"CONSUMER SATISFACTION TOWARDS REVERSE OSMOSIS SYSTEM" - AN ANALYTICAL APPROACH

Dr. (Mrs.).T.Jeyanthi Vijayarani, M.Com., Ph.D.,
Associate Professor, Research Centre of Commerce, Fatima College, Madurai

P.Sindhujoy M.Com(CA)., M.Phil.,
Assistant Professor, Department of Commerce, Lady Doak College, Madurai

Abstract

In India nearly 80% people die due to water related diseases. Both urban and rural areas in India are suffering from scarcity of clean water for domestic use. Customer satisfaction is a term frequently used in marketing. It is a measure of how products and services supplied by a company meet or surpass customer expectation. This study is all about consumer satisfaction towards Reverse Osmosis water purification system in Madurai city.

Introduction

Water is the resource that covers almost three quarters of planet and upon which all life depends. The water available from untreated sources such as well and boreholes is not hygienic and safe drinking water. Thus it is necessary to purify the water. Consumer plays a vital role in working towards the level of satisfaction. Level of satisfaction is measured by a full array of features. It is consumer who will decide where the firm is heading. Thus the challenge before the manufacturer is to ensure that they satisfy every customer. The manufacturers have to create a positive attitude towards the product and render service to satisfy the consumer need and wants. Hence an attempt is made to find out the persons satisfaction level of RO water purification system.

Statement of the Problem

Water is a vital fluid essential for human existence on the globe. According to World Health Organisation, around 1.1 billion people globally do not have access to improved water supply sources. Addressing the problem of purifying contaminated water requires water purification system that is simple, reliable, affordable, sustainable and effective technology must be paired with concern for environment and public health in order deal with the need for a fast inexpensive and energy conserving method of water purification. For improving the quality of drinking water, water treatment equipment or purification system that is the best equipped to eliminate the impurities present in the water, is installed in houses. In this context an attempt has been made to study the consumer satisfaction towards RO system.

Objective of the Study

The prime objective of the study is to analyse consumer satisfaction towards Reverse Osmosis (RO) water purification system.

Hypothesis of the study

To give specific focus to the objectives, a few hypotheses have been drawn up and tested using appropriate statistical tools.

- There is no significant relationship in ranks assigned by different respondents regarding the factors influencing the installation of RO system.
- There is no relationship between the income of the respondents and installation cost of RO system.
- There is no relationship between educational qualifications and awareness of waterborne diseases.
- There is no relationship in ranks assigned by different respondents regarding the promotional measures considered for Reverse Osmosis water purification system.

Research Design and Methodology

The research design adopted for this study is descriptive research design. They are studies concerned with describing characteristics of a particular individual or a group. The study includes only primary data. The data have been collected from 150 respondents through questionnaire method in Madurai city on the basis of convenience sampling method.

Frame Work of Analysis

Percentage analysis, Chi-square test, Garrett's Ranking Technique, Kendall's coefficient of concordance, Intensity value and Factor Analysis is used to analyze the primary data.

Analysis and Results

Age Wise Classification

Age of the respondents is one of the most important characteristics in understanding the respondents' views and also to examine the responses. Age shows the maturity and the experience of the respondents and the need and the interest for any product often vary with the consumer's age. Age is considered as a useful demographic variable for distinguishing segments and to indicate the relative position in the marketing environment. The age of the respondents are furnished in table 1.

Table - 1 Age-wise classification

Age	Number of respondents	Percentage
Upto 20	17	11.33
20 to 40	82	54.67
40 to 60	41	27.33
Above 60	10	6.67
Total	150	100

Source: Primary data

Table 1 shows that out of 150 respondents 82 (54.67%) of the respondents belong to the age category of 20 – 40 years. In the category of 40 – 60 years, there were 41 (27.33%) respondents. The other, 17 (11.33%) respondents of them belongs to the age category of upto 20 years and the remaining 10 (6.67%) respondents belong to the age category of above 60 years. **Income wise classification**

Income of a person plays an important role in shaping the economic conditions of an individual. Income is a very important distinguishing demographic variable because it indicates the capacity or ability of the consumers to purchase the product. Income is an economic indicator, which determines not only the levels of living but also the economic status of a family. Table 1 shows income wise classification of the respondents.

Table – 2 Income-Wise Classification

Monthly Income	Number of Respondents	Percentage
Upto Rs.15000	75	50.00
Rs.15000-30000	29	19.33
Rs.30000-45000	20	13.33
Rs.45000-60000	12	8.00
Above Rs.60000	14	9.33
Total	150	100.00

Source: Primary data

It is inferred from table 2 that the highest percentage (50%) of the respondents belong to the income group of upto Rs.15000. Followed by the above,19.33 per cent of the respondents belong to the income group of Rs.15000-30000. Next 13.33 per cent of the respondents belong to the income group of Rs.30000-45000. Then 9.33per cent of the respondents come under the category of above Rs.60000 and finally 8 per cent of the respondents are in the category Rs.45000-60000.

Educational Qualification

Education is one of the most important characteristics that might affect the person's attitudes and the way of looking and understanding any particular social phenomena. The response of an individual can be determined by his educational status and therefore it is imperative to know the educational background of the respondents. Education grips the mind of the young and the old and has the power to determine the purpose for which knowledge and experience can be used to create new attitude to install the RO system. Table 3.3 shows the educational qualification of the respondents.

Table – 3 Educational Qualification

Educational Qualification	Number of Respondents	Percentage
Upto higher Secondary	21	14
Bachelor's Degree	68	45.33
Master's Degree	20	13.33
Professional Degree	36	24
No formal Education	5	3.33
Total	150	100

Source: Primary data

From table 3 it is observed that, majority of the respondents 68 (45.33%) have completed their Bachelor's Degree. Nearly 36 (24%) have completed Professional Degree and 20 (13.33%) have completed their Higher Secondary. Only 21 (14%) out of 150 respondents have completed Master's Degree. The least score of 5 (3.33%) respondents are illiterate.

Reasons for Opting RO system

The market is flooded with products that claim to provide clean water. The aim of usage of any product is to give satisfaction to the consumers. The dissatisfaction with the product may enable the consumers to opt other product. The reasons for opting RO system is given in table 2.

Table – 4 Reasons for Opting RO System

Reasons	Number of respondents	Percentage
Safe drinking water	39	26
Reduces waterborne diseases	37	24.67
Removes chemicals	9	6
Increases the taste of water	28	18.67
High cost of buying bottled water	37	24.67
Total	150	100

Source: Primary data

From table 4 it is revealed that, 26 percent respondents have opted RO system as it provide safe drinking water. Nearly 25 per cent of the respondents have equally opined that RO reduces water borne diseases and the high cost of bottled water is the reasons for opting RO system.

Factors Influencing the Installation of RO System

Factors play an important role in affecting consumer buying behaviour. Some of those factors which influence the consumers to install Reverse Osmosis system are; reasonable price, quick installation, easy maintenance, warranty and payment in installments. Factors that influence the installation of RO system are given in the table 5.

Table 5 Factors influenced to install Reverse Osmosis system

Factors	Number of respondents					Mean Rank
	1	2	3	4	5	
Reasonable price	30	19	41	37	23	3.02
Quick installation	43	24	37	18	28	2.76
Easy maintenance	31	29	28	25	37	3.05
Warranty	14	49	22	28	37	3.16
Payment in installments	32	28	21	43	26	3.01

Source: Primary data

H_o- There is no significant relationship in ranks assigned by different respondents regarding the factors influenced to install RO system.

Friedman test is undertaken to find the relationship in ranks assigned by the respondents.

Table 5

Degrees of freedom	Calculated value	Table value
4	9.69	9.49

As the Calculated value is greater than the table value, it is inferred that there is a significant relationship in ranks assigned by different respondents for the factors influencing the installation of RO system.

Installation Cost of RO System

Cost is an important factor which is primarily considered while purchasing a product. The installation cost RO system is presented in table 6.

Table – 6 Installation Cost

Cost	Number of respondents	Percentage
Upto Rs.5,000	17	11.33
Rs.5,000-10,000	70	46.67
Rs.10,000-15,000	27	18
Above Rs.15000	36	24
Total	150	100

Source: Primary data

From table 6, it is inferred that 70 (46.67%) respondents have spent between Rs.5,000 and 10,000 to install the RO system. Nearly 36(24%) respondents have incurred more than Rs.15,000 and 27 respondents have met the cost of installation between Rs.10,000 and Rs.15000. Only 17 respondents have spent upto Rs.5,000 on installation.

Income and Installation Cost of RO System

To find out the relationship between income and the installation cost chi-square test is used. The result of Chi-square test is presented in table 6.1.

H_o- There is no relationship between the income of the respondents and installation cost of RO system

Table 6.1

Degrees of Freedom	Level of Significance	Calculated value	Table value
12	5%	53.399	21.026

Since the calculated value (53.399) at 5% level of significance (d.f = 12) is greater than the Table value (21.026), the null hypothesis is rejected. Thus it is inferred that, there is a relationship between income and the installation cost.

Features of Reverse Osmosis System

Reverse osmosis, is the finest filtration available today and it is the most common treatment technology used by premium bottled water companies. RO is effective in

eliminating or substantially reducing a very wide array of contaminants, and of all technologies used to treat drinking water in residential applications. A Reverse Osmosis Unit, depending on the style, contains one, two or more activated carbon filters for the removal of organic chemicals, chlorine and its by-products, pesticides[1]. The features of RO system is shown in table 7.

Table – 7 Features of RO system

Features	Number of respondents					Garret's Score	Average Score	Rank
	1	2	3	4	5			
Reduces Total Dissolved Solids	57	53	24	8	8	9487	63.25	I
Reduces bacteria and virus	37	28	42	24	19	8731	58.21	II
Removes organic contaminants	24	28	13	49	36	8394	55.96	IV
Reduces harmful impurities	26	20	49	36	19	7176	47.84	V
Reduces suspended impurities	6	21	22	33	68	8482	56.55	III

Source: Primary data

From table 7, it is inferred that, Total Dissolved Solids is the first feature with the Garret's score of 9487.RO reduces bacteria and virus is the second feature cited by the respondents with the Garret's score of 8731. reduces suspended impurities is in third place with the Garret's score of 8482, removes organic contaminants takes fourth place with the Garret's score of 8394 and reduces harmful impurities is in last place with the Garret's score of 7176.

Level of Satisfaction for RO System

Customer satisfaction measures how well the expectations of a customer concerning a product or service provided by your company have been met. Consumer purchase is always associated with a perceived level of satisfaction which they expect to get it from the purchase they make. The performance of product forms short of expectations the customer dissatisfied. If the performance matches expectations the customer is satisfied. If the performance exceeds expectations, the customer is highly satisfied or delighted. The respondents were posed with the question to state the level of satisfaction with the following option mentioned in table 8.

Table – 8 Level of satisfaction for RO system

Factors	SA	A	NO	DA	SDA	Intensity value	Rank
Ample variety	33	67	39	11	-	572	IV
Performance	20	95	31	4	-	581	III
Price	30	44	67	8	1	544	V
Model	26	56	53	15	-	543	VI
Storage capacity	28	90	27	4	1	590	II
Warranty	41	78	22	7	2	599	I

Source: Primary data

The table 8 shows that, warranty is the first factor cited by the respondents for their satisfaction with the intensity value of 599. The respondents are satisfied with the storage capacity of RO system and is ranked second with the intensity value of 590.Next to that the respondents are satisfied with performance of RO system. Fourth rank is given with the availability of varieties with the intensity value of 572. Price is the fifth factor ranked by the respondents. Model of RO system is the last factor mentioned with the intensity value of 543.

Age and Level of Satisfaction

To find out the relationship between age of the respondents and level of satisfaction for reverse osmosis system Chi-square test is applied. The result of Chi-square test is presented in table 9.

H_o – There is no relationship between age of the respondents and level of satisfaction for reverse osmosis system.

Table - 9

Degrees of Freedom	Level of Significance	Calculated value	Table value
6	5%	12.254	12.6

Since the calculated value (12.254) at 5% level of significance (d.f = 6) is greater than the table value (12.6), the null hypothesis is accepted. Thus it is inferred that, there is no relationship between age of the respondents and level of satisfaction for reverse osmosis system.

Income and Level of Satisfaction

As the income is the significant determinant, to find out whether the income has any influence on level of satisfaction, Chi-square test is used. The result of Chi-square test is presented in table 10

H_o – There is no relationship between income of the respondents and level of satisfaction for reverse osmosis system.

Table - 10

Degrees of Freedom	Level of Significance	Calculated value	Table value
8	5%	9.504	15.5

Since the calculated value (9.504) at 5% level of significance (d.f = 8) is greater than the table value (15.5), the null hypothesis is accepted. Thus it is inferred that, there is no relationship between duration of using reverse osmosis system and level of satisfaction for reverse osmosis system.

Problems Faced in using RO System

Problem is a matter or situation regarded as unwelcome or harmful and needing to be dealt with and overcome. The problems faced in using RO system is stated in table 11.

Table – 11 Problems faced in using RO system

Problems	Ranks						Garret score	Average score	Rank
	1	2	3	4	5	6			
Frequent change RO membrane	34	18	55	18	11	14	8279	55.19	III
Frequent change of carbon filter	39	59	25	16	6	5	9143	60.95	I
Heavy maintenance	45	23	34	34	8	6	8748	58.32	II
High power consumption	6	21	9	14	45	55	5845	38.97	V
Expected life not met	13	18	21	63	14	21	7168	47.79	IV
More water consumption	12	10	7	7	66	48	5800	38.67	VI

Source: Primary data

It is inferred from table 11 that, frequent change of carbon filter is the first problem ranked by many of the respondents with the garret score 9143. Heavy maintenance and frequent change of RO membrane is ranked second and third with the garret score 8748 and 8279 respectively. Expected life not met is the fourth problem ranked with the score of 7168. High power consumption and more water consumption are ranked fifth and sixth.

Promotional Measures

Promotion is an activity or series of activities that boost the sales of a product or service, usually in the short-term. It is all about the actions a company can take to stimulate customers to buy right now rather than later. The promotional measures considered for RO system is presented in table 12.

Total – 12 Promotional Measures

Measures	Rank						Total
	1	2	3	4	5	6	
Offering safety assurance	22	22	29	33	27	17	150
Bringing quality awareness	60	19	13	27	24	7	150
Lowering the price	27	27	31	29	16	20	150
More varieties	16	25	16	35	23	35	150
Allowing discounts	11	39	23	20	36	21	150
Consistent advertisements	14	18	38	6	24	50	150

Source: Primary data

H_o– There is no significant relationship in ranks assigned by different respondents regarding the promotional measures considered for RO system.

The Kendall's coefficient of concordance (W) is used for judging significant agreement in ranking by different respondents is worked out by using the formula,

$$W = \frac{S}{1/12K^2(N^3 - N)}$$

The calculated value of S = 260.02

W = 0.066

To judge the significance of W the Table value at 5% level significance is 221.4 and the calculated value is 260.02. The calculated value is more than the table value. Hence the null hypothesis is rejected and it is inferred that there is a significant relationship in ranks assigned by different respondents regarding the promotional measures considered for RO system.

Awareness of Waterborne Diseases

Awareness is the ability to perceive, to feel, or to be conscious of events, objects, thoughts, emotions, or sensory patterns. Waterborne diseases are caused by pathogenic microorganisms that most commonly are transmitted in contaminated fresh water. Awareness of waterborne diseases among the respondents is shown in table 13.

Table – 13 Awareness of Waterborne Diseases

Awareness	Number of respondents	Percentage
Yes	131	87.33
No	19	12.67
Total	150	100

Source: Primary data

It is inferred from table 13 that, 131(87.33%) respondents are aware of waterborne diseases and only 19(12.67%) respondents are not aware of waterborne diseases.

Educational Qualification and Awareness of Waterborne Diseases

To find out the relationship between educational qualification and awareness of waterborne diseases Chi-square test is applied. The result of Chi-square test is presented in table 14.

H_o – There is no relationship between educational qualification and awareness of waterborne diseases.

Table – 14

Degrees of Freedom	Level of Significance	Calculated value	Table value
4	5%	9.012	9.488

Since the calculated value (9.012) at per cent level of significance (d.f = 4) is lesser than the Table value (9.488), the null hypothesis is accepted. Thus it is inferred that, there is no relationship between educational qualification and awareness of waterborne diseases.

Opinion on RO System

Opinions of the respondents are grouped based on certain factors. Statements relating to opinion of the respondents towards RO system were given to the respondents and their opinions were obtained. Factor analysis is a technique used in identifying a smaller number of factors underlying a large number of observed variables. The following tables depict the statements with factor loadings.

Factor – I

Statements	Factor loadings
RO system purifies salt water	.954
Removes impurities present in the water	.887
Improves the quality of water	.887

All these statements are related to common factor called 'attributes'. Salt water is desalinated to produce fresh water suitable for human consumption or irrigation[2].It is also clear from the four statements; the first statement that is "RO system purifies salt water" has high factor loadings close to 1. It is interpreted that 95% of the respondents feels that Reverse Osmosis water purification system purifies salt water.

Factor – II

Statements	Factor loadings
Provides safe drinking water	.915
Reduces the effect of waterborne diseases	.738
Eliminates impurities that cause high BP, Kidney stones etc.	.513

All these statements are related to common factor called 'Benefits'. It is also clear from the three statements; the first statement i.e. "RO system provides safe drinking water" has high factor loadings close to 1. It is interpreted that 91% of the respondents feels that Reverse Osmosis water purification system provides safe drinking water.

Factor – III

Statements	Factor loadings
Investment in RO system is worthy	.954
Reduces the scarcity of water	.558

All these statements are related to common factor called 'Usefulness'. It is also clear from the three statements; the first statement i.e. "Investment in RO system is worthy" has high factor loadings close to 1. It is interpreted that 95% of the respondents feels that investment in Reverse Osmosis water purification system is beneficial.

Factor – IV

Statements	Factor loadings
Enhances the taste of water	.775
Electricity consumption is less	.677
Output per hour is high	.628

All these statements are related to common factor called 'Performance'. It is also clear from the three statements; the first statement i.e. "RO system enhances the taste of water" has high factor loadings close to 1. It is interpreted that 77% of the respondents feels that investment in Reverse Osmosis water purification system enhances the taste of water.

Factor - V

Statements	Factor loadings
Drinking purified water is part of healthy life style	.754
Reduces physical strain to carry water	.699
Follow up of technological upgradation	.631

All these statements are related to common factor called 'Technology'. It is also clear from the three statements; the first statement i.e. "Drinking purified water is part of healthy life style" has high factor loadings close to 1. It is interpreted that 75% of the respondents feels that drinking purified water become a part of healthy life style.

Factor - VI

Statements	Factor loadings
RO system is less expensive	.783
Warranty period is adequate	.737
RO system is available with different capacity of storage tank	.604
Reasonable maintenance cost	.599

All these statements are related to common factor called 'facilities'. It is also clear from the three statements; the first statement i.e. "RO system is less expensive" has high factor loadings close to 1. It is interpreted that 78% of the respondents feels that drinking purified water become a part of healthy life style.

Factor - VII

Statements	Factor loadings
Demonstration for RO system is effective	.776
Professional and attractive response	.561

All these statements are related to common factor called 'Effective service'. It is also clear from the two statements; the first statement i.e. "Demonstration of Ro system is effective" has high factor loadings close to 1. It is interpreted that 77% of the respondents feels that demonstration of RO system is effective.

Findings

- Out of 150 respondents 54.67 per cent of the respondents fall in the age group of 20 – 40 years.
- It is noted that per cent of the respondents earn a monthly income upto Rs.15, 000.
- It is captured that 45.33 per cent of the respondents are completed their Bachelor's Degree.
- It is revealed that 26 per cent respondents opted RO system as it provide safe drinking water.

- There is significant relationship in ranks assigned by different respondents regarding the factors influencing the installation of RO system.
- It is observed that 46.67 per cent respondents are spending upto Rs.5, 000 to purchase RO system.
- There is a relationship between the income of the respondents and installation cost of RO system
- The Total Dissolved Solids is the first feature with the Garret's score of 9487.
- It is observed that 50 per cent of the respondents are using RO system for a period 3-6 years.
- It is inferred that warranty is given the first place as the respondents are highly satisfied with the warranty period with the intensity value of 590.
- There is no relationship between age and level of satisfaction for RO system.
- There is no relationship between income and level of satisfaction for reverse osmosis system.
- The frequent change of carbon filter is the first problem ranked by many of the respondents with the garret score 9143.
- There is a significant relationship in ranks assigned by different respondents regarding the promotional measures considered for RO system.
- It is inferred that, 131(87.33%) respondents are aware of waterborne diseases and only 19(12.67%) respondents are not aware of waterborne diseases.
- There is no relationship between educational qualification and awareness of waterborne diseases.

Suggestions

- To overcome the problem of frequent change of RO membrane, measures can be taken by the RO manufacturers to introduce alternative in order to enable the consumers to be relieved from the problem.
- The price of RO system can be made reasonable in comparison with other purifiers.
- Though advertisement is considered as important source of information, respondents can be informed by increasing the use of other sources as well.

Conclusion

This chapter describes consumer satisfaction towards RO system. The opinion of the respondents towards a particular product varies based on their level of satisfaction towards the Reverse Osmosis water purification system.

Reference

1. Bhardwaj, V., &Mirliss, M. J. (2001) "NATIONAL DRINKING WATER CLEARINGHOUSE"
2. Wikipedia. (2011, May 8). Retrieved May 11, 2011, from Water fluoridation: http://en.wikipedia.org/wiki/Water_fluoridation

3. C.R. Kothari, Research Methodology – Methods and Techniques, Second edition (2004).
4. Gupta S.P, 2006' Statistical Methods, New Delhi, Sultan Chands & Sons.
5. Pillai R.S.N., Bagavathi, 2010' Statistical theory and Practice, New Delhi, S. Chand & Company LTD
6. www.aeruswater.com
7. www.safewater.org
8. www.indiawaterportal.org
9. www.nesc.wvu.edu