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Visualisation of Training Management Operations through a Web-Based Dashboard Platform

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ABSTRACT

The reliance on manual processes for training administration often results in fragmented data, slow decision-making, and limited visibility of training effectiveness. Although Training Management Systems (TMS) exist, many function merely as record-keeping platforms and lack real-time visualisation to support strategic training decisions. This study aims to develop and evaluate an interactive, web-based Training Management System (TMS) dashboard that enhances transparency, monitoring and performance reporting of training operations. A mixed-method approach was employed. First, workflow analysis and semi-structured interviews were conducted with 14 personnel from Malaysia Productivity Corporation (MPC) to identify critical process indicators and dashboard requirements. A web-based dashboard was then developed using the Laravel PHP framework to visualise training activities, participation, proof-of-concept outcomes, and trainer performance. Finally, system usability and perceived usefulness were evaluated through a user survey involving 12 MPC officers. Findings demonstrate that the system successfully transforms static training records into actionable and real-time visual analytics. This enables process owners to continuously monitor training status, outcomes, and effectiveness, leading to significantly improved decision accuracy and accelerated managerial response. The research contributes a practical model for digital transformation, illustrating how cost-effective visualisation platforms can strengthen data-driven decision-making and performance monitoring in training and workforce development. Implemented with the Malaysia Productivity Corporation (MPC), the solution directly supports national initiatives to enhance workforce readiness and digital capability, aligning with Malaysia's Fourth Industrial Revolution (4IR) agenda and effort to improve global competitiveness. Beyond operational efficiency, the study offers an evidence-based approach that education and training institutions can replicate to improve transparency in training, monitoring, and learning accountability.

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1. INTRODUCTION

A Training Management System (TMS) is a web-based software application that automates the planning, administration, tracking, and reporting of training programs and learning activities. However, contemporary literature emphasises that a truly effective TMS extends far beyond simple scheduling or record-keeping. It functions as an integrated digital ecosystem that centralises and automates all training-related administrative processes while providing self-service, adaptive access, and collaborative functionalities for trainers, trainees, and managers alike (Zhang et al., 2025; Yusof & Lee, 2024). In traditional settings, these operations are often fragmented, relying on manual tracking tools such as spreadsheets, paper-based records or Google Forms. Such approaches are not only time-consuming but also susceptible to data redundancy and inconsistency, hindering strategic decision-making (Mohan et al., 2023). However, existing studies focus mainly on system features and automation, which places limited emphasis on how visualisation supports transparency, decision-making accuracy, and accountability in training operations. This creates a gap in understanding of how a dashboard can transform training processes from data recording to data-driven decision-making.

In contrast, adopting a web-based TMS provides centralised, integrated control, consolidating data from various sources and visualising it in real time. This integration enables organisations to maintain consistency, transparency, and traceability across all learning and development activities (Al-Mashaqbeh et al., 2025) and Nurul Nadiah et al. (al,2023).

Visualisation is a defining feature of modern TMS architectures. A web-based Training Management Dashboard provides real-time visualisation of training operations, including schedules, participation rates, resource utilisation, competency development, and learning outcomes. Supported by Business Intelligence (BI) tools, these dashboards transform raw training data into analytical insights that reveal performance trends, resource bottlenecks, and training impact metrics (Tan & Goh, 2024; Khalid et al., 2022).

The incorporation of data visualisation within TMS platforms enhances situational awareness and enables managers to make timely, data-driven decisions. Studies have shown that visual analytics in training systems can improve operational responsiveness by up to 30%, as visual cues accelerate the interpretation of training performance metrics and learner engagement patterns (Yusof & Lee, 2024; Rahman et al., 2024). Moreover, the integration of machine learning–based analytics into dashboards supports predictive modelling of training outcomes, enabling proactive planning and resource optimisation (Chen & Park, 2025).

The integration of real-time data visualisation not only improves transparency but also strengthens an organisation's capacity to identify performance gaps, forecast training needs, and implement corrective actions efficiently (Zhang et al., 2025). Ultimately, adopting a digital, web-based TMS promotes a data-driven learning culture—a key enabler of continuous improvement, operational excellence, and strategic workforce development in the context of Industry 4.0 and beyond (Tan & Goh, 2024; Chen & Park, 2025). Although the literature establishes the benefits of TMS and visualisation dashboards, few empirical studies examine their implementation in real training environments, particularly in the Malaysian context. Most research focused on system development rather than on evaluating users' perceptions or the operational improvements achieved after implementation.

This study was conducted at Malaysia Productivity Corporation (MPC), which manages the productivity trainings for Malaysia industry players for 14 nexus, which are aerospace, agrifood, automotive, chemical products, construction and built environment, digital, electrical and electronics, logistics, machinery and equipment, pharmaceutical, private healthcare, professional services, retail food and beverages and tourism. A total of 510 companies are involved in training using this system, with 1043 participants. Daily training management operations in MPC required a dedicated 14-person team to handle activities such as receiving training requests from participants, managing training registrations by submitting training needs analyses, and analysing the impact of training on participants and industries. Real-time status was unavailable because training management was handled through manual paperwork and Google Forms, making it impossible to make an informed decision quickly enough to prevent operational losses. A study was conducted focusing on the training management operations to initiate a process visualisation that would serve as their monitoring dashboard for these operations.

2. LITERATURE REVIEW

The transformation of training management within organisations has evolved from administrative scheduling to intelligent, data-driven ecosystems. The integration of digital technologies such as cloud computing, analytics, and artificial intelligence (AI) has enabled organisations to move beyond conventional Learning or Training Management Systems (LMS/TMS) toward platforms that visualise training performance in real time and support strategic decision-making.

2.1 Evolution of Training Management Systems (TMS)

Training Management Systems emerged as digital solutions to automate administrative processes such as scheduling, attendance tracking, and course registration. However, the contemporary role of TMS extends to strategic workforce development through data analytics and performance visualisation (Gómez & Calderón, 2020). Almarashdeh (2021) demonstrated that modern TMS platforms not only enhance efficiency but also support adaptive learning and personalised pathways. These systems enable organisations to align learning outcomes with corporate objectives, strengthening human capital development. The inclusion of analytics transforms the TMS from a reactive reporting tool to a proactive decision-support system capable of correlating training data with key performance indicators (Khalid & Hassan, 2021; Rashid & Rahman, 2023).

The evolution of TMS aligns with the broader Industry 4.0 narrative, in which digital systems facilitate agility, transparency, and knowledge reuse (Jang & Kim, 2023; Kumar & Singh, 2022). However, the effectiveness of such systems depends on their ability to integrate diverse datasets and visualise information in meaningful ways that support managerial insight.

2.2 Web-Based Dashboards and Visualisation in Training Operations

A well-designed dashboard converts complex datasets into actionable insights, improving the timeliness and precision of decisions (Han & Park, 2020). The usability and interactivity of dashboards have emerged as critical success factors. According to Daryanto and Wibowo (2023), dashboards must provide flexible visualisation modes—such as charts, heatmaps, and progress indicators—that allow users to customise views according to their roles. Zhang (2024) added that poor visualisation design may lead to cognitive overload, undermining the purpose of BI systems. Consequently, effective dashboards must balance clarity, density, and relevance, ensuring users can rapidly interpret trends and act accordingly.

Visualisation not only enhances understanding but also fosters engagement among stakeholders by making training performance transparent in organisations adopting continuous improvement philosophies such as Lean or Six Sigma. Visualisation dashboards act as digital equivalents of visual management boards, reinforcing accountability and a data-driven culture (Lim & Cheah, 2024).

2.3 PHP Laravel for Web-Based Data Visualisation and Dashboard Systems

The rapid digital transformation of organisations in the era of Industry 4.0 has increased demand for dynamic, web-based systems capable of processing and visualising data in real time. Among various technologies, PHP (Hypertext Preprocessor) remains one of the most widely adopted open-source scripting languages for developing robust, flexible, and scalable web applications, particularly dashboards and performance monitoring systems (Lee & Chen, 2022; Tan & Goh, 2024). Its ability to integrate seamlessly with diverse databases and front-end frameworks enables the creation of intelligent, interactive dashboards that enhance decision-making efficiency and operational transparency (Ahmed et al., 2021; Kumar & Singh, 2023). PHP-based dashboards enhance information transparency and knowledge visualisation within organisations, particularly in education and training management. For instance, Rahman and Yusof (2022) developed a PHP-driven academic performance monitoring system that improved administrative response time by 35%. Likewise, Ali and Magalhães (2021) demonstrated how PHP-enabled hospital dashboards provided real-time insights into patient flow and resource utilisation, thereby improving the accuracy of decision-making in healthcare operations.

3. METHODOLOGY

The study adopts a mixed-methods case study design. It applies the Kaizen 6 Steps (Fig. 1), which involve reviewing the current condition, defining targets, developing improvement strategies, implementing solutions, and evaluating outcomes. The commitment from Malaysia Productivity Corporation management to the kaizen needs of training management visualisation initiated the study.

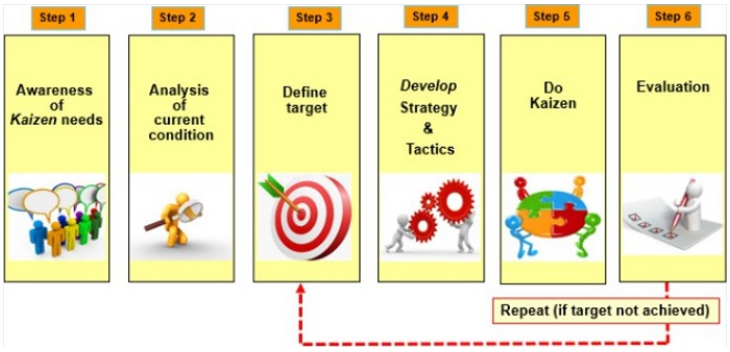

Fig. 1 *The Kaizen 6 steps (Khairi et al., 2024)*
Source: Author (2026)

A review of existing manual training management records and procedures was conducted, supported by semi-structured interviews with personnel from the Malaysia Productivity Corporation to understand and analyse the current workflow before establishing improvement targets. Based on the findings, a strategy was developed and carried out three major phases: (i) review and diagnosis of the existing training management workflow, (ii) development of a web-based visualisation dashboard, and (iii) survey evaluation of the dashboard's effectiveness. The overall process flow of the study is illustrated in Fig. 2.

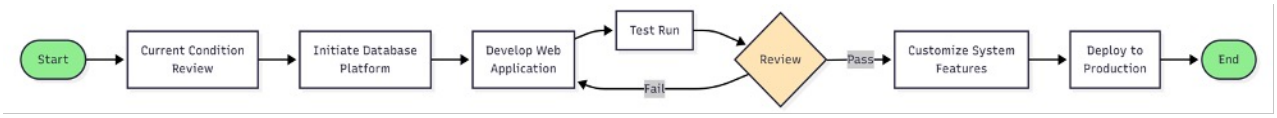

Fig. 2 *Flow of conducting a study*
Source: Author (2026)

3.1 Phase 1: Review of Existing Workflow and Identification of Visualisation Requirements

The first phase concentrated on understanding MPC's current training management operations, which relied heavily on manual paperwork, Google Forms, and fragmented record-keeping. A review of existing documents (training records, registration sheets, feedback forms) was carried out alongside semi-structured interviews with 14 MPC personnel involved in daily training activities.

This review enabled the research team to map existing processes, identify bottlenecks, and determine the critical items requiring visualisation. These included the status of training programs, trainer activity, participant registration, company involvement, and progress on proof-of-concept (POC) submissions. The findings guided improvements and defined the dashboard's functional requirements.

3.2 Phase 2: Development of the PHP Laravel Web Application

The Laravel framework, one of the most widely adopted open-source PHP frameworks for modern web development, is used to build the visualisation dashboard as a PHP web application. Laravel offers a structured, modular coding environment based on the Model-View-Controller (MVC) architecture. This architecture facilitates the separation of logic, presentation, and data administration layers. The development process is facilitated by Laravel, which includes Blade templating, the Eloquent ORM for database interaction, built-in security mechanisms, and route and middleware administration. In contrast to traditional PHP coding, these functions facilitate more scalable, maintainable, and rapid development. It is also possible to generate interactive dashboards with dynamic components such as scorecards, tables, graphs, and filters by integrating the Laravel framework seamlessly with data visualisation libraries and front-end technologies (such as Chart.js, ApexCharts, and Bootstrap). This ensures users can monitor performance indicators in real time while maintaining a consistent, intuitive interface design. In this project, Laravel serves as the primary development framework, overseeing data retrieval, visualisation logic, and user interface rendering. This ensures that the dashboard is secure, reliable, and consistent with Kaizen's Step 5 objective of continuous monitoring and improvement through data-driven insights.

3.3 Phase 3: Evaluation of Dashboard Effectiveness Using the System Usability Scale (SUS)

The third phase of this study focused on evaluating the usability and practical suitability of the developed dashboard. The evaluation was conducted using the System Usability Scale (SUS), a widely used, validated instrument for assessing the usability of web-based interfaces, portals and dashboard systems (Brooke, 1996). SUS consists of 10 items rated on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). It has demonstrated consistently high reliability, with Cronbach's alpha typically ranging from 0.85 to 0.92 (Bangor, Kortum, and Miller, 2008), making it appropriate even for small-sample usability studies.

A total of 12 personnel from the Malaysia Productivity Corporation (MPC) participated in this evaluation. These respondents represented three key stakeholder groups: management, training coordinators, and operational staff. Participation occurred after respondents were given access to the dashboard and allowed to explore its functions. Responses were collected via an online survey, and descriptive statistics (frequencies, percentages, and mean scores) were used to analyse the SUS results.

The use of 12 participants is appropriate and well-supported for a usability-focused study. Usability research consistently demonstrates that a small number of representative users is sufficient to uncover most usability issues (Nielsen, 2000; Virzi, 1992). The SUS items used are as follows:

SUS Items (Brooke, 1986)

1. I think that I would like to use this system frequently.
2. I found the system unnecessarily complex. (reverse-scored)
3. I thought the system was easy to use.
4. I think that I would need the support of a technical person to use this system. (reverse-scored)
5. I found the various functions in this system were well integrated.
6. I thought there was too much inconsistency in this system. (reverse-scored)
7. I would imagine that most people would learn to use this system very quickly.
8. I found the system very cumbersome to use. (reverse-scored)
9. I felt very confident using the system.
10. I needed to learn a lot of things before I could get going with this system. (reverse-scored)

4. RESULTS AND DISCUSSION

By following the Kaizen 6 Steps, a dashboard is created to provide interactive information for Malaysia Productivity Corporation training operations. The results obtained during dashboard establishment are shown in Fig. 3.

4.1 Reviewing Current Operational Record

From interviews and actual process observations, the interrelationships among processes within the training management operations are clarified and illustrated in Table 1. This review provides the baseline understanding needed to identify inefficiencies and define the dashboard's visualisation requirements, directly supporting Phase 1 of the study.

Table 1
Process activities and capture the record matrix

Activities	Description	Record
Admin	Create a new program and track registration through training feedback.	Attendance list, Training Outcome Report
User	Enrol in the training program, submit the training output and provide training feedback.	Attendance Training Report

The matrix in Table 1 shows that training data is dispersed across multiple manual records, underscoring the need for an integrated visualisation platform to centralise operational information.

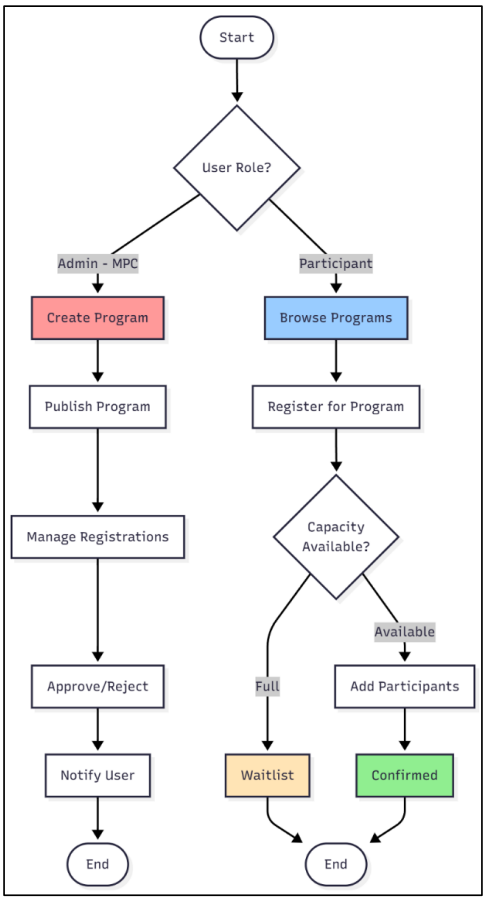

Fig. 3 *Process interaction of Malaysia Productivity Corporation training management operation*
Source: Author (2026)

4.2 Developing Visualisation Using the PHP Laravel Framework

The development of the training management system dashboard started with the creation of several core interfaces, including the access dashboard page where the integrated sheet containing data on training programs and list of all expert trainers (Fig.4), participation registration page (Fig.5), registration notification page (Fig.6), trainer database page (Fig.7), training programs page (Fig.8), company training database page (Fig.9), participants database page (Fig.10) and Proof of Concept (POC) Management page (Fig.11).

These interfaces collectively integrate scattered operational data into a centralised, web-based platform. For Proof of Concept, the management page monitors the training program, training schedule, total participants, number of POC submissions, and the status of POC for each training program. This consolidation marks a significant improvement over MPC's manual record-keeping practices, enabling faster data retrieval, improved transparency, and real-time monitoring of training activities.

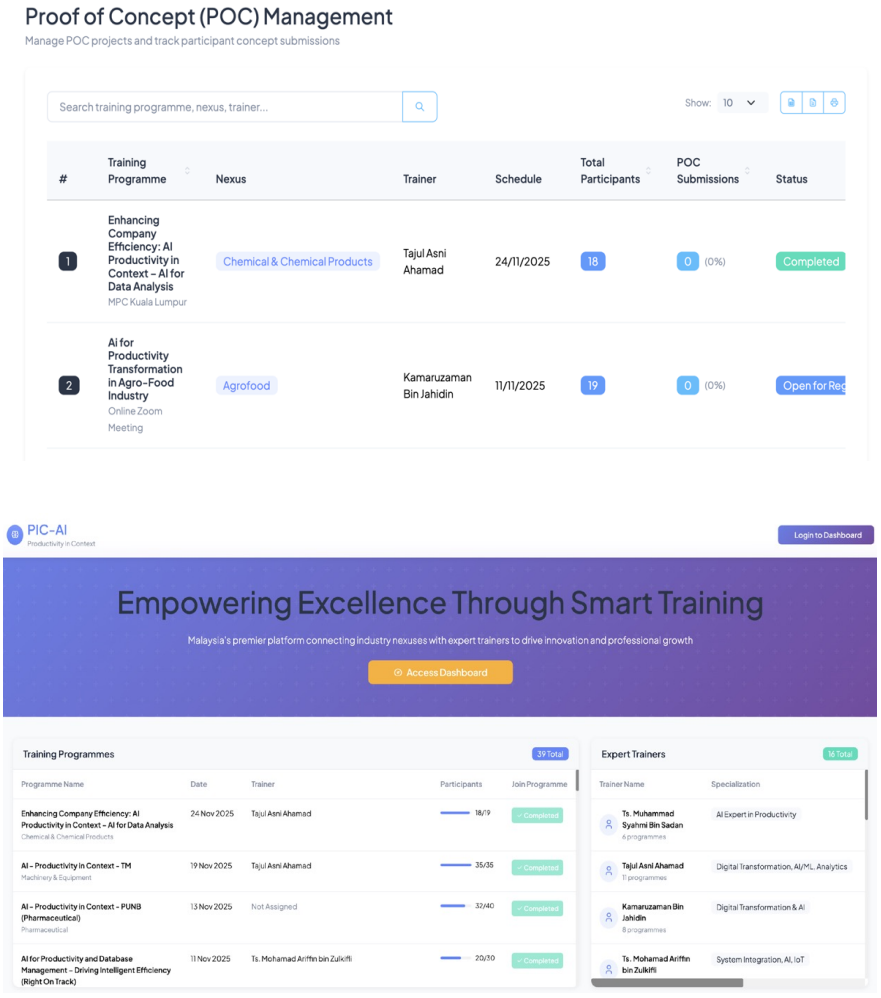

Fig. 4 *Front page (access dashboard page)*
Source: Author (2026)

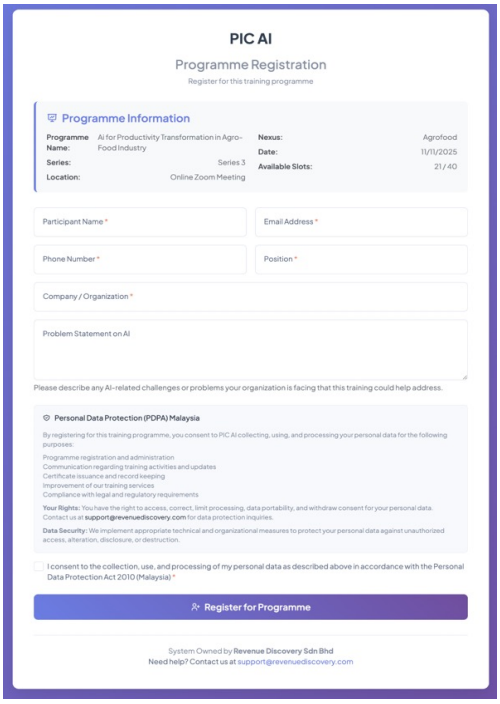

Fig.5 *Participant registration page*
Source: Author (2026)

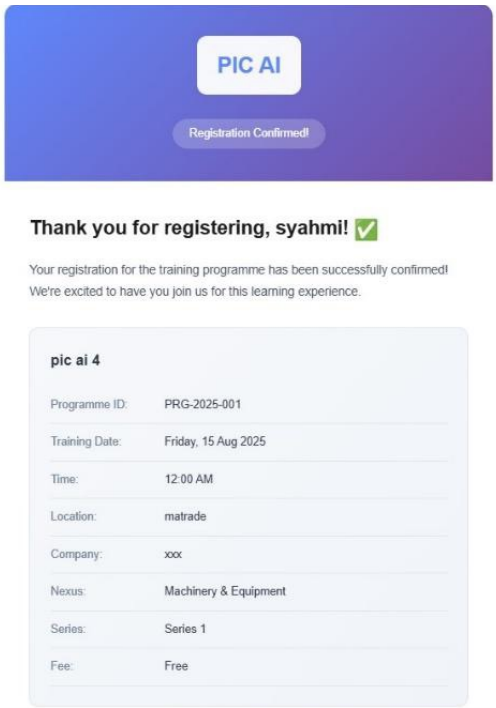

Fig.6 *Participation registration notification*
Source: Author (2026)

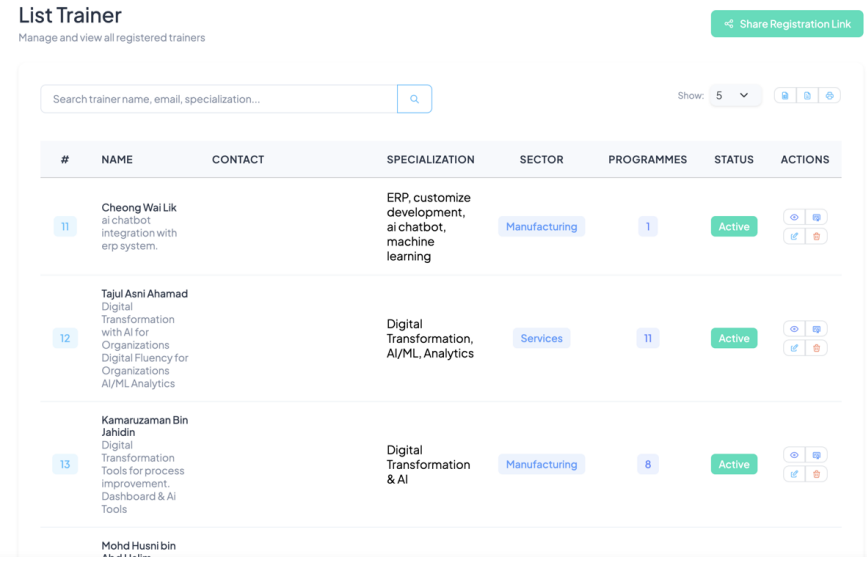

Fig.7 *Database of Trainers*
Source: Author (2026)

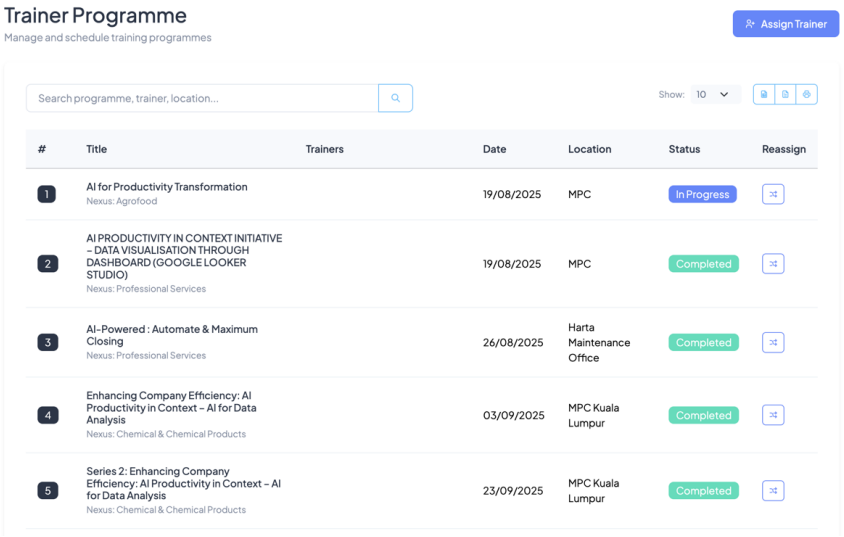

Fig.8 *Trainer Programme (Trainer name, date, location and status)*
Source: Author (2026)

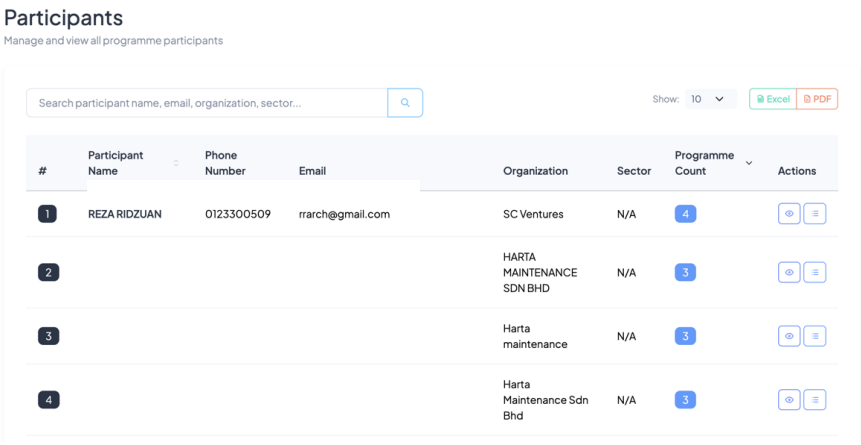

Fig.10 *Participants page*
Source: Author (2026)

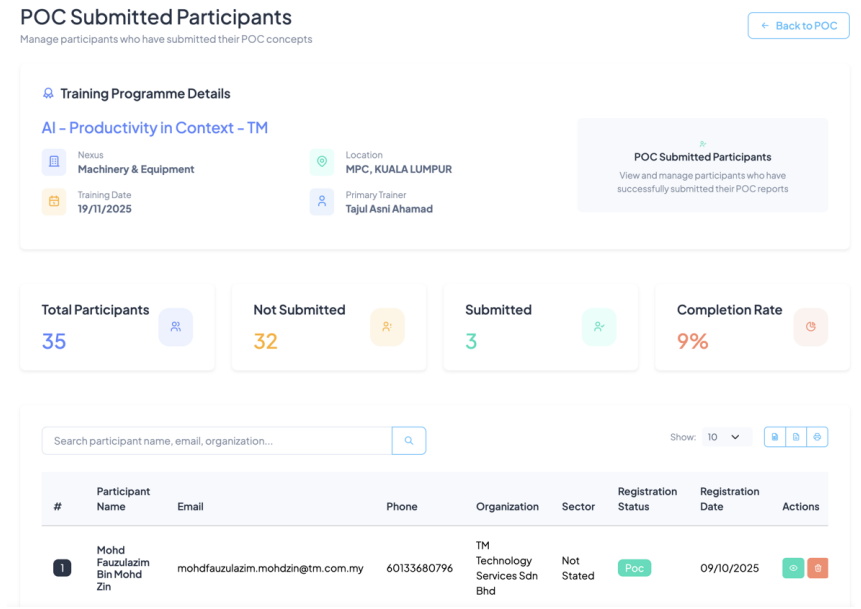

Fig.11 *Proof of Concept (POC) Management*
Source: Author (2026)

Two main performance dashboards were developed: the admin dashboard and the nexus dashboard (Fig. 12). The nexus dashboard includes scorecards displaying key indicators such as the number of involved and active nexus, the total number of participating companies in the productivity training, the total number of training participants and the total number of Proof of Concepts (POC) outputs generated.

In the Nexus dashboard, the monthly status of Nexus trainings is shown in a bar chart, while each Nexus performance is visualised with a doughnut chart. Recent training activities are displayed in a table, and the bottom section of the Nexus dashboard shows the Nexus training participants, the number of companies, and the total number of proof-of-concept projects. The dashboard has been designed to visualise information on training management operations activities across 4 MPC nexus, continuously within a one-year cycle, without requiring any updates. By selecting a desired month, the user can interact with the dashboard to view related information for that month. This dashboard provides the user with the information they need, especially when making decisions.

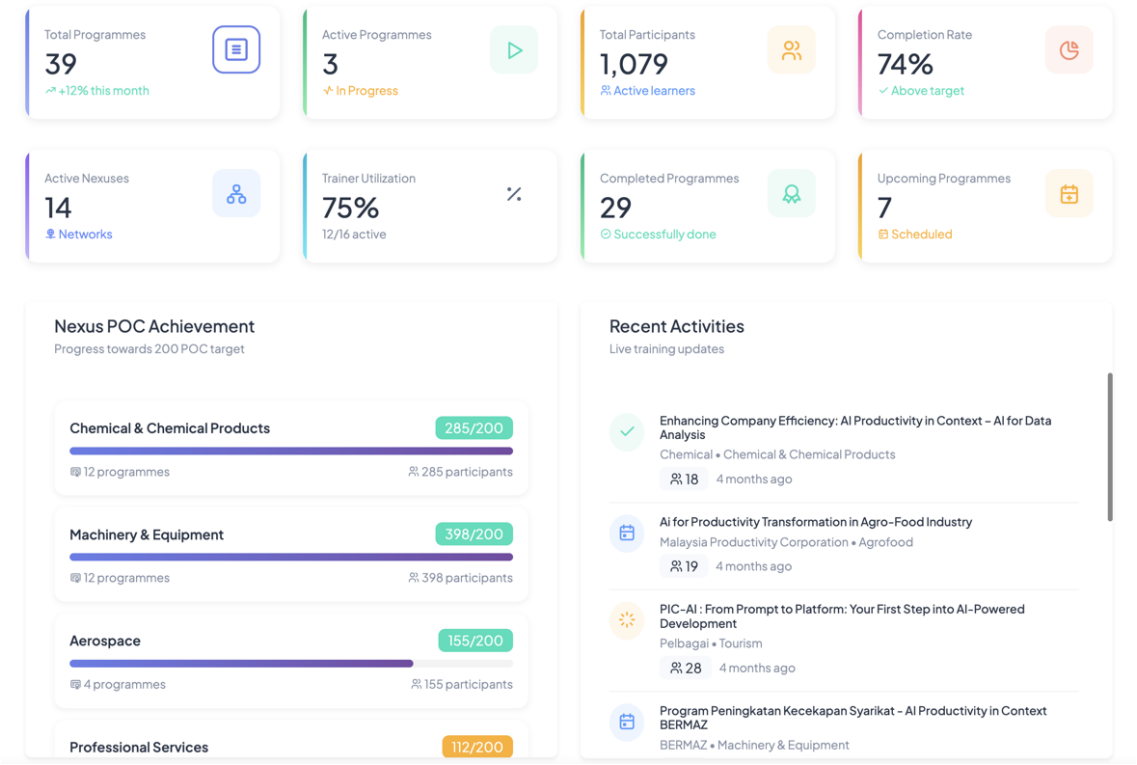

Fig.12 *Training Performance Status Dashboard*
Source: Author (2026)

4.3 Users' Feedback on The Dashboard

An online survey based on the System Usability Scale (SUS) was administered to assess the dashboard's usability and operational suitability. A total of 12 MPC personnel—representing management, training coordinators, and operational staff—completed the evaluation. Collected user feedback was evaluated on the effectiveness and suitability of the system for managing regular training operations within MPC. In total, twelve respondents from three functional groups — management, training coordinators, and operational participants — provided their feedback through the survey. The main objective of the survey was to understand users' perceptions of the system's functionality and its support for their daily training activities. The results indicated that 100% of respondents agreed that the system simplified the overall training management process, with 75% giving it a full rating of 5/5 for user-friendliness and automation. In comparison, the remaining 25% rated it 4/5. Regarding accessibility and communication, 83% of users reported that automated notifications and reminders helped them stay informed about training schedules and updates. Additionally, 92% agreed that the availability of detailed training information and faster reporting improved their overall experience. This survey concluded that implementing the system has significantly improved the efficiency, transparency, and professionalism of training operations within MPC, particularly through the integration of technology for pedagogical learning, which serves as a transformative enabler of engagement, employability, and ethical resilience in learning management (Abdillah, 2026). The technological infrastructure, pedagogical design, user experience design, feedback and learning analytics, and support systems are crucial to online learning and management technology (P J Thomas, Hieng et al., 2026).

5. CONCLUSION

A simple, easily customizable, informative, and interactive operational dashboard has been successfully developed using PHP Laravel. This outcome fulfils the aims of the study, which was to visualise training management processes and support informed decision-making. The dashboard was developed based on input from system users regarding daily training operation activities at MPC. The dashboard displays information that users can select to view, serving as a central reference point.

Previous manual recording has been eliminated and replaced with a cloud-based database. The operational information and real-time status provided through the dashboard help users obtain accurate, fast information for timely decision-making, thereby improving organisational performance. Beyond improving operational efficiency, the dashboard enhances transparency and learning accountability by making training progress and outcomes visible to stakeholders.

User feedback collected via the SUS instrument further validates the dashboard's practicality and usability, providing strong evidence that the system supports MPC's operational needs and will contribute to more efficient training governance in the future.

6. CO-AUTHOR CONTRIBUTION

The authors affirmed that there is no conflict of interest in this article. Mohd Syahmi Syahar carried out the fieldwork and prepared the literature review; Saliza Saari guided and prepared the overall conceptual framework; Kamaruzaman Jahidin, Afiq Durrani Azli, Falah Abu and Sharipah Ruzaina Syed Aris conducted the analysis and interpretation of the results; and Noor Azlina Mohd. Salleh overlooked the analysis and write-up of the whole article.

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