Development Economics of China
2025, VOL. 9, NO. 3, 98-103
DOI: 10.47297/wspdecWSP2515-797319.20250903

Research on the Operation Efficiency of Various Public Welfare Foundations in Shandong Province Based on Factor Analysis

Zilin Dong

School of Public Administration, Shandong Technology and Business University, Yantai, Shandong 264500

ABSTRACT
Public welfare foundations are non-profit social organizations. The provision of their services, the establishment of their credibility and the realization of their missions all rely on good operational efficiency. This paper selects operational efficiency indicators, takes cross-sectional data of 93 public welfare foundations, and uses factor analysis methods to study the operational efficiency evaluation of public welfare foundations. The empirical results show that the operational efficiency of charitable projects and the ability to obtain and use resources are the main factors affecting the operational efficiency of public welfare foundations. Relatively speaking, the operational efficiency of projects has a greater impact. The operational efficiency of public welfare foundations tends to be better when the operational efficiency of projects and the ability to obtain and use resources develop in a balanced way.

KEYWORDS
public welfare foundation; operational efficiency; factor analysis

1 Introduction

As a third sector, foundations can effectively compensate for government failure and market failure. However, in recent years, foundations have suffered from frequent scandals, the credibility of foundations has dropped to the freezing point. Therefore, it is relatively difficult to evaluate the operational efficiency of foundations and there are differences in operational efficiency among different types of organizations and missions. Among the foundations , more emphasis is placed on the mission and maximization of social value. This paper mainly focuses on the operational efficiency of public welfare fund organizations.

2 Literature review

Through reviewing the previous foreign literature, it is found that the content of foreign research on the operational efficiency of foundations mainly focuses on the impact factors of operational efficiency.

In the research on the factors influencing the operational efficiency of public welfare foundations, the influencing factors can be divided into two categories: organizational governance and external governance. In the study of organizational governance, Siciliano [1] constructed a supervisory board diversity index using data from 240 nonprofit organizations, and found that the diversity of supervisory board members' characteristics can improve the operational efficiency of the organization. Petrovits et al. [2]explored the causes and consequences of the lack of internal control in nonprofit organizations. Lindenberg[3]explored the causes and consequences of the lack of internal control in one of the largest international relief and development nonprofit organizations in the U. S., which is a public benefit foundation explores how CARE, one of the largest U.S.-based international relief and development nonprofit organizations, improved its strategic framework step-by-step from 1992-1997 in order to achieve greater impact and efficiency in a more competitive global environment. In the study of external governance, Irvin [4]compares and analyzes nonprofit organizations that are regulated by the government and those that are not, and finds that from a cost-benefit perspective, nonprofit organizations should be moderately regulated in order to maximize the efficiency of the organization's operations. It further suggests that nonprofit organizations under strong regulation can be relaxed by simplifying the approval process, etc. Desai & Yetman [5] established indicators reflecting laws, regulations, and disclosure requirements, and found that stringent disclosure requirements are associated with lower internal compensation and reduced overfunding.

Domestic literature has focused mainly on studies exploring the factors influencing the operational efficiency of foundations. Qian Yanwen et al. [6] proposed a set of conceptual models for strategic management of nonprofit organizations by comparing the differences between for-profit and nonprofit organizations in terms of strategic design factors, strategic management objectives, and specific business strategy choices, and identified three strategic priorities identified in the model, which were fundraising strategy, cost reduction strategy, and product and service quality strategy. Yangcheng Hu and Xiaohong Li [7] used questionnaires and structural equation modeling to analyze the relationship between the operational efficiency of nonprofit organizations and two types of strategic responses made by the

organizations in uncertain environments (market orientation and organizational innovation), and found that both types of strategic responses significantly improved the operational efficiency of the organizations. Li Yuli et al.[8] used four factors extracted by factor analysis to reflect the operational efficiency of public welfare foundations from different perspectives, and found that national foundations have better overall operational efficiency, ability to acquire and use resources, and program operational efficiency than local foundations. The longer the foundations have been established, the greater the ability to acquire and use resources, but the organizational management efficiency of the foundations is more poor. The size of the foundation is positively correlated with the comprehensive efficiency and the ability to acquire and use resources, and significantly negatively correlated with the operational efficiency of charitable programs.

3 Research design

(i) Sample selection and data sources

1. Sample selection. This paper includes a sample of 93 randomly selected foundations in Shandong Province, involving a variety of industries and types.

2. Data source. The data used in this paper comes from "foundation center network", the government management departments in the specific management process will be regarded as a regulatory focus of the foundation, and thus with the association, The data disclosed by foundations is relatively sufficient compared with other types of foundations such as associations and chambers of commerce.

In order to minimize the research bias that may be caused by incomplete data, the following foundations were excluded from the data screening process: (1) the sample of foundations that were newly established in the current year, the sample of foundations with obvious inconsistencies in the accounting statements that cannot be verified, and the sample of foundations with singular values. (2) In the analysis process, the data were standardized to eliminate the effects of the scale, the magnitude of the variation of the variables themselves, and the magnitude of the values.

(ii) Variable selection and measurement

In terms of measuring the operational efficiency of public welfare foundations, indicators such as endowment income, public welfare program expenditures, management expenses, fundraising expenses and their changes are usually used. [9]In a study by Ritchie and Kolodinsky (2003) [10], 16 financial indicators were utilized to measure the performance of public benefit foundations through factor analysis. These include: total revenue to net assets, endowment revenue to net assets, and fundraising expense ratio. With reference to the selection and measurement of variables in the above literature and the purpose of this paper's study, this paper utilizes the variables listed in Table 1 to conduct the study.

Table 1 Selection of variables and metrics

variable name	Variable Meaning and Description
Endowment income (X1)	Total endowment income received during the year reflects the capacity for charitable resource mobilization.
Total income (X2)	Total income received during the year, including endowment income, contribution income, from services rendered, sale of goods, government grants, investment income and other income, reflects the ability to obtain resources.
Ratio of income to expenditure on public goods (X3)	The larger the ratio of total expenditures for public welfare/revenue from donations for the year, the more efficient the operation.
Ratio of total income to net assets (X4)	Total income for the year/net assets at the end of the period, reflecting the relative position of the ability to access resources.
Endowment income to net assets (X5)	Total income for the year / net assets at the end of the period, reflecting the relative position of the ability to obtain charitable resources.

(iii) Choice of analytical method

In previous studies, in order to address possible correlations between indicators, scholars have utilized Data envelopment analysis [11], Markov Chain Monte Carlo [12], and Factor Factor Analysis [13] was used to measure and compare the efficiency of the Foundation. Considering the correlation between many indicators for measuring the operational efficiency of public welfare foundations, this paper uses the factor analysis method to comprehensively extract and analyze the selected variables, and uses spss23.0 software to carry out exploratory factor analysis on the above five variables.

(iv) Factor analysis

1. Suitability test. In order to know whether the indicators are strongly correlated with each other, this paper KMO

sample suitability test and Bartlett spherical test were conducted, and the results are shown in Table 2. Table 2 shows that the KMO value is 0.569, which meets the requirements. The probability of significance of the statistical value of the Bartlett spherical test is 0.000, which rejects the hypothesis that the matrix of correlation coefficients is a unitary matrix, and indicates that the data have strong correlation with each other, and it is suitable to be used for factor analysis.

Table 2 KMO test and Bartlett spherical test

KMO Number of Sampling Suitability Measure.		.569
Bartlett's test of sphericity	approximate chi-square (math.)	1148.312
	(number of) degrees of freedom (physics)	10
	significance	.000

2.Factor extraction and score. Following the principles of eigenvalue greater than 1, cumulative variance contribution rate of 80% or more and the number of points before the curve flattens in the gravel test, this paper extracts the public factors in the five indicators. Table 3 and Figure 1 show that the cumulative variance contribution rate of the first two public factors is 90.3%, and the curve in the gravel plot becomes flat from the third factor. Therefore, this paper extracts the first two factors to carry out the subsequent analysis.

Table 3 Total Variance Explained

ingredient	Initial eigenvalue			Extract the sum of the squares of the loads			Rotational load sum of squares		
	(grand) total	Percentage of variance	Cumulative %	(grand) total	Percentage of variance	Cumulative %	(grand) total	Percentage of variance	Cumulative %
1	2.705	54.093	54.093	2.705	54.093	54.093	2.504	50.086	50.086
2	1.812	36.242	90.335	1.812	36.242	90.335	2.012	40.248	90.335
3	.480	9.598	99.933						
4	.003	.059	99.992						
5	.000	.008	100.000						

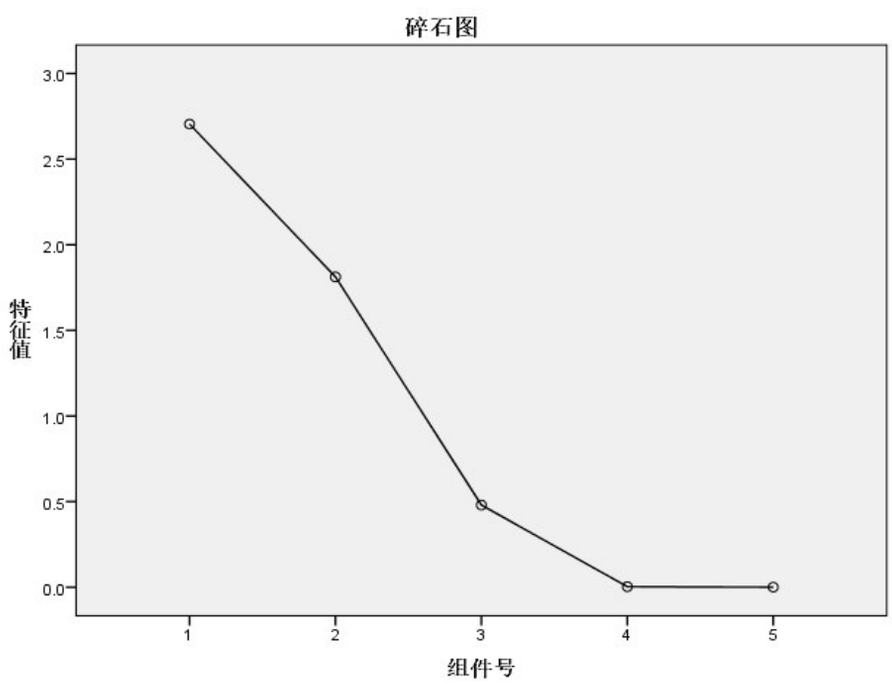

Fig. 1 Fragmentation map for factor extraction

The factors extracted using principal component analysis were rotated orthogonally to obtain a factor loading matrix with clearer results (see Table 4). From the rotated factor loading matrix, it can be seen that X_3, X_4 and X_5 have larger loading coefficients in the first principal component, which is reflected in the efficiency of charitable programs, and is recorded as "Factor 1" ($F_{1)}$; X_1 and X_2 have larger loading coefficients in the second principal component, which reflects that public welfare foundations are able to acquire and use resources, and is recorded as "Factor 2" ($F_{(2)}$); X_1 and X_2 have higher loading coefficients in the second principal component, which reflects that public welfare foundations have greater ability of acquiring and utilizing resources. X(1) and X(2) have larger loading coefficients in the second principal component, reflecting the ability of public welfare foundations to acquire and use resources, which is labeled as "Factor

2" ($F_{2)}$.

Table 4 Component matrix after rotationa

	ingredient	
	1	2
Endowment income X1	.080	.996
Total income X2	.072	.996
Ratio of income to expenditure on public goods projects X3	.805	-.014
Ratio of total income to net assets X4	.961	.121
Endowment income to net assets X5	.960	.120

Extraction method: principal component analysis.Rotation method: kaiser normalized maximum variance method.a. The rotation has converged after 3 iterations.

Table 5 Matrix of component score coefficients

	ingredient	
	1	2
Endowment income X1	-.043	.503
Total income X2	-.046	.503
Ratio of income to expenditure on public goods projects X3	.332	-.068
Ratio of total income to net assets X4	.385	-.011
Endowment income to net assets X5	.385	-.011

Extraction method: principal component analysis.Rotation method: kaiser normalized maximum variance method.

A matrix of factor score coefficients was calculated using the regression method (see Table 5), which in turn allowed for the calculation of each sample public benefit foundation's scores on each factor and the ability to rank them based on the scores. The composite ranking score (denoted as P) can be calculated by weighting the scores of the two factors, where the weight is the proportion of the variance contribution rate of each factor to the total variance contribution rate of the two factors. The formula is shown below.

$F_1 = -0.043X_1-0.046X_2+0.332X_3+0.385X_4+0.385X_5$

$F_2= 0.503X_1+0.503X_2-0.068X_3-0.011X_4-0.011X_5$

Then, the scores of each factor were weighted using the variance contribution of each factor as weights to construct a composite score function, which resulted in the value of the foundation's comprehensive operational efficiency indicator P, i.e:

$P = (50.086F_1+ 40.248F_2)/90.335$

The calculation results in a composite score and ranking of 93 foundations in terms of operational efficiency. Due to space limitations, Table 6 only shows the list of the top 20 foundations in terms of composite score and their composite scores.

Table 6 Top 20 overall

Foundation Name	Factor 1 score	Factor 2 score	aggregate score	Overall Ranking
Shandong Nanshan Aging Career Development Foundation	4.78950	.60451	2.92	1
Taian Taishan Charity Foundation	3.54840	1.70221	2.73	2
Shandong Education Foundation	-.69110	5.68918	2.15	3
Shanxian Rural Revitalization Foundation for Poverty Alleviation	4.24708	-.46405	2.15	4
Shandong Provincial Public Security Police Preferential Appeasement Foundation	-.18363	3.73583	1.56	5
Shandong Province Poverty Alleviation and Development Foundation	-.17956	3.69510	1.55	6
Qingdao Jishang Jofeng Charity Foundation	3.24687	-.62736	1.52	7
Shandong Province Warmth Sending Project Foundation	2.74388	-.67726	1.22	8
Shandong Yangshanren Sports Lottery Charity Foundation	2.20354	-.30283	1.09	9
Jinan Licheng District Jiaxuan Education Development Foundation	-.47442	2.35655	.79	10
Shandong Youfang Public Welfare Foundation	1.70454	-.39848	.77	11
Shandong Yinfeng Life Science Public Welfare Foundation	-.39983	2.18527	.75	12
Jinan Licheng District Yupu Education Development Foundation	-.38893	2.01675	.68	13
Shandong Zhongtai Charity Foundation	1.16420	-.02348	.64	14
Weihai Nanhai Love Foundation	.63709	.19432	.44	15
Shandong Dongming Qilu Hemodialysis Charity Foundation	.35711	.49212	.42	16
Tai'an Education Foundation	-.01596	.68687	.30	17
Shandong University Education Foundation	-.46775	1.21515	.28	18
Shandong Disabled People's Welfare Foundation	-.14983	.62251	.19	19
Shandong Province Population Care Foundation	.23600	.05042	.15	20

4 Analysis of results

(a) Based on the pre-set search criteria, the exploratory factor analysis finally extracted two public factors, namely, the operational efficiency of charitable programs and the ability of foundations to acquire and use resources, indicating that the main factors affecting the operational efficiency of these 93 foundations are the fund-raising ability and the efficiency of program operation. Comparatively speaking, the operational efficiency of the programs has a greater impact on the foundations, as reflected by the share of the variance contribution of the operational efficiency of the programs in the total variance explained, with the operational efficiency of the programs occupying 50.086% of the total variance.

(b) From the distribution of project operation efficiency factor scores, there are 16 foundations with scores greater than 0 on the fund efficiency factor.According to the molecule score in descending order, ranked 16th is the China Confucius Foundation, scored 0.05604, the above foundations in the project operational efficiency are higher than the average level; The remaining 77 foundations scored less than 0, the smallest value of -0.69110, compared with the other foundations, the 77 foundations are lower than the average level of project operational efficiency. foundations are below average in terms of program operational efficiency.

(c) From the distribution of scores on the factor of ability to acquire and use resources, 22 foundations have scores greater than 0 on the factor of ability to raise funds, indicating that these 22 foundations are higher than the average level of ability to raise funds, of which the Shandong Education Foundation, and the 22nd ranked foundation is Qingdao Binhai College Education Development Foundation, with a score of 0.01866, and all the above foundations have higher than average efficiency of program operation; another 71 foundations have a score of less than 0 on the factor of fundraising ability, with a minimum value of -0.67726, and compared with other research subjects, the fundraising ability of these 71 foundations is lower than the average level.

(d) From the announcement of the comprehensive score, 23 foundations have a score greater than 0. A total of 9 foundations have scores greater than 1; the remaining 70 foundations have scores less than 0, with a minimum score of -0.45 at .

5 Conclusions and recommendations of the study

(i) Conclusions of the study

Through the exploratory factor analysis of the operational efficiency data of 93 foundations in Shandong Province, the above article draws the following main conclusions:

(1) the operational efficiency of charitable projects and the foundation's ability to acquire and use resources are the main factors affecting the operational efficiency of China's public welfare foundations, and the public welfare foundations can improve their operational efficiency by improving the efficiency of their projects and their ability to acquire and use resources, among which the efficiency of their projects is more important.

(2) In the study, it is also found that, except for some cases, most of the foundations with top scores have positive scores on both factors, so good operational efficiency of public welfare foundations is based on the balanced development of project operational efficiency and the ability to acquire and use resources.

(ii) Policy recommendations

In response to the above conclusions, the following recommendations for enhancing the operational efficiency of the Foundation are presented for reference:

(1) Regulating internal organizational governance

The foundation should establish corresponding rules and regulations as a guarantee, a clear and reasonable division of powers and responsibilities and a relatively independent monitoring mechanism, establish a sound general meeting of members, council, supervisory board and other institutions, and carry out a reasonable division of powers and responsibilities, to ensure the democratic management of the organization, and effective internal monitoring to ensure that the foundation will not deviate from the mission of the operation of the track. Therefore, the improvement of internal governance should be regarded as an important measure to strengthen the internal management of China's public welfare foundations, focusing on the organizational structure, operational mechanism and democratic decision-making principles stipulated in the statute, and secondly, the supervisory function of the supervisory board should be strengthened, so as to enable it to achieve real organizational independence, operational coordination and effective supervision.

(2) Improving the information disclosure system of foundations

Full disclosure of information can also allow the government to reduce the cost of supervision, so that the government and society to better understand the importance of the work of public welfare foundations, improve the operational efficiency of the whole society. Therefore, the foundation should focus on the establishment of the foundation information disclosure system platform to improve the credibility of public welfare foundations, in this platform need to

publish the articles of association, unified social credit code, registration certificate number and other registration information: decision-making, executive, supervisory body member information: by the seminar auditing agency audited by the financial accounting report, from the Mu donation activities to the project carried out by the annual work report. And should be timely to the donor to inform the fund-raising situation, the management and use of funds raised. Fund office location and staff contact information, the foundation should be responsible for the authenticity of the information disclosed.

About the Author

Zilin Dong (1998.9.12) School of Public Administration, Shandong Technology and Business University, Postgraduate, Research direction is public welfare and philanthropy.

References

[1] Siciliano J I. The Relationship of Board Member Diversity to Organizational Performance [J].Journal of Business Ethics,1996,15(12):1313-1320.

[2] Petrovits C, Shakespeare C, Shih A. The Causes and Consequences of Internal ControlProblems in Nonprofit Organizations[J]. Accounting Review,. 2010,86(1):325-357.

[3] Lindenberg M. Are We at the Cutting Edge or the Blunt Edge: Improving NGO Organizational Performance with Private and Public Sector Strategic Management Frameworks[J]. Nonprofit Management & Leadership,2010,11(3):247-270.

[4] Renée A. Irvin. State Regulation of Nonprofit Organizations: Accountability Regardless of Outcome [J]. Nonprofit and Voluntary Sector Quarterly, 2005,34(2). Nonprofit and Voluntary Sector Quarterly, 2005,34(2).

[5] Desai M A, Yetman R J. Constraining Managers without Owners: Governance of the Not-for-Profit Enterprise [J].

[6] Qian Yanwen, Sun Linyan, Liang Li. Formation of strategic management of nonprofit organizations and its conceptual model [J]. Research Management, 2005(5):75-80.

[7] HU Yangcheng, LI Xiaohong. Research on strategic response of nonprofit organizations under uncertain environment [J]. Scientific Decision Making, 2015(2):21-34.

[8] Li Yuli, Rinati Yilayati, Wu Yang. Operational efficiency of public welfare foundations:An exploratory study based on factor analysis[J]. Xinjiang Finance and Economics,2017(06):21-29.

[9] Callen, J.L and Falk H. Agency and Efficiency in Nonprofit Organizations: the Case of Specific Health Focus Charities[J].The Accounting Review. 1993, 68(1) : 48 -65.

[10] Seongho S. Yi D. The Fundraising Efficiency in U.S. Non -profit art Organizations: an Application of a Bayesian Estimation Approach Using the Stochastic Frontier Production Model[J] Journal of Productivity Analysis, 2011, 35(2) : 171-180.