

**SERVICE DELIVERY ASSESSMENT AT A PUBLIC RESEARCH LABORATORY,
GHANA, WEST AFRICA**

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Abstract

The study evaluated service delivery of a public research laboratory from the perspective of both employees and clients in Accra, Ghana. The quota sampling technique was used to administer copies of structured questionnaire to staff of the laboratory using a five-point Likert scale and based on four constructs of the SERVQUAL model of service delivery. There were significant differences between client expectations and perceived service received. Employees met client expectation on courtesy and their willingness to help customers with undivided attention. Responsiveness, tangibles, and competence were key constructs that emerged as important in the measurement of service quality in the environmental management laboratory services industry. It is recommended that attention be paid to areas where significant gap existed between client perception and expectation of service quality. These may include issues such as acquisition of ultra-modern equipment that can handle several samples at the same time and improvement in visitor reception areas.

Key Words: Employee perception, Customer service, Service quality

Introduction

The customers of an organization may be internal (employees) or external (service consumers and suppliers) and the performance of the organization may be closely linked to the satisfaction of these two categories of customers. Customer satisfaction is a marketing performance metric that assesses consumers' experience with a product, service or firm. "It is a judgment that a product or service provided a pleasurable level of consumption-related fulfilment, including

levels of under or over-fulfilment...” (Oliver, 1997). Studies have shown that low productivity is a direct result of low job satisfaction and low motivation, poor communication between management, supervisors, and employees. The same study also found a correlation between declining corporate citizenship among employees and productivity (Appelbaum et al., 2005). Satisfied service recipients on the other hand may bring in more new customers, thus expanding the client base of the organization.

Several models in the literature suggest a link between customer satisfaction and profitability. Key among them are the Service-Profit Chain model (Heskett, Sasser Jr., & Schlesinger, 1997; Kamakura, Mittal, De Rosa & Mazzon, 2002) which suggests that employee satisfaction leads to customer satisfaction, leading to profitability, the Return on Quality model (Gustafsson and Johnson, 2002; Rust, Moorman & Dickson, 2002), which argues that improvements in quality would lead to improved customer satisfaction, leading to higher levels of customer loyalty and eventually greater profitability. A third model, the Self-Service model (Anitsal and Schumann, 2007), introduces the component of the external customer being part of the service delivery process in a self-service situation. Other customer satisfaction models include the American Customer Satisfaction Index model (ACSI) which measures the quality of goods and services as experienced by a consumer (Anderson and Fornell, 2000) and the Service Quality (Servqual) model which is developed to measure service quality and describes service quality as a “form of attitude, related but not equivalent to satisfaction and results from a comparison of expectations with perceptions of performance” (Parasuraman, Berry and Zeithaml, 1991). The Servqual model is most useful in applying to services rendered by a public organization as it measures the service quality in a simple and easy manner and yet separates the measures of the service quality into different components that enable the study to identify the extent of contribution or importance of various measures to the overall assessment of service quality. The Servqual model is a multiple item scale measuring consumer perceptions of service quality based on five quality dimensions, notably empathy, assurance, tangibles, responsiveness, and reliability (Smith, 1995). It defines perceived service quality as the degree and direction of discrepancy between customer expectations and perceptions and “perceived service quality” is differentiated from satisfaction based on different measures of expectation (Parasuraman et al., 1991).

Rising populations coupled with dwindling scarce resources in developing countries like Ghana is making it imperative for the public sector to operate in a more cost-effective and responsive way in its delivery of services. In spite of this drive, public sector institutions still lag way behind the private sector in the efficiency of delivery of services (Andrews, Beynon, & McDermott, 2016). Public sector institutions on the other hand are mandated to serve the public interest and to ensure the welfare of citizens but the discharge of such a mandate may not be cost effective as opposed to the private sector where the motivation is to make profit at all cost. The Servqual model therefore can provide an assessment of which measures of service quality are important in the delivery of particular types of services in a public sector institution.

Five Servqual scale dimensions: Reliability (ability to ensure reliable, proper service), Tangibles (physical facilities, infrastructure, equipment, appearance and personnel), Responsiveness (willingness to help customers and provide prompt service), Assurance (knowledge and courtesy of employees and their ability to inspire trust and confidence) and

Empathy (care for the client, attention to individual clients, individualization of service) had been tested in the banking, credit cards and in telecommunication services using a 22-item instrument on a seven-point Likert scale (Parasuraman et al., 1991; Parasuraman, Zeithaml & Berry, 1988). It has since been adapted for the evaluation of service quality in various industries, including medical services (Babakus, & Mangold, 1992), higher education services (Zafiropoulos and Vrana, 2008) and public services (Nowacki, 2005; Kim, 2007). Few studies however have assessed the importance of these dimensions of the Servqual model in a public research institution that offers commercial laboratory services in water quality analysis.

CSIR-Water Research Institute (WRI) in Accra, Ghana is a public institution that provides commercial services on its research output and offers laboratory services on analysis of water quality to the public on commercial basis. In assessing citizen satisfaction with the provision of public services in Korea, Kim (2007) examined the association between multiple dimensions of service quality as espoused by Servqual noting that only reliability, responsiveness and tangibles contributed significantly to overall satisfaction in rendering public services. WRI however being a research institution is expected to offer a high degree of assurance to the public, particularly in the quality of its scientific assessments of water samples. This study would therefore include the construct of 'Assurance' in addition to the three mentioned above (reliability, responsiveness, and tangibles) in the testing of service quality at WRI using SERVQUAL.

The objectives of the study therefore would be to evaluate employee perception on the service delivery of CSIR WRI, Accra, Ghana and how this can be improved, assess customer (external) satisfaction of the services rendered by CSIR WRI and to determine which constructs are important in the assessment of customer satisfaction in a scientific research institution offering water quality assessment services.

This paper seeks to test the following hypotheses:

H1: Employees of CSIR WRI (internal customers) are satisfied with the quality of their own service delivery.

H2: External customers are not satisfied with the service delivery of CSIR WRI employees.

H3: The competence of a research institution such as CSIR WRI is a major factor attracting external customers to the institution for commercial transaction.

Research Method

Sampling and Questionnaire Design

To test hypothesis H1, the quota sampling technique was used. To develop these quotas, the relevant control characteristics of the respondents (staff of WRI) were listed and its distribution in the target population determined. A characteristic of the target population taken into consideration were the proportion of scientists to technicians. Sample elements within each quota were selected based on convenience. Data collection was done using copies of questionnaires as a measurement tool, and this was self-administered by staff of WRI. WRI has one hundred and eighty (180) employees categorized as Junior Staff, Senior Staff, Senior Members (technical) and Senior Members (non-technical). Technical staff of WRI comprising scientists and technicians currently stand at seventy-two (72) in all its three stations in Accra, Akosombo and Tamale. Technical staff at Accra and Akosombo stations where this research

took place stands at sixty-five. The study targeted these sixty-five (65) technical staff of WRI who form the core of its mandate. Some questions on the questionnaire were repeated in different ways to improve the quality of the survey. Responses from the questionnaire generated data needed for answering the research questions and all data indicated in the study were obtained by means of questionnaire.

To address hypotheses H2 and H3, the study employed random sampling technique for the administration of questionnaire to sixty (60) external clients or customers of WRI receiving and paying for services at the laboratories of the WRI. Data collection was done using copies of questionnaire and this was self - administered by the clients of WRI. The questionnaire assessed the expectation and perception of the services of WRI using the SERVQUAL model. Twenty-four (24) measures of four constructs of the SERVQUAL model, namely tangibles, reliability, responsiveness, and assurance (Parasuraman, Berry and Zeithaml, 1991) were employed. Twelve (12) measures focused on expectations of clients based on the four constructs while the other twelve (12) focused on their perception. The twenty-four measures were assessed on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The mid-scale comprised of a neutral response (don't know or not sure) (Levesque and McDougall, 1996; Amin, Isa and Fontaine, 2011). The reliability of customer satisfaction indicators was tested by the Cronbach's coefficient (α). Validity testing was done by assessing the measures or indicators using standardized factor loadings.

Ethical Considerations

In the study, the confidentiality of respondents was assured during the administration of the questionnaire. Additionally, respondents were given the option to opt out of the survey if they so desired. Respondents were politely approached, and the survey explained to them in a language they understand. A consent form detailing the above-mentioned issues and why the study is being conducted was signed by each respondent.

Data Analysis

The analysis of the data included the use of some descriptive statistics of the demographics of respondents as well as some of their responses. The chi-square test was used to compare the responses among staff of WRI. T-test was used to compare expectations and perception of external clients or customers of WRI. Cronbach's coefficient, α was used to test the reliability of the measures of satisfaction. When α is more than 0.7, measures of satisfaction were deemed to be good. Validity testing, done by using standardized factor loadings is deemed to be good when it exceeds the recommended value of 0.5 (Kaiser, 1960). Factor analysis conducted, using the principal component analysis approach were rotated using Oblimin Kaiser normalization as constructs are known to have a relationship (Parasuraman, Berry and Zeithaml, 1991). All these analyses were done using Statistical Packages for Social Scientists (SPSS) version 21.0.

Results

Demography of Internal and External Customers of WRI

Copies of the questionnaire were administered to the sixty-five (65) internal customers or technical staff (Scientists and Technicians) of WRI based in Accra and Akosombo and fifty-six

(56) respondents (86.2%) obliged. All the technical divisions of WRI were represented in the sample (Table 1).

Table 1: Characteristics of Staff of WRI who Participated in the Survey

	Scientists	Senior Scientists	Technicians	Total	(%)
Station					
Akosombo	2	1	9	12	21.4
Accra	14	9	21	44	78.6
Total	16	10	30	56	
Division					
GWD	5	1	4	10	17.9
EBHD	4	3	6	13	23.2
ECSED	4	3	13	20	35.7
SWD	1	3	2	6	10.7
FAD	2	0	5	7	12.5
Total	16	10	30	56	
No. of years on the job					
0-5 Years	9	0	10	19	33.9
6-10 Years	4	0	11	15	26.8
11-15 Years	2	2	2	6	10.7
16-20 Years	0	2	0	2	3.6
Over 20 Years	1	6	7	14	25.0
Total	16	10	30	56	
Percentage	28.6	17.9	53.4		

Source: Field Survey, 2018

The technical staff sampled comprised of 29% Scientists, 18% Senior Scientists (comprising of Senior Research Scientists and Principal Research Scientists) and 53% Technicians. The study also targeted sixty (60) external customers of WRI and these respondents were those who come for analysis of water samples from either the microbiology laboratory of the Environmental Biology and Health Division or the laboratories of the Environmental Chemistry and Sanitation Engineering Division or both. Out of the sixty (60) respondents targeted, forty-two (42)

questionnaires (70%) were retrieved. The forty-two (42) respondents consisted of twenty-eight (28) males (66.7%) and fourteen (14) females (33.3%) (Table 2).

Table 2: Characteristics of the Sampled Customers of WRI

Age	Sex		Total	Percentage (%)
	Male	Female		
Below 30 years	5	5	10	23.8
30 - 49 years	14	6	20	47.6
40 - 49 years	4	0	4	9.5
50 years and above	4	1	5	11.9
No response	1	2	3	7.1
Total	28	14	42	
Percentage (%)	66.7	33.3		
Occupation				
Student	0	1	1	2.4
Government employee	2	2	4	9.5
Private sector employee	18	10	28	66.7
Self-employed	4	0	4	9.5
Others	3	0	3	7.1
No response	1	1	2	4.8
Total	28	14	42	
Percentage (%)	66.7	33.3		
Education				
SHS graduate	3	0	3	7.1
University graduate	13	11	24	57.1
Postgraduate degree holder	9	2	11	26.2
Others	1	0	1	2.4
No response	2	1	3	7.1
Total	28	14	42	
Percentage (%)	66.7	33.3		

Source: Field Survey, 2018

Perception and Expectations of Internal Customers (CSIR-WRI Employees) on Service Delivery

The staff of WRI are equally split (27-27) on whether they are satisfied with the way income generating services are rendered (Table 3).

Table 3: Perception and Expectations of Technical Staff on WRI Service Delivery

Satisfied	SCI*	S.SCI*	TECHS*	Totals	(%)
Working tools adequate	1	0	0	1	3.7
Clients are satisfied	4	1	4	9	33.3
Timely delivery of service	1	0	7	8	29.6
Delivers high quality service	1	1	2	4	14.8
Delivers high quality and timely service	0	1	1	2	7.4
No response	1		2	3	11.1
Total	8	3	16	27	100.0
Percentage (%)	29.6	11.1	59.3	100.0	
Not satisfied					
Working tools inadequate	0	1	2	3	11.1
Delays in service delivery	5	1	7	13	48.1
Delays from finance division	2	3	3	8	29.6
Workplace not properly furnished	1	0	1	2	7.4
No response		1		1	3.7
Total	8	6	13	27	100.0
Percentage (%)	29.6	22.2	48.1	100.0	
Expectations for service improvement					
Staff training in customer care	2	0	1	3	5.4
Provision of modern equipment	4	3	8	15	27.0
Better supervision	1	1	1	3	5.4
Bigger working space	0	0	3	3	5.4
Increase remuneration of staff	1	2	2	5	8.5
Increase staff strength	1	0	2	3	5.4
Can't shorten service process	0	0	1	1	1.8
No response	7	4	12	23	41.1
Total	16	10	30	56	
Percentage (%)	28.6	17.9	53.6	100.0	

* SCI (Scientists), S.SCI (Senior Scientists), TECHS (Technicians)

Source: Field Survey, 2018

Customers' highest expectations were on questionnaire items on neatness of appearance of staff and the timely release of analytical results (Table 3). Most staff not satisfied cited delays in service delivery (48%) as the source of their dissatisfaction (Table 3).

Staff listed training in customer care, investment in modern equipment, better supervision, bigger working space, increased remuneration for staff and staff strength increment as ways by which service delivery can be improved (Table 3). A high percentage of WRI technical staff (27%), especially the technicians expect to see more investment in the state-of-the-art equipment for service delivery (Table 3).

Perception and Expectations of External Customers on Service Delivery

Table 4 shows the difference in the means of the scores of expectations and perceptions and the levels of significance of the t-test when compared. Expectations were higher than perceived service quality for all the items measured, except for item 8 and 11.

Table 4: Mean Differences in Expectations and Perceptions Based on Questionnaire Items

Questionnaire items	Expectations	Perceptions	Difference	T-value	N
Tangibles					
1.Modern looking equipment	4.56	3.53	1.03	6.00*	36
2.Employees neatness in appearance	4.63	4.05	0.58	4.30*	40
3.Comfortability of reception area	4.39	3.68	0.71	3.85*	38
Reliability					
4.Fulfil promise to release analytical results on time	4.65	3.63	1.03	5.46*	40
5.Showing sincere interest in solving problems	4.61	4.13	0.47	3.83*	38
6. Insisting on error-free records	4.32	3.87	0.45	3.09*	38
Responsiveness					
7.Employees telling customers exactly when services will be performed	4.40	3.88	0.53	3.06*	40
8.Employees willingness to help customers with undivided attention	4.28	3.97	0.31	1.87	39
9.Employees giving prompt services to customers	4.50	3.78	0.73	4.91*	40
Assurance					
10. Employees behaviour instilling confidence in customers	4.40	3.98	0.43	2.66*	40
11.Employees being consistently courteous with customers	4.41	4.18	0.23	1.94	39
12. Employees having the knowledge to answer customer questions.	4.45	4.13	0.32	2.63*	38

***Significant difference at 95% confidence level.**

Source: Field Survey, 2018

The highest expectations of clients were focused on the timely release of analytical results (item 4) and the neatness in appearance of the employees (item 2) (Table 4). This was followed by the

sincerity of employees in solving their problems (item 5). The highest scores in perception were employees being consistently courteous with customers (item 11), showing sincere interest in solving their problems (item 5) and employees having the knowledge to answer customer questions (item 12).

Employees of WRI met customer expectations on courtesy and willingness to help customers with undivided attention as no significant differences were found between expectations and perceptions for item 8 and 11 (Table 4). The least score was on WRI having modern looking equipment (item 1).

Service Quality Assessment Tools for Water Quality Laboratory Services

The test for reliability of measures of the construct had an alpha (α) value of 0.91 for the twelve measures of expectation which is more than the minimum standard of 0.7 generally accepted as the threshold for reliability (Table 5).

Table 5: Factor Loadings for Expectation

Item No.	Factors	Expectations		
		Factor 1	Factor 2	Factor 3
1	Courteous	0.899		
2	Prompt services	0.835		
3	Interest in solving	0.767		
4	confidence in customers	0.753		
5	Undivided attention	0.649		
6	Neat appearance			
7	Modern equipment		0.806	
8	Results ready on time		0.783	
9	Error-free records		0.712	
10	Comfortable reception		0.599	
11	Answer customer			0.858
12	Services performed			0.693
	Eigen values	6.39	1.24	1.1
	Explained variance (%)	53.2	10.4	9.1
	Cumulative variance (%)	53.2	63.5	72.7
	Cronbach alpha value (α) for 12 items			0.91

Source: Field Survey, 2018

All the 24 measures of the construct of reliability, responsiveness, tangibility and assurance had an α value of 0.89, indicating a good estimate of internal consistency. To assess the convergent validity of the constructs, standardized factor loadings were used to determine the validity of the construct items. Factor loadings on measures of expectation (Table 5) showed three factors using a cut-off point of 0.5 and had eigen values of more than 1 (Kaiser, 1960). These three factors cumulatively contributed to 73% of the total variation. Factor 1 had high loadings on items 1-5, while factors 2 and 3 had high loadings on items 7-10 and 11-12 respectively (Table 5).

Analyzing the Findings in Relation to the Hypotheses

Analysis on the perception and expectations of internal customers (CSIR-WRI employees) on service delivery above helped to test hypothesis H1, ‘ ‘ Employees of CSIR WRI (internal customers) are satisfied with the quality of their own service delivery.’ ’ Table 3 and the analysis of it indicates that, employees of CSIR WRI (internal customers) are neither satisfied nor dissatisfied as equal proportions of WRI staff indication their satisfaction or dissatisfaction. Questions on the questionnaire relating to the satisfactory or dissatisfaction of internal customers was therefore meant to test hypothesis 1. Thus, no significant differences were found between expectations and perceptions of internal customers (Table 3).

Analysis on the perception and expectations of external customers on service delivery above helped to test hypothesis H2; ‘ ‘External customers are not satisfied with the service delivery of CSIR WRI employees.’ ’ In test H2, external customers’ expectations were far above the services rendered by the laboratories in CSIR WRI. Thus, there is a significant difference between expectation and perception of external customers (Table 4). This means that the hypothesis, ‘ ‘External customers are not satisfied with the service delivery of CSIR WRI employees’ ’ is true. This analysis can be inferred from Table 4.

Analysis on the quality of service rendered by CSIR-WRI was done to test hypothesis H3, ‘ ‘The competence of a research institution such as CSIR WRI is a major factor attracting external customers to the institution for commercial transaction.’ ’ From testing H1 and H2 one can deduce for H3 that customers are not satisfied with service delivery of CSIR-WRI but for the competence of staff. Thus, there is no significant difference between the quality of services rendered and the competence of a research Institution (see Table 5). This means that though the quality of service rendered to customers is not up to expectation and does not fully satisfy the SERVQUAL criteria for quality services rendered to customers as inferred from Table 5, customers are attracted to use the services of CSIR-WRI due to the competence of staff.

Discussion and Findings

Demography of Internal and External Customers of WRI

The ratio of 26 Scientists to 30 Technicians sampled (1:1.2) is representative of the actual numbers of the different categories of staff. Thirty-four (34%) percent of WRI technical staff had been with the institute for five years or less and the next largest group is those who had been with the institute for between 6-10 years, thus 61% of WRI technical staff had been with the institute for 10 years or less. The forty-two (42) external customers or respondents consisted of twenty-eight (28) males (66.7%) and fourteen (14) females (33.3%). This 2:1 ratio of males to females may be indicative of the dominance of males in the science profession. These external clients were predominantly private sector employees (66.7%). Fifty-seven (57%) percent of the external clients were University graduates with a bachelor’s degree while twenty-six (26%) percent had postgraduate University degrees. With 83% of the clients having university education, it was not surprising that expectations of these clients were high. In a study conducted by Kim (2007) to evaluate the importance of multi-scale items of the SERVQUAL model in the services of a public institution, the author noted that the expectations

of respondents were very high due to the neighbourhoods where the research was conducted. Respondents in that study were above average income earners.

Perception and Expectations of Internal Customers (CSIR-WRI Employees) on Service Delivery

The staff of WRI were equally split (27-27) on whether they are satisfied with the way income generating services are rendered (Table 3). Baker and Crompton (2000) observed that there are satisfaction-generating factors and dissatisfaction-generating factors operating in organizations. For satisfied staff, majority of them feel satisfied because they believe their clients are satisfied and that services are delivered timely (62.9%). Additionally, other satisfied staff (22.2) believe service rendered are timely and of high quality. Knowing the perception of these external customers on these services therefore is imperative for any improvement in service delivery to take place. Interestingly, external customers' highest expectations were on questionnaire items on neatness of appearance of staff and the timely release of analytical reports (Table 4). There was however a significant difference between external customers' expectations and perceived service delivery, the latter being lower (Table 4). Ironically, most of the staff not satisfied cited delays in service delivery (48%) as the source of their dissatisfaction (Table 3).

Thirty percent of staff attributed their dissatisfaction of service delivery to delays caused by the Finance Division of WRI who are involved in the procurement of consumables and the processing of request for equipment purchase and repairs. Incidentally, inadequate tools were mentioned by 11% of respondents as the source of their dissatisfaction. Clearly, the source of the dissatisfaction among the WRI technical staff has financial management decisions bordering on what to buy (inadequate tools and furnishing) and when to buy (procurement) as significant contributors. High levels of red tape and cumbersome rules are very characteristic of public sector organizations compared with private sector organizations (Boyne, 2002) and this may lead to low motivation and poor service delivery quality (Kjeldsen and Jacobsen, 2012).

Staff listed training in customer care, investment in modern equipment, better supervision, bigger working space, increased remuneration for staff and staff strength increment as ways by which service delivery can be improved (Table 3). Indeed, the human capital and its orientation in public organizations are critical intangible resources for strategic management to achieve corporate goals (Andrews et al., 2016). A high percentage of WRI technical staff (27%), especially the technicians expects to see more investment in the state-of-the-art equipment for service delivery (Table 3). This was anticipated as the number of samples to process would increase with increasing number of clients. Investing in such equipment therefore can shorten the sample processing time and increase the speed of service delivery. An unusually high number of 'no response' (41.1%) was observed. This is characteristic of public institutions, where the possibility of victimization by superiors is high when senior officers feel criticized. Public institutions tend to be political in nature and are usually less fair, less ethical and this may result in diminished employee performance and less job satisfaction, reduced commitment to the organization and low service quality (Ferris and Kacmar 1992, Harris and Kacmar, 2005, Folger, Konovsky and Cropanzano, 1992; Vigoda-Gadot, 2003).

Perception and Expectations of External Customers on Service Delivery

Table 4 shows the difference in the means of the scores of expectations and perceptions and the levels of significance of the t-test when compared. Expectations were higher than perceived service quality for all the items measured, except for item 8 and 11. The highest expectations of clients were focused on the timely release of analytical reports (item 4) and the neatness in appearance of the employees (item 2) as mentioned earlier. This was followed by the sincerity of employees in solving their problems (item 5). All the 12 items had a mean value above 4.0 suggesting that all these items were important to the external clients. Laboratory managers of WRI therefore need to focus on ensuring that staff are properly dressed, and laboratory analytical reports are released on time.

The highest scores in perception were employees being consistently courteous with external customers (item 11), showing sincere interest in solving their problems (item 5) and employees having the knowledge to answer customer questions (item 12). This set of items may be described as competence. Employees of WRI met external customer expectations on courtesy and willingness to help customers with undivided attention as no significant differences were found between expectations and perceptions for item 8 and 11 (Table 4). The least score was on WRI having modern looking equipment (item 1). As clients are usually not allowed into the laboratories, perception on the modernity of the laboratory equipment of WRI therefore may have come from impressions gathered at the reception area. The reception area therefore should be a key point of attention for improving corporate image.

Service Quality Assessment Tools for Water Quality Laboratory Services

The measures of the construct showed very high reliability with an alpha (α) value of 0.91 for the twelve measures of expectation (Table 5). The convergent validity of the constructs for assessing external customer expectations, determined by standardized factor loadings showed three factors having a cut-off point of more than 0.5 and having eigen values of more than 1 (Kaiser, 1960). These three factors cumulatively contributed to 73% of the total variation. Factor 1 had high loadings on items 1-5, while Factor 2 and 3 had high loadings on items 7-10 and 11-12 respectively (Table 5). Constructs for Factor 1 can be described as responsiveness (being courteous, offering prompt services, showing interest in solving the problems of external clients, instilling confidence, and giving undivided attention to external clients). Constructs for Factor 2 having modern looking equipment and prompt, error-free analytical reports are tangibles. Factor 3 consisted of employees having the requisite knowledge and skills to answer the questions of external customers and letting external customers know exactly when services would be performed. This third factor can be described as competence. Studying the expectation and perception of external customers of a publicly owned museum, Nowacki (2005) noted that the customers found competence of personnel to be a particularly important factor. In a study involving the measurement of multiple dimensions of service quality of local government institutions to the citizenry in Korea, Kim (2007) also noted that responsiveness and tangibles were important factors to external customers who in this case happen to be the citizens. This shows that the SERVQUAL model can have a wide range of applications in many industries including environmental laboratory services rendered by a public institution. This observation is

consistent with the findings of Zafiroopoulos and Vrana (2008) who noted a wide applicability of the model, even in public sector educational services.

Conclusion

The study showed a correlation between expectations and perceptions, job satisfaction and productivity thus indicating that there is need to enhance work environment, work relations, and offer more training for greater productivity to meet the expectations of both internal and external customers. For customers to be neither satisfied nor dissatisfied, management could probe further to find ways of satisfying the customers since they are an important component (lifeline) of any organization that depend on customers. Again, knowing the expectations of customers and finding out that they are not satisfied with services rendered is a good thing as that would help shape the services rendered to the customers' expectations.

The type of equipment used can give both the internal and external customers some level of satisfaction to attract more customers and keep older ones. Internal customers will feel comfortable and confident working with the state-of-the-art equipment thereby ensuring internal customer satisfaction. This in a way can trigger internal customers to introduce more external customers to the organisation/institution. This boils down to funding as services must be priced reasonably and equipment and working space upgraded frequently. CSIR WRI will therefore have to source for either external or internal funding to keep upgrading its laboratories to the required standard or training its staff to enhance quality services and for that matter customer satisfaction.

With all these coming together, profitability will be achieved in no time and the state-of-the-art equipment not difficult to acquire and upgrade. However, CSIR WRI will have to put in a lot of effort to get to the stage where the SERVQUAL criteria for quality services rendered to customers are met.

Recommendations

- It is recommended that attention be paid to areas where significant gap existed between client perception and expectation of service quality. This may include issues such as acquisition of ultra-modern equipment that can handle several samples at the same time and improvement in visitor reception areas.
- Training in customer care would need to focus on items of responsiveness mentioned earlier.
- A working environment free of fear and intimidation may also encourage increased productivity.

Limitations of the Study

The findings of the study, particularly with respect to the constructs for the assessment of service quality in the environmental management laboratory services industries must be interpreted with caution as data used were limited. It would therefore be necessary to expand the scope of this research in another organization, increasing the number of respondents.

Recommended changes when implemented need to be evaluated to assess their effectiveness. These recommendations can be tried on a pilot scale and then scaled up for full implementation.

Declaration of Interest

No known conflict of interest exists to the best of the knowledge of authors

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