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Relationship between Leadership Competency and Communication Competency in an Assessment Center Using Canonical Correlation Analysis

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Assessment centers and competency models are modern approaches in organizational human resource processes. This research is an applied and descriptive study, and the aim is to investigate and analyze the relationship between two key competencies—leadership and communication—in an assessment center using canonical correlation analysis. In this study, from a population of 210 managers in an industrial company, 46 individuals were selected through purposive sampling and entered into the assessment center. The tools used to assess these two competencies were group discussion and group exercises, which have appropriate reliability and validity (Thornton, Rupp, 2006). The resulting data were analyzed using SPSS 23 software. This research showed that the canonical correlation coefficient between these two competencies was .441 and was significant (P<.05). As a result, the research hypothesis was confirmed, indicating a

relationship between leadership and communication competencies. Additionally, as secondary objectives, the group discussion tool was identified as the most effective tool for assessing leadership competency with an in-canonical correlation of .669, and the group exercise was identified as the most effective tool for assessing communication competency with an in-canonical correlation of .926.

***Keywords**:* competency, assessment center, canonical correlation analysis, leadership, communication.

The classical approach to human resource management, which is still used in many organizations, especially government organizations in Iran, is the job analysis approach. The main objective of this approach is to create a fit between the individual and the work environment by focusing on four dimensions: skills, knowledge, abilities, and personal characteristics (Alston, 1914; Parsons, 1909). This approach, like other approaches, has its strengths and weaknesses. Its weaknesses are the lack of suitability for managerial positions, the inability to accurately distinguish and categorize skills, knowledge, and abilities, and ambiguity in the precise definition of other factors. On the other hand, it also has strengths such as ease of implementation, low operational cost, the ability to use job analysis results for similar positions in different organizations, low execution costs, and independence from organizational culture (which can also be a weakness). In the competency analysis approach, many of the weaknesses of the classical approach are addressed. However, like other approaches, the competency model also has its strengths and weaknesses. The strengths of this model include emphasis on observable behavior, applicability in various processes,

the ability to teach competencies, objective measurement, variety of tools, and greater validity. For its weaknesses, one can also mention factors such as the very high cost of designing the model, the inability to use the results of competency analysis in one organization for another organization (dependency of results on the organization), the time-consuming nature of the design and measurement process, the difficulty of validating a model for that organization, the lack of sufficient experts for design and evaluation, and so on. These challenges and strengths have been highlighted in various studies, and there has been good research in this area, such as (Howard, 1997; Bray, Grant, 1966; Sanchez, Levine, 2012).

One of the main objectives of shaping the concept of competency can be seen as an effort towards operationalization and emphasis on observable behaviors. Therefore, quoting Berger and Berger (2003), the following characteristics are identified as the foundational components of the competency concept by experts in this field: 1. Observable behavior 2. Leading to effective performance 3. Applicable in various conditions and different situations 4. Relevant to a part of the organization 5. Measurable and assessable 6. Relatively stable over time 7. Volitional 8. Able to be developed or trained.

The beginning of using and naming this concept can be attributed to White (1959), who introduced competency as a feature of human resources. Following that, McClelland (1973) designed a method for predicting and measuring competency, paving the way for smoother subsequent studies. Moreover, before World War II, intelligence was

used as a predictor variable for performance, but after that, Flanagan identified personality traits as influential factors in specific situations. According to Kubeš, Spillerová, and Kurnický (2004), Robert White named it competency, and McClelland further developed it. In the beginning, the concept of competency stemmed from the "Others" dimension of job analysis, and the definitions proposed for this concept were related to this issue. In (1982), Boyatzis contributed to the wider understanding of competency by publishing his book "The Competent Manager". Following that, Hornby and Thomas 1988 emphasized personality traits to enhance the quality and effectiveness of managers' skills and knowledge. In 2009, Armstrong characterized competency as behaviors and specific skills, adding quality and manner of behavior to its definition. Hroník, in 2007, defined competency as a set of knowledge, experience, skills, and abilities that lead to success. According to the writer of this research, considering the mentioned definitions, the theoretical definition of competency in this study is structural, encompassing any prominent knowledge, skill, ability, or personality trait that is behaviorally manifested, interpretable through individual behavior, measurable, and constitutes outstanding behavior, meaning it is effective, impactful, possesses a specific quality, primarily intentional, and subsequently leads to progress within the organization or towards the individual's expected goal.

Assessment centers are one of the modern and comprehensive approaches in the field of human resources, used worldwide for development, diagnosis, and recruitment

purposes (Krause, Thornton, 2009). In this method, the competencies of assessors are evaluated by various tools, tests, and exercises such as role-playing games, group discussions, interviews, case studies, group games, and more, measured by multiple assessors (Kleinmann, Ingold, 2019). This approach is widely utilized globally (Dailey, Cohen, Lockwood, 1999), but due to the diversity of tools and the high level of expertise required for its design and implementation, it is mostly observed in leading companies and at higher management levels. However, organizations are also moving towards utilizing it for other levels (Lievens, Thornton, 2017). Assessment centers, also called assessment and development centers, do not refer to specific locations; rather, they denote a method where individuals are evaluated on various performance aspects or other characteristics (Kolk, Born, Van Der Flier, et al., 2002). Generally, these measured characteristics can be termed competencies or assessment center dimensions.

Canonical Correlation Analysis (CCA), abbreviated as CCA, was first introduced by Hotelling in 1935 to examine the relationship between two sets of data (Hotelling, 1935). Later, in a subsequent paper, he named the series and sequence of one set of data its "canon" and the relationship between two canons from two different sets "canonical correlation" (Hotelling, 1936). This method, which involves complex calculations but yields simple results, became widespread and widely used in multivariable research. Other individuals further improved their algorithms and efficiency. Individuals like Vinograde (1950), Steel (1951), Anderson (1958), DeGroot and Li (1966), Gower (1966), Horst

(1961), Kendall (1957), Koons (1962), and Lawley (1959) have either introduced a new type of correlation analysis or improved the calculation methods of existing ones. This analysis can have other interpretations and applications besides determining the correlation between two data sets. For instance, it can be used to examine the independence of data from each other and assign weights to the data (Alpert, Peterson, 1972). This method can be considered as a variation of multiple regression with changes in assumptions and criteria for the effectiveness of each variable. Since Canonical Correlation Analysis (CCA) requires extensive computations and even involves its distinguishing analysis, it necessitates using computers and software for calculations (Afifi, Clark, May 2004). This method has gained popularity among researchers in recent studies (Yang, Liu, Liu, Tao, 2019). One of the advantages of using this analysis, which is also the reason for its use in this research, is its capability to determine the correlation between two sets of data and, in simpler terms, transform each set of data into a canonical variable.

Additionally, it enables the measurement of variance explained by each canon. Furthermore, each canon's components correlate with its canon and explain a certain amount of variance. On the other hand, by using data space modeling, this analysis considers the best possible arrangement of variables alongside each other and calculates subsequent variables with the remaining variance from the first set. Researchers can then choose the most suitable of these variables regarding power and fit and utilize that variable.

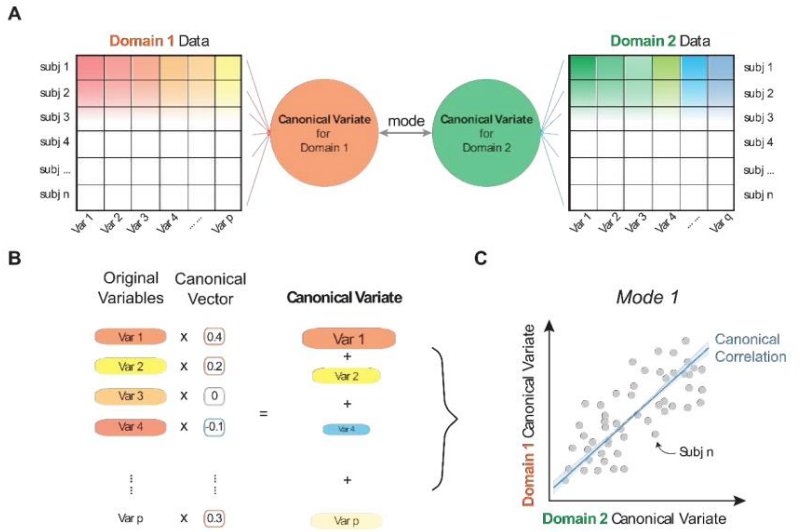

Figure 1. General schematic of Canonical Correlation Analysis. As evident in the figure, the relationship between two different sets of data can be examined using Canonical Correlation Analysis through the use of a two-dimensional space (Wang, Smallwood, Mourao-Miranda, et al., 2018).

The advantage of using Canonical Correlation Analysis to examine relationships within assessment centers compared to using other correlation coefficients lies in the fact that, firstly, since multiple tools are utilized to assess competency within assessment centers, in Canonical Correlation Analysis, each competency is considered as a canonical variable, and the maximum relationships of each tool are entered into the analysis using data space modeling. Secondly, it is possible to identify the most effective assessment tool for each competency. In other words, the most suitable tool for each competency can be selected based on its canonical coefficients. Thirdly, the

variance explained by each competency due to other competencies is also optimally measurable. Therefore, if competencies are indeed a construct in practice (which can arise from various errors), they can be identified.

Since various research studies have pointed to the relationship between leadership and communication, such as (Müller, Turner, 2010; Talukhaba, Mutunga, Miruka, 2011), firstly, it is notable that there are no studies found in these or other conducted research that consider leadership and communication as competencies and assess them in assessment centers. Secondly, if we consider these two constructs, leadership and communication, as competencies, we can explore the relationships between them when considering the role of their measurement tools. We can observe how much of the variance of these two competencies can be explained by each other optimally and also determine which tools are more suitable for measuring which competency. As a result, this research has been conducted due to the lack of sufficient research in this area and its potential use for reducing the costs of assessment centers in the future. If strong relationships can be found between the two competencies through repeated research in this field, instead of examining these two competencies separately, one of them can be used for assessment centers. Additionally, one effective tool can be used to measure that competency instead of multiple tools.

Consequently, the operational costs of assessment centers are reduced, and they can be more widely utilized in organizations, representing a step towards reducing the high costs of designing and implementing assessment centers. Exactly this research hypothesizes that there is a relationship between the competency

of communication and the competency of leadership using canonical correlation analysis. Additionally, which tools are more effective for measuring each competency in this research can be determined.

Method

This research is applied in terms of its objective, and in terms of research method, it is descriptive (correlational). The research population consists of all employees of an industrial company, from which 46 individuals were purposively selected as a sample out of 210 employees. The data obtained from their assessment centers were analyzed using SPSS 23 software. In this study, two competencies, leadership and communication, were selected to investigate their relationship using canonical correlation analysis. The assessment tools for communication and leadership competencies included group discussion and group exercise. Group discussion, also known as leaderless group discussion, is an exercise in assessment centers where assessors are divided into groups of 4 to 8 individuals, each with 5 members in this study. Each group was given an organizational issue and asked to individually contemplate the topic for 5 minutes and then engage in a 40-minute discussion and conversation about the issue. Finally, they were required to submit their discussion results as a strategic document within 10 minutes. This method is one of the effective ways to assess and develop essential leadership skills such as idea generation and guiding the discussion process (Harris, 1949).

Additionally, this approach can evaluate problem-solving skills and decision-making analysis (Bass, 1950; Bass, 1954). Group exercises are another assessment tool used in assessment

centers, where groups are asked to create a scenario (randomly selected from available samples) as part of the exercise. Initially, participants were given a challenge sheet containing the necessary information, dimensions, and rules of construction and play for 5 minutes. They were then asked to work together for 15 minutes to develop the best possible design and, if necessary, make the necessary divisions. Participants had 40 minutes to complete the challenge (Thornton, Rupp, 2006). Due to significant differences among assessment centers in dimensions, evaluators, and tools used, it is impossible to establish precise reliability for a specific assessment center clearly. However, meta-analyses conducted among assessment centers have reported reliability averages ranging from 38 to 91, depending on various conditions (Jackson, Michaelides, Dewberry et al., 2022). Putka and Hoffman (2013) reported reliability for assessment center ratings at 74 for dimensions, 90 for exercises, and 89 for using the overall score (instead of scores for each dimension).

Results

There are two types of statistics used in this study: descriptive statistics and inferential statistics. The following information relates to descriptive statistics. The descriptive indices for the research variables are presented in Table 1.

Table 1

Descriptive Statistics

Variable	Quantity	Standard Deviation	Mean
Competence in Communications (Group Discussion)	46	1.117	6.33
Competence in Communications (Group Exercise)	46	.794	5.24
Leadership Competence (Group Discussion)	46	.645	5.63
Leadership Competence (Group Exercise)	46	.584	5.72

Table 2

Canonical Correlation

	Significance	Degree of Freedom (denominator)	Degree of Freedom (numerator)	F-value	Wilks' Lambda	Special coefficient	Correlation
String 1	.044	84	4	2.564	.794	.241	.441
String 2	.433	43	1	.628	.986	.015	.120

H0 for Wilks test is that the correlations in the current and following rows are zero

In this table, the canonical correlation coefficients and their significance are shown. In canonical correlation, various correlations are formed based on the number of variables. Here,

only the first set is significant at the 0.05 level, so the second set will not be considered in subsequent analyses.

Table 3

Canonical loadings

variable	1	2
(Group Discussion - Communication)	-.341	-.940
(Group Exercise - Communication)	-.926	.378
(Group Discussion - Leadership)	-.669	.743
(Group Exercise - Leadership)	-.574	-.819

In this table, the relationship of each tool with its respective canonical variate in each canonical function is presented (for example, the correlation of the communication group exercise with the communication competency canonical variate in the first function is -0.926 and in the second function is 0.378). Since the second function was not significant, it is not interpretable.

Table 4

Cross-Loadings

variable	1	2
(Group Discussion - Communication)	-.150	-.113
(Group Exercise - Communication)	-.408	.045
(Group Discussion - Leadership)	-.295	.089
(Group Exercise - Leadership)	-.253	-.098

In this table, the relationship of each tool with the other canonical variate in each canonical function is presented (for example, the correlation of the communication group exercise with the leadership competency canonical variate in the first function is -.408 and in the second function is .045). Since the second function was not significant, it is not interpretable.

Table 5

Proportion of Variance Explained

Canonical Variable	Category 1 by self	Category 1 by category 2	Category 2 by self	Category 2 by category 1
1	.487	.095	.389	.075
2	.513	.007	.611	.009

The canonical correlation between these two competencies is .441, which is significant at the .05 level (P=.044). This model (string 1) explains 94% of the correlation variance (according to the eigenvalue). The tools used for measuring communication competency have accounted for 48.7% of the variance in their canonical variate. The group exercise, with a correlation of -.926, has had the greatest impact on this canonical variate (i.e., the communication competency canonical variate). The tools for measuring leadership competency have explained 38.9% of the variance in their canonical variate, with the group discussion showing the highest canonical correlation of -.669, having the most significant impact in measuring this competency.

As a result, the research hypothesis is confirmed here, and a relationship between communication competency and leadership competency is established using canonical correlation analysis. The group exercise tool had the greatest impact in communication competency, while in leadership competency, the group discussion tool had the most significant effect among the instruments used.

Discussion

This study demonstrated a significant relationship between leadership competency and communication competency. Compared to other studies examining the relationship between leadership and communication, the strength of this research is that the measurements and assessments conducted in this study are based on evaluating individuals in real-life situations and specific contexts rather than relying solely on questionnaires or typical attitude surveys. This aspect could serve as a starting point for more comprehensive research and even the replication

of such studies to validate their findings further. On the other hand, since canonical correlation analysis aims to maximize the relationships between two sets of variables, we observe that the power of this correlation does not reach its maximum potential, typically capped at around 0.50. This suggests that other factors may also significantly impact this relationship. This notion has been highlighted in existing research and theoretical frameworks. For example, McCartney and Campbell (2006) discuss the interplay between interpersonal aspects of leadership, revolving around communicative activities, and managerial aspects, focusing on non-interpersonal activities such as planning, organizing, problem-solving, and supervising. This differentiation can also be observed in other studies (Daft, 2003).

On the other hand, in previous studies, researchers have shown that total scores, which are the aggregation of scores across each exercise and tool, demonstrate structural validity in assessment centers. However, structural validity cannot be confirmed for each dimension separately (Wirz, Melchers, Kleinmann, et al., 2020). Considering these two premises - the existence of two different aspects in leadership (interpersonal and non-interpersonal) and the lack of structural validity for dimensions but the presence of structural validity for total scores - alongside the findings of this study, we can conclude that the lack of structural validity for each dimension indicates not cross-sectional but longitudinal overlap in assessment centers. This may explain the absence of structural validity for specific dimensions within the center. Indeed, the role of errors present in assessment centers should not be underestimated. However, the existence of validity criteria for assessment centers (Buckett,

Becker, Melchers, et al., 2020) and the predictive power of assessment center performance relative to other methods (Sackett, Shewach, Keiser, 2017) suggest that the lack of structural validity should be sought somewhere other than the errors inherent in assessment centers. This study also demonstrated that the correlation between leadership competency and communication competency, each representing a dimension of the assessment center, did not reach maximum linearity. Adding another premise to this discussion can potentially address some of the challenges in assessment centers. Indeed, assessment centers are extensively utilized both in Iran and globally, primarily due to the high costs associated with designing and implementing them and their relevance to managerial-level positions (Spychalski, Quinones, Gaugler, et al., 1997). Leadership, encompassing various dimensions of management, is central to this, and the definition of competency is built around the expectation of observable behavior (in this case, leadership behavior) rather than its underlying causes. In other words, it is possible that in conventional assessment centers like the one used in this study, leadership competency is generally and unconsciously assessed, and the overall score obtained from these assessment centers essentially reflects this leadership construct. However, the objective of conducting assessment centers, consciously or unconsciously, is to evaluate the leadership competency of managers. Therefore, considering the premises mentioned above and the existing contradictions in research findings, the conclusions drawn in this study can be confirmed. Indeed, even if the conclusions drawn in this study were incorrect, one can still infer a point from the discussion in this section. Instead of assessing leadership competency directly

in assessment centers, it might be better to consider its dimensions, such as communication skills, analytical thinking, problem-solving, planning and organizing, etc., as competencies to be evaluated in assessment centers. By doing so, leadership competency would indirectly be assessed. This perspective could provide a basis for further research in this field.

Another notable issue in this study is that, as demonstrated in the results section, the group exercise had the greatest impact on its respective competency domain, whether it was communication skills or leadership competency. Firstly, this finding, if replicated in subsequent research, could assist organizations in reducing the costs associated with conducting assessment centers. For instance, organizations could solely utilize group exercises instead of using multiple tools to assess communication skills. Although the results may not be as precise as when using various tools, the organization ultimately incurs significantly lower costs. The reason why leadership competency showed more in group discussions and communication skills demonstrated more in group exercises requires further investigation.

Additionally, the high correlation coefficient of .92 between the group exercise tool and its respective competency domain is noteworthy. This suggests that underlying factors influencing these results might warrant deeper exploration. Answering these questions could be one of the recommendations from this study for researchers interested in this field.

Ethical Considerations

To comply with the ethical considerations of the participants in the assessment center, at the end of the assessment process,

each of them received the necessary feedback, and detailed information was given to them.

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