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Validation of the Korean Version of the Teamwork Quality (TWQ) Scale and its Factors Affecting Employees' Job Performance

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Abstract:

Background: Despite its increasing use in South Korean research, the Teamwork Quality (TWQ) scale has often been modified without proper validation, raising concerns about its reliability and consistency. Given the growing importance of teamwork, validating the Korean version of the 20-item TWQ scale is essential for accurate assessment. Additionally, while TWQ is known to influence job performance, few studies have examined this relationship using a single-construct measure focused on in-role behaviors, highlighting the need for a more precise and standardized approach.

Objectives: This study aimed to enhance the understanding of TWQ by first validating the Korean version of a 20-item TWQ measurement tool and then examining the relationship between TWQ factors and job performance, focusing on in-role behaviors across various organizations in South Korea.

Methods: A total of 266 employed adults in South Korea participated in the study. Confirmatory factor analysis was conducted to evaluate the validity and applicability of the translated TWQ scale in the Korean context. Multiple regression analysis examined the overall relationship between TWQ factors and job performance, as well as the unique contribution of each factor while considering their interdependencies.

Results: The Korean TWQ scale showed strong construct validity and reliability and acceptable convergent validity, though coordination and mutual support overlapped in discriminant validity. Four dimensions, effort, cohesion, balanced contributions, and communication, significantly influenced perceived job performance.

Conclusion: Organizations can use the validated TWQ scale to assess team dynamics, identify strengths, and enhance collaboration. Furthermore, prioritizing effort, cohesion, balance of contributions, and communication can foster a more effective work environment and improve job performance.

Keywords: Teamwork quality, Job performance, In-role behaviors, Effort, Cohesion, Balanced contributions, Communication.

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1. INTRODUCTION

Organizations are increasingly adopting decentralized structures to enhance autonomy and improve overall performance [1, 2]. This shift reflects a broader emphasis on agility and adaptability, which are essential for fostering innovation, facilitating rapid decision-making, and ensuring responsiveness in dynamic environments [3, 4]. Consequently, many companies have transitioned from rigid hierarchical systems to team-based structures that encourage interdependence, collective goal-setting, coordinated task execution, and shared accountability [5, 6]. Such structures are particularly valuable when confronting complex challenges that require diverse expertise and innovative solutions [7-9]. Consequently, teams have become a fundamental component of modern organizations, with many employees working within these structures to drive efficiency and productivity [6, 10, 11]. In South Korea, the economic restructuring triggered by the 1997–2001 International Monetary Fund crisis further reinforced the necessity for companies to adopt small-scale, horizontal organizational models to maintain competitiveness and adaptability in a rapidly changing business landscape [7].

Research on teamwork continues to explore its various dimensions and implications across domains. For example, Crawford *et al*. [12] examined how sports coaches cultivate teamwork by strategically structuring team selection, defining player roles, and fostering strong relationships between coaches and athletes. Their study highlights the importance of leadership in developing cohesive and high-performing teams. Similarly, Bokaii [13] investigated teamwork dynamics within Lebanese NGOs, revealing that organizations implementing structured collaborative practices experience significant performance improvements, primarily due to enhanced communication and the establishment of effective compensation systems. These studies collectively emphasize the universal value of teamwork and provide insights into strategies that organizations can adopt to enhance collaborative success.

However, Hoegl and Gemuenden [14] asserted that existing tools for measuring teamwork often fail to adequately capture the multifaceted nature of team operations, leading to inconsistent assessments. Furthermore, despite demonstrating a correlation between the mere presence of team-based organizations and their performance outcomes [15-18], these traditional tools do not clearly define or measure the collaborative processes within teams. In other words, these tools often fall short of measuring the quality of collaborative work, which is essential to good teamwork. Hoegl and Gemuenden [14] assumed that the success of a task is influenced by how well team members cooperate and interact with each other within teams. Accordingly, they devised an instrument to assess teamwork quality (TWQ), conceptualized as a comprehensive measure of the quality of interactions within teams. This measurement instrument is based on the premise that performance is influenced by not only the quantity and precision of task-related activities but also the quality of cooperation and interaction among team members. It encompasses various elements, including the emotions experienced within the team, and places greater emphasis on the interactions among team members rather than solely on their work activities.

Hoegl and Gemuenden [14] elucidated the dynamics of team collaboration by identifying six dimensions of the collaborative team process, which collectively constitute the concept of TWQ. These dimensions encompass both task-oriented activities and social interactions within the team context. The six TWQ dimensions, communication, coordination, balance of member contributions, mutual support, effort, and cohesion, constitute essential metrics for assessing performance-relevant aspects of team internal interaction. Communication, as the foundational element, facilitates information exchange and is characterized by its frequency, formalization, structure, and openness. Effective coordination ensures the harmonization of individual contributions towards a common goal, while a balance in member contributions allows for the equitable sharing of expertise. Mutual support emphasizes cooperation over competition, fostering trust and integration of team members' skills. Norms regarding effort guarantee that all members contribute equally to the team's goals, and cohesion reflects the emotional attachment members feel toward the team, a critical factor for sustained collaboration. Collectively, these elements form a comprehensive framework for understanding and improving TWQ. The framework emphasizes the quality of collaborative efforts rather than the specific content of tasks and activities. These components assess the effectiveness of task-relevant information exchange, irrespective of the subject matter being communicated.

TWQ is conceptualized as a multifaceted higher-order construct, which posits that highly collaborative teams exhibit behaviors across six distinct facets. These facets collectively indicate the collaborative work process within teams and are integral to the TWQ construct. This conceptualization parallels Hackman's [19] "process criteria of effectiveness," where multiple critical indicators combine to define the team task process. Each of the six facets uniquely improves overall teamwork quality, highlighting their collective role in fostering effective collaboration and enhancing team performance.

Recent empirical studies have reinforced the critical role of TWQ in enhancing team performance across various contexts. For instance, Aksekili and Stettina [20] found that all dimensions of TWQ positively impact team performance in agile software development, particularly when organizations integrate teamwork quality with diversity and inclusion initiatives. Their findings underscore the importance of fostering an inclusive team environment to maximize collaboration and innovation. Additionally, Singh *et al*. [21] longitudinally analyzed teamwork quality in project-based learning design teams, revealing that the correlation between TWQ and team performance strengthens over time, particularly in the later phases of projects. This finding highlights the evolving nature of teamwork quality and the necessity of sustained efforts to enhance collaboration throughout the project lifecycle.

TWQ also significantly fosters resilience and drives success in sectors, such as healthcare and IT. In the healthcare sector, Wang *et al*. [22] demonstrated that high teamwork quality leads to better patient outcomes by facilitating effective communication and coordination among medical professionals. Furthermore, a strong teamwork culture contributes to a more positive and resilient workplace, reducing burnout and improving job satisfaction. Similarly, Weimar *et al*. [23] examined the impact of TWQ in IT teams, finding a significant link between teamwork quality and overall team performance as rated by both team members and external stakeholders. These findings illustrate the far-reaching impact of TWQ across diverse industries and highlight the importance of contextual factors, such as cultural diversity and project complexity, in shaping teamwork dynamics.

In South Korea, while some researchers have applied the TWQ scale in empirical studies, many have selectively chosen specific items rather than using the full scale as originally developed [24-27]. Moreover, many have adapted the scale to fit specific research contexts without undergoing rigorous validation, leading to inconsistencies in its interpretation and application. These inconsistencies raise concerns about measurement validity and reliability, highlighting the need for a standardized and thoroughly validated approach to applying the TWQ scale in future research. Given the increasing focus on teamwork in contemporary organizations, establishing a robust, reliable, and culturally adapted version of the TWQ scale for Korean organizational settings is essential. The 20-item TWQ measurement tool developed by Hoegl, Weinkauf, and Gemuenden [28] is particularly well-suited for modern organizations, where teams horizontally collaborate to achieve shared goals. Therefore, validating the Korean version of this tool is necessary to improve the accuracy of teamwork assessments.

Job performance, a key determinant of organizational success, is closely linked to teamwork. In early industrial psychology, job performance was often equated with productivity [29]. However, Murphy [30] later defined it as the intentional actions of organizational members aimed at achieving organizational goals. These behaviors are recognized by formal reward systems and are integral to job descriptions [31]. Research in industrial and organizational psychology highlights job performance as a critical factor in organizational success, influencing company profits, productivity, and sustainability [32]. Given its importance, numerous studies have explored its antecedents, including ability, motivation, and managerial leadership [33-36]. However, universally defining job performance remains challenging because its perception varies by job and context [37].

Given this definitional diversity, job performance has been measured differently across disciplines and research objectives. While organizations often assess performance from a financial perspective, this approach is inadequate because multiple factors influence performance. Consequently, measuring job performance based on individual perceptions of task accomplishment, adherence to job duties, and fulfillment of organizational expectations has been suggested as a more precise alternative [31, 38]. In line with this, the job performance measurement tool developed by Williams and Anderson [31] specifically evaluates behaviors directly related to formal job requirements, distinguishing it from measures that include extra-role behaviors, such as organizational citizenship behavior [39, 40]. The tool's simplicity and specificity make it particularly effective for assessing employees' adherence to core job duties [31]. Its unidimensional nature ensures a clear and focused assessment, facilitating direct correlations between specific job-related behaviors and overall performance outcomes [41, 42].

Although substantial evidence supports the positive impact of TWQ on organizational outcomes, few studies specifically examine this relationship using a single-construct measure of job performance focused on in-role behaviors. Mesmer-Magnus and DeChurch [43] highlighted that much of the literature conflates in-role and extra-role behaviors, potentially obscuring the effects of TWQ on core job responsibilities. Mathieu and his colleagues [44] stress the need for more detailed investigations of how TWQ influences job performance in various environments. Moreover, Kearney, Gebert, and Voelpel [45] noted the significant limitations in existing studies due to the lack of focused measures that distinguish between in-role and extra-role performance.

This study aimed to investigate the relationship between teamwork quality (TWQ) and job performance, specifically in-role behaviors, across various organizations in South Korea. First, it validated the Korean version of the 20-item TWQ measurement tool developed by Hoegl *et al*. [28]. Then, using this validated tool, the study examined the relative impact of TWQ dimensions on job performance, with a particular focus on employees' core responsibilities. By achieving these objectives, this research is expected to strengthen the knowledge base concerning the relationship between TWQ and job performance while offering valuable practical insights for organizational leaders seeking to optimize team-based work environments.

For this study, the following research questions were addressed:

1. Is the Korean version of the 20-item TWQ scale a valid and reliable instrument for measuring teamwork quality within South Korean organizations?

2. Which TWQ factors are significant predictors of employees' perceived job performance in South Korea?

2. METHODS

2.1. Sample and Data Collection

Data were collected after receiving approval from the institutional review board of a university in Seoul, South Korea. Participants were recruited after being informed about the purpose and intent of the study, as well as the scope of the data to be collected. Using a stratified sampling method, 300 adults aged 20 and above, residing in South Korea and currently employed, were initially

selected and voluntarily consented to participate through an online survey platform. However, responses from 34 participants were excluded due to inattentive answering patterns or excessive missing data, resulting in a final sample of 266 participants. The sample size was determined based on the recommendation that the number of cases for factor analysis to verify construct validity should be 5 to 10 times the number of items in the measurement instrument [46, 47]. The instrument used in this study consisted of 20 items, suggesting an appropriate sample size range of 100 to 200 participants.

Out of the 266 participants, 135 (50.8%) were males, and 131 (49.2%) were females. The largest age group was participants in their thirties, comprising 30.5% of the sample, followed by those in their forties at 28.9%, twenties at 15.8%, fifties at 14.3%, and sixties at 10.5%. Regarding organizational type, the largest proportion of participants, 49.2%, were employed by small and medium-sized enterprises, followed by 19.5% in public institutions, 18.8% in middle market enterprises, 17.7% in conglomerates, and 0.8% in other organizations. In terms of years of service, 36.8% of the participants had worked for 10 years or more, 25.9% had less than 3 years of service, 23.3% had between 3 and 6 years, and 13.9% had between 6 and 9 years of service.

To assess test-retest reliability, all participants from the first survey were invited to participate in a second survey, which was administered after a three-week interval to minimize any potential influence on the results [48]. After excluding data from two participants who had missing responses on certain items in the second survey, data from 200 participants were ultimately used for the test-retest reliability analysis. This sample size is considered adequate for enhancing test-retest reliability [49].

2.2. Measures

This study employed two measurement instruments: the 20-item TWQ scale and the Korean version of the job performance scale. The TWQ short form, developed by Hoegl *et al*. [28], consists of 20 items rated on a five-point Likert scale. It incorporates six key dimensions, communication, coordination, balance of member contributions, mutual support, effort, and cohesion, originally identified by Hoegl and Gemuenden [14] as essential for understanding and improving team dynamics.

Hoegl and Gemuenden [14] initially developed the TWQ scale with 37 items but introduced a more concise version after 2004. It primarily assesses the quality of teamwork and collaboration rather than the specific content of tasks and activities. This abbreviated scale retains the original six dimensions while reducing respondent burden, enhancing practicality, and improving data collection efficiency. In its development, the Cronbach's alpha for the six dimensions ranged from 0.70 to 0.89, demonstrating its reliability.

Each dimension of the short-form TWQ scale was assessed using 2 to 5 items. Communication items evaluate interaction frequency, openness in information sharing, and satisfaction with timeliness and accuracy. Coordination items measure task alignment, avoidance of redundancy, and synchronization of interdependent work. Mutual support items reflect constructive discussions, respect for contributions, and a cooperative work atmosphere. Effort items assess commitment, responsibility, and prioritization of team goals. Items assessing the balance of member contributions reflect engagement, active participation, and complementary roles. Cohesion items measure interpersonal bonds and team unity, comprehensively assessing teamwork quality.

The job performance measurement tool developed by Williams and Anderson [31] is a unidimensional scale comprising seven items designed to assess in-role job performance. This scale uses a 5-point Likert format, ranging from 1 ("Strongly Disagree") to 5 ("Strongly Agree"), with higher scores indicating greater role performance. Each of the seven items is crafted to capture different aspects of task performance, such as the efficiency, accuracy, and thoroughness with which employees fulfill their job responsibilities. The items of the job performance scale are as follows: (1) adequately completes assigned duties; (2) fulfills responsibilities specified in the job description; (3) performs tasks that are expected of them; (4) meets formal performance requirements of the job; (5) engages in activities that will directly impact their performance evaluation; (6) neglects aspects of the job they are obligated to perform; and (7) fails to perform essential duties.

This measurement tool has been widely adopted in organizational research due to its reliability, validity, and applicability across various industries and job roles [50-54]. Williams and Anderson [31] reported a Cronbach's α reliability coefficient of 0.91 for the original scale. The Korean version of the job performance scale was validated by Cho [55]. For the Korean version of the scale, Cho [55] reported a Cronbach's α of 0.90, while Ahn [56] reported a Cronbach's α of 0.85. In this study, the sixth item, "neglects aspects of the job he/she is obligated to perform," was modified to "attends to all aspects of the job he/she is obligated to perform," and the seventh item, "fails to perform essential duties," was revised to "successfully performs all essential duties." These modifications were made to align the response orientation of the items.

2.3. Translation Process

The translation process utilized in this study is as follows: the initial step involved forward translation. Two researchers proficient in both English and Korean independently translated each item of the TWQ from English into Korean. They attempted to make the translated items simple, clear, and fluent while preserving the core meaning of the original English items. After completing the forward translation, they compared each item to identify discrepancies. Any differences were discussed and revised until a consensus was reached. This process resulted in a final translated instrument that closely reflected the meaning of the original.

The subsequent step involved backward translation. Two professional translators independently translated the outcomes of the forward translation back into English. The independent back translations were then compared and revised iteratively until a consensus was reached on the

most accurate back translation for each item. The translators followed the same principles used in the forward translation. Consequently, an English version of the TWQ was obtained, derived from the Korean-language version produced in the initial step. The researchers and back-translators compared the original instrument with the back-translated version to evaluate whether there were any conceptual or cultural differences and finalized the preliminary instrument.

Finally, the Korean version of the TWQ underwent a pilot test with 12 participants, all of whom were employees aged 25 years or older. The purpose of the pilot test was to assess the clarity of the questionnaire items and the ease of response. After completing the survey, individual interviews were conducted with the participants to determine if they had any difficulties in understanding or responding to the items. On average, it took approximately 5 minutes to complete the questionnaire, and no significant difficulties were reported. However, two participants mentioned slight difficulty in understanding the term "subtasks" in the item "the work done on subtasks was closely harmonized." Consequently, the item was revised to "the work done on subtasks (detailed tasks) was closely harmonized." This revision resulted in the completion of the final 20-item Korean version of the TWQ.

2.4. Data Analysis

A confirmatory factor analysis (CFA) was employed as one of the primary data analysis techniques in this study to evaluate the validity and applicability of the translated version of the TWQ within the Korean cultural context by examining its underlying structure. CFA is widely used in social science research to assess and validate the psychometric properties of item sets designed to measure latent constructs [57]. As a latent variable modeling technique, CFA posits that responses to related questionnaire items reflect an underlying, complex, and unobservable phenomenon, often referred to as a construct [58]. The reliability of the instrument was further confirmed through test-retest reliability by calculating the intraclass correlation coefficient (ICC) between two sets of measurement scores.

Furthermore, a multiple regression analysis was employed to assess both the overall strength of the relationships between multiple predictor variables and a single dependent variable, as well as the significance of each predictor variable by statistically controlling for the influence of other predictors [59]. Specifically, this analysis was carried out to evaluate the relative impact of independent variables, namely communication, coordination, balance of member contributions, mutual support, effort, and cohesion, on the dependent variable, *i.e.*, job performance. All statistical analyses were completed with SPSS 29.0 and AMOS 26.0.

3. RESULTS

3.1. Research Question 1

The study conducted CFA to assess the construct validity of the Korean version of the TWQ scale and confirm its six-dimensional structure. The model fit indices, presented in Table **1**, indicated a good fit: RMSEA = 0.05 (≤ 0.08), SRMR = 0.04 (≤ 0.05), CFI = 0.96 (≥ 0.90), TLI = 0.95 (≥ 0.90), and χ^2/df = 1.77 (≤ 3). Although the chi-square statistic was significant (χ^2 = 274.83, $p < 0.001$), it did not necessarily indicate poor model fit, as the chi-square test is highly sensitive to sample size and often leads to significant results even when other goodness-of-fit indices suggest an acceptable model [59, 60]. In this study, RMSEA, SRMR, CFI, and TLI all met the recommended thresholds, supporting the adequacy of the measurement model. Overall, the model satisfied the fit criteria established by Hu and Bentler [61] and Kenny, Kaniskan, and McCoach [62], confirming its suitability.

Internal convergent validity was examined based on the criteria proposed by Fornell and Larcker [63] and Bagozzi and Yi [64], using standardized factor loadings (β ≥ 0.50), average variance extracted (AVE ≥ 0.50), and construct reliability (CR ≥ 0.70). As presented in Table **2**, the standardized factor loadings for each item ranged from 0.55 to 0.88, satisfying the required threshold. The AVE values across the factors ranged from 0.42 to 0.72, with all factors except for the coordination factor (0.42) meeting the criterion. Similarly, CR values ranged from 0.68 to 0.86, though the coordination factor (0.68) slightly fell below the recommended threshold.

A comprehensive summary of the CFA results, including the model fit indices, is provided in Table **1**, while the detailed AVE and CR values are presented in Table **2**. Additionally, Fig. (**1**) visually illustrates the measurement model.

Discriminant validity was assessed using the criterion that item-level discriminant validity is established if the 95% confidence interval of the correlation coefficient (r ± 2 × standard error) does not include the value of 1 [65]. The result indicated that item-level discriminant validity was achieved between all factors, except between the coordination and mutual support factors, as the 95% confidence intervals for the correlation coefficients did not include 1. However, only the 95% confidence interval for the correlation coefficient between the coordination and mutual support factors included 1 (0.87, 1.02), indicating a lack of item-level discriminant validity between these two domains. Detailed results are presented in Table **3**.

Table 1. Model fit indices for the korean version of the TWQ scale.

Fitness index	χ^2	χ^2/df	RMSEA	SRMR	CFI	TLI
Model	274.83***	1.77	0.05	0.04	0.96	0.95

Note: $N = 266$, ***$p < 0.001$, RMSEA = root mean square error of approximation, SRMR = standardized root mean residual, CFI = comparative fit index, TLI = Tucker–Lewis index.

Table 2. Convergent validity assessment of the korean version of the TWQ scale.

Factors	Items	C.R.	Standardized Estimate (β)	AVE	CR
Communication	COM 1	11.63***	0.71	0.52	0.84
	COM 2	10.73***	0.66	-	-
	COM 3	11.93***	0.73	-	-
	COM 4	12.09***	0.73	-	-
	COM 5	-	0.77	-	-
Coordination	COO 1	10.52***	0.69	0.42	0.68
	COO 2	8.35***	0.55	-	-
	COO 3	-	0.71	-	-
Mutual support	MUT 1	10.04***	0.65	0.52	0.81
	MUT 2	11.46***	0.75	-	-
	MUT 3	11.64***	0.76	-	-
	MUT 4	-	0.72	-	-
Effort	EFF 1	13.38***	0.79	0.59	0.81
	EFF 2	12.48***	0.75	-	-
	EFF 3	-	0.77	-	-
Balance of member contributions	BAL 1	13.79***	0.76	0.66	0.86
	BAL 2	15.15***	0.82	-	-
	BAL 3	-	0.83	-	-
Cohesion	COH 1	13.15***	0.79	0.72	0.84
	COH 2	-	0.88	-	-

Note: N = 266, ***p < 0.001, C. R. = critical ratio, AVE = average variance extracted, CR = construct reliability.

Table 3. 95% Confidence interval of the correlation coefficient (r ± 2 × SE).

Factors	COM	COO	MUT	EFF	BAL
COM	-	-	-	-	-
COO	0.79, 0.92	-	-	-	-
MUT	0.78, 0.93	0.87, 1.02	-	-	-
EFF	0.81, 0.96	0.84, 0.99	0.76, 0.92	-	-
BAL	0.69, 0.84	0.80, 0.95	0.71, 0.87	0.81, 0.99	-
COH	0.65, 0.82	0.67, 0.82	0.66, 0.83	0.66, 0.85	0.63, 0.82

Note: COM = communication, COO = coordination, MUT = mutual support, EFF = effort, BAL = balance of member contributions, COH = cohesion.

The analysis of the internal consistency of the TWQ measurement tool showed Cronbach's alpha values of 0.84 for the communication factor, 0.70 for the coordination factor, 0.81 for the mutual support factor, 0.81 for the effort factor, 0.85 for the balance of member contribution factor, and 0.82 for the cohesion factor. In the test-retest reliability assessment, the intraclass correlation coefficients (ICCs) for scores across two-time points were 0.91 for the communication factor, 0.84 for the coordination factor, 0.89 for the mutual support factor, 0.86 for the effort factor, 0.87 for the balance of member contribution factor, and 0.88 for the cohesion factor.

3.2. Research Question 2

A multiple regression analysis was performed to assess the relative impact of TWQ factors on employees' job performance in South Korea. As shown in Table 4, communication, coordination, mutual support, effort, balance of member contributions, and cohesion factors collectively accounted for 62% of the variance in employees' overall job performance. Analysis of individual regression coefficients revealed that two factors, effort and cohesion, significantly contributed to explaining the variance in overall job performance, controlling for other factors at the $p < 0.01$ level. Additionally, the balance of member contributions and communication factors explained a significant portion of the variance in job performance at the $p < 0.05$ level. Therefore, each of these four factors significantly contributed to the variance in employees' overall job performance, while the remaining two factors did not show a statistically significant impact on job performance.

4. DISCUSSION

4.1. Validity and Reliability of the Korean Version of the TWQ Scale

Several South Korean studies have employed the TWQ scale. However, they often do so selectively, with items chosen to meet specific research objectives and occasionally combined with elements from other teamwork measurement tools [24, 25, 27]. Additionally, many researchers have modified the scale to fit specific study contexts with-

out thorough validation, leading to inconsistencies in its interpretation and application. These varied adaptations highlight the need for a standardized and validated Korean version of the TWQ scale. Accordingly, this study validated the Korean version of the 20-item TWQ measurement tool developed by Hoegl *et al*. [28].

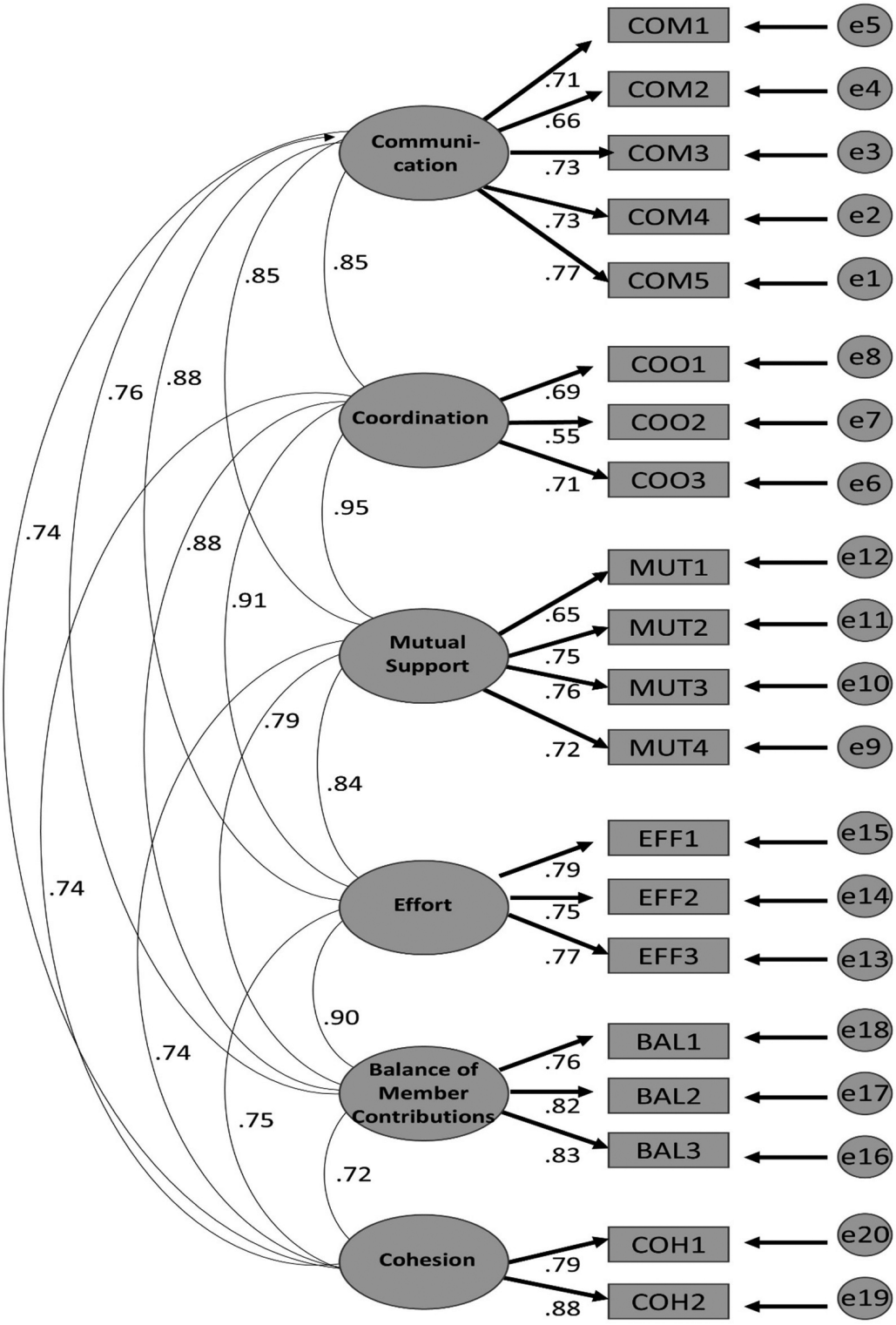

Fig. (1). Measurement model for the Korean version of the TWQ scale.

Table 4. Multiple regression analyses.

Factors	B	SE	β	*t*	*p*	R^2
COM	0.16	0.08	0.17	2.10	0.037	0.62
COO	0.14	0.07	0.14	1.87	0.062	
MUT	0.09	0.08	0.09	1.15	0.251	
EFF	0.23	0.07	0.28	3.18	0.002	
BAL	0.15	0.06	0.19	2.31	0.022	
COH	0.14	0.05	0.19	2.85	0.005	
Constant	1.79	0.19	-	9.64	0.001	-

Note: COM = communication, COO = coordination, MUT = mutual support, EFF = effort, BAL = balance of member contributions, COH = cohesion.

When a measurement tool is developed based on a theoretical foundation and its factor structure has already been established, CFA is appropriate for evaluating the tool's validity across different populations [66]. Therefore, the construct validity of the Korean version of the 20-item TWQ measurement tool was examined using CFA. The CFA results confirmed that the measurement model, consisting of six factors, demonstrated a good fit.

In the detailed CFA results, an evaluation of item-level convergent validity was conducted to assess whether the items comprising the measurement model adequately explained the respective latent variables. The standardized factor loadings met the threshold criteria across all subdomains. Regarding item-level convergent validity evaluated using AVE and CR values, one factor, coordination, did not meet the threshold criteria for AVE and CR. However, based on the guideline by Fornell and Larcker [63], which suggests that convergent validity at the item level is acceptable when the CR value exceeds 0.60 and the AVE value is greater than 0.40, the coordination factor's CR value of 0.68 and AVE value of 0.42 were deemed acceptable. Therefore, it was ultimately confirmed that the items of the instrument consistently represent the six conceptual dimensions.

In evaluating item-level discriminant validity, which assesses whether distinctions between different latent variables are clear, the coordination and mutual support factors showed some limitations. Although the items for each domain did not overlap in content, this result appears to stem from a high statistical correlation between the two factors. Thus, the low item-level discriminant validity between coordination and mutual support likely reflects their close conceptual relationship rather than a flaw in the Korean version of the tool. Nevertheless, reducing six dimensions to five should be considered in future research to determine whether merging these factors improves the scale's parsimony without compromising its theoretical integrity and measurement validity.

High correlations between dimensions of a multifaceted construct, such as teamwork quality, are not uncommon and often indicate strong interdependencies among subdimensions [59]. As these dimensions collectively represent a higher-order construct, their substantial correlations align with the theoretical expectation that teamwork-related factors are inherently interconnected. Moreover, previous research found similar patterns in constructs with closely related subcomponents, where high inter-correlations do not necessarily undermine discriminant validity but rather reflect the cohesive nature of the construct being measured [64].

In the reliability assessment, Cronbach's alpha values for the six factors ranged from 0.70 to 0.85, indicating that each factor surpassed the standard threshold of 0.70 [67], thus confirming internal consistency. The Cronbach's alpha values observed in this study were comparable to those of the original instrument, which ranged from 0.70 to 0.89 [28]. Additionally, the ICCs in this study ranged from 0.84 to 0.91 for each factor, demonstrating a very high level of reliability based on the standard criterion that an ICC above 0.75 is considered excellent [68]. Overall, the reliability assessment demonstrated that the Korean version of the 20-item TWQ measurement tool exhibits high reliability, ensuring both internal consistency and stability over time.

4.2. TWQ Factors Affecting Employees' Perceived Job Performance

This study revealed that four of the six dimensions of TWQ, namely effort, cohesion, balance of member contributions, and communication, significantly impacted South Korean employees' perceived job performance. Effort norms, defined as shared expectations regarding members' behaviors with an emphasis on workload sharing and prioritizing team tasks, significantly enhance team dynamics [14]. By fostering equitable workload distribution and mitigating issues, such as social loafing and free-riding, effort norms contribute to improved team productivity and overall effectiveness [19, 69, 70]. Since team productivity and effectiveness are closely linked to individual perceptions of job performance, it can be inferred that effort positively impacts employees' perceived job performance.

The findings of this study demonstrate that "cohesion" improves employees' perceived job performance, aligning with previous studies showing that cohesion fosters a sense of togetherness and belonging commitment [14] and enhances team performance, effectiveness, efficiency, and viability by facilitating synergistic interactions among team members [69, 71]. Evans and Dion [72], in their meta-analysis investigating the relationship between group cohesion and performance, identified that cohesive groups achieved approximately 18% greater performance than their non-cohesive counterparts. By promoting positive communication and enabling effective conflict resolution,

cohesion strengthens working relationships [69], which can improve individual job performance and overall team outcomes.

This study also found that the “balance of member contributions” positively impacts employees' perceived job performance. Achieving such balance is critical to effective teamwork, as it ensures that all team members can share their relevant knowledge and expertise without the process being dominated by any one individual [19, 73]. This is particularly crucial in cross-functional teams, where members bring diverse expertise from fields, such as engineering, human resources, and marketing, to address complex and innovative challenges. Equitable contributions not only enhance the comprehensiveness of decision-making and problem-solving but also foster a team culture that values mutual respect and recognition of individual inputs [14]. Additionally, balanced participation reinforces employees' sense of being valued, which increases their commitment and engagement toward team objectives. Therefore, balancing member contributions can be critical in fostering TWQ and enhancing employees' perceptions of their job performance.

Lastly, the findings of this study demonstrate that “communication” positively influences employees' perceived job performance. As the most fundamental dimension of TWQ, communication plays a pivotal role in enabling information exchange among team members [74]. The effectiveness of team communication can be evaluated based on its openness, structure, frequency, and formalization [14]. Openness is critical for effective teamwork, as withholding important information can hinder the integration of team members’ knowledge and expertise, which is essential for achieving shared goals [75]. The structure of communication also plays a significant role; direct interactions among team members are more efficient and reduce the risk of miscommunication compared to mediated exchanges through leaders. Informal communication, such as casual conversations or quick messages, has been shown to be particularly effective in fostering innovation and improving team efficiency [74, 76, 77]. Consequently, this study’s findings imply that fostering frequent, spontaneous, direct, and open communication is vital for enhancing employees' job performance.

In contrast, the findings revealed that “coordination” and “mutual support” did not significantly impact employees' perceived job performance. This result conflicts with previous studies finding that coordination is a critical dimension of TWQ [78-80]. One study found that teams should establish and follow well-defined work structures, timelines, and deliverables to ensure tasks are allocated efficiently, avoiding any overlaps or omissions among team members [14]. Moreover, studies have found that effective coordination unifies teams [81, 82], ensuring all members' efforts contribute to results, whereas poor coordination leads to process losses and negatively affects outcomes [83, 84]. Similarly, previous research found that mutual support fosters the cooperative mindset necessary for intensive collaboration, where team members respect each other, offer assistance when needed, and foster the development of ideas rather than engaging in competitive behavior [85]. Moreover, mutual support may play a key role in improving job performance by fostering teamwork and enhancing the effectiveness of individual tasks [86, 87].

Building on the established importance of “coordination” and “mutual support” in fostering collaboration, achieving team goals, and positively influencing outcomes, such as job performance, the findings of this study appear to diverge from those of prior research. One possible explanation could lie in variations in the contextual factors unique to this study, such as the degree of task interdependence or the specific nature of the teams' objectives, which may have moderated the impact of these dimensions on employees’ perceptions of job performance. Additionally, coordination and mutual support may primarily influence other intermediate factors, such as team cohesion or psychological safety, rather than directly affecting job performance. Therefore, their impact may be more indirect or contingent on other mediating mechanisms, warranting further investigation.

CONCLUSION

This study validated the Korean version of the 20-item Teamwork Quality (TWQ) scale, confirming its reliability and construct validity. The results support the six-factor structure of the TWQ model, demonstrating its effectiveness in capturing key aspects of teamwork quality within South Korean workplaces. The scale exhibited strong internal consistency across all dimensions, indicating its reliability as a measurement tool. These findings suggest that the Korean TWQ scale can serve as a valuable instrument for researchers and practitioners seeking to assess and enhance teamwork quality across various organizational contexts. By providing a psychometrically sound measure, this study contributes to the growing body of research on teamwork dynamics and offers practical insights for improving team collaboration and performance.

The findings underscore the critical role of teamwork quality in enhancing job performance. Effort, cohesion, balance of contributions, and communication were significant predictors of employees’ perceived job performance, highlighting the importance of fostering active participation, strong interpersonal bonds, equitable workload distribution, and effective communication within teams. In contrast, coordination and mutual support did not significantly impact job performance, suggesting that their influence may be contingent on contextual factors, such as task interdependence, team dynamics, and organizational culture.

From a practical perspective, the validated TWQ scale offers valuable implications for individuals working in team-based environments, including employees, managers, and organizational leaders. By systematically assessing teamwork quality using the validated measurement tool, organizations can identify strengths and weaknesses within their team dynamics and implement targeted interventions to enhance overall performance. Given that effort, cohesion, the balance of contributions, and communication have a direct positive impact on perceived job performance,

organizations should prioritize strategies that cultivate these teamwork dimensions. These strategies could involve training programs aimed at improving communication skills, initiatives to promote equitable workload distribution, and team-building activities that strengthen social cohesion and foster a shared sense of commitment toward common goals.

For researchers, this study provides a foundation for further exploration of the contextual and situational factors that moderate the impact of teamwork quality on job performance. Future studies should aim to investigate the conditions under which coordination and mutual support significantly contribute to workplace performance, potentially examining variables, such as task complexity, industry-specific teamwork dynamics, and leadership approaches. Furthermore, longitudinal research could offer insights into how teamwork quality evolves and how interventions designed to strengthen teamwork dimensions impact long-term organizational outcomes. By expanding on these areas of inquiry, future research can contribute to a more comprehensive understanding of teamwork quality and its broader implications for organizational effectiveness and employee well-being.

Overall, this study substantially contributes to the literature on teamwork quality by validating a Korean version of the TWQ measurement tool and highlighting its relevance in assessing and improving teamwork dynamics within South Korean organizations. The findings reinforce the critical role of effort, cohesion, balance of contributions, and communication in driving job performance while also identifying areas for further exploration regarding coordination and mutual support. By leveraging the insights gained from this study, researchers and practitioners can work toward developing more effective teamwork strategies that enhance performance, foster collaboration, and ultimately contribute to the success of organizations in an increasingly team-oriented work environment.

LIMITATIONS

This study has some limitations that should be considered when interpreting the findings. First, the study was conducted within a specific cultural and organizational context, which may limit the generalizability of the results. Similar studies should be conducted across a diversity of cultural and industry settings to assess the broader applicability of the findings.

Second, the cross-sectional design restricts the ability to capture the dynamic and evolving nature of TWQ dimensions. Therefore, causal relationships could not be established, and temporal variations in teamwork quality remain unexplored. Longitudinal studies and system dynamics modeling would provide deeper insights into how these dimensions interact and contribute to organizational resilience over time.

Finally, this study does not comprehensively account for the impact of emerging digital technologies and communication platforms on teamwork quality. Given the increasing reliance on virtual collaboration tools and AI-driven communication, future research should examine how these technological advancements shape team dynamics, coordination, and performance in contemporary work environments.

AUTHORS' CONTRIBUTIONS

The authors confirm their contribution to the paper as follows: H.J.K.: Data collection; H.J.C.: Draft manuscript. All authors reviewed the results and approved the final version of the manuscript.

LIST OF ABBREVIATIONS

TWQ	=	Teamwork Quality
CFA	=	Confirmatory Factor Analysis
ICC	=	Intraclass Correlation Coefficient

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical approval was granted by the Hongik University Institutional Review Board (IRB), South Korea. The relevant judgment's reference number is IRB #7002340-202405-HR-008.

HUMAN AND ANIMAL RIGHTS

All procedures performed in studies involving human participants were in accordance with the ethical standards of institutional and/or research committee and with the 1975 Declaration of Helsinki, as revised in 2013.

CONSENT FOR PUBLICATION

Informed consent was obtained from the participants.

STANDARDS OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

All the data and supporting information are provided within the article.

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CONFLICT OF INTEREST

The authors declared no conflict of interest, financial or otherwise.

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