

ASSESSING OUTSOURCING POTENTIAL IN A STATE DOT

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ABSTRACT. The purpose of this project was to develop a systematic, objective procedure to evaluate the potential to outsource functions and activities currently performed by the Louisiana Department of Transportation and Development (LaDOTD). A computer-based model was developed which evaluates the qualitative and cost aspects of contracting out activities and functions. The model was applied to three activities in the LaDOTD; highway markers, highway striping, and maintenance of rest areas. The results were in line with the expectations of officials who have experienced actual outsourcing of these activities. The model was constructed so that the perspectives it considers and the criterion on which outsourcing is assessed may be altered by the user to allow its use in a variety of settings.

INTRODUCTION

A study conducted for the Transportation Research Board's National Cooperative Highway Research Program (NCHRP) in 1997 showed that outsourcing by state highway departments had increased more than tenfold since 1950 (Witthof, 1997). This increase responds to political pressure to downsize government and the need for public agencies to accommodate peak demands and access specialized skills and services because as outsourcing has increased, development of the model described in this paper is timely and useful.

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Outsourcing is often perceived as a means of reducing costs resulting from efficiencies brought about by competition. Private companies must be efficient in order to survive in a competitive environment. Public agencies, on the other hand, do not face the same challenges and, indeed, those within public agencies are often evaluated in terms of the number of people they supervise and the size of their budget. However, public agencies, having to contend with only one set of regulations and standards, and being able to call on outside assistance through outsourcing when required, develop their own efficiencies through specialization. It is also generally accepted that public agencies are best suited to provide so-called 'public goods and services' or administer the 'core competencies' of a public agency. Public goods and services are goods and services consumed by society collectively without distinction of the sectors of society (Poole, 1991). Examples of public goods are national defense, public parks, libraries, and education. Public goods and services are usually funded through taxation. Core competencies, on the other hand, are specialized technical or scientific activities that must be conducted by an organization in order to fulfill its mission and execute its responsibilities (Office of Management and Budget, 1996). Examples of core competencies in a state Department of Transportation are the overall planning of the highway system, setting of priorities in maintenance and construction, establishing and maintaining standards in road construction, and responding to queries from the government, the public, and other agencies regarding the state's transportation system.

A position taken by the proponents of outsourcing is that many of the activities conducted by public agencies today are neither public goods and services nor core competencies, so there is no reason to reserve them for public agency execution. Outsourcing proponents suggest such competencies could be executed more efficiently by the private sector. If this is true, the question becomes, "Which of the activities currently conducted by public agencies could be performed better within the private sector?" The Louisiana Department of Transportation and Development (LaDOTD) addressed this issue by commissioning the Louisiana Transportation Research Center (LTRC) to develop a model which objectively evaluates the outsourcing potential of any activity or function within the department. This paper reports on the development of the model produced to provide this capability.

CURRENT PRACTICE

Outsourcing is conducted in both the private and public sector. It was a major business trend of the 1990s as both the public and private sector sought to retain what they did best and contract out those activities that others did best (Keating, Gates, Pace, Paul & Alles, 2001, p. 47). Initially, outsourcing was directed to routine tasks such as security and janitorial services, but increasingly complex activities such as personnel, finance, and information technology have been outsourced in recent times (Keating et al. , 2001; General Accounting Office, 2001). Considerable literature exists on the topic, and the principles involved are the same for both public and private organizations that outsource their activities.

While outsourcing activities by state highway agencies has been popular for a long time, there are only a few examples of comprehensive models used to aid the contracting decision. A recent study conducted by New Mexico State Highway and Transportation Department found that among ten states that had evaluated their outsourcing practice in recent years (Arizona, Connecticut, Florida, Idaho, Maryland, Michigan, North Carolina, Utah, Virginia, Washington), only two (Arizona, Florida) employed a comprehensive method of assessment (Albright, 1998). The Arizona model was the only one used to assess all activities in the department while the Florida model evaluated activities within maintenance only.

The Arizona legislature created the statewide Competitive Government Program in 1996 to introduce competition into the delivery of public sector services. As part of the process of identifying the functions in state government that are appropriate for the Competitive Government Program, a handbook was developed which describes a systematic approach toward outsourcing to be used by all state agencies in Arizona. The process involves two models that are applied consecutively. The first is used to rank qualitative aspects of an activity while the second is a cost analysis.

Soon after the introduction of the Arizona model, the New Mexico State Highway and Transportation Department launched a study to develop a comprehensive outsourcing procedure of their own. They adopted the cost analysis procedure used in the Arizona model but considered the qualitative model too prone to reflect departmental views which were not shared outside the department and therefore threatened

the credibility of the process. Their process involved first distinguishing activities into “core” and “non-core” competencies and then applying cost analysis to the non-core activities.

The Pennsylvania Department of Transportation (PennDOT) uses a checklist form to develop a contractibility score for maintenance operations (Witthford, 1997). Eight questions are answered and scored. Generally, the higher the score the more outsourcing is favored. Compared to the Arizona model, the PennDOT approach is easier to use but at the expense of its adaptability to other types of activities or organizations.

A study was initiated in 1999 to evaluate the outsourcing potential of nine activities within the Texas Department of Transportation (TxDOT) (Johnson & Ponthieu, 1999). The evaluation was conducted by rating each activity on six factors. The factors described different aspects (including legal, organizational, and functional implications) of the outsourcing potential of an activity. The factors were weighted to reflect their relative importance. Each activity was evaluated using between three and nine criteria on each factor to rate the activities performance. Multiplying each criterion rating by its appropriate factor weighting and summing over all criteria produced a composite score that reflected the outsourcing potential of the activity. Ratings and weightings were solicited from officials at each of the 25 district offices of TxDOT as well as the head office, and the overall values were used to evaluate the activities. The factors and the criteria are described in greater detail in the description of the LaDOTD model below.

The NCHRP Synthesis 246, “Outsourcing of State Highway Facilities and Services,” provides a good review of practice in state highway agencies up to the middle of the 1990s (Witthford, 1997). It shows that the type and proportion of work outsourced differs considerably among state DOTs. However, reflecting the need of public agencies to retain the skills and experience needed for effective management and supervision, few activities are wholly outsourced. Other important studies include the American Association of State Highway and Transportation Officials’ study on the commercialization of Interstate Highway Rest Areas (American Association of State Highway and Transportation Officials, 1990) and the Reason Foundation’s document on “How to Compare Costs Between In-House and Contracted Services” (Martin, 1993).

DEVELOPMENT OF MODEL

The objective of the research reported in this study is to produce a procedure that would assist the LaDOTD to assess the outsourcing potential of activities and functions in the department. The evaluation process had to be generic so that all types of functions and activities could be assessed. The study team attempted to produce a process that was comprehensive and yet manageable in terms of the time and effort required to use it. This suggested a computer-based system that contained as much of the required information as default values within the program as possible and which allowed calculations to be performed automatically.

In developing the model in this study, considerable attention was given to models developed by other states. Some used qualitative assessment only; others used quantitative assessments alone, while others used both. Level of detail, number of factors, degree of automation, and level of subjectivity used in the analysis varied from model to model. Use of the Arizona and Pennsylvania models was tested with district administrators and other senior officials of LaDOTD. Highway striping was the test activity. The officials felt that the Pennsylvania model was easier to use, but the Arizona model provided a more comprehensive assessment. The Texas model includes factors similar to those used in Arizona but which are, in certain cases, more easily understood by users. As an initial test of a computer-based interactive model assessing outsourcing potential, a qualitative model using the factors and criteria in the Texas model was prepared. The model was written in Visual Basic and required relatively easy operation by a user (as described in greater detail below). This initial version of the qualitative model was tested with LaDOTD officials using highway striping, highway markers, and rest area maintenance to produce results that were intuitively correct. A second version of the model was developed to incorporate changes suggested by users of the first version of the model.

Version one of the computer model

The computer model was developed to provide a comprehensive and systematic approach to consider both cost and non-cost (i.e., qualitative) issues associated with potential outsourcing decisions. The computer model is a decision support tool to assist managers. One benefit of the systematic approach inherent in the model is that several managers can independently perform the analysis and then compare their results.

Inconsistent results in any aspect of the model can be discussed to build a consensus solution. The model can also be used to evaluate and then rank an array of activities and functions that are candidates for outsourcing. Ultimately, the decision to outsource rests with management and not with the computer model itself. Hence, activities deemed good for outsourcing by the model should be analyzed further; contractor bids should be obtained, and detailed cost analysis by the accounting department should be sought. Again, the purpose of the computer model is to replace *ad hoc* procedures with a comprehensive and systematic and, hopefully, easier procedures to form initial interpretations of outsourcing viability of potential activities.

Understandably, the qualitative phase of the computer model was the most difficult to develop. Unlike cost analysis, clear principles to conduct qualitative analysis do not exist. Nonetheless, it is almost universally acknowledged that qualitative issues are extremely important—sometimes overriding cost factors (Witthford, 1997). Lacking specific guidelines for the qualitative model, a meta analysis was conducted to determine the propensity of use of specific qualitative issues (or questions). As mentioned earlier, Arizona, Texas, and Pennsylvania have systematic scoring procedures to assess qualitative issues. Five other states (i.e., Virginia, Georgia, Illinois, Michigan, and Maryland) were discovered to have simple checklists of qualitative factors to consider in privatization and outsourcing matters. From the analysis of the qualitative issues across these eight states, an initial list of twenty-five qualitative assessment statements was derived and built into Version 1 of the qualitative computer model. Moreover, the classification scheme used in Texas was used to assign each assessment statement into one of the following six broad factors (General Accounting Office, 2001):

- External mandates and influences,
- Strategic and organizational effectiveness,
- Organizational systems and operations,
- Cost and cost efficiency,
- Human resources and organizational culture, and
- Vendor market.

Table 1 displays meta analysis results that produced twenty-five assessment statements as classified under the six broad factors and lists the states using the assessment statement (or a close derivative thereof). Table 1 also represents Version 1 of the qualitative analysis conducted in the computer model.

TABLE 1
Meta Analysis Results of Qualitative Models

Assessment Statement		
<i>External Mandates & Influences</i>		
Stmt #	Assessment Statement	States Using
1	Outsourcing this activity is consistent with State laws, Rules and Regulations.	AZ, TX, MD
2	The contract provides for the protection of the welfare and public safety of citizens in case of default by the private contractor.	AZ, VA, MD
3	The function or activity has low overall political support.	AZ
4	Citizens, users of the activity, interest groups, or public officials want the function provided in-house.	AZ
<i>Strategic & Organizational Effectiveness</i>		
5	This function is of high strategic importance (e.g., a core competency) to LaDOTD and its performance in-house is critical to accomplishing the mission of LaDOTD.	TX, GA, MI
6	This function deals with confidential information. Revealing such information to outside vendors may have a detrimental effect on LaDOTD.	AZ, TX, GA, MI
7	Contracting out this function negatively impacts (would negatively impact) the quality of output of this function.	AZ, TX
8	This function should be performed in-house because the critical human resource skills in this activity cannot be matched by vendors.	AZ, TX, PA
9	This function should be performed in-house because we have critical technology and equipment in this activity that cannot be matched by vendors.	AZ, TX, PA
<i>Organizational Systems & Operations</i>		
10	This function is interdependent with other functions performed by LaDOTD. And outsourcing this function negatively impacts effective execution of those other functions.	TX

TABLE 1 (Continued)

11	Contracting out this function makes it difficult for LaDOTD to maintain control of this activity.	AZ, TX, IL, MD
12	The activity can be subdivided (especially geographically) so that a portion can be contracted out as a “pilot” test.	GA, MI
13	It will be difficult to monitor (or requires a high level of inspection of) the private contractor’s performance.	GA, IL, MD, MI, MS, PA
14	The labor intensive activity requires large crew sizes and may tie up in-house resources to perform routine functions or to respond quickly to special situations.	PA
<i>Cost & Cost Efficiency</i>		
15	Outside vendors can provide this activity at significant cost savings to LaDOTD.	TX
16	This function should not be outsourced because of the sizable capital investment we have in equipment and/or facilities allocated to this function.	TX
17	Economic delivery (i.e. low cost) of the activity is more important than control and/or accountability.	AZ, VA, MD, MI
18	The private sector can implement and deliver the activity quicker.	AZ, MD, PA
<i>Human Resources & Organizational Culture</i>		
19	Outsourcing this function negatively impacts the culture or organizational values of LaDOTD.	AZ, TX, IL
20	Outsourcing this function results in employee losing loyalty and faith in LaDOTD.	TX
21	Under conditions of outsourcing this function, most of the employees who currently perform this function in-house have been retrained and relocated to other areas of LaDOTD.	AZ, TX, MD, MI
<i>Vendors Market</i>		
22	There are sufficient available, qualified, and reliable private vendors of this function.	AZ, TX, GA, IL, MD, MI, MS, PA
23	Under conditions of outsourcing this function, vendors may raise their prices without cause after the initial contract period.	TX
24	This service has been successfully contracted out in the past by this or other public sector entities.	VA, GA, IL, MI
25	The private contractor can be replaced relatively easily.	VA, IL, MD, MI

Several states include cost as a factor in their qualitative models (see Table 1). However, as can be seen from the statements that are used to assess the significance of cost, either the perception of the analyst regarding cost or cost-related aspects of the activity being evaluated are considered rather than the actual cost itself. The actual cost of outsourcing versus in-sourcing is established in the cost model.

Version 1 of the program required two evaluations by the program user. First, each of the six factors was given a weight of importance ranging from unimportant to important. Second, each of the twenty-five assessment statements was given a level of agreement rating that ranged from “disagree” to “agree.” Both evaluations were made using graphical sliding toolbars. Figure 1 illustrates the weighting of the six factors and Figure 2 illustrates the rating of individual assessment statements.

Using the two types of input supplied by the program user, a numerical score for the qualitative aspect of outsourcing the candidate activity is determined. The index ranges from 1 to 5 with a score of 3 considered decision neutral (e.g., not favoring either outsourcing or insourcing). Computationally, the program allocates a total weight of 1.0 among the six factors based on the importance weights assigned by the program user. Next each assessment rating ranges from a low of 1

FIGURE 1
Version 1: Assign Weights to Six Factors

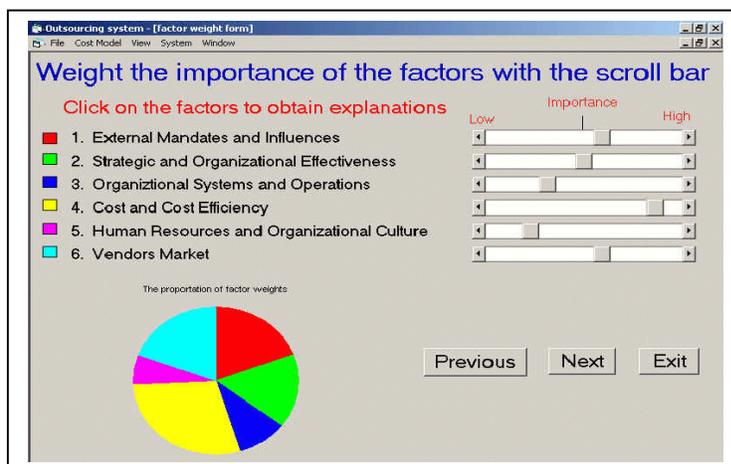


FIGURE 2
Version 1: Assign Rates to Assessment Statements

The screenshot shows a software interface for evaluating outsourcing factors. It is titled "Outsourcing system - [Factor evaluate form]". The main instruction is "Please evaluate the factors using the following Criteria." There are two sections of criteria:

- 1. External Mandates and Influences**
 - (1) Outsourcing this activity is consistent with State laws, Rules and Regulations. Slider is near "Undecided".
 - (2) The contract provides for the protection of the welfare and public safety of citizens in case of default by the private contractor. Slider is near "Disagree".
 - (3) The function or activity has low overall political support. Slider is near "Disagree".
 - (4) Citizens, users of the activity, interest groups, or public officials want the function provided in-house.* Slider is near "Disagree".
- 2. Strategic and Organizational Effectiveness**
 - (1) This function is of high strategic importance (e.g., a core competency) to LaDOTD and its performance in-house is critical to accomplishing the mission of LaDOTD.* Slider is near "Undecided".
 - (2) This function deals with confidential information. Revealing such information to outside vendors may have a detrimental effect on LaDOTD.* Slider is near "Disagree".
 - (3) Contracting out this function negatively impacts (would negatively impact) the quality of output of this function.* Slider is near "Disagree".

(“disagree”) to a high of 5 (“agree”). The third step is to multiply each assessment rating by the factor weight assigned to the factor the assessment statement is classified under and then sum the resulting products and divide by the number of factors. Computationally, the index is calculated as follows:

$$Index = \sum_i w_i \frac{\sum_j r_{ij}}{J_i}$$

Where

- w_i = weight of factor i ,
- r_{ij} = rating of assessment criteria statement j in factor i ,
- I = number of factors (usually 6),
- J_i = number of criteria in factor i .

The resulting composite index was graphically displayed on a toolbar where the midpoint is considered decision neutral and areas to the left (i.e., values less than 3.0) indicate insourcing is preferable while areas to the right (i.e., values greater than 3.0) indicate outsourcing is preferable.

The second phase of the analysis in the computer model pertains to cost analysis. It is assumed that the program user is fairly experienced with the activity such that he or she has a good basis to provide estimates of both inhouse and contractor costs. Obviously, before committing to outsource an activity precise inhouse costs and actual contractor bids should be obtained. The basic approach taken in the computer model was to separate inhouse costs into direct and indirect costs categories. Direct costs were further divided into labor and nonlabor categories (e.g., equipment, supplies). Indirect costs include supervision, support services, and other types of overhead. The program was designed to work with the current accounting system. That is, it makes use of information readily available and does not require an overhaul of the accounting system. The following rates and pay scales are resident in the model: (1) civil service median annual wage rates by civil service GS ranks, (2) a percentage tolerance range to determine the size of the decision neutral zone (10% standard), (3) the payroll additive rate determined by a periodic study conducted by the financial services division of LaDOTD for fringe benefits, and (4) the support services overhead rate determined by a periodic study conducted by the audit department of the financial service division.

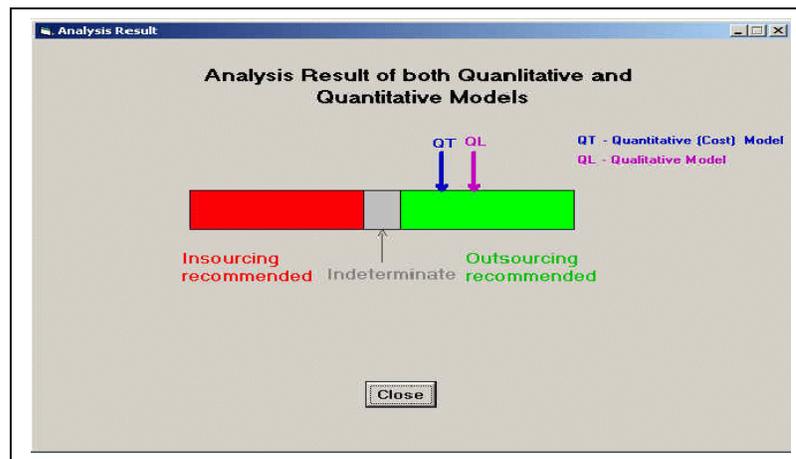
The user may conduct either the qualitative or the quantitative analysis first. In the quantitative (cost) analysis, the computer program takes the user through a series of screens to gather inhouse cost information. First, the program gathers input into the number and classification (i.e., GS level) of personnel required and the amount of time (i.e., FTE) they will spend on the activity. Second, the user inputs information on equipment, supplies, and other materials needed for the activity. Finally, indirect costs such as insurance and supervision are added to develop the full cost to conduct the activity inhouse.

To complete the cost analysis, the program user is also asked to provide estimates of costs to contract out. Besides the direct costs paid to the contractor, the user is also asked to assess the costs to let the contract, monitor the contractor's performance, and inspection of the contractor's work. The estimates can be based on past experience, recent contracts let, or current bids under consideration. Depending on the recency of the past experience, the estimate may require more thorough study to increase the precision of the cost comparison.

Based on the full cost to provide the activity inhouse and the full cost to contract out the activity, the ratio of the two costs is plotted on a

graphical toolbar alongside the qualitative index score. A value of 1.0 for the ratio of inhouse costs divided by contractor costs indicates that cost is decision neutral toward outsourcing the activity. Values exceeding 1.0 represent potential cost savings through outsourcing while values less than 1.0 indicate higher costs are expected with outsourcing. Figure 3 is an illustration of the graphical display of the cost and non-cost assessment made by the program user.

FIGURE 3
Version 1: Example of Computer Model Results



It is worth noting that by using full inhouse costs (e.g., direct plus indirect costs); the cost analysis sets the easiest target in order for contractor costs to be viewed as cost efficient. Conversely, if contractors cannot beat the agency's full cost to provide a service then it is obvious that cost savings are impossible through outsourcing. Caution must be exercised, however, as it is unlikely that all of the estimated cost savings between contractor costs and inhouse full costs can be captured. Indeed, there may be no savings at all. When the cost analysis conducted by the computer model indicates potential cost savings associated with outsourcing, an in depth analysis of inhouse costs should be done concurrently with the solicitation of contractor bids. The purpose of the follow-up cost analysis is to identify inhouse costs that can be eliminated

when the activity is outsourced. Those costs, sometimes referred to as “relevant” or “avoidable” costs, can then be compared to contractor bid amounts to determine the extend of any cost savings.

Version Two of the Computer Model

Following pilot tests of the first version of the model in three activities: (a) rest area maintenance, (b) highway markers, (c) highway striping; and demonstrations of the model before various potential user groups, a second version of the computer model was developed with three primary changes. One change was to adopt the “balanced scorecard” approach developed by Harvard Business School for the qualitative model (Kaplan and Norton, 1992). The balanced scorecard is gaining in popularity in the private sector as a way to assess non-cost factors in the business setting. That approach calls for four areas of qualitative analysis pertaining to (a) customer, (b) internal business, (c) innovation and control, and (d) financial perspectives. Given the unique nature of public sector agencies and the outsourcing decision in particular, employee and contractor market perspectives were added. Hence, the revised computer model retains six broad factor areas now renamed as “perspectives.” Associated with this change, individual assessment statements were analyzed in light of the description of each perspective and were classified according to the perspective felt to best match the theme of the perspective. Table 2 presents the six perspectives and a brief description for each.

TABLE 2
Perspectives

<i>Perspective</i>	<i>Description</i>
Customer Perspective	Focus on the interests of citizens, legislators, public officials, and special interest groups, and the compliance with laws and regulations related to the function or activity under consideration.
Internal Business Perspective	Focus on agency core competencies, processes, technology capability, and technical expertise
Innovation and Control Perspective	Focus on agency need to monitor and control the function, ability to outsource on a limited basis, and effects on other agencies should outsourcing occur

TABLE 2 (Continued)

Financial (Cost) Perspective	Focus on cost aspects, capital investment issues, and timeliness of function or activity under consideration
Employee Perspective	Focus on employee morale, retraining, and relocation
Contractor Market Perspective	Focus on availability of qualified private sector contractors, potential of establishing a “monopoly,” and the degree of prior outsourcing experience in the agency for the function or activity under consideration

As before, the program user assigns a weight of importance to each of the six perspectives. The second significant program change pertains to the user’s evaluation of individual assessment statements. Based on feedback on the first version, the user is also asked to assign a weight of importance to each individual assessment statement along with the rating of agreement required in the first model. As a result, each individual assessment statement receives two evaluations: (1) a rating of the level of agreement with the statement from disagree to agree and (2) a weight of importance from low to high. For each evaluation made by the user the numerical score is also displayed to the right of the sliding toolbar. Figure 3 illustrates an example of weights applied to the six perspectives and Figure 4 displays an example of the two-fold evaluation of selected individual assessment statements.

The final significant change was to normalize the cost index (CI) and non-cost qualitative index (QI) so that they both range from 0 to 1. The midpoint of 0.5 for each index indicates the decision neutral point. Values below 0.5 favor inhouse provision while larger values over 0.5 favor outsourcing. The techniques to develop the two index scores follow:

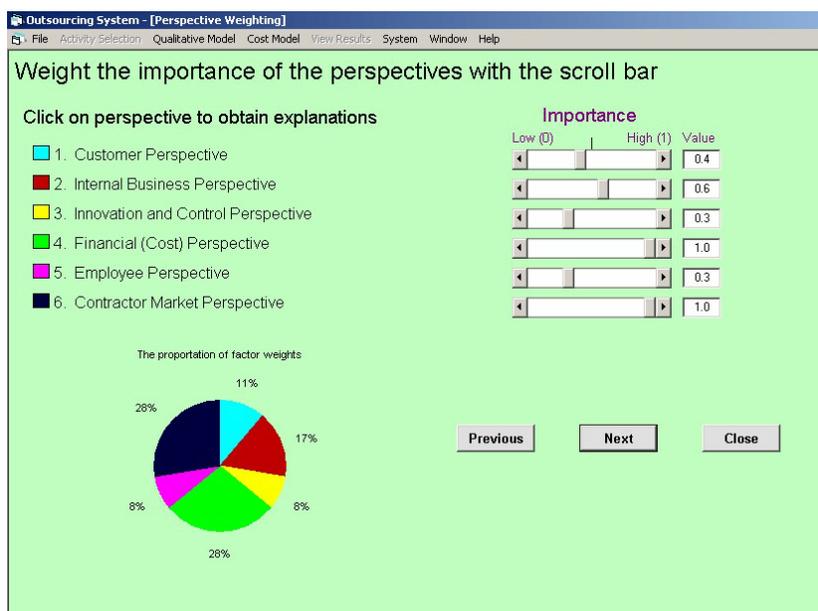
$$QI = \frac{1}{\sum_{k=1}^K I_k} \left[\sum_{k=1}^K I_k \cdot \frac{1}{2} \left\{ \frac{\sum_{j=1}^J (r_{jk} \cdot w_{jk})}{\sum_{j=1}^J w_{jk}} + 1 \right\} \right]$$

where,

QI = Qualitative Index

I_k = Importance rating of the k^{th} perspective

FIGURE 4
Version 2: Assign Weights to Perspectives



K = Number of perspectives
 r_{jk} = rating on the j^{th} criterion of the k^{th} perspective
 w_{jk} = weight of the j^{th} criterion of the k^{th} perspective
 J_k = Number of criteria in the k^{th} perspective

and,

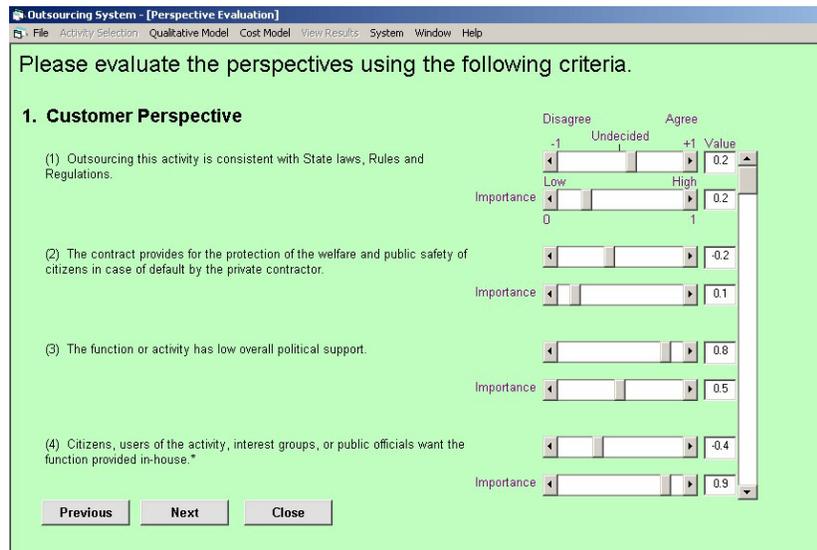
$$CI = \begin{cases} 0.5 \left(\frac{I}{O} \right) & \text{when } I \leq O, \text{ and,} \\ 1 - 0.5 \left(\frac{O}{I} \right) & \text{when } I > O \end{cases}$$

where,

CI = Cost Index
 I = Total insourcing cost
 O = Total outsourcing cost

Figure 5 depicts an example of the graphical display of the two index scores in a hypothetical example. Note that the numerical score for both

FIGURE 5
Version 2: Assign Weights & Rates to Assessment Statements



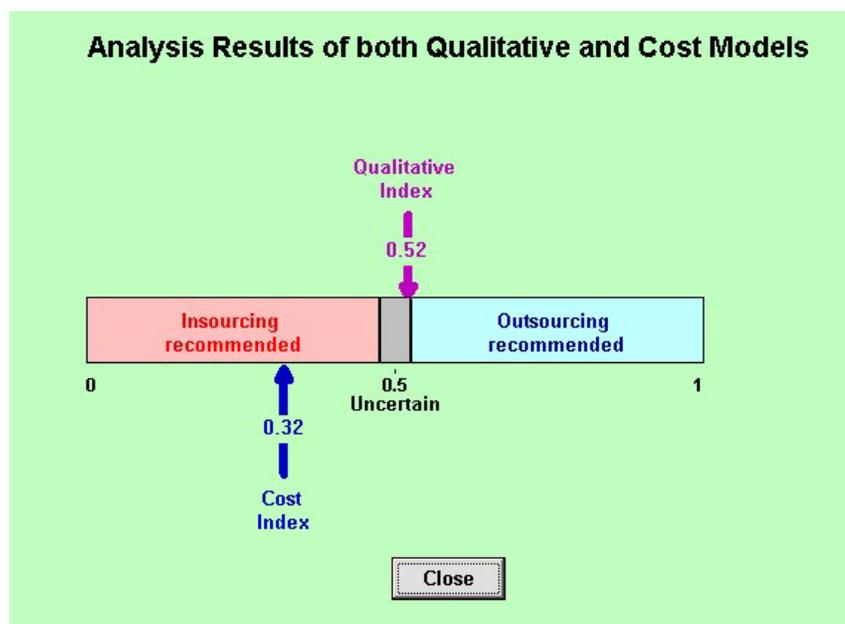
indices are displayed. In the example, the qualitative score is close to the area of uncertainty while the cost index shows a clear preference for outsourcing. The user must weigh the relative importance of the qualitative and quantitative results subjectively in making a decision on outsourcing. That is, in keeping with the intended function of the model as an aid to decision-making rather than as a decision tool itself, the model output is intended to be informative rather than prescriptive.

APPLICATION

One of the initial tasks in conducting an outsourcing assessment is to identify the core competencies of the organization. In the case of the LaDOTD, these were identified as the following functions and activities that related to the department:

- Service to the public,
- Service to the government,
- Maintenance of required expertise in the organization,

FIGURE 6
Graph of Qualitative & Quantitative Index Scores



- Retention of the ability to effectively contract and manage outsourcing, and
- Maintenance of attractive career growth opportunities in the department

Functions or activities related to core competencies of the department are excluded from consideration for outsourcing. Interviews with LaDOTD managers were conducted to determine the types of activities with a history of outsourcing, activities currently under consideration for outsourcing, and activities that are not considered appropriate for outsourcing. As a result of these interviews, a lengthy list of activities to use to pilot test Version 1 of the computer model was generated and discussed with the project review committee overseeing the research project. Following the discussion, three activities were chosen for pilot testing of the model: (a) rest area maintenance, (b) highway pavement markers, and (c) highway striping. Members of the research team met with LaDOTD personnel familiar with each of the

three activities. Using a laptop loaded with the computer model, the model was completed for each activity. Since each activity had either been outsourced in the past or was currently under consideration for outsourcing, the model result was checked against past experience and/or study conducted by LaDOTD. In each case the results of the computer model agree with both the intuition of the personnel familiar with the activity and the results of prior LaDOTD studies. A summary of the pilot test results is provided in Table 3. In the table, the Qualitative Index has been modified to have a lower value of zero and a midpoint value of one to coincide with the scale used in the Cost Index in Version 1 of the model. Thus values below one on both indices indicate a preference for insourcing while values above one indicate a preference for outsourcing. Values in the region of one indicate uncertainty either way.

TABLE 3
Pilot Test Results of Version 1 of the Outsourcing Model

<i>Function</i>	<i>Qualitative Index</i>	<i>Cost Model Index</i>
Rest Area Maintenance	1.5	1.6
Highway Markers	1.4	0.6
Highway Striping	1.3	0.5

The pilot test results show that both the qualitative and cost assessment of the rest area maintenance activity favor outsourcing. However, the activity of installing highway markers or painting lines on highways produces different preferences for the qualitative and cost assessments. The qualitative factors favor outsourcing but the cost assessment shows that it is cheaper to perform these activities in-house. Such results are not contradictory but merely indicate a difference between the qualitative and quantitative aspects of the evaluation. The user must decide on what weight to place on each aspect to arrive at a decision whether to recommend outsourcing or not.

CONCLUSION

The goal of this study was to develop a computer model to assist public sector managers in decision making about the outsourcing of agency functions and activities. Instead of the *ad hoc* nature of most outsourcing analysis found in the public sector, a primary goal was to

generate a comprehensive model to consider both cost and non-cost issues related to outsourcing and to make the process systematic and uniform for all types of activities being scrutinized for outsourcing. Two generations of the computer model were developed during the project. The second version was created from feedback to the first model. Two constraints faced in developing the model were (1) the lack of clear guidelines to develop qualitative models in practice and (2) the necessity of tailoring the cost model to the accounting information system in operation at the agency. The first constraint is important since it opens the possibility for the omission of potentially important qualitative issues. The second constraint is important since alternative cost systems (e.g., using activity-based management) could produce different and perhaps more precise cost comparisons. A meta analysis of qualitative models found in eight states and the balanced scorecard approach popular in business was used to develop the qualitative model and to curtail the effects of the first constraint as much as possible. The second constraint was a limitation to the model development that can be dealt with either by (1) converting the accounting system itself or (2) through an analysis of overhead costs to produce rates relevant to the outsourcing decisions. The study team recommended the second approach to address the second constraint.

Since the research project focused on the development of the computer model, only limited testing occurred. In fact, all pilot tests were conducted on the first version of the model and Version 2 of the model did not undergo pilot tests. Hence, model performance has undergone limited application testing to date and additional testing is recommended.

In terms of the use of the computer model, it is critical to recognize that it is a decision support aid rather than a tool to prescribe outsourcing. Currently, the model is developed for stand-alone personal computer use. It is recommended that several users (e.g., three or more) conduct independent analysis of the activity and compare and reconcile their results. Moreover, depending on the integrity of contractor cost estimates and the precision of the agency cost accounting system, additional cost analysis may be advisable. Possible extensions to the current model include group use in Delphi-type setting (e.g., ("brainstorming")), Internet application, or network application, each of which would help derive consensus solutions for outsourcing analysis.

Finally, the model was developed so that it can be easily used by organizations in other settings. That is, it is not restricted exclusively to

state departments of transportation. Through system maintenance, the program's flexibility is enhanced because wage rates, overhead rates, and the size of the design neutral (i.e., tolerance) zone can be specified.

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