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The Role of Digital Adoption in Business Outreach: A Study of Spice Traders in Idukki District

Dhanya Mohanan[#1], Devika N[*2]

#Research Scholar, Vels Institute of Science, Technology & Advanced Studies (VISTAS), Chennai, India
**Assistant Professor, Vels Institute of Science, Technology & Advanced Studies (VISTAS), Chennai, India*

Abstract—

This study examines the impact of digitalisation on the spice trade, specifically focusing on traders in Kattappana Municipality, encompassing Kumily, Kattappana, and Nedumkandam in Idukki district. The traditional spice market, which is often made up of fragmented structures and relies on middlemen, is slowly adopting digital tools that change how trades are made and how people access the market. In this context, the study investigates the adoption of digital platforms and their effects on traders' economic performance and market connections. The research is based on primary data. Descriptive and inferential statistical methods, including percentage analysis, measures of central tendency, and hypothesis testing, were used to identify patterns, relationships, and statistically significant differences between variables. The results indicate that digital platforms are progressively integrating into trading activities, mostly owing to their accessibility and user-friendliness. When businesses implement digital technology, they see changes in how they do business, such as better market reach and more efficient trade. Traders who use digital tools tend to have greater interaction with consumers and more exposure to the market than traders who rely solely on traditional means, although other parts of the profession remain affected by old habits and structural problems. The findings indicate that digitalisation is facilitating the modernisation of the spice trade, while its effects vary across dimensions. Strengthening digital skills and institutional support can further enhance trade outcomes.

Keywords— Digitalisation; Spice Trade; Economic Performance; Market Linkages; Idukki District

1. INTRODUCTION

India is widely recognized as the "land of spices" due to its long-standing history of producing some of the finest and most aromatic spices in the world. Indian spices are highly valued in international markets for their distinctive aroma, flavor, texture, and medicinal properties (Spices Board India, 2023). These high-value, low-volume commodities are used not only for seasoning and flavoring food but also play a crucial role in enhancing color, pungency, and nutritional value.

Beyond culinary applications, spices are extensively utilized in traditional medicinal systems such as Ayurveda, as well as in cosmetics and wellness industries (Nair, 2019). The spice sector holds a significant place in India's socio-economic and cultural fabric, with the country being the largest producer, consumer, and exporter of spices globally (Spices Board India, 2023).

India's diverse agro-climatic conditions, ranging from the Western Ghats to the Northeastern regions, facilitate the cultivation of a wide variety of spices. Owing to their high economic returns per unit area, spices contribute substantially to agricultural exports and rural livelihoods (Kumar & Singh, 2021).

Traditionally, the spice trade has relied on fragmented market structures, intermediaries, and conventional marketing channels, which often limit transparency, traceability, and price competitiveness (Kumar & Singh, 2021). Technologically advanced traders gain competitive advantages, while traditional traders struggle to keep pace.

With the increasing demand for quality assurance, efficient logistics, and online trading platforms, traders lacking digital capabilities encounter reduced market access and declining profitability. Moreover, global buyers now prefer digital documentation, e-commerce platforms, and real-time supply chain information, thereby intensifying competition in digital trade environments (Joseph & George, 2022).

In recent years, the spice sector has undergone considerable transformation through digitalization and modernization. Technological advancements, innovation ecosystems, digital traceability systems, and quality certification mechanisms have significantly reshaped the spice value chain. Institutional support, policy reforms, infrastructure development, and public-private partnerships have further enhanced the competitiveness and sustainability of the sector in the global market (Joseph & George, 2022).

2. OBJECTIVES OF THE STUDY

- To identify the different digital platforms used by spice traders.
- To analyze the economic impact of digital adoption between users and non-users.
- To evaluate digital platform usage and its impact on customer and supplier base expansion.

3. RESEARCH METHODOLOGY

The study focuses on spice traders operating within Kattappana Municipality, covering the regions of Kumily, Kattappana, and Nedumkandam in Idukki district, which are well-known centers of spice trade. A sample of 51 spice traders was selected from these regions, with a higher representation from Kumily due to its prominence as a major trading hub. However, when the analysis was performed in SPSS, only 49 responses were considered, as some information was incomplete or irrelevant; such data were excluded during the independent samples t-test and Chi-square test.

The study is based on both primary and secondary data sources. Primary data were collected through a structured questionnaire administered via Google Forms, along with direct

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interviews and personal interactions with respondents to ensure accuracy and reliability. Secondary data were gathered from journals, books, research articles, and institutional reports at both national and international levels to support the analysis.

Google Forms served as the main data collection tool, and the questionnaire was designed to capture information related to digital platform usage, financial performance, and market linkages. The collected data were analyzed using percentage analysis and descriptive statistical methods, with findings presented in tables for clarity. Statistical analysis was conducted using SPSS software. To assess the economic impact of digitalization, variables such as number of suppliers, number of workers, traders' experience, revenue, and net income were considered. An independent samples t-test was employed to compare the performance of digital users and non-users, enabling a clearer understanding of how digital adoption influences the economic outcomes of spice traders.

4. LITERATURE REVIEW

The global spice industry has undergone significant transformation due to changing consumer preferences, technological advancements, and increasing digitalization of trade systems. Recent studies indicate that consumers increasingly demand transparency, quality assurance, and traceability in spice products, with digital platforms playing a crucial role in enhancing trust and competitiveness (Thomas & Sajesh, 2025). Technological innovations in postharvest management, including advanced storage and packaging systems, have improved efficiency, reduced spoilage, and enhanced export potential (Adamu et al., 2025).

Historical perspectives highlight the long-standing importance of spices in global trade, shaping economic and cultural exchanges (Dasgupta, 2025; Bhavnani, 2025). In the modern context, digital transformation is reshaping agricultural marketing systems. Platforms such as e-NAM have improved market access, price discovery, and trade efficiency, although infrastructural and digital literacy challenges remain (Raj, 2024).

On a global scale, digitalization is transforming trade patterns by promoting e-commerce, data-driven decision-making, and broader participation of developing economies (Bekkers et al., 2024). Technologies such as artificial intelligence, blockchain, and data analytics have enhanced supply chain transparency, traceability, and resilience (Babu et al., 2024; Belhadi et al., 2024). These advancements also address issues related to food safety and supply chain disruptions. Digitalization has positively influenced small and medium enterprises by improving financial inclusion, operational efficiency, and innovation (Kumarasinghe & Haleem, 2020; Sivasubramanian & Rajendran, 2020). However, challenges such as gender disparities, limited technical knowledge, and inadequate policy support continue to hinder widespread adoption (Prabowo et al., 2024; Chen, 2019).

Overall, the literature suggests that digitalization enhances efficiency, transparency, and competitiveness in the spice value chain. However, structural constraints limit its full potential, necessitating focused research on its impact on traders' financial performance and market linkages.

4.1 Theoretical Framework

This study is grounded in established theoretical perspectives that explain how digitalization influences enterprise performance and market structures within the informal sector. The primary theoretical lens adopted is the Resource-Based View (RBV), complemented by insights from value chain theory and market linkage frameworks.

The Resource-Based View, originally proposed by Barney (1991), posits that firms achieve sustained competitive advantage through the effective utilization of valuable, rare, inimitable, and non-substitutable (VRIN) resources. In the context of informal sector enterprises, digital capabilities such as access to mobile technologies, digital payment systems, and online market platforms can be conceptualized as strategic resources. These resources enable traders to improve operational efficiency, reduce transaction costs, and enhance access to market information, thereby contributing to superior financial performance. Digital literacy and technological adaptability further strengthen these capabilities, allowing traders to leverage digital tools more effectively.

Complementing RBV, value chain theory provides a framework for understanding how activities across production, distribution, and marketing contribute to value creation. Digitalization enhances coordination among value chain actors by facilitating real-time communication, improving transparency, and reducing inefficiencies. Annosi et al. (2022) argue that digital integration strengthens value chain coordination, which in turn improves enterprise performance. For spice traders, this implies better integration with farmers, wholesalers, and export markets, ultimately leading to improved price realization and reduced dependency on intermediaries.

Market linkage theory further explains the importance of relationships and networks in determining economic outcomes. Strong market linkages enable a better flow of information, goods, and financial resources among stakeholders. Digital platforms play a crucial role in strengthening these linkages by expanding market access and reducing geographical constraints. Hidalgo et al. (2023) highlight that digital transformation enhances market connectivity, which acts as a mediating factor in improving firm performance. In regions such as Idukki district, where the spice trade is largely informal and fragmented, improved market linkages through digitalization can significantly enhance trading efficiency and income stability.

Traditional traders mainly depend on long-term relationships, but the transformation of an enterprise from traditional to digital can be explained by different stages of digital maturity. The success of digital transformation depends not only on technology adoption but also on strategic and organizational change (Kurmann & Arpe, 2021).

The adoption of digital technology among spice traders falls between level 2 (Beginner stage) and level 3 (Adopter stage), corresponding to a digital score of between 300 and 500. Spice traders are largely in the late Beginner and early Adopter stages. Although many traders have started using digital tools such as smartphones, digital payments, social media communication, and online banking services, the adoption of advanced digital

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systems for inventory management, data analytics, e-commerce, and integrated supply chain operations remains limited.

This has prompted the researcher to divide digital adoption into two levels. As the Digital India mission has reached every corner of the country, Idukki has also benefited from access to UPI, Google Pay, and Wi-Fi connectivity, bringing a large proportion of previously digitally illiterate people into digitalization. The common practice of using WhatsApp on a smartphone or making payments through a payment gateway is no longer considered a marker of high digital literacy. Hence, the study draws a distinction between low digital adoption and high digital adoption based on the theory of digital maturity.

Additionally, the concept of transaction cost economics provides further theoretical support by explaining how digital tools reduce costs associated with information search, bargaining, and enforcement. By minimizing these costs, digitalization enhances overall market efficiency and supports better financial outcomes for traders.

Based on these theoretical perspectives, this study proposes that digitalization influences financial performance both directly and indirectly through the mediating role of market linkage structure. The integration of RBV, value chain theory, and market linkage frameworks provides a comprehensive understanding of how digital transformation reshapes informal sector dynamics, particularly in the context of spice trading.

5. DATA ANALYSIS AND INTERPRETATION

5.1 Most Commonly Used Digital Platforms Used by Spice Traders

The data collected from 51 spice traders from Kumily, Kattappana, and Nedumkandam region, shown in Fig. 1, indicate that the spice trade is largely male-dominated (90.2%), signalling a need for inclusive policies to improve women's participation, who account for only 9.8% of respondents.

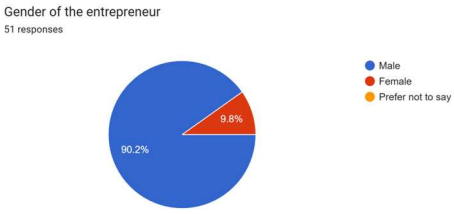

Fig. 1. Gender of the Entrepreneur

Source: Primary data

Many traders follow a hybrid model but lack technical guidance, with 60.8% not seeking professional support. Government assistance remains limited, though the Spices Board plays a key role. Digitalization has positively impacted market reach, with most traders reporting an increased customer base despite existing structural and support-related challenges.

Fig. 2 shows that social media and messaging platforms dominate digital spice trade. Facebook and WhatsApp are the most widely used platforms, indicating that traders prefer low-cost, easy-to-use tools that allow direct customer interaction. Some traders use multiple platforms to market their products.

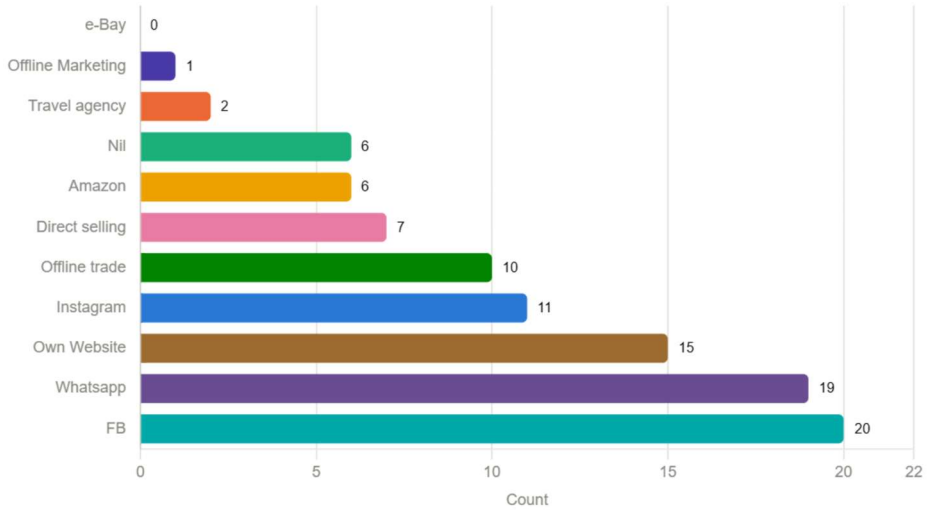

Fig. 2. Most Commonly Used Digital Platforms Used by Spice Traders

Source: Primary data

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Own websites and Instagram are also moderately used, reflecting growing interest in brand building and online presence. In contrast, e-commerce platforms such as Amazon and eBay have limited usage, suggesting barriers such as commissions, technical complexity, or scale requirements. The presence of offline and direct-selling responses highlights that traditional methods still coexist with digital platforms, confirming a hybrid marketing system in the spice trade.

5.2 Descriptive Statistics on the Economic Impact of Digitalization

The dataset consists of 49 valid observations. Table 1 shows that, on average, traders deal with about 8 suppliers, but the lower median (5) suggests skewness, with a few traders having a very high number of suppliers. The relatively high standard deviation indicates that supplier linkages vary widely, reflecting differences in scale and sourcing capacity among traders.

TABLE 1. Descriptive Statistics on the Economic Impact of Digitalization

Particulars		No. of Suppliers	No. of Workers	Total Experience of Trader	Revenue of Trader	Net Amount
N	Valid	49	49	49	49	49
	Missing	0	0	0	0	0
Mean		7.67	—	120,736,556.12	194,419,642.86	73,683,086.73
Median		5.00	—	75,687,500.00	121,875,000.00	46,197,500.00
Std. Deviation		6.105	—	125,801,549.756	202,616,551.142	76,815,009.204

Source: Primary data

Total expenses of traders show a mean significantly higher than the median, indicating a right-skewed distribution: a few traders incur very high expenses, pulling the average upward. This points to high inequality in operational scale, with some traders operating at much larger expense levels than others. Revenue data likewise show a mean much higher than the median, confirming positive skewness. The large standard deviation indicates substantial variation in earnings, suggesting the coexistence of small-scale and large-scale traders in the sample, possibly reflecting economies of scale achieved by larger traders through digitalization.

Net amount (profit) shows a similar gap between mean and median, indicating profit inequality, and the high standard deviation indicates inconsistent profitability. While traders are generally profitable, the level of profit varies widely, reflecting differences in efficiency, scale, or market access. The consistent pattern of mean exceeding median across financial variables indicates positively skewed data, meaning a few large traders dominate the market. High standard deviations across all variables show significant heterogeneity among small-, medium-, and large-scale spice traders.

5.3 Economic Impact of Digital Adoption Between Users and Non-Users

TABLE 2. Economic Impact of Digital Adoption Between Users and Non-Users

Particulars	Uses Digital Platform?	N	Mean	Std. Deviation	Std. Error Mean	Sig.
Total exp. of trader	Yes	31	152,998,709.68	1,476,759,908.657	265,233,376.176	.003
	No	18	65,173,958.33	321,470,264.442	75,777,126.797	
Revenue of trader	Yes	31	246,370,967.74	2,378,524,561.566	427,195,563.197	.003
	No	18	104,947,916.67	517,866,916.935	122,062,933.380	
Net amount	Yes	31	93,372,258.06	901,766,561.833	161,961,88.624	.003
	No	18	39,773,958.33	196,398,93.755	46,291,67.352	

Source: Primary data

The sample consists of 31 digital users and 18 non-users, and the comparison reveals substantial differences in performance indicators. Traders using digital platforms incur significantly higher expenses than non-users, which may reflect larger-scale operations, investment in logistics, hiring of technical experts, or expansion enabled by digital reach. Digital users generate more than double the revenue of non-users, a statistically significant difference indicating that digital adoption is strongly associated with higher sales. Profit levels are likewise significantly higher among digital users; despite higher expenses, digital traders achieve greater profitability, suggesting better market access and efficiency.

5.4 Digital Platform Usage and Its Impact on Customer and Supplier Base Expansion

Change in the Consumer Base Due to the Introduction of Digitalisation

TABLE 3. Cross-Tabulation of Change in Consumer Base Following Introduction of Digitalisation

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Uses digital platform for selling spices?	No change	Slightly increased	Significantly increased	Total
No	14	4	0	18
Yes	0	23	8	31
Total	14	27	8	49

Source: Primary data

Most non-digital traders reported no growth, indicating limited market expansion in the absence of digital platforms. All digital users experienced some level of growth, with a notable proportion achieving significant expansion in their customer base.

A Chi-square test reveals a statistically significant association between digital platform usage and customer base growth ($\chi^2 = 34.338$, df = 2, $p < 0.001$). This indicates that traders who adopt digital platforms are significantly more likely to experience an increase in their customer base than non-adopters.

Change in the Number of Suppliers Due to the Introduction of Digitalisation

TABLE 4. Independent Samples t-Test — Change in Number of Suppliers Following Introduction of Digitalisation

Number of Suppliers	F	Sig.	t	df	Sig. (2-tailed)	Mean Diff.	Std. Error Diff.	95% CI Lower	95% CI Upper
Equal variances assumed	5.726	.021	1.421	51	.162	24.188	17.016	-10.064	58.439
Equal variances not assumed	—	—	1.700	45.269	.096	24.188	14.226	-4.461	52.836

Source: Primary data

The t-test shows a t value of 1.700 with 45.269 degrees of freedom and a Sig. (2-tailed) value of 0.096. As the p-value exceeds 0.05, the difference in the number of suppliers between the two groups is not statistically significant. Although the mean difference is 24.188, the 95% confidence interval (−4.461 to 52.836) includes zero, indicating that the observed difference may reflect sampling variation rather than a true effect.

It is concluded that there is no statistically significant difference in the number of suppliers between digital users and non-users. The relative stagnation in supplier numbers can be attributed to the nature of the supply base, which largely consists of growers with limited digital literacy. These farmers predominantly rely on traditional marketing channels and maintain long-standing relationships with specific traders, supplying consistently to the same buyers; shifting to new traders may be neither feasible nor socially acceptable. This strong dependence on established relationships restricts supplier mobility and contributes to stability in supplier numbers across both groups. It can therefore be concluded that digitalization does not significantly influence the number of suppliers.

6. FINDINGS AND SUGGESTIONS

The spread of digitalization is evident across every sector and plays a crucial role in agriculture, especially among spice traders. Most traders use less complex but widely used social media platforms to sell their products. The research shows that digitalization is more easily adopted by traders than by growers, possibly owing to differences in education level or the nature of the business. These platforms are preferred because they are low-cost, user-friendly, and allow direct interaction with customers. However, the use of formal e-commerce platforms such as Amazon and eBay remains limited due to technical complexity, commission structures, and scale requirements.

Most traders remain confined to basic digital literacy; training and awareness of more advanced e-commerce practices could help them reach a wider market and generate higher profits. The descriptive statistics indicate considerable variation in traders' economic performance. Financial variables such as revenue, expenses, and net income exhibit positive skewness, suggesting that a few large traders dominate the market while many others operate at smaller scales. Wider and more thorough use of available technology should be promoted through grassroots-level training, with government and NGO initiatives supporting spice growers and traders. The comparative analysis between digital users and non-users shows that traders who adopt digital platforms achieve significantly higher revenue and profit levels, with the independent samples t-test confirming statistically significant differences in revenue and net income between the two groups.

All digital users reported some increase in their customer base, while most non-users reported no change. The t-test results indicate that the difference between digital users and non-users in supplier numbers is not statistically significant, likely due to the traditional, relationship-based nature of supplier linkages in the spice trade, where farmers tend to maintain long-standing connections with specific traders.

7. CONCLUSION

The study highlights the growing importance of digitalization in transforming the spice trading sector. The findings indicate that the adoption of digital platforms has positively influenced the economic performance and market reach of spice traders in Idukki district. Digital tools enable traders to access wider markets, communicate more effectively with customers, and enhance their sales and profitability; as a result, digital users demonstrate higher revenue and profit levels than non-users.

Despite the positive impact of digitalization, the study also identifies several limitations in its adoption. Many traders rely primarily on basic digital tools and social media platforms, while the use of advanced e-commerce systems remains

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limited. A lack of technical knowledge, digital literacy, and institutional support may hinder broader adoption.

Overall, the study concludes that digitalization has the potential to significantly enhance the competitiveness, efficiency, and profitability of spice traders. Strengthening digital skills, improving technological infrastructure, and providing institutional support can further accelerate digital adoption and promote inclusive growth in the spice trading sector.

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