

On the Response Consistency of Questionnaire Surveys of State Department of Transportation Management

J. L. HULSEY, P. A. KOUSHKI, AND C. D. VAUGHAN

The approach to decision making in state departments of transportation (SDOTs) is in the process of change because of several important and complex factors. The results of two recent surveys addressed to the secretaries/commissioners and regional directors of SDOTs are reported. The result of the analysis of response consistency of these two groups of management officials to a set of questions dealing with resource allocation decisions is also reported. The officials' views on the impact of political change in DOT upper management on resource allocation decisions and implementation also are presented and shortcomings associated with current management system programs are identified. The results of chi-square test and correlation analysis performed on the responses to the two questionnaire surveys showed a significant degree of consistency in responses of these two groups of upper SDOT management officials to the questionnaire surveys.

This paper presents the results of a research study aimed at determining the response consistency of questionnaire surveys of the upper managements in the state departments of transportation (SDOTs).

Examples of questionnaire surveys in the transportation industry abound. Surveys have been used to analyze park-and-ride lot use (1); determine ridematching system effectiveness (2); identify commuter behavior (3); examine the effect of variable work hour programs on ridesharing (4); study commuter attitudes (5); measure transit route service elasticity (6); identify management structure and decision process (7); evaluate manager attitudes concerning job change (8); examine the effects of disseminating service information on bus ridership (9); perform transit market research (10); compare travel behavior (11) and travel demand management markets (12); and analyze changes in travel patterns (13).

A significant level of effort has also been directed toward improvements in surveying techniques. Examples of such studies include comparison of telephone and door-to-door surveys (10), testing of alternative administrative procedures and survey instruments (14), application and modifications of home interview travel surveys (15), and design of mail and telephone surveys (16).

However, research has not considered the variation in responses when different levels of management hierarchy in an

organization respond to survey inquiries. In a recent research study aimed at the examination and evaluation of management information system programs and decision processes in SDOTs nationwide (17), self-administered surveys of upper managements were undertaken. In addition, telephone and personal interviews of SDOT officials supplemented the questionnaire surveys. Results of these personal interviews indicated that a potential variation in responses may be expected if individuals from different levels of the management decision-making hierarchy are surveyed. Quite clearly, the impact of a survey response is of paramount importance on findings, conclusions, and recommendations of a given study. It was to the quantification of this important point that this study was addressed.

The specific objectives of the study were twofold: First, to present the findings of two surveys and second, to test the following hypothesis— H_0 : depending on the hierarchical level of the management decision maker responding to a questionnaire survey, no significant degree of variation in responses may be expected.

DATA

A structured, yet brief, questionnaire was designed to determine SDOT decision-making patterns, identify the tools and computer programs utilized, and evaluate the shortcomings of these programs. The questionnaire was mailed to the secretary/commissioner of every state DOT. A total of 43 states (86 percent) responded.

The questionnaire was later modified to incorporate a number of additional questions concerning the identification of state DOT boards/commissions and their impact on the decision process, implementation, and stability. The questions addressed in the first questionnaire survey were also included in the second. This questionnaire was mailed to a randomly generated list of regional directors in state DOTs approximately 6 months after the first survey. The random list of regional directors was generated from the organizational charts of SDOTs (18). A total of 48 states (96 percent) responded to the second survey.

Data were coded and compiled for statistical analysis using the mainframe computer at the University of Alaska Fairbanks. Statistical Analysis Software (SAS) was used to process the data.

J. L. Hulsey and C. D. Vaughan, Department of Civil Engineering, University of Alaska Fairbanks, 263 Duckering Building, Fairbanks, Alaska 99775. P. A. Koushki, Civil Engineering Department, College of Engineering and Petroleum, Kuwait University, P.O. Box 5969, Safat, Kuwait 13060.

ANALYSIS OF SURVEY RESULTS

The following is a frequency distribution analysis of responses to each common question in both surveys.

Question 1. With respect to source (budget) allocation, is the process of decision making in your state DOT centralized (decisions made at the top), decentralized (regional/district levels), combination and/or other?

All responses of secretary/commissioners (first survey) fell within two categories. Seventeen states (39.5 percent) indicated a "centralized" decision-making process, whereas the remaining 26 (60.5 percent) selected the "combination" category, reflecting district/regional level participation in decisions concerning the allocation of resources. The responses of regional directors (second survey) were 28 (59.6 percent) "centralized," 16 (34.0 percent) "combination," and 3 (6.4 percent) "decentralized." One director did not respond to this question.

Question 2. In your opinion, is the process of decision making in your SDOT smooth and logical?

In the first survey, no secretary/commissioner responded "no" to this question. However, 21 (48.8 percent) responded "to some extent," and the remaining 22 (51.2 percent) believed that the decision process within their organization was smooth and logical. In the survey of regional directors, the responses were 28 (58.3 percent) "yes," 18 (37.5 percent) "to some extent," and 2 (4.2 percent) "no."

Question 3. Is there any room for improvement in the decision-making process?

Twenty-three secretaries/commissioners (53.5 percent) responded "yes," and another 19 (44.2 percent) indicated "to some extent." One state commissioner (2.3 percent) responded that there was no room for improvement in the budgetary decision process. The responses of the regional directors were 27 (57.4 percent) "yes," 19 (41.7 percent) "to some extent," and 1 (2.1 percent) "no." One director did not respond to this question.

Question 4. Does the organizational structure of your state DOT support/complement the department's decision-making process?

The responses in the first survey were 1 (2.3 percent) "no," 14 (32.6 percent) "to some extent," and 28 (65.1 percent) "yes." In the second survey, the responses were 37 (77.1 percent), 10 (20.8 percent), and 1 (2.1 percent), "yes," "to some extent," and "no," respectively.

Question 5. Please indicate the number of upper-management positions in SDOT that are political appointees.

A wide range of responses was given to this question. In the first survey, the number of political appointees ranged from 0 to 74, for a mean of 12.3 positions and a standard deviation of 12.0. In the second survey, the responses to this question ranged from 0 to 22, for a mean of 7.7 and a standard deviation of 6.1.

Question 6. How does the change in the top-level DOT administrators (political appointees) affect the decision process?

Twenty-two percent of the respondents in the first survey indicated that the process of decision making was "very much" affected by change of the top-level administrators, and 63.4 percent felt it was affected "to some extent." The remaining

14.6 percent indicated that the change of top management had no impact on the decision process. The figures for the second survey were 14, 72, and 14 percent for the "very much," "to some extent," and "no" impact categories, respectively.

Question 7. How does the change of top-level DOT administrators affect the implementation of decisions?

Ten of the respondents (23.2 percent) in the first survey indicated that the implementation of decisions was "not at all" affected by management change, whereas 27 (63 percent) responded that the management change affected decision implementation "to some extent." Four secretaries/commissioners believed that the implementation of DOT decisions was "very much" affected by these management changes. Two respondents did not answer this question. In the second survey, 8 (18.2 percent) regional directors stated that the management change had "no" effect on decision implementation, whereas 33 (75 percent) believed that the implementation of decisions was affected by the change in top administrators "to some extent." Three directors (6.8 percent) responded that decision implementation was "very much" affected by the change in political appointees.

The question "How can the decision process and implementation be improved under the changing management environment?" brought recommendations of important measures from respondents in both surveys:

- Top-level positions should be civil service or under an executive contract.
- Multiyear project commitments should be exempt from changes except for some predefined reasons.
- There should be well-documented information systems that would not have to be resold to each new administration.
- Transition would be smoother if only transportation professionals were appointed.
- There needs to be good communication of objectives to all involved employees. There should be no hidden agendas.
- The basis for decisions should be documented and should be based on clearly stated objectives.
- The establishment of a long-term plan, supported by detail and a "need justification," may be the best hedge against impulse or political expedients.
- A unified management information system should be established.

In response to a question about the names of the management system software programs utilized, a total of 107 programs were reported by the responding state DOTs. Seventy-four of the software programs (69.2 percent) were individually developed "in-house" programs. The remaining 33 (30.8 percent) included a variety of commercial and specially commissioned software programs. The software programs were utilized for the management of pavement, maintenance, highway, and bridge systems.

Numerous criticisms were directed toward the current management system software programs by the respondents of both surveys. The DOT secretaries/commissioners, for example, frequently identified such shortcomings as different data base requirements, the inability to interact, lack of integration, vast data requirements, PC interact limitation, limited analysis

capability, lack of common network reference ability, and lack of predictive capability.

Correlation analyses were performed to examine degrees of associations among the various questionnaire responses. The Pearson correlation coefficients, along with the probability of the null hypothesis that a given coefficient of correlation (r_{xy}) is equal to 0 ($H_0: r_{xy} = 0$), were computed. Results indicated that the degree of association between a number of response variables was rather significant. For example, in the first questionnaire survey, as the number of upper-management political appointees increased, the state DOT decision process tended to include a "combination" of district, regional, and, of course, central headquarters management into the decision-making process for resource allocation ($r_{xy} = 0.3668$; $p = 0.03$).

When the state DOT decision process was reported to be smooth and logical, there was less reported room for improvement ($r_{xy} = -0.4492$; $p = 0.002$), a higher compatibility with the organizational structure ($r_{xy} = 0.3680$; $p = 0.01$), less impact of management change on the decision process ($r_{xy} = 0.2815$; $p = 0.05$), and even less impact on decision implementation ($r_{xy} = -0.3513$; $p = 0.02$). The analysis of correlation also indicated that when a state DOT organizational structure supports the agency's decision-making process, there is less room for improvement in the decision process ($r_{xy} = -0.3781$; $p = 0.02$).

RESPONSE CONSISTENCY OF SURVEYS

The examination of the response consistency of the two upper SDOT management levels (secretaries/commissioners versus regional directors) involved the construction of contingency tables based on the observed frequency of responses to each question. The chi-square test of significance was then used to

test the null hypothesis (H_0). H_0 assumes that response frequencies of the two questionnaires are independent of each other (19). In other words, no significant difference in response to a given question will be found to exist regardless of the responder's hierarchical management level.

The value of chi-square for a 2×3 contingency table may be computed from Equation 1:

$$\chi^2 = \frac{N}{N_A} \left[\frac{a_1^2}{N_1} + \frac{a_2^2}{N_2} + \frac{a_3^2}{N_3} \right] + \frac{N}{N_B} \left[\frac{b_1^2}{N_1} + \frac{b_2^2}{N_2} + \frac{b_3^2}{N_3} \right] - N \quad (1)$$

where

$a_1, \dots, a_3, b_1, \dots, b_3$ = category response frequency of a given question in the first and second surveys, respectively;

N_A and N_B = sample sizes of Survey 1 and Survey 2, respectively;

$N_1, N_2,$ and N_3 = sum of question response frequencies in a given category for both surveys; and

$N = N_A + N_B = N_1 + N_2 + N_3$.

Table 1 gives the contingency tables for common questions in the two surveys.

The result of chi-square computations and the test of the null hypothesis (H_0) are presented in Table 2. With the exception of the first question, the null hypothesis could not be rejected for all other questions at the 95 percent significance level ($\alpha = 0.05$). This indicates that no significant difference was found to exist between the responses of the two groups

TABLE 1 Contingency Tables for Common Questions in Two Surveys

QUESTION NUMBER	CATEGORY RESPONSE FREQUENCY		
	I: yes/very much	II: to some extent	III: no
Q. 1:			
Survey I	17	26	0
Survey II	28	16	3
Q. 2:			
Survey I	22	21	0
Survey II	28	18	2
Q. 3:			
Survey I	23	19	1
Survey II	27	19	1
Q. 4:			
Survey I	28	14	1
Survey II	37	10	1
Q. 6 ^a :			
Survey I	10	27	6
Survey II	6	32	6
Q. 7:			
Survey I	4	27	10
Survey II	3	33	8

^a Question 5 involved the test of significance between means.

TABLE 2 Result of Chi-Square Test of Significance

Question Number	Computed Value of X^2	Test of Hypothesis H_0 : No Sig. Diff. in Response Freq.
One	$X^2 = 7.9 > 5.99^a$	H_0 : is rejected
Two	$X^2 = 2.7 < 5.99$	H_0 : not rejected
Three	$X^2 = 0.14 < 5.99$	H_0 : not rejected
Four	$X^2 = 1.6 < 5.99$	H_0 : not rejected
Six	$X^2 = 1.4 < 5.99$	H_0 : not rejected
Seven	$X^2 = 0.9 < 5.99$	H_0 : not rejected

^a Chi-square value, $df = 2$, $\alpha = 0.05$ (95% significance level)

of SDOT management levels to various categories of questions in the two surveys.

A correlation analysis was also performed to examine the degree of association between category response frequencies of the two questionnaires. Correlation coefficients for the three categories of responses ("yes/very much," "to some extent," and "no") were $r_{xy} = 0.951$, $r_{xy} = 0.793$, and $r_{xy} = 0.932$, respectively.

CONCLUSIONS

Findings of two study surveys of upper managements of state departments of transportation have clarified a number of issues and questions. First, the impact of political change in DOT upper management on resource allocation decisions and decision implementation seems to be significant. Second, a number of shortcomings associated with current management system software programs were identified by the upper DOT management.

Finally, statistical analyses of responses of two different groups of upper DOT management officials to a set of questions in two independent surveys demonstrated a significant degree of consistency in the responses of these two groups of decision makers. This finding is of paramount importance because a significant number of critical decisions in the transportation industry, such as those dealing with resource allocation, service operations, alternative maintenance strategies, and plan evaluations, are based on the result of surveys of transportation management officials and the user public.

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