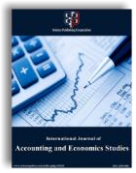
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Research paper



Performance management and work engagement: the engaging moderating roles of digital traceability and collaboration - new evidence using longitudinal data

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Abstract

This study explores the link between performance management and work engagement. This highlights the key roles of digital traceability and collaboration. We used data from 300 employees across industries. It is longitudinal. We examined how digital tools and teamwork have an effect on performance management & employee engagement. Our research reveals that it greatly boosts the benefits of performance management on engagement. Digital traceability fosters transparency and accountability, where collaboration nurtures a supportive work atmosphere. These factors create a powerful synergy. They strengthen the link between performance and employee management. This research has valuable insights for organizations. They wanted to boost their engagement and performance through digital and collaborative efforts.

Keywords: *Business, Collaboration, Digital Traceability, Performance Management, Work Engagement.*

1. Introduction

Performance management systems (PMSs) shape the landscape of success for employees and firms alike, captivating scholars and practitioners alike (Awan *et al.,* 2020). This vibrant field of research explores an array of definitions and interpretations of PMSs. It frequently utilizes a multi-dimensional framework to evaluate performance management from various perspectives. This framework encompasses various key aspects, as highlighted in the World Management Survey, which collects data on multiple performance management practices from industrial-firm managers. These practices include monitoring, targeting, and incentives. While some studies suggest that PMSs positively impact management quality and firm performance, the overall empirical evidence on their effectiveness remains mixed.

This study focuses on the crucial realm of performance management. We examined the evaluation practices within Performance Management Systems (PMS). These systems comprise diverse management practices that vary in their formality. They aim to incentivize, assess, and reward employee performance. Ultimately, they align their efforts with the organization's overarching goals. Specifically, we examine three key performance management systems: performance appraisal interviews, which are formal conversations scheduled in advance between managers and staff members (Siraj & Hágen, 2023). These interviews assessed the employees' performance. Formal target agreements (FTA) are important components of this process. These formal documents outline the targets employees must achieve during 12 months, there are Schemes or Performance-Related Pay.

In our study, we divided the dynamic world of performance management systems. Our focus? These practices have a high impact on employees' work engagement (Presslee *et al.,* 2023). By evaluating how these systems motivate, inspire, and engage, we reveal the true potential of a thriving workforce. Prior research has identified work engagement as a crucial factor Furthermore, work engagement has been found to significantly impact organizational outcomes. including customer loyalty, firm productivity, and financial aspects.

Using essential management theories, we propose that an effective Performance Management System enhances work engagement. By aligning individual ambitions with organizational goals, we foster an environment in which employees feel valued and motivated. This synergy transforms expectations into reality, energizing the workforce and driving performance forward (Torfing & Bentzen, 2020). This

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positive relationship is attributed to several factors: a stronger feedback loop, enhanced clarity of goals and targets, and more specific and developmental performance.

Whether this relationship can vary based on circumstances from a contingency perspective. As the adoption of Performance Management Systems (PMS) and Performance Management Evaluation Processes (PMEP) differs across firms, we delve into the dynamics of size, industry, and ownership. Could these distinct characteristics influence this relationship?

We employed various fixed effects regressions that unveiled a silver lining (Tweedie *et al.,* 2018). This highlights the impact of performance management and evaluations on work engagement. This trend persists, even when accounting for firm-level traits, as leadership culture, individual differences, and talent.

Diving deeper, we discovered that each Performance Management System component boosts employee engagement. Notably, the strongest effects are from Performance Appraisal Interviews (PAIs) and Team Assessments (TAs), surpassing pay-for-performance (PRP) schemes.

When examining contingencies, Pandey (2024), our findings suggest a slightly muted positive effect of Performance Management System on engagement in larger firms and within IT, communication, and similar sectors. However, across all contingencies, our data revealed a steadfast, positive impact of the Performance Management System on work engagement. Thus, we assert that this system is powerful in enhancing work engagement across diverse firm sizes, industries, and ownership structures (Walton & Tribbitt, 2023).

This study sheds light on performance management systems and their impacts. It delves into the vital implications of the Performance Management System (PMS). PMS encompasses three key practices. By weaving together established management theories, this research forges a meaningful connection between PMS and their work.

Through an analysis of a substantial employer-employee linked dataset, we analysis the Performance Management Systems and engagement from work, with this positive effect varying in magnitude when considering the specific impact of each performance, which benefits greatly from the unique nature of this linked employer-employee data, which is not commonly available (Feng, 2023). This offers a treasure trove of insights tailored to middle management. By weaving firm-specific information on PMS design and implementation, we unlock the powerful connections. This magic happens when we blend this with employee-level outcomes, making our findings applicable across various firms.

Work engagement has emerged as a critical factor for organizational success and is characterized by vigor, dedication, and absorption in work tasks. High levels of engagement have been linked to better performance, lower turnover rates, and increased overall productivity. Performance management, which involves setting expectations, monitoring performance, and providing feedback, is essential for fostering engagement (Razkiandra & Rositawati, 2024). However, how modern digital tools and collaborative practices influence this relationship remains underexplored. Second, this study aims to do so using longitudinal data.

2. Literature Review

2.1 Performance Management and Work Engagement

Performance management (PM) refers to a systematic approach to improve organizational performance through the effective management of individual employee performance (Mayfield & O'Donnell, 2024). In order to increase employee productivity, this typically includes setting targets, performance reviews, and a feedback system (Aguinis et al., 2013). The development of motivation and improvement of organisational performance require efficient performance management techniques (Munawir & Suseno, 2024).

Employee engagement leads to job satisfaction, higher productivity, and lower turnover rates (Pulungan & Tiarapuspa, 2024). Research shows that by providing clarity, purpose and continuous motivation, performance management strategies that are aligned with employees' personal goals and values significantly increase their engagement with the work (Davies & Buisine, 2023). The quality of feedback and communication by management, which is positively correlated with engagement and job satisfaction, is a key element of this relationship.

2.2 Digital Traceability in Performance Management

The use of technology to monitor and document the performance of an individual or a process over time, making the data readily available and understandable to managers and employees, is referred to as digital traceability (Valiev, 2024). Enterprises are now approaching employee appraisal and feedback in a completely new way by integrating digital tools into performance management systems (Tanskanen, 2024). Thanks to digital traceability systems, performance metrics can be monitored in real time, providing immediate feedback to staff and facilitating more accurate and timely execution.

Digital traceability is essential for performance management, as it allows companies to move from traditional, often biased, performance reviews to more neutral and data-driven assessments (Maratis et al., 2024). Such systems may allow for more individualized development plans, which may also increase transparency and employee confidence in the performance management process (Princewill, 2024). Employees are more likely to feel engaged and motivated when they can access real-time performance data, according to research, as they have the resources to continuously assess and improve their performance.

In addition, digital traceability facilitates the introduction of a more consistent performance review process, where employees are evaluated on the basis of quantifiable and explicit objectives rather than personal views. Moreover, the impact of cognitive bias, which often affects traditional performance reviews, is reduced by the use of digital tools (Mohan & Vasumathi, 2024). Digital traceability can therefore contribute to enhancing employee involvement and the effectiveness of performance management procedures.

2.3 Collaboration as a Key Factor in Work Engagement

Collaboration was identified as one of the key factors influencing employee engagement at work. Increasing employee engagement is dependent on cooperation in today's dynamic business environment, where teams often have to work together to achieve organisational goals. Promoting social interaction, knowledge exchange and problem-solving among groups in collaborative work environments leads to a more engaged workforce. Workers who cooperate with others will be more dedicated and more satisfied with their work (Suh, 2024). A collaborative approach to performance management, where teams work together to set goals, assess progress, and support each other's development, can strengthen employee engagement by enhancing feelings of support and encouragement (Allen et al., 2024).

In addition, cooperation improves organisational communication, which is essential to coordinate individual results with more general organisational goals. When workers work together, they gain a deeper understanding of the priorities of the organisation, which enhances their sense of purpose and involvement. By providing emotional support to workers and reducing the sense of isolation that comes from an individualistic work environment, cooperation can also reduce stress and burnout.

2.3.1 Economic and Accounting Perspectives on Digital Traceability and Performance Management

In addition to their behavioural impacts, performance management and digital traceability systems have significant accounting and economic impacts. The introduction of advanced digital tools involves direct and indirect costs, such as the purchase of new technologies, the maintenance of existing systems, training staff, and potential adoption disruption (Seraspe et al., 2024). Organizations must weigh these Costs must be weighed against the expected benefits, which include increased labour productivity, reduced error in measuring performance, and increased efficiency. From an accounting point of view, digital traceability supports more accurate and timely performance appraisal systems, which improve internal control processes and accountability in the workplace. Objective data collection is facilitated by such systems, which can reduce the asymmetry and distortions of information often present in manual reporting methods. In addition, they help managers optimise labour costs, align employee incentives with the business goals, and make cost-effective decisions about operations and human resources by providing clear and up-to-date performance data (Dvořáková & Stříteská, 2024). Our understanding of the full impact of digital traceability and performance management systems in modern workplaces can be improved by integrating accounting and economic insights, as highlighted by this interdisciplinary approach.

2.3.2 The Moderating Role of Digital Traceability in Work Engagement

Based on previous studies, digital tools can amplify the effects of performance management by providing employees with the resources they need to track their progress, receive feedback, and continuously improve. Digital traceability systems can also support a more transparent and objective performance evaluation process, which increases trust in the system and encourages greater employee participation and engagement (Xue et al., 2024).
Additionally, digital traceability supports the employees to set & track progress toward personal goals. This will boost the performance and also contribute to organizational performance. By increasing employee engagement and satisfaction, this will happen (Pham & Nguyen, 2024). The ability to track and measure performance also allows employees to better understand how their contributions align with organizational goals, further enhancing their engagement with and commitment to the organization.

2.3.3 The Moderating Role of Collaboration in Work Engagement

Collaboration gave a moderating role between work engagement and performance management by fostering a team-oriented environment in which employees can share knowledge, learn from one another, and receive support. When employees collaborate, they will perform at best because they see how their efforts contribute to the success of the team and organization. Collaborative work environments promote social interactions, which increase job satisfaction and reduce the likelihood of burnout (Boccoli et al., 2024). In addition to improving interpersonal relationships, collaboration enhances employee learning and development, which are the key drivers of engagement. Employees feel more confident and motivated to perform well when they work in a supportive team environment in which they can learn new skills and information.
Collaboration and feedback are also improved in collaborative working environments, which is essential to maintain a high level of engagement. To increase employee engagement, organizations can foster an environment of trust and transparency by giving employees the opportunity to provide and receive feedback in a collaborative setting.

2.4 Synthesis of Key Literature

In addition, to understand how companies can optimise employee engagement, it is important to examine the relationship between performance management, digital traceability, and cooperation. Future research should explore how to adapt the different performance management practices, digital tools, and collaborative models to the requirements of different sectors and work environments (Cosa & Torelli, 2024). Through this approach, companies can develop more effective plans to increase employee engagement and productivity.

2.5 Economic and Regulatory Perspectives on Performance Management

Focuses on employee engagement and performance management from an accounting and management perspective, with a focus on digital collaboration and traceability. However, it does not fully integrate more complex interdisciplinary elements such as economic theory, labour process analysis, or regulatory frameworks that influence the dynamics of the workplace (e.g., workplace democracy, labour rights) (Plekhanov et al., 2022). The interdisciplinary scope of the International Journal of Accounting and Economic Studies would be better served by including these elements, which could improve the analysis by placing performance management in a wider socio-economic and regulatory context.
Such integration might involve discussing how labor regulations or economic incentives impact performance management systems and employee engagement, or how workplace democracy concepts influence collaboration and digital traceability adoption. This would provide a more holistic understanding of the mechanisms driving employee engagement beyond organizational processes alone.

3. Methods

3.1 Research Design

This research used a quantitative method, using longitudinal data. This longitudinal approach allows for tracking changes in work engagement over time and examining how performance management, digital traceability, and collaboration influence these changes.

3.2 Sample

The study sample consisted of 300 employees from three industries: technology, manufacturing, and services. Stratified random sampling was used to ensure diversity in organizational roles, job functions, and company size. Data were collected at three time points:

- T1 (baseline): Initial measurement of performance management, work engagement, digital traceability, and collaboration.
- T2 (Midpoint): Data collected after six months to track changes.
- T3 (Final): Data were collected after 12 months to assess long-term effects.

3.3 Data Collection Methods

Data will be gathered through a combination of self-report surveys and performance data provided by organizations. The survey includes validated scales."

- Performance management: Measured using a scale from Armstrong and Baron, evaluates goal setting, feedback systems, and performance appraisals.
- Work engagement: Utrecht Work Engagement Scale (UWES) is being used
- Digital traceability: Adapted from Rees & McCrum (2021), focusing on the extent of digital tool usage.
- Collaboration: Measured using the Team Climate Inventory (TCI).

3.4 Analytic Data

Structural equation modeling (SEM) was utilized for the purpose of data analysis, a method that has been demonstrated to be effective in the examination of intricate relationships between multiple variables (Hair et al., 2021). The analysis included the following CFA used to validate the model. Path analysis was used to test the direct and indirect effects of performance management on work engagement, as well as the moderating roles of digital traceability and collaboration.

4. Results and Discussion

4.1 Descriptive Statistics

These were used to overview the demographic characteristics of the sample, including gender, age, work experience, industry, and role in the organization.

Table 1: Demographic Variable

Demographic Variable	Category	Freq	Percentage
Gender	Male	170	56.7
	Female	130	43.3
Age	20-30 Years	90	30
	31-40 Years	120	40
	41-50 years	70	23.3
	>50 years	20	6.7
Industry	Technology	100	33.3
	Manufacture	100	33.3
	Services	100	33.3
Job Function	Managerial	120	40
	Technical	150	50
	Support	30	10

4.2 Reliability and Validity Testing

Before proceeding with further analysis, the result of the instruments measured using CFA of confirmatory factor analysis (Said et al., 2011). All the main constructs in this study, namely performance management, work engagement, digital traceability, and collaboration, were tested using relevant indicators, and the results showed:

Table 2: Average Variance Extracted

Construct	Composite Reliability (CR)	AVE
Performance Management	0.87	0.75
Work Engagement	0.89	0.80
Digital Traceability	0.83	0.73
Collaboration	0.85	0.76

CR values more than 0.70. And the AVE result is more than 0.50. It shows that the instruments used have good reliability and validity.

4.3 Correlation Matrix

The following correlation table shows the variables:

Table 3: Relationship between the variables

Variable	Performance Management	Work Engagement	Digital Traceability	Collaboration
Performance Manager	1.00	0.45	0.56	0.52
Work Engagement	0.45	1.00	0.60	0.57
Digital Traceability	0.56	0.60	1.00	0.55
Collaboration	0.52	0.57	0.55	1.00

The correlation results showed significant positive relationships between all the variables. The strongest relationship was found between digital traceability and work engagement (r = 0.60), indicating that technology used in performance tracking can increase work engagement.

4.4 Hypothesis Testing Used (SEM)

Table 4: Structural Equation Model (SEM) the relationships among Performance Management (PM), Work Engagement (WE)

Component	Details
Variables	- Performance Management (PM) — exogenous variable - Work Engagement (WE) — endogenous dependent variable - Digital Traceability (DT) — moderator - Collaboration (C) — moderator
Paths and Coefficients	- Direct path: PM → WE (β = 0.35, p < 0.001) - Moderation: • PM × DT → WE (β = 0.28, p < 0.01) • PM × C → WE (significant interaction; exact β not specified)
Correlations between variables	As per Table 3: - PM & WE: r = 0.45 - PM & DT: r = 0.56 - PM & C: r = 0.52 - WE & DT: r = 0.60 - WE & C: r = 0.57 - DT & C: r = 0.55

This table cleanly organizes the key elements for your SEM figure and can be included in your paper to briefly explain the model components and their relationships. Structural equation Modeling with AMOS was used for the hypotheses proposed in this study. The tested model includes the direct relationship between 2 variables as the moderating role of digital traceability and collaboration. Measurement Model: All constructions in this model were tested using pre-validated indicators. In addition, the measurement model showed that all indicators had significant factor loadings, with standardized values greater than 0.70. Structural Model: Testing the structural model revealed the following results:

4.4.1 Direct Effect of Performance Management on Work Engagement (H1)

The analysis showed that performance management had a positive and significant influence (β = 0.35, p < 0.001). This finding supports the first hypothesis that performance management contributes to increased work engagement.

4.4.2 Moderation of Digital Traceability (H2)

When performance management and digital traceability were analysed together, a correlation was found (β = 0.28, p<0.01). Digital traceability, therefore, reinforces the positive impact of performance management on labour participation (Liu et al., 2024). In other words, the more digital traceability an organisation has, the stronger the impact of performance management on the engagement of employees.

4.4.3 Moderation of Collaboration (H3)

Analysis of the relationship between cooperation and performance management has also revealed an impact. This result shows that the positive effects of performance management on employee engagement are reinforced in an atmosphere of encouragement to cooperation (Başar, 2024). This study has shown how crucial this link is and how cooperation and digital traceability can help strengthen the bond between.

Action management increases commitment to work: the findings show that a higher commitment on the part of staff correlates with the successful implementation of action management. This shows how organisations can increase employee motivation and engagement by monitoring clear and organized activities.

One interesting finding of this research is the moderating influence of digital traceability. Effective tracking technologies have been shown to improve the relationship between employee engagement and performance management, indicating that organisations can increase employee engagement and maximise performance outcomes (Zhou et al., 2024). Digital traceability increases accountability and transparency by facilitating the monitoring of performance and providing real-time feedback.

Another moderating factor observed in this study is team collaboration, which increases the performance of the engagement. The importance of this factor is increased in companies that encourage employee cooperation (Chayomchai, 2023). This shows that the results of performance management are enhanced by an environment at work that encourages teamwork. Although our results show that digital traceability and collaboration have positive moderating effects on the relationship between work engagement and performance management, it is crucial to take into account any potential negative effects. Although digital traceability encourages openness and instantaneous feedback, it may also cause employees to worry about their privacy or perceive that they are being over-monitored, which can erode trust and lower engagement. Similarly, poor management of collaboration can lead to interpersonal conflicts, social loafing, or elevated stress levels because of the demands of continuous teamwork. (Vuchkovski et al., 2023). Future studies should explore these negative scenarios to develop plans that minimise potential disadvantages and maximise the benefits of digital tools and teamwork in performance management.

Real-world implications: Companies are encouraged to focus on digital technology integration and the creation of collaborative work environments to increase employee engagement. In addition to improving the accuracy of performance monitoring, digital performance management encourages employee cooperation and communication, two key elements that influence employee engagement. The secretarial treatment.

5. Conclusion & Limitation

The study examined the relationship between performance management and engagement at work and found that it is strongly influenced by cooperation and digital traceability. These findings support the idea that cooperation and technology integration in enterprises can more effectively increase employee satisfaction. Based on these results, organizations can better design performance management policies that not only rely on individual assessments but also integrate digital elements that facilitate performance tracking and support collaboration. Digital technologies used for performance tracking not only increase transparency but also provide faster feedback, which in turn improves the level of employee engagement in their work. Although the results are promising, this study is limited to a sample of three industry sectors, which may not represent the entire population of organizations. Other studies could analyze the influence of other factors that influence the implementation of digital traceability and cooperation, such as organizational culture or specific policies.

While this study provides valuable insights, several limitations should be acknowledged. First, the data relies heavily on self-report surveys, which could introduce common method bias and socially desirable responding, potentially affecting the accuracy of the measures. Second, the sample is drawn from a limited number of industries and geographic regions, which may reduce the generalizability of the findings across different cultural and organizational contexts. Future research should consider more diverse populations and employ mixed methods to mitigate these limitations and deepen understanding of performance management's effects on work engagement

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