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Determinants of Environmental Sanitation in the City of Tshwane, South Africa

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ABSTRACT

The purpose of the study was to identify and quantify key predictors of satisfactory municipal services on municipal waste management in the City of Tshwane, South Africa. The expected and perceived quality of waste management services were analysed by using SERVQUAL analysis. The study found that the perception and expectation of respondents on the quality of sanitary services provided to them were significantly influenced by the degree of motivation of employees of the City of Tshwane at work, the ability of employees of the City of Tshwane to treat all customers with respect, the ability of employees of the City of Tshwane to provide adequate answers promptly to queries raised by customers, and the degree to which employees of the City of Tshwane were skilled on technical issues, in a decreasing order of strength.

Key words: Environmental sanitation, City of Tshwane, Service quality, Gap score

1 Introduction and background to study

The purpose of study was to assess and evaluate predictors of efficiency in environmental sanitation in the City of Tshwane, South Africa. The general public requires satisfactory service delivery in terms of environmental sanitation and cleanliness. Protests occur over poor sanitary and municipal services from time to time in South African municipalities including the City of Tshwane. The ability to provide satisfactory sanitation services is a key requirement of all employees of the City of Tshwane. Public health and environmental sanitation specialists have shown that developing municipalities experiencing rapid influx from rural areas must have the capacity to enforce environmental and sanitary regulations and bylaws vigorously in order to keep streets clean [1]. The City of Tshwane is characterised by a huge influx of migrants who come to the city in search of jobs and livelihood. The population size of the City of Tshwane has grown significantly since South Africans elected their first democratic government in April 1994. However, the capacity of the City of Tshwane to manage litter and waste properly and ensure environmental sanitation and cleanliness has not improved much in the same period. The City of Tshwane has introduced various tools that could be used for assessing sanitary service quality and customer satisfaction.

Studies conducted by development economists have shown that the task of transforming environmental behaviour among inhabitants of developing cities in Sub-Saharan African countries requires the determination of local municipalities to enforce municipal bylaws with commitment and the clear demonstration of good leadership and management skills [2, 3, 4, 5]. It has also been pointed out that socioeconomic inequalities often undermine cleanliness and environmental sanitation in developing cities

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[6, 7]. An understanding of customer opinions relating to efficiency in environmental sanitation and cleanliness are essential for enhancing the quality of sanitary services [8]. Service quality, and the application of efficiently designed services delivery systems, constitutes a penetrating strategy in ensuring cleanliness and environmental sanitation. It is also beneficial for boosting ecotourism [9]. The study aims to assess and evaluate the extent to which inhabitants are satisfied with the quality of services provided by the City of Tshwane. Findings of the study could contribute to efforts made by the City of Tshwane to improve environmental sanitation and cleanliness. The key benefits of maintaining environmental cleanliness and proper waste management in large metropolitan cities such as the City of Tshwane is the ability of local municipalities to attract viable businesses into city centres as a means of growing tax revenue and job creation, and the optimisation of municipal service delivery [10, 11, 12, 13, 14, 15].

According to the City of Tshwane [16], about 1, 734, 295 tons of solid waste is collected each year from businesses operating in the city. The solid waste produced by businesses in the city includes trash or garbage such as wood, product packaging, empty bottles, used tyres and car parts, and cans, garden refuse, furniture, clothing, leftover food, newspapers, wires, grease, appliances, paint, pieces of metal, broken containers, sheet metal and expired medicine. These businesses produce massive volumes of solid and liquid waste on a daily basis. Taxi ranks, bus stations, open flea markets, food outlets, and small businesses located in Pretoria are synonymous with litter, uncontrolled solid and liquid waste, as well as lack of capacity in the efficient management of waste. Passengers travelling in buses and taxis throw out trash through widows of moving vehicles. The collection, disposal and processing of waste produced by businesses and households is regulated by legislative policies. It has been shown that the use of an integrated solid waste management system is essential for reducing the overall cost of waste management in developing cities worldwide [17]. A similar finding is that the promotion of health education on environmental sanitation and primary health care and a strict enforcement of municipal bylaws are vital for ensuring overall environmental cleanliness and the efficient management of waste in developing cities [18]. The study was prompted by a host of factors that are known to undermine environmental sanitation, cleanliness and efficiency in waste management in the City of Tshwane. Examples of such factors are poor infrastructural capacity, poor awareness about the benefits of proper waste management, lack of socioeconomic incentives to stakeholders relevant to the waste management chain, failure to adequately utilize modern waste management and processing technology, failure to vigorously enforce municipal bylaws on sanitation and waste disposal, and the absence of an integrated waste management system in Tshwane [19]. Based on experience learned from members of the European Union, local municipalities must use highly innovative and modern technological methods of maintaining environmental sanitation and cleanliness in urban centres. The authors have argued that the private sector should be given economic incentives to ensure highly efficient and affordable municipal service delivery [20].

Objective of study

The overall objective of study was to assess the degree to which residents of the City of Tshwane are satisfied with the quality of sanitary services that are provided to them by the City of Tshwane.

2 Materials and methods of study

Data was collected from a stratified random sample of 1, 012 residents of the City of Tshwane on 22 indicators that are commonly used for the assessment of service quality by the City of Tshwane and other municipalities. Data was collected from each of the 1, 012 residents who were selected for the study by using a structured, pre-tested and validated questionnaire of study consisting of 22 indicators of service quality. The questionnaire of study consisted of 5 dimensions of expectation and perception (reliability, assurance, tangibles, empathy and responsiveness). Each of the respondents in the study had to provide answers to 22 questions related to expectations plus 22 questions related to perceptions. As such, each of the respondents had to provide answers to 44 questions (22 questions on expectation + 22 questions on perception). Measurements of expectations and perceptions were done by using a 5-point ordinal scale. Face validity was used for ensuring validity. The Cronbach Alpha test was used for ensuring reliability and internal consistency. The expected and perceived quality of sanitary services that were provided to the general public by employees of the City of Tshwane was analysed by using SERVQUAL analysis. This was done by estimating gap scores (the average difference between expected and perceived scores).

The 5 dimensions of SERVQUAL analysis are tangibles, reliability, responsiveness, assurance and empathy [21]. The 5 dimensions are defined as follows:

- Tangibles: The appearance of physical facilities, equipment and personnel
- Reliability: The ability to perform the promised service dependably and accurately
- Responsiveness: The willingness to help customers
- Assurance: The knowledge and courtesy of employees and their ability to convey trust and confidence
- Empathy: The provision of caring, individualized attention to customers

Service quality is an achievement in customer service. It reflects at each service encounter. Customers form service expectations from past experiences, word of mouth and advertisement. The perception of residents on the quality of environmental and sanitary services depends on a number of socioeconomic factors [22]. The South African Auditor General (2017) has identified numerous areas of environmental sanitation that need improvement [23].

3 Results of study

Table 1 shows frequency proportions that indicate the general characteristics of the participants of study. It can be seen from the table that 854 of the 1, 012 respondents who were selected for the study (84.37%) had a positive overall perception on the quality of services provided to them by employees of the City of Tshwane. Only 158 of the 1, 012 respondents (15.63%) had an overall negative perception. The table shows that 56.62% of the participants of the study were male, whereas the remaining 43.38% were female. The table also shows that 49.01% of the 1, 012 respondents who took part in the study had lived in the City of Tshwane between 11 and 20 years.

Table 1: General characteristics of respondents (n=1, 012)

Variable of study	Percentage
Overall perception of residents on the quality of sanitary services	Positive: 854 (84.37%) Negative: 158 (15.63%)
Gender of respondents	Male: 56.62% Female: 43.38%
Age category of respondents	20 or younger: 16.90% 21 to 30: 31.42% 31 to 50: 33.20% 51 or older: 18.48%
Duration of stay in neighbourhood in years	5 or less: 36.17% 6 to 10: 6.62% 11 to 20: 49.01% 21 or more: 8.20%
Highest level of education	Matric level or less: 5.53% Certificate: 27.57% Diploma: 39.23% Bachelor's degree: 15.22% Master's degree or above: 12.45%
Have you ever complained about poor quality sanitary services that you received from the City of Tshwane?	Yes: 4.94% No: 95.06%
Marital status	Single: 28.16% Married: 37.85% Divorced: 30.43% Widowed: 1.48% Others: 2.08%
Job category of respondents	Business owner: 41.11% Government employee: 11.26% Private sector employee: 7.61% Self-employed consultant: 22.73% Unemployed: 8.30% Others: 8.99%

Table 2 shows percentages for the 5 dimensions (reliability, assurance, tangibles, empathy and responsiveness) that were used for the assessment of expectations and perceptions held by residents and ratepayers on the quality of sanitary services provided to the general public by employees of the City of Tshwane.

Table 2: Expected and perceived scores for dimensions (n=1, 012)

	Dimension	Expectation score	Perception score
	Reliability: Ability to perform service dependably and accurately		
rel1	Employees of the City of Tshwane are committed for handling all operations in our community	Agree: 97.63% Disagree: 2.37%	Agree: 94.66% Disagree: 5.34%
rel2	Employees are adequately equipped and skilled enough to do their job well	Agree: 99.01% Disagree: 0.99%	Agree: 94.57% Disagree: 5.43%
rel3	Residents who need sanitary services can always depend on employees of the City of Tshwane	Agree: 98.91% Disagree: 1.09%	Agree: 96.74% Disagree: 3.26%
rel4	Employees perform their duty accurately at all times	Agree: 99.01% Disagree: 0.99%	Agree: 96.15% Disagree: 3.85%
	Assurance: Ability of staff to inspire confidence and trust		
ass1	Employees are trustworthy in what they do for the community	Agree: 99.70% Disagree: 0.30%	Agree: 96.34% Disagree: 3.66%
ass2	Employees inspire confidence in what they do for the community	Agree: 99.31% Disagree: 0.69%	Agree: 96.64% Disagree: 3.36%
ass3	Employees are highly punctual and effective at what they do for the community	Agree: 100.00% Disagree: 0.00%	Agree: 96.74% Disagree: 3.26%
ass4	Employees are highly dedicated to the residents who rely on their services	Agree: 100.00% Disagree: 0.00%	Agree: 96.15% Disagree: 3.85%
ass5	Employees are highly professional and disciplined in the course of assisting people in our community	Agree: 99.41% Disagree: 0.59%	Agree: 96.54% Disagree: 3.46%
	Tangibles: Physical facilities, equipment and staff appearance		
tan1	Physical facilities used by employees are appropriate for providing sanitary services	Agree: 100.00% Disagree: 0.00%	Agree: 97.53% Disagree: 2.47%
tan2	Equipment used by employees are appropriate enough for providing adequate sanitary services	Agree: 99.41% Disagree: 0.59%	Agree: 97.33% Disagree: 2.67%
tan3	Employees are physically fit for handling sanitary operations	Agree: 99.70% Disagree: 0.30%	Agree: 99.11% Disagree: 0.89%
tan4	Employees are appropriately trained for handling sanitary services	Agree: 99.70% Disagree: 0.30%	Agree: 96.94% Disagree: 3.06%

	Empathy: The extent to which caring individualized service is given		
emp1	Employees care enough for every customer in our community	Agree: 100.00% Disagree: 0.00%	Agree: 95.65% Disagree: 4.35%
emp2	Employees provide individualized assistance and care to each person who needs their assistance	Agree: 99.31% Disagree: 0.69%	Agree: 96.05% Disagree: 3.95%
emp3	Employees are aware of the needs of all people who require their services	Agree: 100.00% Disagree: 0.00%	Agree: 97.04% Disagree: 2.96%
emp4	Employees do not discriminate based on the personal characteristics of customers	Agree: 100.00% Disagree: 0.00%	Agree: 98.22% Disagree: 1.78%
emp5	Employees show enough appreciation for the pain and suffering endured by customers	Agree: 100.00% Disagree: 0.00%	Agree: 98.32% Disagree: 1.68%
	Responsiveness: Willingness to help and respond to customer need		
res1	Employees are willing to assist all customers in our community at all times	Agree: 100.00% Disagree: 0.00%	Agree: 97.13% Disagree: 2.87%
res2	Employees are prepared to provide assistance to customers under all possible circumstances	Agree: 100.00% Disagree: 0.00%	Agree: 94.86% Disagree: 5.14%
res3	Employees respond to all queries who need their help promptly and with vigour	Agree: 100.00% Disagree: 0.00%	Agree: 96.44% Disagree: 3.56%
res4	The methods and strategies used by employees for providing assistance to customers are appropriate, effective and reliable at all times	Agree: 100.00% Disagree: 0.00%	Agree: 96.34% Disagree: 3.66%

It can be seen from the table that expected and perceived percentage scores were generally similar in magnitude for most of the 5 dimensions. Table 3, below, shows 10 significant two-by-two associations obtained from Pearson's chi-square tests of associations. At the 5% level of significance, significant associations have large observed chi-square values and P-values that are smaller than 0.05. Significant results obtained from Pearson's chi-square tests of associations ($P < 0.05$) showed that overall satisfaction with the quality of sanitary services that were provided by the City of Tshwane was significantly associated with the perception of customers on the following 10 variables of study:

1. Employees respond adequately to all queries promptly and with vigour
2. Employees are adequately equipped and skilled enough to do their job well
3. Employees do not discriminate based on the personal characteristics of people
4. Employees are prepared to provide assistance to all members of the community under all possible circumstances

5. Employees are willing to assist all members of the community at all times
6. Employees are aware of the needs of all people who require their services
7. Employees are highly punctual and effective at what they do for the community
8. Employees provide individualized assistance and care to each person who needs their assistance
9. Employees are aware of the needs of all people who require their services
10. Equipment used by employees are appropriate enough for routine operations

Table 3: Results obtained from Pearson's chi-square tests of associations

Overall satisfaction with the quality of sanitary services	Observed Pearson chi-square value	P-value
Employees respond adequately to all queries promptly and with vigour	54.1154	0.0000***
Employees are adequately equipped and skilled enough to do their job well	51.0236	0.0000***
Employees do not discriminate based on the personal characteristics of people	48.2358	0.0000***
Employees are prepared to provide assistance to all members of the community under all possible circumstances	46.2105	0.0000***
Employees are willing to assist all members of the community at all times	41.2233	0.0000***
Employees are aware of the needs of all people who require their services	39.3619	0.0000***
Employees are highly punctual and effective at what they do for the community	36.2546	0.0000***
Employees provide individualized assistance and care to each person who needs their assistance	32.2258	0.0000***
Employees are aware of the needs of all people who require their services	31.2359	0.0000***
Equipment used by employees are appropriate enough for routine operations	30.0123	0.0000***

Legend: Significance levels at * P<0.05; ** P<0.01; *** P<0.001

It can be seen from Table 3 that all 10 factors are highly significant at the 1% level of significance. This is because all 10 P-values are significantly smaller than 1% = 0.01. The Pearson chi-square test of association is commonly used as a screening tool in cases where the number of variables of study is large. The results obtained above in Table 3 were used for subsequent analysis was done by using factor analysis. As part of

SERVQUAL analysis, comparison was made among paired samples by using the two-sample paired t-test. The comparison made was between the perceptions and expectations of respondents on the quality of sanitary services that were provided to them by employees of the City of Tshwane. All paired t-tests were performed at the 5% level of significance. At the 5% level, true average differences between the two groups being compared with each other were said to be significant if the P-value was less than 0.05. True average differences between the two groups being compared with each other were said to be insignificant if the P-value was greater than or equal to 0.05.

The Cronbach Alpha test [24] was used for ensuring reliability and internal consistency in the measurement tools used for the assessment of expected and perceived values from respondents. Table 4 shows estimated Cronbach Alpha coefficients for expected and perceived values. It can be seen from the table that all estimated coefficients for expected and perceived values by respondents have magnitudes of 75% or above. It can also be seen from the table that estimated coefficients for expected and perceived values were fairly well similar with each other. This shows that the tools used for the assessment of expected and perceived values of the 5 dimensions in the study (reliability, assurance, tangibles, empathy and responsiveness) were fairly highly reliable and suitable for the purpose of the study [25].

Table 4: Cronbach Alpha coefficients for expected and perceived values

Dimension	Number of items	Coefficients for expected values	Coefficients for perceived values
Reliability	4	0.8011	0.8109
Assurance	5	0.7845	0.7902
Tangibles	4	0.7759	0.7784
Empathy	5	0.7616	0.7688
Responsiveness	4	0.7584	0.7596

Table 5 shows estimated gap scores for expected and perceived values. A gap score is defined as the difference between the mean of perceived and expected values [25].

Gap score = Perception mean score – Expectation mean score

$$Average\ \ gap\ \ score = \frac{\sum_{i=1}^{k}\left(\overline{P}_i - \overline{E}_i\right)}{k}$$ where k denotes the number of items used for assessment of dimensions. In this study, the statistical significance of gap scores was assessed by using P-values obtained from the two-sample paired t-test [24]. At the 5% level of significance, a gap score is said to be statistically significant is the P-value is less than 0.05. If the P-value is greater than or equal to 0.05, a gap score is said to be statistically insignificant. Table 5 shows gap scores estimated from analyses. It can be seen from the table that 20 of the 22 gap scores were significant at the 5% level of significance. There were only 2 items (out of a total of 22 items) that did not produce significant gap scores. These 2 items were items 2 and 3 of the dimension on tangibles. Item 2 of the dimension on tangibles was an assessment on the degree of suitability of the equipment used by employees of the City of Tshwane. Item 3 of the dimension on tangibles was an assessment on the degree of physical fitness of employees of the City of Tshwane for carrying out sanitary services effectively. With the expectation of the 2 gap scores corresponding to these 2 items, all other gap scores (20 out of 22) were statistically significant at the 5% level of significance. At

the 5% level of significance, the results show a significant disparity between expected and perceived values. As such, the City of Tshwane must make the initiative to let stakeholders know more about the sanitary services that are routinely provided to the community as a means of increasing awareness and appreciation about the quality of services provided, and to enable members of the community to utilize the services optimally [25].

Table 5: Estimated gap scores for expected and perceived values

DIMENSION	Item	EXPECTATION MEAN SCORE	PERCEPTION MEAN SCORE	GAP SCORE (P – E)	P-value
Reliability	1	1.378446	1.486729	-0.108	0.0000
	2	1.302558	1.504429	-0.202	0.0000
	3	1.296529	1.423322	-0.127	0.0000
	4	1.281149	1.412654	-0.132	0.0000
Total		**5.258682**	**5.827134**	**-0.568**	
Average gap score [Total of (P – E) / 4]				**0.14211**	
Assurance	1	1.227654	1.325523	-0.098	0.0000
	2	1.201155	1.341121	-0.140	0.0000
	3	1.192245	1.323426	-0.131	0.0000
	4	1.230524	1.314987	-0.084	0.0000
	5	1.202646	1.392145	-0.189	0.0000
Total		**6.054224**	**6.697202**	**-0.642**	
Average gap score [Total of (P – E) / 5]				**-0.1284**	
Tangibles	1	1.240012	1.400567	-0.161	0.0000
	2	1.271359	1.363521	-0.092	0.0000
	3	1.281456	1.308090	-0.027	0.0001
	4	1.285677	1.387540	-0.102	0.0001
Total		**5.078504**	**5.459718**	**-0.382**	
Average gap score [Total of (P – E) / 4]				**0.09550**	
Empathy	1	1.284417	1.420608	-0.136	0.0001
	2	1.215674	1.352642	-0.137	0.0000
	3	1.194687	1.431257	-0.237	0.0000
	4	1.220048	1.419080	-0.199	0.0000
	5	1.192671	1.362358	-0.170	0.0000
Total		**6.106945**	**6.985945**	**-0.879**	
Average gap score [Total of (P – E) / 5]				**-0.1758**	
Responsiveness	1	1.281456	1.482564	-0.201	0.0001
	2	1.262328	1.362546	-0.100	0.0001
	3	1.251169	1.435687	-0.185	0.0000
	4	1.291567	1.552648	-0.261	0.0001
Total		**5.086445**	**5.833445**	**-0.747**	
Average gap score [Total of (P – E) / 4]				**-0.1868**	

Table 6 compares male and female respondents with regards to the 5 dimensions (reliability, assurance, tangibles, empathy, and responsiveness) based on group mean scores and P-values obtained from two-sample t-tests.

Table 6: Comparison of dimensions with regards to gender based on t-tests

Dimension	Mean score for male respondents	Mean score for female respondents	P-value
Reliability	0.229	0.212	0.4609
Assurance	0.163	0.287	0.0083**
Tangibles	0.104	0.096	0.8541
Empathy	0.229	0.212	0.6779
Responsiveness	0.196	0.218	0.5510

Legend: Significance levels at * P<0.05; ** P<0.01; *** P<0.001

It can be seen from the table that male and female respondents differed significantly at the 1% level of significance with regards to assurance values. Table 7 compares 4 age categories of respondents with regards to the 5 dimensions (reliability, assurance, tangibles, empathy, and responsiveness) based on group mean scores and P-values obtained from the one-way Analysis of Variance (ANOVA) test. The one-way ANOVA test is appropriate for comparison as the number of age categories is more than 2, and the variables of comparison are continuous [24].

Table 7: Comparison of dimensions with regards to age category

Dimension	Mean score for respondents 20 years old or younger	Mean score for respondents 21 to 30 years of age	Mean score for respondents 31 to 50 years of age	Mean score for respondents 51 years of age or older	P-value
Reliability	0.112	0.124	0.279	0.212	0.0149*
Assurance	0.107	0.180	0.281	0.260	0.0566
Tangibles	0.004	0.078	0.164	0.120	0.0517
Empathy	0.150	0.228	0.235	0.250	0.4435
Responsiveness	0.088	0.306	0.211	0.127	0.0001***

Legend: Significance levels at * P<0.05; ** P<0.01; *** P<0.001

It can be seen from the gap scores of reliability and responsiveness differed significantly by age category at the 1% level of significance. The difference with regards to reliability gap scores is attributed to differences between age categories (21 to 30) and (31 to 40) based on a P-value of 0.028 < 0.05 obtained from Bonferroni's test (Hair, Black, Babin & Anderson, 2010). The difference with regards to responsiveness gap scores is attributed to differences between age categories (20 or less) and (21 to 30) based on a P-value of 0.000 < 0.05 as well as age categories (21 to 30) and (51 or above) based on a P-value of 0.003 < 0.05 obtained from Bonferroni's test. Factor analysis (Field, 2013: 134-158) was used for identifying influential predictors of perception and expectation. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was used in order to test the adequacy of the sample used for factor analysis, and the test gave an estimated KMO value of 0.849 = 84.9%, a figure that is greater than 75%. This large figure indicates that results estimated from factor analysis for perception are fairly well reliable. Bartlett's test of Sphericity was used for testing the adequacy of the correlation matrix, and gave an observed chi-squared value of 1046.777 (very large value) with 229 degrees of freedom (very large degrees of freedom) and a P-value of 0.000 (a P-value that is much smaller than 0.05). These estimated figures show that the use of factor analysis for identifying key predictors of perception is fairly well justified and appropriate.

Table 8: Estimates obtained from the KMO and Bartlett's test for perception

Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy	0.849
Observed value of chi-square statistic for KMO test	1046.777
Bartlett's Test of sphericity Degrees of freedom	229
P-value for Bartlett's Test of sphericity Degrees of freedom	0.000

The principal axis factoring method was used for estimating communalities for 4 influential predictors of perception. Table 9 shows the communalities estimated for the 4 influential predictor variables of perception.

Table 9: Communalities extracted for 4 influential predictors of perception

Variable of study	Extraction based on principal component analysis
Employees do not discriminate based on the personal characteristics of customers	0.701
Employees are aware of the needs of all people who require their services	0.684
Employees are highly punctual and effective at what they do for the community	0.574
Employees provide individualized assistance and care to each person who needs their assistance	0.536

Table 10 shows estimated Eigen values [26] and percentages of explained variation for the 4 key predictors of perception. Based on results obtained from factor analysis for expectations, the expectation of respondents on the quality of sanitary services that were provided to them was significantly influenced by 4 key predictors of perception. These 4 predictor variables were the ability of employees not to discriminate among customers based on personal characteristics, the ability of employees to be aware of the needs of all people who require their services, the ability of employees to be punctual and effective, and the ability of employees to provide individualized assistance and care to each person who needs their assistance, in a decreasing order of strength. It can be seen from the table that the cumulative variation explained by the 4 influential variables is equal to 77.448%, a figure which is larger than 75%. This indicates that the 4 extracted factors account for variability in perception adequately enough.

Table 10: Eigen values estimated from factor analysis for perception

Variable	Eigen value	Percentage of explained variance	Cumulative percentage of explained variance
Employees do not discriminate based on the personal characteristics of customers	2.889	30.119	30.119
Employees are aware of the needs of all people who require their services	2.809	15.884	46.003
Employees are highly punctual and effective at what they do for the community	2.771	15.449	61.452
Employees provide individualized assistance and care to each person who needs their assistance	2.003	15.996	77.448

4 Discussion of results

The study has found that 84.37% of the 1, 012 respondents who took part in the study were satisfied with the overall quality of sanitary services that were provided to them by the City of Tshwane. Only 15.63% of respondents were not satisfied with the overall quality of services provided to them. The study showed that most of the respondents had a positive perception on the quality of routine sanitary services such as water and lights and waste removal by employees of the City of Tshwane. The study found that as many as 87.13% of respondents had a positive perception about the degree of commitment shown to them by employees of the City of Tshwane. Based on results obtained from SERVQUAL analysis, 20 of the 22 gap scores were found to be significant at the 5% level of significance. There were only 2 items (out of a total of 22 items) that did not produce significant gap scores. These 2 items were items 2 and 3 of the dimension on responsiveness. Item 2 of the dimension on responsiveness was an assessment on the degree of suitability of the equipment used by sanitary employees for carrying out routine services. Item 3 of the dimension on responsiveness was an assessment on the degree of physical fitness of employees of the City of Tshwane for carrying out routine sanitary services effectively. With the expectation of the 2 gap scores corresponding to these 2 items, all other gap scores (20 out of 22) were statistically significant at the 5% level of significance.

Based on results obtained from factor analysis, the perception and expectation of respondents on the quality of sanitary services that were provided to them were significantly influenced by 4 key predictors of perception. These 4 predictor variables were the degree of motivation of employees of the City of Tshwane at work, the ability of employees of the City of Tshwane to treat all customers with respect, the ability of employees of the City of Tshwane to provide adequate answers promptly to queries raised by customers, and the degree to which employees of the City of Tshwane were skilled on technical issues, in a decreasing order of strength. Similar results were obtained from logit analysis. The results showed that the perception and expectation of respondents were influenced by similar variables of study. The key finding of the study is that 854 of the 1, 012 respondents who were selected for the study (84.37%) had a positive overall perception on the quality of sanitary services provided to them by employees of the City

of Tshwane. Only 158 of the 1, 012 respondents (15.63%) had an overall negative perception. The study also showed that 92.66% of respondents had a positive perception about the degree to which employees of the City of Tshwane were appropriately qualified for the work they had to do for the community. The percentage of respondents who had a negative expectation was only 7.34%. The study showed that 95.55% of respondents had a positive perception about the degree to which employees of the City of Tshwane provide individualized assistance and care to people who need their assistance. The percentage of respondents who had a negative expectation was only 4.45%. Based on results obtained from the two-sample paired t-test, 20 of the 22 gap scores used in the study were significant at the 5% level of significance. There were only 2 items (out of a total of 22 items) that did not produce significant gap scores. These 2 items were items 2 and 3 of the dimension on tangibles. Item 2 of the dimension on tangibles was an assessment on the degree of suitability of the equipment used by employees of the City of Tshwane. Item 3 of the dimension on tangibles was an assessment on the degree of physical fitness of employees of the City of Tshwane for carrying out sanitary services effectively. With the expectation of the 2 gap scores corresponding to these 2 items, all other gap scores (20 out of 22) were statistically significant at the 5% level of significance. At the 5% level of significance, the results show a significant disparity between expected and perceived values [25]. As such, the City of Tshwane must make the initiative to let stakeholders know more about the sanitary services that are routinely provided to the community as a means of increasing awareness and appreciation about the quality of services provided, and to enable members of the community to utilize the services optimally.

Gap scores estimated from the paired t-test showed that the gap scores of reliability and responsiveness differed significantly by age category at the 1% level of significance. The difference with regards to reliability gap scores is attributed to differences between age categories (21 to 30) and (31 to 40) based on a P-value of $0.028 < 0.05$ obtained from Bonferroni's test [26]. The difference with regards to responsiveness gap scores is attributed to differences between age categories (20 or less) and (21 to 30) based on a P-value of $0.000 < 0.05$ as well as age categories (21 to 30) and (51 or above) based on a P-value of $0.003 < 0.05$ obtained from Bonferroni's test. Results obtained from factor analysis for expectations showed that the expectations of respondents on the quality of sanitary services that were provided to them were significantly influenced by 4 key predictors of perception. These 4 predictor variables were the ability of employees not to discriminate among customers based on personal characteristics, the ability of employees to be aware of the needs of all people who require their services, the ability of employees to be punctual and effective, and the ability of employees to provide individualized assistance and care to each person who needs their assistance, in a decreasing order of strength. Similar findings were obtained from binary logistic regression analysis [27]. Studies conducted by the World Bank [28], Buckley and Ghauri [29], Alexander [30], Akinboade, Mokwena and Kinfack [31], [32], [33], [34], [35], [36], [37], [38], [39], [40] have shown that failure to provide satisfactory sanitary and waste management services to ratepayers, inhabitants and entrepreneurs living and conducting business in major metropolitan centres such as the City of Tshwane often leads to municipal protests over poor service delivery, and failure to attract viable business enterprises into South Africa. King (2014) has published a code of good corporate governance and leadership that should be followed by all municipal officials, project leaders and civil servants working in the 205 local municipalities in South Africa [41, 42].

Results obtained from factor analysis for perceptions showed that the perceptions of respondents on the quality of sanitary services that were provided to them were significantly influenced by 4 key predictors of perception. These 4 predictor variables were the ability of employees not to discriminate among residents based on the personal characteristics of customers, the ability of employees to be aware of the needs of all people who require their services, the ability of employees to be punctual and effective at what they do for the community, and the ability of employees to provide individualized assistance and care to each person who needs their assistance, in a decreasing order of strength. Results obtained from logit analysis showed that the degree of satisfaction of customers with the quality of sanitary services provided to them was significantly influenced by 4 predictor variables. These predictor variables were the degree of motivation of employees of the City of Tshwane at work, the ability of employees of the City of Tshwane to treat all customers with respect, the ability of employees of the City of Tshwane to provide adequate answers promptly to queries raised by customers, and the degree to which employees of the City of Tshwane were skilled on technical aspects of their job.

REFERENCES

[1] Aguilar, O. M., & Krasny, M. E. (2011). Using the Communities of Practice Framework to Examine an after-School Environmental Education Program for Hispanic Youth. Environmental Education Research, *17*(2), 217–233.

[2] Brown, B. A. (2011). Isn't That Just Good Teaching? Disaggregate Instruction and the Language Identity Dilemma." *Journal of Science Teacher Education, 22*(8), 679–704.

[3] Carmi, N., Arnon, S., & Orion, N. (2015). Transforming Environmental Knowledge into Behavior: The Mediating Role of Environmental Emotions. *The Journal of Environmental Education, 46*(3), 183–201.

[4] Fauconnier, A., & Mathur-Helm, B. (2013). Black economic empowerment in the South African industry: A case study of Exxaro limited. *South African Journal of Business Management, 39*(4), 1-14.

[5] Elliot, R., & Boshoff, C. (2013). The influence of organisation factors in small tourism businesses on the success of internet marketing. *Management Dynamics, 14*(3), 44 -58.

[6] Fletcher, R. (2012). Using the Master's Tools? Neoliberal Conservation and the Evasion of Inequality. *Development and Change,* 43(1), 295–317.

[7] Forestelli, R. M., & Angulo-Aguilar, J. E. (2013). *Panorama socioconómico de los cantones de Osa & Golfito: tendencias y desafíos para el desarrollo sostenible*. Stanford, CA: INOGO, Stanford Woods Institute for the Environment.

[8] Gruenewald, D. A., & Smith, G. A. (2014). *Place-based Education in the Global Age: Local Diversity*. New York: Routledge.

[9] Hunt, C. A., Durham, W. H., Driscoll, L., & Honey, M. (2015). Can Ecotourism Deliver Real Economic, Social, and Environmental Benefits? A Study of the Osa Peninsula, Costa Rica. *Journal of Sustainable Tourism, 23*(3), 339–357.

[10] Grant, R. M. (2013). The Resource-based Theory of Competitive Advantage. *California Management Review,* 33(3), 114-135.

[11] Bloodgood, J. M. (2012). Organizational routine breach response and knowledge management. *Business Process Management Journal, 18*(3), 376-399.

[12] Boyne, G. J. O., John, P., & Petrovsky, N. (2010). Does public service performance affect top management turnover? *J Public Adm Res Theory, 20*(2), 261-279.

[13] Hood, C., & Dixon, R. (2010). The political payoff from performance target systems: no-brainer or no- gainer? *J Public Adm Res Theory, 20*(2), 281-298.

[14] Bhatt, G. D., & Grover, V. (2013). Types of Information Technology Capabilities and Their Role in Competitive Advantage: An Empirical Study. *Journal of Management Information Systems, 22*(2), 253-277.

[15] Globerman, S., Mike, W. P., & Daniel, M. S. (2011). Corporate governance and Asian companies. *Asia Pacific Journal of Management, 28*(1), 1-14.

[16] City of Tshwane. 2017. *Annual report on the City of Tshwane for 2015/2016*. Pretoria: City of Tshwane. Retrieved from http://www.tshwane.gov.za/AboutTshwane/

[17] Jambeck, J.R., Geyer, R., Wilcox, C., Siegler, T. R., Perryman, M., Andrady, A., Narayan, R., & Law, K. L. (2015). Plastic waste inputs from land into the ocean. *Science*, *347*(6223), 768-771.

[18] Lohri, C.R., Camenzind, E. R., & Zurbrugg, C. (2014). Financial sustainability in municipal solid waste management–Costs and revenues in Bahir Dar, Ethiopia. *Waste Management*, *34*(2), 542-552.

[19] Worku, Y., Snyman, J., & Muchie, M. (2014). The management of municipal solid waste generated by businesses operating in the city of Tshwane, South Africa. *European Journal of Engineering and Technology*, *2*(2), 77-106.

[20] Karlstrom, H., & Finstad, T. (2013). The Stedegenhet of Nordic STS. *Nordic Journal of Science and Technology, 1*(1), 5-11.

[21] Zeithaml, V., Bitner, M. J., & Gremler, D. (2009). *Service Marketing: Integrating Customer Focus Across the firm. 5th ed*. Boston: McGraw International.

[22] Meeusen, R. (2014). Exercise, nutrition and the brain. *Sports Medicine*, *44*(1), 47-56.

[23] South African Auditor-General. (2017). *Audit report on Tshwane municipal service delivery for the financial year 2015/2016.* Retrieved from http://hsf.org.za/resource-centre/ Pretoria: South African Auditor-General.

[24] Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate Data Analysis: A Global Perspective*. London: Pearson.

[25] Parasuraman, A. (1998). Customer service in business-to-business market. *Journal of Business and Industrial Marketing, 13*(1), 310-321.

[26] Field, A. (2013). *Discovering Statistics Using IMB SPSS Statistics. 3rd ed*. London: SAGE Publications.

[27] Hosmer, D. W., & Lemeshow, S. (2013). *Applied Logistic Regression Analysis.* New York: John Wiley & Sons.

[28] World Bank. (2015). *World development report: making services work for poor people.* Washington DC: World Bank.

[29] Buckley, P. J., & Ghauri, P. N. (2012). Globalisation, Economic Geography and the Strategy of Multinational Enterprises. *Journal of International Business Studies, 35*(2), 81-98.

[30] Alexander, P. (2010). Rebellion of the poor: South Africa's service delivery protests–a preliminary analysis. *Review of African Political Economy, 37*(123), 25-40.

[31] Akinboade, O. A., Mokwena, M. P. & Kinfack, E. C. (2013). Understanding citizens' participation in service delivery protest in South Africa. *International Journal of Social Economics, 40*(5), 461-462.

[32] Khale, S., & Worku, Z. (2013). Factors that affect municipal service delivery in Gauteng and North West Provinces of South Africa. *African Journal of Science, Technology, Innovation and Development, 2*(3), 61-70.

[33] Khale, S., & Worku, Z. (2015). Benefits of good corporate governance principles: A study of the City of Tshwane, South Africa. *Journal of Corporate Governance and Control, 13*(1), 753-770.

[34] Worku, Z. (2015). Barriers to the development of entrepreneurial activities in newly established small, micro and medium-sized enterprises in Tshwane. *Journal of Corporate Ownership and Control, 3*(12), 332-340.

[35] Municipal IQ Hotspot Monitor. (2017). *Press Release: Municipal IQ's Municipal Hotspots results for 2016.* Pretoria: Municipal IQ Hotspot Monitor. Retrieved from http://www.municipaliq.co.za/

[36] Statistics South Africa. (2017). *Fast facts and figures*. Retrieved from www.statssa.gov.za Pretoria: Statistics South Africa.

[37] Kovacevic, N. (2012). Righting wrongs: Affirmative action in South Africa. *Harvard International Review, 6*(1), 12-15.

[38] Dzansi, D. Y., Dzansi, L. W. (2010). Understanding the impact of human resource management practices on municipal service delivery in South Africa: An organizational justice approach. *African Journal of Business Management*, *4*(6), 995- 1005.

[39] Fahlenbrach, R., & Stulz, R. M. (2011). Bank CEO incentives and the credit crisis. *Journal of Financial Economics, 99*(1), 11–26.

[40] City of Cape Town. (2017). *Annual report on the City of Cape Town for 2015/2016*. Cape Town: City of Cape Town. Retrieved from http://www.capetown.gov.za/en/reports/Pages/default.aspx

[41] Khale, S. (2015). Assessment of the quality of municipal services in the City of Tshwane, South Africa. *Journal of Corporate Governance and Control, 13*(1), 678- 695.

[42] King, M. E. (2014). *The King report on corporate governance for South Africa*. Johannesburg: Institute of Directors in Southern Africa.

