Applying DANP to Investigate the Important Constitution Criteria on Effective Leadership Behaviors

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Abstract
Leaders play an important role for subordinates' job satisfaction and organization performance. This paper adopts the DANP approach proposed by Ou Yang et al. (2008) which combines the DEMATEL and ANP procedures to investigate the important constitution criteria on effective leadership behaviors. The fifteen evaluation criteria for effective leadership behavior are extracted from the past literature and are classified into four clusters. For consolidating the research structure, this paper firstly consults ten scholars/experts who are excellent in human resources domain to verify the fifteen evaluation criteria and the four clusters, then collects those scholars/experts' opinions about the mutual influence among clusters. Finally, interviews another nine practical senior Human Resources managers by pair-wise comparison questionnaire to assess the importance priority of the criteria. The research results show that the External-oriented cluster has the greatest impact on the other clusters, but also is the least important cluster. Change-oriented cluster displays on the opposite direction, it is highly influenced by the other clusters. In addition, the HR manager respondents specify the top three criteria are Encouraging Innovation criterion, External Scanning criterion, and Advocating Change criterion, while the least three criteria are Consideration, Recognition criterion, and Empowering criterion. Unexpectedly, the research results imply that most HR managers in Taiwan are incline to the "concern for production" dimension of the managerial grid instead of the "concern for people" dimension.

Keywords: MCDM (Multi-Criteria Decision Making), DEMATEL, ANP, DANP, Effective Leadership

1. Introduction

From the heritage of old buildings and historical stories, it is reasonable to deduce that there must exist many large organizations and their operating management methods in ancient times. Unfortunately, those ancient effective management methods are seldom and systematically retained to recent days. Until early 20 century, Taylor published "*The Principles of Scientific Management"* in 1911, he proposed that productivity can increase through jobs simplifying based on the philosophy of 'hardworking could not optimizing the efficiency.' In 1930s, Hawthorne Studies ignited the 'human relations era' which completely changed the perception of managers on motivation, job productivity, and employee satisfaction, thereafter. Hawthorne Studies also shed light on the schools of human relationship and the study on leadership theories.

People frequently mixed up that management and leadership to be the same thing. They believed that managers are equivalent to leaders. Yet, this concept is not entirely correct (Algahtani, 2014; Bohoris & Vorria, 2007). According to past researches, the differences between management and leadership are based on the behaviors they engage in. Bennis and Nannus (1985) pointed out that "managers do the things right, leaders do the right thing." In general, managers are responsible for completing day-to-day tasks, focusing on actions, maintaining operations, and applying the rules (Algahtani, 2014; Yukl, 1989; Zaleznik, 1992). It implies that managers will complete daily tasks efficiently. Whereas, leaders stress on inspiring people's enthusiasm, caring more about people, realizing vision, pursuing long-term goals, innovating, and daring to challenge the status quo (Algahtani, 2014; Bennis & Nanus, 1985; Kotter, 2001; Simonet & Tett, 2013; Zaleznik, 1992).

Past researchers were eager to search for the particular behaviors (e.g., planning, recognizing, and advocating change) that the effective leaders have to perform (Yukl, 2012) or the specific attributes (e.g., vision, inspiration, empathy, and trustworthiness) that the effective leaders must possess (Bennis & Townsend, 1989). Considering that not every leadership behavior or attribute can effectually help organization to develop and create competition competence, it is necessary to explore this issue in a more deeply and systematically manner to explore the determinants of effective leaders. Organizational leaders often face variety challenges. In such situation, what behaviors should an effective leader exhibit to solve the problems, and which behaviors can be classified as effective leadership behaviors are interesting research topics. Past studies on effective leadership mostly focused on the viewpoints of the followers while evaluating effective leadership behaviors or attributes, this paper will instead stress on the criteria of effective leadership under the perspective of leaders themselves.

This paper finds that Encouraging Innovation is the most important leadership behavior. Organizations should seek and cultivate future high-level managers with innovative thinking to meet the future diverse needs. External Scanning is the second important behavior. It indicates that effective leaders must constantly gather external information and share useful information internally. The third important behavior is Advocating Change behavior. In current complex and changing environment, effective leaders should cultivate a change-oriented mindset. All the relaxing three behaviors fall into the Relationship-oriented cluster, reflecting that effective leaders concern more on work-related affairs.

This paper is organized as follows: Section 2 reviews the past literature concerning about the effective leaders' behaviors or attributes, extracts the criteria for effective leadership; The

adopted research methodology is described in Section 3; The research results is shown in Section 4; Section 5 is the conclusion of this paper.

2. Literature Review and Criteria Extraction

Based on Yukl (2012) and reviewed relative literature, this paper extracts fifteen criteria and classifies into four clusters, namely Task-oriented Cluster, Relationship-oriented Cluster, Change-oriented Cluster, and External-oriented Cluster.

2.1 Task-oriented Cluster

Task-oriented Cluster aims to accomplish the assigned tasks. For ensuring people, equipment, and other resources are used in an efficient way (Yukl, 2012), Task-oriented Cluster includes Clarifying Criterion, Planning Criterion, Monitoring Criterion, and Problem Solving Criterion.

1. Clarifying Criterion: For avoiding misunderstand the goal of their duties, effective leaders have to assign tasks (Kim & Yukl, 1995), inform responsibilities, expected task goals and performance (Yukl & Van Fleet, 1982), work deadlines, and specify work rules to their inexperienced subordinates (Holloway, 2012; Yukl & Van Fleet, 1982).

2. Planning Criterion: For creating a guideline to achieve their goals, effective leaders will determine short-term and long-term plans to develop activities and allocate resources according to the goals, identify the resources and labors required to complete the task, and allocate the priority of resources according to their degree of importance (Yukl, 2012; Kim & Yukl, 1995; Yukl & Van Fleet, 1982; Yukl & Kanuk, 1979; Amabile et al., 2004; Holloway, 2012).

3. Monitoring Criterion: Effective leaders have to pay attention to employees to ensure that subordinates accurately follow his instructions (Kim, 2019), check the work progress and quality (Kim & Yukl, 1995; Yukl, 2012; Hollway, 2012), supervise the working results of subordinates for correctly evaluating their performance (Klein et al., 2006; Künzle et al., 2010), detect and correct operation errors simultaneously for forbidding the subordinates will make serious mistakes (Klein et al., 2006; Künzle et al., 2010).

4. Problem Solving Criterion: Effective leaders have to identify the work-related problems which may disrupt operations before becoming seriously. They need to analyze the cause and consequence of the problem systematically but timely and find solutions of the problem. Then take relevant actions quickly, and implement those solutions to solve the problems (Yukl & Van Fleet, 1982; Furlan et al., 2019).

2.2 Relationship-oriented Cluster

Relationship-oriented Cluster is an approach which focuses on the subordinates' job satisfaction and motivation (Rüzgar, 2018). For understanding deeply on job satisfaction and motivation, the related factors will be discussed on Supporting Criterion, Recognition Criterion, Development Criterion, and Empowering Criterion.

1. Consideration Criterion: Effective leaders must take care of the feelings of subordinates (Druskat & Wheeler, 2003). Through showing friendliness and understanding, support, and

sympathy (Kim & Yukl, 1995; Yukl & Van Fleet, 1982; Yukl & Kanuk, 1979; Druskat & Wheeler, 2003; Yukl et al., 2009) to their subordinates, and encouraging subordinates when they encounter difficulties to help subordinates build self-confidence (Kim & Yukl, 1995; Yukl, 2012 Yukl et al., 2009). Effective leaders also have to treat subordinates fairly and impartially to reduce turnover (Yukl &Van Fleet, 1982; Yukl & Kanuk, 1979).

2. Recognition Criterion: Effective leaders have to respect and pay attention to subordinates (Hansen et al., 2002; Luthans, 2000), praise for affirming performance (Yukl, 2012; Kim & Yukl, 1995; Yukl & Van Fleet, 1982; Amabile et al., 2004; Yukl, 2009) and offer rewards for completing certain tasks or goals (Yukl, 2012; Kim & Yukl, 1995; Lartey, 2021) to form a positive reinforcement to improve and increase the willingness of subordinates to take responsibility and reducing employee turnover rate and increasing productivity (Luthans, 2000).

3. Development Criterion: Effective leaders have to expand the work capacity (Dachner et al., 2021; McCauley & Hezlett, 2001), provide useful guidance (Yukl, 2012; Yukl & Van Fleet, 1982; Yukl et al., 2009), assist in learning necessity skills (Yukl et al., 2009), and enable to function effectively (McCauley & Hezlett, 2001) to subordinates to enhance the professional skills of subordinates and promote organizational performance.

4. Empowering Criterion: Effective leaders will decentralize of power and responsibility for important tasks to highly autonomous knowledge workers (Yukl, 2012; Kim & Yukl, 1995; Amabile et al., 2004; Wall et al., 2002; Leach et al., 2003; Ahearne et al., 2005; Cheong et al., 2019; Yukl & Van Fleet, 1982; Amundsen & Martinsen, 2015). They invite members into work-related decision-making (Yukl, 2012; Yukl & Van Fleet, 1982; Amabile et al., 2004), take into account the suggestions provided by subordinates (Yukl, 2012; Yukl & Van Fleet, 1982; Yukl & Kanuk, 1979; Amabile et al., 2004; Sharma & Kirkman, 2015), transfer power from top manager to subordinates to solve work problems without the approval (Yukl et al., 2009; Yukl, 2012) for improving the subordinates' self-confidence (Kim & Yukl, 1995) and increasing their team motivation and productivity.

2.3 Change-oriented Cluster

In the permanent changing world, one of the primary objectives for effective leaders is to identify and implement desirable changes in tasks, outputs or work procedures for the leader's team or work unit (Yukl et al., 2019). For successfully undertaken necessary changes in the organization, the Advocating Change Criterion, Encouraging Innovation Criterion, and Facilitating Collective Learning Criterion deserve to be discussed.

1. Advocating Change Criterion: Effective leaders have to advocate for change by proposing ideal changes, raising appropriate strategies, and explaining to subordinates the need to respond to change (Yukl, 2012; Park et al., 2018). They will alternate the existing operation processes and strategies, resource allocation, and even its members in the organization (Shin, Taylor, & Seo, 2012; Huber et al., 1993) to reduce the impact of change (Bejinariu et al., 2017).

2. Encouraging Innovation Criterion: Effective leaders have to stimulate and support followers to adopt innovative thinking to solve problems, create new products and service processes (Yukl, 2012; Park et al., 2018; Dionne et al., 2004; Rafferty & Griffin, 2004), inspire followers to reconsider ideas that have long not been challenged (Dionne et al.,

2004) to comply the changing environment.

3. Collective Learning Criterion: Effective leaders will encourage members of an organization to learn together (Yukl, 2009), exchange skills and knowledge besides accompany with changing interaction patterns and behaviors among members (Garavan & McCarthy, 2008), improve existing processes or developing new processes (Yukl, 2012) to help the organization to achieve good performance and complete work in a more efficient way.

4. Charismatic Leadership Criterion: Effective leaders have to clearly express their ideas to win the subordinates to support their vision and values (Supratman et al., 2021), strengthen subordinates' commitment to internalize the vision, and create exceptionally strong admiration and respect to the leaders (Waldman & Yammarino, 1999) to encourage subordinates to transform their personal interests into group interests (Shamir et al., 1993; Hansen et al., 2020).

2.4 External-oriented Cluster

External environment significantly impacts the performance of effective leaders. To comply with the influence of external environment, Mintzberg (1973) declared that effective leaders have to collect outer intelligence to improve their effective of decision-making. In this subsection, External Cluster explores the Networking Criterion, External Scanning Criterion, and Representing Criterion, respectively.

1. Networking Criterion: Effective leaders have to keep in touch with the sources of information and strive for their support through social activities (Kim & Yukl, 1995; Day, 2000; Gould & Penley, 1984; Forret & Dougherty, 2004), focus on goal-oriented behavior within/outside the organization that creates, cultivates, and utilizes interpersonal relationships to receive valuable information to facilitate work-related activities (Gibson, Hardy, & Buckley, 2014; Wolff & Moser, 2009), and maintain good relationships with outsiders by participating in events, clubs, professional conferences, and ceremonies (Yukl, 2012; Hassan et al., 2018), to create networking.

2. External Scanning Criterion: Effective leaders have to accurately scanning the external environment in trends, changes, and information to identify potential opportunities and threats or discover the potential customers (Park et al., 2018; Yukl et al., 2002; Yukl, 2019; Choo,1999; Hassen et al., 2018), collect and apply external information to organization's future planning (Auster & Choo, 1993; Choo, 1999), and pay heavy attention on industry-related technologies, political situations, and behaviors of stakeholders (Brown & Kline, 2020; Albright, 2004; Hassen et al., 2018), to improve management efficiency and organizational performance.

3. Representing Criterion: Effective leaders have to play the roles as promoter, ambassador, and external coordinator to arrange external affairs (Yukl, 2012), speaking for the organization, guarding the organization's reputation, and protecting subordinates (Park et al., 2018). They also have to liaise with people outside the organization and negotiate to leverage the strengths of all parties for the benefit of the organization (Yukl, 2012; Yukl & Van Fleet, 1982; Hassan et al., 2018).

3. Methodology

This paper adopts the DANP model that was proposed by Ou Yang et al. (2008). The DANP model combines DEMATEL and ANP. It is a procedure to deal with the problems of criteria interdependence and feedback. DEMATEL is used to determine the degree of influence between clusters, and is weighted according to the degree of influence which improves the shortcomings of ANP assuming that each cluster has the same weight.

3.1 Research Procedure

To investigate criteria that affect effective leaders' behaviors, this paper firstly extracts fifteen criteria from related literature and consults with ten experts and scholars excellent in this field to revise the initial criteria and further classified into four clusters, namely Task-oriented Cluster, Relationship-oriented Cluster, Change-oriented Cluster, and External-oriented Cluster. The description of effective leadership behavior criteria is shown as Table 3.1. In the final stage, this paper interviews another nine senior HR managers to collect the actual perception of the real world.

Table 3. 1 The Description of Effective Leadership Behaviors Criteria

Clusters	Criteria	Description	Sources
(T) Task-oriented	(T1) Clarifying	For avoiding misunderstand the goal of their duties, effective leaders have to assign tasks, inform responsibilities, expected task goals and performance, work deadlines, and specify work rules to their inexperienced subordinates.	Kim & Yukl, 1995 Yukl &Van Fleet, 1982 Holloway, 2012
	(T2) Planning	For creating a guideline to achieve their goals, effective leaders will determine short-term and long-term plans to develop activities and allocate resources according to the goals, identify the resources and labors required to complete the task, and allocate the priority of resources according to their degree of importance.	Yukl, 2012 Kim & Yukl, 1995 Yukl & Van Fleet, 1982 Yukl & Kanuk, 1979 Amabile et al., 2004 Holloway, 2012
	(T3) Monitoring	Effective leaders have to pay attention to employees to ensure that subordinates accurately follow his instructions, check the work progress and quality, supervise the working results of subordinates for correctly evaluating their performance, detect and correct operation errors simultaneously for forbidding the subordinates will make serious mistakes.	Kim, 2019 Kim & Yukl, 1995 Yukl, 2012 Hollway, 2012 Klein et al., 2006 Künzle et al., 2010
	(T4) Problem Solving	Effective leaders have to identify the work-related problems which may disrupt operations before becoming seriously. They need to analyze the cause and consequence of the problem systematically but timely and find solutions of the problem. Then take relevant actions quickly, and implement those solutions to solve the problems.	Yukl & Van Fleet, 1982 Furlan et al., 2019
(R) Relationship -oriented	(R1) Consideration	Effective leaders must take care of the feelings of subordinates. Through showing friendliness and understanding, support, and sympathy to their subordinates, and encouraging subordinates when they encounter difficulties to help subordinates build self-confidence. Effective leaders also have to treat subordinates fairly and impartially to reduce turnover.	Druskat & Wheeler, 2003 Kim & Yukl, 1995 Yukl & Van Fleet, 1982 Yukl & Kanuk, 1979 Yukl et al., 2009
	(R2) Recognition	Effective leaders hav-e to respect and pay attention to subordinates, praise for affirming performance and offer rewards for completing certain tasks or goals to form a positive reinforcement to improve and increase the willingness of subordinates to take responsibility and reducing employee turnover rate and increasing productivity.	Hansen et al., 2002 Luthans, 2000 Yukl, 2012 Kim & Yukl, 1995 Yukl & Van Fleet, 1982 Amabile et al., 2004 Yukl, 2009 Lartey, 2021
	(R3) Development	Effective leaders have to expand the work capacity, provide useful guidance, assist in learning necessity skills, and enable to function effectively to subordinates to enhance the professional skills of subordinates and promote organizational performance.	Dachner et al., 2021 McCauley & Hezlett, 2001 Yukl, 2012 Yukl & Van Fleet, 1982 Yukl et al., 2009
	(R4) Empowering	Effective leaders will decentralize of power and responsibility for important tasks to highly autonomous knowledge workers. They invite members into work-related decision-making, consider the suggestions provided by subordinates, transfer power from top manager to subordinates to solve work problems without the approval for improving the subordinates' self-confidence and increasing their team motivation and productivity.	Yukl, 2012 Kim & Yukl, 1995 Amabile et al., 2004 Wall et al., 2002 Leach et al., 2003 Ahearne et al., 2005 Cheong et al., 2019 Yukl & Van Fleet, 1982 Amundsen & Martinsen, 2015 Yukl & Kanuk, 1979 Sharma & Kirkman, 2015

Table 3.1 The Description of Effective Leadership Behaviors Criteria (Con't 1)

Clusters	Criteria	Description	Sources
(C) Change-oriented	(C1) Advocating Change	Effective leaders have to advocate for change by proposing ideal changes, raising appropriate strategies, and explaining to subordinates the need to respond to change. They will alternate the existing operation processes and strategies, resource allocation, and even its members in the organization to reduce the impact of change.	Yukl, 2012 Park et al., 2018 Shin, Taylor, & Seo, 2012 Huber et al., 1993 Bejinariu et al., 2017
	(C2) Encouraging Innovation	Effective leaders have to stimulate and support followers to adopt innovative thinking to solve problems, create new products and service processes, inspire followers to reconsider ideas that have long not been challenged to comply the changing environment.	Yukl, 2012 Park et al., 2018 Dionne et al., 2005 Rafferty & Griffin, 2004
	(C3) Collective Learning	Effective leaders will encourage members of an organization to learn together, exchange skills and knowledge besides accompany with changing interaction patterns and behaviors among members, improve existing processes or developing new processes to help the organization to achieve good performance and complete work in a more efficient way.	Yukl, 2009 Garavan & McCarthy, 2008 Yukl, 2012
	(C4) Charismatic Leadership	Effective leaders have to clearly express their ideas to win the subordinates to support their vision and values, strengthen subordinates' commitment to internalize the vision, and create exceptionally strong admiration and respect to the leaders to encourage subordinates to transform their personal interests into group interests.	Supratman et al., 2021 Waldman & Yammarino, 1999 Shamir et al., 1993 Hansen et al., 2020
(E) External-oriented	(E1) Networking	Effective leaders have to keep in touch with the sources of information and strive for their support through social activities, focus on goal-oriented behavior within/outside the organization that creates, cultivates, and utilizes interpersonal relationships to receive valuable information to facilitate work-related activities, and maintain good relationships with outsiders by participating in events, clubs, professional conferences, and ceremonies, to create networking.	Kim & Yukl, 1995 Day, 2000 Gould & Penley, 1984 Forret & Dougherty, 2004 Gibson, Hardy, & Buckley, 2014 Wolff & Moser, 2009 Yukl, 2012 Hassan et al., 2018
	(E2) External Scanning	Effective leaders have to accurately scanning the external environment in trends, changes, and information to identify potential opportunities and threats or discover the potential customers, collect and apply external information to organization's future planning, and pay heavy attention on industry-related technologies, political situations, and behaviors of stakeholders, to improve management efficiency and organizational performance.	Park et al., 2018 Yukl et al., 2002 Choo,1999 Hassen et al., 2018 Auster & Choo, 1993 Hagen et al., 2003 Brown & Kline, 2020 Albright, 2004
	(E3) Representing	Effective leaders have to play the roles as promoter, ambassador, and external coordinator to arrange external affairs, speaking for the organization, guarding the organization's reputation, and protecting subordinates. They also have to liaise with people outside the organization and negotiate to leverage the strengths of all parties for the benefit of the organization.	Yukl, 2012 Park et al., 2018 Yukl and Van Fleet, 1982 Hassan et al., 2018

3.2 Data Processing Steps

Based on the model of Ou Yang et al. (2008) and the revised version of Lee (2021), this paper depicts the flowchart of the modified DANP as Fig. 3.2. In this subsection, each step of the modified DANP will be described in more detail.

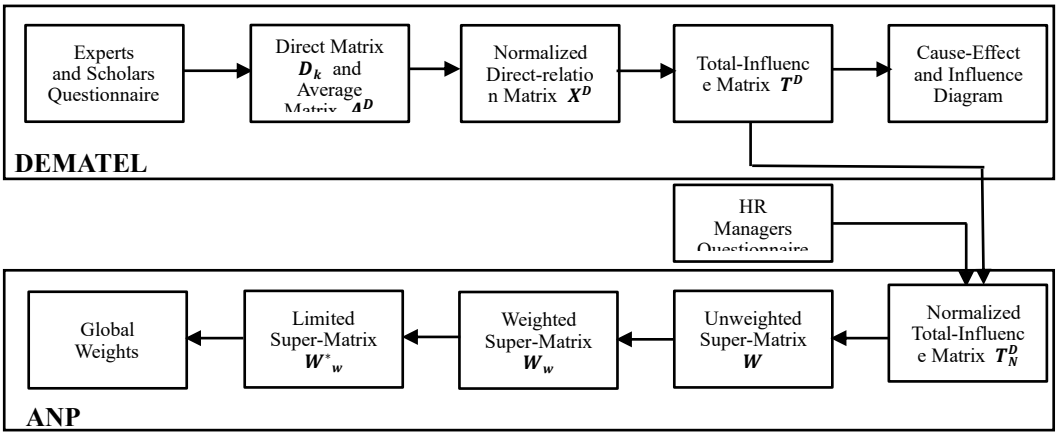

Fig. 3. 1 The Flowchart of DANP Steps (Source: Rearranged by This Paper)

3.2.1 DEMATEL for Network Relationship

Step1: Calculate the direct relation matrix $\boldsymbol{D_k}$ *and average direct-relation matrix* $\boldsymbol{A^D}$

Each respondent questionnaire gives a direct matrix $\boldsymbol{D_k}$, $\boldsymbol{k}$ = 1, 2, ⋯, n, where n represents the number of respondents, the elements of $\boldsymbol{D_k}$, denoted by d_{ij}^k, presents the influence cluster *i* impacts on cluster *j*, shown as Eq. (1). By averaging each corresponding element in $\boldsymbol{D_k}$, gains the average direct-relation matrix $\boldsymbol{A^D}$. The element in average matrix, denotes as a_{ij}^D. The $\boldsymbol{A^D}$ equation is calculated by Eq. (2).

$$\boldsymbol{D_k} = \begin{bmatrix} d_{11}^k & \cdots & d_{1j}^k & \cdots & d_{1n}^k \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ d_{i1}^k & \cdots & d_{ij}^k & \cdots & d_{in}^k \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ d_{n1}^k & \cdots & d_{nj}^k & \cdots & d_{nn}^k \end{bmatrix} \tag{1}$$

$$a_{ij}^D = \frac{\sum_{k=1}^{n} d_{ij}^k}{n} \tag{2}$$

Step2: Normalizing the direct-relation matrix

Normalizing $\boldsymbol{A^D}$ by Eqs. (3) and (4), receive the normalized direct-relation matrix $\boldsymbol{X^D}$, and all principal diagonal factors are equal to zero.

$$\boldsymbol{S^D} = min\left[\frac{1}{max\sum_{j=1}^{n}\left|a_{ij}^d\right|}, \frac{1}{max\sum_{i=1}^{n}\left|a_{ij}^d\right|}\right] \tag{3}$$

$$\boldsymbol{X^D = S^D \times A^D} \quad (4)$$

Step D3: Deriving the total influence matrix $\boldsymbol{T^D}$

The direct/indirect matrix $\boldsymbol{T^D}$ can be obtained by Eq. (5), where $\boldsymbol{I}$ denotes identity matrix, and t_{ij}^{d} is expressed as the direct and indirect influence from cluster *i* to cluster *j*.

$$\boldsymbol{T^D} = \lim_{k\to\infty}\left(\boldsymbol{X^D + X^{D^2} + X^{D^3} + \cdots + X^{D^k}}\right) = \lim_{k\to\infty} \boldsymbol{X^D}\,(\boldsymbol{I - X^D})^{-1} \quad (5)$$

Step D4: Analyzing the results of influences and relationships

Vector *r* and vector *c* denote the vector of row sum and vector of column sum of $\boldsymbol{T^D}$, can be obtained by Eqs. (6) and (7).

$$r = (r_i)_{n\times 1} = \left[\sum_{j=1}^{n} t_{ij}\right]_{n\times 1} \quad (6)$$

$$c = \left(c_j\right)_{1\times n} = \left(c_j\right)'_{1\times n} = \left[\sum_{i=1}^{n} t_{ij}\right]'_{1\times n} \quad (7)$$

In Eq. (6), r_i is the sum of the i^{th} row of $\boldsymbol{T^D}$ which represents the sum of direct and indirect influences of cluster *i* impacting on the other clusters; Similarity, c_j in Eq. (7) is the sum of the j^{th} column of $\boldsymbol{T^D}$ which represents the sum of direct and indirect influences cluster *j* received from the other clusters. When $i = j$, the $r_i + c_i$ is called the "prominence" of cluster *i* that indicates the strength of total influence accumulated both gives to and receives from the other clusters. The higher $r_i + c_i$ value of cluster *i* is, the stronger connection with the other clusters will be. High $r_i + c_i$ value means that the cluster *i* plays a central role and has a higher priority. On the other hand, the $r_i - c_i$ is called "relation" that indicates the prioritization of cluster *i*. If $r_i - c_i$ is positive, then cluster *i* is net affecting other clusters; if $r_i - c_i$ is negative, then cluster *i* is net influenced by the other clusters (Tzeng et al., 2007). When the $r_i - c_i$ value is high, it means that cluster *i* has a strong influence on other clusters than it receives from the other clusters, it represents that cluster *i* may have the low priority (Li and Tzeng, 2009; Wu, 2011).

Step D5: Setting an α-cut as a threshold to filter the minor clusters

$\boldsymbol{T^D}$ expresses the influence strength of cluster *i* imposes on cluster *j*. Ou Yang et al. (2008) suggested to set a threshold to screen out the minor influence clusters. The α value is calculated by the average of all elements in $\boldsymbol{T^D}$, $\alpha = \sum_{i=1}^{n}\sum_{j=1}^{n} t_{ij}\,/n^2$ where *n* is the number of clusters. If the original value of each element in $\boldsymbol{T^D}$ is smaller than α, then the element value will be replaced by 0 as $\boldsymbol{T_{\alpha}^{D}}$. Because the element values in $\boldsymbol{T^D}$ are always with slightly difference, eliminating the minor influence elements may disregard some key clusters in DEMATEL, and then distort the result in ANP. This paper employs the suggestion of Du & Li, (2021) and Dalvi-Esfahani et al. (2019), just sign an asterisk "*" mark on the upper right of the minor influence elements instead of replaced by 0.

3.2.2 Weighted Measurements by ANP

Step A1: Building the direct super matrix $\boldsymbol{A}_{\mathrm{y}}$

After interviewing and gathering information from the eight Human Resource managers, each respondent's reply is recorded as a direct matrix $\boldsymbol{A_y}$, $\boldsymbol{y}$ = 1, 2, …, n, where n represents the number of respondents, expressed as Eq. (8). Each element in $\boldsymbol{A_y}$ is denoted by a_{ij}^{y}, expresses the original direct effects of each criterion exerts to and receives from the other criteria.

$$\boldsymbol{A_y} = \begin{array}{c} \\ \boldsymbol{C_1} \\ \boldsymbol{C_2} \\ \vdots \\ \boldsymbol{C_n} \end{array} \begin{array}{c} \begin{array}{cccc} \boldsymbol{C_1} & \boldsymbol{C_2} & & \boldsymbol{C_n} \end{array} \\ \begin{bmatrix} a_{11}^{y} & a_{12}^{y} & \cdots & a_{1n}^{y} \\ a_{21}^{y} & a_{22}^{y} & \cdots & a_{2n}^{y} \\ \vdots & \vdots & \vdots & \vdots \\ a_{n1}^{y} & a_{n2}^{y} & \cdots & a_{nn}^{y} \end{bmatrix} \end{array} \tag{8}$$

In Eq. (8), c_n represents the n^{th} cluster, e_{nm} represents the m^{th} element in n^{th} cluster, $\boldsymbol{A}_{ij}$ represents the principal eigenvector of the influence of elements compared in the j^{th} cluster to the i^{th} cluster.

Step A2: Averaging the direct matrix

The average matrix $\boldsymbol{A^S}$ is to calculate the mean of the same elements in each direct matrix. Each element of $\boldsymbol{A^S}$ is expressed as a_{ij}^{A}, denoted as Eq. (9).

$$a_{ij}^{A} = \frac{\sum_{y=1}^{n} a_{ij}^{y}}{n} \tag{9}$$

Step A3: calculating the initial direct-relation matrix $\boldsymbol{X^A}$

By Eqs. (10) and (11), normalize $\boldsymbol{A^S}$ and gain the initial direct-relation matrix $\boldsymbol{X^A}$, the principal diagonal elements are all equal to zero.

$$\boldsymbol{S^A} = \min\left[\frac{1}{max\sum_{j=1}^{n}\left|a_{ij}^{A}\right|}, \frac{1}{max\sum_{i=1}^{n}\left|a_{ij}^{A}\right|}\right] \tag{10}$$

$$\boldsymbol{X^A} = \boldsymbol{S^A} \times \boldsymbol{A^A} \tag{11}$$

Step A4: Deriving the total influence matrix $\boldsymbol{T^A}$

By Eq. (12), obtains the total influence matrix $\boldsymbol{T^A}$, where $\boldsymbol{I}$ represents the identity matrix. The element *ij* in $\boldsymbol{T^A}$ denotes the direct and indirect influence from element *i* to element *j*.

$$\boldsymbol{T^A} = \lim_{\boldsymbol{y}\to\infty}\left(\boldsymbol{X^A} + \boldsymbol{X^{A^2}} + \boldsymbol{X^{A^3}} + \cdots + \boldsymbol{X^{A^y}}\right) = \lim_{\boldsymbol{y}\to\infty} \boldsymbol{X^A}\left(\boldsymbol{I} - \boldsymbol{X^A}\right)^{-1} \tag{12}$$

Step A5: Normalizing the total influence matrix $\boldsymbol{T_N^A}$

By Eq. (13), the normalized total influence matrix $\boldsymbol{T_N^A}$ is calculated.

$$\boldsymbol{T_N^A} = \begin{array}{c} \\ \boldsymbol{C_1} \\ \\ \\ \boldsymbol{C_2} \\ \\ \vdots \\ \boldsymbol{C_n} \\ \\ \end{array} \begin{array}{c} \begin{array}{cccc} \boldsymbol{C_1} & & \boldsymbol{C_2} & & \boldsymbol{C_n} \\ e_{11} \cdots e_{1m_1} & e_{21} \cdots e_{2m_2} & \cdots\cdots & e_{n1} \cdots e_{nm_n} \end{array} \\ \begin{bmatrix} T_N^{A^{11}} & T_N^{A^{12}} & \cdots & T_N^{A^{1n}} \\ & & & \\ T_N^{A^{21}} & T_N^{A^{22}} & \cdots & T_N^{A^{2n}} \\ & & & \\ \vdots & \vdots & \vdots\vdots\vdots & \vdots \\ T_N^{A^{n1}} & T_N^{A^{n2}} & \cdots & T_N^{A^{nn}} \end{bmatrix} \end{array} \tag{13}$$

The process for calculating $\boldsymbol{T_N^A}$ is as follows: Firstly, separate each cluster in $\boldsymbol{T^A}$, then calculate the summation of all the elements in that cluster, finally divide every element by the summation. Thus, we can normalize the clusters in $\boldsymbol{T^A}$. For example, the calculating procedure of $\boldsymbol{T_N^{A^{11}}}$ is illustrated by Eqs. (14) and (15).

$$s_{ei}^{11} = \sum_{j=1}^{m1} t_{ei}^{A^{11}}, i = 1, 2, \ldots, m_1 \tag{14}$$

$$\begin{aligned} \boldsymbol{T_N^{A^{11}}} &= \begin{bmatrix} t_{11}^{A^{11}}/s_{e1}^{11} & \cdots & t_{12}^{A^{11}}/s_{e1}^{11} & \cdots & t_{1m_1}^{A^{11}}/s_{e1}^{11} \\ \vdots & & \vdots & & \vdots \\ t_{21}^{A^{11}}/s_{e2}^{11} & \cdots & t_{22}^{A^{11}}/s_{e2}^{11} & \cdots & t_{2m_1}^{A^{11}}/s_{e2}^{11} \\ \vdots & & \vdots & & \vdots \\ t_{m_1 1}^{A^{11}}/s_{em_1}^{11} & \cdots & t_{m_1 2}^{A^{11}}/s_{em_1}^{11} & \cdots & t_{m_1 m_1}^{A^{11}}/s_{em_1}^{11} \end{bmatrix} \\ &= \begin{bmatrix} t_{N_{11}}^{A^{11}} & \cdots & t_{N_{12}}^{A^{11}} & \cdots & t_{N_{1m_1}}^{A^{11}} \\ \vdots & & \vdots & & \vdots \\ t_{N_{21}}^{A^{11}} & \cdots & t_{N_{22}}^{A^{11}} & \cdots & t_{N_{2m_1}}^{A^{11}} \\ \vdots & & \vdots & & \vdots \\ t_{N_{m_1 1}}^{A^{11}} & \cdots & t_{N_{m_1 2}}^{A^{11}} & \cdots & t_{N_{m_1 m_1}}^{A^{11}} \end{bmatrix} \end{aligned} \tag{15}$$

Step A6: Obtaining the unweighted super-matrix $\boldsymbol{W}$

The unweighted super-matrix $\boldsymbol{W}$ is obtained by transposing matrix $\boldsymbol{T_N^A}$ as Eq. (16) for the preparation to calculate the weighted super-matrix $\boldsymbol{W_W}$.

$$\boldsymbol{W} = \begin{array}{c} \\ \\ \boldsymbol{C_1} \\ \boldsymbol{C_2} \\ \vdots \\ \boldsymbol{C_n} \end{array} \begin{array}{c} \begin{array}{cccc} \boldsymbol{C_1} & & \boldsymbol{C_2} & \qquad\qquad & \boldsymbol{C_n} \\ e_{11} \cdots e_{1m_1} & & e_{21} \cdots e_{2m_2} & \cdots\cdots & e_{n1} \cdots e_{nm_n} \end{array} \\ \begin{bmatrix} W_{11} & W_{12} & \cdots & W_{1n} \\ & & & \\ W_{21} & W_{22} & \cdots & W_{2n} \\ \vdots & \vdots & \vdots\vdots & \vdots \\ W_{n1} & W_{n2} & \cdots & W_{nn} \end{bmatrix} \end{array} \begin{array}{l} e_{11} \\ e_{12} \\ \vdots \\ e_{1m_1} \\ e_{21} \\ e_{22} \\ \vdots \\ e_{2m_2} \\ \vdots \\ e_{n1} \\ e_{n2} \\ \vdots \\ e_{nm_n} \end{array} \tag{16}$$

Step A7: Obtaining the normalized total-influence matrix $\boldsymbol{T_N^D}$

Saaty (1996) assumed that each cluster has the even weight in ANP method. is a phenominon in the actual world. For correcting this unreal assumption, this paper utilizes the diverse cluster weights established in DEMATEL to normalized the total-influence matrix $\boldsymbol{T^D}$. Then, employ Eqs. (17) and (18) to obtain the normalized total-influence matrix $\boldsymbol{T_N^D}$.

$$\boldsymbol{T^D} = \begin{bmatrix} t_{11}^D & \cdots & t_{1j}^D & \cdots & t_{1n}^D \\ \vdots & & \vdots & & \vdots \\ t_{i1}^D & \cdots & t_{ij}^D & \cdots & t_{in}^D \\ \vdots & & \vdots & & \vdots \\ t_{n1}^D & \cdots & t_{nj}^D & \cdots & t_{nn}^D \end{bmatrix}, \; d_i = \sum_{j=1}^{n} t_{ij}^D \tag{17}$$

$$\boldsymbol{T_N^D} = \begin{bmatrix} t_{11}^D/d_1 & \cdots & t_{1j}^D/d_1 & \cdots & t_{1n}^D/d_1 \\ \vdots & & \vdots & & \vdots \\ t_{i1}^D/d_i & \cdots & t_{ij}^D/d_i & \cdots & t_{in}^D/d_i \\ \vdots & & \vdots & & \vdots \\ t_{n1}^D/d_n & \cdots & t_{nj}^D/d_n & \cdots & t_{nn}^D/d_n \end{bmatrix} = \begin{bmatrix} t_{N_{11}}^D & \cdots & t_{N_{1j}}^D & \cdots & t_{N_{1n}}^D \\ \vdots & & \vdots & & \vdots \\ t_{N_{i1}}^D & \cdots & t_{N_{ij}}^D & \cdots & t_{N_{in}}^D \\ \vdots & & \vdots & & \vdots \\ t_{N_{n1}}^D & \cdots & t_{N_{nj}}^D & \cdots & t_{N_{nn}}^D \end{bmatrix} \tag{18}$$

Step A8: Obtaining the weighted super-matrix $\boldsymbol{W_w}$

Multiply the unweighted super-matrix $\boldsymbol{W}$ by the transposed normalized total-influence matrix $\boldsymbol{T_N^{D'}}$, i.e. $\boldsymbol{W_W} = \boldsymbol{T_N^{D'}} \times \boldsymbol{W}$, results the weighted super-matrix $\boldsymbol{W_W}$, shown as Eq. (19).

$$\boldsymbol{W_w} = \begin{bmatrix} t_{N_{11}}^D \times W_{11} & \cdots & t_{N_{j1}}^D \times W_{1j} & \cdots & t_{N_{n1}}^D \times W_{1n} \\ \vdots & & \vdots & & \vdots \\ t_{N_{1i}}^D \times W_{i1} & \cdots & t_{N_{ji}}^D \times W_{ij} & \cdots & t_{N_{ni}}^D \times W_{in} \\ \vdots & & \vdots & & \vdots \\ t_{N_{1n}}^D \times W_{n1} & \cdots & t_{N_{jn}}^D \times W_{nj} & \cdots & t_{N_{nn}}^D \times W_{nn} \end{bmatrix} \tag{19}$$

Step A9: Obtaining the limited super-matrix $\boldsymbol{W^*_w}$

By raising the weighted super-matrix $\boldsymbol{W_W}$ to a sufficiently large power k, shown as Eq. (20), until it converges to a long-term stable super-matrix named limited super-matrix $\boldsymbol{W_W^*}$. From $\boldsymbol{W_W^*}$, there obtains a global priority vector or is called the DANP weights (Chen, Hsu, and Tzeng, 2011).

$$\lim_{k\to\infty} W_w^k \quad (20)$$

Step A10: Ranking the global weights

Refer to the limited super-matrix $\boldsymbol{W_W^*}$, according to the global priority vector, the global weights are ranked.

4. Research Results

Follow the data processing steps in section 3.2, this paper analyzed the interrelationships between clusters and the relative importance of criteria, and ranked the importance of effective leadership behaviors.

4.1 The Relationships among Clusters

In DEMATEL stage, this paper collected the opinions of ten scholars/experts on the influence relationship between the four clusters to create ten direct matrices $\boldsymbol{D_K}$, k=1, 2, 3, …, 10. Based on the Eq. (2), results in the average matrix $\boldsymbol{A^D}$. Normalize $\boldsymbol{A^D}$ by Eqs. (3) and (4), obtain the initial direct-influence matrix $\boldsymbol{X^D}$ as Table 4.1.

Table 4.1 The Initial Direct-Influence Matrix $\boldsymbol{X^D}$

Cluster	Task-oriented	Relationship-oriented	Change-oriented	External-oriented
Task-oriented	0	0.24638	0.37681	0.21739
Relationship-oriented	0.30435	0	0.30435	0.14493
Change-oriented	0.24638	0.21739	0	0.28986
External-oriented	0.21739	0.26087	0.31884	0

Calculate the total influence matrix $\boldsymbol{T^D}$ by Eq. (5) as shown in Table 4.2.

Table 4.2 The Total-Influence Matrix $\boldsymbol{T^D}$

Cluster	Task-oriented	Relationship-oriented	Change-oriented	External-oriented
Task-oriented	0.78298	0.93897	1.23911	0.88285
Relationship-oriented	0.95627	0.68143	1.11952	0.77607
Change-oriented	0.91653	0.86292	0.88566	0.87088
External-oriented	0.92930	0.91789	1.16264	0.67205

For understanding the direct/indirect influence of cluster *i*, this paper adopts Eqs. (5) and (6) to calculate the values of give-influence r_i and receive-influence After obtaining the values of r_i and c_i; then calculate the values of $r_i + c_i$ and $r_i - c_i$ to analyze the relationships of influence among the four clusters. The received and gives influences of the four clusters shown as Table 4.3.

Table 4.3 The Received and Gives Influences of the Four Clusters

Cluster	r_i	c_i	$r_i + c_i$	$r_i - c_i$
Task-oriented	3.84391	3.58508	7.42899	0.25883
Relationship-oriented	3.53328	3.40121	6.93449	0.13208
Change-oriented	3.53599	4.40693	7.94292	-0.87094
External-oriented	3.68188	3.20184	6.88372	0.48004

To illustrate the interactions among the four clusters more clearly, this paper has plotted the impact-relation map (IRM), shown as Fig. 4.1.

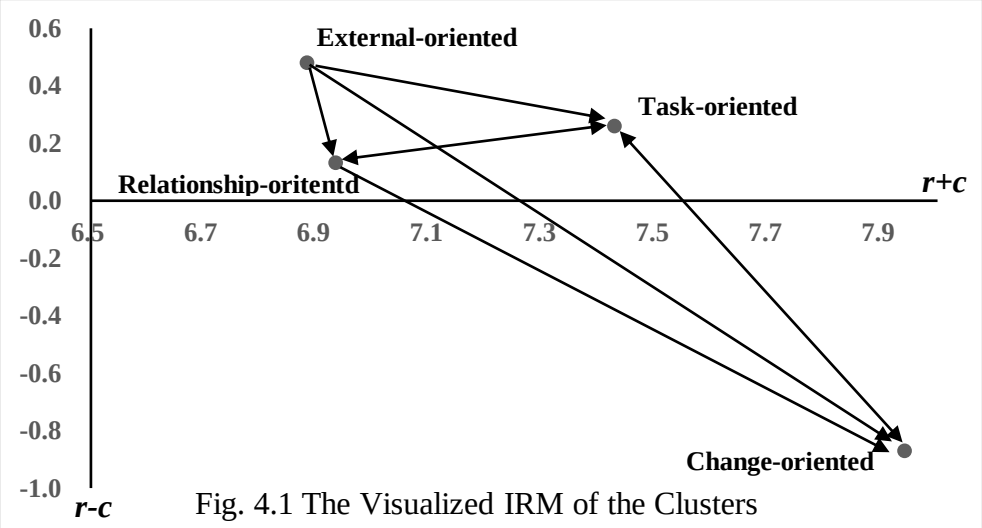

Fig. 4.1 The Visualized IRM of the Clusters

From Fig. 4.1, the External-oriented cluster has the highest $r_i - c_i$ value. It means that External-oriented cluster has the greatest impact on the other clusters and is typically referred to as the "main cause-factor". At the same time, External-oriented cluster also is the least important cluster with the smallest $r_i + c_i$ value. It expresses that effective leader can only adopt passive reaction behaviors to the criteria in External-oriented cluster. On the other hand, Change-oriented is completely opposite to External-oriented cluster. Change-oriented cluster has the smallest $r_i - c_i$ value, reflecting that it is highly influenced by the other clusters which is typically referred as the "main effect-factor". However, its $r_i + c_i$ value is the largest, indicating that the effective leader need to proactively pay more attention to the criteria in Change-oriented cluster. As for the Task-oriented cluster and Relationship-oriented clusters, it seems that they are “stuck in the middle” with medium $r_i + c_i$ value and positive $r_i - c_i$ value. The effective leader just imposes minor attention on the criteria in those two clusters.

To identify the strength of influence between clusters, this paper uses the total average value of all elements in matrix $\boldsymbol{T^D}$ as a threshold value α, in order to filter the less significant clusters. The value of $\alpha = \sum t_{ij}/16$=0.91219. Elements in $\boldsymbol{T^D}$ that are lower than α will be marked with a “*” in the upper right corner to distinguish their influence as Table 4.4.

Table 4.4 The α-cut Total Impact Matrix $\boldsymbol{T_\alpha^D}$

Cluster	Task-oriented	Relationship-oriented	Change-oriented	External-oriented
Task-oriented	0.78298*	0.93897	1.23911	0.88285*
Relationship-oriented	0.95627	0.68143*	1.11952	0.77607*
Change-oriented	0.91653	0.86292*	0.88566*	0.87088*
External-oriented	0.92930	0.91789	1.16264	0.67205*

Based on the Table 4.4, the influence diagram of the four clusters is drawn as Fig. 4.2.

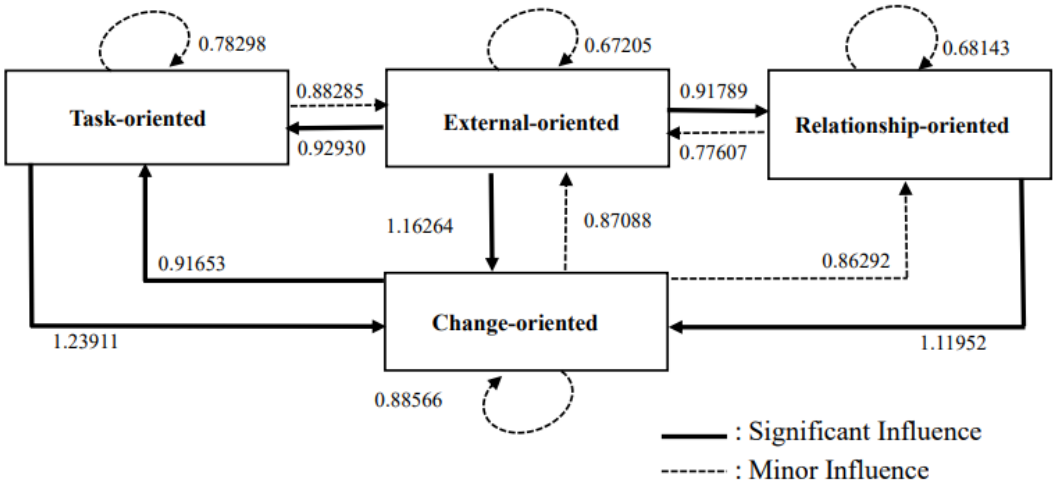

Fig. 4.2 Influence Diagram of the Four Clusters

Observe Fig. 4.2, the External-oriented cluster plays as a radiation role that affects every other clusters, it shows that the behaviors in the other clusters of effective leaders are constrained by External-oriented cluster when they are engaging in effective leadership. On the other hand, the Change-oriented cluster is the most influenced by the other clusters, it expresses that the effective leaders should pay more attention on the Change-oriented cluster when they are exerting the behaviors in the other clusters. In addition, Fig. 4.2 also illustrates that every cluster as only minor influence loop or is said weak self-influence effect. It reveals that every criterion in its cluster is relatively mutual independent.

4.2 Measuring the Priority of Criteria by ANP

In the ANP stage, this paper interviews nine senior human resource managers with practical experience, they provide a more authentic reflection of the workplace situation. and obtained nine direct super matrices $\boldsymbol{A_y}$, **y** =1, 2, …, 9. Average the nine direct super matrices by Eq. (9), receives the average matrix $\boldsymbol{A^S}$. Adopt Eqs. (10) and (11) to normalize the average matrix $\boldsymbol{A^S}$, results the initial direct-influence matrix $\boldsymbol{X^A}$ as Table 4.5.

Table 4.5 The Initial Direct-Influence Matrix $\boldsymbol{X^A}$

Criteria	T1	T2	T3	T4	R1	R2	R3	R4	C1	C2	C3	C4	E1	E2	E3
T1	0.023	0.021	0.029	0.068	0.086	0.066	0.104	0.072	0.078	0.046	0.079	0.072	0.052	0.066	0.100
T2	0.099	0.023	0.012	0.054	0.042	0.053	0.039	0.035	0.036	0.043	0.045	0.047	0.024	0.035	0.030
T3	0.060	0.084	0.023	0.066	0.062	0.065	0.069	0.070	0.059	0.060	0.053	0.042	0.068	0.039	0.042
T4	0.055	0.057	0.049	0.023	0.012	0.018	0.039	0.057	0.066	0.062	0.036	0.013	0.020	0.039	0.025
R1	0.026	0.036	0.060	0.087	0.023	0.025	0.056	0.043	0.046	0.049	0.045	0.030	0.034	0.036	0.025
R2	0.048	0.030	0.049	0.088	0.047	0.023	0.042	0.031	0.027	0.039	0.042	0.040	0.054	0.057	0.052
R3	0.021	0.064	0.053	0.047	0.049	0.060	0.023	0.027	0.022	0.026	0.030	0.026	0.033	0.027	0.021
R4	0.046	0.064	0.052	0.047	0.028	0.063	0.078	0.023	0.016	0.035	0.023	0.041	0.047	0.054	0.057
C1	0.046	0.067	0.071	0.046	0.069	0.071	0.070	0.079	0.023	0.051	0.042	0.038	0.047	0.043	0.032
C2	0.072	0.062	0.054	0.043	0.067	0.072	0.073	0.062	0.046	0.023	0.023	0.036	0.029	0.028	0.045
C3	0.037	0.034	0.056	0.067	0.065	0.060	0.075	0.045	0.052	0.056	0.023	0.064	0.034	0.033	0.031
C4	0.052	0.037	0.082	0.086	0.048	0.059	0.072	0.063	0.058	0.068	0.053	0.023	0.043	0.063	0.060
E1	0.078	0.104	0.039	0.071	0.051	0.047	0.086	0.042	0.031	0.053	0.028	0.057	0.023	0.067	0.058
E2	0.042	0.086	0.061	0.060	0.064	0.052	0.082	0.030	0.045	0.059	0.037	0.045	0.013	0.023	0.030
E3	0.036	0.092	0.064	0.071	0.086	0.047	0.093	0.028	0.035	0.039	0.036	0.040	0.013	0.034	0.023

Substitute $\boldsymbol{X^A}$ into the Eq. (12), obtains the total influence matrix $\boldsymbol{T^A}$. Next, utilize Eqs. (14) and (15), obtains the normalized total influence matrix. Then transpose $\boldsymbol{T_N^A}$ by Eq. (16), results the unweighted super-matrix $\boldsymbol{W}$ as Table 4.6.

Utilize the four cluster weights established in DEMATEL, employs Eqs. (17) and (18) to normalize $\boldsymbol{T^D}$, obtains the normalized total-influence matrix $\boldsymbol{T_N^D}$ as Table 4.7. Multiplying the transposed $\boldsymbol{T_N^D}$ by the unweighted super-matrix $\boldsymbol{W}$ by Eq. (19), yields the weighted super-matrix $\boldsymbol{W_W}$ as Table 4.8. By Eq. (20), $\boldsymbol{W_W}$ will converge to a long-term stable state, referred as the limited super-matrix $\boldsymbol{W_W^*}$, shown as Table 4.9.

Table 4.6 The Unweighted Super-Matrix $\boldsymbol{W}$

Criteria	T1	T2	T3	T4	R1	R2	R3	R4	C1	C2	C3	C4	E1	E2	E3
T1	0.212	0.310	0.238	0.251	0.198	0.226	0.197	0.227	0.221	0.251	0.218	0.220	0.242	0.212	0.200
T2	0.244	0.219	0.286	0.277	0.236	0.228	0.285	0.275	0.269	0.262	0.238	0.232	0.289	0.285	0.287
T3	0.230	0.185	0.195	0.239	0.247	0.229	0.245	0.233	0.250	0.230	0.246	0.255	0.199	0.234	0.234
T4	0.313	0.286	0.282	0.234	0.318	0.317	0.274	0.266	0.261	0.257	0.298	0.294	0.270	0.269	0.279
R1	0.249	0.244	0.240	0.210	0.220	0.261	0.261	0.218	0.240	0.243	0.249	0.231	0.239	0.254	0.272
R2	0.228	0.257	0.241	0.221	0.224	0.221	0.279	0.264	0.243	0.247	0.241	0.241	0.232	0.237	0.224
R3	0.306	0.283	0.288	0.300	0.318	0.300	0.255	0.328	0.282	0.289	0.301	0.298	0.320	0.314	0.318
R4	0.217	0.215	0.231	0.269	0.238	0.218	0.205	0.190	0.236	0.221	0.209	0.230	0.209	0.195	0.186
C1	0.262	0.242	0.258	0.292	0.260	0.237	0.242	0.228	0.227	0.275	0.258	0.263	0.236	0.250	0.250
C2	0.242	0.266	0.277	0.298	0.281	0.273	0.270	0.281	0.288	0.253	0.280	0.293	0.283	0.287	0.272
C3	0.252	0.245	0.238	0.225	0.243	0.248	0.249	0.228	0.245	0.225	0.200	0.242	0.220	0.226	0.238
C4	0.244	0.247	0.226	0.185	0.216	0.243	0.239	0.263	0.240	0.247	0.262	0.202	0.261	0.237	0.241
E1	0.278	0.288	0.342	0.284	0.316	0.309	0.329	0.298	0.323	0.296	0.313	0.289	0.255	0.284	0.282
E2	0.338	0.364	0.330	0.379	0.361	0.354	0.350	0.351	0.354	0.335	0.349	0.361	0.383	0.354	0.378
E3	0.383	0.348	0.328	0.336	0.323	0.337	0.321	0.351	0.324	0.369	0.337	0.350	0.361	0.363	0.339

Table 4.7 The Normalized Total Influence Matrix of the Four Clusters $\boldsymbol{T_N^D}$

Cluster	**Task-oriented**	**Relationship-oriented**	**Change-oriented**	**External-oriented**
Task-oriented	0.204	0.244	0.322	0.230
Relationship-oriented	0.271	0.193	0.317	0.220
Change-oriented	0.259	0.244	0.250	0.246
External-oriented	0.252	0.249	0.316	0.183

Table 4.8 The Weighted Super-Matrix $\boldsymbol{W_W}$

Criteria	T1	T2	T3	T4	R1	R2	R3	R4	C1	C2	C3	C4	E1	E2	E3
T1	0.043	0.063	0.049	0.051	0.054	0.062	0.054	0.062	0.058	0.066	0.057	0.058	0.062	0.054	0.051
T2	0.050	0.045	0.058	0.057	0.065	0.063	0.078	0.075	0.070	0.069	0.063	0.061	0.074	0.073	0.074
T3	0.047	0.038	0.040	0.049	0.068	0.063	0.067	0.064	0.066	0.060	0.065	0.067	0.051	0.060	0.060
T4	0.064	0.059	0.058	0.048	0.087	0.087	0.075	0.073	0.068	0.067	0.078	0.077	0.069	0.069	0.072
R1	0.061	0.060	0.059	0.051	0.042	0.050	0.050	0.042	0.059	0.060	0.061	0.057	0.059	0.062	0.067
R2	0.056	0.063	0.059	0.054	0.043	0.042	0.053	0.050	0.060	0.061	0.059	0.059	0.057	0.058	0.055
R3	0.075	0.069	0.070	0.073	0.061	0.057	0.049	0.063	0.069	0.071	0.074	0.073	0.079	0.077	0.078
R4	0.053	0.053	0.056	0.066	0.045	0.042	0.039	0.036	0.058	0.054	0.051	0.056	0.051	0.048	0.046
C1	0.085	0.079	0.084	0.095	0.083	0.076	0.077	0.073	0.057	0.069	0.065	0.066	0.076	0.080	0.080
C2	0.079	0.087	0.090	0.097	0.090	0.087	0.086	0.090	0.072	0.063	0.070	0.073	0.091	0.092	0.087
C3	0.082	0.080	0.078	0.073	0.078	0.079	0.080	0.073	0.061	0.056	0.050	0.061	0.070	0.072	0.076
C4	0.080	0.081	0.074	0.060	0.069	0.078	0.076	0.084	0.060	0.062	0.066	0.051	0.083	0.076	0.077
E1	0.063	0.065	0.077	0.064	0.068	0.067	0.071	0.064	0.078	0.071	0.076	0.070	0.045	0.050	0.050
E2	0.076	0.082	0.074	0.086	0.078	0.076	0.075	0.076	0.085	0.081	0.084	0.087	0.068	0.063	0.067
E3	0.086	0.078	0.074	0.076	0.070	0.073	0.069	0.076	0.078	0.089	0.081	0.084	0.064	0.064	0.060

Table 4.9 The Limited Super-Matrix W_W^*

Criteria	T1	T2	T3	T4	R1	R2	R3	R4	C1	C2	C3	C4	E1	E2	E3
T1	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057
T2	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065
T3	0.058	0.058	0.058	0.058	0.058	0.058	0.058	0.058	0.058	0.058	0.058	0.058	0.058	0.058	0.058
T4	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070
R1	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056
R2	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056
R3	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070
R4	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051
C1	0.076	0.076	0.076	0.076	0.076	0.076	0.076	0.076	0.076	0.076	0.076	0.076	0.076	0.076	0.076
C2	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083
C3	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071
C4	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071
E1	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065
E2	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077
E3	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075

4.3 Ranking the Criteria priority

Each steady row value in W_W^* represents the global weight of the corresponding criterion. Sum up the global weights in each cluster can obtain the local weight of that cluster. Then, dividing the local weight by the global weights of the criteria will give the criteria's local weights. Finally, rank the global weights gains the priority orders of criteria, shown as Table 4.10.

Table 4.10 Weights and Ranks of the Evaluation Criteria

Cluster	Criterion	Local Weight	Global Weight	Rank
		0.24960		
Task-oriented	(T1) Clarifying	0.23732	0.05924	11
	(T2) Planning	0.25724	0.06421	10
	(T3) Monitoring	0.23366	0.05832	12
	(T4) Problem Solving	0.27178	0.06784	8
		0.23264		
Relationship-oriented	(R1) Consideration	0.23710	0.05516	14
	(R2) Recognition	0.24774	0.05763	13
	(R3) Development	0.29355	0.06829	7
	(R4) Empowering	0.22160	0.05155	15
		0.30039		
Change-oriented	(C1) Advocating Change	0.25547	0.07674	3
	(C2) Encouraging Innovation	0.27562	0.08279	1
	(C3) Collective Learning	0.23260	0.06987	6
	(C4) Charismatic Leadership	0.23631	0.07099	5
		0.21737		
External-oriented	(E1) Networking	0.30139	0.06551	9
	(E2) External Scanning	0.35354	0.07685	2
	(E3) Representing	0.34507	0.07501	4

Examining Table 4.10, the HR manager respondents indicate the most important criterion in each cluster from the global weight perspective are listed as follows: Problem Solving criterion in the Task-oriented cluster; Development criterion in the Relationship-oriented cluster; Encouraging Innovation criterion in the Change-oriented cluster; and External Scanning criterion in the External-oriented cluster. While from the global weight perspective, the HR manager respondents specify the top three criteria are Encouraging Innovation criterion, External Scanning criterion, and Advocating Change criterion, while the last three

criteria are Consideration criterion, Recognition criterion, and Empowering criterion. Unexpectedly, the last three criteria are all located in the Relationship-oriented cluster, which is traditionally seen as the essential elements for effective leadership behaviors. This result reveals that most HR managers in Taiwan are incline to the “concern for production” side of the managerial grid (Blake & Mouton, 1964) instead of the “concern for people” side.

5. Conclusion

In today's rapidly changing environment, leaders play a critical role in organizations. Their every behavior can impact their subordinates, departments, and even the future of the company. With an increasing number of challenges arising, leaders face increasingly complex and difficult problems. Therefore, in order to keep the company competitive, how can the effective leaders exercise suitable behaviors to effectively lead their subordinates or teams for helping organizations to raise performance, expand prosperity, achieve sustainable development, and maintain longevity is an important research subject.

The research results indicate that effective leaders should focus more on the External-oriented cluster rather than being drawn the way by the Change-oriented cluster from the perspective of clusters. In terms of criteria level, leaders must pay more attention on Encouraging Innovation criterion, External Scanning criterion, and Advocating Change criterion. On the other hand, Consideration criterion, Recognition criterion, and Empowering criterion may not list on the immediate priority for effective leaders.

This paper proposes the following findings. Effective leaders in Taiwan consider "Encouraging Innovation" as the most important leadership behavior. They believe that effective leaders can drive the growth of organizations and the career of employees by encouraging innovation, enabling organizations to gain a competitive advantage, and creating value in the market. Therefore, organizations should seek and cultivate future high-level managers with innovative thinking to meet the future diverse needs. The second important criterion is "External Scanning", it indicates that effective leaders must constantly gather external information and share useful information internally so that organizations can keep their steps with external environmental changes. Finally, the third most important criterion is "Advocating Change". In the current complex and changing environment, change is a challenge for many organizations. Effective leaders should cultivate a change-oriented mindset in the organization and subordinates during regular times to reduce obstacles during change and minimize the impact on the organization during dynamic environmental changes. The last three criteria all fall into the Relationship-oriented cluster, reflecting that effective leaders in Taiwan concern more on work-related affairs than that of their subordinates, which aligns with traditional Chinese occupational values. Although past literature often emphasizes the importance of leader-subordinate relationship issues, this paper discovers that most present HR managers in Taiwan still incline to perform the “concern for production” side of managerial grid.

Finally, the conclusion of this paper not only can provide valuable insights for those who aspire to become effective leaders to understand the important leadership behaviors they must behave, but also offers the aggressive organizations the guide lines to correctly assess potential candidates for future qualified high-level managers.

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