The importance of operations management problems in service organizations

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Abstract

This article reports on the research to empirically determine which operations management problems are the most important to small service organizations. The authors asked managers of service organizations to rank a set of operations problems according to their relative importance using Q methodology. In this article, Q method is explained, significant factors are analyzed, and explanations are offered for the ranking of the operations problems. The results indicate that forecasting, quality management, and resource utilization are important operational issues for service organizations. However, the results also indicate that facility location and layout, waiting line systems, and distribution requirements planning were for the most part unimportant to the respondent service organizations. In addition, Schmenner's service typology does not provide an explanatory basis for the variations in the factor results. Lastly, the results are used to suggest operations management techniques that should be taught to students who are expected to work in service organizations upon graduation. © 2002 Elsevier Science Ltd. All rights reserved.

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1. Introduction

Service organizations have many problems and challenges that can be addressed by operations management methods. However, little research has been done to investigate the importance of the operations problems and the methods used to address these problems in the service sector. This paper investigates the first of these two issues; the operational problems that service organizations consider most important. The results of this research can then be used to address the second of these two issues; the operations management methods that would be most useful to service organizations in addressing these problems. This information can then inform educators as to what they should teach as they work to adequately prepare their students for successful careers in service organizations.

Studies specifically devoted to the employment of various operations management methods in industry have been conducted. Shannon et al. [1] reported a ranking of 12 such

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techniques by practitioners and academics combined in descending importance of usage. Thomas and DeCosta [2] and Forgionne [3] surveyed only practitioners who consisted of larger corporations in the US who ranked a number of methods in descending frequency of use. These practitioners also ranked the types of planning and decision-making issues, that these techniques were designed to support according to the descending frequency with which these issues were addressed. The research of Shannon et al. [1], Thomas and DeCosta [2] and Forgionne [3] focused on the importance or frequency of usage of techniques rather than the importance of the problems. In addition, they did not consider service organizations separately from manufacturing organizations. Literature concerned with the application of these methods to *service* operations issues appears to be generally limited to a specific kind of application (e.g., [4–6]) or reports on deliverables devised and constructed for consulting jobs (e.g., [6–8]). There is clearly a lack of investigation of operations problems that are important to service organizations.

In our research, a typology was used to separate service operations into categories to test the importance of different operations problems in different types of organizations.

Several ways of typing service organizations have been suggested — Lovelock [9], Schmenner [10], Heskett [11], and the U.S. Department of Commerce — Office of Service Industries. The authors selected Schmenner's service process matrix typology that categorizes service operations into *service factories* (1), *mass services* (2), *service shops* (3), and *professional services* (4) according to a sequence of overlappings in their respective degrees of labor intensity and customer interaction/customization. Schmenner [10] proposed to demonstrate the commonality of management problems across service industries with his matrix. Since any one of these four service industries must necessarily be both similar and/or different from the others in degree of labor intensity and customer interaction/customization, one would expect its problems to be both similar and/or different from the others in the same way. Thus, Schmenner's service process matrix provides a convenient and useful heuristic by which to organize the data collected and statistically analyze the results generated.

Q method was used to determine the importance of operations problems to service organizations in this research. *Q* method was selected because the study sought to determine the operations problems that were the most important to service organizations. In addition, a tool that forces the respondent to be discriminating was desired. Although tools such as a survey utilizing the Likert scale also achieve a similar result, they do not require the user to rank the operations problems with respect to each other. The *Q* methodology was seen as unique in its ability to both require the user to rank the operations problems in terms of their own importance and their importance with respect to other operations problems.

Q method possesses advantages over other statistical methods for the researcher. One advantage of particular importance is that it does not require large samples (e.g., $n \geqslant 30$). In *Q* methodology, it is necessary only to have enough subjects to establish that a factor exists [12]. According to Benedict [13], "one quickly reaches the point where the testimony of great numbers of additional informants provides no further validation". This means that a large sample size and a large response rate are unnecessary. Another advantage as mentioned earlier is that the subject is forced to make difficult decisions as he sorts the *Q* sample because each operational problem is considered with respect to the others. The method also allows investigation of an issue that can be subjectively addressed, such as the importance of various operational problems to an organization. In addition, the method and *Q* sample do not require a pre-test because they seek to determine something that is subjectively interpreted.

2. *Q* methodology: background

The authors use *Q* methodology as presented and interpreted by Stephenson [14–16], Brown [12,17] and McKe-

own and Thomas [18]. *Q* methodology is used to systematically examine the importance of problems related to service operations because it places the decision maker's subjective perceptions of the most and least important operations problems as central to the analysis [18]. This article does not include a complete description of *Q* method — its nuances and statistical methods; there are many sources of information on *Q* method. Brown [12], and McKeown and Thomas [18] cover these topics in great detail. *Operant Subjectivity*, the journal of the International Society for Scientific Study of Subjectivity, is an excellent reference. There is a *Q* method community that participates actively and regularly in discussions on the Internet and at the annual *Q* method conference. In addition, the current software available for *Q* methodology analysis, such as PCQ [19] and *Q* method [20], simplify the statistical processes considerably. Mathematically, *Q* method is not significantly different from factor analysis; the difference is what is measured. Factor analysis is,

> a method of expressing data linearly in terms of factors which are of special relevance so far as the construction of appropriate models is concerned. For example, the scores of *n* individuals obtained on *K* tests may be related linearly to such relevant factors as arithmetic or verbal facility. [21, p. 38]

Whereas, *Q* method,

> enables the respondent to model his or her-viewpoints on a matter of subjective importance through the operational medium of a *Q*-sort. This 'modeling' is accomplished by a respondent systematically rank-ordering a purposively sampled set of stimuli, namely, a *Q*-sample, according to a specific condition of instruction... Once viewpoints are modeled in *Q*-sorts, data analysis occurs with the intercorrelations of the *N* *Q*-sorts as variables (hence persons, not traits or *Q*-sample items, are correlated) and factor analysis of the $N \times N$ correlation matrix. Resulting factors represent points of view and the association of each respondent with each point of view is indicated by the magnitude of his or her loading on that factor... Interpretation of the factors is advanced in terms of consensual and divergent subjectivity, with attention given to the relevance of such patterns to existing or emerging theories, propositions and the like. [18, p. 12–13]

We now provide a brief description of the method. First, the user gathers a sample of statements from the population of statements on the subject in question that are of concern to the organization (e.g., operations problems). Then the user selects a sample of these statements (the *Q* sample). There is no set number of statements to include in the *Q* sample. Next, the *Q* sort is administered to the subjects. When

sorting the Q sample, the subject is forced to make difficult choices about his or her perceived importance of each statement. Brown [12], notes that if there are 23 statements in the Q sample, "the number of different ways in which the statements could be rank ordered is $N! = 23! = 2.5852017$ E22. Although the subject cannot possibly consider all of these combinations, the choices of how to rank order the Q sample are significantly complicated. This forces the subject to consider each statement carefully; whereas with Likert scales and other similar assessment tools, the subject is not forced to make such difficult decisions. The Q sort results are then factor-analyzed with any one of the software packages currently available, such as PCQ [19] or Q method [20]. See Brown [22] for information on obtaining Q method from the Internet.

3. Selection of subjects

A survey was conducted to determine the relative importance of operations-related service problems. The subject organizations were selected in the following manner. First, SICs for service organizations were selected randomly from the North Carolina Business Directory [23]. Five hundred service organizations were randomly selected from the service SICs so that approximately 125 corresponded with each of the four categories in Schmenner's Service Process Matrix [10]. The survey, was mailed to the respondents with a self-addressed stamped envelope. The surveys were addressed to "owner/manager" unless the name of that individual was available. No incentives to encourage responses were used.

4. Respondents

Fifty-four service organizations responded to the survey, three responses were not usable. Table 1 shows the respondents by Schmenner's service type (i.e., *service factories* (1), *mass services* (2), *service shops* (3), and *professional services* (4)), organizational type, number of full-time employees and position of respondent within the organization. Forty-two of the fifty-one respondents held a high-level managerial position within the organization. The average organizational size was 57.7 full-time employees with a standard deviation of 108.6 and a median of 25. Table 2 indicates the distribution of the respondents with respect to Schmenner's typology.

Baruch [24], recently, conducted a study to explore response rates in academic studies, specifically, the behavioral sciences. The Journal of International Business (JIBS) was one of the journals studied by Baruch. This journal includes studies most similar to this research in that most of the respondents in JIBS surveys are high-level employees within the organization. Baruch reports that the response rate in JIBS was 32.19% with a standard deviation of 21.9%. He recommends that the norm for response rate in academic studies should be within 1 standard deviation of the mean. Therefore, for organizations where the respondent was a high-level employee, a response rate of 10.3% is acceptable according to the research of Baruch. He notes that between 1975 and 1995, the response rate in academic research has decreased. In addition, most survey research reports on larger organizations with the average size being 1000 employees. Baruch recommends that organizational size, the level of the respondents within the organization, and method of survey as well as the use of incentives to encourage returns be considered when determining an appropriate response rate. Interestingly, Baruch notes that in the area of marketing, a response rate of 10–20% is the acceptable norm.

5. The survey instrument

In order to determine the importance of operations problems within the subject organizations using Q-methodology, subjects rank ordered a set of problem statements according to a relatively normal distribution. The underlying assumption in this survey was that managers of organizations know the kinds of problems they face, even though they may neither be familiar with the techniques needed to address these problems nor may they use them.

Service operations problems presented in the survey were identified by consulting numerous texts. This resulted in the concourse or Q sample of 23 different statements of operations problems shown in Table 3. The subjects were asked to rank these problems according to their relative importance to their respective organizations. The directions to the subjects are shown in the appendix.

Q method does not require a certain number of statements for inclusion in the concourse, rather, a well-balanced set of representative statements is recommended. According to Stephenson [15] "the notion of validity [of the concourse] has no place since there is no external criterion for a person's own point of view: the 'operational definition' of a person's attitude is not *in* the items, but in terms of what he does with them" [17]. Clearly, conclusions can be made only with respect to the problems actually in the concourse. Therefore, every effort was made to include all probable service operations problems. The following texts were utilized to determine the problems [25–32].

Subjects sorted the concourse according to their respective perceptions of the most and least important operations problems that their organization encountered. Brown provided the authors' guidance in writing appropriate survey instructions [33]. In addition, the survey was pre-tested on several local business owners and managers to determine if the survey was clear. The authors mailed a brief cover letter, the instructions, score chart and survey, and the Q statements shown in Table 3 to the subjects. The instructions, score sheet and survey are shown in the appendix.

Table 1

Respondents by business type, number of full-time employees and organizational position

Factor	Schnenner's type	Business type	No. of full-time employees	Organizational position of respondent
1	2	Funeral services	8	Manager
1	4	Outdoor advertising	20	General Mgr/Partner
1	2	Retail/installation of window coverings	12	Co-Owner & VP
1	1	Resort	720	H.R. Services Mgr
1	3	Lawn & tree care	75	Branch Manager
1	3	Electronic installation & repair	9	President
1*	3	Repair heavy trucks & equipment	20	General Manager
2	2	Office machines sales & services	2	Partner
2*	2	Sell & service air compressors & dryers	140	President
2*	2	Retail	180	Manager
2*	2	Retail pet supplies	23	President
2	3	Cleaning & insurance restoration	15	Owner/President
3	1	Ice cream manufacturing & distributor	120	Administrative Asst
3	2	Grade, warehouse, distribute & sell	4	Treasurer/Analyst
3	2	Reseller of pagers/cellular phones	2	Manager
3	3	Crankshaft reclamation	70	CPA/Operations Manager
3	3	Motor repair	40	President
3*	4	Income tax preparation	3–80	Owner
4	2	Property casualty insurance adjusting	NR	Vice President
4	1	Recycling	25	Operations/Fleet Mgr
4	2	Medical equipment sales	4	Sales Manager
4*	2	Sell & service spas & pools	5	Owner
4*	1	Camping, cabin & tube rental, retail	2	Owner
4	3	HVAC installation & repair	12	Accounts Manager
5	2	Emergency management	85	Chief
5	3	Nursing home	80	Administrator
5	2	Library	40	Director of Library
5	2	Library	31	Library Director
5	1	Recreation (e.g. driving range, mini golf)	5	President
6	2	Exterior cleaning services	25	Operations Supervisor
6	1	Warehouse distribution	95	Sr. Dir. Dist & Eng
6	2	Elevator sales	60	Zone Manager
7	2	Travel services	40	President
7	4	Insurance adjusting	3	Manager
8	4	Home designers/architects	15	CEO
8	1	Car rental	18	President
8	1	Bed & breakfast inn	6	Owner/President
8	3	Hospital	140	CEO
8	4	Architects	9	Owner
8	2	Community college	215	President
8	1	Motor coach & charter tours	27	President
8	4	Investment company	2	Office Administrator
N/A	4	Engineering & environmental consulting	85	Office Mgt. HR Adm.
N/A	2 & 3	Travel plaza with repair	120	General Manager
N/A	1	Outdoor recreation/food/lodging/retail	100	President
N/A	1	Resort: food/lodging	8–70	Owner/Manager
N/A	4	Architectural/engineering services	32	President
N/A	3	Landscape installation & maintenance	4	Owner
N/A	4	Telephone & cable TV engineering	45	President
N/A	1	Household & industrial moving & storage	14	Owner/Manager
N/A	4	Event management	6	President

*indicates a negative factor loading.

Table 2

Distribution of respondent data within Schmenner's service process matrix by type

Degree of labor intensity	Degree of interaction and customization	
	Low	High
Low	(1) 12	(3) 9
High	(2) 19	(4) 11

Table 3

Problem statements

1. Location — where to locate facilities
2. Facility layout — how to physically layout facilities
3. Transportation — how to get your services to the customer by expending the smallest amount of resources
4. Transportation — determining the most efficient order in which to call on customers
5. Decision making with both tangible and intangible factors
6. Planning future long-term capacity needs
7. Managing customer waiting lines
8. Predicting future events, conditions, customer demand, price/cost levels, etc.
9. Simulating processes, planning outcomes, etc.
10. Determining which employees should be assigned to each task
11. Management of large complex projects with multiple activities
12. Determining order quantities and monitoring inventory
13. Determining ways to operate while carrying as little inventory as possible
14. Managing continuous organizational improvement activities
15. Monitoring and measuring the quality of services
16. Decision making with known probabilities
17. Determining how to maximize profit with a mix of products
18. Determining how to utilize resources most efficiently
19. Methods for work measurement and job design
20. Management and scheduling of maintenance activities
21. Determining distribution requirements for facilities you supply
22. Staff scheduling
23. Attempting to anticipate actions of competitors and planning your actions accordingly

6. Analysis

Q method software factored the data recorded by each subject into factors or groups of organizations that have similarly perceived categories of important operational problems [20]. Selected output from the analysis appears in Table 4 in which significant (98%) factor loadings are identified with an 'x'. Significance of a factor score at the 98% level is determined by the following, where n is the number of statements in the concourse or Q sample.

$$2.326 \left(\frac{1}{\sqrt{n}} \right) \tag{1}$$

The factor loading determines significance on a factor. Brown [17] notes that if the subject's perceptions are stable then "the factor analysis of a second set of Q sorts administered after time 2 (i.e. at a later point in time) will produce a similar factor score for the same statements ..." Normally, a person's reliability coefficient with himself ranges from 0.80 upward according to Frank [34] and Stellar and Meurer [35]. A reliability coefficient estimate of the individual of 0.80 is used to estimate the reliability of a factor where p is the number of subjects defining a factor. The reliability (r_{xx}) of each factor appears in Table 4.

$$r_{\alpha} = [0.80p]/[1 + (p - 1)0.80] \tag{2}$$

Once identified, a comparison is made of each significant factor's arrangement of the statements. The arrangement of these statements does not necessarily represent any subject; rather each represents the overall factor, where those subjects with higher factor loadings contributed a larger weight to the arrangement of the statements for that factor. The ranking of the operations problem statements by each factor is shown in Table 5.

7. Results

The first question, with regard to the respondents, is whether or not the factors correspond with Schmenner's Service Process Matrix. Table 1 clearly shows that none of the factors contain respondents from only one of Schmenner's Service Types. In addition, Schmenner's types are widely distributed among the factors. Therefore, the need for certain operations management tools for certain types of service organizations cannot be generalized. Table 1 shows that factors seem to be neither directly related to the organizational position of the respondent nor the size of the organization. In addition, no generalizations can be made with respect to degree of labor intensity or degree of interaction and customization for any of the factors. This leads to a question of how best to investigate the resulting factors. First, we discuss the general results that are common across several of the factors. Then, we discuss some of the more interesting observations with regard to several of the individual factors.

7.1. General results

Many operations problems were common across many of the factors; these problems will be addressed first. Statement 15 (monitoring and measuring quality) was relatively important to most of the factors, whereas statement 14 (managing continuous improvement activities) was not viewed as important by all but factors 2 and 8. This leads to a natural question about whether the subject organizations view monitoring quality as an important activity without believing that it is important to have continuous improvement activities.

Table 4
Factors and their subject organization's factor loadings

Respondent*		Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
1	Retail	0.1718	−0.7134X	−0.1387	0.2496	0.0437	0.2603	−0.2080	0.1335
2	Investment company	0.1955	0.0119	0.0843	−0.1650	0.1257	0.2759	0.2711	0.4857X
3	Property casualty insur. adj.	0.1060	0.2442	−0.3724	0.6110X	0.1725	0.1191	0.0788	0.0606
4	Medical Equip. Sales	−0.0476	−0.1045	0.2266	0.6139X	−0.3849	−0.0003	−0.1762	0.2352
5	Elevator sales	0.4474	0.1740	0.3156	0.1369	−0.0710	0.5218X	0.1500	0.3872
6	Cleaning/insur. restoration	0.0313	0.5926X	−0.2564	0.1734	0.4320	0.2876	−0.1728	0.1338
7	Phone/cable TV engineering	0.4510	0.3277	−0.1797	−0.4559	0.2828	0.4803	−0.0722	0.0820
8	Exterior cleaning services	0.1619	−0.0114	0.0246	0.0608	0.0289	0.8011X	−0.0654	0.2022
9	Landscape install & maint.	0.5149	0.4830	0.1062	0.4018	0.0799	0.1848	−0.0709	−0.1177
10	Mfg/distribute ice cream	−0.2189	0.1470	0.6753X	0.1761	0.1712	−0.1325	0.3607	0.0965
11	Moving & storage	0.2223	0.4364	0.3405	0.0163	0.2900	0.1738	0.0842	0.4093
12	Library	0.4935	0.0636	0.0137	0.0337	0.5470X	0.2768	−0.0225	0.2940
13	Insurance adjusting	0.1839	0.3227	−0.0306	0.1308	−0.1552	−0.1361	0.8139X	0.2009
15	Library	0.2473	−0.1685	−0.1528	−0.0292	0.7435X	−0.2330	−0.2329	0.0450
16	Community college	0.3108	0.1516	−0.1015	0.1487	0.0701	0.0987	0.1736	0.7440X
17	Driving range, mini golf, etc.	0.0842	−0.2304	0.2172	−0.1589	0.5276X	−0.1472	−0.5584	0.0612
18	Crankshaft reclamation	0.0008	0.0705	0.8601X	−0.0753	−0.2731	−0.0103	−0.1737	−0.1319
19	Resell pagers/cell phones	0.1148	−0.2467	0.5836X	0.0085	0.2191	−0.2327	−0.0391	−0.0303
20	Sell/service aircompressors	−0.2083	−0.8104X	0.1426	−0.2703	−0.0227	−0.2331	−0.0956	−0.0067
21	HVAC install/repair	0.2016	−0.2204	0.1478	0.5694X	0.2519	0.3032	0.2792	−0.2145
22	Income tax preparation	0.4998	−0.3505	−0.5084X	−0.1244	0.2729	−0.2463	−0.1834	0.3100
23	Travel plaza with repair	0.1373	0.3135	−0.3362	−0.0653	0.1507	0.2924	0.3954	0.5193X
24	Camping/tubing rental, retail	0.2547	0.0491	0.2715	−0.6410X	−0.3426	−0.3789	−0.1011	−0.0725
25	Outdoor recreation center	0.1388	−0.2200	0.0310	−0.0069	0.2659	0.2535	0.4433	0.5120X
26	Sell & service spas & pools	0.2025	−0.1054	0.0713	−0.7396X	−0.1430	0.2440	0.0340	0.1232
27	Warehouse, grade, dist. iron	0.1049	−0.0397	0.7131X	−0.1714	−0.2247	0.3088	0.1278	0.2907
28	Home designers/architects	0.2284	−0.1567	−0.0005	−0.3154	−0.3494	0.1898	−0.1459	0.6033X
29	Emergency management	−0.0464	0.4537	−0.0780	0.0953	0.6364X	−0.0196	0.2493	0.3388
30	Electronic installation/repair	0.5207X	−0.4969	0.2550	0.1036	0.1566	−0.0530	0.1833	0.1852
31	Recycling	0.2398	0.1839	0.2568	0.7666X	−0.0526	−0.0143	0.0194	0.0487
32	Warehousing/distribution	−0.1573	−0.0328	−0.0431	−0.0212	0.0515	0.6769X	0.0562	0.0444
33	Hospital	0.0213	0.2330	0.2159	0.0927	0.4092	−0.0226	−0.1810	0.6669X
34	Office machine sales/service	−0.2035	0.05858X	0.1474	0.1993	−0.1887	0.1516	0.2592	0.3538
36	Resort	0.2783	−0.0882	−0.2650	−0.0898	0.4410	0.2437	0.1197	0.3224
37	Sell/install window covers	0.6913X	−0.0962	0.1982	−0.1678	0.0102	−0.1252	0.1787	0.046
38	Bed & breakfast inn	0.3788	−0.0558	−0.2475	0.2314	0.3133	0.0156	−0.0024	0.5700X
39	Motor repair	0.4050	−0.1538	0.6748X	0.0243	0.1937	0.4064	0.0788	0.0968
40	Car rental	−0.0643	−0.1814	0.0905	0.0305	0.0467	0.0823	−0.0262	0.8955X
41	Nursing home	0.0333	−0.0308	0.0798	0.2152	0.8087X	0.3567	−0.0684	0.0666
43	Travel services	0.0231	−0.0760	0.1840	−0.1044	−0.0250	0.0037	0.7910X	0.0119
44	Repair heavy equipment	−0.0724	−0.4106	0.1952	−0.5176X	0.3943	0.1675	0.2176	−0.0885
45	Funeral services	0.6525X	0.1963	0.1854	−0.0105	0.1872	0.2314	−0.2272	0.2926
46	Event management	0.2085	0.5193	−0.4587	−0.1961	0.3377	0.0473	−0.0268	0.3427
47	Architectural/engineering	−0.3437	−0.1756	0.1721	−0.0481	−0.3685	0.4423	−0.1687	−0.4199
48	Motor coach charter/tours	0.1748	0.4175	0.4418	0.0677	0.1399	−0.0338	0.2345	0.4923X
49	Architects	0.2457	0.4106	−0.0125	−0.0834	−0.0412	−0.0143	−0.0014	0.5926X
50	Outdoor advertising	0.6829X	−0.0556	−0.0734	0.1319	0.0445	−0.0411	0.0001	0.3323
51	Retail pet supplies	0.1094	−0.7883X	0.0026	−0.1439	0.1287	0.3656	0.0071	−0.0251
52	Lawn & tree service	0.6066X	−0.0938	−0.3047	0.4146	−0.0015	0.1999	0.3442	−0.1187
53	Environmental consulting	0.0410	0.4611	0.1581	0.0226	0.4549	−0.2489	−0.0915	0.4239
54	Resort	0.5732X	0.1784	−0.0839	−0.1584	0.0969	−0.0556	0.0568	0.4481
Eigenvalue		4.996	5.503	4.682	4.229	4.733	3.7740	3.167	6.022
Average reliability coefficient		0.800	0.800	0.800	0.800	0.800	0.800	0.800	0.800
R_{xx}		0.952	0.952	0.952	0.96	0.941	0.889	0.889	0.96
S.E. factor scores		0.218	0.218	0.218	0.2	0.243	0.333	0.333	0.2

*X indicates a factor loading significant at 98%.

Table 5
Ranking of the operations problems by each factor

Factor 1			Factor 2			Factor 3			Factor 4		
No.	Z-scores	Statement placement	No.	Z-scores	Statement placement	No.	Z-scores	Statement placement	No.	Z-scores	Statement placement
18	1.852	+3	20	1.727	+3	3	1.502	+3	22	1.318	−3
15	1.732	+3	11	1.513	+3	23	1.460	+3	3	1.269	−3
23	1.000	+2	4	1.319	+2	8	1.387	−2	12	1.224	+2
8	0.914	+2	16	1.244	+2	12	0.932	+2	18	1.146	+2
5	0.852	+2	14	1.105	+2	18	0.899	+2	4	1.062	+2
14	0.828	+1	9	0.461	+1	13	0.779	+1	20	0.962	+1
17	0.770	+1	5	0.419	+1	21	0.671	+1	10	0.717	+1
22	0.437	+1	15	0.413	+1	15	0.618	+1	5	0.561	+1
6	0.426	+1	19	0.354	+1	4	0.570	+1	7	0.508	+1
1	0.419	0	8	0.193	0	17	0.518	0	11	0.424	0
20	0.111	0	18	0.161	0	6	0.180	0	15	0.321	0
10	0.072	0	3	−0.054	0	1	0.126	0	19	0.173	0
4	0.065	0	21	−0.067	0	20	−0.005	0	16	0.081	0
19	−0.027	0	6	−0.169	0	2	−0.125	0	14	−0.236	0
7	−0.232	−1	23	−0.222	−1	10	−0.595	−1	17	−0.237	−1
12	−0.862	−1	17	−0.278	−1	16	−0.645	−1	23	−0.584	−1
9	−0.952	−1	10	−0.325	−1	11	−0.686	−1	13	−0.643	−1
16	−0.993	−1	13	−0.850	−1	22	−0.711	−1	21	−0.894	−1
2	−1.073	−2	2	−0.930	−2	9	−0.976	−2	8	−0.988	−2
13	−1.078	−2	22	−1.006	−2	5	−1.215	−2	9	−1.213	−2
3	−1.194	−2	12	−1.264	−2	19	−1.289	−2	2	−1.553	−2
11	−1.427	−3	7	−1.869	−3	14	−1.305	−3	1	−1.610	−3
21	−1.639	−3	1	−1.875	−3	7	−2.092	−3	6	−1.807	−3

Factor 5			Factor 6			Factor 7			Factor 8		
No.	Z-scores	Statement placement	No.	Z-scores	Statement placement	No.	Z-scores	Statement placement	No.	Z-scores	Statement placement
22	1.621	+3	17	1.928	+3	11	1.594	+3	8	2.070	+3
18	1.597	+3	10	1.688	+3	15	1.553	+3	22	1.580	+3
10	1.402	+2	12	1.428	+2	4	1.300	+2	23	1.186	+2
15	1.245	+2	5	1.318	+2	7	1.259	+2	18	0.853	+2
2	0.992	+2	13	1.188	+2	17	1.217	+2	6	0.765	+2
11	0.881	+1	16	0.838	+1	6	0.965	+1	16	0.732	+1
8	0.459	+1	15	0.338	+1	8	0.923	+1	14	0.432	+1
6	0.219	+1	19	0.318	+1	18	0.335	+1	9	0.408	+1
5	0.217	+1	6	0.208	+1	9	0.294	+1	12	0.322	+1
12	0.157	0	9	−0.032	0	5	0.041	0	5	0.251	0
20	0.147	0	22	−0.032	0	13	0.000	0	15	0.171	0
16	0.146	0	8	−0.142	0	19	0.000	0	17	0.171	0
14	−0.109	0	23	−0.272	0	3	−0.294	0	7	0.048	0
17	−0.158	0	14	−0.292	0	20	−0.335	0	11	−0.104	0
3	−0.329	−1	18	−0.402	−1	21	−0.335	−1	13	−0.126	−1
9	−0.424	−1	21	−0.532	−1	12	−0.377	−1	3	−0.372	−1
1	−0.578	−1	20	−0.642	−1	14	−0.882	−1	19	−0.402	−1
13	−0.762	−1	3	−0.772	−1	10	−0.923	−1	10	−0.924	−1
19	−0.773	−2	2	−1.012	−2	23	−0.923	−2	20	−1.082	−2
7	−0.942	−2	4	−1.123	−2	22	−1.259	−2	21	−1.257	−2
23	−1.487	−2	11	−1.252	−2	2	−1.300	−2	2	−1.487	−2
21	−1.608	−3	1	−1.252	−3	1	−1.300	−3	4	−1.564	−3
4	−1.911	−3	7	−1.493	−3	16	−1.553	−3	1	−1.672	−3

Statement 8 (predicting future events, conditions, demand, etc.) is also generally important to the respondent organizations. Clearly, the ability to accurately forecast the future is important for the long-term survival of any business. Lastly, five factors rank statement 18, at +2 or higher. A sixth factor ranks this statement as +1. This is not surprising because all but two of the respondents have fewer than 200 employees and resource allocation is often more critical in small organizations.

The results also indicate problems that most of the factors generally rank as unimportant. Table 5 indicates that our respondent service organizations generally view issues of location (statement 1), facility layout (statement 2), managing customer waiting lines (statement 7), and determining distribution requirements for facilities supplied (statement 21) as relatively unimportant. It is generally believed that managing customer waiting lines (statement 7) is an important concern of most service organizations, as indicated by the coverage of queueing in most texts. One of the reasons that this statement may have ranked low on most factors is that many service organizations do not have physical queues of customers. Instead, queues may be intangible, such as work waiting to be completed or customer contact may occur primarily through remote devices such as the phone or Internet. In this case, our respondents may have believed that they did not have "customer waiting lines" in their organizations.

There are several explanations for the low ranking of statements about facility location and layout. First, in service organizations, often the service is provided at the customer location. For these types of businesses, location and layout of the business are perceived as not important. Second, many service organizations, which are usually small, may view location, layout and waiting line systems as something that cannot be changed. Third, they may view these issues as less important since they are considered only every few years. The respondents were neither franchises nor multiple location service organizations. However, in such organizations, decisions about queueing, layout and location may be made at higher (i.e., corporate) organizational levels rather than at local levels.

The authors do believe the issues of location, layout and queueing systems are important to service organizations in spite of the survey results. However, they acknowledge that they emerge infrequently relative to day-to-day tasks. Finally, with respect to distribution requirements planning (statement 21), this was probably not important to our respondents because few of them were distribution focused.

7.2. Analysis of individual factors

The commonalities already discussed are true for a majority of the factors in this study. However, there are differences and other important issues for individual factors that should be addressed. Factor eight has the strongest eigenvalue. Statement 8 is a distinguishing statement for this fac-

tor. Statement 23 also ranks high. Both statements suggest that predictions about conditions, events, competitors, etc., are important. In addition, the high placement of statements 22 "staff scheduling" and 18 "determining how to utilize resources most efficiently" indicate a concern for resource allocation and utilization.

Factor three, like factor eight, is concerned with forecasting and anticipating competition. Unlike factor eight, factor three is concerned with inventory management and distribution (statement 21). Three of the five subjects with a positive loading on factor three have characteristically costly inventory (i.e. an ice cream distributor, an iron grader, warehouser and seller, and a crankshaft reclamation company), this can create both inventory management and distribution concerns.

The ranking of statements by factor one is relatively similar to factors three and eight, where statements 18, 23 and 8 are all ranked +2 or higher. However, factor one is different in that "monitoring and measuring the quality of services" (statement 15) and "decision making with both tangible and intangible factors" (statement 5) are ranked +3 and +2, respectively, and are ranked much lower on factors three and eight. There are a variety of different types of organizations on this factor and the results do not seem attributable to a particular situation that they might have in common. However, it is possible to consider that, with the exception of the resort, the customer's physical presence is not necessary for the completion of the service for the subject organizations on this factor. This may account for the placement of these subjects on this factor.

Factor seven, which consists of a travel agency and an insurance adjuster, placed statement 11, "management of large complex projects with multiple activities", as the most important. Although one would not classify the services of these organizations as primarily the management of projects, they have shown through their placement of this statement that they view each vacation/trip or insurance claim as a large complex project. Statement 15 is concerned with monitoring and measuring the quality of services actually provided to their customers (e.g. the quality of a cruise ship, hotel or airline, or the quality of a contractor or autobody shop that would repair insured damaged property). The high placement of "determining how to maximize profit with a mix of products" (statement 17) is also logical, since most travel and insurance agencies sell packages of services from a variety of pre-existing service choices, these organizations are concerned about maximizing the profit from the product mix which they often suggest to the customer.

The subject organizations on factor five are concerned about staffing and resource utilization issues. This factor consists of organizations with relatively large numbers of employees: an emergency management organization, one nursing home, a recreation facility and two libraries. The libraries and recreation facility noted that they employ many part-time employees in addition to their full-time

employees. This may account for their concerns with staffing issues. Because of the tight budgets within which nursing homes operate, they too have exceptional staffing concerns and this type of organization operates 24 h a day 365 days a year.

There are two types of subject organizations on factor two. The subject organizations with positive factor loadings rank ordered their problem statements in a manner similar to the factor sort shown in Table 5; whereas the subjects with negative factor loadings ranked the problem statements very much the opposite of those with positive factor loadings.

The subject organizations on factor two with positive factor loadings, a cleaning and insurance restoration company and an office machine sales and service company, view "management and scheduling of maintenance activities" (statement 20), which is a distinguishing factor, as most important to their organizations. When one considers the primary business functions of these companies, it is clear that their ranking of this statement indicates their concern for staffing; since their employees provide maintenance tasks. These subjects are particularly unconcerned about customer waiting lines. This may be the result of a misperception that their businesses do not have waiting lines.

The subjects on factor two with negative factor loadings are retail establishments and an air compressor and dryer seller and servicer where critical concerns might include location, inventory, staffing, facility layout and customer lines. These concerns are all relatively unimportant to the subject organizations with positive factor loadings on factor two because those organizations provide relatively pure services at the customer's location. The analysis of factors four and six does not add significantly to the results and information presented.

8. Conclusions

8.1. Problems

Schmenner's service process matrix was chosen because it was believed that operations problems in service organizations might be related to the degree of labor intensity as well as degree of interaction with customers and degree of customization. However, the results show that this is not the case. Instead, we have shown that, as Schmenner claims, management problems are common across the service industries. In addition, it is clear that some operations problems are very firm specific.

Overall, statements 18, 15, and 8 represent the three most important problems. These are "determining how utilize resources most effectively", "monitoring and measuring quality of services", "predicting future events, conditions, customer demand, price/cost levels", etc., respectively. Also, statements 1, 2 and 21 are ranked at zero or lower on all factors, with the exception of factor three that ranks statement 21 at +1. These unimportant statements are

related to location, facility layout and determining distribution requirements. In addition, statement 8, which refers to waiting line systems, is ranked as unimportant (i.e., ranked at zero or lower) by all but two factors.

8.2. Business education implications

The survey results indicate problems that are important to the respondent service organizations. The authors have little confidence that most of these organizations use the quantitative techniques that would be most appropriate for their operations problems. This leads to the question of how best to use this information. Clearly, some operations management methods that are covered at length in such texts can address the problems cited by the respondents. If one considers the problems cited as most important by the respondents, it is clear that these problems imply particular operations management methods (e.g. forecasting, quality measurement methods, various mathematical programming methods, etc.). If these methods can be matched with service operations problems, we may then determine which methods might be relevant to teach to students who are expected to work in the service sector upon graduation.

Second, this study's results indicate that several techniques are considered unimportant to service organizations. One can take this information at face value or look more deeply into its meaning. The low ranking problems that imply queueing, as well as those of facility layout and facility location, may represent the view that location, layout and queueing systems are fixed. In addition, as mentioned previously, a lack of physical customers waiting in lines may imply to organizations that they do not have queues. This suggests that business educators should emphasize that waiting lines are not necessarily physical, and organizations that provide pure services at customer locations must manage waiting lines as well.

Third, this study's results support Schmenner's suggestion that management problems are common across different service industries. However, his claim that service managers share common challenges, and the problems that arise there are based on the degree of labor intensity and degree of interaction and customization that their respective service industries share are not supported by our results. Instead, our results imply that many problems are common to all types of service industries. This suggests that the methods one selects for instruction have a general applicability regardless of the category of service organization in which a student might eventually find employment. Although it is beyond the scope of this research, further research that investigates more thoroughly the claims implied by Schmenner's matrix is needed.

Another question is which operations problems in service organizations are the most important from a strategic, rather than purely operational, standpoint. This too warrants further research.

Appendix Instructions

Enclosed is a set of 23 statements of potential quantitative operations problems encountered by managers of service organizations. As you read each one, determine whether or not the statement is about an important problem that your organization encounters. You will probably find that some of these problems are very important in your business and others are not.

You will require a flat, clear space about the size of a desk.

1. First, read all of the statements printed on the white slips of paper and begin the sorting process by dividing the statements into three piles: place in one pile the most important problems that your organization encounters, place in a second pile the least important problems that your organization encounters and place the remainder in a third pile.
2. Place the yellow slips of paper across the desk top in front of you with +3 on your right, and −3 on your left, and with the remaining slips in between — much as shown on the score chart below. This is your scale for assessing the statements.
3. Spread out the pile of statements that are the most important problems your organization encounters, and from this group, select the two that are the most important to your organization. Place these, one under the other

beneath the +3 (as shown in the score chart below). Then, select the three that are the next most important to your organization and place these under +2.
4. Then it is a good idea to turn to the pile of statements that are the least important problems that your organization encounters. Select the two problems that are the least important to your organization and place them under the column labeled −3, then put the next three least important problems that your organization encounters under the column labeled −2.
5. Continue sorting the problem statements in a similar fashion until all statements have been placed in the appropriate columns. You should end up with the statements arranged as shown on the score sheet; *two* statements in the columns labeled +3 and −3, *three* statements in the columns labeled +2 and −2, *four* statements in the columns labeled +1, −1 and lastly, *five* statements under the column labeled 0. The order of your statements within each column is not important.
6. When you are done sorting the statements, record the *number of each statement* in the appropriate square of the score chart below, thereby providing us with a record of the way in which you sorted them.
7. After you record your sorting results on the following Score Chart, please answer the questions below the chart and return this survey before Thanksgiving, if at all possible, in the enclosed envelope.

Score Chart

-3	-2	-1	0	+1	+2	+3
2 Statements	3 Statements	4 Statements	5 Statements	4 Statements	3 Statements	2 Statements

1. Is your organization a service organization? Yes __ No __

2. Type of service organization to which your business is the most similar (circle one)

For the most part, the services you provide your customers are *standardized* and you regard your operation to be *capital intensive*. Examples: Airlines, Trucking, Hotel, Resort, Recreation, etc.

For the most part, the services you provide your customers are *standardized* and you regard your operation to be *labor intensive*. Examples: Retailing, Wholesaling, Schools, etc.

For the most part, the services you provide your customers are *not standardized* but designed to meet their individual needs and you regard your operations to be *capital intensive*. Examples: Hospital, Auto Repair, or other repair services, etc.

For the most part, the services you provide your customers are *not standardized* but designed to meet their individual needs and you regard your operations to be *labor intensive*. Examples: Doctors, Lawyers, Accountants, Architects and other professionals.

3. What does your business do? ———

4. Number of full-time employees in your organization? ——————————————

5. What is your position in your organization? ————

6. I would like a copy of the results of this survey. Yes —— No ——

7. List any other operational problems that your organization encounters: ——————————————

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