Research Article

Exploring the Triple Reciprocity Nature of Organizational Value Cocreation Behavior Using Multicriteria Decision Making Analysis

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Service-dominant (S-D) logic is a service science framework that is more robust than the traditional goods-dominant (G-D) logic. It emphasizes the importance of operant resources and value Cocreation. This study employs social cognitive theory to explore the triple reciprocity of organizational value Cocreation behavior. Further, this study uses DEMATEL-based ANP to examine the dynamic nature of organizational value Cocreation behavior. The major results of this study can be described as follows. First, the triadic reciprocity of personal, environmental, and behavioral factors are validated. Second, the dominant influencing trends are clearly identified. From a dimensional point of view, environmental factors affect personal factors and behavioral factors, and personal factors affect behavioral factors. Similarly, in terms of organizational value Cocreation behavior, organizational identification affects altruistic behavior and knowledge-sharing behavior, and altruistic behavior affects knowledge-sharing behavior. These findings may provide helpful guidance in effectively promoting organizational value cocreation behavior, enabling organizations to leverage operant resources to their maximum potential.

1. Introduction

Both academics and practitioners have noticed the important relationships between service, performance, and competitive advantage. The link between superior performance and competitive advantage has been well validated. However, according to Lusch et al. [1], there is little evidence regarding significant increases in service quality. Therefore, they posit that a relatively new perspective, named service-dominant (S-D) logic, is needed to view markets, exchange, and competing through the lens of service.

S-D logic is a more robust framework for service science than the traditional goods-dominant (G-D) logic is [2], with the following important tenets: (1) service is conceptualized

as a process rather than a unit of output; (2) service focuses on dynamic (or operant) resources, such as knowledge and skills, rather than static (or operand) resources, such as natural resources; and (3) service looks upon value as a collaborative process between stakeholders (i.e., providers and customers), not a unilateral one where producers create value and then deliver it to customers.

Under this background, organizational performance and competitive advantage hinge on the effectiveness of the value cocreation network formed by participatory employees. Because knowledge and skills are important operant resources under S-D logic, knowledge-sharing behavior is an essential value cocreation activity that deserves deep examination. Knowledge sharing between employees and within

and across teams allows organizations to exploit knowledge-related resources [3, 4] to create and sustain competitive advantages in a highly competitive and dynamic economy [4, 5]. In order to reap these benefits, many organizations have invested tremendous resources and efforts in knowledge management initiatives. However, most of these investments have not produced desirable outcomes [6].

According to Davenport and Prusak [4], when implementing knowledge management initiatives, organizations usually consider their technology infrastructure to be the most important component. Therefore, they tend to focus only on the technological aspects of the system. However, because organizational value cocreation behavior (i.e., knowledge sharing) is an inherently social process, its ultimate success involves social and environmental factors in addition to technology investment. Consequently, a social-technical approach can shed light on the way technology is adapted and used in an organization [7].

As a result, this study follows a social-technical approach, specifically social cognitive theory. First, we identify important elements related to the environmental, personal, and behavioral dimensions through a literature review. Then, appropriate tools from multicriteria decision making (MCDM), such as decision-making trial and evaluation laboratory (DEMATEL) and analytical network process (ANP), are applied to explore the triple reciprocity of value cocreation behavior. These tools are particularly valuable because they rely on extensive pairwise comparisons among system elements; no prior assumptions about their relationships are needed. Subsequently, the final influence patterns (directions and degrees) are objectively derived by mathematic calculations instead of subjective judgments. In this way, the present study can contribute insightful and complementary findings to this research field.

2. Theoretical Background

This study employs social cognitive theory to explore the triple reciprocity of organizational value cocreation behavior. Related theories are discussed below.

2.1. Social Cognitive Theory. Social cognitive theory (SCT) is a widely accepted, as well as empirically validated, model of individual behavior [8]. It is based on the premise that cognitive and other personal factors, environmental influences, and behavior are reciprocally determined, as shown in Figure 1 [9].

In general, personal factors include personality and demographic characteristics, and environmental influences come from social pressure or unique situational characteristics. According to SCT, individuals choose the environments they are involved in and are influenced by the environment incidentally. Furthermore, cognitive and personal factors are determined, as well as reshaped, by behavior. Finally, in a given situation, behavior is affected by environmental and/or situational characteristics, which are in turn influenced by behavior. Bandura denotes the nature of these relationships

FIGURE 1: Interaction between the environment, individual, and behavior.

as “triadic reciprocity” [10]. This study concerns dynamic interactions in the context of organizational value cocreation.

2.2. Organizational Value Cocreation Behavior (Behavior Dimensions of SCT). This study explores organizational value cocreation from the perspective of organizational citizenship behavior (OCB), including organizational identification, altruistic behavior, and knowledge-sharing behavior.

Davenport and Prusak [4] argued that it is often unnatural for people to engage in knowledge sharing, as they consider their knowledge to be valuable and important. Thus, individuals may have a natural tendency to withhold their knowledge from others. Moreover, research has addressed the challenge that knowledge sharing rarely occurs spontaneously [11]. Therefore, it is beneficial to explore how voluntary knowledge sharing can be facilitated effectively.

Clearly, active knowledge sharing requires that individual members be willing to provide spontaneous assistance without assurance of reciprocation, which is strongly related to OCB. Organ [12] defined OCB as work-related behavior that is discretionary, not related to the formal organizational reward system, and, in aggregate, promotes the effective functioning of the organization.

Specifically, Organ and Konovsky [13] defined the following five types of OCB:

- (1) altruism: voluntary actions that help another person with a work-related problem,
- (2) conscientiousness: going well beyond the required levels of responsibility,
- (3) civic virtue: responsible and constructive involvement in the political process of an organization,
- (4) sportsmanship: tolerating the inevitable inconvenience and impositions of work without complaining,
- (5) courtesy: providing advance notice to people who need such information.

In a knowledge management context, sharing knowledge with others without an expectation of reciprocation represents altruistic behavior. Further, when sharing knowledge, the contributors participate conscientiously and actively (courtesy) with civic virtue, and they tolerate the efforts required to share their resources (sportsmanship). Thus, knowledge-sharing behavior can be viewed as a typical OCB.

William and Anderson [14] further divided OCB into two major dimensions: (1) behaviors directed at specific

individuals in the organization, such as courtesy and altruism (OCB-I, I: individual) and (2) behaviors concerned with benefiting the organization as a whole, such as conscientiousness, sportsmanship, and civic virtue (OCB-O, O: organization). OCB-I refers to the behaviors that benefit specific individuals within an organization first and then contribute indirectly to organizational effectiveness [14, 15]. OCB-I involves voluntarily helping to solve work-related problems. In contrast, OCB-O refers to behaviors that benefit the organization in general, without actions aimed specifically toward any organizational member. Podsakoff et al. [16] labeled OCB-O as a form of organizational compliance involving an internalization of a company's rules and policies. This study follows this classification of OCB and adopts organizational identification and altruistic behavior to represent OCB-O and OCB-I, respectively. Table 1 further elucidates the organizational value cocreation behaviors referenced in this study.

2.3. Organizational Climate (Environment Dimensions of SCT). Organizational climate refers to the perceptions and feelings of organizational members regarding their work environment [17]. It is multidimensional in nature and is assumed to influence personal motivation and behavior [18–20]. For example, Schulte and Ostroff [21] maintained that organizational climate plays an important role in understanding organizational members' attitudes. Moreover, they proved that individuals' evaluations of the climate are positively related to their attitude. Specifically, the more positive the perception of the organizational climate, the more energetic the collective attitude.

Different aspects of organizational climate have been identified as critical drivers of knowledge sharing, such as top management support [11], employee involvement [22, 23], stimulus to develop new ideas [24], an open and freely expressive atmosphere where information keeps flowing [25, 26], communication network [27, 28], and reward systems linked to knowledge sharing [29].

In line with previous research [24, 30, 31], we identify four subfactors of organizational climate, as identified in Table 2.

2.4. Self-Efficacy and Outcome Expectations (Personal Dimensions of SCT). In terms of personal factors, SCT emphasizes two sets of expectations as the major cognitive forces guiding behavior. The first set of expectations relates to outcome expectations, and the second set encompasses self-efficacy [10, 32, 33]. Outcome expectations refer to the judgment of likely consequences of specific behavior. Outcome expectations may be personal, such as a sense of satisfaction or happiness, or team-related, such as improved project performance. Meanwhile, self-efficacy is the belief that one possesses the skills and abilities to successfully accomplish a specific task [34].

Without incentives, people are seldom willing to spend their time and effort to perform specific behaviors. Therefore, outcome expectations play an important role in inducing desired behaviors. According to economic exchange theory, an individual's behaviors are strongly motivated by self-interest (i.e., positive personal expectations). Furthermore,

based on social exchange theory, if employees believe they can improve their relationship with other employees by offering knowledge (i.e., positive team-related outcome expectations), they develop a more positive attitude toward knowledge sharing [35].

Though positive outcome expectations are essential for producing actual behavior, they must be supplemented by positive self-efficacy. Perceived self-efficacy plays an important role in one's choices about which behaviors to undertake and in the effort and persistence one invests in overcoming obstacles to the performance of those behaviors [10, 32, 36, 37]. People who have higher self-efficacy are more likely to perform related behaviors than are those with lower self-efficacy. As a result, Bandura [32] posited that self-efficacy ultimately leads to the mastery of behaviors.

In the context of knowledge sharing, self-efficacy plays a particularly dominant role [38, 39]. It has a direct impact on outcome expectations [32], and individuals with positive outcome expectations are more likely to share their knowledge [39]. Table 3 summarizes the aspects of self-efficacy and outcome expectations referenced in this study.

Finally, we investigate dynamic interactions in an organizational value cocreation context. With the support of the previous literature, this study utilizes social cognitive theory to explore the triple reciprocity of organizational value cocreation behavior. Therefore, this study proposes the research framework shown in Figure 2. Further, this study employs DEMATEL-based ANP to examine the dynamic nature of organizational value cocreation behavior.

3. Building a DANP Model for Exploring the Dynamics of Knowledge-Sharing Behavior

This study applies DEMATEL-based ANP (DANP) to validate the proposed research framework. DANP can identify the interdependence among various dimensions and criteria. Figure 3 provides an illustration of DANP.

3.1. DEMATEL. Originating from the Geneva Research Centre of the Battelle Memorial Institute, the DEMATEL approach is a mathematical procedure designed to deal with important issues of world societies [40]. The DEMATEL possesses some excellent features. For example, it is based on matrices to represent the contextual relation as well as strength of influence of the elements of the target system. It can also convert the cause–effect relationship of elements into visible structural models.

Due to its practical benefits, the DEMATEL has been widely applied in various fields, such as marketing [41], education [42, 43], investment [44], and supply chain management [45].

The steps for building an impact-relation map (IRM) using a DEMATEL technique (Steps 1–3) and finding influential weights using an ANP technique (Steps 4–6) are summarized below.

TABLE 1: Examples of organizational value cocreation behaviors.

Behavioral dimensions	Examples
Knowledge-sharing behavior	(1) I will share my work reports and official documents with other team members more frequently in the future. (2) I intend to share my experience or know-how from work with other team members more frequently in the future. (3) I try to share my expertise from my education or training with other team members in an effective way.
Organizational identification	(1) I make every effort to safeguard the image of my company. (2) I make every effort to demonstrate the strength of my company. (3) I put forward good suggestions voluntarily to the members of my company. (4) I participate in the activities of my company with a positive attitude.
Altruistic behavior	(1) Rather than evading assigned tasks, I willingly take on new or challenging tasks. (2) I help members to resolve conflicts and misunderstandings to maintain a harmonious company. (3) I am able to maintain good relations with my team members. (4) I communicate with my team members actively while carrying out communal tasks.

Reference: [64, 65].

TABLE 2: Four subfactors of organizational climate.

Environment dimensions	Examples
Top management support.	Top management clearly supports the role of knowledge sharing.
Open communication	Employees are encouraged to interact with their colleagues.
Innovativeness	Employees are encouraged to suggest ideas for new opportunities.
Reward system	Organization provides a reward system to induce knowledge sharing.

Reference: [24, 30, 31].

TABLE 3: Definitions and examples of self-efficacy and outcome expectations.

Personal dimensions	Examples
Self-efficacy: the confidence in one's ability to provide knowledge that is valuable to the work group.	I have confidence in my ability to (1) provide knowledge that people I work with consider valuable, (2) provide knowledge that people I work with consider informative, (3) provide knowledge that people I work with consider helpful, (4) be well informed in order to provide valuable knowledge, (5) have the expertise needed to provide knowledge.
Personal outcome expectations: the knowledge contributor's judgment of the likely consequences that his or her knowledge sharing may bring to himself or herself.	Sharing my knowledge will (1) help me make friends with other members in the work group, (2) give me a feeling of happiness, (3) build my reputation in my work group, (4) give me a sense of accomplishment, (5) strengthen the tie between me and others in the work group, (6) enable me to gain better cooperation in the future from outstanding members in the work group.
Team outcome expectation: the knowledge contributor's judgment of the likely consequences that his or her knowledge sharing may bring to the team.	Sharing my knowledge will help my work group (1) be more capable of meeting project goals, (2) produce a greater amount of knowledge, (3) produce a higher quality of knowledge, (4) adhere more closely to project schedules, (5) have higher operational efficiency, (6) have higher operational speed.

Reference: [38, 39].

FIGURE 2: Research framework of this study.

FIGURE 3: DEMATEL-based ANP.

Step 1 (generate the initial direct-relation matrix). Acquire the assessments about the direct influence between each pair of elements from a committee of experts. The pairwise comparison is designated by five levels—0, 1, 2, 3, and 4—to represent “no influence,” “very low influence,” “low influence,” “high influence,” and “very high influence,” respectively. The initial direct-relation matrix A is an $n \times n$ matrix in which a_{ij} is denoted as the degree to which the element i affects the element j ; that is, $A = [a_{ij}]_{n \times n}$.

Step 2 (normalize the initial relation matrix to attain total-relation matrices). The normalized direct-relation matrix $X = [x_{ij}]$ can be obtained through

$$s = \max_{ij} \left[\max_{1 \leq i \leq n} \sum_{j=1}^n a_{ij}, \max_{1 \leq j \leq n} \sum_{i=1}^n a_{ij} \right], \quad (1)$$

$$X = \frac{1}{s} A. \quad (2)$$

Here, (1) represents the maximum values of the sums of all the rows and the sums of all the columns. Equation (2)

represents the normalized initial direct-relation matrix. All elements in matrix X are complying with $0 \leq x_{ij} \leq 10$, and all principal diagonal elements are equal to 0. Thus, the total relation matrix, T , can be obtained by using the following numerical calculation:

$$T = X + X^2 + \cdots + X^p = X \times (1 - X)^{-1} = [x_{ij}]_{n \times n} \quad p \rightarrow \infty \quad (3)$$

$$T = [t_{ij}]_{n \times n}, \quad i, j = 1, 2, \dots, n.$$

Here, I is the identity matrix and p represents the power. Hence, when p tends to infinity, the matrix X will converge.

The total relation matrix produced by the DEMATEL approach is based on the comparisons among criteria. Therefore, it can be renamed as a total criteria relation matrix ($T_c = [T_c^{ij}]_{n \times n}$), as shown in (4), with m dimensions and n_1 to n_m criteria each. D_m denotes the m_{th} dimension; C_{mm} represents the m_{th} criteria in the n_{th} dimension; and T_c^{ij} is the principle eigenvector of the influences of the elements in the i_{th} dimension, as compared to the i_{th} dimension:

$$T_c = \begin{matrix} & & \begin{matrix} D_1 & \cdots & D_j & \cdots & D_m \\ C_{11} & \cdots & C_{1n_1} & \cdots & C_{j1} & \cdots & C_{jn_j} & \cdots & C_{n1} & \cdots & C_{mm_m} \end{matrix} \\ \begin{matrix} D_1 \\ \vdots \\ C_{1n_1} \\ \vdots \\ C_{i1} \\ C_{i2} \\ \vdots \\ C_{in_i} \\ \vdots \\ C_{m1} \\ C_{m2} \\ \vdots \\ C_{mm_m} \end{matrix} & \begin{bmatrix} T_c^{11} & \cdots & T_c^{1j} & \cdots & T_c^{1m} \\ \vdots & & \vdots & & \vdots \\ T_c^{i1} & \cdots & T_c^{ij} & \cdots & T_c^{im} \\ \vdots & & \vdots & & \vdots \\ T_c^{m1} & \cdots & T_c^{mj} & \cdots & T_c^{mm} \end{bmatrix} & \end{matrix} \quad (4)$$

Based on T_c , the total dimensions relation matrix T_d can be generated from the total criteria matrix using the following, where t_d^{ij} is the average of elements of matrix T_c^{ij} :

$$T_d = \begin{bmatrix} t_d^{11} & \cdots & t_d^{1j} & \cdots & t_d^{1m} \\ \vdots & & \vdots & & \vdots \\ t_d^{i1} & \cdots & t_d^{ij} & \cdots & t_d^{im} \\ \vdots & & \vdots & & \vdots \\ t_d^{m1} & \cdots & t_d^{mj} & \cdots & t_d^{mm} \end{bmatrix}. \quad (5)$$

Step 3 (produce the IRM). The IRM of T_c and T_d is established via the vectors r and s , the sums of rows and columns, respectively, which are obtained by

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

$$s = [s_j]_{n \times 1} = \left[\sum_{i=1}^n t_{ij} \right]_{1 \times n}'.$$

r_i denotes the sum of the i_{th} row, representing all influences of criteria (or dimensions) on other criteria (or dimensions). Moreover, s_j denotes the sum of the i_{th} column of matrix T_c (or T_d), meaning the total impact that criterion (or dimension) j gets from other criteria (or dimensions).

The IRM can be constructed by mapping the dataset of $(r_i + s_j, r_i - s_j)$. The horizontal axis vector $(r_i + s_j)$, named “prominence,” is produced by adding r_i to s_j , which shows the importance of the element. Similarly, the vertical axis $(r_i - s_j)$, named “relation,” is produced by subtracting r_i from s_j . Generally, when $(r_i - s_j)$ is positive, the element belongs to the cause group; otherwise, the element belongs to the effect group [46, 47].

After calculating the means of $(r_i + s_j)$ and $(r_i - s_j)$, the IRM can be divided into four quadrants. Elements in quadrant I have both high prominence and relation, which means they have the highest level of interaction influence on other elements; thus, they can be identified as driving factors. Elements in quadrant II have low prominence but high relation and can be identified as voluntary factors. Elements in quadrant III have both low prominence and relation, and they are relatively disconnected from the system. Finally, the elements in quadrant IV have high prominence and low relation, which means they are important items affected by other elements [48].

3.2. ANP. Saaty [49] established the analytical network process (ANP) as a way to determine complicated nonlinear network relationships. This method addressed the limitations of the analytical hierarchy process (AHP), which hypothesizes that all factors of indices under each level of the framework possess mutual independence [50]. Nevertheless, the ANP survey questionnaire would be too laborious to fill out [51, 52]. To solve this problem, we based the questionnaire on

the total criteria matrix and total dimensions matrix generated by DEMATEL. This enabled us to conduct further procedures required by ANP to deal with the problems of dependence and feedback among criteria, as described in the following steps.

Step 4 (normalize the total criteria relation matrix). Using the total degree of effect and influence of the dimensions, the total criteria relation matrix T_c can be normalized to obtain T_c^* , as shown in

$$d_{ci}^{11} = \sum_{j=1}^{m_1} t_{ij}^{11}, \quad i = 1, 2, \dots, m_1,$$

$$T_{c*}^{11} = \begin{bmatrix} \frac{t_{c11}^{11}}{d_{c1}^{11}} & \dots & \frac{t_{c1j}^{11}}{d_{c1}^{11}} & \dots & \frac{t_{c1n_1}^{11}}{d_{c1}^{11}} \\ \vdots & & \vdots & & \vdots \\ \frac{t_{ci1}^{11}}{d_{ci}^{11}} & \dots & \frac{t_{cij}^{11}}{d_{ci}^{11}} & \dots & \frac{t_{cin_1}^{11}}{d_{ci}^{11}} \\ \vdots & & \vdots & & \vdots \\ \frac{t_{cn_11}^{11}}{d_{cn_1}^{11}} & \dots & \frac{t_{cn_1j}^{11}}{d_{cn_1}^{11}} & \dots & \frac{t_{cn_1n_1}^{11}}{d_{cn_1}^{11}} \end{bmatrix}$$

$$= \begin{bmatrix} t_{c11*}^{11} & \dots & t_{c1j*}^{11} & \dots & t_{c1n_1*}^{11} \\ \vdots & & \vdots & & \vdots \\ t_{ci1*}^{11} & \dots & t_{cij*}^{11} & \dots & t_{cin_1*}^{11} \\ \vdots & & \vdots & & \vdots \\ t_{cn_11*}^{11} & \dots & t_{cn_1j*}^{11} & \dots & t_{cn_1n_1*}^{11} \end{bmatrix}, \quad (7)$$

$$T_c^* = \begin{bmatrix} T_{c*}^{11} & \dots & T_{c*}^{1j} & \dots & T_{c*}^{1m} \\ \vdots & & \vdots & & \vdots \\ T_{c*}^{i1} & \dots & T_{c*}^{ij} & \dots & T_{c*}^{im} \\ \vdots & & \vdots & & \vdots \\ T_{c*}^{m1} & \dots & T_{c*}^{mj} & \dots & T_{c*}^{mm} \end{bmatrix}.$$

Step 5 (normalize the total dimensions relation matrix). The total dimension matrix T_d can be normalized by (8) to obtain T_d^* , representing the weights of dimensions:

$$t_d^1 = \sum_{j=1}^m t_d^{ij},$$

$$T_d^* = \begin{bmatrix} \frac{t_d^{11}}{t_d^1} & \dots & \frac{t_d^{1j}}{t_d^1} & \dots & \frac{t_d^{1m}}{t_d^1} \\ \vdots & & \vdots & & \vdots \\ \frac{t_d^{i1}}{t_d^i} & \dots & \frac{t_d^{ij}}{t_d^i} & \dots & \frac{t_d^{im}}{t_d^i} \\ \vdots & & \vdots & & \vdots \\ \frac{t_d^{m1}}{t_d^m} & \dots & \frac{t_d^{mj}}{t_d^m} & \dots & \frac{t_d^{mm}}{t_d^m} \end{bmatrix}$$

$$= \begin{bmatrix} T_{d*}^{11} & \dots & T_{d*}^{1j} & \dots & T_{d*}^{1m} \\ \vdots & & \vdots & & \vdots \\ T_{d*}^{i1} & \dots & T_{d*}^{ij} & \dots & T_{d*}^{im} \\ \vdots & & \vdots & & \vdots \\ T_{d*}^{m1} & \dots & T_{d*}^{mj} & \dots & T_{d*}^{mm} \end{bmatrix}. \quad (8)$$

Step 6 (build the weighted supermatrix, and obtain the influential weights of elements). Multiply the normalized total criteria relation matrix (T_{c*}) by the normalized total dimensions relation matrix (T_{d*}) to produce the original weighted supermatrix S , as shown in

$$S = \begin{bmatrix} T_{c*}^{11} \times T_{d*}^{11} & \dots & T_{c*}^{1j} \times T_{d*}^{1j} & \dots & T_{c*}^{1m} \times T_{d*}^{1m} \\ \vdots & & \vdots & & \vdots \\ T_{c*}^{i1} \times T_{d*}^{i1} & \dots & T_{c*}^{ij} \times T_{d*}^{ij} & \dots & T_{c*}^{im} \times T_{d*}^{im} \\ \vdots & & \vdots & & \vdots \\ T_{c*}^{m1} \times T_{d*}^{m1} & \dots & T_{c*}^{mj} \times T_{d*}^{mj} & \dots & T_{c*}^{mm} \times T_{d*}^{mm} \end{bmatrix}. \quad (9)$$

S is further transposed to a column-stochastic supermatrix S^* , as shown in

$$S^* = \begin{bmatrix} T_{c*}^{11} \times T_{d*}^{11} & \dots & T_{c*}^{i1} \times T_{d*}^{i1} & \dots & T_{c*}^{m1} \times T_{d*}^{m1} \\ \vdots & & \vdots & & \vdots \\ T_{c*}^{1j} \times T_{d*}^{1j} & \dots & T_{c*}^{ij} \times T_{d*}^{ij} & \dots & T_{c*}^{mj} \times T_{d*}^{mj} \\ \vdots & & \vdots & & \vdots \\ T_{c*}^{1m} \times T_{d*}^{1m} & \dots & T_{c*}^{im} \times T_{d*}^{im} & \dots & T_{c*}^{mm} \times T_{d*}^{mm} \end{bmatrix}. \quad (10)$$

Limit the weighted supermatrix S^* by raising it to a sufficiently large power φ (i.e., $\lim_{\varphi \rightarrow \infty} (S^*)^\varphi$) until it converges and becomes a long-term stable supermatrix. Then, the final global priority matrix (i.e., $W = [W_1, \dots, W_j, \dots, W_n]$) defines the influential weights among criteria.

TABLE 4: Background information for survey respondent.

Category/classification	Number
Sex	
Male	12
Female	4
Age	
Between 31 and 40 years	12
Between 41 and 50 years	2
Older than 50 years	2
Education level	
Bachelor	2
Master	12
Ph.D.	2
Working background	
Academic field	7
Industry field	9
Position	
Managerial	3
Professional	13
Years of work experience	
Less than 3 years	3
Between 7 and 9 years	7
More than 10 years	6
Company size (capital, in New Taiwan Dollars)	
Less than 10 million	1
Between 10 and 50 million	10
More than 50 million	5

4. Applications of the Proposed Model

In order to explore the dynamic relationships between the personal, environmental, and behavioral factors that influence organizational value cocreation behavior, we developed a questionnaire to survey experts who have rich experiences in knowledge-intensive activities. Based on their input, we conducted a DANP analysis.

4.1. Representativeness of the Surveyed Experts

4.1.1. Background of Surveyed Experts. Northcutt and McCoy ([53], p. 87) suggested that a representative focus group should include 12 to 20 members who have the following desirable characteristics: (1) they are knowledgeable of, and experienced with, the research issue; (2) they have the abilities to ponder the questions and to adequately put their thoughts into words; (3) they have the motivation and time to participate in the study; (4) they are homogeneous concerning the important dimensions of distance and power; (5) they have good team spirit, and they are neither overpowering nor too timid to speak.

We followed these guidelines in assembling domain experts. Table 4 provides a summary of the background information regarding these experts.

To ensure that these experts understood the meaning of the research constructs, we conducted the survey face-to-face. For additional clarity, we prepared detailed definitions and examples to present in the questionnaire. Participants were asked to make comprehensive pairwise comparisons regarding all research constructs in order to evaluate their effects and influences.

Pairwise relative comparison is an essential aspect of AHP and ANP. It allows decision makers to set priorities and make choices based on their objectives, knowledge, and experiences in a way that is consistent with their intuitive thought process [54]. With pairwise comparison, weights and priorities are not arbitrarily assigned; rather, they are *derived* from a set of redundant judgments. This method for deriving priorities is deemed reliable because (1) it is based on a sound mathematical foundation and (2) it has been validated through studies [54].

4.1.2. The Appropriateness of Sample Size. Denzin and Lincoln [55] proposed that, in qualitative research, the size of the sample is not as important as its appropriateness and richness. Moreover, following the principle of theoretical saturation, researchers should continue sampling respondents until the information collected achieves theoretical saturation. Theoretical saturation means that no new or relevant data emerge concerning a category, that the category is well developed, and that the linkages between categories are well established [56].

The DEMATEL approach allows for the evaluation of asymmetric influences between elements. Thus, unlike in AHP, which has a consistency index, there is no consistency indicator in DEMATEL. This problem can be overcome by calculating the errors of gap ratio (EGR), as defined below [57].

Consider $EGR = (1/n(n-1)) \sum_{i=1}^n \sum_{j=1}^n (|a_{ij}^p - a_{ij}^{p-1}|/a_{ij}^p) \times 100\%$, where p denotes the number of sample and a_{ij}^p is the average influence of i criteria on j . The number of gap ratio elements is $n(n-1)$. When EGR is α , the significance of the confidence interval is $(1-\alpha)$. In general, when α is less than 5%, we have over 95% confidence, demonstrating that there is no significant difference between the evaluations of sample size p and $p-1$. Consequently, it is reasonable to propose that sample size p is significantly close to theoretical saturation and, thus, is an appropriate size.

Based on the data in Tables 5 and 6, EGR is found to be 4.449%, representing a 95.551% confidence level. Consequently, Table 6 is used as input data for further DEMATEL calculations.

4.2. The Application of DEMATEL to Build an IRM. The DEMATEL technique is used to model influential relationships among dimensions and criteria and to establish an IRM representing these relationships.

4.2.1. Generate the Initial Direct-Relation Matrix. As shown in Table 6, the group consensus results yield matrix A , the initial direct-relation matrix. Matrix A is normalized using (1) and (2) to produce matrix G , as shown in Table 7.

TABLE 5: Group consensuses of the 15 respondents on the degree of influence among the criteria (unit: %).

Criteria	a_1	a_2	a_3	b_1	b_2	b_3	b_4	c_1	c_2	c_3
a_1	0.000	3.200	3.133	0.333	1.200	0.333	0.267	1.733	2.133	3.133
a_2	1.200	0.000	2.667	0.333	1.200	0.133	0.400	2.200	1.933	1.733
a_3	1.067	2.000	0.000	0.867	1.533	1.067	0.733	2.667	1.667	2.267
b_1	3.200	2.733	3.067	0.000	2.867	3.000	2.467	2.800	2.400	2.800
b_2	2.067	2.467	2.533	0.400	0.000	2.467	0.533	2.133	2.733	2.867
b_3	1.933	2.467	2.200	0.400	2.000	0.000	1.000	1.733	1.667	2.400
b_4	2.400	2.600	2.733	0.667	1.600	3.133	0.000	2.600	2.067	2.800
c_1	1.067	1.800	2.333	1.067	1.467	1.133	0.200	0.000	2.667	2.933
c_2	1.067	1.467	1.533	0.533	1.067	0.467	0.000	1.067	0.000	3.333
c_3	1.600	1.533	2.200	1.067	1.267	1.000	0.200	1.267	2.467	0.000

TABLE 6: Group consensuses of the 16 respondents on the degree of influence among the criteria (unit: %).

Criteria	a_1	a_2	a_3	b_1	b_2	b_3	b_4	c_1	c_2	c_3
a_1	0.000	3.188	3.125	0.313	1.125	0.313	0.250	1.625	2.188	3.125
a_2	1.125	0.000	2.750	0.313	1.125	0.125	0.375	2.250	1.938	1.750
a_3	1.000	1.875	0.000	0.813	1.438	1.000	0.688	2.500	1.563	2.188
b_1	3.188	2.688	3.063	0.000	2.688	2.938	2.313	2.625	2.250	2.813
b_2	2.063	2.438	2.500	0.375	0.000	2.313	0.500	2.000	2.563	2.813
b_3	1.938	2.500	2.188	0.375	1.875	0.000	0.938	1.625	1.563	2.500
b_4	2.375	2.563	2.688	0.688	1.500	3.063	0.000	2.500	1.938	2.875
c_1	1.125	1.875	2.313	1.000	1.438	1.063	0.188	0.000	2.625	2.875
c_2	1.000	1.500	1.563	0.500	1.125	0.438	0.000	1.000	0.000	3.313
c_3	1.500	1.438	2.063	1.000	1.188	0.938	0.188	1.188	2.313	0.000

TABLE 7: Normalized initial direct-relation matrix.

Criteria	a_1	a_2	a_3	b_1	b_2	b_3	b_4	c_1	c_2	c_3
a_1	0.000	0.130	0.127	0.013	0.046	0.013	0.010	0.066	0.089	0.127
a_2	0.046	0.000	0.112	0.013	0.046	0.005	0.015	0.092	0.079	0.071
a_3	0.041	0.076	0.000	0.033	0.059	0.041	0.028	0.102	0.064	0.089
b_1	0.130	0.109	0.125	0.000	0.109	0.120	0.094	0.107	0.092	0.115
b_2	0.084	0.099	0.102	0.015	0.000	0.094	0.020	0.081	0.104	0.115
b_3	0.079	0.102	0.089	0.015	0.076	0.000	0.038	0.066	0.064	0.102
b_4	0.097	0.104	0.109	0.028	0.061	0.125	0.000	0.102	0.079	0.117
c_1	0.046	0.076	0.094	0.041	0.059	0.043	0.008	0.000	0.107	0.117
c_2	0.041	0.061	0.064	0.020	0.046	0.018	0.000	0.041	0.000	0.135
c_3	0.061	0.059	0.084	0.041	0.048	0.038	0.008	0.048	0.094	0.000

Then, the total criteria relation matrix and total dimensions relation matrix can be derived by (3)–(5), as shown in Tables 8 and 9.

Furthermore, the total influence given and received by each dimension and criterion can be summarized using (6), as shown in Table 10. Thus, the IRM of the DEMATEL technique can be obtained as shown in Figures 4–7.

4.3. The Application of ANP to Obtain Influential Weights of Criteria. Having determined the relationship structure of all dimensions and criteria, ANP is applied to obtain the influential weights of the criteria. First, the total criteria relation matrix and total dimensions relation matrix are normalized based on (7) and (8), as shown in Tables 11 and 12.

TABLE 8: Total criteria relation matrix.

Criteria	a_1	a_2	a_3	b_1	b_2	b_3	b_4	c_1	c_2	c_3	r_i
a_1	0.074	0.223	0.237	0.048	0.115	0.065	0.033	0.158	0.192	0.247	0.533
a_2	0.103	0.084	0.198	0.042	0.102	0.050	0.034	0.161	0.161	0.174	0.386
a_3	0.111	0.168	0.111	0.064	0.123	0.091	0.050	0.180	0.161	0.204	0.391
b_1	0.256	0.288	0.323	0.058	0.228	0.211	0.133	0.262	0.270	0.333	0.630
b_2	0.168	0.217	0.235	0.056	0.086	0.150	0.048	0.186	0.223	0.261	0.339
b_3	0.156	0.208	0.212	0.052	0.148	0.059	0.062	0.163	0.176	0.234	0.321
b_4	0.198	0.245	0.268	0.074	0.159	0.192	0.035	0.225	0.223	0.290	0.461
c_1	0.120	0.175	0.205	0.073	0.128	0.096	0.033	0.093	0.206	0.238	0.537
c_2	0.094	0.132	0.146	0.046	0.095	0.057	0.018	0.106	0.079	0.216	0.401
c_3	0.122	0.144	0.178	0.067	0.107	0.082	0.029	0.125	0.176	0.112	0.413
s_j	0.289	0.475	0.546	0.239	0.621	0.612	0.278	0.323	0.461	0.566	

TABLE 9: Total dimensions relation matrix.

Dimensions	A	B	C	r_i
A	0.146	0.068	0.182	0.396
B	0.231	0.109	0.237	0.578
C	0.146	0.069	0.150	0.365
s_j	0.523	0.246	0.569	

TABLE 10: Sum of influences given and received on dimensions and criteria.

	r_i	s_j	$r_i + s_j$	$r_i - s_j$
A	0.396	0.523	0.919	-0.127
a_1	0.533	0.289	0.822	0.245
a_2	0.386	0.475	0.861	-0.089
a_3	0.391	0.546	0.937	-0.156
B	0.578	0.247	0.824	0.331
b_1	0.630	0.239	0.869	0.390
b_2	0.339	0.621	0.960	-0.282
b_3	0.321	0.612	0.933	-0.292
b_4	0.461	0.278	0.739	0.183
C	0.365	0.569	0.935	-0.204
c_1	0.537	0.323	0.860	0.214
c_2	0.401	0.461	0.862	-0.060
c_3	0.413	0.566	0.979	-0.154

Second, the normalized total criteria relation matrix is weighted by the normalized total dimensions matrix to obtain an original weighted supermatrix. The matrix is transposed to produce the weighted supermatrix shown in Table 13.

Finally, the influential weights of criteria can be obtained by limiting the power of the weighted supermatrix until it reaches a stable state, as shown in Table 14.

4.4. Results and Discussions. In the context of organizational value cocreation, the major results of this study can be

described as follows. First, the triadic reciprocity of personal, environmental, and behavioral factors is validated. The total criteria relation matrix and total dimensions relation matrix capture the effects and influences of elements, and there are no empty cells in the matrix. Therefore, all elements influence and are influenced by all other elements. This conclusion reflects the dynamism and complexity of the real world quite well. Second, the dominant influencing trends are visually identified. Though all elements influence each other, there still exist some significant relationships, as shown in Table 15.

FIGURE 4: Impact-relation map of dimensions.

FIGURE 5: Impact-relation map of criterion b . FIGURE 6: Impact-relation map of criterion a . FIGURE 7: Impact-relation map of criterion c .

From a dimensional point of view, the environmental factors affect both the personal and behavioral factors ($B \rightarrow \{A, C\}$). Further, the personal factors affect the behavioral factors ($A \rightarrow \{C\}$). This implies that, in order to increase organizational value cocreation behavior, managers first need to improve environmental factors. Such an approach would motivate individuals to conduct the desired behaviors.

Similarly, in terms of the environmental dimension, top management support affects the reward system, innovativeness, and open communication ($b_1 \rightarrow \{b_4, b_2, b_3\}$). Further, the reward system affects innovativeness and open communication ($b_4 \rightarrow \{b_2, b_3\}$), and innovativeness affects open communication ($b_2 \rightarrow \{b_3\}$). Consequently, to encourage organizational value cocreation behavior, management should implement an effective reward system capable of motivating innovativeness and open communication among employees.

Regarding personal factors, self-efficacy affects personal outcome expectations and team outcome expectations ($a_1 \rightarrow \{a_2, a_3\}$). In addition, personal outcome expectations affect team outcome expectations ($a_2 \rightarrow \{a_3\}$). Thus, it is clear that self-efficacy drives personal as well as team performance.

In terms of behavioral factors, organizational identification affects altruistic behavior and knowledge-sharing behavior ($c_1 \rightarrow \{c_2, c_3\}$). Moreover, altruistic behavior affects knowledge-sharing behavior ($c_2 \rightarrow \{c_3\}$). This result shows that organizational identification acts as a foundation for altruistic behavior in general and, specifically, for knowledge-sharing behavior.

Third, the influential weights of criteria are clearly identified. As shown in Table 14, the highest relative weights are found mainly in the behavioral dimension, such as knowledge-sharing behavior (c_3 , assessed at 0.158), altruistic behavior (c_2 , 0.131), and organizational identification (c_1 , 0.115). This indicates that all domain experts gave high priority to the behaviors related to knowledge sharing. The second-most-important dimension is personal factors, stressing the important role of team outcome expectations (a_3 , 0.145) and personal outcome expectations (a_2 , 0.127). Moreover, the results show that open communication (b_2 , 0.090) is the most critical environmental factor for knowledge sharing.

5. Conclusion

In the era of the knowledge economy, the importance of organizational value cocreation behavior, especially knowledge sharing, cannot be overemphasized. In fact, knowledge is of limited value if it is not updated and shared [58]. Traditional research has used large sample surveys to validate hypotheses that generally emphasize the antecedents of organizational value cocreation behavior. Instead, this study applies an MCDM approach with the following features.

First, this study utilizes social cognitive theory in its investigation of organizational value cocreation behavior. To be consistent with real-world cases, where all factors interrelate and influence each other, this study did not assume any previously hypothesized relationships in terms of direction and degree. In this regard, the findings of this

TABLE 15: Dominant influences.

Elements\Influences	Primary	Secondary
Dimensions	Environmental (B)	Personal (A) Behavioral (C)
Environmental (B)' criteria	Top management support (b_1)	Reward system (b_4) Open communication (b_2) Innovativeness (b_3)
Personal (A)' criteria	Self-efficacy (a_1)	Personal outcome expectation (a_2) Team outcome expectation (a_3)
Behavioral (C)' criteria	Organizational identification (c_1)	Altruistic behavior (c_2) Knowledge sharing behavior (c_3)

study provide insightful and complementary contributions to related studies.

Second, the subjects interviewed are domain experts who have rich experience with organizational value cocreation behavior. Therefore, the responses reflect their accumulated experience, rather than judgments about specific organizations. Furthermore, respondents were screened for qualifications according to suggestions for qualitative research. In addition, the number of interviewees was determined by the principle of theoretical saturation. It is significant that the final consensuses of these experts were derived by objective mathematical calculations, not subjective judgments. In this way, the results of this study can be expected to have satisfactory reliability and validity.

According to the IRMs derived from this study, the environmental dimension affects both the personal dimension and the behavioral dimension. Liebowitz [59] noted that organizations must shape and support a knowledge-sharing culture in order to promote knowledge management. Zárraga and Bonache [60] and Bock et al. [11] remarked that a comfortable organizational climate may encourage individuals to share personal knowledge or to create new knowledge.

In the environmental dimension, management support is needed to establish an appropriate reward system that promotes a positive organization climate characterized by open communication and innovativeness—values that are conducive to organizational value cocreation behavior. In fact, many scholars have mentioned that supervisor or leader support is a crucial factor in successful knowledge management [11, 59, 61]. Fullan [62] noted that leadership behavior plays an important role in guiding knowledge-sharing behavior. Under this supportive environment, employees establish their personal as well as team outcome expectations according to their self-efficacies. These outcome expectations enhance their organizational identification, which further motivates their altruistic, especially knowledge-sharing, behaviors.

Cabrera et al. [63] found that personal characteristics also influence members' willingness to share knowledge.

Cabrera and Cabrera [3] pointed out that if team members have a higher degree of recognition for the team, the team members are more willing to share knowledge. Bock et al. [11] referred to the influence of self-efficacy on individuals' willingness to share knowledge. Staff members with a high level of self-efficacy are more likely to engage in knowledge-sharing behaviors. Moreover, Hsu et al. [38] pointed out that individuals who share their knowledge and have a high level of self-efficacy and positive outcome expectations will influence their community members to engage in knowledge-sharing behavior.

In our analysis of the factors influencing organizational value cocreation behavior, knowledge-sharing behavior is found to be the most significant, followed by outcome expectations. Furthermore, open communication is found to be the most vital factor in creating a supportive environment.

This study applies MCDM to explore the triple reciprocity of value cocreation behavior. As a result, the findings of this study are expected to provide insightful and complementary contributions to related studies. Our results may be useful in guiding the effective promotion of organizational value cocreation behavior, allowing organizations to leverage operant resources to their maximum potential.

This study utilized the DANP method to quantify the complex relationships between factors. This allowed respondents to prioritize criteria, improving the overall structure of the problem. Nevertheless, there are shortcomings of this study that can also provide directions for future related studies. First, we employed evaluation criteria that were derived from previous studies. There are some criteria that are not taken into account, such as trust and organizational citizenship. We suggest that future research include these criteria for further analysis. Second, organizational cocreation behavior may have differences within different programs. Therefore, case studies can be conducted to shed further light on this issue. In addition, future research can use other MCDM tools, such as VIKOR, to further explore tactics for motivating organization value cocreation behaviors at specific organizations.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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