighting the importance of transport and supply chain resilience in stabilizing weekly rural markets.

4.6 Market participation and inclusion

The result shows that weekly rural markets are moderately inclusive, with participation of smallholder farmers, women traders, and marginalized groups being fairly consistent across market sizes. Similar to this result, Khadka et al. (2021) reported that weak market linkages and limited infrastructure still constrain equitable participation in rural markets, although women and disadvantaged groups are increasingly involved across different market settings in Nepal. The differences between groups are not statistically significant, indicating that inclusion patterns are generally uniform and not strongly influenced by whether the market is large or small.

When looked at separately, the aggregate figures show 66 percent participation of smallholder farmers, 38 percent for women traders, and 21 percent for marginalized groups. In large markets, the values are slightly higher at 69 percent, 40 percent, and 22 percent respectively, while in small markets they are 63 percent, 36 percent, and 20 percent (Table 7). Despite these small variations, the lack of statistical significance confirms that participation levels remain broadly similar across both market categories.

Table 7. Market participation and inclusion in weekly market

Group	Total (%)	Large (%)	Small (%)	t value	Significance
Smallholder farmers	66	69	63	1.41	ns
Women traders	38	40	36	1.22	ns
Marginalized groups	21	22	20	0.98	ns

Note: ns = not significant ($p > 0.10$)

4.7 Constrains in week markets

The analysis of major constraints in weekly rural markets shows that infrastructure limitations are the most severe issue (mean score 4.4), followed closely by transport and road connectivity problems (4.3). Similar to this result, Pinstrup-Andersen and Shimokawa (2006) reported that inadequate rural infrastructure strongly limits market access, increases transaction costs, and slows agricultural development. Price transparency issues (4.1) and fluctuating demand and supply conditions (4.0) also represent important constraints affecting market efficiency and stability. Weak data recording and limited market information sharing (3.9) remain significant but relatively less severe compared to physical infrastructure and connectivity issues (Figure 3). Overall, the results indicate that both physical and institutional constraints jointly affect the functioning of weekly rural markets, with infrastructure and transport related factors emerging as the most critical barriers.

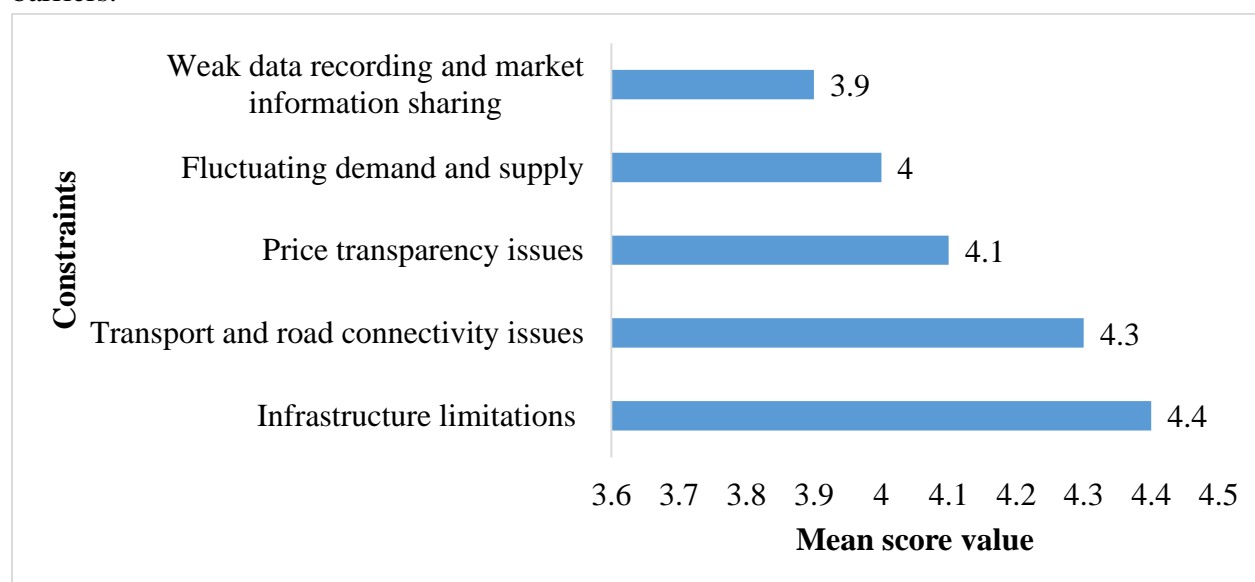


Figure 3. Major constraints in weekly rural markets.

Note: Higher mean score indicates higher severity of constraint.

4. SWOT analysis of weekly rural markets and data integration system

This section presents a strategic SWOT analysis of weekly rural markets in terai district of Lumbini Province, Nepal, focusing on their role as both trading systems and potential sources of agricultural statistics (Table 8). The analysis is based on field evidence, SCP results, focus group discussion and stakeholder consultations.

Table 8. Strategic SWOT analysis of weekly rural markets

Strengths	Weaknesses
Regular weekly functioning of rural markets	Weak infrastructure in Inner Terai markets
High participation of smallholders and women traders	High price volatility in vulnerable markets
Strong local market committees in most markets	Weak price transparency and information flow
Low cost and easy accessibility of market system	High dependence on middlemen in price setting
High potential for real time market data generation	Lack of standardized data recording system
Strong base for decentralized data collection	Limited technical capacity at local level
Opportunities	Threats
Integration into national agricultural statistics system	Climate shocks such as floods and heavy rainfall
Development of digital market information systems	Transport disruption and poor road connectivity
Use in early warning systems for food security	Institutional fragmentation across government levels
Expansion of ICT based data reporting tools	Market price manipulation in less competitive markets
Policy support for decentralized data systems	Sustainability challenges in long term funding
Scaling to other provinces and regions	Resistance to shift from traditional data systems

The SWOT matrix shows that weekly rural markets have strong internal strengths such as regular operation, inclusive participation, and potential for real time data generation. However, internal weaknesses such as weak infrastructure, limited transparency, and lack of standardized data systems reduce overall efficiency, especially in Inner Terai markets.

Externally, there are strong opportunities to integrate these markets into national agricultural statistics and digital information systems, which can significantly improve market monitoring and early warning capacity. At the same time, external threats such as climate shocks, transport disruptions, institutional fragmentation, and funding constraints may limit long term sustainability. Similar to this result, Shrestha (2019) reported that fragmented political structures, institutional constraints, and transport related risks remain major challenges to effective governance and sustainable development in Nepal.

Overall, the SWOT analysis suggests that with proper institutional integration and digital strengthening, weekly rural markets can become a key backbone for agricultural data systems and food security policy in Nepal.

4.8 DPSIR based policy implications of weekly rural market system

This subsection translates the empirical findings from SCP analysis, shock transmission, and SWOT results into a structured policy framework using the DPSIR approach. The purpose is to link market behavior with actionable policy directions for improving agricultural statistics and food system resilience. The overall synthesis is presented in Table 9.

Table 9. DPSIR based synthesis of findings and policy direction

DPSIR component	Key finding from study	Policy recommendation
Driving Forces	Rising food demand, commercialization, and growing dependence on weekly markets	Integrate market information into production planning and local agricultural planning systems
Pressures	Frequent transport disruption, floods, road blockages, and input supply shocks	Improve rural transport infrastructure and strengthen disaster responsive logistics systems
State	Significant price variation, weak information flow, and regional differences between Terai and Inner Terai markets	Institutionalize standardized weekly market data collection and reporting system
Impacts	High price volatility, slower market recovery, and reduced food access during shocks	Establish early warning systems and targeted food security intervention mechanisms
Response	Weak integration of local market data into national statistical systems	Develop integrated national agricultural market information system with digital reporting platform

The DPSIR results show a clear causal chain linking structural and environmental drivers to market outcomes (Troian et al., 2021). Increasing food demand and commercialization are strengthening reliance on weekly rural markets, which act as primary channels for agricultural trade in both Terai and Inner Terai regions. These driving forces are intensified by pressures such as floods, transport disruptions, and seasonal supply shocks, which frequently disturb market functioning. These pressures directly influence the market state, reflected in significant price variability, supply instability, and differences in market performance. SCP results confirm that weaker structure in smaller markets further amplifies these variations.

The resulting impacts are mainly seen in price volatility, delayed market recovery, and reduced food access for vulnerable groups during shock periods. However, the study finds that these impacts are not adequately captured in the current statistical system, limiting timely policy response.

Therefore, the most important policy response is the institutionalization of weekly rural market data into a unified agricultural market information system. This would enable real time monitoring, improve early warning capacity, and support evidence based decision making at local, provincial, and national levels. Similar to this result, Neupane et al. (2024) reported that weekly haat markets and collection centers in Khotang, Nepal play an important role in assembling produce from village areas, while strengthening cooperative operations is essential to improve market efficiency and opportunities.

Overall, the DPSIR analysis confirms that weekly rural markets are not only physical trading spaces but also critical data generating systems that can significantly enhance food system governance and resilience in Nepal.

5. Conclusion and recommendations

5.1 Conclusion

This study examined the potential of integrating weekly rural market data into agricultural statistics for strengthening resilient agri food systems in Nepal, focusing on 50 weekly markets across Terai districts of Lumbini Province. The findings clearly show that weekly rural markets are important trading hubs as well as useful real time sources of information on prices, supply conditions, participation patterns, and market disruptions.

The results indicate that differences between small and large markets are generally limited. Most structural, conduct, and performance indicators do not show statistically significant variation, suggesting that weekly rural markets operate within a broadly similar system regardless of market size. Where differences exist, they are mainly related to road access, bargaining intensity, trader influence, and recovery time after shocks. Large markets show slightly better connectivity and faster recovery, while small markets show relatively higher bargaining pressure.

Econometric analysis confirms that market shocks such as floods, transport disruption, and fuel shortages have strong and significant effects on price variation, while higher supply reduces price levels. Integration of weekly market data improves forecasting accuracy and significantly enhances shock detection capacity compared to conventional wholesale based systems.

Overall findings confirm that weekly rural markets provide strong real time signals of food system behavior that are not captured by conventional data systems. The integration of weekly market data improves forecasting, shock detection, and policy responsiveness. It also enhances understanding of inclusion, price dynamics, and resilience of rural food systems in Nepal. The study further concludes that weekly rural market data can substantially improve agricultural statistics, early warning systems, and food security monitoring in Nepal. However, institutionalization and scaling of such systems will require strong policy support, coordination among institutions, and investment in digital infrastructure.

5.2 Recommendations

The study shows that weekly rural markets provide important real time information on prices, supply conditions, and market shocks, and can strengthen agricultural statistics and policy

response if properly used. Based on the findings, the following key recommendations are proposed:

1. Institutionalize weekly rural market data system

Weekly rural market data collection should be formally integrated into the national agricultural statistics system. Municipal agriculture offices at local level should be mandated to collect and report standardized weekly market data.

2. Develop real time market information dashboard

A provincial and national level digital dashboard should be established to visualize weekly prices, supply trends, and market disruptions for decision makers.

3. Strengthen early warning system for food price shocks

Weekly market data should be used to develop an early warning system that can detect sudden price increases and supply disruptions, especially in flood and disaster prone areas.

4. Improve rural market infrastructure and connectivity

Investment in rural roads, transport systems, and logistics infrastructure should be prioritized to reduce price volatility, especially in Inner Terai markets.

5. Enhance capacity of local data collection system

Training and capacity building programs should be conducted for municipal staff and local enumerators to improve data quality, consistency, and reporting efficiency.

6. Promote inclusive market based agricultural planning

Policy makers should use weekly market data to support smallholder farmers, women traders, and marginalized groups through targeted agricultural and market support programs.

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