*J. Appl. Environ. Biol. Sci.*, 7(3)191-198, 2017

ISSN: 2090-4274
Journal of Applied Environmental and Biological Sciences
www.textroad.com

# Profitability Analysis of Reverse Osmosis Drinking Water Plants in Faisalabad, Punjab

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*Received: August 29, 2016*
*Accepted: January 2, 2017*

**ABSTRACT**

The quality of drinking water becomes a question due to urbanization, industrialization and increases in water pollution. Reverse osmosis safe and clean drinking water plants are a way to clean the water and made it fit for drinking. The aim of present study was to check the costs and return involved in the working of safe and clean drinking water plants. Total variable cost was Rs. 900,153.63 per year for medium plant whose capacity of production was 2,000 liters per hour. Total variable cost was Rs. 623,062.55 per year for small plant whose capacity of production was 1,000 liters per hour. Gross margin was Rs. 1,141,633.71 per year on average basis for small plant and it was Rs. 1,808,554.47 per year on an average for medium plant. Net income was Rs. 828,295.60 per year on average basis for small plant and it becomes Rs. 1,355,901.15 per year on an average for medium plant. The benefit cost ratio was 1.89 in case of small plant and shows that the return was Rs. 1.89 on an average for each rupee invested in this business. The benefit cost ratio was 2.00 in case of medium plant and shows that the return was Rs. 2.00 on an average for each rupee invested in this business. It is recommended that it is a beneficial business and there is a need to create awareness among people in order to increase the demand. The increase in demand will provide benefits to existing and new producers but the increase in competition will give the opportunity for consumer to purchase quality product at low price.
**KEY WORDS:** Drinking water plant, reverse osmosis, gross margin, net Income, BCR

## I. INTRODUCTION

Safe drinking water comes from improved water sources comprising public standpipes, household connections, protected dug wells, boreholes, rainwater collections and protected springs. Access means that a person used 20 liters water on daily basis from an improved water source located within 1 kilometer [1]. The primary uses of water for households are for cooking, drinking and washing clothes. Moreover, water is also used for washing floors, watering plants, cleaning vehicles, animals drinking and other related activities [2].

High population, urbanization and inefficient use of water are responsible for gradually falling fresh water resources [3]. Prediction shows that the population of Pakistan will be 228.8 million in 2025 and becomes 295 million in 2050. In 1952, per capita availability of water was 5600 cubic meter while in 2003 it becomes only 1200 cubic meter per capita [4]. The reason behind ground and surface water pollution is by-products of industrial sector such as pesticides, fertilizers, cement, metal, textile, engineering, dying chemicals, power, food processing, leather, petrochemical, steel, construction, sugar processing, mining energy and others related activities. Polluted drinking water had various anions as well as heavy metals like Cr, Cd, Co, Ni, Hg, Zn and Pb which are harmful for human beings [5-6]. In Pakistan, infant deaths due to diarrhea were reported as 45 percent and the figure was 60 percent for infectious waterborne diseases [7].

A popular method for safe and clean drinking water production is the use of reverse osmosis plant. Lindkvist [8] mentioned the advantages of reverse osmosis technique like dissolution of constituents from water without chemicals, disinfection of treated water, removal of natural organic and inorganic matter and environment friendly nature.

Bhattacharyya et al. [9] showed that water system under private ownerships was working more efficiently while districts under self governing water were working less efficiently. Another reason for this increase was examined by Shih et al. [10] that unit costs decrease by 0.16 percent when the production increases by 1 percent.

There is an increase in the industry and market of bottled water within short period. There are 200 registered companies distributed purified drinking water but surprisingly only 27 companies concern about standard and quality [11]. Pakistan Council of Research in Water Resources (PCRWR) is working since 1964 in Pakistan as focal point agency in order to increase and monitor the quality of bottled water. It is an independent

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authority and responsible for conducting, organizing, coordinating and promoting research in all fields of water resources [12]. The procedure of purification of bottled water involved various steps started from collecting water from an appropriate source, filtration, demineralization, blending with salts, aeration, standards conformation testing, bottling and packaging [13]. The complete process flow diagram is as under.

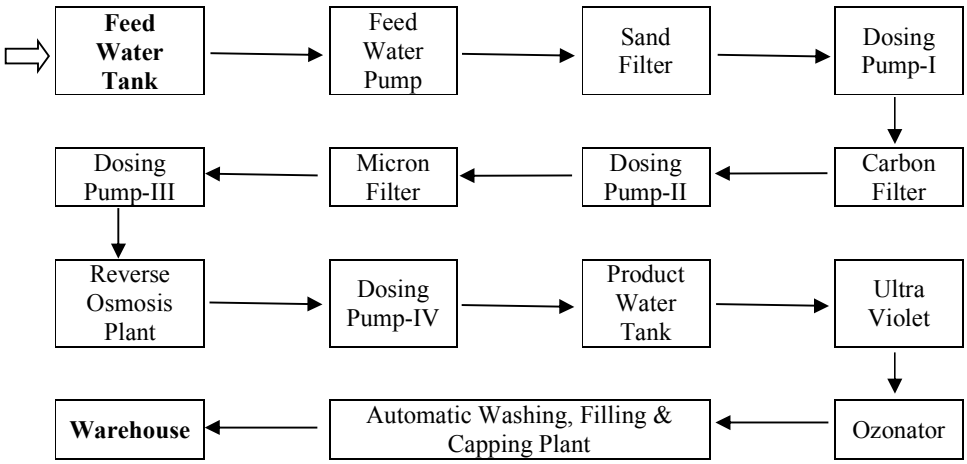


**Fig. 1: Flow diagram of safe drinking water production [13]**

There exists salinity in the ground water of city Faisalabad and is not fit for drinking. The major duty of WASA Faisalabad is to provide clean and safe water which is appropriate for health. Approximately 88.5 Million Gallons per Day (MGD) water is produced by the WASA Faisalabad with the help of various resources [14].

Atikol and Aybar [15] calculated the cost of fresh water production in 1000 $m^3$/day reverse osmosis technology such as cost of electricity, cost of capital, cost of membrane replacement, cost of maintenance and chemical cost. The efficient and new plant showed a cost of 0.68$/$m^3$ while the production cost was 0.86$/$m^3$ for a similar plant outside the study area.

Worthington and Higgs [16] treated Capital and operating costs as a function of microbiological and chemical compliance, water quality, water losses, total connected properties, water main breaks and urban water supplied. For economies of scope, it was cleared that there were significant cost benefits in joint production of treated quality water with less water losses and main breaks. The major cost advantage at each output level was declining water losses.

Government of Pakistan [11] prepared a pre-feasibility report for bottled water production according to standards set by World Health Organization. Safe drinking water was a major problem in Pakistan. In bottled water production, fixed costs were estimated as Rs. 17, 58,000 for 168000 liters/month/192hrs in single shift while working capital costs were Rs. 2, 41, 000 per month. Total capital investment was Rs. 19, 99, 000. Net profit was 1, 56, 927. For eight years project the project cost, IRR, pay-back period were Rs. 2.00 million, 21%, 1.5 years and Rs. 2.00 million respectively. For two years project the project cost, IRR, pay-back period were Rs. 2.00 million, 88%, 1.5 years and Rs. 2.00 million respectively.

Feo et al. [17] estimated the cost involved in the desalination of $m^3$ of water in case of small reverse osmosis plant. Economy of scale was affected by optimum production cost. The cost was 1.5% less for efficient production as compared to normal production.

Indeed, the water supplied by WASA Faisalabad through pipe lines is relatively cheap but it is not in sufficient quantity. The pipe line structure is out dated and mixed with sewerage line in many areas. The pressure is also low and it does not reach in a large number of houses. Some people used electric motor in order to pump the water from pipeline. The installation of electric motor is illegal activity and it further reduces the water pressure. Another problem is that water is available in limited hours especially in summer season. The problem is severe in summer season due to load shedding, so people are unable to use the electric motor. The above reasons forced both quality and quantity oriented consumer to purchase safe drinking water from private sources. Many people purchase water from renders in morning and evening. The water supplied by renders has only sweet taste but the consumer does not known about the quality and they are forced to purchase it due to less purchasing power. However, for quality concerned citizens, private safe drinking water filter plants are also working and delivered quality water to consumers but it is expensive.

Due to the problems cited above, it is required to increase the production of clean drinking water. It is a need of time to enhance the investment in this sector and creation of awareness among consumers. By increasing the number of reverse osmosis drinking water plants, water become available in large quantity and

the presence of more producers creates more competition among producers. As a result of increased competition, water quality will improve and prices will low.

Despite the economic as well as nutritional significance of safe drinking water, complete and updated information in the study area about the economic analysis of reverse osmosis drinking water plant is still not satisfactory. So, the present study is organized to determine the costs and returns involved in safe and clean drinking water production with reverse osmosis plant. The study also explored the gross margin, net income and benefit cost ratio of safe and clean water production with reverse osmosis plant.

## 2. METHODOLOGY

This study was carried out by using a primary data collection from safe and clean drinking water producers those used reverse osmosis plant in city Faisalabad. In an empirical investigation it is impossible to collect information from the whole population [18]. A sample size of 60 is considered as the minimum requirement for larger population that will give reliable results for decision-making [19], cited in [18]. The sample size for current study was 84 safe and clean drinking water producers in city Faisalabad. The producers were categorized in two types on the basis of plant capacity. First category was the producers whose plant capacity was 1000 liters per hour while other category was the producers working on a plant capacity of 2000 liters per hour.

Simple random sampling technique was used for the collection of data in which each unit of the population has an equal chance for selection. Due to the absence of producer's records regarding plant activities, data collection depended on a combination of methods, which rely on memory recall for basic information such as labor use, wages, input costs. Selected respondents were interviewed personally with the help of pre-tested questionnaires. Reverse osmosis drinking water plants were also visited in order to get clear understanding, observations and perceptions about the production in the study area. Data collected was entered, cleaned and analyzed to address the objectives. The software (s) of statistical and econometric analysis SPSS-15 and Microsoft Excel were used for data analysis.

### 2.1 Socio-economic characteristics

Socio-economic characteristics determine the status of an individual. For the purpose of the present study, socio-economic indicators used were age of respondent, education of respondent and experience of respondent in safe and clean drinking water business.

### 2.2 Initial investment in the production of safe and clean drinking water

Initial investment exists in the production of safe and clean drinking water. Break up of total investment is given as:

#### 2.2.1 Reverse osmosis drinking water plant cost

Reverse osmosis drinking water plant cost includes cost on water tanks, membrane vessel, multi-stage high pressure pump, gauges, automatic pressure control valve, flow meter, TDS meter, electric panel, feed pump, sand filter, carbon filter, micron filters, ultraviolet disinfectant system, dozers, motor pump and accessories, and costs on other miscellaneous parts used in the fitting and installation of plant.

#### 2.2.2 Laboratory and quality control cost

Establishment of micro-biological laboratory is necessary in order to maintain the quality of safe and clean drinking water. With the help of laboratory, PH level of drinking water and its chemical composition is examined. Establishment of a proper and standard laboratory is expensive, so many producers does not purchase full laboratory apparatus. They purchase less apparatus or they checked the quality of water from private laboratory analysis.

#### 2.2.3 Bottles cost

The producers purchase empty bottles in order to sell their safe and clean drinking water. These bottles are available in various sizes like 0.5 liter, 1 liter, 1.5 liters, 19 liters, 20 liters and other sizes. Generally, they purchase the bottles in bulk quantity.

#### 2.2.4 Starting expenses

Starting expenses covers the cost of deep bore for water pumping, purchase of vehicle like motorcycle loader rickshaw or delivery van, cost of furniture and other official accessories, security deposit to electricity department, expenses including company formation, project preparation, technical consultancy, travelling expenses, and other during construction period, license or registration fees, advertisement and publicity expenses.

### 2.3 Estimation of production costs and revenue in safe and clean drinking water

Cost is the money spent on purchase of inputs in order to make production and earn profit by selling the output. There are two main types of costs like fixed cost and variable costs. Fixed costs are those costs

which a producer pays irrespective of output production. Variable costs are those costs which change with the output production. These costs are zero if there is no production.

**2.3.1 Variables costs in the production of safe and clean drinking water**

Working capital or variable costs involved in the production of safe and clean drinking water are mineral cost, filter changing cost, salary of workers, electricity charges, postage and stationary cost, telephone cost, repairing cost of plant and delivery vehicle, transportation charges in water supply and other related costs.

**2.3.2 Fixed costs in the production of safe and clean drinking water**

Fixed costs involved in safe and clean drinking water production are depreciation charges, interest on initial investment, interest on variables cost, administrative cost and rent of building. Many parts of reverse osmosis plant are used for more than 1 year. Therefore, depreciation value was calculated for each material which is used for more than one year as described by [20]. The formula for calculation of annual depreciation used by [20] is expressed as:

$$Depreciation = \frac{Purchase\ price - Salvage\ value}{Number\ of\ years\ of\ life} - - - - - - - - (1)$$

Salvage value is 10 percent of purchase price of equipment and the entire depreciation is considered as a fixed cost [20]. He also calculated the interest on total initial investment costs and total variable costs. Therefore, interest on total initial investment costs and total variable costs was calculated at 8% interest rate. Administrative cost is 3% of total variable cost. Rent of building was also asked from the respondents and considered as a part of fixed cist.

**2.3.3 Estimation of revenue in the production of safe and clean drinking water**

As we know that, safe and clean drinking water producers sold their water in two ways. First way is to sell their water product in bottles and the other way is to sell their water product openly. Here the word openly means that the consumer brings self purchased empty can or bottle to the plant and producers filled their can or bottle at low rate. Revenue was calculated by multiplying the total quantity of water sold in each ways with their respective price.

Revenue (Rs.) = Total Production (bottles) × Price (Rs. /bottle)

Revenue (Rs.) = Total Production (liter) × Price (Rs. /liter)

**2.4 Economic indicators in the production of safe and clean drinking water**

Gross margin, net income and benefit-cost ratio was calculated by using formulas used by [21] expressed as:

**2.4.1 Gross Margin**

Gross margin was calculated by subtracting total variable cost from total revenue.

$$GM = TR - TVC$$

Where:

GM=Gross Margin

TR=Total Revenue

TVC= Total Variable Cost

**2.4.2 Net Income**

Net income is calculated by subtracting total cost from total revenue.

$$NI = TR - TC$$

Where:

NI=Net Income

TR=Total Revenue

TC= Total Cost

**2.4.3 Benefit Cost Ratio (BCR)**

It is a ratio of total revenue with total cost. It is defined as the amount of revenue a producer received when total cost is one rupee.

$$BCR = TR/TC$$

Where:

TR=Total Revenue

TC= Total Cost

## 3. RESULTS AND DISCUSSION

Table 1 shows the socio-economic characteristics of sampled safe and clean drinking water producers. Average age was 36.39 years for small plant producer while it was 40.35 years for medium plant producer. The education level of medium plant producers was 11.95 years which was higher as compared to average education of small plant producers which was 11.42 years. Average experience of small plant producer was 3.17 years while it was 5.65 years for medium plant producer. It means that medium plant producers were more experienced than the other category.

**Table 1: Socio-economic characteristics of safe and clean drinking water plant producers**

| Socio-economic Variables | Small R.O. plant (1000 liters per hour) | Medium R.O. plant (2000 liters per hour) |
|---|---|---|
| **Age (years)** | 36.39 | 40.35 |
| **Education (years)** | 11.42 | 11.95 |
| **Water business experience (years)** | 3.17 | 5.65 |

Table 2 gives information about total initial investment in the establishment of reverse osmosis plant. Total cost of reverse osmosis plant was Rs. 378593.63 for small plant and Rs. 546994.50 for medium size plant. The expenses on laboratory were Rs. 67343.75 for small plant and Rs. 130500.00 for others. The owner of small plant spends Rs. 96180.72 for purchase of plastic bottles while this expenditure was Rs. 147308.57 in case of medium plant. Total starting expenses was also higher for medium plant. Total initial investment in the establishment of small sized plant was Rs. 919246.41and Rs. 1381747.51 for medium sized plant.

**Table 2: Total initial investment (Rs. /plant) involved in the production of safe and clean drinking water**

| Particulars | Plant Size | |
|---|---|---|
| | Small R.O. plant (1000 liters per hour) | Medium R.O. plant (2000 liters per hour) |
| **Raw water tank (Rs.)** | 18771.00 | 33060.00 |
| **Purified water tank (Rs.)** | 25648.44 | 46897.50 |
| **Membrane vessel (Rs.)** | 81843.02 | 183837.50 |
| **Multi-stage pump (Rs.)** | 54953.13 | 58500.00 |
| **Gauges (Rs.)** | 9268.07 | 10385.25 |
| **Automatic pressure-control valve (Rs.)** | 15117.19 | 17700.00 |
| **Flow meter (Rs.)** | 5712.50 | 5750.25 |
| **TDS meter (Rs.)** | 2979.69 | 3525.00 |
| **Electric panel (Rs.)** | 7054.69 | 7250.00 |
| **Feed pump (Rs.)** | 14523.44 | 16300.00 |
| **Sand filter (Rs.)** | 13437.50 | 15975.00 |
| **Carbon filter (Rs.)** | 13492.19 | 16075.00 |
| **Micron filter (Rs.)** | 3620.92 | 4329.00 |
| **Ultraviolet system (Rs.)** | 26546.88 | 34450.00 |
| **Dosing pump (Rs.)** | 26718.75 | 28810.00 |
| **Motor pump (Rs.)** | 27312.50 | 29900.00 |
| **Miscellaneous charges (Rs.)** | 31593.75 | 34250.00 |
| **(A) Total reverse osmosis drinking water plant cost (Rs.)** | **378593.63** | **546994.50** |
| **(B) Laboratory and quality control cost (Rs.)** | **67343.75** | **130500.00** |
| **PP bottles (Rs.)** | 54104.10 | 87018.75 |
| **PC bottles (Rs.)** | 42076.63 | 60289.82 |
| **(C) Total bottle cost (Rs.)** | **96180.72** | **147308.57** |
| **Deep bore for water pumping (Rs.)** | 19882.81 | 22350.00 |
| **Delivery vehicle cost (Rs.)** | 274394.05 | 415355.56 |
| **Cost of furniture, furnishing and official accessories (Rs.)** | 17046.88 | 38200.00 |
| **Security deposit to electricity department (Rs.)** | 27890.63 | 34850.00 |
| **Company formation, project preparation, technical consultancy, travelling and others (Rs.)** | 20390.63 | 25750.00 |
| **Advertisement and Publicity (Rs.)** | 12296.88 | 14550.00 |
| **License and other fees (Rs.)** | 5226.42 | 5888.89 |
| **(D) Total starting expenses (Rs.)** | **377128.28** | **556944.44** |
| **Total initial investment (Rs.) = A+B+C+D** | **919246.41 (0.919)*** | **1381747.51 (1.382)*** |

*Amount in million rupees

Table 3 explained the variable costs involved in the production of safe and clean drinking water by using reverse osmosis plant. The mineral cost was Rs. 3570.52 per month in summer season for a small plant while it was Rs. 1785.26 per month for winter. Some costs were decreased in winter season because of low production. The safe and clean drinking water production was less in winter due to decrease in safe and clean drinking water demand. Total variable cost was Rs. 58965.01 per month in summer season for small safe and clean drinking water plant but it was Rs. 42061.50 per month in winter for the same sized plant. Total variable cost was Rs. 84597.75 per month in summer season for medium safe and clean drinking water plant but it was Rs. 61593.88 per month in winter for the same sized plant. On an average there are 5 months in winter season starts from October 15 to March 15. On an average there are 7 months in summer season starts from March 15 to October 15. Total variable cost was Rs. 412755.07 in summer season for small safe and clean drinking water plant but it was Rs. 210307.48 in winter season for the same sized plant. Total variable cost was Rs. 592184.25 in summer season for medium safe and clean drinking water plant but it was Rs. 307969.38 in winter season for

the same sized plant. Total variable costs were Rs. 623062.55 per year for small safe and clean water drinking plant whose capacity of production was 1000 liters per hour. Total variable costs were Rs. 900153.63 per year for medium safe and clean water drinking plant whose capacity of production was 2000 liters per hour.

**Table 3: Average variable costs (Rs. /month) involved in the production of safe and clean drinking water**

| Particular | Plant Size | | | |
|---|---|---|---|---|
| | Small R.O. plant (1000 liters per hour) | | Medium R.O. plant (2000 liters per hour) | |
| | Summer | Winter | Summer | Winter |
| **Minerals (Rs.)** | 3570.52 | 1785.26 | 5961.25 | 2980.63 |
| **Filter Changing (Rs.)** | 4817.11 | 2408.56 | 6576.50 | 3288.25 |
| **Wages (Rs.)** | 25157.96 | 25157.96 | 38590.00 | 38590.00 |
| **Electricity Charges (Rs.)** | 15675.00 | 7837.50 | 21350.00 | 10675.00 |
| **Postage and Stationery (Rs.)** | 1082.81 | 541.41 | 1375.00 | 687.50 |
| **Telephone/Fax Charges (Rs.)** | 1332.81 | 666.41 | 1635.00 | 817.50 |
| **Repairing/Maintenance of Plant (Rs.)** | 2329.69 | 1164.84 | 2650.00 | 1325.00 |
| **Repairing/Maintenance of Vehicle (Rs.)** | 1214.29 | 607.14 | 1585.00 | 792.50 |
| **Transport Charges (Rs.)** | 2628.57 | 1314.29 | 3425.00 | 1712.50 |
| **Miscellaneous Expenses (Rs.)** | 1156.25 | 578.13 | 1450.00 | 725.00 |
| **Total Variable Cost (Rs.)/month** | **58965.01** | **42061.50** | **84597.75** | **61593.88** |
| **Total Months of Season (No.)** | 7 (15 Mar to 15 Oct) | 5 (15 Oct to 15 Mar) | 7 (15 Mar to 15 Oct) | 5 (15 Oct to 15 Mar) |
| **Total Variable Cost (Rs.) per Season** | **412755.07** | **210307.48** | **592184.25** | **307969.38** |
| **Total Variable Cost (Rs.) per Year** | **623062.55 (0.623)*** | | **900153.63 (0.900)*** | |

*Amount in million rupees

Table 4 explains the fixed cost involved in the production of safe and clean drinking water for small as well as medium sized plants. Average depreciation was Rs. 88011.52 for small safe and clean drinking water plants and Rs. 135606.62 for medium safe and clean drinking water plants. Depreciation was higher for medium plants because equipments are more in medium plants than small plants. Annual interest on initial investment was higher (Rs. 110539.80) for medium plants because a large investment is required for the construction of medium plant as compared to small plant. Interest on variable cost was Rs. 49845.00 for small plants and Rs. 72012.29 for medium plants. Interest on variable cost was higher for medium plants because medium plants were engaged in higher production of safe and clean drinking water. Administrative cost is also very important and it was higher (Rs. 27004.61) in case of medium plants and lower (Rs. 18691.88) in case of small plants. Rent of building was also higher (Rs. 107490.00for medium plants. Total fixed cost was Rs. 313338.11 in case of small safe and clean drinking water plants while it was Rs. 452653.32 for medium safe and clean drinking water plants.

**Table 4: Average fixed costs (Rs. /year) involved in the production of safe and clean drinking water**

| Particulars | Plant Size | |
|---|---|---|
| | Small R.O. plant (1000 liters per hour) | Medium R.O. plant (2000 liters per hour) |
| **Depreciation** | 88011.52 | 135606.62 |
| **Interest on initial investment** | 73539.71 | 110539.80 |
| **Interest on variable cost** | 49845.00 | 72012.29 |
| **Administrative cost (@ 3% of variable cost)** | 18691.88 | 27004.61 |
| **Rent of building** | 83250.00 | 107490.00 |
| **Total fixed cost** | **313338.11 (0.313)*** | **452653.32 (0.453)*** |

*Amount in million rupees

Table 5 shows the safe and clean drinking water production and the revenue associated with this production. On an average safe and drinking water production was 3851.56 liters per day in summer season for small reverse osmosis safe and clean drinking water plant and it was 1925.78 liters per day in winter season for the same type plant. On an average safe and drinking water production was 6275.00 liters per day in summer season for medium reverse osmosis safe and clean drinking water plant and it was 3137.50 liters per day in winter season for the same type plant. Water was sold either in PC bottle of 20 liters capacity with an average price of Rs. 78.52 per PC bottle for small plant and it was Rs. 75.79 for medium plant. The price on water was Rs. 1 on an average for sale in other ways like open sale or sold in PP bottle of 19 liter capacity. The total revenue was Rs. 6191.92 per day in summer season for small plant and it was Rs. 3095.96 per day in winter season for same kind of plant. The total revenue was Rs. 9504.24 per day in summer season for medium plant

and it was Rs. 4752.12 per day in winter season for same kind of plant. The total revenue was Rs. 1764696.26 per year on an average in case of small safe and clean drinking water plant and it was Rs. 2708708.10 per year on an average in case of medium plant.

**Table 5: Revenue (Rs. /day) in safe and clean drinking water production**

| Particular | Plant Size | | | |
|---|---|---|---|---|
| | Small R.O. plant (1000 liters per hour) | | Medium R.O. plant (2000 liters per hour) | |
| | Summer | Winter | Summer | Winter |
| **Water production (liters/day)** | 3851.56 | 1925.78 | 6275.00 | 3137.50 |
| **Waste/unsold water @ 2% (liters/day)** | 77.03 | 38.52 | 125.50 | 62.75 |
| **Water for sale (liters/day)** | 3774.53 | 1887.27 | 6149.50 | 3074.75 |
| **PC bottles sold (20 liters) (No./day)** | 41.31 | 20.65 | 60.13 | 30.07 |
| **Price of PC Bottle** | 78.52 | 78.52 | 75.79 | 75.79 |
| **Water sold in PC Bottle (liter/day)** | 826.14 | 413.07 | 1202.63 | 601.32 |
| **Water sold other than PC (liters/day)** | 2948.40 | 1474.20 | 4946.87 | 2473.43 |
| **Average price of Water (Rs./liter)** | 1.00 | 1.00 | 1.00 | 1.00 |
| **Revenue from other (Rs./day)** | 2948.40 | 1474.20 | 4946.87 | 2473.43 |
| **Revenue from PC bottles (Rs./day)** | 3243.52 | 1621.76 | 4557.37 | 2278.69 |
| **Total revenue (Rs.)/day** | **6191.92** | **3095.96** | **9504.24** | **4752.12** |
| **Total revenue (Rs.)/month** | **185757.50** | **92878.75** | **285127.17** | **142563.58** |
| **Total months of season (No.)** | 7 (15 Mar to 15 Oct) | 5 (15 Oct to 15 Mar) | 7 (15 Mar to 15 Oct) | 5 (15 Oct to 15 Mar) |
| **Total revenue (Rs.)/Season** | **1300302.51** | **464393.75** | **1995890.18** | **712817.92** |
| **Total revenue per year (Rs.)** | **1764696.26 (1.765)*** | | **2708708.10 (2.709)*** | |

*Amount in million rupees

Table 6 demonstrated the economic analysis of safe and clean drinking water plants in the study area. It shows that the gross margin was Rs. 1141633.71 per year on average basis for small safe and clean water drinking plant and it was Rs. 1808554.47 per year on an average for medium plant. Net income was Rs. 828295.60 per year on average basis for small safe and clean water drinking plant and it becomes Rs. 1355901.15 per year on an average for medium plant. The benefit cost ratio was 1.89 in case of small safe and clean drinking water plant and shows that the return was Rs. 1.89 on an average for each rupee invested in this business. The benefit cost ratio was 2.00 in case of medium safe and clean drinking water plant and shows that the return was Rs. 2.00 on an average for each rupee invested in this business.

**Table 6: Economic analysis (per year basis) of safe and clean drinking water production**

| Particulars | Plant Size | |
|---|---|---|
| | Small R.O. plant (1000 liters per hour) | Medium R.O. plant (2000 liters per hour) |
| **Total fixed costs (Rs.)** | 313338.11 | 452653.32 |
| **Total variable cost (Rs.)** | 623062.55 | 900153.63 |
| **Total cost per year (Rs.)** | **877858.21 (0.878)*** | **1266841.94 (1.267)*** |
| **Total revenue per year (Rs.)** | **1764696.26 (1.765)*** | **2708708.10 (2.709)*** |
| **Gross margin (Rs.)** | 1141633.71 (1.142)* | 1808554.47 (1.809)* |
| **Net income (Rs.)** | 828295.60 (0.828)* | 1355901.15 (1.356)* |
| **BCR** | **1.89** | **2.00** |

*Amount in million rupees

## 4. CONCLUSION AND SUGGESTIONS

It is clear that the production of safe and clean drinking water by using reverse osmosis process is a useful and economical activity. The price of safe and clean drinking water was Rs.1 in open sale which was not too much high but it was still expensive for a large community or people have not money to purchase it. It is recommended that government should create awareness among people that underground water is a health risk for them. The existing producers have ability to double their production to fulfill increased demand. Due to increase in production, producers feel it economical to reduce the prices. Moreover increase in the number of safe and clean drinking water producers increase the competition in this business. Increase in competition will be beneficial for consumers due to improvement in quality and reduction in price. The quality of safe and clean

drinking water was also a serious question because a large number of producers have not standard laboratories where they check the quality of water regularly. Establishment of stander laboratory is very expensive and it is difficult for a middle class producer to invest such a large amount which results decrease in water quality by such producers. It is recommended that government should allow five safe and clean drinking water producers to establish a standard laboratory on sharing basis, so the producers regularly check their water quality with less cost and supply quality water confidently. Moreover, government should ban the use of blue can of acid for the purpose of drinking water which is very dangerous to health.

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