Journal of Advances in Science, Engineering and Technology

Development of an Agricultural Machinery Rental System for Small and Medium-Scale Farmers in Tanzania using a Mobile Application

Nelson Makange*, Brenda Lyimo, Shamsidini Msuta, Stephano Mashauri, Edson Daniel

[a]*Department of Agricultural Engineering, School of Engineering and Technology, Sokoine University of Agriculture, Tanzania*.

ABSTRACT

Nowadays, many online services are trending and greatly supporting the development of a mobile app aimed at improving agricultural machinery rentals for farmers in Tanzania. This app also helps equipment owners maximize their machinery utilization. The initiative addresses key issues in traditional machinery rentals, especially limited access and lack of transparent pricing. The app offers a centralized, easy-to-use platform that allows registered users to browse, select, and book equipment tailored to their specific farming needs. The system consists of four modules: login and registration, equipment listing, machinery selection, and booking and payment. It is built using the Flutter framework for a responsive interface, Dart as the primary programming language, and Firebase for dependable backend services. Thorough testing, including Unit, Integration, System, and Acceptance tests, was carefully conducted. This extensive validation ensured the system's functionality, seamless communication between modules, and stability across various Android devices. The app achieved positive results, with an average score of 4.47 for user interface design and 4.36 for usefulness, ease of use, and overall usability. The standard deviation values ranged from 0.6 to 0.8, indicating that most user ratings were close to the average while allowing for some individual differences in perception. This demonstrates its effectiveness as a practical and innovative solution for agricultural machinery rental in Tanzania.

ARTICLE INFO

Keywords:
Agricultural Machinery Rental,
Mobile Application,
Online Services.

Article History:
Received 23 July 2025
Received in revised form 21 October 2025
Accepted 22 October 2025
Available online 31 October 2025

1. Introduction

Agricultural machinery rental or hire agencies are organizations that offer short-term leasing of equipment to their customers for a specified period, usually for a fee. In Tanzania, these rental services have become the preferred choice for many, especially smallholder farmers. This is because not all farmers can afford to own machinery. Large-scale farmers are often hesitant to provide services to smallholders because they have large areas of land that require machines for their own use. In Tanzania, medium-scale farmers are willing to provide services to small-scale farmers after they have completed their tasks. Machine owners face unpredictable demand, leading to underused assets, faster depreciation, and obsolescence, which results in poor returns on investment. Consequently, as agricultural machinery rental services in Tanzania continue to expand, they require improvements and a reliable monitoring system.

In Tanzania, the agricultural sector is primarily dominated by smallholder farmers, with a significant number of medium-scale farms also present. A common practice is for medium-scale farmers to rent out their machinery to smallholder farmers after they have completed their own operations. This practice enables smallholders to access essential equipment that they might not be able to afford individually, while also providing medium-scale farmers with an additional income stream. It was found that there is fewer than one tractor for every 20 farmers in Tanzania, as the National Sample Census of Agriculture 2019/20 shows that only 5% of farm households used tractors (URT, 2021).

In studying the tractor rental system, it is essential to understand the farm sizes of farmers in Tanzania, where most farms are smallholder farms (1-10 ha), medium-scale farms (11-100 ha), and large-scale farms (owning more than 100 ha of land). In Tanzania, small-scale and medium-scale farmers constitute a significant portion of the agricultural sector. Small-scale farmers

* Corresponding author. e-mail: nmakange@sua.ac.tz
Editor: Gershom Mutua, Masinde Muliro University of Science and Technology, Kenya.
Citation: Makange N., Lyimo B., Msuta S., Mashauri S., & Daniel E. (2025). Development of an agricultural machinery rental system for small and medium-scale farmers in Tanzania using a Mobile Application. Journal of Advances in Science, Engineering and Technology 2(1), 70 – 77.

make up approximately 70% of the rural population engaged in agriculture, which is the primary livelihood for many (Suleiman, 2018).

Mobile apps have significantly impacted various fields in Tanzania, enhancing efficiency and accessibility. In healthcare, apps like AfyaPopote enable patients to access medical services remotely, reducing the burden on physical facilities (Mwangoka et al., 2020). In agriculture, platforms such as Kilimo Salama provide farmers with real-time weather updates and market prices, improving productivity and income (Sanga et al., 2019). In education, apps like Eneza Education offer interactive learning materials, bridging the gap in access to quality education (Mtebe & Raisamo, 2014). Additionally, mobile banking apps like M-Pesa have revolutionized financial inclusion, enabling millions of Tanzanians to conduct transactions seamlessly (Jack & Suri, 2011). These examples illustrate how mobile apps are transforming Tanzania across multiple sectors.

Earlier studies have shown that various digital solutions supporting farmers focus on the potential of web-based platforms and mobile applications to improve access to agricultural inputs, services, and machinery. Iqbal et al. (2020) introduced a comprehensive web-based farmer assistance system, demonstrating how digital platforms can close gaps in accessing essential resources and services. This work highlights the broader benefits of integrating technology into agricultural practices, particularly in enhancing efficiency and reducing reliance on traditional intermediaries.

A significant area of research has focused on Agri-Equipment Rental Systems, which address the critical need for affordable and accessible machinery. Bhuvan (2019) and Kumar et al. (2022) offered valuable insights into designing user-friendly interfaces and managing rental operations effectively. Their studies highlight the importance of intuitive design and operational efficiency in ensuring the success of such platforms. Bamanikar et al. (2022) further expanded on this by proposing an integrated agricultural portal that combines equipment rental with a variety of other services, emphasizing the value of a unified platform for farmers.

The development of a tractor rental app significantly advances the field of Information and Communication Technology for Agriculture (ICT4Ag) by improving access to essential agricultural machinery for smallholder farmers, thereby boosting productivity and economic empowerment. Recent studies highlight ICT's transformative potential in agriculture, emphasizing the integration of advanced technologies like Artificial Intelligence (AI) and the Internet of Things (IoT) to optimize resource use and lower costs (Baviskar, 2024; Patwa et al., 2024). The app follows the "Uber for tractors" model, aiming to reduce high transaction costs and enhance service accessibility for farmers, though challenges such as digital literacy and infrastructure still exist (Daum et al., 2020). Additionally, the use of ICT in agricultural extension services has been shown to improve the dissemination of timely information, increasing resilience and productivity among farmers (Khatri et al., 2024). Overall, the app represents a strategic effort to address smallholders' barriers, promote sustainable farming practices, and contribute to the broader ICT4Ag landscape (Novotná, 2023).

Although platforms like Hello Tractor and AgriShare already facilitate tractor and equipment sharing among farmers in Africa, they face several limitations in the Tanzanian context. For instance, Hello Tractor requires IoT device installation on tractors and relies on booking agents to coordinate demand, increasing costs and dependency on middlemen. AgriShare offers a more flexible equipment rental marketplace but encounters challenges with smartphone adoption and local customization across regions.

Our contribution in this study includes (1) a lightweight mobile and USSD hybrid system tailored for Tanzanian small and medium-scale farmers; (2) a context-aware matching algorithm that reduces travel distance and scheduling conflicts; (3) an offline fallback mode and agent interface for areas with low connectivity; and (4) an empirical evaluation of usability and performance with Tanzanian farmers using standardized tools. This fills a gap in adapting mechanization platforms for East Africa.

Related works, key features, limitations, and how our work differs or extends from them are summarized in Table 1. Empirical research by Rakhra & Singh (2021) provided practical insights into real-world equipment hiring practices, identifying preferred types of machinery and common rental challenges. These findings are essential for customizing systems to meet the specific needs of regional and local areas. Meanwhile, Raju et al. (2022) and Bagaitkar & Lande (2019) contributed to understanding user interaction and system scope, with the former proposing a straightforward form-based rental method and the latter creating a mobile-based tractor rental app. Both studies emphasize the importance of accessibility and simplicity in encouraging adoption among farmers.

Digital tools are increasingly regarded as crucial enablers in agriculture, especially across Africa. Platforms like Hello Tractor have demonstrated that mobile apps can effectively connect machinery owners with smallholder farmers, boosting access to, use of, and productivity from machinery. In Tanzania, where smallholder farmers comprise over 65% of the farming workforce (Eldridge et al., 2022), utilizing mobile technology to enhance mechanization could be a viable solution.

This paper aims to develop a mobile application for renting agricultural machinery in Tanzania. Specifically, we designed, developed, tested, and evaluated the usability of this mobile application. Therefore, this study helps transition agricultural machinery service provision from traditional and manual methods to utilizing modern mobile technology. We created an Android app tailored for Tanzanian users, enabling farmers and machinery

owners to register and interact seamlessly. Owners will list their machines with detailed information, and registered farmers can browse, select, and rent equipment under transparent terms. This digital marketplace not only addresses inefficiencies but also supports the broader goal of rural mechanization—enhancing productivity, reducing waste, and promoting economic inclusion.

Table 1: Comparison of other works and the developed App

Platform / Study	Key Features	Limitations / Gaps	How Our Work Differs / Extends
Hello Tractor	IoT-equipped tractors, booking agents, fleet tracking, service rating, and scheduling.	High hardware cost; reliance on agents; limited local adaptation in Tanzania.	We forgo IoT hardware, use smartphone + USSD, and a context-specific matching algorithm.
AgriShare	Marketplace model for equipment rentals, multiple equipment types, cross-country deployment.	Lower standardization, less performance metrics published, and limited adaptation per region.	We localize UI/UX for Tanzanian farmers, integrate scheduling optimization, and evaluate server performance.
eKichabi v2 (Tanzania)	Dual-platform (USSD + Android app) directory of agricultural enterprises.	Focus is on directory services, less on mechanization matching.	Our system goes beyond directory to an operational renting system with matching, scheduling, and rental transactions.

2. Proposed System

The mobile app consists of four main modules: login and registration, equipment listing, machinery selection, and booking and payment. These modules are explained in the following section.

2.1. Login and registration module

This module handles user authentication. Users begin by entering their email and password to log in to their account. If it's the user's first time logging in, a registration form will appear, requiring details such as name and address. For returning users, the app allows direct access to the next steps. During registration, the user will be able to set the password and email that will be used to log in.

2.2. Equipment listing module

This section displays a list of agricultural machinery available for rent, including information on capacity, model, location of the machine, and its owner. The app provides details such as the owner's addresses and contact numbers. Users can browse through and view the available equipment and tractors. The module includes a detailed inventory of farming equipment, along with the quantity, allowing users to select tools based on their specific agricultural needs.

2.3. Machinery selection module

In this module, users can view and choose from a range of tractors and agricultural machinery. They can specify the number of hours needed for the equipment, and the system will connect the farmer with the machine owner at the rental price. This module facilitates equipment selection based on individual requirements.

2.4. Booking and payment module

This module manages the renting process. Users must enter the required rental duration, select the preferred date and time, and confirm the booking. Once confirmed, the system displays the total cost for the selected equipment and tractor. The user is then directed to the payment section, where rental charges and payment details are provided, completing the renting process.

3. Methodology

3.1. System requirements and Sampling

This includes the hardware and software specifications needed to run the application on a device. We purposively recruited 30 participants from two wards in Morogoro, stratified by age groups (≤35, 36–55, >55), farming experience (0–5 years, >5 years), and smartphone familiarity (novice, intermediate, expert). The sample size was selected to ensure enough participants for SUS score comparison. We used the system usability instrument to measure perceived usability (score from 1 to 5). Additionally, we asked Likert-scale questions on Perceived Ease of Use and Perceived Usefulness, along with open-ended questions for qualitative feedback. During the pilot, we collected system performance logs (API response time, average latency, error rates) under typical rural network conditions (3G, 4G, intermittent).

3.1.1. Software requirement

This section includes the software tools used to develop the application and the services it will utilize. Android Studio, based on IntelliJ IDEA, is the official development environment for Android apps. It significantly boosts productivity by offering a flexible, Gradle-based build system, a fast emulator, and a unified environment for developing across Android devices. You can quickly push changes to your Android app with Instant Run and utilize code templates and GitHub integration for common features. It also includes extensive testing tools, lint tools for identifying common problems in C++ and NDK support, and built-in integration with Google Cloud Platform for Google Cloud Messaging and App Engine. Essentially, Android Studio is designed to help build high-quality Android apps efficiently for any device.

User Interface (UI)

The User Interface that was used is Flutter Framework. Flutter is primarily a UI (User Interface) framework, while it excels at building beautiful and performant user interfaces for mobile, web, and desktop, it does not directly handle server-side logic, database management, or API hosting. Flutter was used to create the client-side application that users interact with on their Android devices.

Flutter is an open-source UI software development kit created by Google. It allows developers to build natively compiled applications for mobile (Android, iOS), web, and desktop from a single codebase.

For Android apps, Flutter provides a rich set of pre-built UI widgets that comply with Material Design guidelines, enabling developers to create visually appealing and highly interactive interfaces. Its "hot reload" feature dramatically speeds up development by allowing developers to see code changes reflected almost instantly in the app without a full recompile.

Backend

The programming language used is Dart, developed by Google and optimized explicitly for building user interfaces. It is the language used by the Flutter framework. Dart is an object-oriented, class-based, garbage-collected language with C-style syntax. It was used to compile native machine code (ahead-of-time, AOT compilation) for fast startup and performance on mobile devices.

All Flutter applications were written in Dart. Dart's features, including null safety, asynchronous programming support (utilizing async/await), and a strong type system, make it well-suited for building responsive and robust mobile applications. It handles the logic and state management for the Flutter UI.

Firebase

Firebase is a mobile and web application development platform developed by Firebase, Inc. in 2011, which was acquired by Google in 2014. Firebase provides ready-to-use backend services, enabling frontend developers (such as those using Flutter) to build full-stack applications without managing their servers. This is known as "Backend as a Service" (BaaS) or "serverless" development.

Deployment Using Render API

To streamline deploying and scaling the backend application, the Render platform was used. Render is a cloud-based platform that offers a unified interface for managing web services, databases, static sites, and more. It simplifies infrastructure management, allowing developers to focus mainly on application development.

In this project, the backend application ("Python Tiger") was deployed as a web service on Render. The deployment process was integrated with a Git-based workflow (e.g., GitHub), allowing automatic and continuous deployment with code updates. Render managed the provisioning of servers, configuration, and horizontal scaling of the application.

Additionally, the Render API was utilized to facilitate the programmatic management of the deployment process. The API enabled automated service provisioning, monitoring of deployment status, and integration with a Continuous Integration/Continuous Deployment (CI/CD) pipeline. This approach enhanced operational efficiency by allowing scripted deployment workflows and reducing the need for manual intervention during updates or scaling.

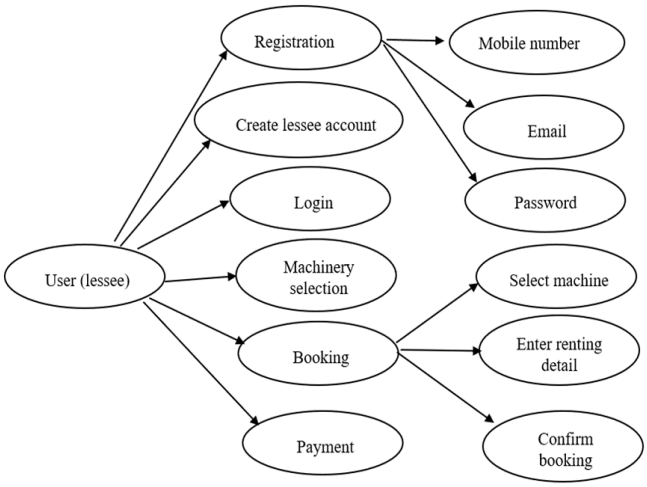

Fig. 1: User case diagram of Mobile Application for Renting Agricultural Machinery in Tanzania.

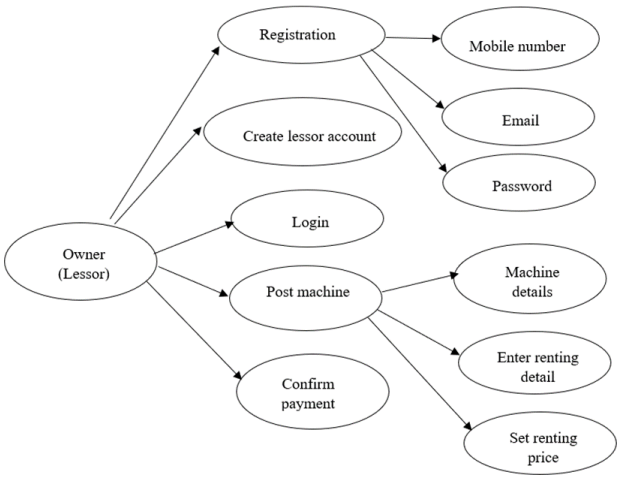

Fig. 2: Owner case diagram of Mobile Application for Renting Agricultural Machinery in Tanzania

3.1.2. Hardware Requirements

This section includes the hardware requirements of an application and the type of hardware used during the development of the application. The application is an Android app that requires a compatible device to run.

3.2. System Design

System design is used to define the modules, interfaces, and data required to satisfy the system's requirements. Systems design could be seen as the application of systems theory to product development. Various diagrams are used to represent the system's process and flow, as presented in the following section.

3.3. Use Case Diagram

The use case diagram presented here is the user case and owner's case diagrams, which are explained in the following section.

The user case diagram represents a user's interaction with the system, illustrating the relationship between the user and the various use cases in which they are involved (Fig. 1). In the user section, every new user

must first register for an account in the application to use this system. If a user already has an account, they can log in and then access various activities, such as machinery selection. When renting machinery, a user can select the type of tractor, along with the equipment, the number of hours to be rented, and the date and time of the rental. After renting a tractor, the user will pay the owner the rental fee. The owner's case diagram of the Mobile Application for Renting Agricultural Machinery in Tanzania is shown in Fig. 2.

3.4. Flow chart

There is only one login for users who want to post or book a tractor. Users must register with their mobile number. After logging in, they can search for nearby machinery, select the tractor along with the necessary equipment, and specify the rental duration in hours. After booking, the machinery user receives the payment details (Fig. 3).

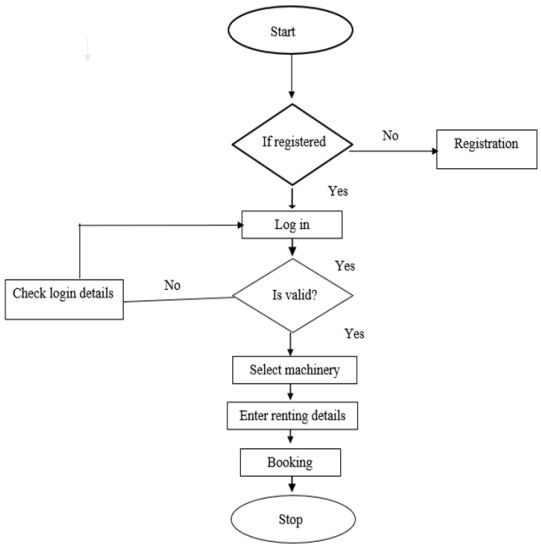

Fig. 3: Flow chart of the proposed system.

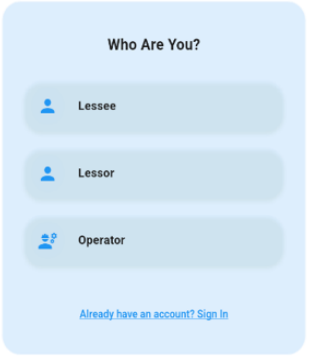

Fig. 4: Login page.

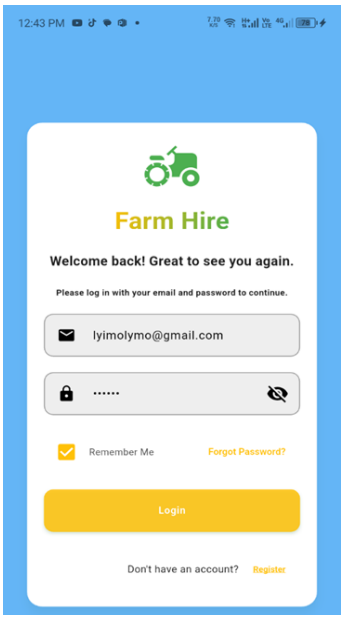

Fig. 5: Registration page.

3.5. Software Testing

The software was tested to identify any discrepancies between the intended behavior (expected output) and the actual behavior (given input). This software testing acted as both a verification and a validation.

A structured four-level testing methodology was implemented to ensure the robustness and reliability of the agricultural machinery rental application. Unit Testing was conducted first, rigorously evaluating individual components such as the user login module, machine listing display, and booking system in isolation to verify their functionality. Integration Testing followed, examining interactions between different modules, including user authentication with machinery browsing and booking confirmation with payment processing. Hardware-software integration was also tested for features such as camera uploads and GPS-based machinery location. System Testing was then performed by deploying the application on various Android devices and operating system versions to assess compatibility and performance across Tanzania's diverse mobile landscape. Finally, Acceptance Testing was carried out with key stakeholders, including farmers and machinery owners, to validate that the application met operational requirements and provided a practical, user-friendly solution. This comprehensive testing approach ensured a high-quality, fully functional application prior to deployment.

4. Result And Discussion

4.1. Developed Mobile application

The developed mobile application was developed and the features appear as shown in the following sections. Similar results were obtained by (Bagaitkar et al., 2019). Fig. 4 shows a registration page for mobile app users. Fig. 5 shows the login page, where users enter their credentials to monitor their account. The pages for displaying available machines and for owners to post machines are shown in Fig. 6 and Fig. 7, respectively.

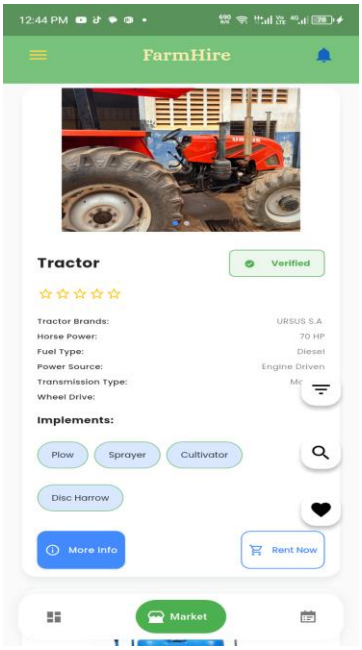

Fig. 6: The page showing available machines

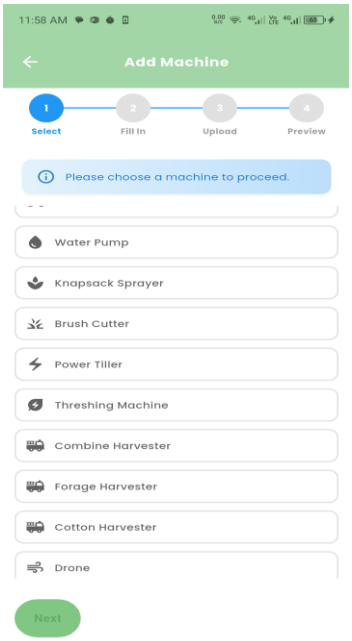

Fig. 7: The page showing renting details for users

The pages showing renting details, such as hours and coverage, and the payment confirmation are shown in Fig. 8 and Fig. 9.

4.2. Evaluation of the usability of the mobile application

To evaluate the user acceptance testing on the mobile application, the study was tested on thirty (30) respondents. The study assessed the effectiveness of the application, which contains thirteen (13) questions overall and is categorized into two (2) parts. The score value with scale one (1) to five (5) was given for every criterion. Every scale represents the following options: strongly disagree (1), disagree (2), average (3), agree (4), and strongly agree (5).

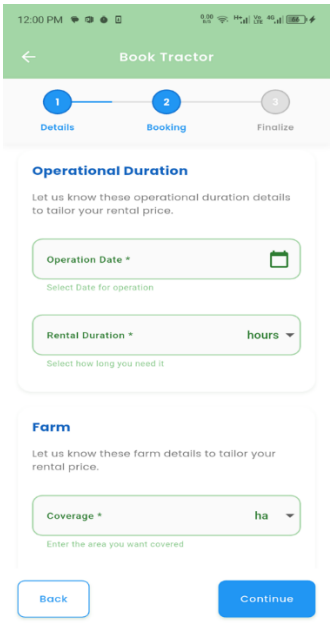

Fig. 8: The page showing renting details for users

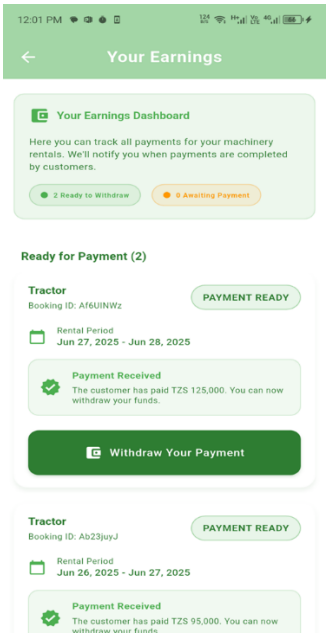

Fig. 9: Payment confirmation page

Table 1 presents the overall results, indicating that respondents were satisfied with the system, which helped them complete their tasks more easily and quickly. This is proven by the results where the total mean for the criteria was calculated as 4.27 for the user interface design and 4.36 for the usefulness, ease of use and usability. Also, most participants were accepted and satisfied with the system, as each of the question criteria's mean score was above 4.0. Similar evaluation was observed in the study by (Osman et al., 2017)

Along with reporting the mean scores for each usability item, we calculated the standard deviation (SD)

to reflect response variability among participants (Table 2). The SD values mostly ranged from 0.6 to 0.8, showing that most user ratings were close to the mean while allowing some individual differences in perception. These results indicate that users evaluated the app's interface and usability features consistently. However, the modest spread highlights that not all users felt the same level of satisfaction.

Table 2: Scores and mean on the effectiveness of the mobile application

S/N	Criteria	Score (1-5)					Mean	Std. Dev (σ)
		1	2	3	4	5		
	User interface design							
1	The characters of the app are easy to read	0	0	3	10	17	4.47	0.67
2	The terms used in the app are consistent	0	0	5	15	10	4.17	0.75
3	The interface of the app is pleasurable	0	0	5	14	11	4.20	0.79
4	I like the interface of this app	0	0	6	14	10	4.13	0.82
5	Performing tasks in this app is clear	0	0	3	12	15	4.40	0.71
	Total mean						**4.27**	
	Usefulness, ease of use and usability							
6	Using the app helps me to rent faster	0	1	2	9	18	4.47	0.72
7	Using the app saves my time	0	0	2	11	17	4.50	0.65
8	This app is easy to use	0	0	3	10	17	4.47	0.67
9	I am satisfied when using this app	0	0	2	14	14	4.40	0.68
10	I am comfortable using the app	0	0	2	13	15	4.43	0.71
11	It is easy to find the information needed in the app	0	1	4	14	11	4.17	0.80
12	The app has all functions and capabilities I want	0	1	5	11	13	4.20	0.82
13	I found that various functions in the app were working well	0	0	4	14	12	4.27	0.75
	Total mean						**4.36**	

5. Conclusions

By developing a mobile application for renting agricultural machinery in Tanzania, this work effectively addresses the challenges local farmers face in accessing essential farming equipment. The solution offers a convenient, transparent, and accessible platform that enables farmers to book machinery digitally, eliminating the need for informal or inconsistent rental methods. By applying software engineering principles and utilizing technologies such as Dart, we developed an Android-based application that streamlines the rental process and enhances service delivery. The system was designed with user-friendliness in mind. The entire development process adhered to the Software Development Life Cycle (SDLC), ensuring a structured and efficient approach from problem analysis to deployment. However, although the mobile-based rental system presents promising opportunities for small and medium-scale farmers in Tanzania, its implementation faces key practical challenges: inconsistent network and data connectivity in rural areas; concerns over data privacy and security that might discourage user participation; varying levels of digital literacy among farmers and machine owners, which reduce effective adoption; and affordability barriers such as device ownership, data costs, and rental fees that must match farmers' economic realities. This application has great potential for future improvements and expansion. Key features, such as GPS tracking, digital payment integration, push notifications, farmer-to-farmer equipment sharing, and support for multiple languages, can be added. The platform can also grow to include other agricultural services like labor hiring, land leasing, or input purchases. With wider adoption, it could become a nationwide digital hub for agricultural support, boosting efficiency and income for both smallholder and large-scale farmers across Tanzania.

References

Bagaitkar, K., Lande, K., Welekar, A., Yadav, A., Tambe, A., & Chopade, A. (2019). Tractor Hiring application for Farmers. *International Research Journal of Engineering and Technology*, 6(3), 2401–2409.

Bamanikar, A. A., Awate, H. Katre, J., Rasal, H., Mahadik, S. (2022). "Farmers agricultural portal", 9 (5).

Baviskar, P. (2024). Empowering Farmers through Technology: A Sustainable Approach to Agricultural Equipment Rental and Income Generation. *International Journal For Science Technology And Engineering*. https://doi.org/10.22214/ijraset.2024.58825.

Bhuvan, S., Purushotham, G. K., Manoj, A., Chandan, A. M, & Chandraprabha, K. S. (2019). Agri-Equipment Rental System, International journal of scientific Development and Research.

Daum, T., Villalba, R., Villalba, R., Anidi, O., Mayienga, S. M., Gupta, S., & Birner, R. (2020). Uber for Tractors? Opportunities and Challenges of Digital Tools for Tractor Hire in India and Nigeria. Social Science Research Network. https://doi.org/10.2139/SSRN.3526918.

Eldridge, E., Rancourt, M. E., Langley, A., & Héroux, D. (2022). Expanding perspectives on the poverty trap for smallholder farmers in Tanzania: The role of rural input supply chains. *Sustainability*, 14(9), 4971.

Iqbal, M., Kumar, V., & Sharma, V. K. (2007). Krishi Portal: Web Based Farmer Help Assistance. International *Journal of Advanced Science and Technology*, 29, 4783-4786.

Jack, W., & Suri, T. (2011). Mobile money: The economics of M-Pesa. NBER Working Paper Series. Learning, 15(2).

Khatri, A., Lallawmkimi, M. C., Rana, P., Panigrahi, C. K., Minj, A., Koushal, S., & Ali, M. U. (2024). Integration of ICT in Agricultural Extension Services: A Review. *Journal of Experimental Agriculture International*, 46(12), 394–410. https://doi.org/10.9734/jeai/2024/v46i123146.

Kumar, C. A., & Saravanamuthu, M. (2022). “Agraryans: Farm Equipment Rental System/Based on Agriculture”, 9 (6).

Mtebe, J. S., & Raisamo, R. (2014). Investigating perceived barriers to the use of open educational resources in higher education in Tanzania. The International Review of Research in Open and Distributed.

Mwangoka, G., Mbuya, K., & Mkwela, B. (2020). Mobile health interventions for healthcare delivery in Tanzania: A systematic review. *BMC Health Services Research*, 20(1).

Novotná, A. (2023). Mapping the ICT in Agricultural Research: A Bibliometric Analysis. AGRIS On-Line Papers in Economics and Informatics. https://doi.org/10.7160/aol.2023.150404.

Osman, M. N., Zain, N. M., Paidi, Z., Sedek, K. A., NajmuddinYusoff, M., & Maghribi, M. (2017). Online car rental system using web-based and SMS technology. *Computing Research & Innovation (CRINN)*, 2 (277).

Patwa, D., Nikam, U., Bali, A. S., Mhaske, V., & Dhadake, S. (2024). Bridging the Gap: A Comprehensive Study on Web-Based Agricultural Machinery Rental Systems. *International Journal of Advanced Research in Science, Communication and Technology*, 90–94. https://doi.org/10.48175/ijarsct-22312.

Raju, M. N., Manikumar, T. & Kumar, N. N. (2022). “Web Based Form Equipment Rental System for Agriculture”, 10 (6).

Rakhra, M., & Singh, R. (2021, September). Economic and social survey on renting and hiring of agricultural equipment of farmers in Punjab. In 2021 9th *International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions)* (ICRITO) (pp. 1-5). IEEE.

Sanga, C., Kalungwizi, V. J., & Msuya, C. P. (2019). Bridging the agricultural digital divide: Lessons from Tanzania. *Journal of Agricultural Informatics*, 10(2).

Suleiman, R. A. (2018). Local and regional variations in conditions for agriculture and food security in Tanzania. https://pub.epsilon.slu.se/16577/.

URT. (2021). National Sample Census of Agriculture 2019/20.