

Access to Safe Drinking Water and Economic Development : A Comparative Analysis of Developed and Developing Countries

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Water is at the core of sustainable development goals and it is critical for socio-economic development, energy and food production, healthy ecosystems and for human survival itself. Safe drinking water is an essential component of primary health care and have vital role in poverty alleviation which further accelerate the process of economic development. In this present study, an attempt has been made to provide a comparative analysis of the access to safe drinking water and economic development, which explores a comparative situation of the universal access in the developed world and an inadequate access in the developing one. It also addresses how inadequate access to water impact the different aspects of human life such as health, education, livelihoods, gender equality etc. This study is a comparative analysis of developed and developing countries. The study concluded that the highest proportion of population in the

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world had no access to safe drinking water. The problem of access to safe drinking water is more severe in the developing countries, particularly in rural areas. Moreover, the life expectancy at birth, female labour force participation rate and female population with at least secondary education are positively correlated with water coverage of total population whereas, infant mortality rate and mortality rate under 5 years of age are inversely related to the total population with water coverage. The study also suggests that the access of safe drinking water in developing countries could be improved by increase public as well as private investments in infrastructure and projects related to water.

[**Keywords** : Safe drinking water, Health, Education, Developed and developing countries]

JEL Classification : I1, I15, Q01, Q25, Q28.

1. Introduction

Improved longevity, reduced infant mortality, health, labour productivity, and material well-being are usually recognized as fruits of development. The developing country populations generally have poor ranking on these indices compared to those of developed ones. Availability of safe drinking water for domestic use and adequate sanitation to dispose of waste have long been known to be fundamental to the development process, with benefits, such as labour productivity, spread across all sectors. In the last few decades, there have been improvements to the use of water resources; however, there are still an estimated 1.1 billion people in the world who do not have access to safe drinking water and about 4 billion people who live under water scarcity at least one month per year (Gadgil, 1998). Universal access to safe drinking water is a fundamental need and human right. Securing access for all would go a long way in reducing illness and death, especially among children. In 2015, about 89 per cent of the world population relied on improved source of drinking water called basic service which was 83 per cent in 2004. As many as 844 million people are still living without adequate availability of basic water services in the developing countries. Among them, almost 159 million people still collected drinking water directly from rivers, lakes and other surface water sources (WHO 2004, 2013, 2017). There are pronounced disparities, with the poorest and those living in rural areas are least likely to use a basic service (WHO/UNICEF, 2015). Only 71 per cent of the global population used a safely managed drinking water service located on premises and free from contamination which clearly indicates that one third of

the global population had no access to safe drinking water (WHO/UNICEF, 2017). Rapid growth of population, with change in climatic conditions and dietary changes led to increase the demand for safe drinking water. The world population is predicted to grow from 6.9 billion in 2010 to 8.3 billion in 2030 and further to 9.1 billion in 2050. The urban population is projected to increase by 2.9 billion. Thus, the urban areas of the world are expected to absorb all of the population growth over the next three decades (UN, 2009). This also points towards the need of the increase in access to clean drinking water in the urban areas. Lack of clean water causes millions of children in the developing world to suffer needlessly and die from disease and malnutrition. Lack of safe water contributes significantly to the high incidence of diarrheal disease and chronic malnutrition. Parasites transferred by waterborne contamination, consume nutrients, aggravate malnutrition and retard children's physical development. The broader effect of these conditions is weak regional economic development (Braghetta, 2006). According to the World Health Organization Report, as many as 3.4 million people die from water-borne diseases each year. Progress on access to drinking water is critical for the achievement of sustainable development targets, including reducing poverty and achieving universal access to basic services, ending all forms of malnutrition, ending preventable child deaths, combating neglected tropical diseases and waterborne diseases and achieving universal health coverage, providing safe and inclusive learning environments, ending violence against women and girls and reducing gender inequality, ensuring adequate, safe and affordable housing for all and reducing deaths caused by disasters (UNICEF/WHO, 2017). Climate change is also expected to have an impact on the availability of water in many regions. According to the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report, climate change over the twenty-first century is projected to reduce renewable water resources significantly in many dry subtropical regions.

The basic structure of this present paper is divided into four sections including the introductory one. Section 2 presents the theoretical perspective and past empirical studies related to it. Section 3 discusses the methodology and specific objective of the study. Section 4 provides empirical evidence regarding the impact of access to safe drinking water on health, education and economic

development. The final section comes with conclusion and policy suggestions.

2. Brief Review of Literature

A number of studies have been conducted on the issue of water in the developed as well as the developing countries. Hence, it is important to review the related studies in order to have an overview of not only the situation in the past in various parts of the world but also to find the research gaps. Some of the studies are given below :

Grover (1984) highlighted the main features of international drinking water supply and sanitation during late 1990s. This study found that more than half of population in LDCs does not have adequate supplies of water and facilities for the disposal of human wastes. The people in developing countries were less healthy than developed countries and children born in the developing countries were twelve times more likely to die before the age of four than children in developed nation because of lack basic water supply and sanitation.

Goldblatt (1996) analyzed the challenges of urban water supply for South Africa. This study finds that South Africa's water supply authorities are facing so many challenges like severe blockage in urban areas, growing urban population and large capital requirements. Reddy & Rathore (1993) focused on regional disparities in distribution pattern between rural and urban areas of Rajasthan and analyzed bias in social consumption of residential water which would result in inequalities such as hygiene and health. This study finds existing bias between urban and rural water supply distribution like benefits of subsidized water are not distributed equally in both societies and public distribution of drinking water is more favourable for rich people in urban areas as compared to rural areas.

Nayar (1997) investigated that health promoting factors such as housing conditions availability of safe drinking water, adequate sanitary facilities could contribute to health improvements among the population even more than health services. The study based on the results of findings related to experiences of European and American countries related to unavailability of basic services during 18th and 19th century. The study found negative correlation between availability of piped water supply and crude death rate, households

with water source in premises and infant mortality rate. Another study on safe water by Roy et al. (2004), found that there is a positive correlation between expenditure on purification and ability to pay and also with level of education and as any consumer earns more, his spending capacity on averting measures increases with the positive influence of education level.

Shah (2005) looks at the cost of delivery and benefits of a drinking water and supply projects undertaken in Anantpur district in Andhra Pradesh. It has been found that unsafe water creates health problems and insufficient water would hinder the ingestion of food over time. O'Reilly (2010) analyzed a study on women participation in Rajasthan considering water supply and sanitation provisions are key elements in progress of women participation to the sustainability of the MDG projects. This study finds that prevailing social inequalities and difficulties faced by women are big challenges for sanitation coverage projects.

Begum et al. (2011) focused on the effect of improved drinking water and sanitation facility on the incidence of water-borne diseases among children in Bangladesh. It has been observed that the children from households with access to improved drinking water source and improved sanitation face less vulnerability to diarrhoeal attack than those households who did not have such access.

Odaro (2012) conducted a study on Sub Saharan Africa (SSA) and analyzed the causes of poor services delivery and its impact on development. This study finds out that weakness in service delivery can be attributed to a number of issues and states that only private investment is not enough to fill the gap and to build strong infrastructure for services delivery.

Wardrop et al. (2016) conducted a study on drinking water and sanitation at global level to examine drinking-water and sanitation availability, safety, accessibility and sustainability and evaluate the related policy changes. The results of the study show that there is lack of international harmonization and standardization relating to safety, accessibility and sustainability of services.

No doubt the various studies related to water and sanitation have been conducted at national and international levels but no such detailed study has been made to examine the impact of access to

water, sanitation and hygiene on the economic development from all dimensions.

3. Objectives, Database and Methodology

The access to drinking water in the world especially, in the developing countries, is a matter of concern which continuously ignored by researchers. To fill this gap, in the present study, an attempt has been made to provide a comparative analysis of the importance, nature and extent of access to safe drinking water in the developed world as well as in the developing ones. Moreover, the study also analyzed the impact of access to safe drinking water on different indicators of economic development such as health, education and labour force participation rate. This research paper is a comparative analysis of 20 countries across the world, out of which 10 developing and 10 developed countries which has been selected according to the higher and lower access to safe drinking water coverage respectively (as given UNICEF Report 2017). For any empirical analysis availability of a good database is pre-condition. For the purpose of this present study, the secondary data-set has been used and taken from various sources for the period of 2000 and 2015. Data on population with improved water coverage were obtained from World Development Indicators, World Bank 2017. Education and health related data were collected from Human Development Report, 2016 and Health Statics, 2017. The other main sources of the related information for developed and the developing countries are the reports from the WHO, UNICEF, UNDP and UN-Water. For further analysis, simple statistical tools such as percentages, simple averages, correlation coefficients etc., have been used to derive the meaningful findings.

4. Results and Discussion

In this section, we discuss the main findings of the study obtained from the secondary data that include the trends of access to improved water in developed and developing countries.

Improved water and sanitation coverage has been rapidly increasing since 2000 because of global efforts. Developed countries such as Australia, New Zealand, Netherlands, Germany, Norway, Sweden and France, have better access to improved water sources. The perusal of Table-1 presents the total as well as rural and urban

population in developed as well as in developing countries with improved drinking water coverage over the period 2000 to 2015.

Table-1 : Proportion of Population with Improved Water Coverage among Developed and Developing Countries

Developed Countries				
Country Name	Year	Rural Pop. (Per cent)	Urban Pop. (Per cent)	Total Pop. (per cent)
Australia	2000	100.0	100	100.0
	2015	100.0	100	100.0
Chile	2000	67.8	99.2	94.9
	2015	93.3	99.7	99.0
Canada	2000	99.0	100.0	99.8
	2015	99.0	100.0	99.8
France	2000	100.0	100.0	100.0
	2015	100.0	100.0	100.0
Germany	2000	100.0	100.0	100.0
	2015	100.0	100.0	100.0
New Zealand	2000	100.0	100.0	100.0
	2015	100.0	100.0	100.0
Norway	2000	100.0	100.0	100.0
	2015	100.0	100.0	100.0
Netherlands	2000	100.0	100.0	100.0
	2015	100.0	100.0	100.0
Sweden	2000	95.8	99.6	98.8
	2015	98.2	99.4	99.2
United States	2000	100.0	100.0	100.0
	2015	100.0	100.0	100.0
Developing Countries				
Country Name	Year	Rural Pop. (Per cent)	Urban Pop. (Per cent)	Total Pop. (per cent)
Afghanistan	2000	24.3	52.2	30.3
	2015	47.0	78.2	55.3

Bangladesh	2000	73.7	83.2	76.0
	2015	87.0	86.5	86.9
Bhutan	2000	79.0	98.2	83.9
	2015	100.0	100.0	100.0
China	2000	70.8	97.2	80.3
	2015	93.0	97.5	95.5
Nepal	2000	74.5	94.3	77.1
	2015	91.8	90.9	91.6
India	2000	76.1	92.3	80.6
	2015	92.6	97.1	94.1
Indonesia	2000	68.2	91.3	77.9
	2015	79.5	94.2	87.4
Malaysia	2000	88.6	97.4	94.1
	2015	93.0	100.0	98.2
Pakistan	2000	85.0	95.4	88.5
	2015	89.9	93.9	91.4
Sri Lanka	2000	76.3	94.8	79.7
	2015	95.0	98.5	95.6

Source : WHO/UNICEF, 2017 & World Bank, 2017

A comparison of rural and urban areas shows that a greater progress has been made in expanding water sources to urban areas than the rural ones. The table gives an overview of the proportion of population in the country that receives a good quality of drinking water supply coverage. In 2015, in Chile, 99 per cent of the population had access to improved water. This coverage for improved sources of water stood at 99.7 per cent and 93.3 per cent in urban and rural areas respectively. In 2010, the United Nations General Assembly explicitly recognized access to safe and clean water and sanitation as a human right which is essential for the full enjoyment of life. There have been remarkable achievements in increasing the extent of improved water coverage over the last decades in developed countries, which is clearly observed from the above data.

In Canada, 99.8 per cent of the population had good quality of water coverage. The drinking water supply in cities is continuous and of excellent quality. While United States achieved universal access to water target with 100 per cent safe water coverage in 2015. France

also have good water supply in rural as well as urban areas. It has been observed from above table that New Zealand, France, Germany, Netherlands are the countries where nearly all the people have good drinking water supply. Thus we have seen that nearly 100 per cent of population residing in the developed countries has access to improved water but few studies outline that in these nations few communities are still struggling to meet water standards (Davis & Ryan 2017& Calderon et al. 2018).

Access to safe water source and improved sanitation is the one of the main objective of Millennium Development Goals (MDGs). Improved sanitation and safe drinking water have important impact on the health status and socio-economic development of country. The large portions of the populations in developing countries are living in the rural areas. Lack of access to improved water and sanitation facilities is a predominant feature, especially in the rural areas of the developing countries because a greater proportion of population in developing countries lives in the rural areas. According to the UNICEF Report 2017, only two out of six people having access to safely managed water live in rural areas.

The perusal of Table-1 also shows the relative share of population with access to safe drinking water coverage between the rural and urban areas of developing countries. It is clearly evident from the data that Afghanistan has the highest number of people in the world without access to safe water coverage. In the country, only 55.3 per cent of the population receives the improved water. This share is very low as compared to the other developing countries. The further result reveals that India comes at the second place with maximum number of people in the world without access to safe drinking water.

The majority of the people comes from impoverished communities and is forced to collect dirty water from open ponds and rivers or spend most of what they earn buying water from tankers. If they have the opportunity to buy water from a tanker it can costs higher, sometimes double if supplies are scarce. Drinking water has always been on top of the priority list of social consumption items, because it is not only essential but also scarce in most parts of the country, especially clean and healthy water (NITI Aayog, 2018).

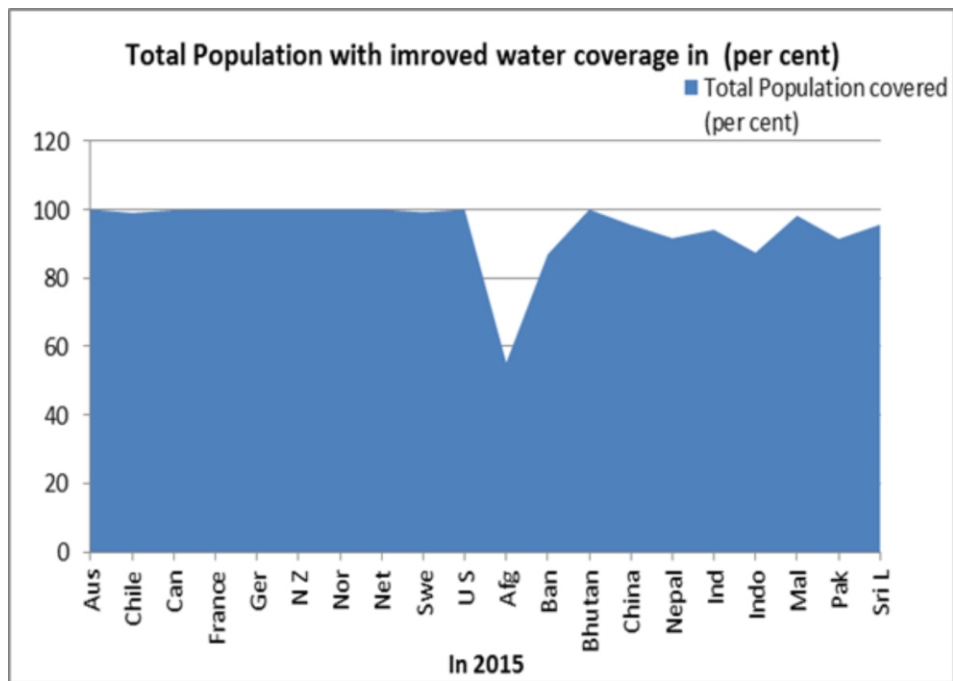
In India, the number of piped water supply systems in rural areas is rapidly increasing, driven in part by water resource

constraints, but increasingly because people want a higher level of service. In 2010, about one third of rural households already use piped water and about one third of these have house connections. However it should be noted that there are significant inequalities between the rich and the poor and this needs to be addressed in moving forward. For example while about 32 per cent of the rich people have piped connections on their premises, only about 1 per cent of the poorest have this facility (GoI, 2011a). Earlier also, keeping in view the need and the unequal distribution of safe water, the Seventh Plan aimed at providing safe drinking water to all sections of the population besides raising the per capita norms of water supply from 40 to 70 litres per capita per day (Planning Commission, 1985). But the evidence indicates that the achievements of this plan were far below the targets (Reddy & Rathore, 1993). In continuation of earlier goals regarding the access to safe drinking water, the 12th five year plan had the vision for rural domestic water supply in order to cover all rural households with safe piped drinking water supply for 70 litres per capita per day.

It is clearly evident that the proportionate share of population with access to improved drinking water was the highest (100 per cent) in Bhutan during 2015 followed by Malaysia Sri Lanka, China and India. But it was the lowest in Afghanistan (55.3 per cent) during the same period of time. Further the data clearly shows that there is highly unequal distribution of improved drinking water sources within the developing countries.

The above table also highlights the coverage of improved drinking water sources among rural and urban population of developing countries. Almost 97.1 per cent of the urban population and 92.6 per cent of the rural population in India use improved water in 2015. There are considerable variations in the coverage of safe water among various developing countries such as Afghanistan, Indonesia and India with a difference of 31.2, 14.7 and 4.5 percentage points between rural and urban dwellers respectively. It is observed that Bhutan has maximum coverage of access to drinking water with 100 per cent in both rural and urban population. Thus, the level of disparities in the access of water is very high across the developing countries. On the one hand, the proportion of population with safe drinking water is higher among the Bhutan, Malaysia, Sri Lanka, and China, while lower across the India, Indonesia Nepal and Pakistan in both rural as well as urban areas.

Figure-1 : Total Population with Improved Water Coverage among Developed and Developing Countries

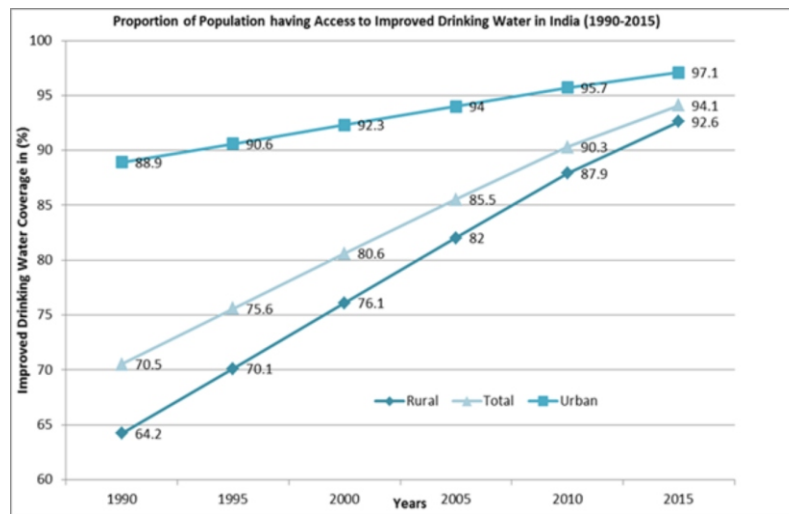


Source : WHO/UNICEF, 2017 & World Bank, 2017

It is evident from the above area graph that in developed countries the total population with improved water coverage is much higher than the developing ones. Most of the selected developed countries come under the category of above 95 per cent population coverage with water sources. This is visible from the horizontal line of the graph. Whereas, shrinking point demonstrates that the maximum number of people in the developing world is without access to safe water. The majority of developing countries belong to the range of coverage between 35 to 75 per cent. The population with water coverage is highly skewed within developing countries. The area graph show that the developing countries are still far away from the desired goals of universal coverage of safe drinking water.

According to the recent World Health Organization report, about 783 million people have no access to safe drinking water. The problem is particularly more severe in Asia. However, eighty five per cent of the global population without access to improved drinking water sources lives in the regions—Central Asia and Southern Asia, East and South-Eastern Asia, and Sub-Saharan Africa (WHO/UNICEF, 2017).

Figure-2 Proportion of Population having Access to Improved Drinking Water in India (1990-2015)



Source : WHO/UNICEF, 2017 & World Development Indicators World Bank, 2017

India is home to 1.2 billion people (GoI, 2011). With 16 per cent of the global population, it has only 4 per cent of the world's water resources (GoI, 1999). India has made significant progress in development of water resource and supporting infrastructure, yet rapid industrial and agricultural development, population growth and unequal water distribution have resulted in demand for water exceeding supply.

Equal access to essential health and improved water sources continue to be a first priority for India. The issues of health and well-being are closely related to an adequate water supply and improved sanitation facilities. India is a country of villages; more than 830 million people (69.84 per cent) are still living in the villages. According to Census of India 2011, around 70 per cent of India's rural and slum population is exposed to water-borne diseases due to lack of safe drinking water (GoI, 2011b). In India during 2015, about 150 million people had not access to improved source of drinking water. If we consider the improved water sources, it shows the greater change in rural as well as in urban India.

The above bar graph reveals the information about changes in the proportion of population with access to improved drinking water in rural as well as in urban India from 1990 to 2015. The figure illustrate that the access to safe drinking water coverage had

increased slightly between the given periods of time. In 2015, almost 94 per cent of the population had access to improved water sources in India. But there is high degree of variations among the rural and urban areas of the country. In rural areas, where 72 per cent of India's population lives, the respective share of population with access of drinking water comes to be 92 per cent whereas, it is the highest (94 per cent) for urban areas. The overall access of water has improved from 71 per cent in 1990 to 94 per cent in 2015. No doubt in the last two decades, there have been improvements in the access of drinking water in rural as well as in the urban areas of India. However, there are still an estimated 150 million people in the country who do not have access to safe drinking water.

4.1 Health, Education and Labour Force Participation Rate in Developed Countries

The poor access to water supply is a prevalent issue in over 850 million people worldwide. The global burden of disease and mortality rates could be reduced by about 9.1 per cent and 6.3 per cent, respectively, if rapid success is attained in facilitating access to water, sanitation, and hygiene facilities. A large proportion of these diseases are related to diarrhoea incidences which contribute to the mortality rate of about 1.9 million and new diarrhoea cases estimated at 4 billion annually especially among children under five years old. Developing countries account for around 19 per cent of those mortality rates (Joshi & Amadi, 2013).

The Table-2 shows the health outcomes such as life expectancy, mortality rate and mortality due to unsafe drinking water sources, level of secondary education and labour force participation rate in the developed countries. The data reveals that life expectancy at birth in 2015 was the highest in case of Australia (82.5years) and the lowest in case of United States (79.2years). Infant mortality rate as well as mortality under five is the lowest in Norway that is 2.0 and 2.6 per1000 live births and it is the highest in Chile where these are respectively, 7.0 and 8.1 per thousand live births. On the other hand, in case of labour force participation rates, it has been found that it is the highest for the females in New Zealand (62.4 per cent) while for the males, the highest rate has been observed in Chile (74.6 per cent) among all the countries listed in the Table-2 on next page.

Table-2 : Health, Education and Labour Force Participation Rate in Developed Countries

Developed Countries								
Country Name	Water Coverage of Total population, 2015	Life Expectancy at birth (2015)	Mortality rate (per 1,000 live births) 2015		Labour Force participation (% ages 15 and older 2015)		Population with at least some secondary education (% ages 25 and older) 2005	
	%	Years	Infant	Under -5	Female	Male	Female	Male
Australia	100.0	82.5	3.0	3.8	58.6	70.9	91.4	91.5
Chile	99.8	82.0	7.0	8.1	50.7	74.6	76.1	76.9
Canada	99.0	82.2	4.3	4.9	61.0	70.3	100.0	100.0
France	100.0	82.4	3.5	4.3	50.7	60.1	79.7	85.5
Germany	100.0	81.1	3.1	3.7	54.5	66.4	96.4	97.0
New Zealand	100.0	81.7	3.2	3.8	57.5	70.2	86.2	90.3
Norway	100.0	82.0	4.7	5.7	62.4	73.1	98.8	98.7
Netherlands	100.0	81.7	2.0	2.6	61.2	68.5	96.1	94.6
Sweden	99.2	82.3	2.4	3.0	60.9	68.2	87.8	88.3
United States	100.0	79.2	5.6	6.5	56.0	68.4	95.4	95.1
Average	99.8	81.7	3.8	4.6	57.3	69.0	90.7	91.7

Source : Human Development Report, 2016 & Health Statics, 2017

The table also reveals that France has the lowest labour force participation rate for the males (60.1 per cent) as well as the females (50.7 per cent) among all the developed countries. Similarly, the information regarding secondary education shows that the proportion of the population with at least secondary education is the highest in Chile (100 per cent) for both the males and the females while the lowest values have been observed in Canada for both the males (76.9) and the females (76.1). Thus, we have seen that the achievements of the developed economies on the indicators of the

health as well as education are very high as compared to the developing economies. In case of the most of the indicators, the lowest values registered in the developed countries are higher than most of the developing countries with highest outcomes within their own group.

4.2 Health, Education and Labour Force participation Rate in Developing Countries

On the other hand, with the average coverage of 99.80 per cent of water coverage, the average value of life expectancy at birth is 81.71 years in developed countries. The average value of labour force participation is found to be as 57.35 per cent of female and 69.07 per cent in case of male participation. From the above analysis, it can also be seen that average value of population with at least secondary education is 90.79 per cent for female and 91.79 per cent for men. Along with the life expectancy, education and labour force participation, the above table also reveals that the mortality rate for infant is 3.88 per cent and 4.64 per cent for under-five age. But interesting fact is found that average mortality rate for due to lack of water, sanitation and hygiene (WASH) is just 0.53 per which is very less as compare to developing countries.

Table-3 shows the status of health, labour force participation as well as education in selected developing countries. It is clearly evident that in 2015, the life expectancy at birth was the highest in China (76 years) and the lowest in Afghanistan (60.70 years). Infant mortality rate as well as mortality rate of children aged under five is the lowest in Malaysia (6per thousand and 7 per thousand) and the highest in Afghanistan where these are found to be as high as 66.30 and 91.10 per1000 live births, respectively. The mortality rate due to unsafe WASH services is the lowest in case of Malaysia and China that is (0.40) and the highest in Afghanistan (34.60 per 1000 live births), followed by India (27.40) and then Pakistan (20.70). As far as the employment status is concerned, from a comparison of Table 3.2 and 3.3, we can observe that the gender differences in the labour force participation rate of the females, is much higher in the developing countries than the developed ones. The highest male as well as female labour force participation has been found in Nepal (79.70 per cent for females and 86.80 per cent for the males).

Table-3 : Health, Education and Labour Force Participation Rate in Developing Countries

Developing Countries								
Country Name	Water Coverage of Total population, 2015	Life Expectancy at birth (2015)	Mortality rate (per 1,000 live births) 2015		Labour Force participation (% ages 15 and older 2015)		Population with at least some secondary education (% ages 25 and older) 2005	
	%	Years	Infant	Under-5	Female	Male	Female	Male
Afghanistan	55.3	60.7	66.3	91.1	19.1	83.6	8.8	35.4
Bangladesh	86.9	72.00	30.7	7.6	43.1	81	42	44.3
Bhutan	100	69.9	27.2	32.9	58.7	72.8	5.8	13.4
China	95.5	76	9.2	10.7	63.6	77.9	69.8	79.4
India	94.1	68.3	37.9	47.7	26.8	79.1	35.3	61.4
Indonesia	87.4	69.1	22.8	27.2	50.9	83.9	42.9	51.7
Malaysia	98.2	74.9	6	7	49.3	77.6	75.4	79.1
Nepal	91.6	70	29.4	35.8	79.7	86.8	21.4	41.2
Pakistan	91.4	66.4	65.8	81.1	24.3	82.2	26.5	46.1
Sri Lanka	95.6	75	8.4	9.8	30.2	75.6	80.2	80.6
Average	89.6	70.03	30.37	35.09	44.57	80.05	40.81	53.26

Source : Human Development Report, 2016 & Health Statics, 2017

The male-female differences in the labour force participation rate have been found to be the widest in case of Afghanistan which has registered the lowest female labour force participation rate (only 19.10 per cent) while in case of males, the lowest labour force participation has been found in Bhutan (72.80 per cent). On the other hand, in case of the educational outcomes, we can observe that the highest proportion of those with secondary education is reported by

Sri Lanka where for the population older than 25 years, 80.6 per cent of the males and 80.20 per cent of the females have attained at least secondary level of education. But these proportions are only 13.40 per cent for males and 5.80 per cent for the females in the same age group in Bhutan.

On the other hand, with the average coverage of 89.60 per cent of water, the average value of life expectancy at birth is 70.03 years in developing countries. The average value of labour force participation is found to be as 44.57 per cent of female and 80.05 per cent in case of male participation. From the above analysis, it can also be seen that average value of population with at least secondary education is just 40.51 per cent for female and 53.26 per cent for men. Along with the life expectancy, education and labour force participation, the above table also reveals that due to lack of safe drinking water and other basic facilities there is very high rate of mortality rate. The average value of mortality rate for infant and under-five is 30.37 per cent and 35.09 per cent respectively.

We know that the access to safe drinking water as well as sanitation facilities greatly influence the health outcomes, education status as well as labour force participation rate, especially that of the women. Hence, it is important to examine the links between the access to water and these outcomes. For this purpose, the correlation matrix is used to explain the relationship between these variables.

Correlation matrix is used to show the impact of access to safe drinking water on different indicators of economic development such as life expectancy rate at birth, Infant mortality rate, female labour force participation rate and secondary education. The correlation matrix among the different variables is present in Table-4. The results of correlation matrix shows that there is a strong and positive correlation between water coverage of total population and life expectancy at birth (0.759) and it is also significant at 1 per cent level. It means life expectancy rate at birth increases with the water coverage of total population. Whereas, the value of correlation coefficients is - 0.758 for the infant mortality rate which clearly indicates that infant mortality rate is negatively correlated with the water coverage. These results are also statistically significant at one percent level. It simply means that an increase in water coverage of total population will reduce the infant mortality rate.

Table-4 : Correlation Matrix of the Variables

Variables	WCTP	LE	IMR	< 5 MR	FLFP	FPSE
Water Coverage of Total Pop. (WCTP)	1					
Life Expectancy rate at Birth (LE)	.759** (0.000)	1				
Infant Mortality Rate (IMR)	-.758** (0.000)	-.911** (0.000)	1			
Mortality Rate Under 5 (<5 MR)	-.750** (0.000)	-.876** (0.000)	.962** (0.000)	1		
female Labour Force participation (FLFP)	.565** (0.009)	.582** (0.007)	-.653** (0.002)	-.636** (0.003)	1	
Female Population with at least some secondary Education (FPSE)	.623** (0.003)	.915** (0.000)	-.859** (0.000)	-.807** (0.000)	0.389 (0.09)	1
N	20	20	20	20	20	20

**Correlation is significant at the 0.01 level (2-tailed).

In case of mortality rate under 5, the value of correlation coefficient found to be -0.750. There is significant and negative correlation had been observed between mortality rate under 5 years of age and water coverage. Further results of the correlation matrix point out that there is moderate and positive correlation between the female labour force participation rate and water coverage of total population (0.565) among the selected countries of the world. In nutshell, it is concluded from the above analysis that the life expectancy at birth, female labour force participation rate and female population with at least secondary education are directly associated with water coverage of total population whereas, infant mortality rate and mortality rate under 5 years of age are inversely related to the total population with water coverage.

5. Conclusion and Policy Implications

Economic development is impossible without any improvement in health, education and female labour force participation rate. Improvement in health, education and female labour force participation rate is not possible without increasing the access of water in developing and developed countries. In nutshell, it is concluded from the overall analysis that the highest proportion of

population without improved water facilities is still living in the present world, particularly in developing countries. On the one hand, Australia, France, Germany, New Zealand, Norway, Netherlands and United States have already achieved the universal access to water with 100 per cent safe water coverage in 2015. These countries also have a higher rank in terms of human development index and value of living standards of life. On the extreme side, developing countries have greater proportion of people with inadequate water coverage. It has been found that among the developing countries, Afghanistan, Bangladesh, and India have the maximum number of people in the world without access to safe water facilities. The study highlighted the interesting fact that the life expectancy at birth, female labour force participation rate and female population with at least secondary education is positively related with access to safe drinking water. The overall status of coverage of water and sanitation services appears to be unsatisfactory in developing countries. Outbreak of water-borne and water-related disease are very common among children. Lack of safe drinking water leads to not only poor health and lesser education achievement but it also affects the living standard of people, per person earnings, GDP growth and overall development of any economy. Access to safe drinking water is most likely a stronger driving force behind improving the health and education related variables. In developing countries, the budget allocations devoted to provide safe drinking water is inadequate hence; there is a need to allocate more funds to water projects so that the fixed targets to achieve the SDGs can be successfully accomplished. The importance of water, sanitation and hygiene services greatly affect the health standards and quality of life of people. Access to these services is significant for economic development. But to make all round development of the economy and for welfare of the communities, holistic approach is needed and no partial or half-hearted effort can make any improvement. To ensure the access to safe drinking water in the developing countries there is need to increase public and private investments in water related projects.

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