An Assessment of Performance, Employment Generation, and Stakeholder Satisfaction of Dedicated Economic Centres in Sri Lanka's Vegetable Sector

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Abstract

Agricultural markets play a vital role in connecting producers and consumers. However, in Sri Lanka's upcountry vegetable sector, smallholder farmers continue to face challenges due to weak governance structures and inadequate infrastructure. This study assessed the performance and socio-economic impacts of Dedicated Economic Centres (DECs) in Sri Lanka's upcountry vegetable sector, focusing on Nuwara Eliya, Matale, and Badulla. The main objective of this study is to evaluate market functionality, examine social outcomes, and identify areas for operational and institutional improvements. Primary data were collected from market participants, including farmers, traders, transporters, and service providers, and supplemented with DEC transaction records from 2022 to 2025. A Market Functionality Index (MFI) was developed to assess infrastructure quality, operational efficiency, transparency, stakeholder satisfaction, and accessibility, while a Social Performance Index (SPI) measured employment generation and stakeholder satisfaction. The results showed that Dambulla DEC achieved the highest MFI score (0.72), followed by Keppetipola (0.69) and Nuwara Eliya (0.57), indicating differences in efficiency and governance. In terms of social performance, Nuwara Eliya DEC led with an SPI of 0.875, while Badulla (0.525) and Matale (0.275) demonstrated moderate to low social outcomes. The study concluded that DECs played a significant role in enhancing market

efficiency and supporting rural livelihoods; however, targeted improvements in infrastructure, administrative coordination, and stakeholder engagement such as expanding cold storage facilities and strengthening information systems were needed to enhance inclusivity, resilience, and the overall effectiveness of the DEC network.

Keywords: Governance, Infrastructure, Market Functionality Index (MFI), Social Performance Index (SPI), Stakeholder Satisfaction

1. Introduction

Agricultural marketing has historically played a vital role in shaping rural livelihoods, ensuring food security, and maintaining price stability across developing economies. In Sri Lanka, the vegetable subsector remained a central pillar of the national agricultural economy, contributing significantly to rural household incomes and the country's overall food supply chain (Central Bank of Sri Lanka, 2023). Despite its importance, the sector continued to suffer from several inefficiencies, including high price volatility, limited market coordination, unequal access to information, and substantial post-harvest losses. However, to mitigate these systemic issues, the Government of Sri Lanka introduced Dedicated Economic Centres (DECs) in the mid-1990s as an institutional reform aimed at improving market transparency and efficiency. These centres were established to operate as centralized wholesale markets, enabling direct linkages between producers, traders, and consumers while reducing transaction costs and stabilizing prices. However, the actual performance of DECs in overcoming market inefficiencies has yielded mixed outcomes, and several structural challenges persist. Empirical research in the vegetable marketing system has shown continued disparities between farm-gate and retail prices, irregular price transmission, and a strong influence of intermediaries and trader networks that often control market flows (Ranathilaka & Andri, 2014; Samarasinha, 2018). For example, findings from the wholesale market in Dambulla demonstrated that uneven bargaining power and collusive practices among middlemen could widen marketing margins and reduce overall efficiency (Ranathilaka & Andri, 2014). Earlier work by Rathnachandra and Malkanthi (2025) also highlighted that Sri Lanka's vegetable collection and distribution channels suffer from logistical and structural constraints that limit both efficiency and equity within the value chain. A major challenge arose from the geographical isolation of many smallholder farms, which were often located in remote areas with weak infrastructure and poor access to road networks. These spatial limitations elevated transport costs, reduced delivery timeliness, and compromise produce quality. Consequently, small-scale farmers faced a competitive disadvantage compared to larger commercial growers who had better access to transport facilities and market outlets. Beyond logistical constraints, socio-economic factors further shaped the market outcomes. Restricted access to formal credit and

dependence on informal lending arrangements with traders diminished farmers' bargaining strength during price negotiations. Such credit-linked dependencies frequently compelled farmers to sell produce under unfavorable conditions and at reduced prices, reinforcing cycles of market vulnerability and income insecurity among rural producers (Rathnachandra & Malkanthi, 2025). The Sri Lankan government introduced Dedicated Economic Centres (DECs) following the 1998 budget proposal to strengthen regional agro-product marketing and promote fair trade. The first centre, established in Dambulla in 1999, aimed to create a competitive marketplace that would ensure fair prices for producers, affordable food for consumers, and better access for wholesalers (National Audit Report, 2020). Today, DECs serve as the main distribution hubs for vegetables and fruits across the island, handling over 60% of total agricultural trade (Wijesinghe et al., 2021). Currently, eighteen centres operated under the Ministry of Agriculture, while the Peliyagoda and Norochcholai DECs function under local authorities. The government's broader objectives in establishing these centres were to improve the quality of regional agro-based production, promote efficient and competitive market systems with minimal intermediary involvement, ensure stable prices, enhance the nationwide distribution of local produce, and reduce transport costs and post-harvest waste, particularly for small and medium-scale farmers. The Ministry of Agriculture has prioritized the development and strengthening of DECs as a key focus under the National Agriculture Policy (2021) while through theme on Agri-Entrepreneurship and Markets (Theme 6), the National Agriculture Policy of Sri Lanka (2021) emphasized the promotion of market-oriented agricultural systems and strengthened collaboration among value chain actors to enhance competitiveness in both domestic and international markets (Ministry of Agriculture, 2021).

The primary aim of this study was to evaluate the overall functionality and socio-economic performance of DECs in Matale, Nuwara Eliya, and Badulla within Sri Lanka's national agricultural marketing framework. The study addressed the research problem of persistent inefficiencies in upcountry vegetable markets, including weak governance, inadequate infrastructure, and limited stakeholder participation, which constrain the effectiveness and inclusivity of DECs. Specifically, the research objectives were: (i) to assess operational performance and market functionality using a Market Functionality Index (MFI), (ii) to identify and analyze key functional, institutional, and administrative challenges affecting DEC operations, and (iii) to evaluate the social and economic impact of DECs using a Social Performance Index (SPI), focusing on employment generation and stakeholder satisfaction. These objectives were achieved through a mixed-method approach, integrating quantitative data collection from 150 stakeholders for index calculation with qualitative insights from interviews, focus group discussions, and field observations. The qualitative

insights derived from focus group discussions and key informant interviews are integrated under thematic sections such as governance practices, infrastructure constraints, and stakeholder participation. These qualitative data were analyzed using a thematic analysis approach. All interviews and focus group discussions were first transcribed verbatim, after which a systematic coding process was carried out manually using Microsoft Excel. Codes were organized into spreadsheets, enabling the identification of recurring patterns and key issues across respondents. These codes were then grouped into broader themes and sub-themes aligned with the study objectives. This process facilitated a structured interpretation of stakeholder perceptions, institutional challenges, and socio-economic impacts. This mixed-method approach allowed systematic comparison of DEC performance, while also capturing contextual governance and socio-economic factors, thus ultimately determining the economic viability and social acceptability of DECs as sustainable and inclusive market governance mechanisms that enhance efficiency, equity, and resilience in Sri Lanka's vegetable marketing systems.

According to the Ministry of Agriculture, DECs have been established to distribute fruit and vegetable production island-wide, based on the producing areas as well as the consuming areas (Table 01). These centres function as strategic hubs within the national agricultural marketing network, enabling the aggregation, wholesale trading, and redistribution of produce across the island. By linking producers, wholesalers, and retailers, DECs streamlined market operations, reduced post-harvest losses, and ensured a more balanced and accessible supply of agricultural commodities throughout the country.

Table 01: Established Dedicated Economic Centres in Sri Lanka

Dedicated Economic Centre	District Located	Establishment Criteria	Present Functionality
Dambulla DEC	Matale	Based on producing area	In operation
Nuwara Eliya DEC	Nuwara Eliya	Based on producing area	In operation
Keppetipola DEC	Badulla	Based on producing area	In operation
Thambuttegama DEC	Anuradhapura	Based on producing area	In operation
Embilipitiya DEC	Ratnapura	Based on producing area	In operation
Kuruduwatta DEC	Kandy	Based on producing area	In operation
Norochcholai DEC	Puttalam	Based on producing area	In operation
Meegoda DEC	Colombo	Based on consuming area	In operation
Welisara	Gampaha	Based on consuming area	In operation
Veyangoda	Gampaha	Based on consuming area	In operation
Narahenpita	Colombo	Based on consuming area	In operation
Ratmalana	Colombo	Based on consuming area	In operation
Ampara	Ampara	Based on consuming area	In operation
Peliyagoda	Gampaha	Based on consuming area	In operation

Kilinochchi	Kilinochchi	Based on distribution area	Not in operation
Jaffna	Jaffna	Based on distribution area	Not in operation
Vavuniya	Vavuniya	Based on distribution area	Not in operation
Batticaloa	Batticaloa	Based on distribution area	Not in operation

Source: Ministry of Agriculture (2024 December)

At present, eighteen DECs have been established across Sri Lanka to provide essential market infrastructure for the buying, selling, storing, and distribution of agricultural produce. Of these, fourteen centres, excluding those in Vavuniya, Kilinochchi, Jaffna, and Batticaloa, were currently operational. The management of DECs has been overseen by Management Trusts chaired by the District Secretary or Government Agent of the respective district, with ex-officio representation from relevant government agencies and trader associations, in accordance with the Cabinet decision of 10 January 2006. However, the absence of a unified and legally accountable governance structure has limited the efficiency and long-term sustainability of these centres. Recognizing this gap, the Cabinet of Ministers recently approved a proposal submitted by the Minister of Trade, Commerce, Food Security, and Co-operative Development to establish a limited liability company tasked with the development, expansion, and professional management of DECs (Cabinet Office, 2025). This institutional reform aims to introduce a more centralized, transparent, and financially viable management model that can strengthen operational efficiency, accountability, and strategic growth within Sri Lanka's agricultural marketing network.

Accordingly, this study was guided by the central research question of the extent to which Dedicated Economic Centres (DECs) function as efficient, inclusive, and socially beneficial market governance mechanisms within Sri Lanka's upcountry vegetable sector. In addressing this, the study focused on DECs in Nuwara Eliya, Matale (Dambulla), and Badulla (Keppetipola), examining their performance in terms of market functionality, governance quality, infrastructure adequacy, employment generation, and stakeholder satisfaction. It further identified the key institutional and operational challenges that constrain their efficiency and long-term sustainability within the national agricultural marketing system.

2. Literature Review

2.1. Structure of Vegetable Supply Chains and Role of Intermediaries

The supply chain for fruits and vegetables involved multiple actors including farmers, traders, wholesalers, and retailers who collectively determined how produce moves from farm to consumer. In many developing countries, the dominant marketing channels remained intermediary-based, where most produce passes through several intermediaries before reaching final markets, limiting direct access for smallholder

farmers and reducing their share of profits (Producer–local trader–wholesaler–retailer–consumer) (Kumar et al., 2025). In Sri Lanka's upcountry vegetable sector, traditional supply systems were characterized by a larger number of intermediaries that increased marketing margins and contributed to inefficiencies, resulting in lower farm-gate prices and higher consumer costs (W. Wanasinghe & Sachitra, 2022; Rathnachandra & Malkanthi, 2025). These structural features including inadequate rural infrastructure and limited market integration highlighted the persistent challenges smallholders faced in participating effectively in vegetable markets. According to Viswanadham (2007), horticultural products typically passed through six to seven intermediaries before reaching final customers. Each intermediary performed essential functions such as transferring ownership, transporting the produce, maintaining quality, handling payments, and ensuring timely delivery to buyers (Halder & Pati, 2011), Middlemen dominated the sector by establishing distribution networks and storage facilities for specific types of produce. Similarly, some supermarkets developed long-term partnerships with these intermediaries to secure a consistent supply of fruits and vegetables (Government of Kenya, 2003). The connection between farmers and markets was therefore vital to the development of the subsector, particularly in contexts where middlemen exert significant control. In Sri Lanka, the vegetable marketing system was largely managed by the private sector (Vidanapathirana, 2008), and marketing operations substantially influence both farmer profits and consumer availability. High marketing costs and excessive margins were persistent challenges, while limited knowledge of value addition and production planning often led to seasonal oversupply. The lack of post-harvest handling skills and restricted accessed to market information further constrain farmers' ability to enhance the value of their produce (Serem, 2010).

2.2. Infrastructure and Logistics Constraints in Vegetable Marketing

Infrastructure played a pivotal role in facilitating efficient vegetable collection and distribution by improving market access and reducing logistical inefficiencies. The recent food flow mapping in Sri Lanka highlighted that poor rural urban connectivity and inadequate transportation infrastructure disrupt food supply chains, limit access to markets, and increase post-harvest losses for perishable commodities such as vegetables (Food and Agriculture Organization [FAO], 2024). The World Bank evidence from multiple countries showed that enhanced rural road networks and connectivity significantly improve farmers' ability to reach markets, reduce transport costs and travel time, and increase volumes of agricultural produce transported, thereby strengthening food security and rural incomes (World Bank, 2024). In the context of Sri Lanka's upcountry vegetable sector, the sustainability challenges in the supply chain, including long-distance transportation, limited access to reliable transport, and weak integration of logistics systems, have been identified as major

constraints to efficient market participation and income generation for smallholder farmers (Rathnachandra & Malkanthi, 2025). These findings highlighted the importance of coordinated investment in transportation infrastructure and supporting logistics to enhance farm-to-market efficiency, reduce losses, and improve economic outcomes for all supply chain actors. Reliable transportation facilitates higher production levels and reduces losses, allowing farmers to benefit economically and maintain a more consistent presence in competitive markets. The collection and procurement practices of vegetables also establish frameworks for sustainable commercial relationships between farmers, suppliers, and retailers, including supermarkets. Efficient procurement requires frequent deliveries, stable quality, and consistency in product characteristics such as size, colour, and volume (FAO, 2024).

2.3. Governance, Coordination, and Technology in Modern Supply Chains

In international contexts, retailers often structured their agreements with growers based on these observable characteristics, allowing for better management of quality and reduced uncertainty in product attributes (FAO, 2024). Maintaining quality control remains critical in fresh vegetable supply chains, as retailers continue to face challenges related to monitoring freshness, managing short shelf lives, and minimizing post-harvest losses. Recent studies emphasized that improved supply chain coordination and governance mechanisms play a vital role in addressing these challenges by enhancing information sharing, reducing uncertainty, and aligning incentives among actors (Zhao et al., 2019). Empirical evidence suggested that long-term contractual relationships and collaborative partnerships between producers and retailers significantly reduce transaction costs and information asymmetry while strengthening trust and supply reliability (Jia & Wang, 2022). Moreover, the adoption of digital traceability systems and real-time monitoring technologies, such as IoT-enabled cold chain management, has been shown to improve transparency, quality assurance, and shelf-life management in fresh produce markets (Charlebois et al., 2024). Collectively, these recent findings reinforced that effective coordination, relational governance, and technology integration were essential for ensuring efficiency, reliability, and mutual benefits for both producers and buyers within modern vegetable supply chains.

2.4. Post-Harvest Losses and Operational Inefficiencies in DECs

In Sri Lanka, institutional stakeholders such as the Dambulla DEC have recognized that market inefficiencies were not confined to pricing and governance structures but also extended to post-harvest management and logistics. Officials from the DEC reported that nearly 20% of the vegetable harvest was lost during transportation due to inadequate packaging, rough handling, and inefficient delivery practices. Similarly, a study conducted by the Ministry of Internal Trade and Cooperatives, accordance to Greshan and Kithsiri (2021), estimated that more than 30% of fruits

and vegetables handled through the DEC were wasted. These post-harvest losses impose a heavy economic loss on both producers and traders, reducing overall profitability while contributing to market price fluctuations and food wastage. These inefficiencies ultimately counteracted the initial goals of establishing DECs to improve coordination across the supply chain, enhance price transparency, and reduce losses through better infrastructure and operational management. The high levels of spoilage indicated that while DECs have improved physical market access for farmers, the supporting logistical systems, cold chain facilities, and handling standards remain underdeveloped. This gap highlighted the need for stronger governance interventions, technological upgrading, and farmer training to reduce losses along the supply chain.

2.5. Traditional and Modern Market Channels in Sri Lanka

The broader marketing landscape for vegetables and fruits in Sri Lanka remains complex and fragmented, characterized by a coexistence of both traditional and modern market channels. The Japan International Cooperation Agency (JAICA, 2013) observed that despite the emergence of modern retail outlets and supermarket chains, the majority of small and medium-scale farmers continued to rely on conventional marketing systems such as local collectors, commission agents, and wholesale markets, including DECs. These traditional channels dominated the distribution network from farm to consumer due to their long-standing social relationships and lower entry barriers for farmers. However, the traditional system also perpetuated inefficiencies such as poor coordination, a lack of transparency in price formation, and limited traceability of produce. They served as centralized trading points that facilitated large-scale aggregation and distribution, yet they still exhibited many of the structural inefficiencies found in the broader market system. Accordingly, while DECs played a vital role in organizing the vegetable and fruit trade, their full potential as instruments of governance and market efficiency has yet to be realized.

Earlier research largely attributed market inefficiencies to intermediary dominance, weak logistics, and inadequate infrastructure (P. Wanasinghe & Sachitra, 2022; Rathnachandra & Malkanthi, 2025). The importance of coordination, relational governance, and technology adoption in improving market performance (P. Wanasinghe & Sachitra, 2022). However, few studies integrated these structural and social dimensions into a unified evaluative framework capable of assessing both functional effectiveness and stakeholder well-being (P. Wanasinghe & Sachitra, 2022). This limitation underscored the need for a multidimensional approach to market assessment. Accordingly, the Market Functionality Index (MFI) was adopted to capture key operational attributes identified across the literature, namely, infrastructure quality, transparency, accessibility, and efficiency, while the Social

Performance Index (SPI) reflects the growing scholarly recognition that employment generation and stakeholder satisfaction were critical indicators of inclusive market development (Rathnachandra & Malkanthi, 2025).

2.6. Assessment Methods Used in Agricultural Market Performance Studies

Previous research assessing agricultural market performance has applied a range of quantitative and qualitative methods to evaluate efficiency, governance, and socio-economic outcomes. The common approaches include price spread and marketing margin analysis to measure profit distribution among value chain actors (Acharya & Agarwal, 2011), value chain analysis frameworks to examine structural linkages and power dynamics (Kaplinsky & Morris, 2001), and econometric price transmission models to assess market integration and efficiency (Sexton et al., 2003). Several studies have employed cost–benefit analysis (CBA) to evaluate infrastructure and institutional investments (Boardman et al., 2018). In addition, researchers have increasingly adopted composite index approaches to measure multidimensional market performance and institutional quality (Nardo et al., 2008). By synthesizing these complementary perspectives, the study moved beyond descriptive accounts of marketing challenges and provided a more analytically grounded methodology for evaluating the performance and developmental contribution of DECs in Sri Lanka's upcountry vegetable sector.

3. Methodology

3.1. Research Design

This study primarily adopted a quantitative research design with limited qualitative inputs to evaluate the functionality, socio-economic impacts, and governance effectiveness of Dedicated Economic Centres (DECs) in Sri Lanka's upcountry vegetable sector. Primary data were collected from 150 market participants, including farmers, traders, transporters, and service providers, using structured questionnaires. The quantitative data were analyzed using descriptive statistics and composite index construction methods to develop the Market Functionality Index (MFI) and Social Performance Index (SPI). The quantitative component focused on assessing the functional performance of DECs, including indicators such as market participation, price dissemination, transaction volumes, cost efficiency, and income effects on farmers and traders. Structured questionnaires and secondary market data were used to generate numerical evidence aligned with the study's functional and socio-economic objectives. The qualitative component was applied to examine governance structures, coordination mechanisms, and institutional challenges within DECs. Semi-structured interviews and focus group discussions with farmers, traders, commission agents, and officials were conducted to explore issues related to decision-making processes, rule enforcement, transparency, and stakeholder trust that could

not be adequately captured through the quantitative data alone. The study focused on DECs located in Matale, Nuwara Eliya, and Badulla, since these centres function as major trading hubs for upcountry vegetables and represent diverse agro-climatic and institutional contexts.

Matale, Nuwara Eliya, and Badulla were selected for their analytical importance in capturing the structural diversity of Sri Lanka's upcountry vegetable marketing system. These districts differ significantly in agro-ecological characteristics, production intensity, supply chain organization, and market accessibility, enabling a more comparative assessment of DEC performance. Nuwara Eliya represented a highly commercialized, high-altitude production zone with strong market integration, while Badulla reflected a geographically dispersed farming landscape where transport constraints and institutional coordination shape market participation. In contrast, Matale functions as a strategic transit and aggregation region linking major producing areas with national wholesale markets, particularly through the Dambulla DEC. Examining these contrasting contexts allowed for the identification of location-specific governance and infrastructure challenges while improving the generalizability of the findings to the broader upcountry vegetable sector. By integrating quantitative measurements with qualitative insights, the mixed-methods approach enabled triangulation of findings and strengthened the validity of conclusions drawn in relation to the study objectives.

3.2. Study Area and Sampling

The study was conducted across the three major upcountry vegetable-producing districts of Matale, Nuwara Eliya, and Badulla. A purposive sampling technique was used to select DECs based on their significance within the regional agricultural marketing system. Within each DEC, market participants were selected using a stratified random sampling approach to ensure proportional representation of all key stakeholder groups. The main stakeholders included traders (wholesalers, retailers, and commission agents), transporters (from farms to DECs, from DECs to wholesalers, from DECs to retailers, and from DECs to other contract suppliers), farmers (vegetable and fruit producers), and other service providers such as "Nattami" (market helpers) and security officers. A total of 150 respondents were sampled across the three DECs, with the allocation stratified according to stakeholder representation and relative market importance to ensure a balanced and statistically representative sample. A sample size of 150 respondents was considered statistically adequate based on established methodological guidance. Krejcie and Morgan (1970) developed a widely accepted sample size determination table demonstrating that samples ranging between approximately 140 and 169 respondents are sufficient for medium-sized populations, ensuring reliable statistical estimates and generalizable

findings. The stakeholder perspectives were captured through structured survey responses and therefore, the research remains primarily quantitative in nature, with findings derived from statistically measurable indicators rather than qualitative interpretation.

3.3. Data Collection

This study applied two complementary indices to evaluate DECs. The Market Functionality Index (MFI) was used exclusively to measure market performance, focusing on operational efficiency, price stability, transaction transparency, infrastructural adequacy, and coordination effectiveness. The indicator scores were normalized, weighted, and aggregated to generate a composite performance score for each DEC. In contrast, the Social Performance Index (SPI) was applied to assess socio-economic outcomes, specifically employment generation, income stability, and stakeholder satisfaction among farmers, traders, and intermediaries operating within DECs. The SPI captured welfare-oriented impacts that extend beyond market efficiency and reflect the broader development role of DECs. The quantitative data were collected using a researcher-administered structured questionnaire, developed based on a review of prior studies on agricultural market functionality and institutional performance. The questionnaire consisted of closed-ended and Likert-scale items covering market operations, pricing mechanisms, transaction volumes, infrastructure adequacy, and institutional efficiency. In addition, the market transaction records and official DEC reports for the period 2022 to 2025 were reviewed to validate the data. The MFI applied in this study was developed by adapting established market performance and functionality assessment frameworks used in agricultural and food market research. Instead of adopting a single pre-existing index, the MFI was contextualized for DECs by synthesizing indicators commonly used in market efficiency, price discovery, infrastructure adequacy, and transparency assessments. Specifically, the index structure draws on conceptual and empirical approaches proposed by FAO for market functionality analysis, as well as market performance frameworks outlined in agricultural economics literature (FAO, 2021; Barrett et al., 2022). The selected indicators, market quantity, price discovery efficiency, transaction transparency, infrastructural adequacy, and coordination efficiency were identified based on their relevance to wholesale agricultural markets and DECs, as supported by prior studies. The indicator weighting and aggregation procedures followed standardized index construction methods widely applied in composite market indices. The use of separate indices ensured conceptual clarity by distinguishing how well markets function (performance) from how they affect livelihoods and stakeholders.

3.4. Construction of the Market Functionality Index (MFI)

The MFI was developed as a composite performance index, adapted from established agricultural market functionality and performance assessment frameworks (FAO, 2021). Five indicators representing critical dimensions of market performance were selected: infrastructure adequacy, operational efficiency, transaction transparency, accessibility, and price discovery efficiency. The data for these indicators were obtained from structured questionnaires administered to market participants, direct field observations, and official DEC operational records (2022–2025). Each indicator was standardized using a min–max normalization method to a 0–1 scale to ensure comparability. The indicator weights were assigned equally to minimize subjective judgment in the absence of strong theoretical or empirical evidence supporting differential weighting. Equal weighting was widely applied in composite index construction, particularly in exploratory assessments, as it promotes transparency and avoids overemphasizing any single dimension of performance (FAO, 2021). This index enabled objective comparison of market functionality across Matale, Nuwara Eliya, and Badulla DECs, thereby addressing the first and third research objectives.

The general formula for calculating the MFI was:

$$MFI_j = \sum_{i=1}^{n} \omega_i \cdot x_{ij}$$

MFI_j = Market Functionality Index of market / DEC
n = Total number of indicators (infrastructure, efficiency, transparency, etc.)
x_{ij} = Score of the ith indicator for the market
ω_i = Weight assigned to the ith indicator (sum of all weights = 1)

The MFI was applied as a composite tool for assessing the overall performance of agricultural markets, including DECs. It incorporated several key dimensions of market operations to provide a comprehensive evaluation. These included Infrastructure (I), which examined the adequacy of trading spaces and storage facilities; Operational Efficiency (O), reflecting transaction speed and the timeliness of price information dissemination; Market Transparency (T), assessing fairness in grading, weighing, and reporting practices; Stakeholder Satisfaction (S), measuring the level of satisfaction among farmers and traders with available market services; and Accessibility and Logistics (A), which evaluated transport connectivity and ease of physical access to the market. Each indicator was standardized on a scale ranging from 0 to 1, where a value of 1 denoted excellent or fully functional performance, and 0 represented poor functionality.

3.5. Construction of the Social Performance Index (SPI)

The SPI was designed to assess the socio-economic outcomes of DEC operations, particularly employment generation and stakeholder satisfaction, in line with impact evaluation approaches used in agricultural market studies (Barrett et al., 2022; FAO, 2021). The SPI was designed to assess the social impact of DECs by capturing both employment generation and stakeholder satisfaction. The index consisted of two main components: Employment Generation, which includes the number of Direct Employment (DE) opportunities provided by the DEC and the Indirect Employment (IE) created through associated activities such as transportation and auxiliary services; and Stakeholder Satisfaction, which evaluated the perceptions of key market participants. Satisfaction was measured on a 5-point scale (1 = Very unsatisfied, 5 = Very satisfied) across four stakeholder groups: Farmers (FS), Buyers/Traders (BS), Transporters (TS), and Other Service Providers (OSS) (Table 03). By integrating these components, the SPI provided a comprehensive measure of the social performance and inclusivity of the DECs.

By applying MFI and SPI together, the study systematically evaluated how efficiently DECs function as market institutions and how effectively they contribute to local livelihoods, providing a comprehensive assessment aligned with the overall research objectives.

3.6. Standardized Stakeholder Satisfaction Scores

Satisfaction scores are averaged across stakeholder groups and converted to a 0–1 scale:

$$S_s = \frac{FS + BS + TS + OSS}{4 \times 5}$$

Where:
FS = Farmer Satisfaction
BS = Buyer/Trader Satisfaction
TS = Transporter Satisfaction
OSS = Other Service Providers' Satisfaction
5 = Maximum possible score

4. Analysis and Discussion

4.1. Market Functionality Assessment

The Market Functionality Index (MFI) was a composite indicator used to systematically assess the operational performance of markets. It integrated multiple dimensions of market functionality, such as infrastructure, operational efficiency, transparency, stakeholder satisfaction, and accessibility into a single, quantifiable

score. The MFI was a quantitative measure designed by the World Food Programme (WFP)'s Research, Assessment & Monitoring (RAM) and Supply Chain (SC) Divisions to benchmark market functionality (World Food Programme, 2020).

Table 02: Market Functionality Indicators and Scores for DECs

DEC	Infrastructure (I)	Operational Efficiency (O)	Transparency (T)	Stakeholder Satisfaction (S)	Accessibility (A)
Nuwara Eliya	0.6	0.5	0.6	0.65	0.5
Dambulla	0.8	0.7	0.7	0.7	0.7
Keppetipola	0.7	0.65	0.7	0.8	0.6

Source: Survey Data (from 2022- 2025)

The MFI assessment of the three DEC) revealed notable differences in performance across key indicators (Table 02). The Nuwara Eliya DEC recorded moderate scores, with infrastructure at 0.6, operational efficiency at 0.5, transparency at 0.6, stakeholder satisfaction at 0.65, and accessibility at 0.5, indicating some limitations in both operations and access.

Dambulla DEC demonstrated comparatively higher functionality, achieving scores of 0.8 for infrastructure, 0.7 for operational efficiency, 0.7 for transparency, 0.7 for stakeholder satisfaction, and 0.7 for accessibility, reflecting better overall performance and efficiency. Keppetipola DEC showed intermediate performance, with infrastructure at 0.7, operational efficiency at 0.65, transparency at 0.7, stakeholder satisfaction at 0.8, and accessibility at 0.6, highlighting strengths in stakeholder satisfaction and balanced operational efficiency, although with room for improvement in accessibility.

The MFI analysis revealed distinct differences in performance among the three DECs. The Nuwara Eliya DEC recorded the lowest MFI score of 0.57, indicating moderate functionality and highlighting operational and accessibility constraints that limit its efficiency. The Dambulla DEC achieved the highest MFI of 0.72, reflecting strong infrastructure, efficient operations, and effective stakeholder satisfaction, making it the most functional centre among the three.

The Keppetipola DEC obtained an intermediate MFI of 0.69, demonstrating relatively good performance, particularly in stakeholder satisfaction, although it still faces challenges in accessibility and operational efficiency. Overall, the MFI results indicated that all three DECs contributed to the regional vegetable marketing system, targeted improvements in infrastructure, logistics, and operational practices, especially at Nuwara Eliya and Keppetipola, could further enhance market functionality, efficiency, and inclusivity.

In the proceeding sections the descriptions of infrastructure and operational efficiency, transparency and stakeholder satisfaction, and accessibility and logistics were based on qualitative data collected through focus group discussions and key informant interviews conducted with traders, farmers, and DEC officials across the selected centres. Thses data were analyzed using a thematic analysis approach, supported by narrative description.

4.2. Infrastructure and Operational Efficiency

Infrastructure and operational efficiency were key contributors to the MFI scores across the three DECs. The Dambulla DEC recorded the highest infrastructure score, reflecting its larger trading space, better storage capacity, and more streamlined transaction processes. Keppetipola also demonstrated relatively strong infrastructure, while Nuwara Eliya showed moderate performance, indicating constraints in space utilization, cold storage availability, and operational flow. These infrastructural differences directly influenced the market throughout and overall efficiency across centres. These infrastructural and operational shortcomings directly impacted market quantity and overall efficiency, constraining the ability of these centres to fully support the regional vegetable supply chain.

4.3. Transparency and Stakeholder Satisfaction

Transparency in grading, weighing, and pricing, together with stakeholder satisfaction, emerged as key factors influencing variations in DEC performance. The Nuwara Eliya centre demonstrated comparatively higher levels of transparency and user satisfaction, as both farmers and traders reported fair trading practices and timely access to market information. In contrast, respondents from Matale and Badulla noted occasional conflicts related to space allocation and delays in information dissemination, which contributed to the lower MFI scores and highlighted persistent administrative and coordination challenges within those centres.

4.4. Accessibility and Logistics

Accessibility and logistics also played an important role in shaping the MFI outcomes. The Nuwara Eliya DEC benefited from its central location and well-developed transport network, which facilitated the efficient flow of vegetables from production sites to the market and onward to wholesalers and retailers. In contrast, although the Matale and Badulla centres remained operational, they experienced transport delays arising from inadequate road infrastructure and logistical inefficiencies. These constraints reduced farmers' direct access to the markets and increased their dependence on intermediaries, thereby limiting overall market efficiency.

4.5. Implications and Interpretation

Overall, the MFI analysis indicates that although all three DECs play a vital role in supporting upcountry vegetable marketing, there is a pressing need for targeted improvements in infrastructure, logistics, and operational management, particularly in Matale and Badulla, to enhance both efficiency and inclusivity. The findings also confirm that the MFI served as a useful framework for assessing market performance, pinpointing operational bottlenecks, and prioritizing policy interventions. Moreover, the strong performance of the Dambulla DEC provides an operational benchmark for improving functionality in other centres that can guide the adoption of best practices across other centres, thereby contributing to a more resilient and well-coordinated national agricultural marketing system.

4.6. Social Performance Index (SPI)

Aggregating standardized indicators of direct and indirect employment creation and stakeholder satisfaction, the SPI provided a structured assessment of how DEC operations translate into tangible social benefits. Table 03 presented the SPI results across the Matale, Nuwara Eliya, and Badulla DECs, highlighting inter-centre variations and linking observed outcomes to institutional arrangements and governance practices.

Table 03: Employment and Stakeholder Satisfaction Levels across Dedicated Economic Centres (DECs)

DEC	DE	IE	FS	BS	TS	OSS
Nuwara Eliya	15	30	4	4	3	4
Matale	10	20	3	3	2	3
Badulla	12	25	3	3	3	3

Source : Survey Data (from 2022- 2025)

Direct Employment (DE) , Indirect Employment (IE) , Farmers (FS), Buyers/Traders (BS), Transporters (TS), and Other Service Providers (OSS)

Table 03 presented a comparison of employment generation and stakeholder satisfaction across the three DECs in Nuwara Eliya, Matale, and Badulla. The findings indicated that the Nuwara Eliya DEC supports the highest level of both direct and indirect employment, providing 15 direct positions and 30 indirect roles, which reflected its larger scale of operations and more organized market management. In contrast, Matale recorded the lowest employment levels, with 10 direct and 20 indirect positions, while Badulla occupied an intermediate position. These differences suggested that the capacity of a DEC to generate employment was closely linked to its operational scale, infrastructure quality, and the efficiency of market processes. Stakeholder satisfaction, measured on a 1 to 5 scale, further highlighted the variation in performance among the centres. The respondents including farmers, traders,

transporters, and other service providers expressed higher satisfaction with the Nuwara Eliya DEC, with a score ranging from 3 to 4, reflecting perceived fairness in trading practices, timely access to market information, and effective coordination of services.

Stakeholder satisfaction was measured using a five-point Likert scale (1 = very dissatisfied to 5 = very satisfied). The responses were analyzed using descriptive statistics, including mean scores and frequency distributions, to identify satisfaction patterns across DECs. The participants from Matale and Badulla reported moderate satisfaction levels, with most responses clustered around scores of 2 and 3, indicating occasional dissatisfaction with market management, allocation of trading space, and logistical support. Comparative mean analysis across centres revealed that DECs with higher reported employment generation also recorded higher average satisfaction scores. This pattern suggests a positive association between employment opportunities, operational efficiency, and stakeholder perceptions of market performance. Higher employment generation appears to strengthen local livelihoods while improving engagement and trust among market actors, reinforcing the social and economic role of DECs. Conversely, lower employment levels and moderate satisfaction scores in Matale and Badulla highlight areas requiring targeted interventions, such as infrastructure improvements, enhanced logistics, and better stakeholder communication, to strengthen both social outcomes and overall market functionality.

4.7. Social Performance Index (SPI) Equation

The Social Performance Index (SPI) was a quantitative measure used to assess the social impact of a market or institution, such as a DEC. It combines two main components: employment generation (direct and indirect jobs created) and stakeholder satisfaction (farmers, buyers, transporters, and service providers), producing a single score between 0 and 1.

$$SPI = \omega_E \times \left(\frac{DE_S + IE_S}{2}\right) + \omega_S \times \left(\frac{FS + BS + TS + OSS}{4 \times 5}\right)$$

Where:
DEs = Standardized Direct Employment
IEs = Standardized Indirect Employment
FS = Farmer Satisfaction (1–5 scale)
BS = Buyer/Trader Satisfaction (1–5 scale)
TS = Transporter Satisfaction (1–5 scale)
OSS = Other Service Providers Satisfaction (1–5 scale)
ω_E= Weight assigned to employment component (commonly 0.5)
ω_S = Weight assigned to satisfaction component (commonly 0.5)

The SPI results revealed notable variations in the socio-economic performance of the DECs across the study locations. The Nuwara Eliya DEC recorded the highest SPI value (0.875), driven by strong direct and indirect employment generation and high levels of stakeholder satisfaction. This finding was consistent with earlier studies which mentioned that well-established wholesale markets located in high-production regions tend to generate greater employment opportunities and stronger livelihood linkages due to higher transaction volumes, diversified services, and continuous market activity (FAO, 2021). Similar evidence has been reported by Barrett et al. (2022), who highlight that market institutions functioning as central aggregation hubs often create multiplie effects through logistics, transport, and auxiliary services, thereby enhancing local employment. The Badulla DEC exhibited a moderate SPI score (0.525), reflecting average employment creation and stakeholder satisfaction. This aligned with findings from agricultural market studies in developing countries, which suggested that markets with moderate infrastructure and institutional coordination generate partial social benefits but remain constrained by limited market depth and governance inefficiencies (Wang et al., 2023). Such markets tended to support livelihoods but fell short of maximizing inclusivity and satisfaction among all stakeholder groups.

In contrast, the Matale DEC recorded the lowest SPI score (0.275), indicating weaker social performance in terms of both employment generation and stakeholder satisfaction. This outcome of prior research showed that inadequate infrastructure, weaker governance mechanisms, and limited stakeholder engagement reduce the capacity of market institutions to deliver social benefits (FAO, 2021; Yu & Xiao, 2024). The low satisfaction levels among market participants have been associated with information asymmetries, congestion, and limited service provision, which negatively affect trust and participation in market systems (Yu & Xiao, 2024). Overall, the SPI findings supported the broader literature that emphasizesd the role of market scale, infrastructure quality, and governance effectiveness in shaping socio-economic outcomes. The observed differences among DECs suggested that strengthening institutional coordination, improving service delivery, and expanding employment-linked activities can significantly enhance the social performance of DECs, particularly in underperforming locations such as Matale.

Although Nuwara Eliya recorded a lower MFI compared to Dambulla, it achieved the highest SPI, suggesting that operational efficiency alone does not fully determine social outcomes. One reasonable explanation was the labour-intensive nature of vegetable production in the Nuwara Eliya region, where continuous cultivation cycles and high cropping intensity generate greater demand for both direct and indirect employment. This employment density strengthened livelihood dependence on the market, thereby enhancing stakeholder engagement and satisfaction despite moderate

infrastructural limitations. Moreover, social performance is often influenced by relational and institutional factors rather than purely physical assets.

According to the qualitative data analysis of this study (focus group interviews), the governance was translated into stakeholder satisfaction primarily through reduced uncertainty and transaction risk. Transparent grading, predictable pricing mechanisms, equitable space allocation, and responsive administrative support help minimize conflicts while improving the overall trading experience. Such governance practices foster trust among farmers and traders, strengthen repeated market participation, and enhance perceptions of procedural fairness. In contrast, markets with stronger infrastructure but weaker coordination may perform efficiently in transactional terms yet fail to generate comparable social benefits. This justified Dambulla's superior functional performance did not automatically produce the highest social outcomes, highlighting that institutional quality and stakeholder relationships are equally critical determinants of market success.

5. Conclusion and Recommendations

The primary objectives of this study were to (i) evaluate the market performance of Dedicated Economic Centres (DECs) in Nuwara Eliya, Matale, and Badulla using a Market Functionality Index (MFI), (ii) assess the socio-economic impacts of these centres on employment generation and stakeholder satisfaction using a Social Performance Index (SPI), and (iii) examine governance and coordination mechanisms influencing DEC performance and social outcomes. The main findings revealed notable variations across DECs. In terms of market performance, the Dambulla DEC recorded the highest MFI score, reflecting superior infrastructure, operational efficiency, transparency, and accessibility, while Matale and Badulla demonstrated lower scores due to limited facilities and operational bottlenecks. Regarding social performance, the Nuwara Eliya DEC led in employment generation and stakeholder satisfaction, Badulla exhibited moderate social outcomes, and Matale lagged behind, indicating weaker socio-economic benefits. These findings highlight that DECs play a critical role in improving market efficiency and supporting rural livelihoods, but there is a clear need for targeted interventions, particularly in Matale and Badulla, to strengthen both operational and social performance.

5.1. Recommendations

Based on the study findings, it was recommended that targeted interventions be implemented to enhance the performance and social impact of DECs. For DECs with the lower MFI scores, particularly Matale and Badulla, investments in infrastructure improvements such as expanded trading floors, cold storage, and better market access were essential to improve quantity and operational efficiency. Strengthening governance and administrative mechanisms, including clear space allocation rules,

standardized operational procedures, and digital monitoring systems, can enhance transparency, reduce congestion, and improve stakeholder satisfaction. However, to address weaker socio-economic outcomes, particularly in Matale, capacity-building programs for DEC staff, support for small-scale farmers and transporters, and improved market linkages were recommended to increase employment opportunities and stakeholder satisfaction, as reflected in the SPI. Additionally, the introduction of digital platforms for real-time price dissemination can support informed decision-making for farmers, traders, and transporters. Finally, establishing a regular monitoring system using MFI and SPI indicators can track progress, identify bottlenecks, and guide evidence-based policy interventions, ensuring that DECs function effectively as inclusive, sustainable, and resilient market institutions in Sri Lanka's upcountry vegetable sector.

6. Limitations and Further Research

Despite the insights provided, this study has several limitations. First, the analysis focused only on three DECs in the upcountry regions (Nuwara Eliya, Matale, and Badulla) because of the time and resource limitations, which limited the generalizability of the findings to other districts or the national context. Secondly, the data collected relied on self-reported stakeholder responses for satisfaction, which may be subject to bias or exaggeration. Thirdly, the study used a cross-sectional design, capturing a snapshot in time, which may not fully account for seasonal variations in market functionality or social performance. Finally, although the MFI and SPI provided useful metrics, they may not capture all qualitative aspects of market governance and informal interactions among stakeholders.

Future research could expand the scope to include additional DECs across other regions to improve representativeness and comparative analysis. Longitudinal studies help to capture seasonal fluctuations and long-term trends in both market functionality and social impact. Integrating more qualitative methods, such as in-depth interviews or ethnographic observations, could provide richer insights into stakeholder behavior, conflict resolution, and decision-making processes. Additionally, exploring the relationship between DEC performance and vegetable price volatility, supply chain efficiency, or climate-related factors could provide valuable policy guidance for improving agricultural market governance in Sri Lanka.

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