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Safe Drinking Water Supply in Economic Growth and Development of Kerala: An Analysis

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Abstract

Water is our life and the most important contributor to economic progress. The study explains that the relationship between the growth of a safe water supply and healthy human development is essential. It provides a strong causal relationship between improved health and increased employment to contribute to economic growth and development. The study's finding proves that improved water supply directly impacts human health by increasing employment opportunities and contributing to economic growth and development. In this background, the researcher used the article to help individuals understand the importance of water conservation (using our water supply wisely and responsibly) in their lives. The study also emphasizes that everyone should use each drop of water effectively, as water is considered the backbone of the economy.

Keywords: Water supply, Human health, Employment, Education, Economic growth, Socio-economic development.

Introduction

Water is a basic human need, and every person has the right to demand safe drinking water. The United Nations declared access to safe drinking water a fundamental human right and an essential step towards improving living standards. Water covers more than two-thirds of the Earth's surface and is salty and undrinkable. Only 3 per cent of fresh water is available on Earth. The available freshwater is used for drinking, domestic needs, food production, sanitation and hygiene, and a wide range of other uses. Water is also an input to almost all production in development sectors like agriculture, industry, energy, transport, etc. Safe and clean drinking water is essential for the proper functioning of our bodies. So, safe water is vital to support human health, and it is necessary for the daily life of human beings for direct and indirect activities.

Globally, the availability of drinking water is less than one per cent of the total water demand (Economic Review, 2008). Due to the increasing growth of the population and their changing water use patterns, the demand for limited water resources has increased. Unhygienic human practices and different types of pollution are the major causes of frequently contaminated drinking water sources. This contaminated water resource is one of the major threats to limited water resources. So, it is necessary to take appropriate measures to protect and save the limited water resources because it is a vital element for human life and economic growth.

According to the JMP (Joint Monitoring Programme) report, about 663 million people did not have access to a safe water source in 2015; this increased to 768 million people in 2011 (WHO/UNICEF, 2019). The JMP also reported that every day, more than 800 children under 5 die from diarrhea. The statistics show the importance of clean water for the world. Most of these illnesses and deaths can be prevented by the use of safe and clean drinking water.

Kerala is considered the land of water resources with high rainfall, groundwater, and surface water sources. The average rainfall of the state is 3055 mm; surface water sources like rivers, backwaters, lakes, and streams are very plentiful. The state is identified as the only place in the world with a large number of open wells. However, due to large-scale pollution and various human unhygienic practices, major resources are contaminated. This contaminated water resource has a large negative effect on human health and economic progress.

Presently, two types of drinking water systems are popularly followed in Kerala. One is the individual families creating their drinking water resources by

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constructing wells on their house compounds and managing the water supply source by themselves. Other schemes are owned and operated by the state government through the KWA (Kerala Water Authority) and local government (SEUF, 2000). But in the first case, most of the sources were unable to provide sufficient quantities of drinking water for the household, then the chances of households substituting inferior sources would be higher (Pushpangadan, 2003). In urbanized Kerala, the most practical and appropriate way to get water is to depend on the public water supply system. The increasing demand for safe drinking water has put pressure on the water supply system. The primary objective of the drinking water supply is to provide safe drinking water to beneficiaries and protect their health.

Public water supply was more popularized during the five-year plans in both the central and state governments. KWA was the primary agent of supply and management of drinking water in the state. But the system is not performing well at the moment, as the main constraint is a lack of finance. The new democratic initiatives of 1993-94, the decentralized movement, helped to provide strong financial support and extended service mechanisms to institutions. This movement helped the active participation of both local government institutions and KRWSA (Kerala Rural Water Supply & Sanitation Agency). This initiated reforms in the field of water supply and management in Kerala. The government supplies water at a reasonable rate and satisfactory quantity and quality, especially in domestic connections. However, the beneficiary's water use scenario has changed over time, and in most cases, it has been managed and used carelessly. For example, most domestic connection is used for non-domestic purposes. Wastage was another issue.

This type of misuse and mismanagement of water utilization is continuously followed; it is not doubtable we are giving a highly priced future for this valuable resource. So, it is crucial to protect limited water resources from this type of unscientific usage and convince societies of the importance and necessity of protecting and conserving safe water as a precious good. For this purpose, the researcher tries to explain the positive relationship between the availability of improved safe water supply and increasing economic growth and socio-economic progress. And also tries to explain that safe water is necessary for human development. Several studies explain the relationship between water resources and economic growth in different ways. But in recent studies, no attempt has been made in this manner. So, the paper examined the present water supply; how can it support contributing to economic growth and development.

Objectives

The present paper examines

1. To study the trend of drinking water supply in decentralized Kerala
2. To analyse the impact of drinking water supply on economic growth.

Hypothesis

The hypothesis states that a safe and clean public water supply contributes to economic growth and development.

Methodology and Data Source

The study is based on secondary data. The main data regarding water service connection, water supply schemes, water quality programs, waterborne diseases, and employment were taken from various issues of economic reviews and various reports of the WHO/UNICEF in this paper. The progressive growth of water supply in Kerala happened after decentralization. So, the present study concentrates on the post-decentralization period. The study analyzed the growth performance of drinking water supply services in the period of 1995-96 to 2021-2022. To analyze the growth trend using AAGR (Average Annual Growth Rate) and explain the connection of water supply schemes and its coverage for using correlation. The study used three important variables, like water supply, health, and employment, and took education as a supporting variable for the purpose.

Growth of Drinking Water Supply

General Picture of Drinking Water Supply

Article 47 of the Indian constitutional provision explains the subject of safe drinking water supply. The systematic way to supply water in India started during the 1st five-year plan. However, notable progress in water supply started during the 5th plan. This plan emphasized the importance of providing a safe water supply for the first time as an objective. During the 6th plan, begin implementing a variety of programs for providing water facilities in the state, especially in rural areas.

The world population's use of safe water service increased to 71 per cent in 2017 from 61 per cent in 2000. ie, 5.3 billion people used a safe water supply in 2017 from 3.8 billion people in 2000 (WHO/UNICEF report, 2019). The trend shows that 1.8 billion people gained access to a safe water supply in the period. Presently, 87.7 per cent of rural and 88.1 per cent of urban households get safe drinking water in India, and 94.7 per cent of rural and 90.2 per cent of urban households get safe

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drinking water in Kerala (NSSO 69th round). The picture shows an increasing trend of people utilizing safe water services in day-to-day life.

Growth of Drinking Water Supply in Kerala

Kerala has given importance to water supply schemes when introducing the period of five-year plans. This has led to the potable water supply also becoming a serious concern. The Public Health Engineering Department (PHED) was established in 1956 for water-related activities in the state. The department was providing better management of water supply in both rural and urban areas until the mid-eighties. On 1st April 1986, PHED was recast into an autonomous body called KWA. KWA was the primary supplier of water in the state, and it is performing well today.

The government of Kerala decided to use institutional finance for water supply in the early seventies. LIC (Life Insurance Corporation) was the first and major donor of water supply in the period. The financial setup for water supply has been strong since the 1970s, as a result of the state government allowing internal and external assistance. The main internal agencies, like HUDCO (Housing and Urban Development Corporation Limited), the centrally sponsored ARWSP, and the state government, are performing during the period. The government of Kerala was accepting support from outside sources at the beginning of the 1980s. The World Bank was the main external support in the period. In the mid-1980s, the state got assistance from bilateral agencies for water supply.

Second plans onwards, rural water supply has gained importance. However, the serious step towards the provision of drinking water to rural Kerala began with the ARWSP (Accelerated Rural Water Supply Programme) schemes launched in 1972-73. These schemes provide safe drinking water to rural areas. The third plan onwards gives important consideration to urban water supply. But it was not impressive in the past. The major reason is poor financial support for urban supply in the period. To extend the financial support of urban supply after AUWSP (Accelerated Urban Water Supply Programme) was launched in 1994. This scheme helps to extend safe and adequate water supply facilities to urban populations. At the end of the 11th plan, the government of India launched JNNRUM (Jawaharlal Nehru National Urban Renewable Mission) & UIDSSMT (Urban Infrastructure Development Scheme for Small and Medium Towns). This is also bringing strong financial support to the urban supply.

Present Condition of Drinking Water Supply in Kerala

Presently, the drinking water system in Kerala is managed and maintained by the state government through the KWA, local government and KRWSA, in both urban

and rural areas. Now, the state government depends on national and international agencies fund for water supply finance. This is reflected by good financial strength in water supply.

Water Service Connections Implemented by KWA

In the beginning stage of decentralized Kerala, KWA concentrates on domestic connections only. It achieved 5.2 per cent growth of house connections and 5.1 per cent growth of stand post connection in the period. Since 2000, KWA has extended its service connections to non-domestic and industrial sectors.

Table 1: Water Service Connections Implemented by KWA (in percent)

Year	Service connections			Street tap connection
	Domestic	Non-domestic	industrial	
2001-04	4.53	2.85	-16.28	3.89
2004-07	5.25	4.68	3.16	3.09
2007-10	5.00	4.93	1.96	1.55
2010-13	6.74	4.26	5.22	-0.28
2013-16	4.57	1.08	7.09	0.30
2016-19	10.38	13.21	12.38	-0.76
2019-22	14.52	7.76	8.35	-9.99

Source: Economic Review, various issues, state planning board, TVM.

The AAGR (Average Annual Growth Rate) trend of water service connections is increasing, and a significant improvement in connections is visible after 2016. This trend shows the positive movement of accepting consumers' safe water supply connection and their more consuming nature. However, in 2019-22 period shows a declining nature in both non-domestic and industrial connections. It is related to the 2018 flood, affecting water service connections in the state. Then the domestic connections are increasing as usual in the period. The growth trend of street tap connections is in decline, and it has become negative in recent periods. This result is due to the changing habit of consumers' utilisation pattern of street tap water to more domestic house connections.

Population Covered by Water Supply Schemes

The primary aim of the state water supply schemes is to provide drinking water and other domestic purposes. The effect of decentralization in 1995-98 recorded

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4.98 per cent growth, which the government can extend to more area coverage of the population. But, the trend growth recorded only 2.41 per cent in 1998-2001, which is a decline from 1995-98.

Table 2: Number of Water Supply Schemes and its population coverage

Variables		Scheme	Population coverage
Scheme	Pearson correlation	1	.457
	Sig (2-tailed)		.014
	N	28	28
Population coverage	Pearson correlation	.457	1
	Sig (2-tailed)	.014	
	N	28	28

Correlation is significant at the 0.05 level (2-tailed).

Source: Economic Review, various issues, state planning board, TVM.

The analysis table shows that the two variables—water supply schemes and population coverage—are positively correlated. However, the correlation is only moderate, indicating that public water supply schemes currently cover less than half of the total population in the state. The major reasons for this shortfall include limited availability of safe water and financial constraints. As a result, the delivery of water services has declined in many areas across the state. To address this issue, the government has been implementing additional initiatives such as AMRUT 2.0, Jal Jeevan Mission, Mazhapolima rainwater harvesting, and recharge well schemes to expand water supply coverage, particularly in the aftermath of the two major floods that Kerala experienced.

Water Supply Connections Implemented by KRWSA

The decentralization initiatives in Kerala happened in 1993-94. As part of this initiative, the Kerala Rural Water Supply and Sanitation Agency (KRWSA) were launched to implement water supply in rural areas. KRWSA was implemented in mid-1999, but it has been functioning as an autonomous institution since 2001. The main objective is to improve the quality of water supply in rural areas. Till 2004-05, this agency was functioning only in four districts: Trissur, Malappuram, Palakkad and Kozhikode. Since 2005-06 extended its services to all districts of Kerala.

Table 3: Water supply domestic connection implemented by KRWSA (In percent)

year	Domestic connection
2007-10	5.94
2010-13	3.32
2013-16	9.83
2016-19	16.85
2019-22	1.74

Source: Economic Review, various issues, state planning board, TVM

The table indicates that the Average Annual Growth Rate (AAGR) shows an increasing trend, with particularly high growth recorded during 2016–2019. This growth can be attributed to the Kerala Rural Water Supply and Sanitation Agency (KRWSA) implementing large-scale water supply schemes instead of focusing mainly on smaller projects, as done previously. However, the trend shows a slowdown after the 2018 floods. Despite this, the successful implementation of Jalanidhi projects in rural areas has helped improve KRWSA's water supply connections in recent years.

The above picture explains that consumers are more demanding of safe drinking water and prefer government water supply schemes in the kerala state.

Drinking Water Quality

Table 4: Quality profile of water supply in Kerala (In number)

Year	Total source tested	Total contaminated source
2012	102900	34717(33.74)
2016	118023	79255(67.15)

Source: Economic Review, various issues, state planning board, TVM

In 2012, 34 per cent of contaminated water sources were identified from the total amount of tested sources. It has increased by 67 per cent, which was identified in 2016. In Kerala, the water quality of groundwater and surface water is continuously reported for high levels of chemical and biological contamination (Economic Review, 2016). Lack of good quality drinking water has been a serious threat to the water supply for a long time. So, the appropriate treatment is necessary before service. The first step is to take the national water policies of 1987, 2002 and

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2012 in India. The policies emphasized the need for both surface and groundwater quality, and a phased program should be undertaken for improvements in water quality.

The following table lists the various programmes implemented by the government to improve the quality of water supply at different periods.

Table 5: Quality Programmes Implemented by Government

Name	Year	objective	program
Technology Mission/ National Drinking Water Mission(NDWN)	1986	Implemented Schemes In Water Quality Affected Areas	Up to 20 per cent of the ARWSP funds are to be earmarked for new projects designed to address water quality issues.
Kerala Rural Water Supply And Environmental Sanitation Project	1999	Improve the quality of rural water supply and environmental sanitation	The project will cover 200 Grama panchayath in Kerala
Bharat Nirman	2005	Safe source of drinking water in every habitation by 2009	Centrally sponsored scheme of ARWSP which funded on a 50 percent.
National Rural Drinking Water Quality Monitoring And Surveillance Program	2006	Strengthen the community participation in the drinking water sector for sustainability	5 person in each Grama panchayat are to be trained to carry out regular surveillance of drinking water sources for which 100 percent financial assistance including water texting kit provided
Establishment of Mobile Testing Laboratory for the Quality Assurance of Water Resource	2017	Assure the quality of water resource in State for awareness of the communities with respect to protection of source of water.	Services of the mobile laboratory in 120 panchyaths, 15 municipalities and 3 corporations. More than 3000 samples were tested using the facility.

Jivamritan project	2018	Over 100,000 villages in Kerala, spread across14 districts have begun to receive clean drinking water	127 water filtration units have been installed by this project.

Source: Economic Review, various issues, state planning board, TVM.

The above various quality improvement programs and the various water quality treatments like purification, chlorination and fluoridation are helpful to the authority to distribute treated water to society. People demand quality drinking water, but most water sources are contaminated and cannot be used directly. This condition created a high demand for a safe water supply. The government attaches great significance to the supply of safe drinking water to the entire population to ensure public health.

Rivers are a major source of drinking water in Kerala. Large-scale pollution and unhygienic human activities are major threats to our rivers. The unavailability of safe drinking water is a medium for the spread of waterborne diseases. The report estimated that around 37.7 million Indians are affected by waterborne diseases, and 73 million working days are lost due to waterborne diseases each year (UNICEF, 2017). So, we cannot escape the risk of waterborne diseases due to the inefficient use of an adequate and safe water supply.

Table 6: Causes Affected on Water Borne Disease (In number)

Year	Diarrhea	Hepatitis -A	Typhoid	Cholera
2011-12	357252	6305	2849	30
2012-13	411819	6166	2930	20
2013-14	442109	2833	1955	8
2014-15	467102	1980	1772	1
2015-16	493973	1351	1668	10
2016-17	463368	988	314	8
2017-18	540814	1369	109	9
2018-19	390345	979	23	7

Source: Economic Review, various issues, state planning board, TVM.

The table shows a declining trend in the number of waterborne diseases in the state. The latest period shows that the number of causes of diarrhoea also declined. This shows a positive sign for the safe drinking water utilization of communities.

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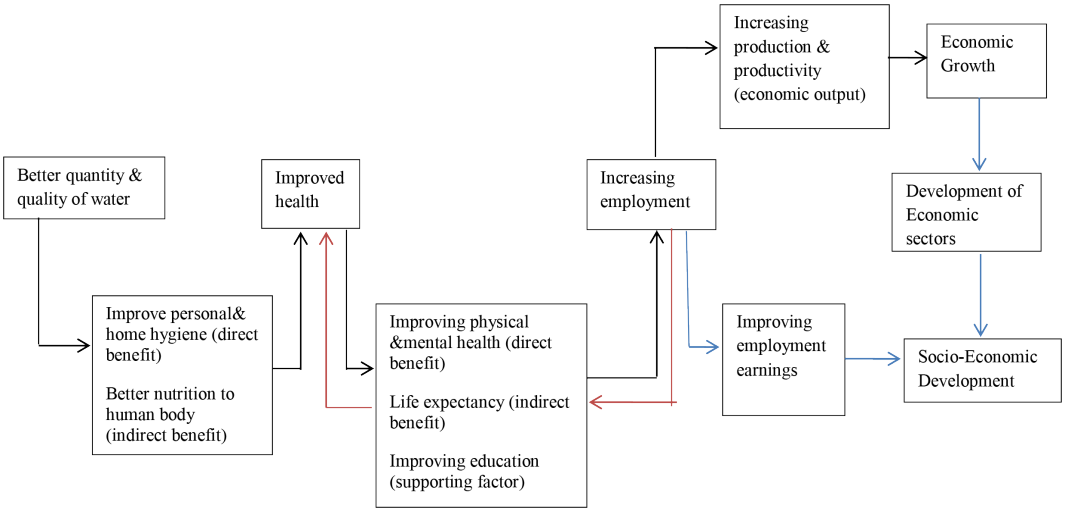
Water quality is the most controlling factor for diseases and protecting human health. Almost one-tenth of the global disease burden can be prevented by improving water supply (WHO, 2008).

So the safe water supply is essential for not only improving sufficient quantity of water but also maintaining good quality of water.

SAFE DRINKING WATER FOR ECONOMIC GROWTH AND DEVELOPMENT

Water is essential for human survival and well-being, and important to many sectors of the economy.

Linkages between human access to safe water and economic growth



Access to a safe and continuous supply of water improves personal hygiene and home hygiene, with directly contributes the human health. Clean water for drinking is essential for the proper functioning of the human body, and it represents a critical nutrient for human health in the form of energy, weight and human functioning. So human beings get benefits to enjoy lifelong personal health, and to use of this safe drinking water. So in this way, adequate quantity and satisfactory quality maintain an improved safe water supply, positively contributing the human health.

Improvement of human health helps contribute to an individual's own physical and mental well-being. A mentally and physically strong individual can easily sustain a long time to improve their strength and happiness, with reduced health care costs and time saved from illness, achievements in life expectancy

and improved living conditions through their employment. Education is a strong supporting factor contributing to the positive linkage between human health and employment opportunities here. This means that improving health provides people with the chance to spend more time in school while earning high technical and efficient skills. It helps individuals easily attain various employment opportunities. Education is a big investment in employment and contribution to society.

Kerala has made notable achievements in the health sector for a long period. The impressive health structure provides a huge investment in a healthy workforce, with employment contribution through support from the education system. Kerala also held a considerable position in the high literacy state and has held the first position in women's literacy for a long time.

The interesting point is that more employment opportunities can improve human health. O.e. Employment opportunities can improve social capital, enhancing an individual's physical and mental well-being and providing high employment opportunities and income. The individuals are spending their employment earnings on investing in their education. Education is a major factor in employment opportunities, and it helps increase the number and variety of employment opportunities. More employment opportunities are available to healthy and physically fit workers because they can give more output. Employment increases health status, while at the same time, healthy people are more likely to seek and maintain employment (Ross & Mirowsky, 1995). This procedure is continuous as a cyclical process.

Table 7: Employment situation in Kerala (In percentage)

Year	Primary sector	Secondary sector	Territory sector
2004-05	79	50	71
2011-12	55.6	62.2	82.2
2015-16	43.1	50.6	106.4

Source: Economic Review, various issues, state planning board, TVM.

The table shows the sector-wise distribution of the working population in Kerala. The trend shows worker participation rate is high in the territory sector, including various services. The high participation in this sector of Kerala is in education and public health (Economic Review, 2016). Employment in the organized sector increased by 10.8 lakh in 2012 from 12.4 lakh in 2019. Within 12.5 lakh persons employed in the organized sector, 5.6 lakh (44.8 per cent) are in the public sector,

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and 6.9 lakh (55.2 per cent) are in the private sector (Economic Review, 2019). In unorganized sector contributes more than 90 per cent of the workforce and nearly 50 per cent of the GDP in the economy (Economic Review, 2019).

Employment is one of the most important factors in achieving economic growth. i.e., an improved healthy workforce can contribute to greater economic output, due to an increase in the number of productive working days from reducing the loss due to ill-health. This is also a chance to spend more time in school more effectively. This benefit helps the workforce produce more ideas and thereby contributes to improved productive activities. A healthy workforce (lack of illness and skilled and mental happiness) can actively participate in productive activities for full working times and maintain the improvement of their average quantity of hourly production. This leads to the workforce attaining improved production and productivity and contributing to economic growth. This contributes more output and income in various economic sectors, which leads to the development of the whole economy.

Workers produce valuable goods and services, and in turn, receive employment earnings (wages) which they can part of spend on buying the goods produced. This helps the development of the market economy and leads to the development of infrastructure facilities. Part of these earnings is also spent on the availability and accessibility of safe water and other necessities in their life. Another part of their earnings is also invested in health care facilities and educational attainment in their life. This process is connected as a chain of contributions to self-development, and their families' development, and it leads to communities' development, with the whole society's progress and development.

Conclusion

The paper concludes that the adequate availability of safe and clean water is essential for human health, whether used for drinking or other domestic uses. Drinking water quality is a key pillar of basic prevention from waterborne diseases. Better health is central to human happiness and well-being, and an important contributor to human capital. A healthy workforce is helpful to boost employment conditions, which contributes to higher economic productivity, by supporting their skills. The employment opportunities increase the household's income and fulfil their food security and other necessities. This financial condition also contributes to poverty reduction and improvement in their standard of living. So, daily access to clean water is essential for human survival, and improving healthy communities

leads to significant socio-economic growth and development.

Here, it's proven that improved water services are essential conditions for human development with economic growth and development. The time is taken to rethink to individual water utilization and behavioural practices of the limited resource. The researcher suggests that every individual consider water as one of the most precious resources, using and managing our water supply wisely and responsibly. Save a drop of clean water like gold.

Policy Implication

- The study explains the current condition of water supply in the state. The figure illustrates that local (community) water supply schemes are the major contributors to the state's overall water supply. Therefore, the study highlights the importance of implementing and maintaining local water supply systems across the state.
- The study explains that a safe water supply is the cornerstone of human health and the socio-economic development of society. Therefore, it emphasizes the importance of public water supply systems and raises awareness about protecting and usage of water resources for a sustainable future.
- The study also explains the importance of water conservation techniques and their applications—such as recharge well schemes, rainwater harvesting, and deep tube wells—which contribute a significant share to the state's current water supply.

Future Research

- Demand and supply are two sides of the same coin in the context of water supply. However, the study focuses only on the supply-side mechanisms, while the demand aspect—though equally important—has not been addressed.
- Private water supply services also contribute a major share to the state's current water supply system, but the study does not attempt to examine the role of the private sector.
- The study demonstrates that local water supply schemes play a significant role in the state's water supply, this area has also been largely overlooked in the analysis.

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