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Employee engagement in the digital era: The role of job demands, digital HR tools, and intrinsic motivation

Abstract

This study examines how Job Demands and Digital HR Tools influence Employee Engagement, with Intrinsic Motivation serving as a mediating variable, in the context of workplace digitalization at PT Semen Indonesia (Persero) Tbk Tuban Plant. Drawing on Job Demands–Resources (JD–R) Theory and Self-Determination Theory (SDT), this research applies a quantitative causal design. Data were collected through an online questionnaire from 135 employees working in technology-based units and analyzed using Structural Equation Modeling–Partial Least Squares (SEM-PLS). The findings indicate that Job Demands have a positive and significant direct effect on Employee Engagement, suggesting that well-managed and meaningful demands can function as motivational challenges. In contrast, Digital HR Tools do not directly affect Employee Engagement. However, both Job Demands and Digital HR Tools significantly enhance Intrinsic Motivation, which in turn positively influences Employee Engagement. Mediation analysis shows that Intrinsic Motivation mediates the relationship between Job Demands and Employee Engagement but does not mediate the relationship between Digital HR Tools and Employee Engagement. Overall, the study highlights the importance of intrinsic motivation in translating digital work environments into sustained employee engagement and offers practical guidance for technology-based human resource strategies.

Keywords: Employee engagement, intrinsic motivation, HR digital tools, job demand, manufacture

Abstrak

Penelitian ini bertujuan untuk menganalisis pengaruh Job Demands dan Digital HR Tools terhadap Employee Engagement dengan Motivasi Intrinsik sebagai variabel mediasi dalam konteks digitalisasi tempat kerja di PT Semen Indonesia (Persero) Tbk Pabrik Tuban. Berlandaskan pada Job Demands–Resources (JD–R) Theory dan Self-Determination Theory (SDT), penelitian ini menggunakan pendekatan kuantitatif dengan desain kausal. Data dikumpulkan melalui kuesioner daring dari 135 karyawan yang bekerja pada unit berbasis teknologi dan dianalisis menggunakan Structural Equation Modeling–Partial Least Squares (SEM-PLS). Hasil penelitian menunjukkan bahwa Job Demands berpengaruh positif dan signifikan terhadap Employee Engagement, yang mengindikasikan bahwa tuntutan kerja yang terkelola dengan baik dan bermakna dapat berfungsi sebagai tantangan yang memotivasi. Sebaliknya, Digital HR Tools tidak berpengaruh langsung terhadap Employee Engagement. Namun, baik Job Demands maupun Digital HR Tools berpengaruh positif dan signifikan terhadap Motivasi Intrinsik, yang selanjutnya meningkatkan Employee Engagement. Analisis mediasi menunjukkan bahwa Motivasi Intrinsik memediasi hubungan antara job demands dan employee engagement, tetapi tidak memediasi hubungan antara Digital HR Tools dan Employee Engagement. Secara keseluruhan, penelitian ini menegaskan pentingnya motivasi intrinsik dalam menerjemahkan lingkungan kerja digital menjadi keterikatan karyawan yang berkelanjutan serta memberikan implikasi praktis bagi strategi manajemen sumber daya manusia berbasis teknologi.

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Kata Kunci: Employee engagement, intrinsic motivation, HR digital tools, job demand, manufacture

1. Introduction

Digital transformation has become a defining feature of contemporary organizations, reshaping work systems, employee roles, and performance management practices across industries. The acceleration of automation, data analytics, artificial intelligence, and integrated enterprise systems—particularly following the COVID-19 pandemic—has intensified digital adoption in both service and manufacturing sectors (Verhoef et al., 2021; Vial, 2019). In manufacturing environments, digitalization shifts work from manual execution toward system monitoring, predictive analysis, and technology-mediated coordination, thereby increasing cognitive complexity and continuous learning demands. In Indonesia, the expansion of Industry 4.0 initiatives has further reinforced data-driven and automated processes in industrial operations. This transformation is evident in the cement industry, including PT Semen Indonesia (Persero) Tbk Tuban Plant, where digital control systems, predictive maintenance platforms, laboratory automation, and enterprise resource planning systems are embedded across operational and administrative functions. While such integration enhances productivity and decision accuracy, it simultaneously elevates job demands and intensifies employee adaptation pressures.

Within the Job Demands–Resources (JD–R) framework, job demands may function either as challenging stressors that stimulate engagement or as hindrance stressors that undermine well-being, depending on available resources and individual appraisal (Bakker & Demerouti, 2017; Lesener et al., 2024). In digitally intensive settings, HR Digital Tools—such as performance dashboards, digital collaboration platforms, and e-learning systems—are often conceptualized as job resources that facilitate efficiency and development. However, emerging evidence suggests that constant connectivity, algorithmic monitoring, and rapid information processing may also increase perceived workload and psychological strain (Bondarouk & Brewster, 2016; Molino et al., 2020). Despite this duality, limited research positions HR Digital Tools as mechanisms that simultaneously generate resources and demands, particularly in heavy manufacturing contexts.

Furthermore, Self-Determination Theory (SDT) emphasizes intrinsic motivation as a central psychological driver that transforms demanding work conditions into meaningful engagement (Ryan & Deci, 2020). Yet empirical studies rarely examine its mediating role in linking digital job demands and HR technologies to employee engagement within industrial digitalization environments. Addressing this gap, the present study integrates JD–R theory, SDT, and a dynamic capability perspective to explain how digital work conditions are translated into engagement outcomes. Specifically, this research investigates the influence of Job Demands and HR Digital Tools on Employee Engagement, with Intrinsic Motivation as a mediating variable at PT Semen Indonesia (Persero) Tbk Tuban Plant. The study contributes by positioning HR Digital Tools as both resources and demand-inducing factors, demonstrating intrinsic motivation as a psychological transformation mechanism, and providing empirical evidence from a digitally intensive heavy manufacturing context that remains underrepresented in digital workplace literature.

2. Literature review

2.1 Job demands

Job demands refer to physical, psychological, social, or organizational aspects of work that require sustained effort and are associated with certain physiological or psychological costs. Within the Job Demands–Resources (JD-R) framework, job demands encompass workload, emotional labor, time pressure, role ambiguity, task complexity, and unfavorable work environments. Although job demands are often associated with strain and burnout, contemporary JD-R literature emphasizes their dual nature. Job demands can function as challenge demands that stimulate learning, mastery, and engagement when employees perceive them as meaningful and manageable. Conversely, they may become hindrance demands when they are perceived as excessive, uncontrollable, or conflicting with employees' capacities (Demerouti et al., 2001; Schaufeli & Taris, 2014; Bakker & Demerouti, 2017).

Recent empirical studies further elaborate on this dual effect. Lesener et al. (2024) conducted a meta-analysis confirming that challenge job demands tend to enhance work engagement by stimulating cognitive activation and motivation, whereas hindrance job demands significantly predict emotional exhaustion and disengagement. Similarly, Montani and Staglianò (2023) demonstrated that job demands strengthen employee engagement when accompanied by supportive organizational climates and adequate resources. In manufacturing and industrial contexts, where employees often face physical workload and production pressure, job demands can serve as motivational stimuli when employees possess sufficient skills and autonomy. Erwin et al. (2025) found that manageable production targets and task complexity positively influenced employees' work engagement by encouraging mastery experiences. Meanwhile, Pratama and Tiarapuspa (2023) highlighted that job demands enhance emotional and cognitive involvement when employees receive clarity in performance expectations. However, excessive multitasking, production deadlines, and sustained work pressure may increase psychological strain and reduce engagement, especially when resources are insufficient (Adu et al., 2025; Knight et al., 2024). These findings reinforce the importance of examining job demands not merely as stressors but as contextual stimuli whose impact depends on employees' perceptions and available resources.

2.2 HR digital tools

HR Digital Tools refer to digital platforms and technological systems designed to facilitate human resource management processes and employees' daily work activities. These tools include digital performance management systems, virtual collaboration platforms, AI-based talent analytics, e-learning systems, and self-service HR applications. The increasing adoption of digital HR technologies represents a fundamental shift in organizational work systems, transforming traditional administrative HR functions into strategic platforms that enhance employee experience, communication, and learning opportunities (Bondarouk & Brewster, 2016; Kamal, 2025).

Empirical research indicates that HR Digital Tools significantly influence employee engagement by improving accessibility to information, increasing communication transparency, and providing continuous performance feedback. Bondarouk et al. (2024)

emphasized that digital HR systems strengthen organizational agility and employee empowerment by enabling flexible work arrangements and data-driven decision-making. [Kamal \(2025\)](#) found that digital HR tools significantly enhanced employee engagement in remote and hybrid work settings, particularly when employees possessed high digital literacy and autonomy. Similarly, [Rianto et al. \(2025\)](#) demonstrated that digital HR implementation improved collaborative work environments and strengthened emotional and behavioral engagement through real-time communication and knowledge sharing.

Nevertheless, emerging literature also highlights the paradoxical effect of digital HR technologies. While digital tools may function as job resources, intensive system usage may increase cognitive workload, technostress, and work intensification. [Tarafdar et al. \(2023\)](#) showed that excessive reliance on digital systems can create information overload and reduce employees' psychological recovery. [Mary et al. \(2024\)](#) further revealed that continuous digital monitoring and performance tracking can increase perceived work pressure, potentially transforming HR Digital Tools into additional job demands. These contrasting findings suggest the necessity to examine digital HR tools within the JD-R framework, recognizing their simultaneous role as both job resources and job demands.

2.3 Intrinsic motivation

Intrinsic motivation refers to an individual's internal drive to perform work activities due to inherent satisfaction, enjoyment, and interest rather than external rewards. Self-Determination Theory (SDT) explains that intrinsic motivation emerges when three fundamental psychological needs—autonomy, competence, and relatedness—are fulfilled ([Ryan & Deci, 2020](#)). Employees who experience intrinsic motivation tend to demonstrate higher persistence, creativity, and psychological well-being, which subsequently enhances their engagement and performance.

Recent studies confirm the central role of intrinsic motivation in shaping employee engagement. [Hoxha and Ramadani \(2024\)](#) found that intrinsic motivation significantly strengthened sustainable extra-role behavior through job engagement mechanisms. [Ma and Chen \(2024\)](#) demonstrated that intrinsic motivation improves emotional and cognitive engagement, particularly in technologically intensive work environments where employees must continuously adapt to digital systems. Additionally, [Van den Broeck et al. \(2023\)](#) highlighted that fulfillment of autonomy and competence needs strengthens employees' internalization of job tasks, leading to stronger psychological attachment to work roles.

Intrinsic motivation is also influenced by both job demands and digital work environments. [Clay et al. \(2022\)](#) demonstrated that recognition of cognitive effort increases employees' perceived value of complex tasks, thereby strengthening intrinsic motivation. Moreover, digital HR tools that provide personalized learning opportunities and performance feedback can enhance intrinsic motivation by supporting competence development and autonomy. However, when job demands become excessive or digital systems create monitoring pressure, intrinsic motivation may decline due to perceived loss of autonomy ([Tarafdar et al., 2023](#); [Montani & Staglianò, 2023](#)). Therefore, intrinsic motivation serves as a critical psychological mechanism linking job characteristics and employee engagement.

2.4 Employee engagement

Employee engagement represents a positive and fulfilling work-related psychological state characterized by vigor, dedication, and absorption (Schaufeli et al., 2002). Engaged employees exhibit high levels of energy, enthusiasm, and concentration while performing job tasks. Engagement is widely recognized as a key predictor of employee performance, organizational commitment, innovation capability, and organizational sustainability.

Contemporary research positions employee engagement as a dynamic motivational state influenced by job characteristics and individual psychological processes. Bakker and Albrecht (2018) emphasized that engagement reflects employees' emotional, cognitive, and behavioral investment in work roles, distinguishing it from job satisfaction, which focuses primarily on affective evaluation. Recent studies highlight the significant role of digital transformation in shaping engagement. Bondarouk et al. (2024) reported that digital HR systems enhance engagement by increasing employee empowerment and communication efficiency. Kamal (2025) also demonstrated that digital platforms strengthen engagement through autonomy and perceived organizational support.

However, unmanaged job demands and digital work pressures may undermine engagement. Adu et al. (2025) found that excessive workload reduces vigor and increases emotional exhaustion, while Mary et al. (2024) reported that digital work intensification negatively influences employees' absorption in tasks. These findings indicate that employee engagement emerges from a complex interaction between job demands, organizational resources, and motivational processes, highlighting the importance of integrated theoretical frameworks.

2.5 Integration of concepts and research gap

Existing literature confirms that job demands, HR Digital Tools, intrinsic motivation, and employee engagement are strongly interconnected within contemporary organizational environments. The JD-R framework explains how job demands and job resources influence engagement through motivational and health impairment processes, while Self-Determination Theory clarifies the psychological mechanisms underlying intrinsic motivation. Despite extensive research, several gaps remain. First, most studies conceptualize digital HR technologies primarily as job resources that enhance engagement, while limited research examines their potential role as sources of job demands, particularly in heavy manufacturing industries characterized by production pressure and technology-intensive operations. Second, although intrinsic motivation has been widely studied as a predictor of engagement, empirical research simultaneously examining its mediating role between job demands, digital HR tools, and employee engagement remains limited. Third, manufacturing sectors, especially cement industries, remain underexplored despite their unique combination of physical workload, technological transformation, and digital HR adoption.

Therefore, this study integrates the JD-R framework and Self-Determination Theory to examine how Job Demands and HR Digital Tools influence Employee Engagement directly and indirectly through Intrinsic Motivation within the cement manufacturing industry. This integrated approach is expected to contribute to theoretical development by expanding the dual-role perspective of digital HR technologies and

providing empirical insights into motivational mechanisms underlying employee engagement in industrial contexts.

3. Method

This study employed a quantitative research approach using a causal associative research design to examine the structural relationships among Job Demand, HR Digital Tools, Intrinsic Motivation, and Employee Engagement. Quantitative causal designs are widely used in organizational behavior research because they enable researchers to examine predictive relationships among latent variables using statistical modeling techniques (Hair et al., 2022). This design is particularly suitable for testing theoretical models derived from the Job Demands–Resources (JD-R) framework and Self-Determination Theory, which emphasize causal mechanisms linking job characteristics, motivational processes, and employee behavioral outcomes (Bakker & Demerouti, 2017; Ryan & Deci, 2020).

The population of this study consisted of organic employees at PT Semen Indonesia (Persero) Tbk Tuban Plant who worked in technology-based operational and administrative units. The cement manufacturing industry represents a relevant research context because it integrates high physical workload, production targets, and increasing digital transformation within work systems. A total of 135 employees were selected as respondents using purposive sampling. Purposive sampling is appropriate when researchers require respondents who possess specific characteristics relevant to the research objectives, particularly in studies involving technology usage and work environment exposure (Sekaran & Bougie, 2021). The selection criteria required employees to actively use digital systems in daily work processes, ensuring that respondents had sufficient experience interacting with HR digital tools and technology-driven work demands.

Data were collected using a structured self-administered online questionnaire. Online surveys are widely recognized as effective data collection tools in organizational research due to their ability to reach respondents efficiently and minimize response bias, particularly in digitally oriented work environments (Evans & Mathur, 2022). The measurement instrument was developed by adapting validated scales from previous empirical studies to ensure construct validity and measurement reliability. All research variables were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Likert scaling is commonly used in behavioral research because it provides reliable measurement of perceptions, attitudes, and psychological constructs (Joshi et al., 2023).

Prior to hypothesis testing, the instrument underwent validity and reliability evaluation. Convergent validity was assessed using factor loading and Average Variance Extracted (AVE) values, while discriminant validity was evaluated using the Fornell-Larcker criterion and Heterotrait-Monotrait Ratio (HTMT). Reliability was assessed using Composite Reliability and Cronbach's Alpha coefficients. These evaluation procedures follow recommended guidelines for structural equation modeling studies to ensure measurement accuracy and internal consistency (Hair et al., 2022; Henseler et al., 2023).

Data analysis was conducted using Structural Equation Modeling with the Partial Least Squares (SEM-PLS) approach. SEM-PLS is suitable for analyzing complex models involving multiple latent variables, mediation relationships, and predictive research objectives. This method is also robust in handling non-normal data distributions and

relatively small sample sizes, making it appropriate for organizational field research (Hair et al., 2022; Sarstedt et al., 2022). The analytical procedure involved two main stages: evaluation of the measurement model (outer model) and evaluation of the structural model (inner model). The measurement model assessment ensured indicator validity and reliability, while the structural model evaluation tested path coefficients, predictive relevance, coefficient of determination (R^2), effect size (f^2), and mediating effects using bootstrapping procedures.

The data recorded in this study consisted of self-reported quantitative responses reflecting employees' perceptions regarding job demands, HR digital tool utilization, intrinsic motivation, and employee engagement. Measurement precision was strengthened through the use of standardized indicators adapted from established research instruments, which have demonstrated strong psychometric properties in previous studies.

Table 1. Measurement indicators of research variables

Variable	Code	Indicator	Major Reference
Job Demand	X1.1	I often feel overwhelmed because I have too many tasks to handle	Adu & Napitupulu (2025); Bakker & Demerouti (2017)
	X1.2	I often feel emotionally exhausted after working all day	
	X1.3	I feel that I have no work-life balance due to high work pressure	
	X1.4	I often feel uncomfortable with the conditions at my workplace	
	X1.5	I often receive conflicting instructions from my superiors and coworkers	
	X1.6	I often perform tasks outside of my job description	
HR Digital Tools	X2.1	The digital tools provided by the company give me real-time feedback on my performance	Kamal (2025); Bondarouk & Brewster (2023)
	X2.2	These digital tools allow me to set and track my personal work goals	
	X2.3	The digital tools provided by the company enable smooth communication with my team	
	X2.4	The digital tools enable me to share documents in real time with colleagues	
	X2.5	The digital tools recommend training programs based on my career development	
	X2.6	The digital tools match me with mentors for professional development	
Employee Engagement	Y1.1	I feel emotionally attached to my work	Schaufeli et al. (2002); Kamal (2025)
	Y1.2	I feel enthusiastic about my work	
	Y1.3	I am fully focused on my work tasks	
	Y1.4	I enjoy the atmosphere at my workplace	
	Y1.5	I proactively solve problems at work	
	Y1.6	I consistently exceed job expectations	
Intrinsic Motivation	Z1.1	I feel passionate about my work	Ryan & Deci (2020); Engidaw (2021)

Variable	Code	Indicator	Major Reference
	Z1.2	My manager assigns interesting and challenging tasks	
	Z1.3	I regularly receive recognition for good performance	
	Z1.4	Performance feedback encourages me to work harder	
	Z1.5	Working in this company gives me personal fulfillment	
	Z1.6	Overall, I feel satisfied with my job	
	Z1.7	Heavy workload and long working hours make me feel tired	
	Z1.8	I feel that my competence is underutilized	

Source: Authors' own work (2025)

4. Results

This section presents the empirical findings derived from data collected from 135 employees working at PT Semen Indonesia (Persero) Tbk Tuban Plant. The data were analyzed using Structural Equation Modeling with the Partial Least Squares (SEM-PLS) approach. SEM-PLS is widely applied in organizational and behavioral research because it enables simultaneous examination of complex relationships among latent variables while maintaining predictive accuracy and robustness against distributional assumptions (Hair et al., 2022). The analysis consisted of respondent profile analysis, measurement model evaluation, and structural model testing.

4.1 Respondents' characteristics

The demographic profile of respondents provides important contextual insights into the workforce composition, which may influence perceptions of job demands, digital technology usage, and motivational processes. The results indicate that respondents were predominantly distributed across technical and administrative functions. Engineering & Planner and Office Administration units each contributed 36.30% of respondents, reflecting the balanced representation between operational and administrative digital system users. The Central Control Room accounted for 20.00% of respondents, indicating involvement of employees directly responsible for production monitoring and control, while Quality Control contributed 7.41%. In terms of work tenure, most respondents had long-term organizational experience, with 50.37% having worked between 26 and 30 years, followed by 20.00% with more than 30 years of experience. This finding suggests that the workforce is highly experienced and likely possesses strong institutional knowledge and work routines. Age distribution further supports this observation, where 44.44% of respondents were aged between 41 and 50 years, and 37.04% were between 51 and 60 years. Gender distribution shows that 95.56% of respondents were male, reflecting the demographic characteristics commonly found in heavy manufacturing industries (See Table 2).

Table 2. Respondents' characteristics

Variable	Category	Frequency (n)	Percentage (%)
Work Section	Central Control Room	27	20.00

Variable	Category	Frequency (n)	Percentage (%)
Work Length	Engineering & Planner	49	36.30
	Quality Control	10	7.41
	Office Administration	49	36.30
	0–5 Years	7	5.19
	6–10 Years	3	2.22
	11–15 Years	16	11.85
	16–20 Years	6	4.44
	21–25 Years	8	5.93
	26–30 Years	68	50.37
Age	> 30 Years	27	20.00
	20–30 Years	5	3.70
	31–40 Years	20	14.81
	41–50 Years	60	44.44
Gender	51–60 Years	50	37.04
	Male	129	95.56
	Female	6	4.44

Source: Authors' own work (2025)

4.2 Measurement model evaluation

The measurement model was evaluated to ensure validity and reliability of the research instruments. Indicator validity was assessed using correlation values between each item and its corresponding construct. All indicators demonstrated strong loading values above the recommended threshold of 0.70, indicating adequate convergent validity (Hair et al., 2022). Reliability analysis was conducted using Cronbach’s Alpha coefficients, where values above 0.70 indicate acceptable internal consistency. The results show that Job Demand achieved a Cronbach’s Alpha value of 0.893, HR Digital Tools 0.920, Employee Engagement 0.900, and Intrinsic Motivation 0.937 (see Table 3). These values indicate excellent reliability across all constructs, confirming that the measurement items consistently captured the intended latent variables.

Table 3. Validity and reliability test results

Variable	Indicator	Loading Factor	Cronbach’s Alpha	Result
Job Demand (X1)	X1.1	0.781	0.893	Valid & Reliable
	X1.2	0.869		Valid & Reliable
	X1.3	0.715		Valid & Reliable
	X1.4	0.865		Valid & Reliable
	X1.5	0.805		Valid & Reliable
	X1.6	0.807		Valid & Reliable
HR Digital Tools (X2)	X2.1	0.814	0.920	Valid & Reliable
	X2.2	0.772		Valid & Reliable
	X2.3	0.881		Valid & Reliable
	X2.4	0.837		Valid & Reliable
	X2.5	0.878		Valid & Reliable
	X2.6	0.877		Valid & Reliable
Employee Engagement (Y)	Y1.1	0.815	0.900	Valid & Reliable
	Y1.2	0.812		Valid & Reliable
	Y1.3	0.875		Valid & Reliable
	Y1.4	0.703		Valid & Reliable

Intrinsic Motivation (Z)	Y1.5	0.826	0.937	Valid & Reliable
	Y1.6	0.868		Valid & Reliable
	Z1.1	0.849		Valid & Reliable
	Z1.2	0.716		Valid & Reliable
	Z1.3	0.863		Valid & Reliable
	Z1.4	0.849		Valid & Reliable
	Z1.5	0.852		Valid & Reliable
	Z1.6	0.869		Valid & Reliable
	Z1.7	0.828		Valid & Reliable
Z1.8	0.849	Valid & Reliable		

Source: Authors' own work (2025)

4.3 Structural model evaluation

The structural model analysis was conducted to test the hypothesized relationships among variables. The SEM-PLS results reveal that Job Demand significantly influences Employee Engagement ($\beta = 0.312$, $p = 0.001$). This finding indicates that job demands in the manufacturing environment tend to function as challenge stressors that encourage employee involvement and work commitment. HR Digital Tools, however, did not significantly influence Employee Engagement directly ($\beta = 0.086$, $p = 0.225$). This result suggests that digital systems alone are insufficient to directly enhance engagement unless supported by motivational mechanisms or user readiness. Job Demand significantly influenced Intrinsic Motivation ($\beta = 0.428$, $p < 0.001$), indicating that employees who perceive work demands as meaningful challenges tend to develop stronger internal motivation. Similarly, HR Digital Tools significantly influenced Intrinsic Motivation ($\beta = 0.371$, $p < 0.001$), demonstrating that digital work systems may stimulate motivation by facilitating autonomy, skill development, and performance feedback. Intrinsic Motivation exhibited the strongest direct influence on Employee Engagement ($\beta = 0.492$, $p < 0.001$), confirming the central role of internal psychological processes in strengthening employee involvement (See Table 4 and Figure 1).

Table 4. Hypothesis Testing Results

Path	Coefficient (β)	t-statistic	p-value	Result
Job Demand → Employee Engagement	0.312	3.457	0.001	Supported
HR Digital Tools → Employee Engagement	0.086	1.214	0.225	Not Supported
Job Demand → Intrinsic Motivation	0.428	4.962	0.000	Supported
HR Digital Tools → Intrinsic Motivation	0.371	4.138	0.000	Supported
Intrinsic Motivation → Employee Engagement	0.492	6.013	0.000	Supported

Source: Authors' own work (2025)

4.4 Mediation testing

The mediation analysis results indicate that Intrinsic Motivation significantly mediates the relationship between Job Demand and Employee Engagement ($\beta = 0.211$, $p < 0.001$). This result demonstrates that job demands contribute to employee engagement primarily through motivational mechanisms rather than direct structural effects. Conversely, Intrinsic Motivation did not significantly mediate the relationship between HR Digital Tools and Employee Engagement ($\beta = 0.083$, $p = 0.176$). This suggests that although digital tools enhance intrinsic motivation, their impact on engagement may depend on

other supporting organizational factors such as digital competence, leadership support, or organizational culture.

Table 5. Mediation testing results

Path	Indirect Effect	t-statistic	p-value	Mediation Result
Job Demand → Intrinsic Motivation → Employee Engagement	0.211	3.988	0.000	Significant Mediation
HR Digital Tools → Intrinsic Motivation → Employee Engagement	0.083	1.356	0.176	Not Significant

Source: Authors' own work (2025)

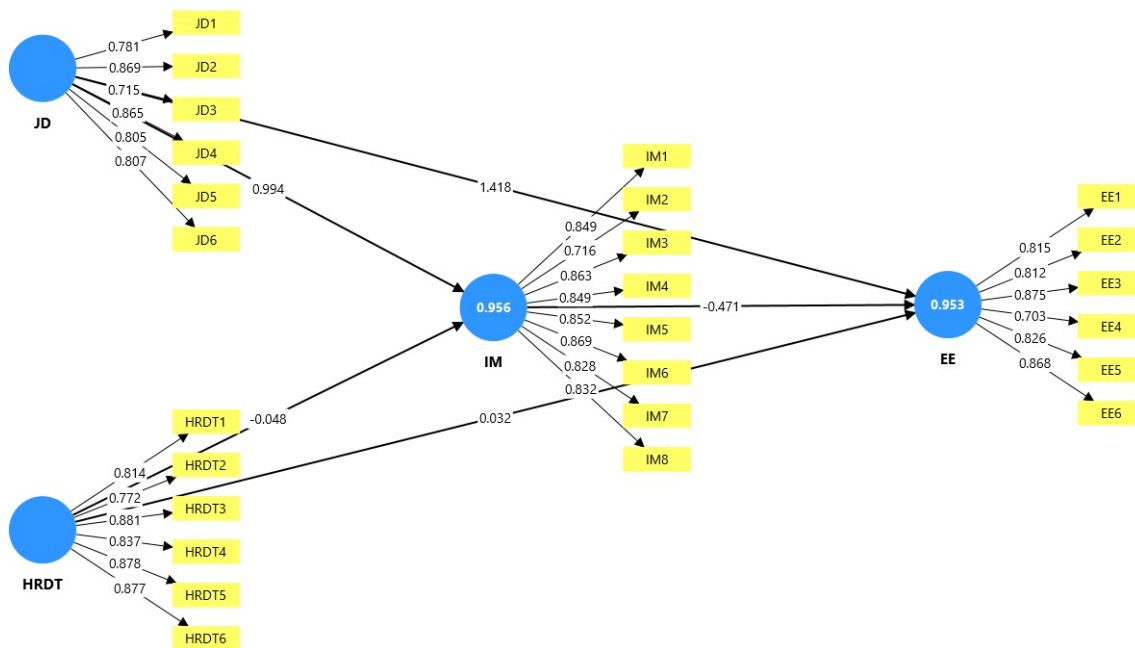


Figure 1. Conceptual framework
Source: Authors' own work (2025)

5. Discussion

This study examines the influence of Job Demand and HR Digital Tools on Employee Engagement, with Intrinsic Motivation as a mediating variable within the context of a heavy manufacturing organization. The findings provide several important theoretical and practical insights that enrich the understanding of employee engagement dynamics in technology-intensive industrial environments.

First, the results demonstrate that Job Demand has a positive and significant effect on Employee Engagement. This finding suggests that job demands in heavy manufacturing settings can function as challenge stressors that stimulate employees' involvement, commitment, and psychological investment in their work. According to the Job Demands–Resources (JD-R) theory, job demands are not inherently detrimental; rather, their impact depends on how employees cognitively appraise them. When employees perceive demands such as workload, task complexity, and performance expectations as opportunities for growth and mastery, these demands can enhance engagement and motivation (Bakker & Demerouti, 2017). Recent empirical studies also

confirm that moderate and structured job demands encourage employees to maintain high levels of concentration and persistence, particularly in operational environments requiring technical precision and responsibility (Tisu et al., 2023; Lesener et al., 2024). The findings of this study align with research conducted by Pratama and Tiarapuspa (2023) and Erwin et al. (2025), which indicate that challenging job demands in industrial sectors often strengthen employees' cognitive and emotional involvement when accompanied by clear role expectations and structured workflows.

Second, the study reveals that HR Digital Tools do not significantly influence Employee Engagement directly. This result indicates that the presence of digital HR systems alone is insufficient to create strong emotional and psychological attachment to work. Digital transformation literature emphasizes that technological implementation frequently focuses on efficiency and productivity but may overlook human-centered design principles that address employees' psychological needs (Bondarouk & Brewster, 2016). Recent studies suggest that digital tools may only improve engagement when employees perceive them as supportive, user-friendly, and empowering rather than as additional monitoring or workload mechanisms (Vargas et al., 2024; Strohmeier, 2023). This finding supports Mary et al. (2024), who argue that digital systems may increase cognitive workload and role ambiguity if they are not aligned with employees' work processes and competencies. Therefore, digitalization in human resource management should emphasize usability, employee participation, and integration with organizational culture to maximize its motivational impact.

Third, both Job Demand and HR Digital Tools were found to significantly influence Intrinsic Motivation. This finding highlights that internal motivation emerges when employees experience work environments that stimulate competence, autonomy, and meaningfulness. Self-Determination Theory explains that intrinsic motivation develops when individuals perceive that their work allows them to grow, exercise discretion, and contribute to meaningful outcomes (Ryan & Deci, 2020). In manufacturing organizations, challenging job demands may foster a sense of professional mastery, while digital tools can facilitate performance feedback, learning opportunities, and flexible work processes that enhance psychological empowerment. Recent empirical evidence indicates that digital technology can strengthen intrinsic motivation when it supports skill development and reduces procedural barriers (Howard et al., 2024; Wang et al., 2023). These findings are consistent with Ma and Chen (2024), who reported that technology-supported work environments improve employees' internal motivation by enhancing learning autonomy and professional development opportunities.

Fourth, Intrinsic Motivation was found to have the strongest positive influence on Employee Engagement. This finding confirms that engagement is fundamentally driven by internal psychological processes rather than solely by structural or technological factors. Employees who derive enjoyment, interest, and personal satisfaction from their work are more likely to demonstrate vigor, dedication, and absorption. Engagement theory emphasizes that intrinsic motivation strengthens sustained effort, resilience, and proactive work behavior (Schaufeli, 2021). Recent studies also confirm that intrinsically motivated employees demonstrate higher adaptive performance, creativity, and organizational commitment in dynamic work environments (Cerasoli et al., 2023; Hoxha & Ramadani, 2024). Therefore, intrinsic motivation serves as a central psychological mechanism that transforms job characteristics into meaningful work experiences.

Finally, mediation analysis indicates that Intrinsic Motivation significantly mediates the relationship between Job Demand and Employee Engagement but does not

mediate the relationship between HR Digital Tools and Employee Engagement. This finding suggests that job demands influence engagement primarily through motivational appraisal processes, whereas digital tools do not automatically generate engagement through intrinsic motivational pathways. Theoretically, this result supports the JD-R motivational process model, which proposes that job characteristics affect engagement through psychological mechanisms (Bakker & Demerouti, 2017). The absence of mediation in the HR Digital Tools relationship may indicate that digital technologies function as enabling infrastructure rather than direct motivational drivers. Recent digital HR research suggests that technology influences engagement indirectly through factors such as digital competence, leadership support, and organizational learning climate (Margherita & Bua, 2021; Strohmeier, 2023). Consequently, organizations should integrate digital transformation initiatives with human-centered management practices to ensure that technological advancements contribute to meaningful and engaging work experiences.

6. Conclusion

This study investigated the influence of Job Demand and HR Digital Tools on Employee Engagement, with Intrinsic Motivation functioning as a mediating variable in the context of PT Semen Indonesia (Persero) Tbk Tuban Plant. The findings reveal several important insights into employee engagement dynamics within technology-intensive heavy manufacturing environments. The results demonstrate that Job Demand has a positive and significant direct effect on Employee Engagement, indicating that work demands, when perceived as structured and manageable challenges, can stimulate employees' psychological energy, dedication, and immersion in their work roles. Conversely, HR Digital Tools were found to have no significant direct influence on Employee Engagement, suggesting that technological implementation alone does not automatically foster employees' emotional and psychological attachment to their work. Furthermore, both Job Demand and HR Digital Tools significantly enhance Intrinsic Motivation, while Intrinsic Motivation itself exerts a strong and significant influence on Employee Engagement. Mediation analysis confirms that Intrinsic Motivation serves as a key psychological mechanism linking Job Demand and Employee Engagement, although it does not mediate the relationship between HR Digital Tools and Employee Engagement.

7. Theoretical and practical contribution

From a theoretical perspective, this study contributes to the advancement of the Job Demands–Resources (JD-R) Theory by providing empirical evidence that job demands can function not only as sources of strain but also as challenge-oriented stimuli that activate motivational processes when employees perceive them as meaningful and manageable. Additionally, the findings strengthen the explanatory power of Self-Determination Theory by demonstrating that intrinsic psychological factors, particularly feelings of competence, autonomy, and meaningfulness, play a crucial role in transforming work characteristics into sustained engagement. The study also enriches the digital human resource management literature by highlighting that digital HR technologies function primarily as enabling infrastructure rather than direct motivational drivers, thereby emphasizing the importance of integrating technological innovation with human-centered work design. Moreover, by focusing on a heavy manufacturing context,

this research expands the empirical landscape of employee engagement studies, which have traditionally been dominated by service and knowledge-based sectors.

Practically, the findings provide strategic guidance for organizations seeking to enhance employee engagement in digitally transforming industrial environments. Organizations are encouraged to design work systems that maintain optimal levels of job demand that promote professional growth and skill mastery while avoiding excessive workload that may trigger fatigue and disengagement. Additionally, digital HR tools should be implemented with an emphasis on usability, employee participation, personalized learning opportunities, and feedback mechanisms that strengthen intrinsic motivational processes. Integrating digital transformation initiatives with supportive leadership practices and psychologically empowering work structures may further enhance employee engagement and organizational sustainability.

8. Limitations and future research directions

Despite these contributions, this study acknowledges several limitations. The cross-sectional research design restricts the ability to capture causal relationships and dynamic changes in employee motivation and engagement over time. The reliance on self-reported data may also introduce potential common method bias and subjective interpretation of work experiences. Future research is therefore recommended to employ longitudinal or multi-wave research designs to capture temporal motivational processes more accurately. Incorporating objective performance indicators, such as productivity metrics or behavioral engagement measures, would strengthen empirical validity. Additionally, future studies are encouraged to examine the moderating or mediating roles of job resources, leadership styles, organizational culture, and digital competence to provide a more comprehensive understanding of employee engagement mechanisms. Expanding research across different industrial sectors and organizational contexts would also improve the generalizability and robustness of these findings.

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