



Copyright © 2018 American Scientific Publishers
All rights reserved
Printed in the United States of America

Application of the Analytic Hierarchy Process for the Evaluation of Corporate-Nonprofit Collaborative Outcomes

Yangcheng Hu, Anmin Qiu*

School of Business Administration, Nanchang Institute of Technology, Nanchang
330099, China

**jqnit@126.com*

Abstract: Cross-sector partnership is now growing to be an important way to solve complex social issues, as it combines complementary resources and capabilities of the collaborative partners. Whereas the evaluation of collaborative outcomes still has not been fully addressed. The purpose of this paper is to identify and prioritize the critical factors for corporate-nonprofit collaborative outcomes using analytic hierarchy process (AHP) approach. Results show that “direct and organizational effect” is the most critical factor. A case study was carried out to clarify how to apply the AHP method. This study contribute to extant research of cross-sector partnership by providing a comprehensive framework for the evaluation of corporate-nonprofit collaborative outcomes. Future research in different cultural background is required. Additionally, analytic network process (ANP) can be used to achieve a more accurate decision model.

Key words: AHP; Corporate-nonprofit partnerships; Collaborative outcomes; Nonprofit organizations.

1 INTRODUCTION

As the third sector that is independent of governments and corporations, nonprofit organizations are playing a more and more irreplaceable role in addressing the crisis caused by “government failure” and “market failure” [1]. Because of the social and public attributes of nonprofit organizations (e.g. volunteerism, non-profitability, commonweal etc.), they are fundamentally different from corporations in governance structure, organizational culture and mission [2]. The existing strategic alliance theory within for-profit sector cannot fully explain corporate-nonprofit partnerships, thus restricting the guiding role of the theory to practice. This study responds to the call for research to improve our understanding of cross-sector partnerships by the evaluation of corporate-nonprofit collaborative outcomes with analytic hierarchy process (AHP)

approach.

The reminder of this paper is organized as follows. Next section reviews some literature on alliance performance, with particular attention to the context of corporate-nonprofit partnerships. Following this, we describe the AHP methods. We then evaluate corporate-nonprofit collaborative outcomes in a case study. Finally, we discuss conclusions and implications and highlight directions for future research.

2 ALLIANCE PERFORMANCE AND CROSS-SECTOR PARTNERSHIPS

Although researchers agree that alliance performance is a multi-dimensional concept, there is no

universally accepted classification of its dimensions [3]. Alliance performance is highly dependent on the specific context, which will show significant differences in different relationship characteristics. The corporate-nonprofit partnerships include not only the interactions between the two parties, but also the interactions with other stakeholders which are obviously different to the strategic alliance within for-profit sector. Therefore, it is difficult to apply the scale of strategic alliance performance to the context of cross-sector partnerships.

Studies on corporate-nonprofit collaborative outcomes mainly involve two aspects: the key influencing factors of collaborative success, and the evaluation of collaborative outcomes. As to the first aspect, the key factors identified by scholars include partner fitness [4]; shared values, previous experience of collaboration [5]; trust, communication, power balances [6]; commitment, trust [7]; opportunistic behaviour and relationship learning [8]. Austin (2000) [9] classified the factors that influence the success of corporate-nonprofit partnerships into two categories: the driving factors and the promoting factors. The former include the consistency of strategy, mission and values, interpersonal ties, and shared vision and the latter include multiple communication, institutionalization, clear accountability and shared responsibility.

As to the second aspect, Selsky and Parker (2005) [10] argued collaborative outcomes of corporate-nonprofit partnerships can be measured at three levels: the impact on specific social issues and its stakeholders; the impact on capacity building, knowledge and reputational capital; and the impact on social policy or system change. It can be seen that the first level emphasizes the measurement of short-term and direct results; the second level emphasizes the measurement of knowledge and competence; and the third level focuses on the possible impact

on broader external community, society and environment. Austin and Seitandi (2012) [11], from the view of value creation, put forward that corporate-nonprofit collaborative outcomes can be measured within the collaboration and external to it. Internally, they examined value accruing at the meso level for the partner organizations and at the micro level for the individuals within organizations. Externally, they focused on societal welfare and its improvement as a result of the collaboration in the form of benefits at the micro (to individual recipients), meso (other organizations), and macro (systemic changes) levels.

3 ANALYTIC HIERARCHY PROCESS AND CASE STUDY

3.1 Analytic Hierarchy Process Procedure

AHP is a methodology proposed by Saaty (1980) [12], and has been applied to deal with complex, unstructured and multiple-attribute decisions. With this method, a complicated problem can be converted to a hierarchical system. The hierarchy is commonly structured in such a way that the top level represents the overall goal, the intermediate levels represent decision criteria and sub-criteria, and the bottom level represents the possible decision alternatives.

AHP provides unique features for criteria weight and subjective evaluations by pairwise comparisons. The decision makers can express their preference between every two criterion verbally by using of the 1-9 ratio scale in Tab. 1. Further, consistency of pairwise comparisons is checked by using of the consistency ratio, thus minimizing errors of arbitrary subjective evaluations [13, 14], the procedure of AHP methodology used in this study is illustrated in Fig. 1.

Tab. 1. The 1-9 Scales for Pairwise Comparisons in AHP

Scale	Definition
1	Equal importance
3	Moderate importance of one over another
5	Strong importance of one over another
7	Very strong importance of one over another
9	Extreme importance of one over another
2, 4, 6, 8	Intermediate values between the two adjacent judgments

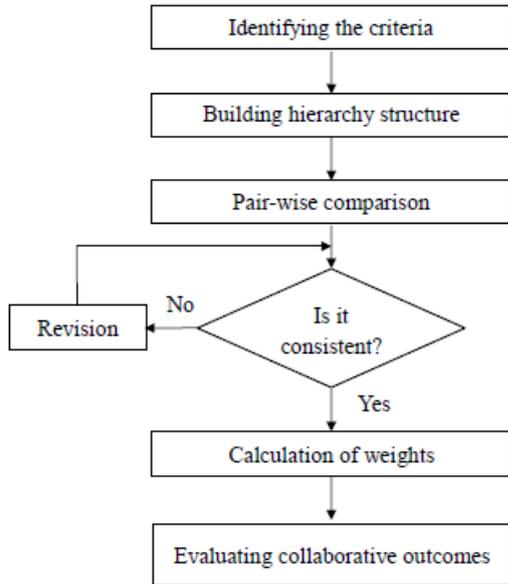


Fig. 1: AHP Procedure in This Study

3.2 Identifying the Criteria

Given that no simple indicator can adequately capture the multifaceted nature of COR-NPO collaborative outcomes, three broad categories of

measures adapted from previous studies were used in this study [5, 8, 10, 11]. The first category is related to knowledge and learning effect, the second category is related to direct and organizational effect, and the third category is related to social impact effect. We further created and validated a new measurement scale of corporate-nonprofit collaborative outcomes on survey data. The exploratory factor analysis and confirmatory factor analysis results showed the three dimensional 12 item scale with good reliability and validity.

3.3 Building Hierarchy Structure

Based on the scale of corporate-nonprofit collaborative outcomes, a proposed hierarchical structure is constructed as shown in Fig. 2. The overall goal is to evaluate the level of corporate-nonprofit collaborative outcomes (Level 1). Under the overall goal, the second level represents the criteria of collaborative outcomes, including “knowledge and learning effect” (KLE), “direct and organizational effect” (DOE), and “social impact effect” (SEI). Various sets of sub-criteria which are related to the second level criteria are given in the third level.

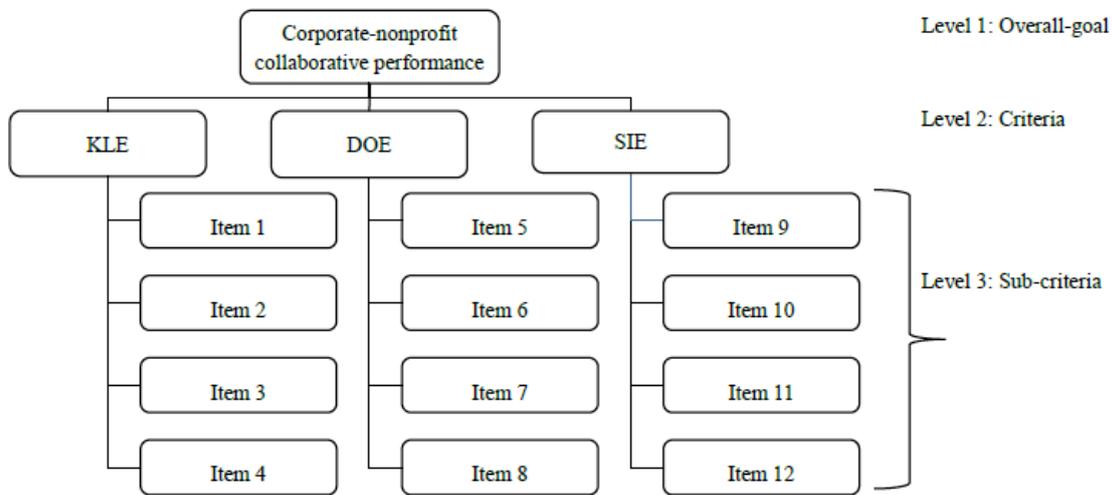


Fig. 2: Hierarchical Structure of Collaborative Outcomes

3.4 Pair-wise Comparison for Each Level

Once the hierarchy has been structured, the next step is to determine the relative importance of the criteria at each level. The pairwise comparison highlights the relative importance of each criteria or sub-criteria.

An n -by- n matrix A is derived as follows:

$$A = [a_{ij}] = \begin{bmatrix} 1 & a_{12} & \cdots & a_{1n} \\ 1/a_{12} & 1 & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ 1/a_{1n} & 1/a_{2n} & \cdots & 1 \end{bmatrix} \quad (1)$$

In formula (1), a_{ij} represents a judgment on a pair of elements c_i, c_j .

To avoid the biased responses, a group decision making approach was employed in this study. One scholar in the field of cross-sector partnerships, two managers from nonprofit organizations and two managers from corporations were invited to be decision-makers because they are academic researchers or experienced practitioners. The five experts were requested to compare carefully the

criteria by assigning a nine-point scale (Tab. 1) in a pair-wise fashion with respect to the overall goal. If the opinions were inconsistent, the five experts were further asked to discuss until an agreement was reached. Similarly, the pair-wise comparisons of all sub-criteria with respect to the corresponding criteria were also done. The results of pair-wise comparisons were shown in Tab. 2 and Tab. 3.

Tab. 2. Pairwise Comparison for Criteria and Sub-criteria of KLE

Criteria	KLE	DOE	SIE	Sub-criteria of KLE	Item 1	Item 2	Item 3	Item 4
KLE	1	1/2	1/2	Item 1	1	1/2	1/3	1/2
DOE	2	1	2	Item 2	2	1	1/2	2
SIE	2	1/2	1	Item 3	3	2	1	3
				Item 4	2	1/2	1/3	1
	CR = 0.05			CR = 0.03				

Tab. 3. Pairwise comparison for sub-criteria of KLE and SIE

Sub-criteria of DOE	Item 5	Item 6	Item 7	Item 8	Sub-criteria of SIE	Item 9	Item 10	Item 11	Item 12
Item 5	1	1/3	1/2	1/2	Item 9	1	1/4	1/2	1/3
Item 6	3	1	2	3	Item 10	4	1	2	2
Item 7	2	1/2	1	1	Item 11	2	1/2	1	1/2
Item 8	2	1/3	1	1	Item 12	3	1/2	2	1
	CR = 0.02				CR = 0.02				

3.5 Consistency Test

Having done all the pair-wise comparisons. Consistency index (CI) and consistency ration (CR) can be used to check the consistency of the comparison matrix [13, 14]. CI and CR can be calculated as follows:

$$CR = \frac{CI}{RI} \tag{2}$$

$$CI = \frac{(\lambda_{max} - n)}{(n-1)} \tag{3}$$

The largest eigenvalue can be calculated as follows:

$$\lambda_{max} = \sum_{j=1}^n a_{ij} \frac{W_j}{W_i} \tag{4}$$

If A is a consistency matrix, eigenvector X can be calculated as follows:

$$(A - \lambda_{max} I)X = 0 \tag{5}$$

In formula 2, RI denotes the average consistency

index. In formula 3, n denotes number of criteria or attributes in the consideration. If CR < 0.1, the estimate is accepted. In this study, the consistency test were performed with the help of computer software “Expert Choice 11.5”. The CR of the comparison matrices for the criteria and the sub-criteria are all smaller than “0.1”, indicating “consistency.” Furthermore, the overall CR is also below “0.1”.

3.6 Calculation of Weights

This step is to calculate the local weights and global weights. Local weights are the priority weights with respect to the preceding hierarchical level, while “global weights” are the priority weights with respect to the highest hierarchical level, which is the objective. The weights were computed with the help of computer software “Expert Choice 11.5”. The first-level computation results indicated that direct and organizational effect is the most important criteria for collaborative outcomes with a weight of 0.493. After calculating the relative value with respect to the immediate above node, the global weight of each sub-criteria was calculated by multiplying its local weights (Tab. 4).

Tab. 4. Local and global weights for criteria and sub-criteria

Criteria	weights	Sub-criteria	Local weights	Global weights	Rank
Knowledge and learning effect (KLE)	0.196	Item 1	0.119	0.0233	12
		Item 2	0.261	0.0512	9
		Item 3	0.451	0.0884	6
		Item 4	0.169	0.0331	10
		Item 5	0.119	0.0587	7
Direct and organizational effect (DOE)	0.493	Item 6	0.460	0.2268	1
		Item 7	0.220	0.1085	3
		Item 8	0.201	0.0991	4
		Item 9	0.097	0.0302	11
Social impact effect (SIE)	0.311	Item 10	0.435	0.1353	2
		Item 11	0.182	0.0566	8
		Item 12	0.286	0.0889	5

3.7 Case Study

Based on the scale of corporate-nonprofit collaborative outcomes and the weights of the criteria and sub-criteria, a case study was performed to evaluate three corporate-nonprofit collaborative projects. Direct evaluation (with a rating from 1 to 10, with higher values indicating a higher level of collaborative outcomes) was used to measure the 12 sub-criteria. The five experts in pair-wise comparison procedure were asked to rate each sub-

criteria until an agreement was reached. Tab. 5 lists the evaluating results of the three collaborative projects of A, B, and C. It can be seen the project B had the highest score. If the AHP had not been used and simply computed the non-weighted scores, project A would have the highest final score (the non-weighted score of A = 73; B = 70; C = 62). The AHP methodology gave the decision makers a more objective approach to evaluate the level corporate-nonprofit collaborative outcomes.

Tab. 5. The evaluating results for corporate-nonprofit collaborative projects

Sub-criteria	Global weights	A	B	C
Item 1	0.023	7	6	5
Item 2	0.051	6	4	3
Item 3	0.088	6	6	6
Item 4	0.033	6	7	5
Item 5	0.059	7	5	3
Item 6	0.227	5	6	5
Item 7	0.109	6	7	4
Item 8	0.099	7	6	7
Item 9	0.030	7	5	6
Item 10	0.135	5	7	5
Item 11	0.057	6	6	6
Item 12	0.089	5	5	7
Total scores		5.761	5.997	5.223

4 CONCLUSIONS AND IMPLICATIONS

The main strength of this study lies in its development of a decision model for the evaluation of corporate-nonprofit collaborative outcomes. A case study was then performed to illustrate the application of the proposed model. The decision model provided an objective and effective instrument for evaluating corporate-nonprofit collaborative outcomes.

With the results of this study, the collaborative partners may learn about the critical factors for collaborative projects implementation. That is, the partners can use the decision model to compare their collaborative practices against other collaborative projects or to identify deficiencies in their current collaborative practices. This will enable the partners to improve the overall collaborative outcomes. The AHP methodology together with a case study was presented to clarify how to evaluate corporate-nonprofit collaborative outcomes. Thus our study provided a step forward in developing empirical insights into the nature of corporate-nonprofit collaborative outcomes.

A limitation of this study is that AHP assumes that the decision criteria and sub-criteria are independent of each other, but this is not the case. Therefore, analytic network process (ANP) can be used to achieve a more accurate decision model since ANP can establish relationships between different levels and within the same level.

ACKNOWLEDGMENTS

This study was supported by the National Natural Science Foundation of China (Grant No. 71462026).

REFERENCES

- [1] Salamon LM, Anheier HK. *The Emerging Nonprofit Sector: An Overview*. Manchester University Press, Manchester (1996).
- [2] Rivera-Santos M, Rufin C. *Odd Couples: Understanding the Governance of Firm-NGO Alliances*. *Journal of Business Ethics* (2010) 94(S):55-70.
- [3] Christoffersen J, Plenborg T, Robson MJ. *Measures of Strategic Alliance Performance, Classified and Assessed*. *International Business Review* (2014) 23(3):479-489.
- [4] Vock M, Dolen WV, Kolk A. *Changing Behaviour Through Business-nonprofit Collaboration*. *European Journal of Marketing* (2013) 47(9):1476-1503.
- [5] Murphy M, Arenas D, Batista JM. *Value Creation in Cross-Sector Collaborations: The Roles of Experience and Alignment*. *Journal of Business Ethics* (2015) 130(1):145-162.
- [6] Kuipers LMF, Meershoek AM. *NGO-Business Collaboration in Kenya: A Case Study and Broader Stakeholder Analysis*. *Journal of Corporate Citizenship* (2013) (50):91-105.
- [7] Sanzo MJ, Álvarez LI, Rey M, García N. *Business-Nonprofit Partnerships: A New Form of Collaboration in a Corporate Responsibility and Social Innovation Context*. *Service Business* (2015) 9(4):611-636.
- [8] Barroso-Méndez MJ, Galera-Casquet C, Seitanidi MM, Valero-Amaro V. *Cross-Sector Social Partnership Success: A Process Perspective on the Role of Relational Factors*. *European Management Journal* (2016) 34(6):674-685.
- [9] Austin JE. *Strategic Collaboration between Nonprofits and Business*. *Nonprofit & Voluntary Sector Quarterly* (2000) 29(1):69-97.
- [10] Selsky JW, Parker B. *Cross-sector Partnerships to Address Social Issues: Challenges to Theory and Practice*. *Journal of Management* (2005) 31(6):849-873.
- [11] Austin JE, Seitanidi MM. *Collaborative Value Creation: A Review of Partnering between Nonprofits and Businesses. Part 2: Partnership Processes and Outcomes*. *Nonprofit and Voluntary Sector Quarterly* (2012) 41(6):929-968.
- [12] Saaty TL. *The Analytic Hierarchy Process*. McGraw-Hill Book Co, New York (1980).
- [13] Deb M, Lomodavid E. *Evaluation of Retail Service Quality Using Analytic Hierarchy Process*. *International Journal of Retail & Distribution Management* (2014) 42(6):521-541.
- [14] Yadav V, Sharma MK. *Multi-criteria Supplier Selection Model Using the Analytic Hierarchy Process Approach*. *Journal of Modelling in Management* (2016) 11(1):326-354.