



How to cite this article:

Mohaideen, N. A., Rahmat, A. R. & Murdi, A. A. (2026). A Web-based Virtual Training Platform for Sustainable Palm Oil Farming in Malaysia. *Journal of Digital System Development*, 4(2), 1-16. <https://doi.org/10.32890/jdsd2026.4.2.1>

A WEB-BASED VIRTUAL TRAINING PLATFORM FOR SUSTAINABLE PALM OIL FARMING IN MALAYSIA

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Received: 4/2/2026

Revised: 26/3/2026

Accepted: 27/4/2026

Published: 28/10/2026

ABSTRACT

The palm oil industry is a major contributor to Malaysia's agricultural economy; however, small-scale farmers often face limited access to structured training, modern agronomic knowledge, and sustainable cultivation practices, particularly in rural areas. This study presents the design, development, and evaluation of a web-based Virtual Training Platform for Palm Oil Farmers (VTPPOF) that addresses these challenges through accessible digital learning. The platform integrates multimedia instructional modules, downloadable learning materials, interactive assessments, and progress-tracking features to support continuous skills development. The team used an Agile development methodology, and the system supports three user roles: administrator, trainer, and farmer. Usability testing with 30 participants demonstrated high perceived usefulness, ease of use, and user acceptance, with mean scores exceeding 4.0 on a five-point Likert scale. The findings indicate that VTPPOF has strong potential to enhance agricultural knowledge dissemination, promote sustainable farming practices, and support digital transformation within Malaysia's palm oil sector. This study contributes a web-based training platform for palm oil farmers, demonstrating high usability and acceptance. Future work will enhance mobile access, integrate advanced technologies, and evaluate long-term agricultural impact.

Keywords: digital agriculture, e-learning system, palm oil farming, sustainable agriculture, virtual training platform

INTRODUCTION

The palm oil sector plays a pivotal role in Malaysia's socioeconomic development, contributing substantially to export revenue and rural employment. Despite its economic significance, knowledge dissemination among smallholder farmers remains uneven, with many relying on traditional cultivation practices and limited exposure to sustainable agricultural standards (Sawirman, 2019). These constraints adversely affect productivity, environmental compliance, and long-term farm profitability.

Advances in digital technology have encouraged the adoption of online learning platforms within agriculture, enabling flexible, scalable, and cost-effective training delivery (FAO, 2025; GetCourse, 2026). Nevertheless, most existing platforms provide generalised agricultural content and lack specialisation in palm oil agronomy, which requires crop-specific guidance on fertilisation, pest management, harvesting techniques, and sustainability certification standards.

To address this gap, this study proposes the Virtual Training Platform for Palm Oil Farmers (VTPPOF), a dedicated web-based learning system that delivers structured, localised training content tailored to the Malaysian context. The objectives of this research are:

1. To identify the learning needs of palm oil farmers.
2. To design a user-friendly multimedia learning interface.
3. To develop a functional training platform prototype.
4. To evaluate usability and user acceptance among potential users.

This paper details the platform's development process, system design, implementation, and evaluation results, offering insights into how digital tools support agricultural education and sectoral sustainability.

RELATED WORK

The digital transformation of agriculture has introduced various e-learning and training platforms to improve farmers' knowledge and skills. These platforms leverage technology to overcome geographical and logistical barriers, providing scalable access to agricultural education. This section reviews existing digital agricultural training systems, focusing on their scope, strengths, and limitations, to contextualise the development of the VTPPOF.

General agricultural e-learning platforms, such as the FAO eLearning Academy, offer a wide range of courses on sustainable farming, food security, and climate resilience. With a global reach and multilingual support, the academy has successfully trained more than 1 million users (FAO, 2025). However, its content is broadly thematic and lacks depth in specific, high-value crops like oil palm, limiting its direct applicability to Malaysian palm oil farmers who require detailed, crop-specific agronomic guidance.

Nationally in Malaysia, the MyLatih initiative represents a significant step toward modernising agriculture through digital literacy. It focuses on Agricultural Technology (AgTech), covering topics like IoT applications and smart farming for a younger, tech-savvy audience (MyLatih, n.d.). While MyLatih introduces important digital concepts, its curriculum does not delve deeply into the specialised cultivation practices, pest management, or sustainability standards unique to palm oil production. This creates a knowledge gap for farmers seeking to improve yields and environmental compliance within this specific sector.

In the European context, platforms like CoLead provide vocational training with a strong emphasis on sustainability and digitalisation within the agri-food sector. CoLead's ISO 21001-certified system ensures quality training, often incorporating interactive phytosanitary resources (CoLead, 2025). Despite its rigorous framework, its programs are designed for EU agricultural contexts and professional audiences, making them less relevant to the socio-economic and climatic conditions faced by smallholder palm oil farmers in Southeast Asia.

Similarly, the Rainforest Alliance Learning Network offers certification-oriented training in sustainable, climate-resilient farming practices. It is a valuable resource for farmers aiming to meet international sustainability standards (Alliance, 2025). Nevertheless, its approach is generalised across multiple commodities. It is primarily tailored for medium-to-large commercial operations seeking certification, rather than for the day-to-day, practical learning needs of independent smallholders.

Beyond these, more specialised platforms also exist, but have distinct limitations. The Roundtable on Sustainable Palm Oil (RSPO) offers a comprehensive suite of online training modules, guidelines, and certification support focused exclusively on sustainable palm oil production. (RSPO, 2026). While it is the leading global standard-setter for the crop, its training materials are often complex, tailored for auditors and larger estates seeking certification. They can be less accessible to independent smallholders with limited resources or foundational knowledge.

Another relevant case is Digital Green, a platform that utilises community-sourced agricultural videos to disseminate best practices among smallholder farmers in the Global South (Green, 2026). Its participatory video model has proven effective for behavioural change and technique adoption. However, its content is crowd-generated and varies widely in quality and specificity, lacking the standardised, curriculum-based structure required for comprehensive training in a technically complex field such as palm oil agronomy.

A comparative analysis of these platforms (Table 1) reveals a consistent gap: the absence of a dedicated, accessible training solution focused exclusively on the foundational and practical aspects of palm oil cultivation for the average farmer. Existing systems are either too general, technologically abstract, regionally misaligned, commercially oriented, or tailored for compliance rather than foundational education. This gap underscores the need for a platform like VTPPOF, which aims to deliver localised, practical, multimedia-rich training designed to address the identified challenges in palm oil farming, filling a critical niche in agricultural digital education.

Table 1

Comparison of Existing Digital Agricultural Training Platforms

Platform	Focus & Scope	Key Strength	Identified Limitation	Relevance to Palm Oil Farmers
FAO eLearning Academy	Global sustainable agriculture: broad topics.	Wide recognition, free access, multilingual.	Generalised content; lacks crop-specific depth.	Low: provides foundational knowledge but no

					palm oil specialisation.
MyLatih (Malaysia)	National AgTech; smart farming & digital skills.	Local context, modern tech focus, youth engagement.	Focuses on technology over core agronomy; not crop-specific.	Moderate - introduces digital tools but not palm oil cultivation techniques.	
CoLead(EU)	EU agri-food sustainability & vocational training.	High-quality certification (ISO 21001), strong sustainability focus.	Geared towards the EU context and professional/business audiences.	Low - content and context are not aligned with Malaysian palm oil farming.	
Rainforest Alliance Learning Network	Global sustainable certification & climate resilience.	Practical examples, expert-backed, market-linked.	Commercial and certification-oriented; generalised across commodities.	Moderate - teaches sustainability principles but is not tailored to daily palm oil farming practice.	
RSPO Academy	Sustainable palm oil certification & standards.	Globally recognised, crop-specific, comprehensive sustainability framework.	Complex, compliance-focused; less accessible to smallholders; high barrier to entry.	High on sustainability, Low on accessibility – essential for certification but not for basic agronomic training.	
Digital Green	Community-led agricultural video dissemination.	High local relevance, effective for behavioural change.	Variable content quality; lacks a standardised curriculum.	Moderate - good for peer learning but lacks a structured, expert-verified palm oil curriculum.	

This project presents the development of a virtual training platform specifically designed to meet the educational needs of palm oil farmers in Malaysia. It aims to contribute meaningfully to the agricultural sector by providing an accessible and interactive digital platform for acquiring essential knowledge on sustainable palm oil cultivation, modern farming techniques, and effective crop management. (Defarmercist Media, 2026).

By combining structured learning with engaging multimedia elements such as instructional videos, downloadable modules, and interactive quizzes, the platform encourages farmers to associate learning with practical, actionable insights. This makes skills development more natural, self-paced, and directly applicable to daily farming activities.

The platform enhances both cognitive and practical skills through its interactive design. Features such as progress tracking, module-based learning, and knowledge assessments promote active engagement and help reinforce the adoption of best practices. By educating farmers on sustainable, environmentally sound methods, the platform fosters stewardship and long-term responsibility for land and resource management.

For farmers, agricultural trainers, and administrators, this platform offers a scalable, cost-effective educational tool that aligns with national goals for agricultural modernisation and sustainability. It supports capacity building in a safe, flexible, and user-friendly digital environment, effectively bridging the gap between conventional extension services and the growing need for on-demand, specialised knowledge.

The Virtual Training Platform for Palm Oil Farmers is not merely a repository of information; it actively motivates learners to explore, retain, and apply new knowledge in real-world settings. This underscores the vital role of targeted, technology-enabled learning in advancing the competence, productivity, and sustainability of one of Malaysia's most important agricultural industries.

METHODOLOGY

The development of VTPPOF followed the Agile software development approach. This methodology was selected for its emphasis on iterative progress, flexibility, and continuous user feedback, ensuring the final product was functional and closely aligned with end-user needs. (Laoyan, 2026). The project was executed across six distinct phases, as illustrated in Figure 1: Planning, Design, Development, Testing, Deployment, and Review.

Figure 1

Agile Development Lifecycle



Source: Laoyan (2026)

Planning Phase: This initial phase focused on defining the project's scope and foundational requirements based on desk research. To address the first objective of identifying learning needs, we conducted extensive secondary research. This involved analysing academic literature, reports from bodies such as the Malaysian Palm Oil Board (MPOB) and reviewing existing digital agricultural platforms to understand common

challenges in palm oil cultivation and gaps in available training. The findings were synthesised into a comprehensive Project Proposal that included a problem statement, clear objectives, and a project scope.

Design Phase: The second objective, to design a user-friendly and responsive web interface, was addressed in this phase. We created low-fidelity wireframes and interactive prototypes in Figma, focusing on intuitive navigation, clear information architecture, and a visually simple layout suitable for users with varying levels of digital literacy. The design prioritised accessibility, with large buttons, consistent colour schemes, and support for multimedia content (videos, PDFs, images).

Development Phase: This phase focused on building a functional prototype to meet the third objective. The platform was developed as a web application using the Laravel framework (PHP) for the backend logic, MySQL for the database, and Bootstrap 5 for the responsive frontend. Core features included user authentication, multimedia content management, interactive quizzes, and progress tracking.

Testing Phase: To meet the fourth objective, a structured field test was conducted with 30 participants, including agriculture students, palm oil farmers, and plantation staff. They engaged with the prototype by completing tasks such as registration, module completion, and quizzes. Subsequently, participants completed a questionnaire to assess the system's usability, usefulness, and acceptance.

Deployment Phase: Following successful testing and necessary refinements, the stable prototype was deployed on a local web server to create a live demonstration environment. This allowed stakeholders broader, asynchronous access for final evaluation. During this phase, we implemented performance, cross-browser compatibility, and basic security configurations.

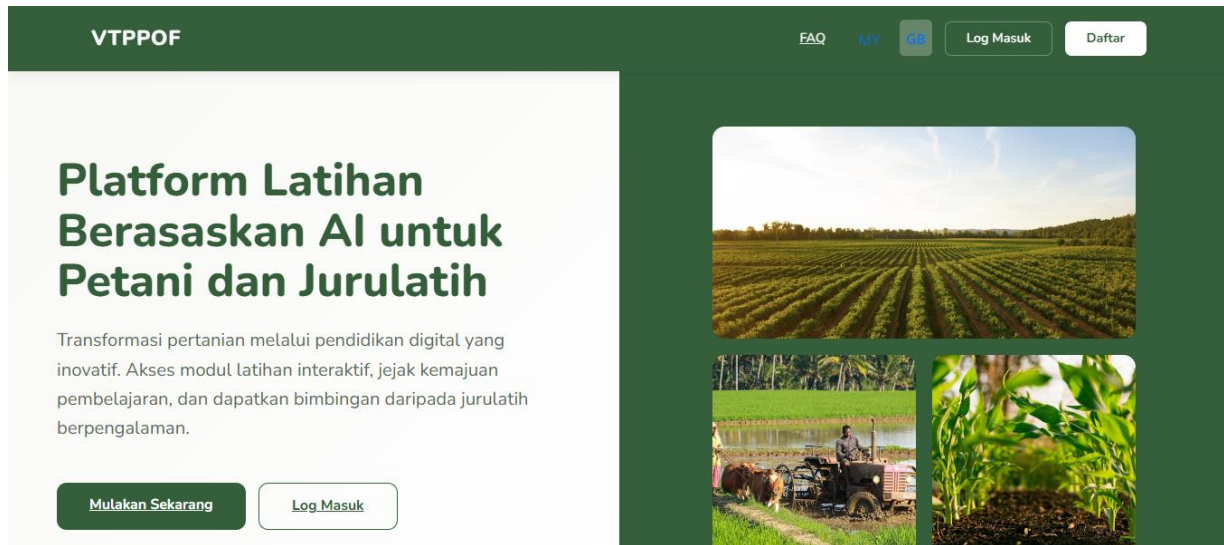
Review Phase: The final phase involved a holistic review of the project against its initial objectives. The team consolidated all documentation, test results, and user feedback. The team evaluated the outcomes to assess the project's success, documented lessons learned and outlined clear recommendations for future work and potential platform scaling.

VTPPOF PROTOTYPE DEVELOPMENT

To demonstrate VTPPOF's functionality and interface design, the screenshots below show key views from the working prototype. These visuals highlight the user experience, platform architecture, and core interactive elements designed specifically for three user roles: Farmer, Trainer, and Administrator. The platform was developed using Laravel (PHP), Bootstrap 5, and MySQL, with role-based design as a key objective. The selected screens illustrate the home page, user authentication pages, and the main dashboards for each user role.

Figure 2

VTPPOF's Home Page



The home page serves as the platform's main entry point, featuring a bilingual interface (Malay/English), clear navigation, and introductory content explaining the platform's purpose. It provides direct access to the FAQ, registration, and login functions.

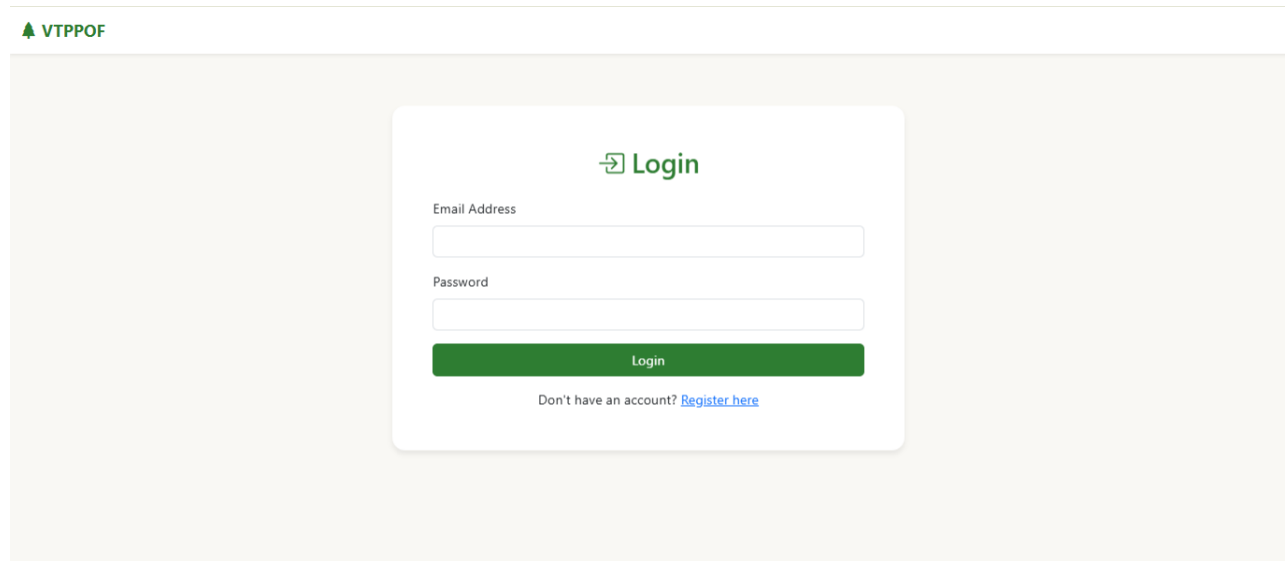
Figure 3

VTPPOF's Register Page

The registration page allows new users to create an account by entering their personal details and selecting their role (Farmer or Trainer). This role selection determines their access level and dashboard layout within the system.

Figure 4

VTPPOF's Login Page

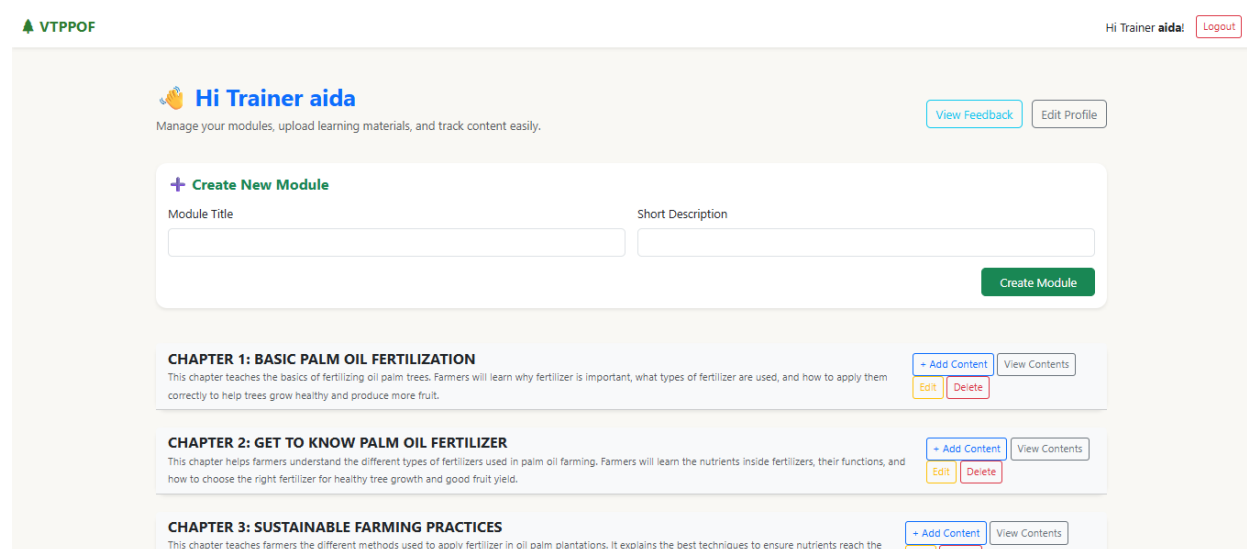


The screenshot shows the VTPPOF login page. At the top left is the VTPPOF logo. The main content is a white login box with a green 'Login' button. Below the button is a link to 'Register here' for users who don't have an account. The login form includes fields for 'Email Address' and 'Password'.

The login page provides secure authentication for registered users. It features a simple email/password form with options for users who need to register or recover their credentials.

Figure 5

VTPPOF's Trainer Page



The screenshot shows the VTPPOF trainer dashboard. At the top, there's a header with the VTPPOF logo, the user name 'Hi Trainer aida', and a 'Logout' button. Below the header, there's a section for 'Hi Trainer aida' with a description and buttons for 'View Feedback' and 'Edit Profile'. The main content area has a 'Create New Module' section with fields for 'Module Title' and 'Short Description', and a 'Create Module' button. Below this, there are three chapters listed: 'CHAPTER 1: BASIC PALM OIL FERTILIZATION', 'CHAPTER 2: GET TO KNOW PALM OIL FERTILIZER', and 'CHAPTER 3: SUSTAINABLE FARMING PRACTICES'. Each chapter has a description and buttons for '+ Add Content', 'View Contents', 'Edit', and 'Delete'.

The trainer dashboard enables agricultural experts to create, manage, and organise training modules. Trainers can upload multimedia content, write chapter descriptions, and structure learning materials for farmers.

Figure 6

VTPPOF's Farmer Page

Welcome, nana
Track your progress and access training materials.

[View Feedback](#) [Edit Profile](#)

Overall Progress
Completed 0 of 12 modules

Available Training Modules

CHAPTER 1: BASIC PALM OIL FERTILIZATION Trainer: aida
This chapter teaches the basics of fertilizing oil palm trees. Farmers will learn why fertilizer is important, what types of fertilizer are used, and how to apply them correctly to help trees grow healthy and produce more fruit.

[View Contents](#)

PDF: **1.1 Introduction to Palm Oil Fertilization**
Read this for further understanding. [Download](#) [View File](#)

Video: **1.2 How to Apply Fertilizer Correctly**
Step-by-step guide on the correct way and time to apply fertilizer. [Open Link](#)

Quiz: **1.3 Quiz: Basic Palm Oil Fertilization**
Short quiz to test understanding of this chapter. [Take Quiz](#)

CHAPTER 2: GET TO KNOW PALM OIL FERTILIZER Trainer: aida
This chapter helps farmers understand the different types of fertilizers used in palm oil farming. Farmers will learn the nutrients inside fertilizers, their functions, and how to choose

The farmer dashboard displays available training modules, tracks learning progress, and provides access to educational resources, including PDF documents, instructional videos, and interactive quizzes for self-assessment. A farmer can also submit feedback, either directed to a specific trainer or to the general feedback channel.

Figure 7

VTPPOF's Admin Page

VTPPOF Hi Admin Admin User! [Logout](#)

Admin Dashboard

5 Total Farmers **5** Total Trainers **12** Total Modules

Create New User

Name Email Phone Role... Password

[Create User](#)

Manage Users

ID	Name	Email	Role	Status	Actions
3	nana	aidahnrd@gmail.com	Farmer	Active	Toggle Status Delete
9	wiwi	minthocoteen@gmail.com	Farmer	Active	Toggle Status Delete
10	yushi	aidahnotaida@gmail.com	Farmer	Active	Toggle Status Delete
11	kuri	myydicam@gmail.com	Farmer	Active	Toggle Status Delete

The administrator dashboard provides system oversight, displaying platform statistics and offering user management functions. Admins can create new user accounts, monitor active users, and manage account statuses.

RESULTS AND DISCUSSION

Demographic Profile of Participants

The field test involved 30 participants (50% male, 50% female), predominantly aged 18–24 (60%). Occupations included agriculture students (56.7%), plantation staff (36.7%), and palm oil farmers (3.3%). Most participants (73.3%) had prior experience with online systems, and 93.3% used the internet daily. Table 2 provides the detailed demographic breakdown.

Table 2

Demographic Data of Field Test Participants (N=30)

Category	Group	Number of Participants	Percentage (%)
Gender	Male	15	50.0
	Female	15	50.0
Age Range	18-24 years	18	60.0
	25-34 years	8	26.7
	35-44 years	4	13.3
Occupation	Agriculture Student	17	56.7
	Plantation Staff	11	36.7
	Palm Oil Farmer	1	3.3
	Other	1	3.3
Prior Online System Experience	Yes	22	73.3
	No	8	26.7
Internet Usage Frequency	Every Day	28	93.3
	Sometimes	2	6.7

Usability and User Experience

Participants rated the platform highly on ease of use, interface clarity, and navigation. The results for App Experience, as shown in Table 3, indicate strong positive responses, with mean scores ranging from 3.97 to 4.27 on a 5-point Likert scale (Taherdoost, 2019). Participants particularly praised the design for aiding content understanding ($M = 4.27$, $SD = 0.8683$).

Table 3

App Experience Evaluation (N=30)

Statement	Mean Score	Standard Deviation
The app was easy to understand at first.	4.00	0.7878
The app looked clean and simple.	4.20	0.8052
It was easy for me to move from one page to another.	4.20	0.8052
The design (colours, pictures, layout) helped me understand the context.	4.27	0.8683
I did not face many problems while using the app.	3.97	0.6687

Note. Scored on a 5-point Likert Scale (1 = Strongly Disagree, 5 = Strongly Agree).

Usefulness and Learning Value

The platform was perceived as highly useful for learning and relevant to farming activities. As illustrated in Figure 8, participants strongly agreed that the app helped them learn something new (M=4.37, SD=0.7184) and was useful for farmers (M=4.33, SD=0.6609). Interactive quizzes and downloadable materials were highlighted as engaging and practical features that added significant value.

Figure 8

Perceived Usefulness of the VTPPOF Platform

USEFULLNESS

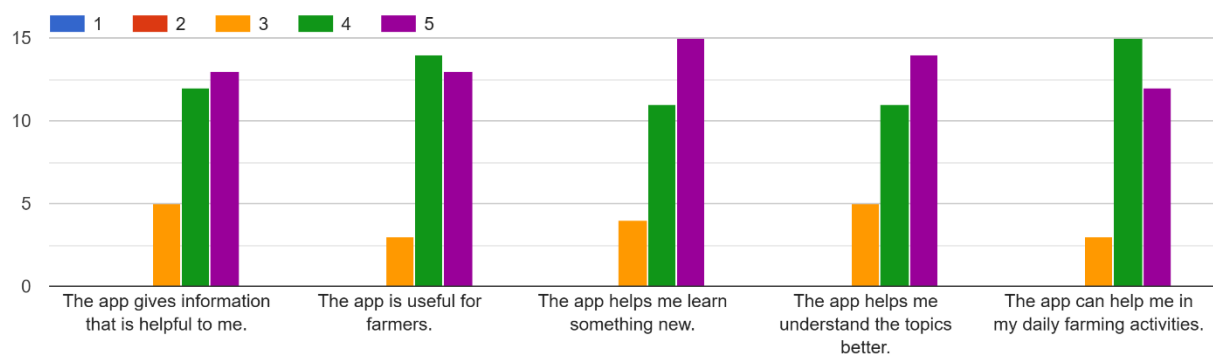


Table 4

Perceived Usefulness Evaluation (N=30)

Usefulness Statement	Mean Score	Standard Deviation
The app gives information that is helpful to me.	4.27	0.7397
The app is useful for farmers.	4.33	0.6609
The app helps me learn something new.	4.37	0.7184
The app helps me understand the topics better.	4.30	0.7497
The app can help me in my daily farming activities.	4.30	0.6513

Acceptance and Intent to Use

User acceptance scores were strong, with high agreement that the platform suits farmers, including those with low digital skills. As summarised in Table 5, participants expressed confidence in using the app (M=4.17, SD=0.7915), trust in its information (M=4.27, SD=0.7397), and high overall satisfaction (M=4.37, SD=0.6687). Furthermore, as shown in Figure 10, there was a strong intention to reuse and recommend the platform, with the highest score for recommending the platform to other farmers (M=4.27, SD=0.6915).

Figure 9

Acceptance of the VTPPOF Platform

ACCEPTANCE

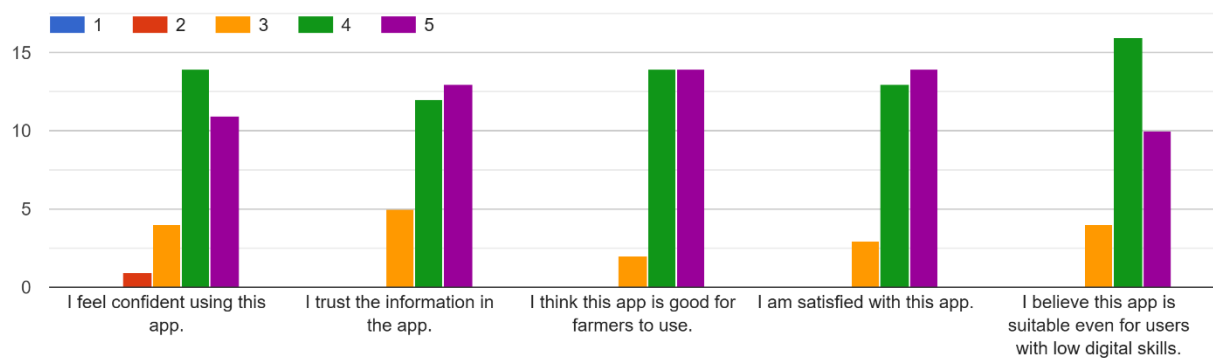


Figure 10

Intent to Use of the VTPPOF Platform

INTENT TO USE

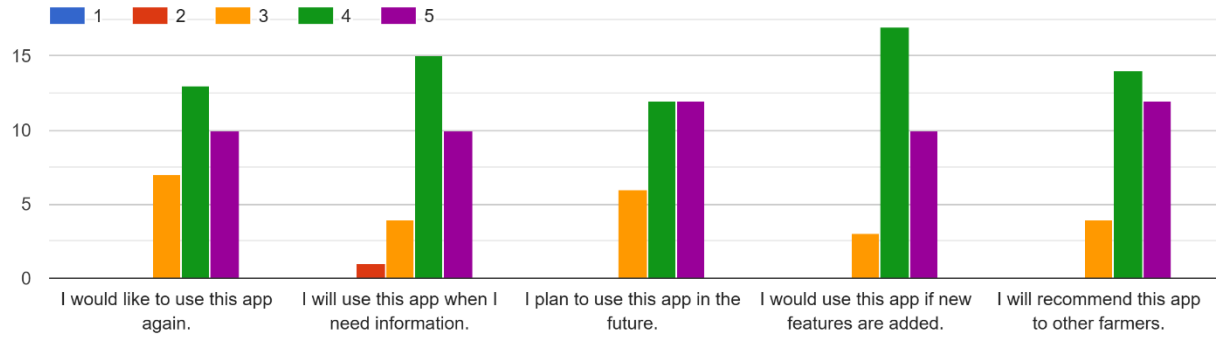


Table 5

User Acceptance and Intent to Use Evaluation (N=30)

Category	Statement	Mean Score	Standard Deviation
Acceptance	I feel confident using this app.	4.17	0.7915
	I trust the information in the app.	4.27	0.7397
	I think this app is good for farmers.	4.40	0.6215
	I am satisfied with this app.	4.37	0.6687
	I believe this app is suitable even for users with low digital skills.	4.20	0.6644
Intent to Use	I want to use this app again.	4.10	0.7589
	I will use this app when I need information.	4.13	0.7761
	I plan to use this app in the future.	4.20	0.7611
	I would use this app if new features are added.	4.23	0.6261
	I will recommend this app to other farmers.	4.27	0.6915

The positive results confirm that VTPPOF meets its design goals of usability, relevance, and accessibility. High acceptance among users with varying levels of digital experience suggests the platform can effectively bridge the digital divide in agricultural training. The feedback also identifies actionable refinements, such as localised content and improved navigation, which will be incorporated into future versions.

CONCLUSION

This project successfully developed and evaluated VTPPOF, a specialised web-based learning system designed to address the knowledge gap in Malaysian palm oil farming. Using Agile development, the team created a functional prototype with distinct user roles, multimedia modules, quizzes, progress tracking, and feedback mechanisms. Field testing with 30 participants confirmed the platform's effectiveness, with high ratings in usability, perceived usefulness, and overall acceptance. Participants valued the intuitive interface and relevant content, suggesting that VTPPOF bridges the digital divide for farmers with varying levels of technological literacy.

While the platform demonstrates strong potential as a scalable digital training tool, user feedback highlighted areas for improvement, including bilingual support (Bahasa Melayu), simplified navigation, and enhanced administrative features. These insights provide a clear roadmap for future iterations. In summary, VTPPOF stands as a viable and impactful digital solution that supports the modernisation and sustainability of Malaysia's palm oil sector. By making agricultural knowledge more accessible, interactive, and tailored to local needs, the platform enhances farmers' competence, productivity, and long-term environmental stewardship.

While the VTPPOF prototype demonstrated strong usability and acceptance in field testing, user feedback identified several limitations that highlight opportunities for future enhancement. The platform's initial development prioritised core functionality, resulting in certain constraints. While the interface was rated user-friendly, some participants noted that the menu structure could be simplified for quicker navigation. Additionally, the content was primarily presented in English, which may limit accessibility for farmers who are more comfortable with Bahasa Melayu. The prototype also lacked advanced features such as an integrated helpdesk or AI-based support, which could improve user assistance. Furthermore, the administrative tools, though functional, were reported to require refinement to improve the efficiency of user management.

Based on participant suggestions, several directions for future development are proposed. First, we will prioritise enhancing language accessibility through bilingual support (Bahasa Melayu and English) to broaden the platform's reach. Second, the interface will be refined to streamline menu layouts and improve content discoverability. Increasing the volume and variety of video-based training modules, particularly those demonstrating practical and in-field techniques, will cater to diverse learning preferences. The plan also includes implementing a more robust feedback system, including direct farmer-to-trainer communication channels. Finally, integrating an AI-powered helpdesk or chatbot could provide immediate assistance. At the same time, backend improvements will focus on scalable content management and more detailed analytics for trainers and administrators. These enhancements aim to transform VTPPOF into a more comprehensive, accessible, and impactful tool for the digital upskilling of Malaysia's palm oil farming community.

ACKNOWLEDGMENT

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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