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Transformational and Transactional Leadership in Technology Adoption: A Qualitative Study of the Economic Implications of AviMet Use in Tanzania's Aviation Meteorology Office

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Abstract

This study examined how transformational and transactional leadership styles influence the adoption and sustained use of AviMet technology in Tanzania's aviation meteorology operations. Guided by the Unified Theory of Acceptance and Use of Technology and the Full Range Leadership perspective, the study adopted a qualitative case study design involving thirteen leaders and key decision-makers from aviation meteorology offices at Arusha Airport, Moshi Airport and Kilimanjaro International Airport. Data were collected through open-ended questionnaires and follow-up semi-structured interviews, and analysed using reflexive thematic analysis supported by MAXQDA. The findings indicate that transformational leadership was perceived as more influential in promoting AviMet acceptance and sustained use through shared vision, visible role modelling, staff confidence, learning support, problem-solving and ownership of digital change. Transactional leadership also contributed to strengthening compliance, accountability, monitoring utilization of resources, corrective feedback and adherence to standard operating procedures. Leadership further shaped performance expectancy efficiency and productivity, effort expectancy, social influence and facilitating conditions. The study concludes that successful technology adoption in safety-sensitive aviation settings requires a balanced leadership approach in which transformational leadership builds commitment and confidence, while transactional leadership maintains consistency, control and procedural discipline.

Keywords: Transformational leadership; Transactional leadership; Technology adoption; AviMet; UTAUT; Aviation meteorology; Tanzania

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1.0 INTRODUCTION

The aviation industry is a core infrastructure for global and national connectivity. Globally, the sector supports the movement of approximately four billion passengers and 61 million tons of cargo annually, demonstrating its importance in linking people, markets and services across regions (Küfeoğlu, 2024). In Tanzania, air transport has continued to expand, with passenger traffic increasing from 6.037 million in March 2025 to approximately 6.181 million passengers in March 2026 (Uchukuzi, 2026). This growth reflects increasing aviation activity and strengthens the need for dependable digital aviation systems capable of supporting real-time decision-making in areas such as aviation meteorology, air traffic control and airport operations. This is particularly important because technology, alongside training and regulations, serves as one of the primary safety defenses in modern aviation operations (Bastola, 2020). Aviation meteorology is especially critical because weather information influences flight planning, take-off, landing, route decisions and overall operational safety (Kwasiborska et al., 2023).

Digital technologies have become central to aviation modernisation by supporting safer, faster and more coordinated operational decision making. Recent developments in aviation meteorological services show a clear movement from traditional observation practices towards integrated digital systems, advanced forecasting tools, artificial intelligence and data-driven service models (Song & Ye, 2025). In this context, AviMet has been introduced as a digital aviation weather management platform intended to improve weather observation, reporting, situational awareness and operational coordination(Polvinen et al., 2014).

However, the value of such technology depends not only on system installation, but also on user acceptance, confidence and sustained use (Bayaga & du Plessis, 2024). Technology adoption is therefore both a technical and organisational process. Although systems such as AviMet can improve efficiency, data accuracy and safety support, users may still experience uncertainty, perceived complexity, resistance or uneven readiness (Pazhanimala, 2024). Leadership becomes critical because leaders explain the purpose of technology, shape staff attitudes, create expectations, provide support and reinforce correct use. In high-reliability aviation settings, leadership must also balance motivation with compliance because system use must meet strict professional and regulatory standards (Nuur & Ariyanto, 2024).

The present study examined the influence of transformational and transactional leadership styles on AviMet adoption within Tanzania's Aviation Meteorology Office. Transformational leadership is associated with vision, inspiration, role modelling, intellectual stimulation and individualised support (Antonakis et al., 2003; Keskinen, 2024). Transactional leadership, in contrast, is associated with structured expectations, contingent recognition, monitoring, corrective feedback and accountability (Hossin et al., 2024; Hundie & Habtewold, 2024). Both styles may contribute to technology adoption, but their influence may differ depending on whether adoption requires commitment, compliance, learning or routine operational control.

Existing studies have linked leadership to technology adoption across education, manufacturing, mining, Small and medium-sized enterprises (SMEs) and aviation contexts (Afshari et al., 2008; Kangeri, 2021; Osman, 2025; Sujati et al., 2023). In the airline context, Osman (2025) examined transformational leadership and employee’s intention to accept artificial intelligence-enabled transformation in the Malaysian airline industry, showing that leadership can strengthen self-efficacy and acceptance of digital change. Similarly, Sewsankar and Loewenberger (2024) compared leadership styles at Malaysia Airlines and Southwest Airlines, highlighting the relevance of transformational leadership to organisational performance, employee engagement and adaptability in the airline industry (Sewsankar & Loewenberger, 2024). However, these airline studies focus mainly on airline operations, acceptance of artificial intelligence, organisational performance and employee engagement, rather than on aviation meteorological technology. They also provide limited evidence from sub-Saharan Africa and do not specifically examine how transformational and transactional leadership influence the acceptance and sustained use of specialised systems such as AviMet. Therefore, this study aims to provide context-specific evidence on how transformational and transactional leadership influence the acceptance and sustained use of AviMet within the Tanzanian Aviation Meteorology Office, using the Unified Theory of Acceptance and Use of Technology and the Full Range Leadership perspective.

The study was guided by the following research questions: (i) How do transformational leadership behaviours facilitate AviMet adoption? (ii) How do transactional leadership practices support compliance and sustained use? (iii) Which leadership style is perceived as more effective in sustaining AviMet use? (iv) How does leadership enhance technology acceptance constructs in AviMet adoption?

2.0 LITERATURE REVIEW AND THEORETICAL FOUNDATION

2.1 Transformational and Transactional Leadership in Technology Adoption

Technology adoption in organisations is not only a technical process, but also a behavioral and organisational change process. The successful introduction of digital systems depends on how users understand the value of the technology, how confident they are in using it, how much support they receive and how strongly the organisation communicates the need for change (Sujati et al., 2023). In safety-sensitive and procedure-driven sectors such as aviation meteorology, technology adoption is more complex because new systems must improve efficiency and accuracy without weakening operational discipline, safety standards and regulatory compliance(Muecklich et al., 2023). Leadership, therefore, becomes an important organisational factor in explaining why employees accept, resist or consistently use new technologies.

Transformational leadership has received strong attention in the technology adoption literature because it supports change through vision, motivation, intellectual stimulation and individual support (Davis, 2023; Schepers et al., 2005). Transformational leaders encourage followers to understand the value of new practices, believe in a shared organisational direction and participate actively in improvement processes. In technology adoption, such leadership may reduce resistance by making technology appear meaningful, useful and connected to organisational progress (Zhang & Huang, 2024). Rather than presenting technology as a forced administrative requirement, transformational leaders help employees understand why the technology matters, how it improves work performance and how it supports the broader goals of the organisation.

The relevance of transformational leadership in technology adoption is further supported by Carreiro and Oliveira (2019), who examined the impact of transformational leadership on the diffusion of innovation in firms, using mobile cloud computing as the technology context. Their study is particularly useful because it does not treat transformational leadership as a general leadership concept only, but links specific leadership components to stages of technology diffusion, including intention to adopt, adoption and routinization (Carreiro & Oliveira, 2019). This is relevant to the present study because AviMet adoption also requires more than initial acceptance. It requires aviation meteorological personnel to integrate the system into routine work practices and continue using it consistently in operational decision-making.

The main components of transformational leadership are also relevant to AviMet technology adoption. Idealised influence enables leaders to act as role models by showing commitment to the responsible use of digital systems. Inspirational motivation helps leaders communicate a clear vision of how AviMet can improve meteorological service delivery, aviation safety and operational efficiency. Intellectual stimulation encourages staff to question outdated practices, solve technology-related problems and develop confidence in new ways of working. Individualised consideration allows leaders to recognise that employees may differ in their readiness, exposure, skills and confidence in using digital systems (van Dun & Kumar, 2023). Through these behaviours, transformational leadership may strengthen employees' perception that AviMet is useful, necessary and aligned with professional growth.

Empirical studies have also associated transformational leadership with ICT adoption, organisational innovation and employee readiness for technological change (Afshari et al., 2008; Keskinen, 2024). These studies suggest that transformational leadership can support technology acceptance by improving users motivation, confidence and openness to change. In aviation meteorology, this is particularly important because digital technology is not adopted in isolation from operational responsibilities. Meteorological personnel are required to produce timely, accurate and reliable information for aviation users. Therefore, leaders must promote innovation while preserving the professional discipline required in safety-related operations.

However, transformational leadership alone may not be sufficient in technology adoption, especially in highly regulated operational environments. While transformational leadership may build motivation, a shared vision, and ownership, it may not fully address the need for procedural consistency, monitoring, accountability, and compliance (Clarke, 2013; Sujati et al., 2023). This is where transactional leadership becomes relevant. Transactional leadership contributes to technology adoption through clear expectations, performance monitoring, corrective feedback, recognition and compliance with established procedures (Hossin et al., 2024). It is more concerned with ensuring that employees understand what is required, how performance will be assessed and what consequences follow from compliance or non-compliance.

The evidence on transactional leadership in technology acceptance is more mixed than that of transformational leadership. Schepers et al. (2005), for example, directly examined transformational and transactional leadership as antecedents of technology acceptance. Their study found stronger support for transformational leadership, while transactional leadership showed limited influence on perceived usefulness and perceived ease of use. This finding is important because it suggests that transactional leadership should not be presented as universally effective across all technology acceptance contexts (Schepers et al., 2005). However, the limited effect found in a general service context does not necessarily mean that transactional leadership is irrelevant in aviation meteorology. In more procedure-driven settings, technology use is often shaped by standards, monitoring, formal expectations and compliance requirements, which are central features of transactional leadership.

This interpretation is supported by more recent operational-industry evidence. Mokganya et al. (2024) examined leadership and technology adoption in the South African mining industry and proposed the Ambidextrous Leadership-Technology Adoption model. Their study argues that traditional technology adoption models such as TAM, DOI and UTAUT often focus heavily on individual-level factors while giving limited attention to the strategic and organisational role of leadership. The study further suggests that transformational leadership supports innovation and exploration, while transactional leadership supports efficient technology integration and operational control (Mokganya et al., 2024). Although mining and aviation meteorology are different sectors, both are operationally sensitive industries where technology adoption must be reliable, disciplined and aligned with safety and performance requirements.

Transactional leadership is therefore relevant to AviMet adoption because the system is not merely an optional digital tool. Its use is connected to the accuracy of aviation weather information, operational coordination, standard procedures and compliance expectations. Through contingent reward, leaders may reinforce proper and consistent use of the system. Through active monitoring, they can identify whether staff are using the system correctly and whether there are operational gaps requiring attention (Mokganya et al., 2024; Sujati et al., 2023). Through corrective feedback, leaders can address errors, misunderstandings or delays before they affect service quality. Through accountability and compliance, leaders can ensure that AviMet use becomes part of formal work routines rather than an informal or inconsistent practice.

Aviation-specific support for the relevance of transactional leadership can be drawn from Yılmaz (2023), who examined transactional leadership, employee voice and communication satisfaction in the aviation sector. Although the study was not directly about technology adoption, it is useful because it shows the importance of transactional leadership in aviation-related communication, feedback and supervisor-employee interaction. These elements are important in technology adoption because employees need clear instructions, feedback channels and communication with superiors when using new digital systems (YILMAZ, 2023). In aviation meteorology, effective feedback and communication are particularly important because errors or delays in technology use may affect the quality and timeliness of operational information.

Sujati et al. (2023) also provide useful industry evidence by showing that transactional leadership influenced acceptance of predictive maintenance technologies in a mining context, particularly through performance expectancy, effort expectancy and social influence. This supports the argument that transactional leadership may be more influential where technology use is linked to measurable performance, technical reliability and procedural control(Sujati et al., 2023). For AviMet, this is important because users may accept and use the system more consistently when leaders clarify expected performance standards, provide guidance and monitor proper use.

Taken together, the literature suggests that transformational and transactional leadership should not be treated as competing or mutually exclusive leadership styles in technology adoption. Transformational leadership appears more suitable for creating motivation, shared vision, readiness for change and positive attitudes towards technology. Transactional leadership appears more suitable for ensuring clarity, consistency, feedback, accountability and compliance during implementation. The need for such balance is consistent with studies on technology adoption in operationally sensitive sectors, where leaders must support exploration, learning and innovation while also ensuring stability, control and standardised implementation (Mokganya et al., 2024; van Dun & Kumar, 2023).

In this study, transformational and transactional leadership are therefore treated as complementary organisational influences on AviMet technology adoption. Transformational leadership is expected to shape users positive perceptions of AviMet by promoting vision, encouragement, learning and readiness for change. Transactional leadership is expected to support adoption by strengthening expectations, monitoring, corrective feedback and compliance with operational procedures. This balanced view is more realistic for aviation meteorology because successful technology adoption requires both user motivation and procedural discipline.

2.2 UTAUT and Technology Acceptance

The study uses the Unified Theory of Acceptance and Use of Technology as the main analytical lens for examining AviMet technology adoption. UTAUT explains technology acceptance and use through four main constructs: performance expectancy, effort expectancy, social influence and facilitating conditions (Tanantong & Wongras, 2024; Venkatesh et al., 2003). Performance expectancy refers to the belief that using a technology will improve job performance. Effort expectancy concerns the perceived ease of learning and using the technology. Social influence refers to the extent to which important people in the organisation encourage or expect the user to adopt the technology. Facilitating conditions refer to the availability of resources, infrastructure, training and technical support required for effective use.

UTAUT is appropriate for this study because AviMet adoption is influenced by both individual perceptions and organisational conditions. Aviation meteorological personnel may be more willing to use AviMet when they believe that it improves the accuracy, timeliness and reliability of their work. This reflects performance expectancy. They may also be more willing to use the system when it is easy to learn and operate, which reflects effort expectancy. In addition, their intention to use AviMet may be influenced by supervisors, trainers, colleagues and organisational expectations, which reflects social influence. Actual use may also depend on training, connectivity, equipment, technical assistance and clear procedures, which reflect facilitating conditions (Feng et al., 2025).

In aviation, technology adoption cannot be understood only as an individual decision. It is shaped by safety requirements, regulatory expectations, operational routines and the quality of organisational support (Mhangami et al., 2024; National Academies of Sciences & Medicine, 2024). Recent aviation-related technology studies have applied UTAUT to explain acceptance of digital systems in airport and aviation contexts, confirming the relevance of perceived usefulness, ease of use, social influence and support conditions (Truong et al., 2025). This supports the use of UTAUT in the present study because AviMet adoption also depends on how users perceive the value of the system, how easy it is to use and whether the working environment supports its use.

The leadership literature and UTAUT are connected in this study because leadership can shape the four UTAUT constructs. Transformational leadership may influence performance expectancy by helping staff understand how AviMet improves work performance and supports aviation safety. It may influence effort expectancy by encouraging learning, reducing fear of change and supporting users who may initially lack confidence. It may also influence social influence by creating a shared vision that makes technology adoption appear important and professionally expected (Perera, 2023).

Transactional leadership may also influence UTAUT constructs, but through a different mechanism. It may strengthen performance expectancy by linking system use to measurable work outputs and service standards. It may influence social influence by making technology use an organisational expectation rather than an individual preference. It may also support facilitating conditions by ensuring that users receive training, guidance, feedback and corrective support. In addition, transactional leadership may strengthen actual use by monitoring whether the system is used correctly and consistently in daily work processes (Lupiyoadi et al., 2025; Sujati et al., 2023).

Therefore, the conceptual position of this study is that leadership influences AviMet technology adoption indirectly through users' perceptions of usefulness, ease of use, social expectation and available support. Transformational leadership primarily contributes by fostering motivation, confidence, and readiness for change. Transactional leadership mainly contributes by reinforcing structure, feedback, compliance, and consistency. These UTAUT constructs then influence behavioural intention to use AviMet technology and actual use of the system as shown in Figure 01.

This integrated framework provides a more realistic basis for examining technology adoption in aviation meteorology. It recognises that AviMet use is not driven by leadership alone, nor by individual user perceptions alone. Rather, adoption emerges from the interaction between leadership behaviour, user perceptions, organisational support and operational requirements. By combining transformational leadership, transactional leadership and UTAUT, the study is better positioned to explain how leadership shapes the acceptance and use of AviMet technology in a safety-sensitive aviation meteorological environment.

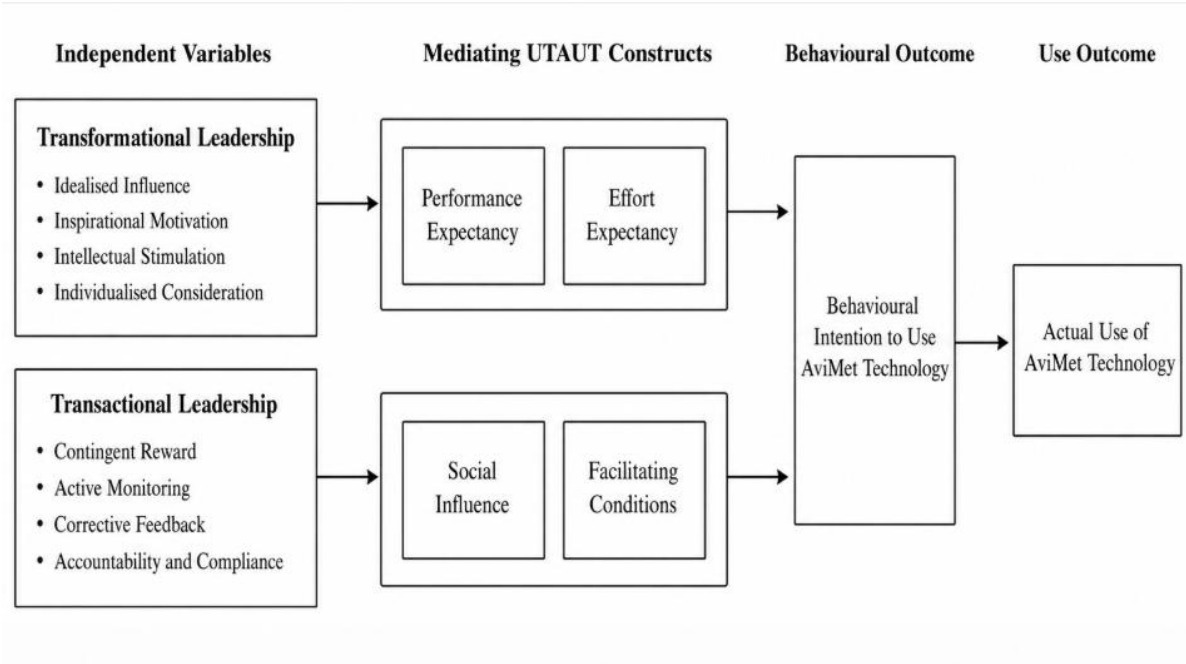

Figure 01: Conceptual Framework Linking Leadership Styles, UTAUT Constructs and AviMet Use
Source: Author's conceptualisation based on the Full Range Leadership perspective and UTAUT.

3.0 RESEARCH METHODOLOGY

The study adopted an interpretivist research philosophy because leadership and technology adoption were understood as social and organisational experiences shaped by meaning, perception and context (Tisdell et al., 2025). A qualitative case study design was used to examine leadership influence within a bounded operational setting, namely the Aviation Meteorology Office in Tanzania. The case was bounded by institution, geography and phenomenon: it focused on aviation meteorology offices at Arusha Airport, Moshi Airport and Kilimanjaro International Airport, and on leadership behaviour related to AviMet adoption and use.

The target population consisted of leaders and key decision-makers involved in the use, supervision or implementation of AviMet. Thirteen participants ultimately completed the study. These included station managers, aviation meteorology training officers, senior aviation meteorological forecasters, supervisors and senior engineers. Purposive sampling was used because the study required participants with direct experience in leadership, decision-making and technology-related operations. Convenience sampling was also applied within practical time and availability constraints.

Data were collected in two stages during the 2025 fieldwork period. First, open-ended questionnaires were distributed electronically to capture participants' leadership experiences and views on AviMet adoption. Second, follow-up semi-structured interviews were conducted with available participants to clarify responses and elicit deeper explanations. These interviews served as clarification sessions and were conducted either in person or electronically, depending on participant availability. The questionnaire drew on transformational and transactional leadership concepts associated with the Full Range Leadership perspective and on UTAUT constructs relevant to technology acceptance. Participant identities were protected using respondent codes from R01 to R13, as shown in Table 01.

Data were analysed through reflexive thematic analysis following Braun and Clarke's six-phase approach (Braun & Clarke, 2006; Byrne, 2022). MAXQDA was used as a data management tool to organise responses, support coding and group related codes. The software did not generate findings automatically; interpretation remained researcher-led. The analysis combined inductive coding from participant responses with deductive sensitivity to transformational leadership, transactional leadership and UTAUT constructs. First, the open-ended questionnaire responses and follow-up interview data were read repeatedly to gain familiarity with participants and accounts. Initial codes were then generated to capture ideas related to leadership behaviours, AviMet acceptance, confidence, training, system use, and operational support. MAXQDA was used as a data management tool to organise responses, support coding, retrieve coded segments, and group related codes into broader categories. The software did not generate findings automatically; interpretation remained researcher-led. The analysis combined inductive coding from participants' responses with deductive sensitivity to transformational leadership, transactional leadership, and UTAUT constructs. Themes were then reviewed, refined, and interpreted in relation to the study objective and research questions.

Table 01: Participant Profile and Interpreted Leadership Orientation

Resp.	**Gender**	**Years**	**Role/Position**	**Interpreted the leadership orientation and technology adoption link**
R01	Male	17	Station Manager	Transformational orientation motivates technology adoption through shared vision.
R02	Male	12	Aviation Meteorology Training Officer	Experiential and supportive orientation; promotes active system use through practical comparisons.
R03	Female	13	Senior Aviation Meteorological Forecaster	Transformational and collaborative orientation; links adoption to a shared future direction.
R04	Female	11	Supervisor at Meteorology	Supportive orientation: promotes consistent training and collaborative support.
R05	Male	22	Station Manager	Strategic orientation: frames technology as a tool for operational efficiency.
R06	Male	15	Supervisor at Weather Observation Station	Role-modelling orientation: uses personal experience to motivate technology use.
R07	Female	15	Senior Aviation Meteorological Forecaster	Innovation and compliance orientation encourage new practices within regulatory limits.
R08	Male	15	Senior Aviation Meteorological Forecaster	Procedural and innovation-oriented leadership promotes innovation alongside SOPs.
R09	Female	7	Aviation Meteorology Training Officer	Developmental and supportive orientation; stresses training according to individual needs.
R10	Female	8	Senior Engineer	Practical support orientation; links system integration with on-the-job assistance.
R11	Male	15	Station Manager	Visible role-modelling orientation; encourages adoption by personally using technology.
R12	Male	20	Supervisor at Meteorological Engineering	Transactional and compliance orientation; stresses structured training and regulatory compliance.
R13	Male	21	Senior Engineer	Procedural orientation promotes consistency in technology adoption.

Source: Field data and coded respondent profile.

4.0 RESULTS

The findings were organised around four themes aligned with the study objectives and research questions: Theme I: Transformational leadership as a driver of technology adoption, Theme II: Transactional leadership elements in practice, Theme III: Leadership style effectiveness in sustaining technology use and Theme IV:

Enhancement of technology acceptance constructs through leadership. Direct quotations are presented with respondent codes and data source labels in order to show their origin while protecting participant identity.

4.1 Transformational Leadership as a Driver of AviMet Adoption

The findings suggest that transformational leadership played a visible role in supporting the adoption and sustained use of AviMet. Participants associated transformational leadership with role modelling, future-oriented communication, guided problem-solving, and individualised support. In this respect, transformational leadership did not operate as a general leadership style only; it shaped how staff interpreted the purpose, usefulness, and practical value of AviMet in daily aviation meteorology work, as shown in Table 02.

A key finding was that visible role modelling by leaders helped normalise the use of AviMet. Participants explained that when leaders personally used the system, demonstrated correct procedures, and remained updated on its functions, staff were more likely to view AviMet as a credible and necessary work tool. This helped reduce the perception that the system was merely an imposed technical requirement. Instead, AviMet was increasingly understood as part of aviation modernisation and service improvement. One participant (R11) stated that, *"I show commitment by using AviMet in daily tasks, staying updated on new features and demonstrating proper usage to my team"*. This suggests that idealised influence supported technology acceptance by making leaders' own behaviour consistent with the change they expected from staff.

Transformational leadership also appeared to strengthen performance expectancy. Participants linked AviMet to improved meteorological service delivery, better access to weather information, enhanced coordination, and more reliable operational decision-making. Leaders who communicated the strategic value of AviMet helped staff understand why the system mattered for aviation meteorology and safety-sensitive operations. This was reflected in the statement by R03, *"AviMet positions us toward a modern aviation future"*. The quotation shows that some staff did not interpret AviMet simply as a new digital platform, but as part of a wider transition towards modern aviation service delivery.

In addition, transformational leadership supported effort expectancy by reducing fear and uncertainty around system use. Participants indicated that staff were more willing to accept AviMet when leaders provided practical demonstrations, mentoring, and training support that responded to different levels of user confidence. This individualised support was important because not all users had the same level of exposure, digital skill, or readiness to use the system. By providing guidance and encouragement, leaders helped staff see AviMet as manageable rather than difficult or intimidating. As explained by R05, *"Our commitment to ICAO Annex 3 is not just about meeting training standards for new systems like AviMet, it is about truly knowing each member of our team. I will personally support your unique professional growth through facilitation of tailored training, mentoring and development opportunities so that every observer, forecaster and technician is fully competent and confident"*.

The findings further suggest that transformational leadership influenced social influence within the workplace. When leaders consistently communicated the importance of AviMet and encouraged staff to use it as part of routine meteorological work, technology adoption became a shared professional expectation rather than an individual choice. This helped create a collective understanding that the system was relevant to operational improvement, aviation safety, and the future direction of aviation meteorological services. As stated by R06, "*In the past, we struggled with slow reporting and delayed updates. Today, by consistently communicating the value of AviMet and making its use a shared professional expectation, our team has embraced it more fully. This collective adoption has improved reporting speed and enabled timely meteorological updates, thereby enhancing aviation safety and supporting our obligations under ICAO Annex 3"* (R06 follow-up interview).

Table 02: Transformational Leadership Codes

Sub-theme	Codes identified	Main respondent origin	Interpretation
Idealised influence through role modelling	Consistent personal use of AviMet; demonstration of correct procedures; leading by example	R01, R06 and R11	Leaders built confidence by personally using AviMet and demonstrating commitment to correct system use.
Inspirational motivation with future-oriented messaging	Positioning AviMet as part of a modern aviation future, aligning team efforts with technological modernisation	R01 and R06	Leaders framed AviMet as part of aviation progress, professional identity, safety and operational efficiency.
Intellectual stimulation through controlled problem-solving	Balancing SOP compliance with creative input, workflow improvement suggestions and efficiency-driven problem-solving	R07 and R08	Leaders encouraged innovation within aviation safety boundaries by allowing staff to suggest improvements without compromising SOPs.
Individualised consideration through practical support	Tailored training interventions; skill-gap identification; mentoring; use of visual aids and practical guidance	R05, R04 and R10	Leaders reduced resistance by supporting staff according to specific skill needs and system-use challenges.

Source: Field data, open-ended questionnaires, follow-up interviews and MAXQDA-supported coding

4.2 Transactional Leadership and Compliance in Technology Use

Transactional leadership also emerged in the findings, though primarily as a supporting mechanism for compliance, accountability, and operational control rather than as the primary driver of AviMet acceptance. The findings show that transactional leadership was reflected through four main practices: contingent reward through recognition, active management-by-exception in performance monitoring, compliance enforcement, and structured supervision, as shown in Table 03. Participants described public verbal recognition, formal appreciation in performance reports, routine observation, review of system logs, corrective feedback, insistence on Standard Operating Procedures and follow-up on non-compliance as important leadership practices for maintaining correct AviMet use.

Recognition emerged as one of the main transactional practices. Leaders used briefing sessions and performance summaries to acknowledge staff who used AviMet accurately. For example, R01 explained that "*accurate work was publicly recognised during briefings and also noted in monthly performance summaries*". This suggests that recognition was used not only to reward individual performance but also to communicate to other staff the expected standard of AviMet use.

Active monitoring and corrective feedback were also strongly reflected in the findings. Participants reported that leaders reviewed daily logs, checked historical data, observed staff performance and intervened early where errors or unusual issues were identified. R02 stated that monitoring was done through daily logs and historical data checks, with errors addressed immediately. Similarly, R12 emphasised that "*unusual issues had to be handled before escalation because aviation does not tolerate errors*". These responses show that transactional leadership helped to maintain accuracy, discipline and operational reliability in a safety-sensitive aviation meteorology environment.

The findings, therefore, suggest that transactional leadership contributed to AviMet adoption by strengthening procedural compliance and reducing ambiguity around expected system use. It helped ensure that staff followed approved procedures, maintained reporting discipline, responded to errors promptly and remained accountable for correct system operation. In terms of technology acceptance, transactional leadership was especially linked to social influence and facilitating conditions because it made AviMet use part of formal professional expectations and created structured support through supervision, rules, monitoring and corrective action.

However, the findings also show that transactional leadership was less influential than transformational leadership in building deeper ownership, confidence and long-term acceptance of AviMet. While transactional practices supported compliance, consistency and correct use, they did not appear to be the main source of motivation or intrinsic commitment. Its strongest contribution was therefore in maintaining operational discipline and standardised use, while transformational leadership remained more influential in promoting acceptance, confidence and sustained engagement with the system.

Table 3: Transactional Leadership Codes

Sub-theme	Codes identified	Main respondent origin	Interpretation
Contingent reward through recognition	Public verbal recognition; formal written recognition; appreciation during briefings and performance reports	R01, R11 and R12	Proper AviMet use was reinforced through visible recognition and positive feedback.
Active management-by-exception in performance monitoring	Integrated staff observation; performance dialogue; early intervention on unusual issues	R02 and R12	Leaders used monitoring and prompt correction to maintain accuracy and prevent operational errors.
Compliance enforcement	SOP adherence, reporting requirements, and accountability for correct system use	R07, R08 and R12	Transactional practices supported consistency, discipline and standardised use in a regulated aviation setting.
Structured supervision	Routine checks; clear expectations; escalation of unresolved issues; follow-up on non-compliance	R10, R12 and R13	Supervision reduced ambiguity and strengthened operational control in AviMet use.

Source: Field data, open-ended questionnaires, follow-up interviews and MAXQDA-supported coding.

4.3 Leadership Effectiveness in Sustaining Technology Use

The comparison between leadership styles showed that transformational leadership was perceived as more influential for acceptance and continued engagement, while transactional leadership was useful for consistency and procedural discipline. The findings do not suggest that one style should completely replace the other. Instead, technology adoption in aviation meteorology appears to require a complementary leadership approach in which motivation and control operate together, as shown in Table 04 and figure 02 below. This interpretation was supported by a participant who explained that staff should be encouraged to suggest improvements while maintaining compliance with SOPs (R08, follow-up interview).

Table 4: Leadership Style Effectiveness in Sustaining AviMet Use

Leadership style	Main contribution to technology use	Effect on sustained AviMet use
Transformational leadership	Builds shared vision, commitment, confidence, learning, trust and ownership.	More effective for long-term acceptance, user confidence and willingness to continue using AviMet.
Transactional leadership	Provides rules, monitoring, recognition, correction and accountability.	Useful for compliance, consistency, accuracy and correct system use.
Combined leadership approach	Integrates motivation with procedural control.	Most suitable for aviation meteorology because AviMet adoption requires both acceptance and discipline.
User involvement and empowerment	Encourages early-stage involvement, participation and ownership.	Reduces resistance and strengthens acceptance when users feel included in the adoption process.

Source: Field data and thematic analysis of coded respondent responses.

4.4 Leadership Influence on UTAUT Constructs

Leadership was found to shape all four UTAUT constructs. Performance expectancy was strengthened when leaders showed how AviMet improves reporting consistency, speed, accuracy and operational safety. Effort expectancy was improved through practical training, demonstrations and simplified guidance. Social influence was reinforced when leaders and peers treated AviMet use as a professional expectation. Facilitating conditions were strengthened through training, system access, technical support, SOP guidance and follow-up mechanisms as shown in Table 05 below.

Table 05: Enhancement of Technology Acceptance Constructs Through Leadership

Technology acceptance construct/outcome	Leadership influence identified	Practical implication for AviMet adoption
Performance expectancy	Leaders communicated how AviMet improves reporting consistency, speed, data accuracy operational safety efficiency and productivity.	Staff were more likely to value the system when its practical work benefits were clearly demonstrated.
Effort expectancy	Leaders provided training, refresher learning, demonstrations, guidance and problem-solving support for efficiency utilization of resources.	Perceived difficulty was reduced when users received practical learning support.
Social influence	Leaders reinforced formal expectations, peer acceptance and regulatory endorsement of AviMet use efficiency.	AviMet use became a recognised professional and organisational expectation.
Facilitating conditions	Leaders supported training availability, technical infrastructure, stable system access, SOP guidance and follow-up.	System use became easier where resources, procedures and technical support were available.
Behavioural intention and actual use	Leadership support, monitoring and routine procedures helped translate positive perceptions into daily system use.	Sustained use depended on whether AviMet became part of normal work practice.

Source: Field data interpreted through UTAUT constructs and thematic coding.

4.5 Illustrative Qualitative Evidence

Selected participant statements demonstrate how leadership behaviours were connected to technology acceptance, learning support, controlled innovation and compliance. The quotations in Table 06 below are presented using respondent codes and data source labels to show their origin while maintaining confidentiality.

Table 6: Selected Illustrative Evidence from Participant Responses

Analytical focus	Illustrative statement	Origin/source	Interpretive meaning
Transformational role modelling	“I show commitment by using AviMet in daily tasks, staying updated on new features and demonstrating proper usage to my team.”	R11, follow-up interview	Visible leader participation legitimised the system and encouraged staff confidence.
Future-oriented motivation	“AviMet positions us toward a modern aviation future.”	R03, open-ended questionnaire	Leaders connected technology use with progress and professional identity.
Controlled innovation	“I encourage creativity by asking staff to suggest workflow improvements that maintain compliance with SOPs.”	R08, follow-up interview	Innovation was encouraged within safety and regulatory limits.
Training and support	“Training should be practical and continuous, especially for staff who need more confidence in using the system.”	R09, open-ended questionnaire	Support and learning were central to reducing resistance and effort concerns.
Compliance and monitoring	“Correct use of AviMet has to be monitored because aviation meteorology work requires accuracy and discipline.”	R12, follow-up interview	Transactional leadership helped maintain procedural control and operational discipline.

Source: Field data from open-ended questionnaires and follow-up interviews.

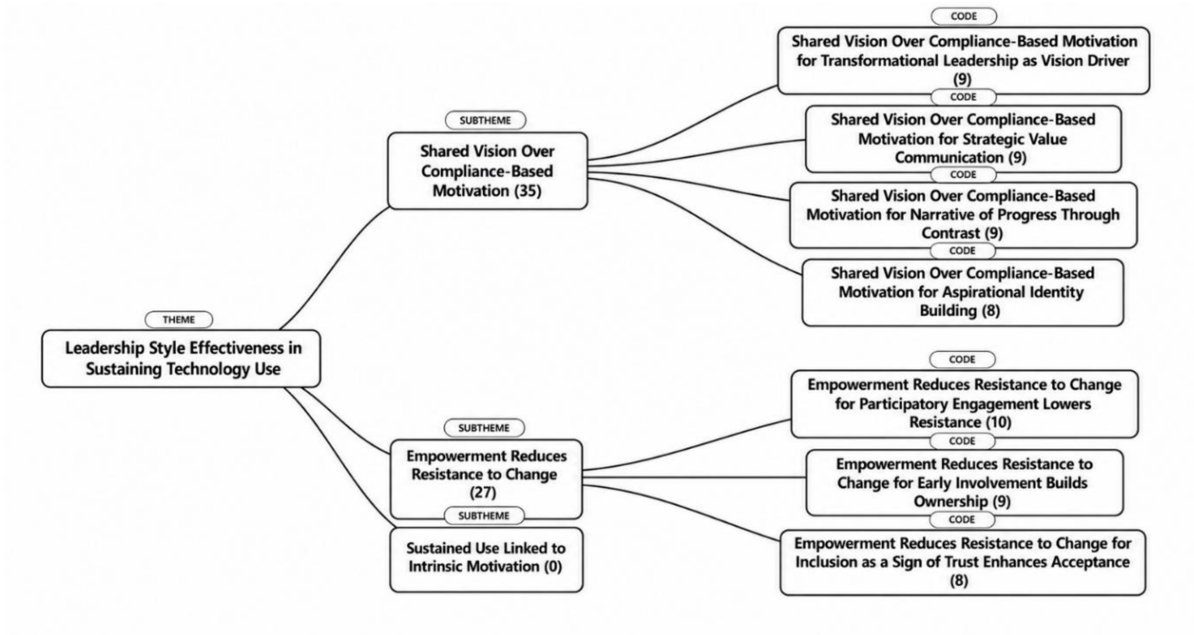

Figure 02: Visualisation of Leadership Effectiveness Themes
Source: Author's Thematic synthesis from the field data

5.0 DISCUSSION

The findings of this study support the view that technology adoption in aviation meteorology should not be understood as a purely technical process. Although AviMet is a digital aviation meteorology system, its effective use depends on how users understand its value, how confident they feel in using it, how strongly the institution expects its use, and whether adequate support conditions are available. Participants viewed AviMet adoption as an organisational change process requiring communication, trust, leadership support, monitoring, reinforcement and operational discipline. This interpretation is consistent with the Unified Theory of Acceptance and Use of Technology, which explains technology acceptance through performance expectancy, effort expectancy, social influence and facilitating conditions (Truong et al., 2025).

This finding holds significant relevance in the aviation industry, where technology is closely linked to safety, reliability and operational decision-making. Aviation meteorology is not a general administrative function; it supports weather observation, forecasting, reporting and the operational information used in flight planning, take-off, landing and aviation coordination. Kwasiborska et al. (2023) emphasise the importance of visibility and meteorological conditions in flight operations, showing that weather-related information remains central to safe aviation decision-making(Kwasiborska et al., 2023). Similarly, Muecklich et al. (2023) argue that aviation is a high-reliability sector in which safety and reliability depend on systems, people and organisational processes working together (Muecklich et al., 2023). Therefore, the adoption of AviMet must be interpreted not only as digital modernisation but also as part of the wider aviation safety and reliability system.

The observation that transformational leadership was perceived as more influential aligns with the nature of digital transformation in aviation. The adoption of AviMet necessitated users to understand the value of the system, trust the change process and build confidence in their ability to use digital tools. Leaders who communicated a shared vision, demonstrated personal commitment and supported staff learning helped users connect AviMet with modern aviation meteorology, improved reporting, operational safety and professional development. This supports Keskinen (2024), who found that transformational leadership in the aviation business context can promote innovation by creating a supportive environment where employees feel encouraged and motivated to participate in change (Keskinen, 2024). It also aligns with Osman (2025), whose study in the Malaysian airline industry showed that transformational leadership strengthened employees' self-efficacy and intention to accept artificial intelligence-enabled transformation. In the present study, similar leadership dynamics were observed, although the technology context was aviation meteorology rather than airline artificial intelligence (Osman, 2025).

The aviation-specific relevance of transformational leadership is also supported by studies that link leadership with employee engagement and adaptability in airline operations. Sewsankar and Loewenberger (2024), in their comparative study of leadership styles in the airline industry, highlight the importance of leadership in shaping organisational performance, employee engagement and adaptability (Sewsankar & Loewenberger, 2024). This is relevant to AviMet adoption because digital systems are sustained not only through installation, but through continuous user engagement and the willingness of staff to integrate the system into daily work. In this study, participants associated transformational leadership with role modelling, future-oriented communication, practical support and confidence-building. This suggests that transformational leadership helped make AviMet meaningful to users by linking it with aviation progress, service improvement and professional identity.

The findings also confirm that technology adoption in aviation requires more than motivation. While transformational leadership supported acceptance and confidence, transactional leadership remained important because aviation meteorology is a regulated and safety-critical environment. Technology use in this setting must be accurate, consistent and procedurally controlled. Transactional practices such as monitoring, recognition, corrective feedback, routine checks and enforcement of Standard Operating Procedures (SOP) helped maintain accountability and operational discipline. This partly aligns with Bastola (2020), who found that leadership style is closely related to aviation safety, with transformational leadership showing a stronger safety score than other leadership styles. It also corresponds with Nuur and Ariyanto (2024), who emphasise leadership effectiveness in the aviation industry, particularly where operational competence and structured work practices are required(Bastola, 2020; Nuur & Ariyanto, 2024). Although these studies did not specifically examine AviMet adoption, they support the broader argument that leadership behaviour is important in safety-sensitive aviation operations. The present study extends this evidence by showing that, in aviation meteorology, transactional leadership practices such as monitoring, corrective feedback, recognition and SOP enforcement help translate technology adoption into accurate, consistent and disciplined system use.

Further support for the significance of transactional leadership is found in Yılmaz (2023), who examined transactional leadership, employee voice and communication satisfaction in the aviation sector (YILMAZ, 2023). Although Yılmaz's study was not directly about technology adoption, it is relevant because it shows that transactional leadership can influence communication, feedback and supervisor-employee interaction in aviation settings. These elements are important for AviMet adoption because staff need clear expectations, correction of errors, feedback channels and procedural direction when using digital systems. In aviation meteorology, a delay, error or inconsistent use of the system may affect the quality and timeliness of operational information. Therefore, transactional leadership contributes by ensuring that AviMet is not used casually or inconsistently, but according to accepted operational standards.

Moreover, the findings are in line with Sujati et al. (2023), who found that transactional leadership influenced employees' acceptance of predictive maintenance technologies in an operational industry context. Their study is useful because it shows that transactional leadership may be relevant where technology use is linked to measurable performance, technical reliability and procedural control (Sujati et al., 2023). In this study, transactional leadership supported AviMet adoption by clarifying expected standards, monitoring system use, recognising correct performance and correcting errors. This indicates that in safety-sensitive settings, transactional leadership may not be the main source of deeper acceptance, but it remains necessary for maintaining consistency, accuracy and compliance.

The study also strengthens the application of UTAUT in aviation technology adoption by showing that leadership shaped all major acceptance constructs. Transformational leadership strengthened performance expectancy by helping users understand how AviMet improves reporting speed, data accuracy, coordination and operational reliability, while practical training, demonstrations and mentoring reduced effort-related concerns. Transactional leadership strengthened social influence and facilitated conditions by making AviMet use a professional expectation and by reinforcing access, SOP guidance, monitoring, feedback and follow-up mechanisms. This supports aviation-related technology acceptance studies such as Mhangami et al. (2024) and Truong et al. (2025), which show that aviation technology acceptance is influenced by perceived usefulness, ease of use, social expectations and support conditions. The findings therefore extend leadership and technology adoption literature by showing that transformational and transactional leadership operate as complementary forces in aviation meteorology: transformational leadership builds acceptance, confidence and ownership, while transactional leadership sustains accuracy, compliance and disciplined system use. This balanced interpretation is consistent with Mokganya et al. (2024), who argue that technology adoption in operationally sensitive sectors requires leadership that supports both innovation and operational control (Mokganya et al., 2024).

An additional finding was the limited explicit evidence of intrinsic motivation among users. Participants spoke more strongly about professional obligation, system usefulness, compliance, operational necessity and leadership support than about personal enjoyment in using AviMet. This suggests that technology acceptance in aviation meteorology may be driven more by professional responsibility, safety requirements and institutional expectations than by personal interest in the technology.

Overall, the study contributes to the understanding of aviation leadership and technology adoption in three significant ways. First, it provides evidence from a sub-Saharan African aviation meteorology context, where empirical studies remain limited. Second, it shows that leadership influences AviMet adoption through both UTAUT-related perceptions and operational control mechanisms. Third, it demonstrates that transformational and transactional leadership should not be treated as competing alternatives in safety-sensitive aviation technology adoption. Instead, they should be understood as complementary leadership approaches: transformational leadership builds acceptance, confidence and ownership, while transactional leadership sustains accuracy, compliance and disciplined use.

6.0 CONCLUSION

The study concludes that leadership is a decisive factor in the adoption and sustained use of AviMet within Tanzania's Aviation Meteorology Office. The findings suggest that transformational leadership was perceived as the more influential style because it built shared vision, staff confidence, learning support, role modelling, problem-solving and ownership of digital change. Transactional leadership remained important because it strengthened compliance, accountability, monitoring, corrective feedback and adherence to standard operating procedures.

The study further concludes that effective AviMet adoption requires a balanced leadership approach. Transformational leadership should take the lead in building acceptance and commitment, while transactional leadership should reinforce operational discipline and consistency. This balance is particularly important in aviation meteorology because digital systems must be accepted by users and also applied accurately within safety-sensitive operational standards.

7.0 RECOMMENDATIONS

First, aviation institutions should strengthen transformational leadership capacity among managers and supervisors involved in digital systems. This should be implemented through practical leadership programmes linked directly to technology adoption. The programmes should include training on vision communication, role modelling, coaching, staff motivation, change management and problem-solving. In practice, institutions should organise regular leadership workshops, on-the-job coaching, peer learning forums and refresher sessions for managers and supervisors.

Second, each aviation meteorology station should appoint or designate a digital leadership focal person responsible for supporting staff, collecting user feedback, reporting implementation challenges and coordinating follow-up actions. This would help ensure that technology-related leadership is not treated as a one-time activity but as part of normal operational management.

Third, transactional leadership mechanisms should be used carefully to maintain compliance without discouraging learning. Monitoring, corrective feedback and SOP enforcement should be combined with supportive coaching so that staff view supervision as part of safety improvement rather than punishment. Recognition of correct system use should also be formalised through briefings, written appreciation or performance review discussions.

Fourth, aviation institutions should strengthen facilitating conditions for AviMet use by ensuring stable system access, continuous technical support, refresher training, updated SOPs and practical demonstrations. These support mechanisms should be linked to the actual challenges users experience in daily operations.

8.0 LIMITATIONS AND AREAS FOR FURTHER RESEARCH

This study was constrained by its qualitative case study design and purposive sampling. The findings are therefore context-specific and should not be statistically generalised to all aviation organisations. Female participation was also limited, and some participants may have given cautious responses because of the operational sensitivity of aviation work. These limitations were mitigated through careful participant selection, confidentiality via respondent codes, follow-up interviews and systematic thematic analysis.

Future studies may extend this research by including a larger sample across more aviation units, applying mixed methods, and comparing leaders' perspectives with those of frontline users. Further research may also examine how leadership influences the actual behaviour of using a system over time, rather than relying only on reported perceptions and experiences.

9.0 PRACTICAL IMPLICATIONS

The practical implication of this study is that aviation technology implementation should be supported by deliberate leadership practice. Installing a digital system is not enough. Managers and supervisors must actively communicate their value, demonstrate its use, guide staff, respond to user challenges, monitor compliance and provide continuous learning support. For safety-sensitive aviation environments, digital transformation should therefore be treated as both a technical project and a leadership process.

10.0 DECLARATIONS

Ethical consideration: The study protected participants through confidentiality, voluntary participation and the use of respondent codes rather than personal names.

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