

Training, Competence, and Employee Productivity: The Mediating of Job Satisfaction and The Moderating of AI Technology

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Keywords: Training; Competence; Job Satisfaction; AI Technology; Employee Productivity.		Abstract. Employee productivity and job satisfaction have become increasingly important in the context of digital transformation, as artificial intelligence (AI) continues to reshape workplace processes and employee experiences. Nevertheless, limited empirical research has examined how competency and training influence employee productivity through job satisfaction while considering the moderating role of AI technology, particularly in the context of IT firms. To address this gap, this study examines the effects of training and competency on employee productivity, the mediating role of job satisfaction, and the moderating role of AI technology. The sample consisted of 168 employees of PT Krakatau Information Technology, selected using a saturated sampling technique. This organizational context is particularly relevant because employees operate in a technology-intensive environment where continuous competency development and adaptation to AI may influence both job satisfaction and productivity. Data were collected through a survey and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4. The results show that training has no significant direct effect on employee productivity ($p = 0.259$; $t = 0.647$), whereas competency has a positive and significant effect on employee productivity ($p < 0.001$; $t = 4.899$). Both training and competency have positive and significant effects on job satisfaction ($p = 0.002$; $t = 3.865$ and $p < 0.001$; $t = 5.603$, respectively). Furthermore, job satisfaction has a positive and significant effect on employee productivity ($p = 0.024$; $t = 3.482$), indicating that employee development may contribute to productivity through greater job satisfaction. These findings suggest that employee competency serves as a strategic asset that can substantially enhance organizational productivity. Organizations should develop a structured AI roadmap, strengthen employees' AI and digital competencies, and integrate AI into core business processes with strong managerial support to maximize its potential productivity benefits.	
Katakunci: Pelatihan, Kompetensi; Kepuasan Kerja; Teknologi AI;		Abstrak. Produktivitas karyawan dan kepuasan kerja menjadi semakin krusial dalam konteks transformasi digital, seiring dengan perubahan prosedur kerja dan pengalaman karyawan akibat kecerdasan buatan (AI). Namun, masih sedikit studi empiris yang	

Produktivitas Karyawan.

mengkaji bagaimana kompetensi dan pelatihan memengaruhi produktivitas pekerja melalui kepuasan kerja dengan mempertimbangkan efek moderasi teknologi AI, khususnya dalam konteks perusahaan TI. Untuk mengisi kesenjangan tersebut, penelitian ini menganalisis pengaruh pelatihan dan kompetensi terhadap produktivitas karyawan, peran mediasi kepuasan kerja, serta peran moderasi teknologi AI. Sampel penelitian terdiri dari 168 karyawan PT Krakatau Information Technology yang dipilih menggunakan teknik sampling jenuh. Konteks PT Krakatau Information Technology sangat relevan karena para karyawannya bekerja dalam lingkungan yang intensif teknologi, di mana pengembangan kompetensi yang berkelanjutan dan adaptasi terhadap AI dapat memengaruhi kepuasan kerja maupun produktivitas. Data dikumpulkan melalui survei dan dianalisis menggunakan *Partial Least Squares Structural Equation Modeling* (PLS-SEM) dengan perangkat lunak SmartPLS 4. Hasil penelitian menunjukkan bahwa pelatihan tidak memiliki pengaruh langsung yang signifikan terhadap produktivitas karyawan ($p = 0,259$; $t = 0,647$), sedangkan kompetensi memiliki pengaruh positif dan signifikan terhadap produktivitas karyawan ($p < 0,001$; $t = 4,899$). Baik pelatihan maupun kompetensi berpengaruh positif dan signifikan terhadap kepuasan kerja (masing-masing dengan $p = 0,002$; $t = 3,865$ dan $p < 0,001$; $t = 5,603$). Selain itu, kepuasan kerja berpengaruh positif dan signifikan terhadap produktivitas karyawan ($p = 0,024$; $t = 3,482$), yang mengindikasikan bahwa pengembangan karyawan berkontribusi terhadap produktivitas melalui kepuasan karyawan terhadap pekerjaan mereka. Temuan ini menunjukkan bahwa kompetensi karyawan berperan sebagai aset strategis yang secara substansial meningkatkan produktivitas organisasi. Perusahaan sebaiknya menerapkan peta jalan AI yang terstruktur, meningkatkan kompetensi digital dan AI karyawan, serta mengintegrasikan AI ke dalam proses bisnis inti dengan dukungan manajemen guna mewujudkan potensi peningkatan produktivitas.

1 Introduction

Rapid advances in digital technology, and in particular artificial intelligence (AI), are reshaping how organizations do their work, manage information, and deliver services. This transformation creates new opportunities to improve work efficiency and productivity, but at the same time requires employees to continuously update their knowledge, skills, and ability to adapt to technology-based work processes (Tarigan et al., 2022). These challenges are particularly important for organizations operating in the information and communication

technology (ICT) sector, where employees are directly involved in the development, deployment, and maintenance of digital solutions. Therefore, it is important to enhance employee capabilities and ensure that the training is relevant to current developments in technology to support organizational performance.

This need is particularly true for PT Krakatau Information Technology (PT KIT), an ICT company that provides digital and technology solutions such as SAP-ERP implementation, software development, cloud and IT infrastructure, cybersecurity, big data and analytics, automation, and IT support. PT KIT is a professional partner for digital transformation, serving clients in the industrial, governmental, healthcare, and other sectors. The extensive involvement of the company in digital transformation requires that employees keep their technical and professional skills updated with the fast-changing technologies. In this sense, training must be relevant to the real work requirements of the employees, and it must be followed by the development of competencies that can be applied to the daily tasks (Alexandro, 2025).

Training can improve employee productivity by increasing knowledge and skills, as shown by previous studies (Jiang et al., 2020; Ariani et al., 2024; Balwant et al., 2020). However, other studies found that training does not automatically lead to higher productivity when it is not supported by suitable organizational conditions, job demands, and work environments (Azeem et al., 2024; Flegl et al., 2022). Competency studies show similar variation. Stronger competencies are generally associated with better work performance and productivity (Nisha et al., 2022; Pea-Assounga & Bindel Sibassaha, 2024), although some studies report insignificant effects (Fitria et al., 2026). These findings indicate that improving employee productivity requires more than increasing the frequency of training; it also requires attention to whether training is translated into relevant competencies and positive employee experiences at work.

Job satisfaction is a plausible mediating mechanism linking training and competency to employee productivity. Job satisfaction tends to be higher among employees who receive development opportunities and whose competencies match job demands. Elevated job satisfaction can,

in turn, enhance motivation, commitment, and work performance (Ahmad et al., 2023; Tarigan et al., 2022). Empirical evidence also indicates that job satisfaction can mediate the relationship between human resource development initiatives and organizational performance (Berhanu, 2023; Keltu, 2024). Nevertheless, studies that simultaneously test job satisfaction's mediating role in the training competency productivity framework remain limited, particularly within the information and communication technology (ICT) industry.

This challenge becomes even more complex as AI rises. Artificial intelligence can help employees to do routine tasks faster, access information more easily, make decisions based on data, and improve the efficiency of processes (Olan et al., 2022; Al Naqbi et al., 2024; Kassa & Worku, 2025). But the benefits of AI depend on employees' ability to understand and use these technologies properly. Digital skills, organizational readiness, and integration of AI into work processes may determine whether AI would be a tool to improve productivity or just another technology resource (Shaikh et al., 2023; Deepa et al., 2024; Zahoor et al., 2024). Hence, employee development in the era of AI should include technical training, strengthening of competencies, and practical guidance on effective use of AI in work activities.

This study focuses on PT Krakatau Information Technology (PT KIT), an ICT firm and subsidiary of PT Krakatau Steel (Persero) Tbk, which provides ERP, digital transformation, IT infrastructure, automation, and managed services. Despite implementing various training and competency development programs, PT KIT has experienced productivity shortfalls relative to its targets, indicating a potential gap between human capital investments and realized productivity outcomes. Accordingly, this community service program aims to strengthen employee capacity at PT Krakatau Information Technology through an integrated program of training, competency development, and practical AI utilization to support employee productivity. Specifically, the program objectives are to: (1) enhance employees' knowledge and skills through training that is relevant to their work requirements; (2) strengthen employees' competencies so that acquired knowledge and skills can be applied effectively in daily work activities; (3) encourage positive work

experiences and job satisfaction through opportunities for learning, development, and competency improvement; and (4) improve employees' ability to utilize AI technology appropriately and effectively as a supporting tool for work efficiency and productivity. Through these activities, the program seeks to provide a practical model of employee capacity building that responds to the demands of digital transformation in an ICT organization.

2 Method

The community service program was held at PT Krakatau Information Technology (PT KIT) and was attended by 168 employees with various functional positions. The program adopted a participatory approach based on the partner's needs, especially in terms of strengthening employee competencies, work effectiveness, and readiness to use artificial intelligence (AI). The activities started with a needs assessment through discussions, observations, and consultations with management and employees to identify competency gaps, training needs, challenges in work productivity, and opportunities for AI utilization.

The program was implemented through training, competency-development activities, interactive discussions, demonstrations, and hands-on practice. The training materials were contextualized to the ICT work environment and focused on strengthening employees' knowledge and skills, improving effective work practices, and introducing appropriate and responsible AI utilization to support daily work activities. Participants were encouraged to apply the knowledge and skills acquired during the activities to practical work situations relevant to their respective roles.

Program effectiveness was evaluated using pre- and post-activity assessments, participant feedback, and observations of participation during discussions and practical exercises. The evaluation focused on changes in participants' knowledge, perceived competency, confidence in using AI, and understanding of effective work practices. Descriptive comparisons of pre- and post-activity responses were used to assess program outcomes, while participant feedback was reviewed to identify

perceived benefits, challenges, and recommendations for future activities. Participation was voluntary, and confidentiality of participant information was maintained throughout the program.

Table 1. Community Service Program Components

Program Component	Operational Focus	Activities	Indicator
Employee Training	Improving job-related knowledge and skills	Training, discussions, and case exercises	Better understanding and application of knowledge
Employee Competency Development	Improving skills and work performance	Practical exercises, problem-solving, and simulations	Improved competency and skill application
Job Satisfaction and Work Engagement	Promoting positive work experiences	Discussions, reflection, and feedback	Positive responses to the program
AI Technology Utilization	Improving appropriate use of AI at work	AI demonstrations and practical exercises	Increased confidence and ability to use AI
Employee Productivity	Improving work efficiency through skills and technology	Applying training and AI in work tasks	Improved work practices and efficiency

3 Results

Participants Profile

The data analyzed in this study comprises completed questionnaires from 168 respondents, which accurately represent the sample size used in the research.

Table 2. Respondents Description

Profile	Criteria	Frequency	Percentage
Gender	Male	123	73.21%
	Female	45	26.79%

Age	< 30 years	47	27.98%
	30-45 years	104	61.90%
	46-56 years	17	10.12%
Length of Work	0-5 years	14	8.35%
	6-10 years	32	19.04%
	11-15 years	122	72.61%
Education	Senior High School	26	15.48%
	Diploma	18	10.71%
	Bachelor's Degree	116	69.04%
	Postgraduate	8	4.77%

The respondent profile was dominated by males, who represented 73.21 of the total respondents, whereas females accounted for 26.79 percent. These findings indicate that the workforce composition is still predominantly male. The age distribution indicates that respondents were concentrated within the prime working-age group. Most respondents were aged 30-45 years, namely 61.90 percent, followed by those younger than 30 years, namely 27.98 percent, and those aged 46-56 years, namely 10.12 percent. The most employees had worked for 11-15 years, namely 72.61 percent, followed by 6-10 years and 0-5 years. In the educational level, the majority held a bachelor's degree, namely 69.04 percent. Smaller proportions had completed senior high school education, namely 15.48 percent, or diploma-level education, 10.71 percent, while only a few respondents held a postgraduate degree, namely 4.77 percent.

Empirical Assessment of Capacity Needs

Before examining the actual results of the community service program, an empirical evaluation was used to determine the capacity development needs of PT Krakatau Information Technology employees. The results of SEM-PLS show that employee competency has a positive and significant effect on employee productivity ($\beta = 0.506$, $t = 4.899$, $p = 0.000$). Meanwhile, employee training has no significant direct effect on employee productivity ($\beta = 0.092$, $t = 0.647$, $p = 0.259$). The results indicate that training should not be considered simply as a direct method for increasing productivity, but rather as part of a broader capacity-

building process to improve employees' competencies and work-related experiences.

The results also showed that there is a positive and significant relationship between employee training and job satisfaction ($\beta = 0.301$, $t = 3.865$, $p = 0.002$) and between employee competency and job satisfaction ($\beta = 0.534$, $t = 5.603$, $p < 0.001$). Furthermore, job satisfaction had a positive relationship with employee productivity ($\beta = 0.190$, $t = 3.482$, $p = 0.024$). The indirect relationships through job satisfaction were also considered in identifying the broader capacity-development needs of employees.

These findings provided an empirical basis for the design of community service activities. Thus, the program focused on providing training materials as well as practical competency development, problem-solving activities, work-related discussions, and the proper use of artificial intelligence (AI) technology. The SEM-PLS results were therefore used to provide supportive evidence for identifying capacity-development priorities, and not as evidence of the causal impact of the community service intervention itself.

Improvement in Participants' Knowledge and Competencies

Pre- and post- program performance was compared to examine changes in the knowledge and competencies of the participants. The evaluation addressed participants' comprehension of training materials, their capability to apply the concepts, and their skill in identifying appropriate uses of artificial intelligence (AI) technology in their work.

Table 3. Average Knowledge and Competency of Post-test and Pre-test Scores

Component	Average Pre-test	Average Post-test
Knowledge	55,1	88,7
Competency	56,5	90,3

The results showed that the average knowledge score increased from 55,1 to 88,7, representing an increase of 60,98%. Similarly, the competency score increased from 56,5 to 90,3, representing an increase of 33,8 points or approximately 59,82%. These results indicate an improvement in participants' measured knowledge and competency scores immediately following the program. The improvement should be

understood within the framework of the program evaluation. It measures the changes in the participants' learning outcomes immediately after the intervention and not the long-term changes in employee performance or organizational outcomes.

Changes in the Ability to Complete Tasks

The community service program was designed to strengthen employees' ability to apply newly acquired knowledge and skills to work-related tasks. The activities included training, practical exercises, problem-solving discussions, and the application of digital and AI-based tools to selected work situations. In this context, task performance was not assessed solely in terms of output quantity, but also in terms of employees' ability to understand work procedures, identify task requirements, solve task-related problems, use technological tools appropriately, and complete assigned activities through more structured work processes.

The empirical assessment done before the practical activities showed that employee competency was an important factor related to productivity. The SEM-PLS results showed that employee competency has a positive and significant relationship with employee productivity ($\beta = 0.506$, $t = 4.899$, $p = 0.000$). Moreover, job satisfaction was found to be positively and significantly related to employee productivity ($\beta = 0.190$, $t = 3.482$, $p = 0.024$). The findings provided a basis for emphasizing competency strengthening and supportive work experiences in the community service activities.

During the practical sessions, participants were encouraged to use the competencies developed through the program to selected work-related tasks. Activities included task completion using a new workflow, implementation of AI-assisted procedures, and elimination of unnecessary steps in task completion. The participants were to define the requirements of tasks, set up appropriate working procedures, and use relevant digital or AI-based tools where appropriate. Observations and participant feedback indicated that participants gained in their ability to apply knowledge and skills learned in the program to practical tasks in their work. The practical activities also allowed participants to

execute tasks using more structured workflows and identify ways to use digital and AI-based tools to support task completion

Changes in The Use of AI in the Workplace

A practical aspect of the program was the introduction and application of artificial intelligence (AI) technology in the work activities of employees. Participants learned about suitable AI applications, followed by demonstrations and interactive exercises with work-related scenarios. The activities were designed to help participants understand how AI could be applied to support routine work processes, such as creating and refining work-related content, summarizing information, organizing ideas, and assisting in the preparation of documents.

The evaluation indicated an increase in participants' understanding of AI and its potential applications in the workplace. The average score increased from 55.1 in the pre-test to 88.7 in the post-test, representing an increase of 33.6 points or approximately 60.98%. This result should be interpreted as an overall learning outcome rather than as a direct measure of AI adoption. During the practical sessions, participants were also encouraged to identify work activities that could potentially be supported by AI and to practice applying AI tools to selected work-related tasks. Through these exercises, participants gained direct experience in formulating appropriate prompts, reviewing AI-generated outputs, and making adjustments to ensure that the results were relevant to their work requirements.

The practical activities provided participants with opportunities to translate newly acquired knowledge into immediate applications of AI in selected work situations. Rather than focusing only on the theoretical understanding of AI, the program encouraged participants to consider how AI could be integrated into specific work processes while maintaining human review of the resulting outputs. Participant observations and feedback further indicated that the practical exercises helped participants become more familiar with the use of AI as a supporting tool in completing selected tasks.

However, the program did not generate sufficient evidence to conclude that AI adoption had changed at the organizational level. The results should therefore be understood as evidence of changes in

participants' knowledge, familiarity, and immediate practical exposure to AI during the program, rather than as evidence of sustained AI utilization in routine workplace activities. Further evaluation would be necessary to examine whether participants continue to use AI after the program and whether such use contributes to measurable improvements in work efficiency or productivity.

4 Discussion

The results of this research indicate that training does not have a significant effect on employee productivity. This finding suggests that neither the intensity nor the quality of training provided by the company has directly translated into measurable improvements in employee productivity. These results are consistent with Azeem et al. (2024), who reported that training programs do not necessarily enhance productivity when training outcomes cannot be effectively applied to job tasks. These findings also align with Flegl et al. (2022), who found that increases in training hours are not always associated with proportional gains in employee performance and productivity. The insignificant relationship between employee training and employee productivity indicates that training alone was not sufficient to produce a statistically significant improvement in productivity among the employees studied. However, the present study did not examine the specific mechanisms or contextual factors that may explain this finding. Therefore, factors such as technological changes, training relevance, or workplace conditions should not be interpreted as established causes and may instead be examined in future research.

While training may raise employees' knowledge and skills, these improvements do not always convert into measurable output. Moreover, productivity in ICT is influenced by additional factors such as project complexity, team coordination, technological support, and evolving customer requirements. From a Human Capital Theory perspective, training investments do not automatically yield immediate productivity gains unless learning transfer to the workplace is optimized. Therefore, organizations should ensure that training content is closely aligned with

job requirements and business objectives to enhance the likelihood of converting training into tangible productivity improvements.

The results of this study indicate that competency has a positive and significant effect on employee productivity. This implies that employees with higher competency levels produce greater work output. The finding is consistent with Pea-Assounga & Bindel Sibassaha (2024), employee competency is pivotal for enhancing productivity through digitally-based HR practices. Nisha et al. (2022) identify core competencies as a determinant of competitive advantage and organizational productivity. In the context of ICT firms such as PT Krakatau Information Technology, competency encompassing technical skills, business knowledge, and problem-solving abilities serves as a principal asset for delivering high-quality services; competent employees are better able to complete tasks effectively and efficiently. Therefore, organizations should prioritize competency development as a strategic measure to enhance productivity.

The results of this research indicate that training has a positive and significant effect on job satisfaction. This finding suggests that employee participation in company training programs enhances their job satisfaction. The result supports Bercu (2017), who reported that training programs positively influence job satisfaction. Paposa & Kumar (2019) found that training and also development practices contribute to increased employee satisfaction. Within organizations, training is perceived not only as a means to improve skills but also as a signal of the firm's commitment to employee career development. Opportunities to attend training convey that the organization invests in its human resources, which strengthens employees' sense of being valued and consequently raises job satisfaction. The finding also implies that in this study the primer benefit of training is psychological improving employees' attitudes and well being rather than producing immediate gains in measurable productivity.

The results reveal that competency has a positive and significant effect on job satisfaction. These findings corroborate Chang et al. (2021), who reported a positive association between competency and job satisfaction, and Prasetyo & Faizal, (2025), which identified competency

as a significant determinant of employee satisfaction. Practically, employees with higher competency tend to demonstrate greater confidence in task execution, deliver higher-quality work, and receive recognition for their contributions; such outcomes enhance feelings of achievement, self-worth, and overall job satisfaction. The results imply that investments in competency development yield dual benefits: they not only support productivity improvements but also promote employees psychological well-being and satisfaction. Organizations particularly knowledge intensive firms-should therefore consider competency enhancement as a central component of human resource strategies aimed at improving both performance and employee welfare.

The results indicate that job satisfaction has a positive and significant effect on employee productivity. This finding implies that employees with higher levels of job satisfaction tend to exhibit greater work productivity. The result aligns with Tarigan et al., (2022), job satisfaction contributes to improved employee productivity, and supports Gazi et al., (2024), which identifies job satisfaction as a key determinant of work performance. Job satisfaction fosters intrinsic motivation, prompting individuals to deliver higher-quality performance. Satisfied employees typically demonstrate greater organizational commitment, lower absenteeism, and stronger willingness to achieve organizational targets, all of which can translate into increased productivity. Consequently, organizations seeking to raise employee productivity should consider interventions that improve job satisfaction alongside competence and work-environment factors.

The results show that job satisfaction is able to strengthen mediates the relationships between training and employee productivity, and between competency and employee productivity. Specifically, training does not exert a direct effect on employee productivity, its influence operates indirectly by increasing job satisfaction, which in turn enhances productivity. This indicates that training programs are more likely to improve productivity when they create positive work experiences and raise employee satisfaction. Competency affects employee productivity both directly and indirectly through job satisfaction, demonstrating that competency improvements enhance

productivity not only by increasing capability but also by elevating employees' psychological well-being. These findings support the view that job satisfaction functions as a psychological mechanism that channels the effects of human resource development into measurable productivity. Therefore, organizations should complement investments in training and competency development with interventions aimed at strengthening job satisfaction, aligning training to job needs, providing career support, recognizing achievements, and improving work conditions to maximize the productivity returns of HR programs.

The present study's finding that AI technology did not exhibit a significant moderating effect on the relationships between training and employee productivity, nor between competency and employee productivity. Jia et al., (2023) report comparable and offer contextual explanations, including nascent AI implementation, uneven adoption across teams, and heterogeneous levels of digital literacy among staff, which collectively help illuminate why theoretical expectations of AI as an unequivocal productivity enhancer may not materialize in practice. Integrating these insights with the current data suggests that the mere availability of AI infrastructure is insufficient to generate synergistic gains from HR development. Realized productivity benefits likely require deeper operational integration of AI, training explicitly aligned to AI-augmented tasks, systematic digital upskilling, and coordinated change-management and process-redesign efforts. The convergence of findings indicates the importance of measuring AI maturity and usage intensity as distinct constructs and of employing longitudinal designs to detect potential lagged effects of AI integration, such refinements would clarify boundary conditions under which AI functions as an effective moderator. Jia et al., (2023) highlights that AI's moderating role is contingent on organizational readiness and complementary human and process investments.

5 Conclusion

The findings conclude that employee competency is positively and significantly associated with employee productivity, whereas training does not have a significant direct effect on productivity but contributes

positively to job satisfaction. Job satisfaction also has a significant positive effect on productivity and mediates the relationships between training and competency with productivity, highlighting its role in translating employee development into productivity outcomes. In contrast, AI technology does not significantly moderate the relationships between training or competency and productivity, indicating that its presence alone does not strengthen the productivity effects of human resource development. Based on these findings, PT Krakatau Information Technology and similar ICT organizations should prioritize competency-oriented training that is closely aligned with employees' job requirements, strengthen learning transfer through practical work-based activities and measurable performance targets, and develop employees' digital and AI competencies alongside the gradual integration of AI into relevant business processes.

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