QUESTIONNAIRE DEVELOPMENT FOR THE PERIODIC SURVEY OF A LOGISTICS INFRASTRUCTURE

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Abstract

This paper illustrates the development of a questionnaire to periodically survey a regional distribution infrastructure. The future respondents of the periodic survey were utilized to develop the survey instrument. While many questionnaires are pre-tested and then revised, in this case contact with the panel was initiated to assist with the writing of the questionnaire itself.

Introduction and Explanation of Terms

Until recently, according to Moskal (1983), "it was possible to lead a very useful life without knowing what the word 'infrastructure' meant." Abelson (1984), a featured column writer for Barron's, called infrastructure "one of those atrocities that have somehow insinuated themselves into the nation's vocabulary and now lumber off even the most sensitive tongue." But infrastructure had been in the logistics lexicon years before the popular press discovered it. In a 1969 speech, Plowman included infrastructure availability as one of three logistical planning areas. Throughout this paper, distribution infrastructure will be used to mean the existing support facilities--e.g., roads, rails, waterways, warehouses, terminals, and ports--which provide time and place utility to physical goods. Omitted from this usage are facilities for passenger travel (although there is much sharing by goods and passengers--roads, for example).

The Louisiana State University in Shreveport's Center for Business Research currently conducts periodical surveys of business activity in the manufacturing, retail, agricultural and construction sectors of the two parish regions which comprise the Shreveport standard metropolitan statistical area (McKee 1984). It was proposed that the Center initiate a quarterly study of the levels of activity in wholesale distribution and freight transportation. Firms in these broad categories are considered to constitute the distribution infrastructure of the region. The trends that such a periodic survey would produce may have policy implications in the region which has the expressed objective of attracting distribution industries. In addition, the Caddo-Bossier Port Commission is developing a public port and industrial park on the Red River Waterway; scheduled completion is "by the early 1990s" (Loftin 1984).

Previous data collection by the Center identified most of the potential participating firms. The sensitive question remains: what data would they be willing to furnish on a quarterly basis? Such data should indicate levels of physical volume of business, employment within the sector, capacity utilization, and expectations for the coming period.

A questionnaire was prepared for distribution by mail to these firms to ask questions pertaining to the following: 1. Would they participate? 2. Would they provide data about their operations? 3. Would they indicate their expectations about employment, business volume, and facilities?

With this information, the Center for Business Research could identify the members of the panel and could design a survey instrument with a greater expectation that responses would be forthcoming. To the extent that panel members would answer questions on their expectations, the results of the ensuing surveys could become leading indicators of economic activity in this sector. Conversely, without the information provided by the initial questionnaire, a periodic survey would tend to be overly long, containing questions that will generate little useful information. The long questionnaire would also tend to discourage replies.

Questionnaires on Community and Sensitive Issues

Miller (1977) counsels researchers to examine the existing inventory of scales and related work because: "simple indices are being constructed de novo for the problem, while scales with far more validity and stability languish unused." But this procedure did not prove fruitful, as might have been expected, given Miller's (1977) introduction to the topic of community research: "Measures of community variables are scarce." He cited several studies of a city's "goodness" and a "Scorecard for Community Services Activity," but these were for social measures rather than business indicators.

Business organizations are targets for much questionnaire-based research. In his position as assistant treasurer for a steel firm, Singhvi (1981) recorded the source of the more than 200 surveys his office received in a five-year period and placed them in five general categories: Faculty members, student, non-profit organizations (e.g., National Association of Accountants and The Conference Board), for-profit organizations (e.g., publishers), and government. Singhvi (1981) also reported his firm's policy of cooperating with researchers if the surveys were not overly time consuming and to the extent that "confidential information is not divulged." Asking business organizations to report their volume of business and their forecasts are generally considered to be treading on sensitive ground.

The issue of investigating sensitive attributes has received much attention in the data collection literature (Tamhane 1981) but the specific attributes have been largely personal. For example, Sheth, LeClaire, and Wachspress (1980) measured the effects of asking race in mail questionnaires; Duncan and Schuman (1980) researched the effects of asking religion. Asking sensitive business questions seems to have not been as well documented. Without these published guidelines, one of the objectives of the initial questionnaire became that of identifying potentially sensitive areas in order to avoid them in the subsequent quarterly questionnaires.

One example of business research that may provide applicable techniques is the "Business Survey" conducted by the National Association of Purchasing Management (NAPM). About 200 purchasing managers per month are surveyed about general business conditions with specific reference to production and new orders. The questions ask the manager to indicate if the conditions in their firm were "better than month ago," the "same as month ago," or "worse than month ago". This method provides ordinal data rather than interval, which would be more desirable for plotting trends. The NAPM published a "consensus" rating by subtracting the "worse than" percent of responses from the "better than" percentage. The consensus percentage is commonly graphed over time to obtain displayable trends (Ammer 1980).

Categories of Transportation and Distribution Data Currently Published

In a sector of the economy that furnishes over 21 percent of the Gross National Product (Wood and Johnson 1981), a large quantity of data is already generated and published. Examples, given in Table 1, are largely financial in form, and report revenues from freight and from selling transportation equipment, inventory levels, operating expenses, price and securities indices. Data not denominated in dollars include numbers of vehicles sold or loaded, and ton-miles or tonne-kilometres of freight. While much of the published data was national in scope, an example of regional transport data for European countries was furnished by the Economic Commission for Europe (1982). Data has also been collected for the specific area of the current study in the Census of Transportation (1981), Census of Wholesale Trade (1981), and Census of Retail Trade (1979), but on a schedule too infrequent to provide timely information. Examples of pertinent information for the Shreveport SMSA are shown in Table 2.

The types of information already tabulated suggest some specific categories that might be feasible, from the standpoints of collectability--i.e., firms are somewhat used to being asked for that information--and comparability with past published data. These categories are measures of volumes, capabilities, and expectations. Volume information was considered to include sales, car loads, truck loads, and tons shipped or received, and labor hours and

TABLE 1

TYPES OF "LOGISTICS INFRASTRUCTURE" DATA IN PUBLISHED SOURCES

CATEGORY	SOURCE
Transportation Equipment	
Sales (monthly), by:	Survey of Current Business, Vol. 63 (October 1983), p. S32.
Aerospace Vehicles	
Motor Vehicles	
Trucks and buses	
Truck trailers and chassis	
Trailer bodies	
Trailer chassis	
Freight cars	
Capacities (annual):	
Freight cars, Class I RR	Association of American Railroads
Railways, mobile equipment	
Lorries	Economic Commission for Europe, Geneva, Annual Bulletin: Transport Statistics for Europe, Vol. 33 (New York: United Nations, 1982), pp. 32, 78, 120, 152, 156, 158.
Tractors	
Trailers	
Total load capacity	
Barges	
Tankers	
Containers	
Oil pipelines	
Volumes of Freight Carried	
Monetary measures:	Survey of Current Business, p. S18.
Operating revenues (monthly)	
Class I Railroads	
Class I Motor Carriers	
Air Carriers	
Physical measures:	
Tonnage (quarterly), motor	Survey of Current Business, p. S18.
Ton-miles (qtr), air and rail	
Tonnes carried (road)	Annual Bulletin of Transport Statistics for Europe, pp. 17, 32, 144-145, 148.
Tonne-kilometres	
Ave. gross wt. of freight trains	
Wagons loaded	
Freight transport (by rivers)	
Goods handled at sea ports	
Networks	
Railroads	Annual Bulletin of Transport Statistics for Europe, pp. 32, 144, 158.
Inland waterways	
Oil pipelines	
Inventories (monthly)	
Monetary measures	Survey of Current Business, p. S3.
Physical measures	
Price Indices	
Transportation equipment	Survey of Current Business, pp. 5-6, S18.
Motor vehicles and equipment	
Railroad freight	American Trucking Association.
Motor carriers, Class I & II	
Financial	
Net incomes of transportation firms (air, motor, rail)	Survey of Current Business, pp. S15-16, S18.
Securities issued	
Bond yields	
Dow-Jones stocks	
Standard & Poors stocks	
NY Stock Exchange	

expenses. Cubic feet or gallons of storage (filled and unfilled; refrigerated and not) were possible measures of capacities.

Information about a firm's expectations would be based on both volume and capacity. A simple questionnaire was developed to ask which types of data the respondents would be willing to furnish on a quarterly basis. This questionnaire appears as Exhibit 1.

Results From Data Collection

To test the usefulness of the survey approach, the questionnaire was mailed to a panel of 64 firms known to be in the transportation and wholesale distribution trades in the Shreveport SMSA. Rankings from the 38 responses are displayed in Table 3 and indicate which of the following were the most acceptable categories of questioning.

TABLE 2
EXISTING DATA DESCRIBING THE DISTRIBUTION INFRASTRUCTURE OF THE SHREVEPORT REGION

CATEGORY	SOURCE
Population	
Shreveport SMSA, by: 1960: 281,481 1970: 294,703 1980: 376,789	U.S., Bureau of the Census, 1970 Census of Population, Part A, Sec. 1, Table 13, pp. 20-25; 1980 Census of Population and Housing, Census Tracts, Shreveport, LA SMSA, June 1983, p. XII.
Wholesale Trade, 1977	
Durable goods Establishments: 472 Sales: $749,547,000	U.S., Bureau of the Census, 1977 Census of Wholesale Trade, Table 4, pp. 19-25.
Nondurable goods Establishments: 240 Sales: $1,154,625,000 (by SICs)	
Retail Trade, 1977	
Establishments: 2,957 Sales: $1,241,237,000 (by SICs)	U.S., Bureau of the Census, 1977 Census of Retail Trade, Table 5, pp. 52-103.
Shipments by Manufacturing Establishments, by Origin and Means of Transport by Destination (Value and Tons, by TCC code)	U.S., Bureau of the Census, 1977 Census of Transportation, Commodity Transportation Survey, Table 1, p. 1.
Freight Carried on Mississippi River System, 1980 Mil. sh. tons: 584 Bil. ton-miles: 228.9 (by Inland, Coastwise, Foreign: imports, exports, since 1950)	U.S., Bureau of the Census, Statistical Abstract of the United States: 1982-83 (103rd) ed.), p. 640.

The data that would be reported most willingly is employment information. Three out of the top four most positive responses were employment-related; one of those three was the employment expectations question. Firms are accustomed to reporting numbers of employees; this is a common indicator of size among organizations.

Also ranking high on the list was the interest in the results of the quarterly survey on the distribution infrastructure. A high level of interest would tend to encourage response to the survey.

Items ranking fifth and sixth were the other expectations questions. These were general enough and would not violate confidential information restrictions so that most firms would not hesitate to respond.

The product type handled by a firm was ranked next and would be important as a categorizing variable.

The first variable to reflect the capacity of facilities was the total cubic feet of storage. The eighth-place ranking made it a clear choice ahead of refrigerated or liquid storage space; the latter were too specialized for a general use survey.

The volume measures that were ranked highest were numbers of truck loads received and shipped. In comments made by respondents, it was apparent that the term "truck load" was not clear in meaning, since there was much less-than-truckload activity. An alternative wording, which would bypass size considerations, would be the number of truck pickups and deliveries.

EXHIBIT 1
INITIAL SURVEY: SHREVEPORT/ BOSSIER CITY DISTRIBUTION REPORT

The Center for Business Research at LSU-Shreveport will be conducting a quarterly survey of regional activity in transportation and distribution at the wholesale level. To prepare for this project, we would like to ask for your cooperation in filling out this brief questionnaire.

YES	NO	
___	___	Would you be interested in the results of the quarterly survey?

Which of the following types of data would you provide in confidence about your operations in the Shreveport/Bossier City area? Please check YES or NO.

YES	NO	NOT APPLICABLE	
___	___	___	Quarterly sales
___	___	___	Total cubic feet of storage in your facility
___	___	___	Total cubic feet of refrigerated space in your facility
___	___	___	Total gallons of liquid storage in your facility
___	___	___	Percentage of each of the above unfilled at the end of the quarter
___	___	___	Cubic feet of storage space unfilled at the end of the quarter
___	___	___	Cubic feet of refrigerated space unfilled at the end of the quarter
___	___	___	Gallons of liquid storage space unfilled at the end of the quarter
___	___	___	Number of car loads shipped
___	___	___	Number of car loads received
___	___	___	Number of truck loads shipped
___	___	___	Number of truck loads received
___	___	___	Tons shipped
___	___	___	Type of products
___	___	___	Labor expenses for the quarter
___	___	___	Labor hours for the quarter

YES	NO	NOT APPLICABLE	
___	___	___	Number of employees (in Shreveport/Bossier City) at end of quarter
___	___	___	Maximum number of employees (in Shreveport/Bossier City) during the quarter
___	___	___	Gallons of diesel fuel purchased
___	___	___	Gallons of diesel fuel pumped

We also want to provide an indication of business expectations. Would you be willing to answer questions such as the following?

YES	NO	NOT APPLICABLE	
___	___	___	Number of employees you expect to employ by end of next three months

What do you expect your activities to be in the coming three months, compared with this quarter, in each of the following categories?

YES	NO	NOT APPLICABLE	
___	___	___	Volume of business (More, About the same, or Lower)
___	___	___	Your facilities (Expand, About the same, Reduced)

Thank you. If you wish to suggest any additional questions, a change in approach on any questions, or make any additional comments, please do so in the remaining space and/or the reverse side.

The remaining question items were given net ratings somewhat lower than the previous items. These questions were considered to be either getting into more sensitive areas of business information or the topic was not applicable to a large proportion of the respondents. For example, labor hours, quarterly sales, and labor expenses were applicable to most firms, but these questions generated the greatest number of negative answers of any questions on the survey. While data on expenses and sales might be desirable, asking these questions

TABLE 3
RANKING OF RESPONSES TO PILOT QUESTIONNAIRE

Rank	Questions
1	Number of employees (in Shreveport/Bossier City) at end of quarter
2	Number of employees (More, About the same, or Fewer)
3	Interested in the results of the quarterly survey?
4	Maximum number of employees (in Shreveport/Bossier City) during the quarter
5	Your facilities (Expand, About the same, Reduced)
6	Volume of business (More, About the same, or Lower)
7	Type of products
8	Total cubic feet of storage in your facility
9	Number of truck loads received
10	Number of truck loads shipped
11	Labor hours for the quarter
12	Gallons of diesel fuel purchased
13	Quarterly sales
14	Labor expenses for the quarter
15	Cubic feet of storage space unfilled
16	Tons shipped
17	Percentage of each of the above unfilled
18	Gallons of diesel fuel pumped
19	Number of car loads shipped
20	Number of car loads received
21	Total gallons of liquid storage in your facility
22	Total cubic feet of refrigerated space in your facility
23	Cubic feet of refrigerated space unfilled
24	Gallons of liquid storage space unfilled

might reduce the reception of the questionnaire among too many of the potential participants.

One pair of questions that ranked somewhat lower but which still may be asked is about the numbers of carloads shipped and received. For companies with rail sidings, this data could be an important indicator and did not generate many negative responses--more likely would be responses of "not applicable."

Another pair of questions were about gallons of diesel fuel purchased and pumped. These gallons would act as a proxy variable of trucking volume for those firms engaged in private carriage. They did not rank highly and, although they may have merit in some applications, will not be used in the quarterly survey.

Other questions related to amount of capacity unfilled at the end of the quarter did not elicit high enough responses to be encouraging for further use.

Conclusions

The obvious conclusions are that some business firms engaging in transportation and distribution in the Shreveport area indicated they were more open to providing possibly sensitive business information than others, and some specific types of information concerning operations and expectations would be furnished more readily than other specific types.

A definite conclusion drawn from the surveys is that the respondents were loath to supply dollar-denominated data. Thus, sales volume and labor expenses should not be asked directly. Other measures, such as numbers of car loads or tons shipped, and numbers of employees, were more amenable as volume and employment measures.

From the knowledge gained by the pilot study, a shorter questionnaire for the quarterly survey has been constructed (see Exhibit 2) and the periodic study has commenced. The process has followed two simple mechanical steps: first, the questions in the pilot survey were re-ordered by the net number of positive responses. Next, this list was reviewed to judge the relative coverage of volume, employment, and facilities measures. Redundant coverage was eliminated and the content for a revised questionnaire resulted.

A limitation of this procedure is that the pilot survey was used only to provide descriptive statistics. Analysis was only by frequency counts, hardly a statistically robust procedure. Yet the questions originally asked--what types of data would be provided, what types would be likely to be not provided--were answered in a simple, straightforward manner.

Another contribution of this initial step in the periodic survey is from the variation in the normal pre-test procedure. That is, while many questionnaires are pre-tested and then revised, in this case contact with the panel was initiated to assist with the writing of the questionnaire itself. Such a procedure may be useful in other situations in which the researchers could accept several from a variety of indicators. From a pragmatic approach, this logic is followed daily, as data for use happens to be those which are most available. Since little in the way of Shreveport distribution infrastructure data was available, it seemed expedient for the providers to assist in

EXHIBIT 2
WHOLESALE/DISTRIBUTION SURVEY

A. QUARTERLY RESULTS

We would like you to compare the quarter just ended with the previous quarter. Please check the appropriate line for each question.

1. **Was the number of people you employed in Shreveport/Bossier City at the end of the last quarter:**

   _____ More than in previous quarter
   _____ About the same as previous quarter
   _____ Fewer than previous quarter
   _____ Not applicable

2. **Was the storage capacity of your facilities at the end of the last quarter:**

   _____ Greater than in previous quarter
   _____ About the same as previous quarter
   _____ Less than previous quarter
   _____ Not applicable

3. **Was the daily average number of trucks making pickups and deliveries (of any quantities) at your facilities during the last quarter:**

   _____ Greater than in previous quarter
   _____ About the same as previous quarter
   _____ Less than previous quarter
   _____ Not applicable

4. **Was the daily average number of rail cars being loaded or unloaded at your facilities during the last quarter:**

   _____ Greater than in previous quarter
   _____ About the same as previous quarter
   _____ Less than previous quarter
   _____ Not applicable

5. **Was the total volume of your business:**

   _____ Greater than in previous quarter
   _____ About the same as previous quarter
   _____ Less than previous quarter
   _____ Not applicable

EXHIBIT 2 (Continued)

B. YOUR EXPECTATIONS

Compared with the quarter just ended, what do you expect for this quarter? Please check the responses which most closely match your opinion.

6. Number of employees at your Shreveport/Bossier City area facilities:

_____ More than previous quarter
_____ About the same as previous quarter
_____ Fewer than previous quarter
_____ Not applicable

7. Storage capacity:

_____ Greater than previous quarter
_____ About the same as previous quarter
_____ Less than previous quarter
_____ Not applicable

8. Daily average number of trucks handled (pickups and deliveries):

_____ Greater than previous quarter
_____ About the same as previous quarter
_____ Fewer than previous quarter
_____ Not applicable

9. Daily average number of rail cars loaded and unloaded:

_____ Greater than previous quarter
_____ About the same as previous quarter
_____ Fewer than previous quarter
_____ Not applicable

10. Total volume of your business for the next quarter should be:

_____ Greater than in previous quarter
_____ About the same as previous quarter
_____ Less than previous quarter
_____ Not applicable

11. Concerning plans for expansion of your facilities, do you anticipate starting on such a project during the next three months?

_____ Yes
_____ No
_____ Plans are in progress for later period

C. PRODUCT TYPES

We will accumulate responses for several product groups. Please list the two-digit Standard Industrial Classification code for most of the products handled in your Shreveport/Bossier City area facilities? (If the SIC's are not available, please write in the types of products and we will look them up.)

_____

_____

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determining the actual types of information to be provided right from the beginning of the project.

More interesting will be to ask why the firms responded as they did. Do the results vary by business activity (transportation vs. storage), by transport mode, by product group, or by business size? Further analysis of the collected data may provide some answers which could prove interesting to those who study the process of data collection.

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