

EVALUATING KNOWLEDGE OUTSOURCING PERFORMANCE OF PUBLIC SECTORS WITH DATA ENVELOPMENT ANALYSIS

EVALUACIÓN DEL RENDIMIENTO DE LA EXTERNALIZACIÓN DE CONOCIMIENTO POR PARTE DEL SECTOR PÚBLICO MEDIANTE ANÁLISIS ENVOLVENTE DE DATOS

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ABSTRACT

With the governmental sectors imitating the reformation of enterprises stressing on Knowledge, Contracting Out and Deregulation have become the core policies. Contracting Out is not based on the arbitrariness of an administrator, but the selective efficiency and competition. Connecting the resources between Public and Private Sectors is a concern of Contracting Out, while Knowledge Outsourcing is an innovation to enhance organizational knowledge and the reduction of organizational ignorance. Based on a Knowledge Outsourcing Investigation by the Kaohsiung City Government (Taiwan) in the past few years, Data Envelopment Analysis (DEA) and Sensitivity Analysis are integrated for measuring the total efficiency (TE), pure technical efficiency (PTE), and scale efficiency (SE) of Knowledge Outsourcing of the sectors in the Kaohsiung City Government for the improvement reference of other counties and cities. From the message acquired from the efficiency and variables with the DEA, one DMU (Data Management Unit), or about 5% of all DMUs, appears to have strong Knowledge Outsourcing efficiency 1, showing favorable Knowledge Outsourcing efficiency. Two DMUs, comprising about 10% of all DMUs, reveal the marginal Knowledge Outsourcing inefficiency between 0.9 and 1. This implies that such sectors could better enhance the Knowledge Outsourcing efficiency. 17 DMUs, representing about 85% of all DMUs, exhibit an obvious Knowledge Outsourcing inefficiency of less than 0.9, so that the Finance and Transportation Bureaus present the lowest Knowledge Outsourcing efficiency.

KEYWORDS

Data Envelopment Analysis; Knowledge Outsourcing; Public sectors.

RESUMEN

En la medida en que el sector público imita la reforma de aquellas empresas que ponen el acento en el conocimiento, la subcontratación y la desregulación se han convertido en las principales políticas. La subcontratación no se basa en la arbitrariedad de un gestor público, sino en la eficacia selectiva y la competencia. El interés de la subcontratación consiste en poner en contacto los recursos del sector público y privado, mientras que la externalización del conocimiento supone una innovación para incrementar el conocimiento organizativo y reducir la ignorancia organizativa. Basándose en una investigación sobre externalización de conocimiento llevada a cabo por el Ayuntamiento de Kaohsiung (Taiwan) en los últimos años, se ha integrado el Análisis Envolverte de Datos (DEA) y el Análisis de Sensibilidad para medir la eficiencia total (TE), la eficiencia técnica pura (PTE) y la eficiencia del tamaño (SE) en la externalización del conocimiento en el Ayuntamiento de Kaohsiung, lo que puede servir para otros países y ciudades. De las variables sobre

eficiencia del DEA se obtiene que un DMU (Data Management Unit), esto es, en torno al 5% de todos los DMU, cuenta con una robusta eficiencia de 1 en la externalización del conocimiento, lo que muestra una favorable eficiencia en la externalización de conocimiento. Dos DMU, lo que supone alrededor del 10% de todos los DMU, revela ineficiencia marginal en la externalización de conocimiento entre 0,9 y 1. Ello supone que esos sectores podrían incrementar la eficiencia en la externalización del conocimiento. Diecisiete DMU, que representan el 85% de todos los DMU, muestran una obvia ineficiencia en la externalización de conocimiento menor de 0,9, por lo que el sector de las finanzas y el de transporte presenta la menor eficiencia en la externalización de conocimiento

PALABRAS CLAVE

Análisis Envolvente de Datos; Externalización de conocimiento; Sector Público.

INTRODUCTION

In the 21st century when computer technology is widely applied, both competition and organization styles are facing innovation. Technology-oriented organizations urgently require the management of experts and professionals when authoritarian leadership is no longer suitable, and many organizations are approaching flat management, which includes the decentralization of experts. The management leadership is gradually subject by experts, i.e. knowledge domination. Broadly viewing the history of Policy Sciences, Outsourcing Research for the government in enhancing the decision-making profession and credibility is maturing. Moreover, the progress of information technology allows the rapid flow of knowledge so that enterprises, with Knowledge Management, engage in production process innovation and organizational reengineering to enhance the competitiveness and governmental sectors in imitating the reformation of enterprises emphasizing Knowledge. Outsourcing Research is considered as a reformation to enhance organizational Knowledge and reduce organizational ignorance. Moreover, the knowledge innovation of Outsourcing Research (research findings and suggestions) is in maximized Knowledge through knowledge classification, storage, expansion, and application.

Facing such a knowledge revolution, Knowledge Economic Development was formulated by the government in 2000, when the National Knowledge Economic Development Conference was also held to discuss the orientation of national development by the elites from industries, officials, and academia. The new structure of Knowledge Management was actively discussed in the conference, where the application of knowledge management to public sectors, the theory development of knowledge management, and the enhancement of productivity through the cooperation between R&D in industries and academia are concerned. With the trend, research on Knowledge Management is increasing. When the governmental sectors face insufficient information, information overload, and different solutions for an event for making decisions, they would outsource to experts in order to make selections, and accurate selection is the presentation of Knowledge. In this case, when decision-makers face organizational ignorance, including contrary, highly complicated decision-making problems and uncertain objectives, Outsourcing Research is considered in efforts to reduce organizational ignorance.

LITERATURE REVIEW

Definition Of Knowledge

Knowledge has been widely discussed in philosophy. A Boundary was defined in Essentials of Kant's Theory of Knowledge where Knowledge was merely a phenomenon, and the noumenon, if there was any, could not establish knowledge (Chen, 2010). Consequently, knowledge merely covered the phenomena. In short, belief as knowledge required sufficient reasons (Yo, 2010). Knowledge therefore contained Domain Boundaries and Elements in philosophy. Amrit Tiwana (2000) indicated that Kant regarded knowledge to merely be the phenomena and the noumenon could not establish knowledge, while Plato considered knowledge being more stable than beliefs, but required rational restrictions. In other words, sufficient reasons were required for beliefs becoming knowledge, which evolved from knowing, believing to beliefs in order to find out the specific conditions for persuading oneself and others to make beliefs become knowledge. From Management, Beckman (1997) considered organizations as the analytic units and from the instructional aspect of Knowledge, solved organizational problems and made decisions as the purposes. It is defined below.

- (1) Knowledge was used to effectively organize information for solving problems.
- (2) Knowledge was organized for analyzed information which could be comprehended and applied to solving problems and making decisions (Hsiao, 2012).
- (3) Intellectual Capital referred to individual knowledge and capabilities for the competitive advantages of an organization that was intangible and the knowledge combination of work and labor (Wen, 2011).

Knowledge Outsourcing Theory in Public Sectors

Liu (2013) stated the public servants consider the more successful knowledge outsourcing could enhance public policy. In addition to the regulations, Administrative institutes conducting Knowledge Outsourcing also base their viewpoint of knowledge as productivity to adhere with Intellectual Capital, which masters knowledge innovation to ensure the competitiveness of the organization. The knowledge innovation, classification, accumulation, and application mentioned in knowledge management are presented as guidelines compiled by administrative institutes (such as the Research, Development and Evaluation Commission, the National Science Council, the Council of Labor Affairs), electronic information (like web pages and sites of such administrative institutes), or established knowledge management systems (such as the Taipei County Government Knowledge Management). Furthermore, based on the viewpoint of knowledge application, the academia and the governmental sectors should collaboratively formulate policies with knowledge for solving risks (Huang, Hsiao & Tsun, 2012), as the principle of Policy

Sciences, expecting to assist the governmental sectors in planning high-quality public policies and improving policy quality through policy research (Chao, 2009). Knowledge Outsourcing therefore is regarded as an essential bridge for official-academic cooperation. In consideration of cost effectiveness, any Knowledge Outsourcing cases should be evaluated by the following factors in the essence of Knowledge Outsourcing (Liebowitz, 1999). 1. How much is the enhanced profession? 2. How much are the reduced human expenses? 3. How much is the enhanced policy credibility? 4. How much are the increased democratic participation in decision-making?

In order to enhance productivity, plan high-quality decisions promote decision credibility and democratic participation, and reduce human resource expenses, Knowledge Outsourcing is essential for administrative institutes.

Stewart (2001) analyzed the planning management, budget performance, and contracting out in the Knowledge Outsourcing process, which was one of the methods administrative institutes outsourced experts or academic institutes for project research (Hsu et al., 2011). From selecting issues, examining and evaluating, executing to applying research results, the schedule and the budget, as a part of planning management, were deliberately set. The budget was first arranged as planning control and budget execution, and then Contracted Out, which could be interpreted by privatization in the new public management trend. Knowledge Outsourcing therefore was implemented through Contracting Out, which was named as Outsourcing Research, based on the theories of Public Choice Theory, Principal-Agent Theory, Transaction Cost Theory, and Resource Dependence Theory.

1. Public Choice Theory argued to reduce governmental competence and advocated introducing market mechanisms into public sectors so as to efficiently allocate resources through competition. Being a part of the political economy, the arguments in Public Choice Theory became the basis of governments reducing expenses under the global storm of a budget deficit. For instance, Mrs. Thatcher's Privatization movement in 1979 reduced the British government's competence by Contracting Out and divestment and introduced market competition mechanisms into the public sector. Public Choice Theory generated the Privatization movement, and Contracting Out was one of the specific measures of Privatization that Contracting Out was based on Public Choice Theory.
2. Principal-Agent Theory. The administrators in governmental sectors would change the roles in the government, from national guards, constitution protectors, to contract agents (Cheng, 2010). Because of the introduction of public administration, national guards in traditional public administration became the constitution protectors in new public administration (as mentioned in the Blacksbury Manifesto), and the administrators in the new public management time period would execute the constitution and be the contract agency of the government. In the examples of Outsourcing Research, the government outsourced

academic units for research whose quality was controlled by inspecting the research plans and results.

3. Transaction Cost Theory. Transaction costs were the operation costs of an economic system (Wang, 2010). With the example of Outsourcing Research, the subjects should be selected in the process for contracting, researching, and evaluating, which were the budget of financial administration in public sectors that belonged to the Transaction Cost Theory in the Privatization Theory (Michael, 1999).
4. Resource Dependence Theory. An organization needed to acquire resources from the environment for development. Nevertheless, reducing the dependence on other organizations was necessary for acquiring rare resources in the environment and the effective routes for sufficient resources (Chiu, 2009). With the example of public sectors conducting Outsourcing Research, the connection with the resources of private sectors was dependent, and the competition among public sectors, like city governments, was competitive and dependent. The Resource Connection between Public and Private Sectors would deepen the symbiosis, i.e. to look for the survival and development.

RESEARCH DESIGN

A Modified Delphi Method is utilized for selecting inputs and outputs in order to combine them with expert opinions, reduce investing costs, and avoid fuzziness in the investigation process. Based on specific considerations, brainstorming-style open-ended questionnaires are omitted. Instead, a structural questionnaire is developed by modifying numerous literature studies for the first questionnaire survey. It could save a lot of time, and such a structural questionnaire allows the expert group to focus on the research subject so as to omit the guessing associated with open-ended questionnaires. A total of 20 questionnaires were distributed, and 17 valid ones were retrieved, with a retrieval rate of 85%. The variables are the prospectuses and annual reports from the government.

The variables are defined as follows.

1. Inputs

- (1) Budget (ten thousand) refers to the amount of outsourcing expenses.
- (2) Period (months) indicates the time for outsourcing.

2. Outputs

- (1) Knowledge Research Outputs refer to the number of research papers from the Kaohsiung City Government sectors.

EMPIRICAL ANALYSIS OF KNOWLEDGE OUTSOURCING EFFICIENCY

Analysis of Knowledge Outsourcing of the Sectors in the Kaohsiung City Government

Based on the input/output indices, CCR and BCC models are used for acquiring the overall production and pure technical efficiency of Knowledge Outsourcing of the sectors in Kaohsiung City, and the efficiencies are divided into the returns to scale of the sectors. The overall production efficiency, pure technical efficiency, scale efficiency, and returns to scale are shown in Table 1.

From Table 1, the overall production efficiency of Bureau of Cultural Affairs equals 1 which is relatively efficient. The overall production efficiency of the rest of the sectors is low. In particular, the Finance Bureau and Transportation Bureau reveal the lowest efficiency. In other words, in addition to the DMU with an overall production efficiency of 1, the rest of the 19 DMUs are relatively inefficient, possibly because they could not effectively apply the inputs or do not achieve optimal production scale. It requires further analyses.

Sensitivity Analysis

The inputs and outputs are sequentially deleted from the DEA in order to understand the sensitivity to such efficiency, in Table 1.

(1) After removing Budget, the efficiency of all DMUs is reduced, presenting the importance of budget to all DMUs. (2) After eliminating Period, Education Bureau, Economic Development Bureau, Agriculture Bureau, Urban Development Bureau, Public Works Bureau, Police Department, Fire Bureau, Mass Rapid Transit, Military Service Bureau, and Land Administration Bureau which appear with lower efficiency, this shows the importance of period to such DMUs. The rest of the DMUs do not change the efficiency after ignoring the period. (3) After removing the Knowledge Research Outputs, the efficiency of all DMUs increases, presenting the importance of knowledge research to all DMUs. Apparently, the Knowledge Outsourcing research outputs of the sectors in Kaohsiung City are insufficient.

Table 1.
Relative efficiency of Knowledge Outsourcing of the sectors in Kaohsiung City

Sectors in Kaohsiung City	Overall efficiency	Pure technical efficiency	Scale efficiency	Returns to scale
Civil Affairs Bureau	0.78	0.73	0.75	IRS
Finance Bureau	0.70	0.71	0.72	DRS
Education Bureau	0.86	0.88	0.81	IRS
Economic Development Bureau	0.83	0.84	0.86	DRS
Marine Bureau	0.72	0.77	0.74	IRS
Agriculture Bureau	0.79	0.71	0.73	IRS
Tourism Bureau	0.84	0.80	0.81	IRS
Urban Development Bureau	0.81	0.83	0.80	IRS
Public Works Bureau	0.77	0.76	0.75	IRS
Water Resources Bureau	0.71	0.66	0.69	IRS
Social Affairs Bureau	0.97	0.98	0.99	IRS
Labor Affairs Bureau	0.90	0.92	0.90	IRS
Police Department	0.78	0.74	0.75	IRS
Fire Bureau	0.74	0.76	0.71	IRS
Environmental Protection Bureau	0.82	0.80	0.78	IRS
Mass Rapid Transit	0.76	0.71	0.73	IRS
Bureau of Cultural Affairs	1.00	1.00	1.00	CRS
Transportation Bureau	0.70	0.72	0.74	DRS
Military Service Bureau	0.75	0.78	0.72	IRS
Land Administration Bureau	0.71	0.64	0.73	DRS

Table 2.
Sensitivity Analysis of sequentially omitting a single input and output

DMU	Original relative efficiency	Deleting Budget	Deleting Period	Deleting Knowledge Research Outputs
Civil Affairs Bureau	0.78	0.66	0.80	0.80
Finance Bureau	0.70	0.63	0.74	0.72
Education Bureau	0.86	0.71	0.76	0.88
Economic Development Bureau	0.83	0.70	0.79	0.90
Marine Bureau	0.72	0.62	0.75	0.80
Agriculture Bureau	0.79	0.75	0.71	0.82
Tourism Bureau	0.84	0.72	0.86	1.00
Urban Development Bureau	0.81	0.74	0.80	0.86
Public Works Bureau	0.77	0.65	0.75	0.81
Water Resources Bureau	0.71	0.60	0.73	0.83
Social Affairs Bureau	0.97	0.84	1.00	1.00
Labor Affairs Bureau	0.90	0.80	0.92	0.96
Police Department	0.78	0.70	0.76	0.82
Fire Bureau	0.74	0.67	0.73	0.84
Environmental Protection Bureau	0.82	0.73	0.84	0.85
Mass Rapid Transit	0.76	0.64	0.75	0.88
Bureau of Cultural Affairs	1.00	0.98	1.00	1.00
Transportation Bureau	0.70	0.58	0.72	0.91
Military Service Bureau	0.75	0.60	0.73	0.87
Land Administration Bureau	0.71	0.66	0.70	0.83
Number of efficient DMUs	1	0	2	3

Data source: Self-organized in this study

CONCLUSIONS AND SUGGESTIONS

According to the efficiency and variables acquired with DEA, one DMU, about 5% of all DMUs, presents strong Knowledge Outsourcing efficiency 1, showing the better Knowledge Outsourcing efficiency. Two DMUs, which comprise about 10% of all DMUs, reflect the marginal Knowledge Outsourcing efficiency 0.9-1, presenting the Knowledge Outsourcing efficiency being easily enhanced. And finally 17 DMUs, which account for about 85% of all DMUs, reveal obvious Knowledge Outsourcing inefficiency lower than 0.9, where the Finance and Transportation Bureaus appear with the lowest Knowledge Outsourcing efficiency. The DEA results show the low Knowledge Outsourcing efficiency of most sectors in the Kaohsiung City Government that the Knowledge Outsourcing research outputs are suggested being increased and the governmental administrators should be familiar with the thinking model and the linguistic expression in the academia. The communication and reliability between the two parties are the key success factors in the interpretation. For this reason, the interaction with academia through oversea observation and learning, in addition to conferences and forums, could reduce different opinions in between. Knowledge management workers in City Government undertake Interpretation that they should communicate with academia. Moreover, Knowledge Outsourcing cases are planned and tracked by the Research, Development and Evaluation Commission, Executive Yuan, and a few staff are in charge of Knowledge Outsourcing in City Government. It is necessary for such staff, like accountants and personnel, to form an independent identification system to hold learning training or meet for the working opinions on knowledge management.

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