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Analysis of Factors Strengthening Human Capital Competitiveness in Indonesia's Industry through Workplace Learning Model based on Indonesian Qualification Framework

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ABSTRACT
Strengthening workforce competitiveness in Indonesia requires workplace learning aligned with the Indonesian Qualifications Framework. This study aimed to identify and validate the latent structure of IQF based workplace learning and to outline an evaluation instrument and policy levers. We conducted an online cross-sectional survey of 400 workers across all provinces and applied exploratory factor analysis with polychoric correlations, oblimin rotation, parallel analysis, and a scree examination, complemented by content analysis of an open-ended question. Sampling adequacy was excellent with KMO 0.96 and Bartlett significance p under 0.001. Four coherent dimensions emerged that together explained about 65 percent of variance. Structured Competency Development captured structured training, standards, research, human resource planning, and certification. Performance Management and Workload gathered assignment, workload, remuneration, performance, and knowledge sharing. Experience Based Learning covered mentoring, internship, coaching, and job rotation. Educational Qualifications was defined chiefly by education level. Model fit was strong with RMSR 0.03 and moderate inter factor correlations, and qualitative keywords on work, skills, and experience converged with these factors. The study contributes a theoretically integrated IQF aligned model and a ready blueprint for measurement and auditing. Practically it informs policy and industry programs that link training with research and technology, formalise mentoring, reward knowledge sharing in performance systems, and map careers to qualification levels, and the instrument can audit learning ecosystems and guide resource allocation across priority sectors.

1. INTRODUCTION

In the context of Indonesia as a developing country, labor competitiveness plays a crucial role as a driver of productivity and economic growth, which depends on the quality of education and the alignment of competencies with industry needs (Cerya & Mustika, 2018; Kebede et al., 2024; Sulistiyono et al., 2025). The landscape of human resource development in Indonesia shows progress as well as gaps that require the design of structured workplace learning models that are aligned with the national qualifications framework; On the one hand, the government aims to strengthen human capital by improving the Human Capital Index from 0.54 in 2020 to 0.59 in 2029 as a benchmark for human resources' contribution to growth. However, achieving this goal requires consistent intervention in education and health, as well as improving the relevance of vocational graduates to industry needs (Bappenas, 2025; PP, 2025, Attachment I). In the labor market, the target of reducing the open unemployment rate to a range of 4.00–4.71 percent and increasing female labor force participation indicates the need to accelerate inclusive competency-based skilling, reskilling, and upskilling so that productive competitiveness extends to all demographic segments and regions (Bappenas, 2025). The policy signal also emphasizes the role of workplace learning, where post-pandemic job recovery is driven by pre-employment cards, job training, and competency tests, the quality of which needs to be improved through work-based learning practices, competency assessments, and certification integrated with industry needs (PP, 2025, Attachment I). The direction of priority projects even mandates the strengthening of the vocational ecosystem and the "3-in-1 system" (training, certification, and placement) to produce a competent industrial workforce, which reflects the need for standardization of learning outcomes at the job level and qualification level so that workforce mobility and productivity increase measurably (PP, 2025, Attachment III). On the medium-term competency supply side, targets for increasing average length of schooling and programs to revitalize leading schools and link and match industry indicate that basic literacy needs to be anchored in workplace literacy and technology in real work environments to reduce skills mismatches (Bappenas, 2025; PP, 2025, Attachment I). Thus, empirical studies on the determining factors of strengthening human capital competitiveness through workplace learning models designed based on

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competency levels and certification are expected to contribute to (i) mapping critical skill gaps that hinder the achievement of national HCI targets, (ii) the formulation of "learning at work" intervention designs that increase the probability of employment and productivity, especially for women and vulnerable groups, and (iii) an industry-education-government partnership model to accelerate the scale of "training-assessment-certification-placement" in line with employment and vocational priority indicators in the Bappenas (2025) plan.

A literature review covering the period from 2016 to 2025 shows that workplace learning (Lee, 2019; Monrouxe, 2017), human resource development (Ekuma, 2024; Ranta, 2023), national qualification frameworks (Zamtinah, 2018), and workforce competitiveness issues (Destek, 2023; Tănase, 2019) have developed rapidly but tend to progress separately. The study by Wardhana et al. (2024) introduced an integrated workplace learning model based on the Indonesian Qualification Framework to bridge industrial competency gaps. This model combines formal, informal, and experiential learning approaches to systematically and sustainably improve the competitiveness of Indonesian workers. This contribution has become a foundation for strengthening human resource development policies based on the actual needs of industry. The novelty of this research lies in its effort to develop a workplace learning model integrated with the IQF in a more systematic and empirical way within the context of enhancing the competitiveness of industrial human resources. This model merges formal learning, informal learning, and experience-based learning into a strategic unity aligned with national standards and industrial demands (Wardhana et al., 2024; Zamtinah, 2018). By overcoming the separation between education, training, and recognition of work experience, this study contributes both conceptually and practically to linking the workplace learning ecosystem with the national qualification framework. Such integration is expected not only to strengthen the development of individual competencies but also to accelerate the achievement of adaptive, innovative, and highly competitive human resource development goals in today's global industrial era (Ekuma, 2024).

This study aims to explain the factor structure of workplace learning based on the IQF by employing an exploratory factor analysis (EFA) approach, to examine the consistency of qualitative findings from open-ended questions in order to strengthen the validity of factor interpretation, and to provide a foundation for developing a workplace learning evaluation instrument aligned with the IQF standards as raised by Wardhana et al., (2024).
The research questions are as follows:
RQ1: How is the factor structure of workplace learning based on the IQF formed through EFA?
RQ2: How do respondents perceive the elements of workplace learning?
RQ3: Do the findings from open-ended content analysis support the interpretation of workplace learning factors identified through EFA?
RQ4: How can the results of the workplace learning factor structure be used to develop a workplace learning evaluation instrument based on the IQF in the industrial sector of Indonesia?

2. METHOD

This study employed a quantitative approach with an exploratory cross-sectional design, combining Exploratory Factor Analysis (EFA) and content analysis to identify and validate the underlying factor structure of IQF-based workplace learning. The use of EFA was deemed appropriate as it allows for the exploration of latent constructs in a domain where the theoretical structure is not yet fully established (Howard, 2016; Watkins, 2018) . This approach is particularly relevant for developing and validating complex instruments in human resource development and workplace learning contexts (Kılıç, 2020; Wardhana et al., 2024).

The study participants consisted of 400 respondents who had been working or were currently working for at least one year across various industrial sectors in Indonesia, aged between 20 and 40 years, with a gender distribution including both male and female participants, and covering socio-economic statuses (upper, middle, lower) across all provinces. A purposive sampling technique was applied to ensure respondent representation in line with inclusion criteria, while exclusion criteria were set for respondents who had never worked or had less than one year of experience. Data collection was conducted using the Populix platform, an online survey service directly connected with respondents throughout Indonesia, which facilitated questionnaire distribution and ensured geographic diversity of the data (Populix, 2025). The research instrument was a workplace learning questionnaire based on the Indonesian Qualification Framework using a differential scale from one to eight and supplemented with an open-ended question to capture deeper perceptions. The instrument was constructed based on Tables 3, 4, and 5 from the study of Wardhana et al. (2024) but without independent expert validation, making exploratory factor analysis necessary to empirically confirm its structure.

Table 1. IQF-Based Workplace Learning Factor Map

Faktor	Category	Variable
Learning	Formal Learning	Structured training, Seminar, Workshop, Course
	Informal Learning	Mentoring, On-the-job training, Coaching & counseling
	Experiential Learning	Job rotation, Internship, Industrial practice
	Learning Environment	Education level, Expert quality, Scholarship, Learning quality
Certification	Managerial Support	Career planning, Recruitment, HR planning, Pre-retirement
	Certification Process	Structured training, Certification, Course, Scholarship
	Conformance to Industry Standards	Research, HR planning, Standards
Competitiveness	Competencies and Skills	Talent management, Competency, Superior HR
	Employee Engagement	Job level, Gender, Performance, Knowledge sharing
	Task and Workload Management	Assignment, Workload, Remuneration
	Innovation and Adaptation	Innovation, Technology

Source: IQF Based Workplace Learning (Wardhana et al., 2024)

Data analysis was conducted in stages using R software (version 4.3.2), employing several packages such as psych, nFactors, and tm according to the following steps: data and library preparation; assumption testing for exploratory factor analysis, including KMO and Bartlett tests; construction of the polychoric correlation matrix; determination of the number of factors using parallel analysis and the scree plot; final EFA extraction with oblimin rotation; content analysis of open-ended questions using word frequency and word cloud methods; and mapping of the EFA results to the IQF as illustrated in Figure 1. These steps were adopted to ensure that the workplace learning instrument was structurally tested and relevant to experiential learning practices in Indonesia, while also providing opportunities for future use of similar instruments (Howard, 2016; Steiner & Grieder, 2020). Through this combination of quantitative procedures and qualitative content analysis, the study aims to formulate a credible and measurable workplace learning evaluation model aligned with the IQF.

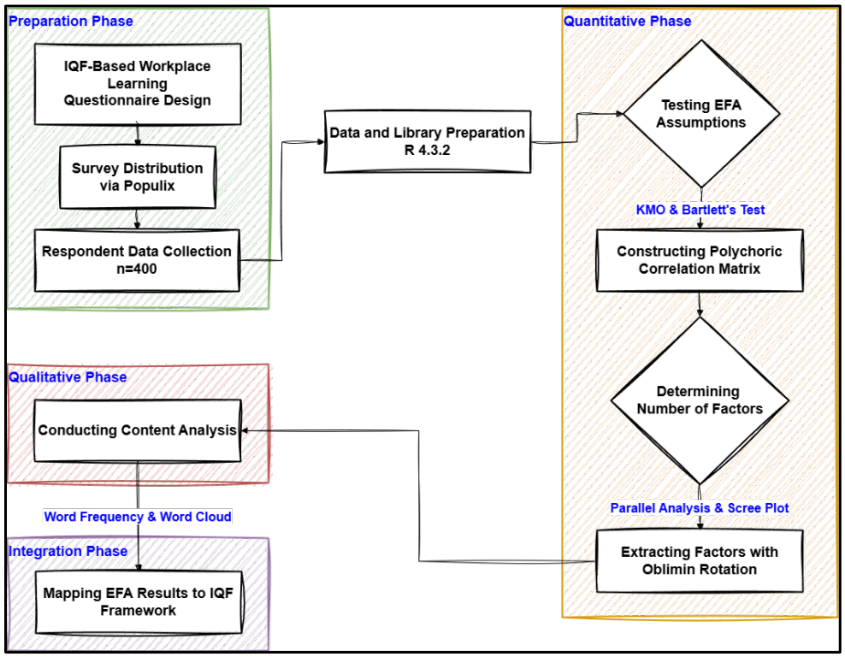

Figure 1. EFA Steps

3. RESULT AND DISCUSSION

Result

Data Overview

The study sample comprised 400 respondents who met the inclusion criteria of having prior or current employment with a minimum of one year of work experience. Data were collected using the Populix online survey platform, whereby all responses were obtained electronically from participants who provided informed consent to participate. Respondents ranged in age from 20 to 40 years; recorded sociodemographic variables included gender (male, female) and socioeconomic status, which was classified into three categories: Upper, Middle, and Lower.

Geographically, respondents are spread across all provinces in Indonesia, as shown in Table 2. This distribution offers comprehensive national coverage, encompassing major islands and diverse provincial jurisdictions.

Table 2. Data collection

Province	Number of respondents	Province	Number of respondents
Jawa Barat	96	Kalimantan Selatan	8
Jawa Tengah	63	Sulawesi Selatan	8
Jawa Timur	61	Kalimantan Timur	9
DKI Jakarta	32	Bali	7
DI Yogyakarta	23	Sulawesi Utara	7
Banten	19	Sumatera Barat	6
Lampung	11	Nanggroe Aceh Darussalam	6
Sumatera Utara	12	Riau	6
Sumatera Selatan	6	Bengkulu	3
Nusa Tenggara Barat	4	Kalimantan Barat	1
Kepulauan Riau	2	Kalimantan Tengah	2
Sulawesi Tenggara	2	Jambi	2
Sulawesi Barat	1	Maluku	1
Bangka Belitung	1	Papua	1
Sulawesi Tengah	1		

EFA Assumption Check

Statistical assumptions were examined for 36 learning items based on the Indonesian Qualifications Framework (IQF) to ensure data validity before exploratory factor analysis was conducted. The results of the data distribution assumption analysis and outlier identification are presented in detail in Table 3.

Table 3. Workplace Learning Item Assumptions

Item	Skewness	Kurtosis	SD	Outlier Detected
Seminar	–0.70	–0.16	1.89	Yes
Workshop	–1.12	1.34	1.41	No
Course 4	–1.30	1.90	1.52	No
Mentoring	–1.61	3.40	1.13	Yes
On-the-job training	–1.59	3.06	1.45	No
Coaching & counseling	–1.47	2.97	1.26	No
Job rotation	–1.45	2.99	1.34	No
Internship	–1.72	3.78	1.20	Yes
Industrial practice	–1.46	3.21	1.31	No
Education level	–1.14	0.74	1.91	No
Expert quality	–1.01	1.18	1.19	No
Scholarship 13	–1.56	2.54	1.60	No
Learning quality	–0.75	0.39	1.15	No
Career planning	–1.31	1.94	1.57	No
Recruitment	–0.79	0.64	1.26	No
HR planning 17	–1.01	0.96	1.42	No
Pre-retirement	–0.90	0.21	1.88	Yes

Item	Skewness	Kurtosis	SD	Outlier Detected
Structured training 19	–0.91	0.85	1.41	No
Certification	–1.53	3.09	1.37	No
Course 21	–0.97	0.65	1.15	No
Scholarship 22	–1.30	1.93	1.59	No
Research	–1.13	1.81	1.39	No
HR planning 24	–0.98	0.64	1.12	No
Standards	–1.14	1.80	1.30	No
Talent management	–0.96	0.92	1.29	No
Competency	–1.52	3.59	1.17	No
Superior HR	–0.90	0.67	1.36	No
Job level	–1.22	2.27	1.30	No
Gender	–1.49	3.20	1.42	No
Performance	–1.13	1.15	1.38	No
Knowledge sharing	–1.00	1.23	1.29	No
Assignment	–1.31	2.73	1.22	No
Workload	–0.93	0.77	1.65	Yes
Remuneration	–0.77	0.37	1.59	No
Innovation	–1.03	1.56	1.38	No
Technology	–0.83	1.22	1.15	No

The findings from the assumption check indicate that the data distribution characteristics are adequate for further factor analysis. Skewness, which consistently had negative values across all items, ranging from -0.70 to -1.72, indicated a tendency for respondents to give positive assessments of the implementation of workplace learning in the workplace. Kurtosis values ranging from -0.16 to 6.81 reflect a distribution that is close to normal, although there is a leptokurtic tendency in several indicators such as Mentoring (6.42) and Internship (6.81), which show a concentration of responses around the mean value. A moderate standard deviation in the range of 1.1-1.9 confirms reasonable variability in responses without extreme deviations in respondents' answer patterns. Multivariate outlier identification through advanced statistical analysis successfully detected 47 respondents with extreme values, who were then excluded before the factor analysis process to ensure model stability. Overall, these findings support the statistical validity of the data and its suitability for processing in the factor extraction stage through EFA, which is in line with methodological standards in psychometric research and instrument development.

KMO and Bartlett's Test

Sample suitability and correlation validity were tested using KMO and Bartlett tests to verify data readiness prior to factor extraction. The results of the analysis presented in Table 4 indicate conditions that are highly adequate for proceeding to exploratory factor analysis.

Table 4. KMO and Bartlett Test Results

Test	Results
Overall KMO	0,96
MSA range per item	0,93 – 0,98
Bartlett’s Chi-square	12.320,79
degrees of freedom (df)	630
p-value	< 0,001

The findings of the factor analysis feasibility test reveal ideal conditions for the factor extraction process. The overall Kaiser-Meyer-Olkin (KMO) value of 0.96 falls within the excellent category according to Kaiser's (1974) standard, indicating exceptional sample adequacy for factor analysis. More specifically, the Measure of Sampling Adequacy (MSA) for each item shows remarkable consistency with values ranging from 0.93 to 0.98, where none of the items have values below 0.90. This proves that each variable in the IQF-based workplace learning instrument has a significant contribution to the overall factor structure. The Bartlett's Test of Sphericity yielded a chi-square value of 12,320.79 with 630 degrees of freedom and a significance value of p 0.001, providing strong statistical confirmation that the correlation matrix is not identical to the identity matrix. These findings empirically support the existence of a strong correlation pattern among the variables analysed, thereby fulfilling

the fundamental prerequisite for meaningful factor extraction. The combination of a very high KMO value and a significant Bartlett test provides solid methodological justification for continuing exploratory factor analysis, while also reflecting the superior quality of the data in representing the workplace learning construct based on the IQF. The statistical validity confirmed by these two tests reinforces the reliability of the analytical procedures applied in this human resource development study.

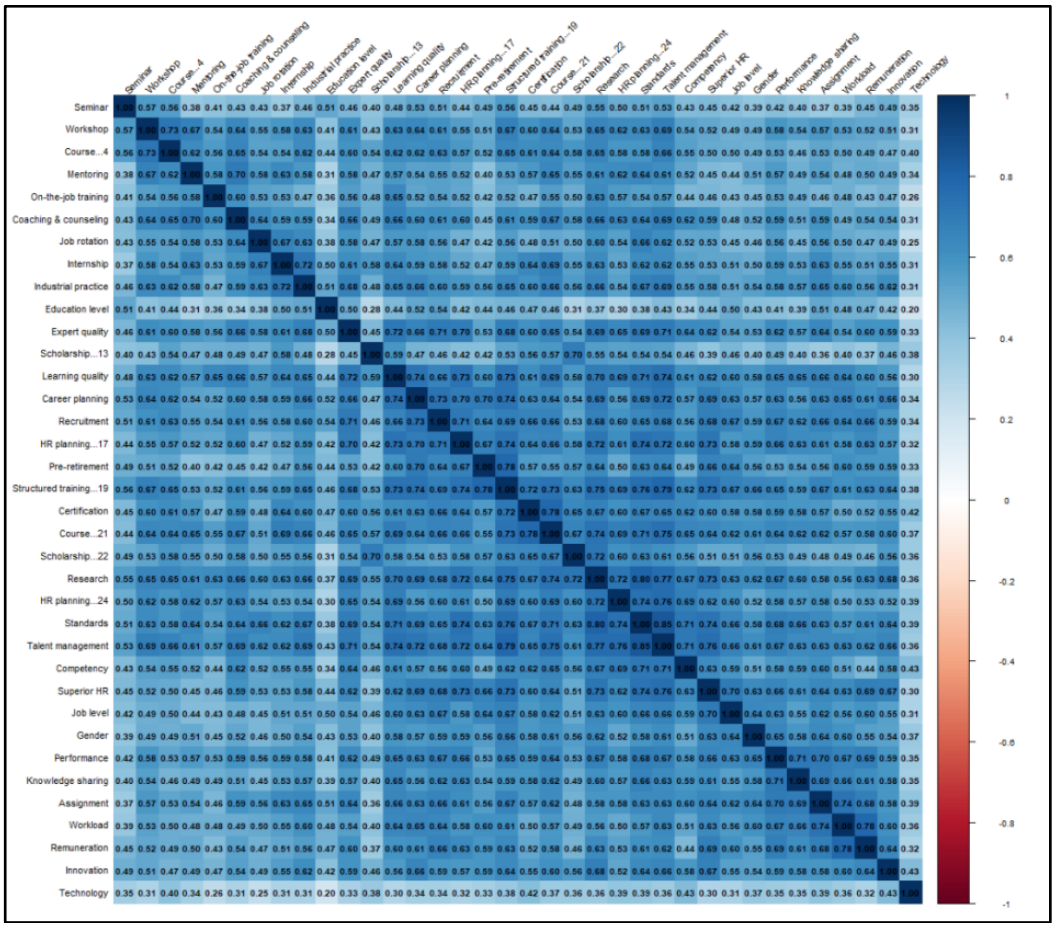

Figure 2 Correlogram Heatmap

The visualization of the polychoric correlation matrix through the heatmap in Figure 2 shows a strong relationship pattern among most workplace learning items, with inter-item correlation values generally above 0.4 and several groups of indicators that are highly correlated above 0.7. For example, structured learning clusters such as Structured Training, Certification, and Standards show a close correlation with each other, reflecting cohesion in the IQF-based formal learning domain. Other groups, such as Mentoring, Internship, and On-the-Job Training, also form a high correlation pattern, indicating the similarity of respondents' perceptions of experiential learning in the workplace. In addition, items related to innovation and technology, although having moderate correlations, remain connected in a positive correlation structure, indicating the relevance of the adaptation and modernization themes in the workplace learning framework. The dark blue gradient color that dominates the heatmap indicates that the data has a consistent internal structure, supporting the basic requirements of EFA to be extracted into meaningful factors.

Parallel Analysis and Scree Plot

To determine the optimal number of factors representing the IQF-based workplace learning structure, parallel analysis and scree plot examination were conducted. Parallel analysis compared the eigenvalues of the actual data with the eigenvalues generated from random data in Table 5, while the scree plot visualized the decrease in eigenvalues to identify the elbow point.

Table 5. Parallel Analysis Results

Factor	Original Data Eigenvalue	Simulation Eigenvalue	Decision
1	21,03	0,72	Maintained
2	1,57	0,59	Maintained
3	1,13	0,53	Maintained
4	1,05	0,48	Maintained
5	0,95	0,43	Not maintained
6	0,81	0,39	Not maintained
7	0,72	0,35	Not maintained

The parallel analysis results confirm that the first four factors have actual data eigenvalues that exceed the simulation eigenvalues, so these four factors are retained. The first factor recorded an eigenvalue of 21.03, which was far above the simulation eigenvalue of 0.72, indicating a very dominant contribution to variance. The second to fourth factors also have actual eigenvalues that are higher than those in the simulation, namely 1.57 versus 0.59 for the second factor, 1.13 versus 0.53 for the third factor, and 1.05 versus 0.48 for the fourth factor. Meanwhile, the fifth factor and subsequent factors have actual eigenvalues below the simulation value, so they are not retained. This finding is consistent with the scree plot visualization in Fig. 3, which shows a sharp decline in eigenvalues in the first factor, followed by a gradual decline up to the fourth factor, and then a relatively stable line thereafter. This pattern confirms that the four main factors represent an adequate and stable latent structure in the data, with a total variance explained of approximately 65 percent. Thus, the decision to retain four factors is supported by converging evidence from both analysis methods, ensuring statistical validity in the extraction of IQF-based workplace learning factors.

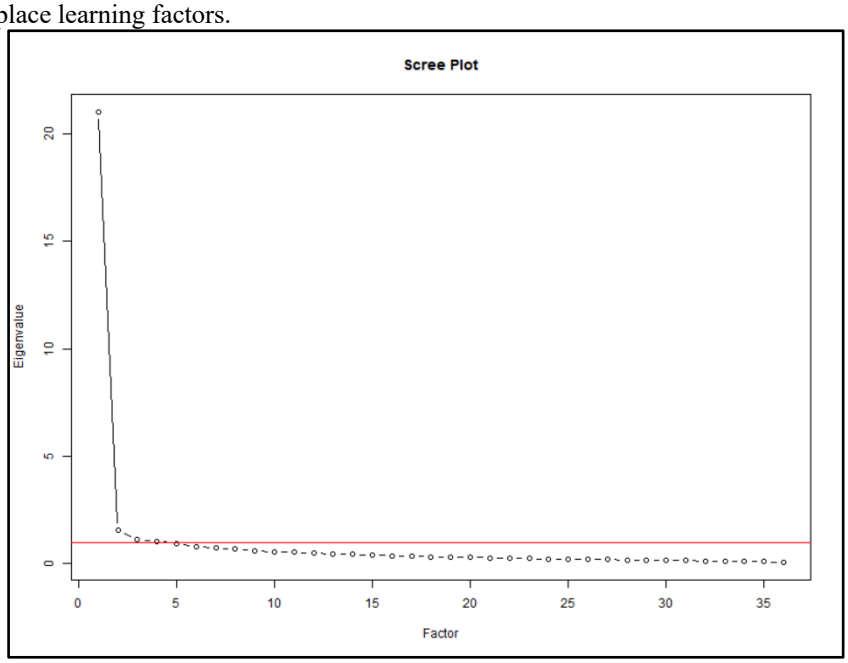

Figure 3. Scree Plot

The scree plot in Figure 3 shows a sharp slope pattern on the first factor, followed by a drastic decline until the fourth factor, then a relatively stable flat line after that. The first factor has an eigenvalue far above the other factors, indicating a dominant contribution of variance to the data, while the second to fourth factors still exceed the eigenvalue = 1 line as the Kaiser limit. After the fourth factor, the decline in eigenvalue is very small and relatively flat, indicating that the fifth factor and so on do not have a significant contribution to the total variance. This pattern supports the decision to extract four main factors in the EFA model, because the four factors are considered sufficient to explain the structure of the IQF-based workplace learning variable consistently.

Exploratory Factor Analysis

To identify the dimensional structure of IQF-based workplace learning, factor extraction was performed using the principal axis factoring method with oblimin rotation. The analysis results showed a clear and interpretable factor loading configuration, as presented in Table 6.

Table 6. Workplace Learning Factor Loadings

Item	PA1	PA2	PA3	PA4	Dominant
Structured training	0.73	0.05	–0.04	0.25	PA1
Certification	0.55	0.02	0.19	0.16	PA1
Standards	0.76	0.13	0.13	–0.09	PA1
Research	0.77	0.01	0.15	0.04	PA1
HR planning	0.65	0.22	–0.04	0.08	PA1
Mentoring	0.17	0.15	0.64	–0.03	PA3
Internship	0.04	0.28	0.55	0.16	PA3
Coaching & counselling	0.31	0.14	0.51	–0.01	PA3
Job rotation	0.09	0.22	0.51	0.10	PA3
Assignment	0.06	0.70	0.21	0.07	PA2
Workload	0.08	0.66	0.08	0.16	PA2
Remuneration	0.19	0.59	0.01	0.16	PA2
Performance	0.32	0.51	0.17	–0.04	PA2
Knowledge sharing	0.34	0.50	0.09	–0.05	PA2
Innovation	0.45	0.25	0.04	0.14	PA1
Technology	0.37	0.02	0.08	0.05	PA1
Education level	–0.17	0.29	0.13	0.61	PA4

The results of factor exploration confirm the formation of four coherent and statistically valid dimensions of workplace learning. The four factors cumulatively explain 65% of the data variance, with individual contributions of 31% for PA1, 14% for PA2, 13% for PA3, and 8% for PA4. The first factor (**PA1**) is dominated by indicators of structured training (0.73), standards (0.76), research (0.77), HR planning (0.65), and certification (0.55), representing the dimension of **Structured Competency Development**. The second factor (**PA2**) contains high loadings on assignment (0.70), workload (0.66), remuneration (0.59), performance (0.51), and knowledge sharing (0.50), reflecting the dimensions of **Performance Management and Workload**. The third factor (**PA3**) consistently shows substantial loading on experiential learning through mentoring (0.64), internship (0.55), coaching & counselling (0.51), and job rotation (0.51), forming the **Experience-Based Learning** dimension. The fourth factor (**PA4**) is primarily determined by education level (0.61) with a moderate contribution from innovation, forming the **Educational Qualifications** dimension. The validity of the model is reinforced by an RMSR value of 0.03, indicating minimal residuals, as well as moderate inter-factor correlations (0.32–0.65), confirming the existence of synergistic relationships while maintaining the unique characteristics of each dimension. All indicators show communality above 0.20 with an average item complexity of 1.8, confirming adequate factor extraction quality. The clean loading configuration without high cross-loading validates a robust factor structure that is ready for the development of IQF-based workplace learning evaluation instruments.

Content Analysis

To enrich the interpretation of quantitative findings, content analysis was conducted on respondents' open-ended responses using word frequency analysis and word cloud visualization, as presented in Figure 4.

Figure 4. Word cloud Workplace Learning Based on IQF

Content analysis reveals significant convergence between respondents' qualitative perceptions and quantitative factor structures. Dominant keywords such as work (90), skills (56), experience (37), training (35), expertise (32), and competence (27) reflect respondents' focus on strengthening practical capabilities in the workplace. This group of words consistently supports the PA1 (Structured Competency Development) dimension through an emphasis on structured training and competency mastery, as well as PA3 (Experience-Based Learning) through a focus on learning based on direct experience. The emergence of the words "power" (33) and "competition" (21) indicates an orientation towards increasing individual competitiveness, which is in line with the integration of the performance system in PA2 (Performance Management and Workload). Meanwhile, the words technology (17) and development (16) reinforce the relevance of innovation adaptation in the learning framework, which is related to the content of innovation and technology in PA1 and the educational foundation in PA4 (Educational Qualifications). This word frequency pattern not only confirms the empirical validity of the four EFA factors but also confirms that IQF-based workplace learning is perceived as an integrated ecosystem that combines formal, informal, and experiential pathways. The consistency of these qualitative-quantitative findings strengthens the reliability of the proposed workplace learning model and provides a contextual basis for the development of holistic evaluation instruments that are relevant to the needs of Indonesian industry.

Discussion

RQ1: How is the factor structure of workplace learning based on the IQF formed through EFA?

The structure of workplace learning factors based on the IQF, validated through EFA on 36 items, shows four statistically coherent and robust dimensions, with a very high KMO values above 0.90 and a significant Bartlett's Test of Sphericity ($p<0.001$), providing strong methodological justification for factor extraction. The four factors successfully extracted cumulatively explain 65% of the data variance, reflecting a learning ecosystem that is perceived as a combination of formal, informal, and experiential pathways. These factors are PA1, which accounts for 31% of the variance, PA2 14%, PA3 13%, and PA4 8%.

Dimension PA1 is dominated by formal learning indicators that are oriented towards systems and standards, with the highest loadings on Research (0.77), Standards (0.76), Structured training (0.73), and HR planning (0.65). This factor also includes aspects of modernization such as Innovation (0.45) and Technology (0.37) and is conceptually like the findings in the LCS (Learning Culture Scale) instrument for Small and Medium Enterprises (SMEs), which includes the need for an organizational learning structure and learning-oriented leadership to facilitate learning. (Vos et al., 2025). Conversely, PA3 explicitly groups informal elements and guidance, as indicated by Mentoring (0.64), Internship (0.55), Coaching & counselling (0.51), and Job rotation (0.51). This finding resonates with the literature on professional development, which recognizes experimenting, reflecting, and asking for feedback as core learning activities in the workplace (Evers et al., 2025), and emphasizes that mentoring is an effective mechanism for social support and learning (Waaland, 2017).

PA2 shows a very distinctive grouping in the context of IQF, where Assignment (0.70), Workload (0.66), and Remuneration (0.59) have a strong relationship with Performance (0.51) and Knowledge sharing (0.50). This factor structure distinguishes it from other studies that often treat workload as a challenge or obstacle to learning, especially in the education sector (Evers et al., 2025; Vos et al., 2025), and highlights the view that knowledge

sharing must be integrated with compensation mechanisms and performance results. This grouping is consistent with relevant research in Vietnam showing that online knowledge sharing positively influences employee innovation, mediated by task crafting (Bui et al., 2025), which implies that sharing knowledge is a proactive behavior that functionally reduces the effort and time required to complete tasks (Bui et al., 2025). Finally, PA4 is the smallest factor and is dominated by Education level (0.61), reflecting an emphasis on formal qualifications within the IQF, which differs from learning frameworks that focus primarily on workplace learning activities such as Professional Development at Work (Evers et al., 2025).

To improve workforce development policies in Indonesia's industrial sector, these findings lead to specific practical recommendations: First, given the dominance of PA1, policies should strengthen formalization and standardization by mandating the integration of research and technology adoption into structured training and certification processes organized by industry, ensuring the relevance of competencies based on the latest knowledge (Vos et al., 2025). Second, there must be a policy that institutionalizes PA3 by establishing mentoring and coaching & counseling as formal job responsibilities for senior employees (Dellve et al., 2025; Waaland, 2017), and not just as an ad hoc activity, thereby ensuring consistent social support and learning for new or inexperienced employees (Dellve et al., 2025; Waaland, 2017). Third, to address the clustering found in PA2, the government and industry must design incentive systems that explicitly link remuneration and performance with active participation in knowledge sharing (Bui et al., 2025), to make knowledge sharing a valued and measurable asset, rather than an additional workload, and to build a culture that is resilient to competition. The implementation of policies aligned with these four dimensions of EFA will facilitate the development of holistic, effective, and measurable competencies in the context of IQF.

WPL Based on IQF Theoretical Model

The IQF-Based Workplace Learning Model in Figure 5 maps four complementary latent constructs to explain workplace learning. PA1 represents formal and standardized learning governance, reflected in structured training, certification, work standards, research, and human resource planning, while also incorporating aspects of innovation and technology. PA2 captures the integration of learning with daily performance systems through assignments, workload, remuneration, performance, and knowledge sharing. PA3 emphasizes capability enhancement mechanisms through mentoring, internships, coaching/counselling, and job rotation. PA4 positions educational level as the foundation that conditions the effectiveness of individual engagement in structured learning and other work practices.

Conceptually, this model positions workplace learning as a multi-level system: PA1 and PA2 serve as supports, PA3 serves as a competency development engine, and PA4 serves as a prerequisite that strengthens individual absorption. Moderate correlations between factors indicate synergy as well as distinct characteristics, making this model relevant as a basis for mapping, measuring, and designing IQF-based learning interventions, as well as a foundation for subsequent confirmatory testing (CFA).

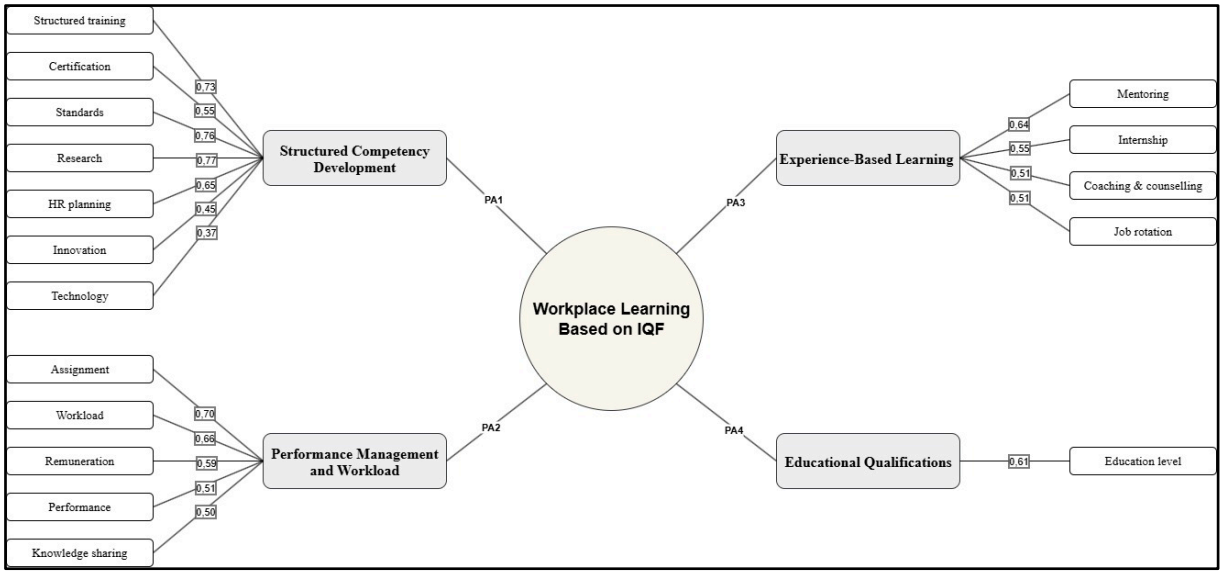

Figure 5. IQF-Based Workplace Learning Model

RQ2: How do respondents perceive the elements of workplace learning?

Based on the results of descriptive analysis and in-depth content analysis of 36 workplace learning items based on the IQF, respondents' perceptions of workplace learning elements tended to be very positive, as reflected in the average skewness value ranging from −0.70 to −1.72, indicating a tendency for respondents to give positive assessments of the implementation of workplace learning. Kurtosis values ranging from −0.16 to 6.81, with several indicators such as Mentoring (6.42) and Internship (6.81) showing a leptokurtic tendency, indicate a high concentration of responses around the average value for these experience-based learning activities.

Qualitatively, respondents' perceptions were highly focused on strengthening practical capacity in the workplace, as indicated by the frequency analysis of dominant keywords such as "work" (90), "skills" (56), "experience" (37), "training" (35), "expertise" (32), and "competence" (27). This group of words consistently supports the PA1 dimension through an emphasis on structured training and mastery of competencies, as well as the PA3 dimension through a focus on learning based on direct experience. Furthermore, the emergence of the words "power" (33) and "competition" (21) indicates the respondents' orientation towards increasing individual competitiveness, which is in line with the PA2 dimension that integrates performance systems. The words "technology" (17) and "development" (16) reinforce the relevance of innovation adaptation within the learning framework, linking it to innovation and technology content in PA1, as well as the educational foundation in PA4. The consistency between these qualitative findings and the four EFA factors confirms that IQF-based workplace learning is perceived as an integrated ecosystem that combines formal, informal, and experiential pathways.

Positive perceptions and a focus on experience and competence reveal similarities and differences with previous workforce development literature. The high perception of mentoring and internships is in line with research highlighting mentoring and coaching as important factors in workplace-based experiential learning (Waaland, 2017). In addition, the focus on experience and skills found in content analysis reinforces findings in the context of vocational education and training (VET) that workplace practices are a powerful and widely recognized source of learning, and that existing work experience plays a role in achieving agency (Erss et al., 2024).

The dominance of keywords referring to skills, expertise, and competence is similar to the finding that informal learning in the workplace, as measured by the Teachers' Professional Development at Work instrument, involves activities such as experimenting, reflecting, and asking for feedback (Evers et al., 2025), all of which are oriented towards improving practices and performance (Evers et al., 2025).

The perception that learning is closely related to competition and power reflects a perspective in the industrial sector that is more results-oriented and utilitarian. This contrasts with the educational context, where emotional demands are the focus of research, but is consistent with findings in IT companies that show stakeholders place great importance on the utilitarian benefits of learning, which aims to increase productivity and the acquisition of skills relevant to remaining competitive (Palmquist, 2023).

Within the IQF framework, respondents' positive perceptions include the unique dimension of PA2. Although workload is often considered an obstacle (Evers et al., 2025; Vos et al., 2025), in this context, workload, remuneration, and assignment are linked to knowledge sharing and performance. This shows that respondents view this system as a single entity, in which performance and knowledge sharing, which are task-oriented, are positively associated with rewards. This differs from other studies that focus on the learning potential of the workplace (LPW) using emotional demands as a construct that is not correlated (divergent) with learning (Evers et al., 2025).

Despite the strong emphasis on experiential (informal) learning, PA4 items remain a significant factor. This shows that, in the Indonesian context (IQF), formal educational qualifications are still considered an important element of workplace learning, which differs significantly from learning approaches that focus exclusively on workplace activities.

Based on the positive and integrated perceptions of respondents, workforce development policies in Indonesia's industrial sector should adopt a holistic approach that combines formal elements, experience, and incentive systems. First, given the high demand for skills, expertise, and competence, and the relevance of the PA1 dimension, policies must ensure that structured training and certification are directly linked to innovative tasks and projects (Innovation and Technology in PA1). The government can provide tax incentives to industrial companies that adopt training curricula that are regularly updated, research-based (Research in PA1), and immediately lead to certified competencies. Second, because Mentoring, Internship, Coaching & Counselling, and Job Rotation (PA3) are perceived as important learning paths, policies must institutionalize the roles of mentors and coaches. Senior employees who become mentors must receive formal pedagogical training and official recognition (remuneration or career incentives) (Waaland, 2017), making mentoring a defined job function, thereby ensuring the quality of support and consistency in the transfer of experience and knowledge. Third, the perception that integrates Knowledge Sharing, Performance, Workload, and Remuneration (PA2) implies that incentives are the main driver. Industry HR policies should develop explicit and transparent performance metric systems that reward

employees for their contributions to online or peer-to-peer knowledge sharing, as this helps increase competitiveness and reduces the risk that knowledge sharing will be perceived as an additional workload that is not valued, in line with findings that knowledge sharing mediates employee innovation (Bui et al., 2025). Fourth, although informal learning is highly valued, the role of education level (PA4) is still important. Policies in the industrial sector must create detailed career path mapping that clearly links formal qualification levels (IQF) with requirements and opportunities for competency development in the workplace (PA1 and PA3). This ensures that educational background serves as a strong foundation, motivating employees to continue formal and informal learning as part of a structured career advancement path.

RQ3: Do the findings from open-ended content analysis support the interpretation of workplace learning factors identified through EFA?

The findings from the open content analysis significantly support the interpretation of workplace learning dimensions identified through Exploratory Factor Analysis (EFA), confirming substantial convergence between respondents' qualitative perceptions and quantitative factor structures, which empirically validate the four proposed factors. This convergence is clearly seen from the dominant keywords expressed by respondents, such as skills, experience, and training. Specifically, the emphasis on training, expertise, and competence consistently supports the PA1 dimension, while a strong focus on direct experience validates the PA3 dimension. Furthermore, the emergence of results-oriented and work environment-oriented words such as power and competition in line with the integration of performance systems in the PA2 dimension shows that learning is seen as a crucial mechanism for improving individual competitiveness in the workplace. The elements of technology and development that also appear reinforce the relevance of innovation adaptation, linking it to the content of innovation in PA1 and the foundation of Education (PA4). The consistency of these qualitative and quantitative findings confirms that workplace learning based on the IQF is perceived as an integrated ecosystem that combines formal, informal, and experiential pathways.

In the context of comparison with previous research, the validation of this factor structure is in line with methodological studies in the development of workplace learning measurement instruments, such as the validation of the Teachers' Professional Development at Work (TPD@Work) questionnaire, which confirmed its six-factor structure among teacher educators through confirmatory factor analysis (CFA) (Evers et al., 2025). The PA1 and PA3 factor structures found in Indonesia are also consistent with the widely recognized workplace learning framework, which emphasizes the importance of activities such as collaboration, reflection, and knowledge renewal through printed materials or training, which are components of TPD@Work (Evers et al., 2025). However, this study provides specific insights into how these factors are articulated in the context of the Indonesian workforce through the lens of the IQF, explicitly highlighting the impact of performance dynamics and workload (PA2), an aspect confirmed by qualitative findings regarding competition and power. Meanwhile, studies on gamification also found that stakeholders have a strong preference for the utilitarian benefits of learning in the workplace, such as increased productivity and efficiency (Palmquist, 2023), The findings here indicate the need for proactive behavioral mechanisms such as task crafting, which acts as a mediator between online knowledge sharing and employee innovation, which is also reinforced by departmental support for innovation (Bui et al., 2025).

For practical policy recommendations to improve workforce development in Indonesia's industrial sector, it is important to adopt a holistic framework that formally integrates Experience-Based Learning (PA3) and Structured Competency Development (PA1). Policies should prioritize investment in programs such as structured mentoring and coaching that are specifically designed to leverage workplace experience and strengthen skills, which have been proven effective in supporting employees' basic psychological needs such as autonomy and competence (Dellve et al., 2025). Given the findings on Performance Management (PA2) being influenced by competition, policies should explicitly link competency learning outcomes (PA1, PA3) to performance management systems, remuneration, and career promotion (Bui et al., 2025), encouraging employees to engage in proactive behavior that is task-oriented and focused on self-development in order to meet the demands of lifelong learning amid rapid technological change (Bui et al., 2025; Palmquist, 2023). In addition, because the Education factor (PA4) correlates with technology adaptation and innovation, government and industry policies must focus on aligning educational qualifications with industry needs (IQF) and providing adequate resources (PA1) for training and adaptation to new technologies, ensuring that a strong educational foundation supports innovation.

RQ4: How can the results of the workplace learning factor structure be used to develop a workplace learning evaluation instrument based on the IQF in the industrial sector of Indonesia?

The structure of workplace learning factors identified through EFA provides a highly valid and ready-to-use framework for developing IQF-based learning evaluation instruments in the industrial sector. With four main dimensions that cumulatively explain 65% of the data variance and supported by a very high KMO value and minimal RMSR, this evaluation instrument must be designed to explicitly measure all four pillars to ensure a

holistic and contextual understanding. PA1 serves as the core dimension for measuring the effectiveness of formal investments, such as structured training, compliance with standards, and certification acquisition, which are crucial components in IQF-based instruments. PA3, which is dominated by mentoring, internships, coaching & counseling, and job rotation, must be translated into items that assess the quality of informal and social learning paths, in line with respondents' perceptions that learning is also driven by experience. Furthermore, PA2 demands that the instrument not only assess learning activities, but also how learning is integrated and results in performance, remuneration, and how workload is managed, which respondents perceive as key to improving competition. Finally, PA4 is a metric for measuring the role of formal background (education level) and its impact on innovation and technology adaptation. The validation of this multidimensional factor structure is consistent with previous research efforts in validating instruments that measure learning activities in the workplace, such as the validation of the TPD@Work questionnaire, which confirmed its six-factor structure in the context of education (Evers et al., 2025). The difference lies in the explicit articulation of PA2 and PA4 as separate dimensions, reflecting specific dynamics and a focus on qualifications in the context of Indonesian industry, compared to TPD@Work's focus, which leans more towards collaborative activities and reflection (Evers et al., 2025). In practice, workforce development policies in Indonesia's industrial sector should adopt this four-dimensional evaluation instrument as an audit tool to identify strengths and weaknesses in the learning ecosystem, as recommended for learning culture measurement tools (Vos et al., 2025). The results of this evaluation can be used to allocate resources in a more targeted manner, for example by increasing support for mentoring and coaching (PA3) and adjusting HR planning (PA1) to ensure that formal training programs are aligned with competency standards relevant to the IQF. In addition, due to the high factor loading on workload and remuneration in PA2, policies must ensure that proactive learning efforts, such as those supported by the emergence of skills and competence in content analysis, are fairly rewarded in the performance management system, while managing workloads so as not to hinder participation in lifelong learning. This evaluation instrument will not only serve as a measurement tool, but also as a policy guide that encourages integration between formal, informal, and performance-based learning to address the challenges of technological adaptation and innovation.

4. CONCLUSION

Main Results

This study maps four statistically valid and complementary dimensions of workplace learning based on the IQF, namely Structured Competency Development, Performance and Workload Management, Experience-Based Learning, and Educational Qualifications. The four dimensions explain approximately sixty-five percent of the data diversity, with contributions of thirty-one percent, fourteen percent, thirteen percent, and eight percent, respectively. The first dimension is supported by structured training, work standards, research, human resource planning, and certification. The second dimension encompasses assignments, workload, remuneration, performance, and knowledge sharing. The third dimension emphasizes the role of mentoring, internships, coaching, and job rotation. The fourth-dimension places educational attainment as the foundation for learning participation and innovation adoption. The decision to extract four factors was supported by parallel analysis and scree plot patterns, while feasibility and inter-factor correlation tests showed a clean structure and very small residuals. Content analysis revealed consistency in the findings with the emergence of verbs, skills, experience, training, competencies, and indications of a competitive and technological orientation that reinforced the mapping of these factors. These findings link the strengthening of the learning ecosystem with policy needs that demand competency standardization, performance system orchestration, and the expansion of meaningful work experience pathways.

Theoretical Contribution

The main theoretical contribution of this study is the formulation of a conceptual model of workplace learning based on the IQF that combines formal learning management, integration of learning with daily performance systems, mechanisms for capacity building through experience, and the role of educational qualification prerequisites. This model positions Structured Competency Development and Performance Management as supporting factors, Experience-Based Learning as a driver of competency, and Educational Qualifications as a reinforcement of individual absorption capacity. The clarity of boundaries and synergy between factors enriches the literature, which previously tended to separate formal and informal pathways, while also justifying that educational qualifications remain relevant as a contextual variable in the national qualification's framework. Therefore, this model provides a foundation for measuring, mapping, and designing workplace learning interventions that are compatible with qualification standards and ready to be followed up through confirmatory testing.

Practical Implications

In practical terms, the results of this study point to policy designs that can be immediately implemented in the Indonesian industrial sector. First, organizations need to link training curricula with research and the adoption of the latest technologies so that certification leads to performance and innovation, in line with KKNI standardization requirements. Second, mentoring, internships, coaching, and job rotation must be positioned as formal senior work functions so that experience transfer is consistent and recognized in career paths. Third, performance systems must weight contributions to knowledge sharing and learning outcomes through transparent metrics and fair incentives so that learning participation is not seen as an additional burden. Fourth, career path maps must link qualification levels with opportunities for competency development in the workplace so that formal education serves as the foundation for skills mobility. Macro-wise, this set of measures is in line with the mandate to strengthen the vocational ecosystem and promote an integrated scheme of training, certification assessment, and placement as instruments for increasing labor productivity and competitiveness.

Research Limitations

The limitations of this study lie in its cross-sectional design, which does not capture the dynamics of learning and performance over time, the questionnaire data source, which relies on respondents' perceptions, and the need for further validation at the construct level through confirmatory testing. The instrument was developed from a factor map based on the IQF and tested using EFA, thus requiring confirmation of the structure through confirmatory analysis, testing of cross-sector invariance, and item calibration in specific industrial populations. Given this background, generalizations should be made cautiously and guided by application studies in real business units to ensure the relationship between dimensions and outcome indicators such as productivity, innovation rate, occupational safety, retention, and career mobility.

Recommendations for Further Research

Further research is needed to validate the model through confirmatory testing and invariance testing in priority sectors, as well as conducting longitudinal studies to assess the effects of learning on performance and innovation. It is recommended that policy trials be conducted in labor-intensive manufacturing plants, medium-sized hospitals, logistics operators, information technology companies, and energy companies to test intervention packages that combine research- and technology-based training, formal mentoring, knowledge-sharing metrics, and career maps that link qualifications to learning opportunities in the workplace. The development of a four-dimensional instrument can be used as a tool to audit the learning ecosystem in business units to target resource allocation, organize HR planning, and align certification programs with the IQF competency standards scheme, while linking learning achievements to the remuneration and workload systems so that learning participation contributes significantly to productivity and competitiveness. This direction will strengthen the synergy between vocational education and industry through an integrated scheme that accelerates the placement of competent workers.

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