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Enhancing Mandatory Training Participation in Aviation Maintenance: A Digital and Collaborative Transformation at Company S

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Abstract

Mandatory training in the aviation Maintenance, Repair, and Overhaul (MRO) sector is essential for regulatory compliance, safety, and operational efficiency. However, Company S, a regional MRO leader under the Safran Group, faces challenges in training participation due to high overseas travel costs, limited local training infrastructure, and lack of digital learning solutions. This concept paper explores a digitally driven and collaborative intervention framework to address these barriers. The proposed model is underpinned by the Technology Acceptance Model (TAM), Self-Determination Theory (SDT) and Lewin's Change Management Model. Interventions include the implementation of online training, a Learning Management System (LMS), and strategic partnerships with local aviation training providers. Results from pilot interventions show a 30% increase in participation and a 90% reduction in travel-related costs. This study offers both theoretical contributions and practical recommendations for improving training accessibility and engagement in regulated industries like aviation.

Keywords: Aviation Training, Digital Learning, Learning Management System, TAM, SDT, Lewin's Change Model, MRO, Training Participation

Introduction

The aviation MRO industry is fundamental to ensuring the continued airworthiness, reliability, and safety of aircraft systems. As a highly regulated sector, aviation MRO organizations must comply with stringent international and national aviation safety standards, which mandate regular technical training and certification of personnel (Sun, Wandelt, & Zhang, 2021). Mandatory training programs not only support regulatory compliance but also foster operational excellence and continuous improvement in workforce competency.

Despite the critical importance of such training, many MRO organizations encounter challenges in ensuring employee participation. Traditional training models, often conducted in centralized overseas locations, impose significant logistical, financial, and operational

burdens. Particularly for facilities operating in geographically distant regions from their corporate training centres (Gauthama et al., 2024). The COVID-19 pandemic further exposed the limitations of in-person training models and accelerated the demand for digital transformation in aviation education and workforce development (Sun et al., 2021).

Company S, a strategic regional hub under the Company Group and the first Centre of Excellence for avionics in Asia-Pacific, exemplifies these challenges. The organization has historically relied on overseas training in France, resulting in high travel costs, extended lead times, and limited flexibility. These constraints have contributed to lower participation rates and disrupted learning continuity.

This concept paper addresses the need for a digital and collaborative training transformation at Company S by exploring scalable interventions that leverage online platforms, localized partnerships, and strategic change management. The case provides a valuable opportunity to study how emerging technologies and behavioural theories can enhance participation in regulated, skill-intensive industries.

Literature Review and Proposition Development

Challenges in Mandatory Training Participation in Aviation MRO

Mandatory training plays a vital role in maintaining the competency and regulatory compliance of employees in the aviation MRO industry. However, participation in such training is often hampered by logistical, financial, and motivational challenges. According to Sun, Wandelt and Zhang (2021), the aviation sector's reliance on centralized, face-to-face training delivery has resulted in disruptions during crises such as the COVID-19 pandemic. Travel restrictions and safety protocols exposed the vulnerabilities of traditional training models, prompting a global shift toward digital platforms.

Moreover, Gauthama, Tan, and Rajendran (2024) emphasize that cost-intensive overseas training, particularly in global hubs like France, imposes financial strain on regional subsidiaries and limits accessibility. In organizations like Company S, where technicians and engineers must undergo recurrent training, the lack of localized infrastructure contributes to lower participation rates, affecting overall compliance and operational efficiency.

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) proposed by Davis (1989) explains how users come to accept and use a technology. TAM suggests that two key beliefs which is perceived usefulness and perceived ease of use, to determine an individual's intention to adopt a new system. In the context of aviation MRO, where employees are traditionally trained in hands-on environments, adopting online learning platforms requires that users perceive the digital approach as effective and easy to navigate (Park, 2009). Studies have confirmed that if employees find the Learning Management System (LMS) to be both beneficial to their learning outcomes and user-friendly, their participation is more likely (Cheng, 2011). For employees in highly technical roles, such as aircraft technicians and engineers, the acceptance of Learning Management Systems (LMS) or virtual training modules hinges on whether the technology is seen as helpful in improving job performance and whether it is easy to operate without prior digital training (Davis, 1989; Venkatesh & Davis, 2000). Holden and Karsh (2010) emphasized that user-centered design and system

quality significantly affect perceived ease of use, especially in high-stakes industries like healthcare and aviation. Furthermore, Roca, Chiu, and Martínez (2006) found that not only do PU and PEOU predict intention to use e-learning platforms, but that system quality, content quality, and user self-efficacy also play crucial roles in shaping these beliefs.

Self-Determination Theory (SDT)

Self-Determination Theory (SDT) provides another useful lens to understand training engagement. Deci and Ryan (1985) posit that human motivation is driven by three basic psychological needs: autonomy, competence, and relatedness. In training contexts, employees are more motivated when they feel a sense of control over their learning (autonomy), which are capable of mastering new skills (competence), and feel supported in a collaborative environment (relatedness). Research by Gagné and Deci (2005) further supports that work environments that support these psychological needs tend to foster higher job performance, organizational commitment, and learning outcomes. LMS platforms that offer self-paced modules, progress tracking, and social interaction components can satisfy these needs, leading to higher intrinsic motivation and training participation (Ryan & Deci, 2000). Moreover, studies show that motivation grounded in SDT leads to better learning retention and satisfaction. Van den Broeck et al. (2010) found that employees who perceive their workplace as autonomy-supportive are more likely to show enthusiasm toward learning activities. Likewise, Niemiec and Ryan (2009) emphasized that autonomy-supportive environments in education lead to deeper learning and more sustained behavioural change where the outcomes that are highly relevant in aviation MRO, where safety-critical tasks require more than surface-level compliance.

Lewin's Change Management Model

Organizational transformation in training delivery also necessitates an effective change management strategy. Lewin's (1947) three-step model—unfreezing, changing, and refreezing which serves as a foundational framework for managing resistance to change. In the aviation context, where standard operating procedures are rigidly enforced, introducing new learning formats requires careful unfreezing of existing mindsets, active support during the transition phase, and reinforcement through policies and leadership engagement. Integrating this model allows for smoother adoption of LMS and digital tools across operational units. The unfreezing stage involves preparing the organization to accept that change is necessary. In aviation, where rigid standard operating procedures (SOPs) and legacy systems dominate, this step is crucial. Resistance often stems from comfort with existing practices or fear of technological complexity (Burnes, 2017). The changing phase represents the transition toward new behaviours, systems, and processes. In this stage, organizations implement LMS platforms, offer hands-on digital literacy training, and encourage collaborative learning to foster buy-in. Armenakis and Harris (2002) emphasized the importance of organizational support and training during this phase to reduce uncertainty and build trust in the new system. Finally, the refreezing phase ensures that the changes become embedded into organizational culture and practices. Without reinforcement, employees may revert to previous habits (Lewin, 1947). Refreezing requires integrating digital learning into standard training policies, performance metrics, and ongoing feedback loops. In summary, applying Lewin's model in the aviation MRO context facilitates smoother adoption of digital tools by addressing psychological resistance, fostering supportive structures during implementation, and institutionalizing new practices.

Proposition Development

Based on the review of literature and contextual understanding of Company S, the following propositions are developed to guide the intervention:

Proposition 1: The implementation of online training modules and a Learning Management System (LMS) will improve perceived ease of use and usefulness, thereby increasing participation in mandatory training (aligned with TAM).

Proposition 2: LMS features that support autonomy, competence, and relatedness will enhance intrinsic motivation, leading to sustained training engagement (aligned with SDT).

Proposition 3: A structured change management approach following Lewin's model will facilitate the successful transition from traditional to digital training formats, ensuring long-term adoption.

These propositions provide a theoretical foundation for the action research intervention and offer a framework for evaluating its outcomes.

Methodology

Sample and Data Collection

The study was conducted at Company S, an MRO facility in Singapore. The purposive sampling technique was employed to select participants who were directly involved in the mandatory training ecosystem, including:

- 1 training managers
- 4 technicians

A total of 5 participants were selected to provide both managerial and technical perspectives. The sample was appropriate for qualitative inquiry, where depth of insight is prioritized over breadth (Palinkas et al., 2015).

- Data collection occurred over two action research cycles, using:
- Semi-structured interviews (30–45 minutes)
- Training participation records before and after intervention
- LMS engagement logs and survey feedback post-implementation
- Training cost reports related to travel, accommodation, and lost productivity

All participants provided informed consent, and data confidentiality was maintained.

Measures

To ensure reliability and validity of outcomes, the study utilized the following measurement tools:

- Training Participation Rate (%): Calculated as the number of employees who completed mandatory training divided by those scheduled, before and after intervention.
- Cost Reduction (%): Based on travel and accommodation expenses saved through the introduction of online and local training alternatives.
- Perceived Usefulness and Ease of Use: Assessed using adapted items from Davis' (1989) TAM scale on a 5-point Likert scale.
- Intrinsic Motivation Indicators: Derived from SDT-based constructs, including autonomy ("I could choose my pace"), competence ("I understood the materials"), and relatedness ("I could interact with my peers").

- Employee Satisfaction and Feedback: Collected via post-training surveys hosted within the LMS and follow-up interviews.

Data Analysis

A mixed-method approach was used to analyse the collected data:

- Quantitative data (e.g., participation rates, cost savings) were analysed using simple descriptive statistics such as percentage change, mean scores, and pre-post comparisons.
- Qualitative data from interviews were analysed thematically using Braun and Clarke's (2006) six-step framework:

1. Familiarization
2. Coding
3. Theme identification
4. Theme review
5. Defining themes
6. Producing the report

Emerging themes included: *improved accessibility*, *digital hesitation*, *increased flexibility*, and *reduced operational disruption*.

Triangulation was applied across datasets (survey, interviews, records) to enhance trustworthiness and minimize bias.

Discussion

The findings strongly support the study's propositions. Following the intervention, training participation increased by 90%, and travel-related training costs dropped by 90%. These results confirm that digital transformation via LMS and online modules significantly enhances training accessibility and efficiency.

The effectiveness of this digital transition is explained by the Technology Acceptance Model (TAM), where the constructs of perceived usefulness and ease of use influence behavioural intention to use technology (Venkatesh & Bala, 2008). It was validated by high scores on perceived usefulness and ease of use. Technicians reported that the online modules allowed them to complete training with minimal disruption to their operational duties, affirming TAM's core construct relationships (Cheng, 2011).

From a motivational standpoint, the Self-Determination Theory (SDT) proved effective. The LMS empowered learners to set their own pace (autonomy), provided consistent feedback (competence), and fostered social interaction through online forums and chat tools (relatedness). These conditions supported internal motivation and sustained engagement (Ryan & Deci, 2000). According to Keller's (2010) ARCS Model of Motivational Design—which includes Attention, Relevance, Confidence, and Satisfaction—learners are more likely to engage in training when content is relevant, self-paced, and accompanied by performance feedback. The LMS used in this intervention incorporated these features and stimulated ongoing learning through gamified badges and interactive forums, which have been shown to improve learner satisfaction (Wang, Wang, & Shee, 2007).

Change management, based on Lewin's three-step model, also played a vital role. The "unfreezing" stage involved communicating the need for digital change, followed by LMS

piloting and training ("change"), and culminating in institutionalizing the system via SOPs and departmental KPIs ("refreezing"). This structured transition contributed to the success and sustainability of the new system. Building awareness of the need for change and providing digital skills training allowed employees to develop the necessary competencies and confidence to use the system effectively (Hiatt, 2006). This structured support helped to manage resistance, particularly among senior technicians who were initially hesitant to transition from traditional classroom training.

Overall, the intervention not only addressed the practical issue of low training participation but also demonstrated the theoretical integration of behavioural and change models in designing organizational learning systems. The sustainability of this change was reinforced through leadership alignment and integration into organizational performance systems. Managers were tasked with monitoring completion rates, and LMS participation became part of departmental KPIs. By linking training to performance and career advancement, the initiative encouraged long-term behavioural change and embedded learning within the organizational culture.

Recommendations and Research Limitations

Based on the findings of this study, several strategic recommendations are proposed to strengthen mandatory training participation through digital transformation. Company S should expand the use of the Learning Management System (LMS) across departments to ensure consistent access to training and centralized performance tracking. Long-term partnerships with local aviation institutions are encouraged to reduce dependency on overseas programs and to localize content delivery. Additionally, a blended learning model combining digital modules with on-site practical sessions can offer flexibility while maintaining hands-on skill development. It is also recommended that Company S utilize LMS analytics to monitor learner engagement and outcomes, enabling timely updates to training design. Promoting a culture of continuous learning through recognition, integration of training goals into performance appraisals, and leadership support will further reinforce employee motivation and long-term engagement.

Despite its practical contributions, the study has several limitations. It was conducted within a single facility in Singapore, which may restrict the generalizability of findings to other organizational or regional contexts. The short post-intervention period limits the ability to assess long-term effectiveness, and the relatively small sample size may not fully reflect diverse learner experiences. Furthermore, differences in digital literacy among employees were not examined, which could influence engagement with the LMS. The study also focused mainly on participation and cost reduction, without evaluating broader metrics such as training effectiveness, skill retention, or return on investment. Future research should explore these dimensions and consider comparative studies across different facilities or industries to validate and refine the intervention model.

Conclusion

This concept paper explored the barriers to mandatory training participation within the aviation MRO sector and proposed a digitally driven, collaborative intervention model implemented at Company S. Anchored in the Technology Acceptance Model (TAM), Self-Determination Theory (SDT) and Lewin's Change Management Model, the study provided

empirical evidence that online training modules, a Learning Management System (LMS), and strategic partnerships with local institutions can significantly enhance training participation, accessibility, and cost efficiency. The interventions not only resulted in a 30% increase in participation but also achieved a 90% reduction in travel-related costs, demonstrating the practical viability of digital transformation in regulated and skill-intensive industries.

Beyond its practical success, the study offers meaningful theoretical and contextual contributions. It extends the application of TAM and SDT by showing that employee attitudes toward digital learning platforms are influenced by both perceived ease of use and intrinsic motivational alignment which particularly autonomy, competence and relatedness. Furthermore, it also affirms the value of Lewin's structured change management process in reducing resistance and embedding new behaviours in safety-critical environments. Contextually, this research fills a significant gap in the aviation MRO literature by offering a replicable model that addresses regional training limitations through digital innovation and localized collaboration. As aviation MRO organizations continue to navigate evolving technological and workforce demands, adopting flexible, scalable and employee-centred learning systems will be essential. Future initiatives should build on this foundation by formalizing learning cultures, strengthening regional partnerships, and leveraging real-time data analytics to enable continuous improvement in workforce development and organizational performance.

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