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Design and Implementation of an Agric-emarketing Web application

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Abstract

Farmers' productivity can be greatly increased by the use of information and communication technologies (ICT) in agriculture. In contrast to their commercial counterparts in metropolitan areas, many subsistence farmers in rural areas have limited access to ICT tools. The efficient marketing of agricultural products must be given top priority since food security is necessary for human survival. For subsistence farmers, one of the biggest obstacles is the effective marketing of their produce to close the gap with urban commercial farmers, boost value, and prevent waste. These difficulties include food waste, delayed information access, and market accessibility because of geographic limitations.

ICT can offer a useful framework for tackling these issues. The goal of this research is to create a user-friendly web-based e-marketing platform specifically for Zambian subsistence farmers. By providing a digital platform for farmers to list their goods, including fruits, vegetables, and grains, the suggested platform expedites the marketing process. Customers can browse and choose their favourite products using the platform's user-friendly web interface. Through the site, buyers may get in touch with vendors directly to discuss rates, schedule pickup or delivery, and finish transactions.

Through a study of the literature and an examination of their present marketing difficulties, the effective dissemination of baseline data about ICT technology use by subsistence farmers was examined. The study's findings emphasise how important it is for subsistence farmers to market their goods effectively and whenever it suits them. This is addressed by the web-based e-market platform, which can be accessed on any device with an internet connection. It assists subsistence farmers in quickly marketing their produce to prevent food waste. The platform's performance evaluations show that it improves market accessibility, does away with the need for middlemen, and maximises farm output and profitability.

Keywords: Agric-emarketing, Information and Communication Technologies (ICT)

1. Introduction

In today's world of trade liberalisation, globalisation, and privatisation, information technology (IT) is essential to agricultural products' ability to compete on the world market. This competitiveness is greatly enhanced by a variety of IT platforms, including email, multimedia, electronic banking, the Internet, and the World Wide Web (Akinnagbe, O.M., 2014) [3]. Food is necessary for human survival, and agriculture has a significant impact on all facets of human existence. Tools that facilitate the exchange, use, and transmission of information through electronic channels are usually referred to as information and communication technologies, or ICTs (Singh *et al*., 2015) [25].

One of the main forces influencing the globe today is technology.

Because web apps are frequently used in daily life and because users have access to an increasing number of devices, developers have concentrated on user interfaces and interaction.

Background

Although they make up a sizable section of the population in developing nations, subsistence farmers have obstacles such restricted access to markets, information, and knowledge that reduce agricultural production (Nicholas-Ere, 2017) [21]. As their main means of existence, many people go to cities in quest of official jobs.

For subsistence farmers, market access is a significant barrier (Mpandeli & Maponya, 2014; Mapiye *et al*., 2018) [19, 17].

According to El Bilali *et al*. (2019) [8], conventional marketing strategies like word-of-mouth and unofficial advertising are time-consuming and ineffective, especially when it comes to preserving perishable goods. Geographical distances to markets appear psychologically greater due to high transportation costs, restricted client access, and opposition to advances (Baumhardt *et al*., 2013) [6].

By removing these obstacles, innovations can increase market reach and guarantee the freshness of perishable items, which are extremely sensitive to pricing (Low & Thompson, 2020) [15]. ICT has the potential to revolutionise agriculture, especially in poor nations like Zambia. Technology has developed over time into easily accessible instruments for gathering, evaluating, and sharing agricultural data (Singh, 2015) [25]. On the go, Subsistence farmers can interact with stakeholders and obtain information thanks to wireless and internet technologies, which promote effective marketing and distribution (The Talathi, M.S. (2007); World Bank, 2017). By offering venues for gathering and sharing data about farming processes, ICT helps close the gap between commercial and subsistence farmers and promotes productivity and income growth.

Product, pricing, promotion, and place are the four main marketing components that are optimised by e-marketing, which makes use of ICT. E-marketing gives farmers greater market access, minimises waste, cuts expenses, and eliminates middlemen by using electronic platforms (El-Gohary, 2016; Kaewprasert, 2019) [9, 13].

By combining the "four Cs" of marketing—customer solution, cost, convenience, and communication—this strategy increases output and supports sustainable agriculture (Anadozie *et al*., 2021) [4].

Subsistence farmers are empowered by ICT-driven e-marketing platforms, which allow them to sell goods effectively while minimising losses and guaranteeing food security. By enhancing agricultural practices and creating communities that are food secure, these technologies have a major positive impact on rural development (Singh, Sankhwar, & Pandey, 2015; Anadozie *et al*., 2021 [4]).

Therefore, through better marketing, sustainable practices, and increased output, ICT has the potential to revolutionise agriculture.

The Statement of the Problem

In order to maximise their output, subsistence farmers must overcome a number of obstacles in their daily lives. Subsistence farmers find it challenging to effectively market their agricultural products since they lack the resources necessary to support their day-to-day activities, in contrast to commercial farmers. One of the main difficulties with subsistence Produce marketing is a challenge for farmers that is made worse by issues with transportation, expensive transactions, and insufficient storage facilities. These problems cause waste and lower the agricultural goods' market value (Low, S.A. & Thompson, A., 2020) [15].

With the use of an ICT tool that would boost their output, it is imperative to enable subsistence farmers market their agricultural products in order to help minimise or completely eradicate waste. Subsistence farmers can effectively promote their produce without the need for middlemen by using a web-based e-marketing platform to close the gap between them and consumers. The platform seeks to increase production, guarantee food security, and advance sustainability in traditional farming by improving communication and giving timely access to market information. In order to improve marketing connections, cut out middlemen, and give quick access to pertinent farming updates, this study suggests creating a web-based e-marke platform. This will ultimately raise farm productivity and profitability.

Justification

Like other southern African nations, Zambia has the chance to improve the quality of life for its people by embracing and leveraging ICT as a tool to close the development gap and revolutionise its agriculture sector (Ajani, 2014; Headey & Ecker, 2013) [1, 11]. By removing the need for middlemen and bringing farmers and customers together directly, the platform ensures a more equitable distribution of revenues (Fafchamps & Hill, 2005) [10]. Additionally, it gives farmers access to useful data on storage facilities, market trends, and sustainable farming methods, empowering them to make wise decisions and boost output (Aker & Mbiti, 2010) [2]. The application presents a promising avenue because of its potential to completely transform Zambian agriculture in the direction of a more affluent and inclusive future (World Bank, 2016).

To create and implement an online e-market platform that links buyers with subsistence farmers, enhancing market accessibility and cutting out middlemen.

Specific Objectives

The purpose of the study is to create an easy-to-use web-based e-marketing platform that will help Zambian subsistence farmers market their agricultural goods. Developing a web application that combines multiple technologies to meet the issues mentioned in Section 1.1 is the main goal of the research. The study will concentrate on the following sub-objectives in order to support this primary goal:

1. Examine and assess Zambian subsistence farmers' difficulties in promoting their goods.
2. Examine the many situations in which web platforms have been utilised to assist subsistence farmers.
3. Create and implement an online e-market platform especially for Zambian subsistence farmers.
4. Assess the developed system's functioning and efficacy.

Scope of the Study

The impact of e-marketing and information and communication technologies (ICTs) on the agriculture industry, specifically for subsistence farmers in underdeveloped nations like Zambia, is the main emphasis of this study. The study is to investigate how these technologies can help traditional farmers overcome a number of obstacles, including inefficient traditional marketing strategies, high transaction costs, restricted market access, and a lack of timely information.

Research Questions

1. What challenges do Zambian traditional farmers face when it comes to selling their agricultural goods?
2. The efficient use of e-market platforms is impeded by smallholder farmers' limited digital literacy (Mansour,

2023) [16].

3. Infrastructure: Electricity and internet connectivity issues in rural areas hinder the adoption of digital technology (Quayson *et al*., 2020) [24]. iii. Stakeholder collaboration: Ecosystem growth is hampered by a lack of collaboration across the public, nonprofit, and corporate sectors (Izuogu *et al*., 2023) [12]. iv. Financial Integration: Access to financial services using e-market platforms is restricted due to a lack of investigation (World Bank, 2020).
4. Cultural Aspects: It is yet unclear how mistrust and bad experiences contribute to resistance to technology (Kieti *et al*., 2022) [14].
5. Studies of Longitudinal Impact: Research frequently concentrates on immediate results without evaluating the long-term effects of e-market infrastructure.

2. Literature Review

1) Introduction

Zambian subsistence farmers confront many difficulties, chief among them being restricted access to markets. Low productivity results from their inability to accept contemporary technologies due to inadequate extension services and a lack of timely information (Balu, 2020) [5]. These problems are made worse by ineffective market channels and expensive transportation, which leave farmers with little profit and dependent on middlemen (Mmbando, 2014 [18]; Soe *et al*., 2015). Furthermore, when farmers lack access to market data, more knowledgeable intermediaries take advantage of them, leading to power imbalances (Thindisa & Urban, 2018).

Inadequate infrastructure, such as bad roads and few financial services, along with geographic isolation, further limits involvement of farmers in lucrative markets (Baloyi, 2010).

Although using sustainable farming methods should lead to better results, ignorance and a lack of education continue to be obstacles (MUSIKA, 2023) [20].

Notwithstanding these obstacles, e-market platforms and digital marketing present chances to expand market reach, boost output, and advance sustainability. These platforms give farmers the ability to make educated decisions by reducing their dependency on middlemen, lowering transaction costs, and providing real-time market information (Sudhakar Reddy, 2021).

3. Related Works

Platforms for agri-e-markets seek to link farmers and buyers, offer agricultural data, and incorporate financial services. However, their acceptance is hampered by accessibility and technological issues.

1. AgriApp provides smart farming advice and agricultural inputs, but it is prone to technological problems and lacks real-time market data.
2. Vegetable Fresh produce delivery is the market's main focus, although it doesn't offer other important agricultural products.
3. EzyFarm does not help with market access; instead, it offers farming knowledge.
4. Fasal encourages intelligent farming methods, although it is more difficult for farmers who are not tech-savvy to employ.
5. Although it lacks more comprehensive market connectivity functions, HerdBoss focusses on livestock record-keeping.
6. Esoko is excellent at sending out market price warnings, but its influence on subsistence farmers is limited because it mostly targets commercial farmers.
7. k place at the respondents' selected sites. To ensure accessibility and precise transcription, interviews were either conducted in English or translated as necessary. Cost-effectiveness and thorough responses were prioritised during the gathering process.

a) Literature Review

The scientific background was supplied by a literature study that examined the use of ICT in agriculture and pointed out areas where current research was lacking. Books, journals, and internet sites were among the materials used, providing information on web and mobile technology for subsistence farming.

b) Distribution of Questionnaires

Farmers were given structured questionnaires with questions about their demographics, farming methods, and the use of ICT to increase food security. 65 of the 80 respondents who were contacted gave thorough answers, which served as the foundation for the analysis.

1) Research Approach

The study used a combination of methodologies. While quantitative surveys obtained quantifiable data on the effectiveness and usability of the platform, qualitative data from focus groups and interviews shed light on the difficulties faced by stakeholders. By combining these approaches, a thorough comprehension of the issue and verification of the suggested fix were guaranteed.

2) Target Population

In order to comprehend the difficulties and advantages faced by farmers in Lusaka and Central Provinces, the study focused on both individuals with and without prior marketing experience. A sample technique was used because it was not possible to survey the complete population due to practical limitations.

Sample Size

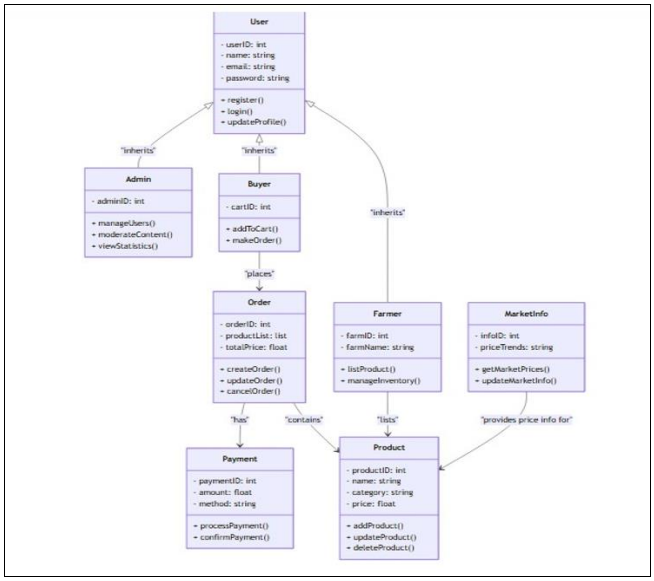
There were 120 responders in the sample, including students, farmers, and regular internet users. Diverse viewpoints on conventional and digital marketing strategies were intended to be captured by this strategy.

Sampling Technique

To concentrate on particular respondents, such as communal farmers in the targeted communities, purposeful sampling was used. Fair representation was guaranteed by random sampling, and survey participants had to be at least 18 years old.

Development of the Application

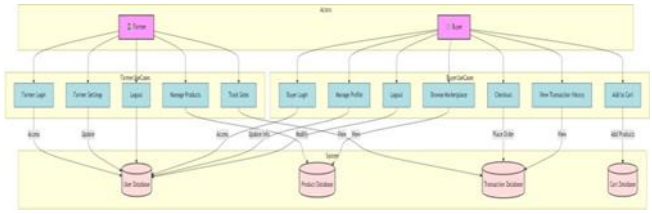
The program was developed using the System Development Life Cycle (SDLC). The process was led through six steps by the waterfall model, which is renowned for its methodical approach: requirements, analysis, design, implementation, testing, and maintenance. This concept guaranteed the methodical creation of an efficient and user-friendly online marketplace for farmers.



Source: Agricultural e commerce, 2015

User case design

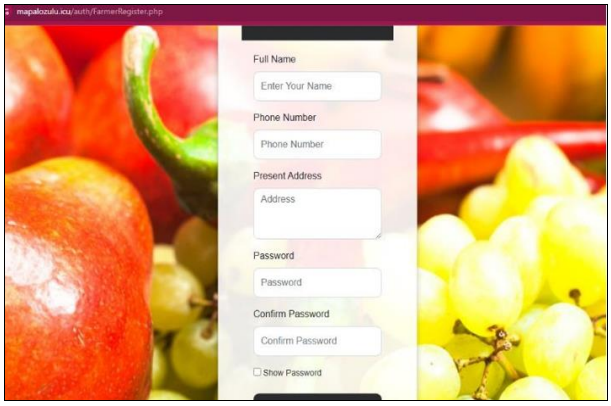
Login to the Application



Source: Agricultural e commerce, 2015

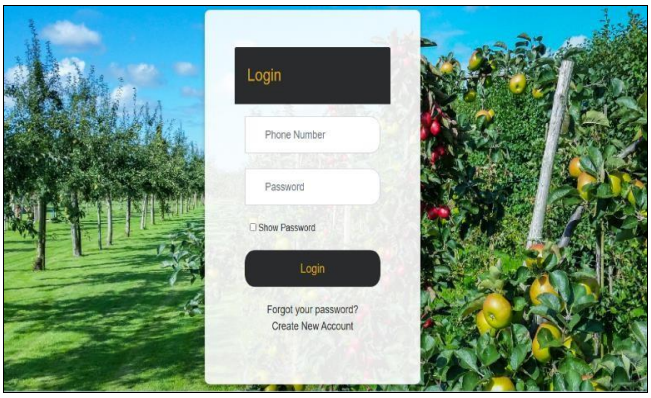
User Interface Design

Interface Design: The interface designer's job is to create interfaces for the system, usually a user interface. Understanding many facets of human behaviour, usability, and the numerous perspectives and methods in which people interact with technology are all part of this. Starting with a broad notion, the designer would typically experiment with different colours and displays to find the best interface ideas. In order to guarantee that the system is properly usable, the designer will also collaborate with others to test interfaces throughout development (Nwakanma, 2015).



Source: "Author 2024"

- It should be possible for both buyers and farmers to log in and make changes to their profiles. It should be observed that the sequence diagram necessitates login into the program, even though it is not a function.



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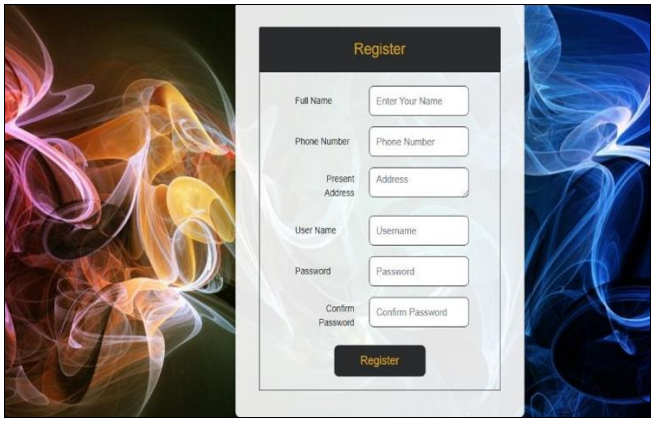
Farmers Registration Page

This is where the farmer registers to create the profile.



Source: Author 2024

4. Results

The outcomes of this study's system are presented in this chapter, which focusses on the planning and execution of an integrated web-based e-market platform for Zambian subsistence farmers. Assessing the system's ability to satisfy user expectations in relation to the system requirements set during the system analysis phase is the main goal of this chapter.

Baseline Study Results

The baseline study evaluated Zambian subsistence farmers' preparedness to embrace a digital platform as well as the difficulties they confront. The results of the survey brought to light problems such restricted market access, dependence on middlemen, and challenges in securing reasonable rates. The study's conclusions guided the creation of an e-market platform that successfully addresses these issues. The platform's user-friendly interface, which ensures accessibility and ease of use, was impacted by farmers' degrees of digital literacy. The findings also indicated that farmers were open to adopting technology as long as it was easy to use and available.

Survey Results and Discussion

Positive answers on the platform's effect on farmers' livelihoods were found in the survey. Farmers valued its capacity to give real-time information, enhance market access, and enable direct buyer relationships. The system's design allowed for widespread adoption by accommodating different levels of digital literacy. Farmers said they were less dependent on intermediaries, resulting in improved

profitability and price.

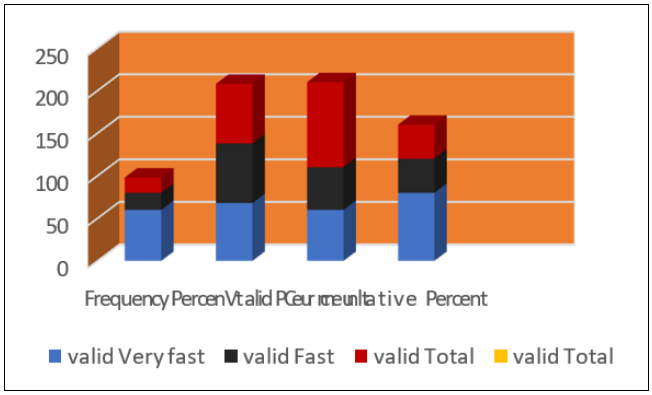
Authenticity and Reliability

The site's reliability and genuineness were major factors in its success. Data verification procedures ensured the accuracy and transparency of product listings, market prices, and transaction information. Metadata and audit trails bolstered data integrity, boosting user confidence. System reliability was ensured by frequent backups and redundant data storage, which decreased disruptions and maintained seamless operations for farmers and buyers.

System Implementation Results

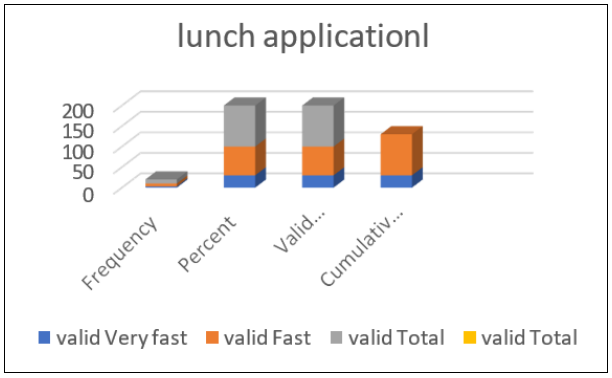
a) Testing

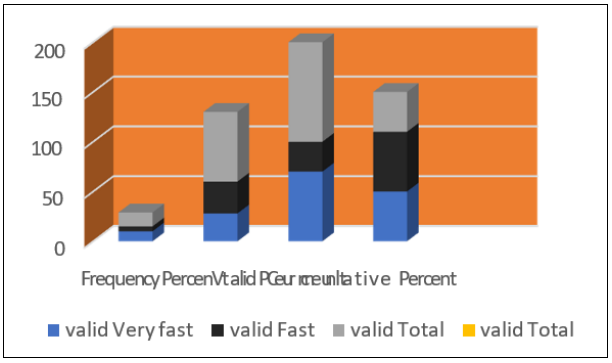
The platform's dependability and functionality were confirmed by extensive testing. The system's ease of use for users with different levels of digital proficiency was confirmed by usability testing. The platform's capacity to manage large user numbers without experiencing performance problems was shown through stress testing.



b) User-Friendly Design

The platform was designed with simplicity in mind, enabling farmers to register, add products, view prices, and connect with buyers. Features such as product description





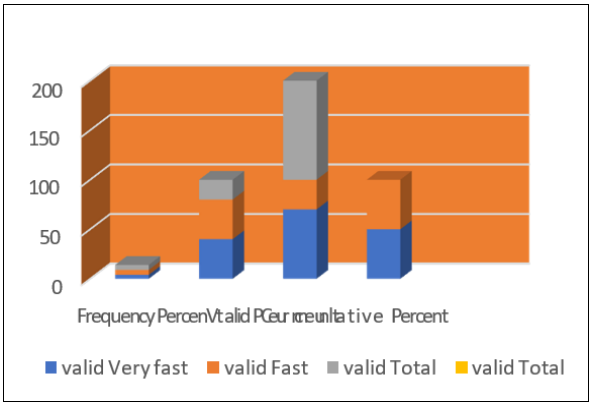
c) Real-Time Updates and Notifications Farmers were updated on buyer interest, questions, and listing statuses via a real-time notification system. Email and SMS were used to transmit notifications, guaranteeing prompt communication even when farmers weren't online.

d) Testing Results

1.) Application Launch Speed: 30% of participants found the app very fast to launch, while 70% found it fast, indicating performance depended on smartphone specifications.

2.) Login Functionality: 80% of respondents successfully logged into the platform, demonstrating its reliability.

3.) Profile Creation: 80% confirmed automatic profile creation upon login, with 40% finding it very easy and 30% finding it easy to update their profile



e) Market Analytics and Insights

With the use of the platform's market analytics, farmers were better able to comprehend demand patterns, set prices, and effectively plan their output. By enabling farmers to make data-driven decisions, these solutions increased their profitability and competitiveness.

Data Analysis

a) User Feedback Analysis

According to survey results, farmers expressed great pleasure with the platform's user-friendly design and simplicity.

Farmers with little to no digital expertise rapidly adjusted, proving that the tool was user-friendly.

b) Quantitative Data Analysis

- Sales and market involvement significantly increased, as seen by metrics like products posted, transactions completed, and buyers engaged. Farmers who actively utilised the site were able to connect with buyers who were previously unreachable. demonstrating how it contributes to the growth of market prospects.

c) Qualitative Feedback

Farmers valued the platform's capacity to enhance pricing, lessen dependency on middlemen, and save time by doing away with the necessity of making frequent trips to actual markets. The ability to conduct remote transactions and receive real-time notifications helped to boost efficiency and productivity.

This thorough analysis highlights how well the platform has worked to improve market access, alleviate the issues encountered by subsistence farmers, and promote economic

growth.

Summary of Results

All things considered, the data analysis indicates that the integrated web-based e-market platform effectively tackled the problems of information asymmetry, market access, and ineffective conventional marketing strategies. The website gave subsistence farmers a useful tool to boost their market visibility, expand their audience, and boost revenue. The platform not only achieved its goals but also offered extra advantages in terms of effectiveness, accessibility, and financial prospects for farmers, as evidenced by the integration of user comments, quantitative data, and qualitative insights. According to the findings, there is a great chance that the platform will be widely adopted, which might improve the standard of living for subsistence farmers in Zambia and possibly other comparable agricultural environments.

5. Discussion and Conclusion

This chapter summarises every subject discussed in the study and goes over the goals of the investigation once more. It is crucial to stress that the purpose of this study was to explore and create an online e-market platform for Zambian subsistence farmers in the countryside. The marketing difficulties that subsistence farmers encounter—such as restricted market access, high transaction costs, and low profitability—were the driving force for this study.

The objective was to use ICT tools to create a system that would improve these farmers' lives by giving them direct access to markets and a more effective means of selling their goods. This chapter addresses how successfully the research's goals were achieved in addition to providing an overview of the methodology and results. User input and system performance are used to assess the web-based e-market platform's efficacy, emphasising both the implementation's achievements and its difficulties. In order to further help the economic empowerment of subsistence farmers and advance sustainable agricultural practices, this chapter also discusses future suggestions for enhancing the platform and broadening its reach.

Discussion: The Baseline Study

Zambian subsistence farmers can benefit greatly from the integrated web-based e-market platform. By enabling farmers to display and sell goods straight from their farms, it saves money and time compared to making actual market excursions. By cutting out middlemen, the platform guarantees farmers better pricing and strengthens ties with buyers. It also helps stakeholders by providing useful data for rural development, including policymakers and agricultural workers. For long-term success, however, issues like the requirement for dependable internet, instruction in digital literacy, and infrastructure investment must be resolved. All things considered, the platform has a great deal of potential to increase farmers' access to markets and revenue streams while fostering efficiency and transparency.

Use of Technology

Subsistence farmers' interactions with agricultural markets have changed as a result of technology, which has increased sustainability, accessibility, and efficiency. Farmers may make educated decisions and maximise productivity by using web-based tools to access real-time market pricing, weather reports, and best practices. E-commerce platforms link farmers with buyers directly, cutting down middlemen and transaction expenses, while farm management software optimise operations.

Farmers gain economic empowerment and increase their market reach through digital marketing and financial inclusion, especially through mobile money. Notwithstanding these advantages, problems like expensive technology and spotty internet access still exist. To guarantee that all farmers profit from these advancements, it is imperative to address these obstacles.

Development of the System as a Solution

The web-based company offers a virtual marketplace that connects farmers and purchasers. Marketplace where pricing are fixed, produce is listed, and safe transactions are carried out. The platform, which was created with Java, PHP, MySQL, CSS, and HTML, guarantees a stable backend and an intuitive user interface.

Real-time notifications for buyer interactions, multilingual support, and a straightforward design are important aspects. Farmers are further empowered by data analytics technologies to maximise resource use, make well-informed decisions, and increase output.

Comparison with Other Similar Works

This platform prioritises ease of use and local market accessibility in contrast to AgroCenta and FarmCrowdy. Although other systems provide a wealth of capabilities for commercial farming, customers with low levels of digital literacy are frequently overwhelmed by them. In order to ensure financial inclusion and accessibility for subsistence farmers, our platform places a high priority on user-friendliness, intuitive design, and mobile money integration. It simplifies transactions and increases opportunities for smallholder farmers by establishing a direct connection between producers and consumers, in contrast to existing options.

Possible Applications

1. Farmer Convenience: This lowers expenses and effort by allowing farmers to market goods and oversee sales from home.
2. Real-Time Information: Provides current pricing, market trends, and buyer-direct communication.
3. Market expansion: Makes it easier to reach larger markets, which boosts revenue and profitability. iv. Data analytics: Enables farmers to match production with market demands by offering insights into demand patterns and ideal pricing.
4. Integration of Financial Services: Provides microfinance and mobile money solutions to facilitate safe transactions and financial inclusion. Sustainability: Encourages environmentally sustainable farming methods and effective resource usage.

1. AI and personalisation: Farmers receive recommendations that are specifically tailored to their interests and past transactions.
2. Integration of Smart Agriculture: Precision farming using sensors, drones, and the Internet of Things.
3. Blockchain for Transparency: Secure and verifiable transactions increase confidence.
4. Expansion of Financial Services: Combining insurance

and credit solutions for smallholder farmers.

5. Sustainability Features: Instruments for encouraging environmentally friendly behaviour and optimising resources.

   Multimodal Logistics: Collaborations with transportation networks to increase the effectiveness of deliveries. International Growth: Expanding the platform to assist farmers in other areas.

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