FUTURE OF WATER CONSUMPTION IN SRI LANKA: A COMPARISON WITH A WATER-SCARCE AND A WATER-RICH COUNTRY

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Abstract

Rainwater, surface water, and groundwater sources fulfil the water requirement of the Sri Lankan population. Access to safe water in Sri Lanka is threatened by various factors, such as water pollution and annual rainfall variation. This study aims to evaluate the demand for fresh water in Sri Lanka in the past decade and compare it with the water demand in a high-income desert country, Saudi Arabia, and a developed temperate country, Germany. Future water demand has been predicted using population projections to indicate the importance of securing the availability of safe water in the future. The per capita water consumption of Sri Lanka (608.4 m^3/capita/year) is less than that of Saudi Arabia (719 m^3/capita/year) and higher than that of Germany (372 m^3/capita/year). Nevertheless, the highest water consumption is in Germany (30.56 Gm^3/Year) and the lowest in Sri Lanka (12.95 Gm^3/Year). The agriculture sector consumes the highest amount of water in both Sri Lanka (87.36%) and Saudi Arabia (83.08%), while it accounts for the least usage in Germany (1.27%). Out of the total water consumption in each country, industry utilizes the highest amount of water in Germany (64.18%), while the industrial contribution in Sri Lanka is low (6.42%). This clearly indicates the need to implement water conservation methods in agriculture to achieve sustainable water management. Population growth indeed increases the total water consumption of a country. This study concludes that in 2030 the total water consumption in all three countries, Sri Lanka, Saudi Arabia, and Germany, is expected to rise by 4.26%, 23.19%, and 0.75%, respectively, with the growth in population. The most dominant water-consuming sector in Sri Lanka and Saudi Arabia is Agriculture, while industrial water consumption is the highest in Germany. Therefore, it is imperative to implement strategies to reduce wastage and apply conservation and treatment technologies available in developed countries to enhance the availability of safe water. In Sri Lanka, policymakers should make rules to maximize the reuse of water and protect existing water resources.

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INTRODUCTION

Sri Lanka is a developing nation in the tropical zone. As a tropical country, climate influences the water demand in Sri Lanka. For instance, Frequent variability of water availability due to extreme climate events induces water scarcity in Sri Lanka (Chandrasekara et al., 2021). In addition, diseases such as chronic kidney disease induced by consumption of unsafe drinking water have seriously affected population in 10 out of 25 districts in Sri Lanka (Hettithanthri et al., 2021). Water demand in Sri Lanka is fulfilled by both surface and ground water sources. The National Water Supply and Drainage Board is the leading authority that provides safe drinking water in Sri Lanka (Dharmaratna & Harris, 2012). Water resources in arid and semi-arid countries such as Saudi Arabia are directly affected by climate events such as decreasing trends of rainfall (Tarawneh & Chowdhury, 2018). Despite fewer water resources, Saudi Arabia has high water consumption per capita, where over 60% of water demand is met by desalinization plants (Krarti & Aldubyan, 2021). Germany is a developed country in the temperate region (Hamilton & Tol, 2007). Groundwater is the primary water source in Germany (>70%) (Tichomirowa et al., 2010). The objectives of this study are to evaluate the per capita water consumption, estimate the variation in water demand with the population projections, determine the patterns of water consumption in Sri Lanka, and compare the water consumption of Sri Lanka with the developed countries, Saudi Arabia and Germany.

METHODOLOGY

Water consumption and population data of Sri Lanka, Saudi Arabia, and Germany were obtained from the AQUASTAT and FAOSTAT databases of the Food and Agriculture Organization of the United Nations (FAO). Per capita water consumption per year was calculated from 2010 to 2020. Water demand in 2030 was estimated based on population projections in each country. Water consumption patterns of Sri Lanka were investigated based on the sector types and compared with Saudi Arabia, a high-income desert country, and Germany, a developed temperate country. MINITAB 17 and Microsoft Excel software were used for data analysis.

RESULTS AND DISCUSSION

Per capita Water Consumption

Figure 1 shows the per capita water consumption in Sri Lanka has slightly increased from 2010 to 2020 from 596.2 m^3/capita/year to 626.4 m^3/capita/year. The average per capita water consumption in Sri Lanka is 608.4 m^3/capita/year. Nevertheless, the per capita water consumption in Saudi Arabia has been consistently higher than that of Sri Lanka, with an average of 719 m^3/capita/year due to the rapid development, increased population growth, and enhanced living standards in that country compared to developing countries (Gabr et al., 2020). Although Saudi Arabia is a desert country, they meet the increasing water demand by the production of desalinated water from seawater and supplying it to the public almost free (< 2 US$ per month) (Ouda, 2013). Germany has an average per capita water consumption of 372 m^3/capita/year which is less than the water consumption of Sri Lanka. Schleich &

Hillenbrand (2009) have studied that rainfall patterns, income levels, and cost pricing induce the reduction of water demand in Germany.
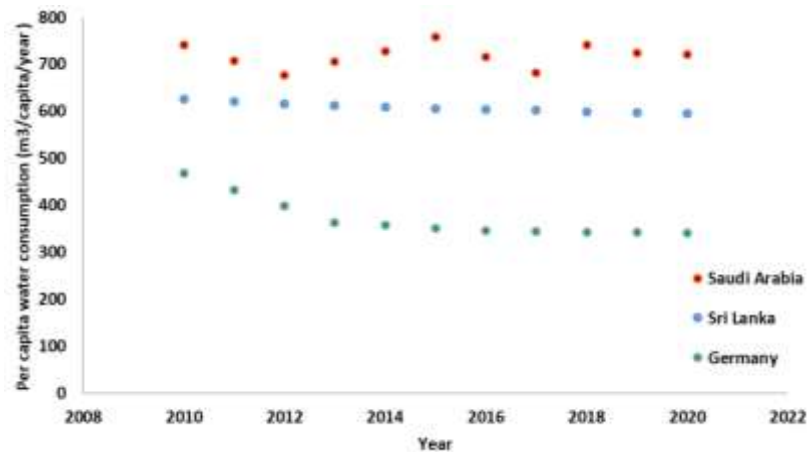

Figure 1: Variation of per capita water consumption in countries from 2010 to 2020

Water consumption by sector

As shown in Figure 2, the contribution of agricultural, industrial, and municipal water consumption to the total water withdrawal of a country varies from country to country. Sri Lanka and Saudi Arabia spend over 80% of their water on agriculture. The highest proportion of agricultural water has been consumed by Sri Lanka (87.36%). Nevertheless, Germany shows the lowest agricultural water consumption, 1.27%, which consumes the highest proportion (64.18%) of industrial water among all three countries. Both Sri Lanka and Saudi Arabia show less industrial water consumption. Sri Lanka consumes the lowest proportion of municipal water (6.23%) and Germany the largest proportion of municipal water (34.55%) among the three countries.
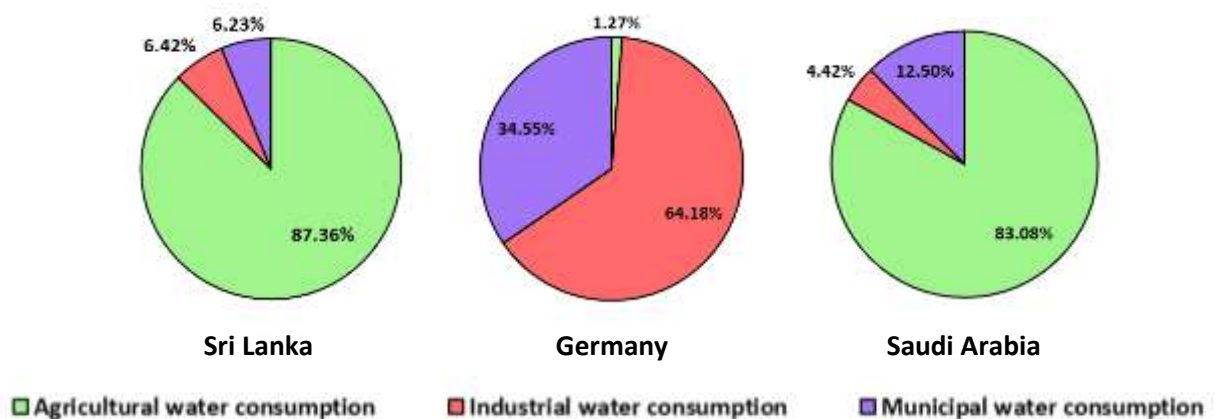

Figure 2: Water consumption in countries by sector from 2010 - 2020

Expected Water Consumption in 2030

According to Table 1, total water consumption in all three countries will increase with the increase in population in 2030. Saudi Arabia has a higher projected increase in water consumption, while Sri Lanka shows a lower water demand increase in 2030. Saudi Arabia fulfills its water demand through conventional water sources, such as surface water and groundwater, and non-conventional water, such as desalinated water, treated wastewater, and rainwater harvesting (Chowdhury & Al-Zahrani, 2015). Nevertheless, Germany is expected to have only a slight increase in total water consumption (0.75%) due to the projected population increase in 2030. Nonetheless, Total water consumption is highest in Germany compared to the other two countries. Despite its higher per capita water consumption than Germany, Sri Lanka shows the lowest total water consumption due to the lower population in the country.

Table 1: Projected changes in population and water consumption of countries in 2030

Country	Expected Population Change in 2030	Average Total Water Consumption (2010-2020) (Gm^3/Year)	Expected Total Water Consumption in 2030 (Gm^3/Year)	% change in Total Water Consumption in 2030
Sri Lanka	+ 4.24%	12.95	13.5	+ 4.26%
Saudi Arabia	+ 23.22%	23.62	29.1	+ 23.19%
Germany	+ 0.68%	30.56	30.79	+ 0.75%

CONCLUSIONS

Sri Lanka is a developing country in the tropical zone. Agriculture sector consumes the highest proportion of water. With the projected increase in population, the total water consumption is expected to rise by 4.26% in 2030. The trends of water use in Sri Lanka show that the country must implement sustainable water resources management. The emerging approaches that could be adopted from countries such as Saudi Arabia and Germany may include rainwater harvesting, enhancing treated wastewater reuse, desalinization of sea water, accelerating water conservation and minimizing wastage and leakage in the water distribution networks. Comprehensive studies need to be conducted to understand the availability of water resources and technology as the initial step for sustainable water resources management in Sri Lanka.

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