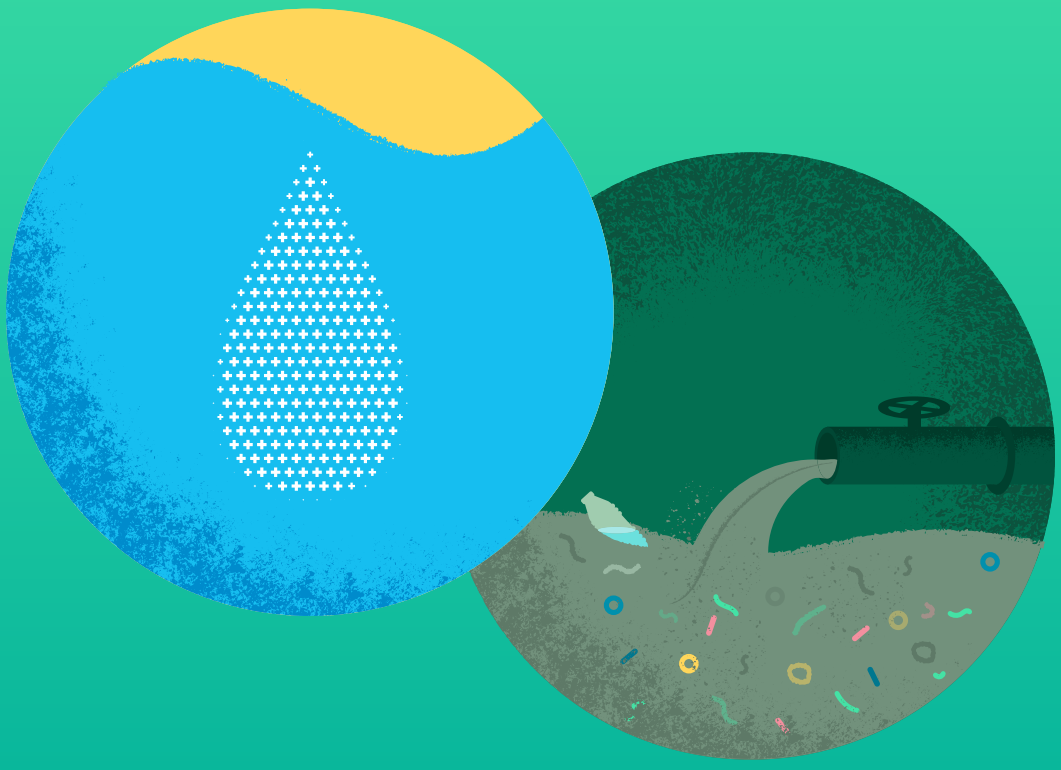
SOCIAL DEVELOPMENT POLICY PAPERS #2018-05

Inequality of Opportunity in Asia and the Pacific

Water and Sanitation



UNITED NATIONS ESCAP
Economic and Social Commission for Asia and the Pacific

The shaded areas of the map indicate ESCAP members and associate members.

The Economic and Social Commission for Asia and the Pacific (ESCAP) serves as the United Nations' regional hub promoting cooperation among countries to achieve inclusive and sustainable development. The largest regional intergovernmental platform with 53 Member States and 9 associate members, ESCAP has emerged as a strong regional think-tank offering countries sound analytical products that shed insight into the evolving economic, social and environmental dynamics of the region. The Commission's strategic focus is to deliver on the 2030 Agenda for Sustainable Development, which it does by reinforcing and deepening regional cooperation and integration to advance connectivity, financial cooperation and market integration. ESCAP's research and analysis coupled with its policy advisory services, capacity building and technical assistance to governments aims to support countries' sustainable and inclusive development ambitions.

Printed in Thailand
ST/ESCAP/2840

Disclaimer

Social Development Division
Economic and Social Commission for Asia and the Pacific
United Nations Building
Rajadamnern Nok Avenue
Bangkok 10200, Thailand
Email: escap-sdd@un.org
Website: www.unescap.org

Inequality of Opportunity in Asia and the Pacific

Water and Sanitation

Acknowledgements

This paper was prepared under the leadership of Patrik Andersson, Chief, Sustainable Socioeconomic Transformation Section, Social Development Division, and the overall guidance of Nagesh Kumar, Director of the Social Development Division. The drafting was led by Ermina Sokou and Orlando Zambrano Roman. The statistical and econometric analysis was done by Yichun Wang and Predrag Savić. Valuable comments and inputs were provided by colleagues in the Social Development Division of ESCAP, including Chad Anderson, Thérèse Björk and Pornnipa Srivipapattana.

Special thanks are due to Evariste Kouassi-Komlan, Regional Adviser, Water, Sanitation and Hygiene (WASH) at the UNICEF East Asia and Pacific Regional Office and to Solene Le Doze, Economic Affairs Officer in the Environment and Development Division (EDD) at ESCAP, who reviewed the paper and provided valuable comments.

The graphic design was done by Daniel Feary.

The paper is part of the Social Development Division's Policy Paper Series.

Table of contents

List of figures

List of tables

Country abbreviations

AF	Afghanistan
AM	Armenia
AS	American Samoa
AU	Australia
AZ	Azerbaijan
BD	Bangladesh
BN	Brunei Darussalam
BT	Bhutan
CN	China
FJ	Fiji
FM	Micronesia, Federated States of
GE	Georgia
GU	Guam
ID	Indonesia
IN	India
IR	Iran, Islamic Republic of
JP	Japan
KG	Kyrgyzstan
KH	Cambodia
KI	Kiribati
KP	Korea, Democratic People's Republic
KR	Korea, Republic of
KZ	Kazakhstan
LA	Lao People's Democratic Republic
LK	Sri Lanka
MH	Marshall Islands
MM	Myanmar
MN	Mongolia
MP	Northern Mariana Islands
MV	Maldives
MY	Malaysia
NC	New Caledonia
NP	Nepal
NR	Nauru
NZ	New Zealand
PF	French Polynesia
PG	Papua New Guinea
PH	Philippines
PK	Pakistan
PW	Palau
RU	Russian Federation
SB	Solomon Islands
SG	Singapore
TH	Thailand
TJ	Tajikistan
TL	Timor-Leste
TM	Turkmenistan
TO	Tonga
TR	Turkey
TV	Tuvalu
UZ	Uzbekistan
VN	Viet Nam
VU	Vanuatu
WS	Samoa

About the Inequality of Opportunity papers

The ESCAP Inequality of Opportunity papers place men and women at the heart of sustainable and inclusive development. The papers do so by identifying seven areas where inequality jeopardizes a person's prospects, namely: education; women's access to health care; children's nutrition; decent work; basic water and sanitation; access to clean energy; and financial inclusion. Each of these opportunities are covered by specific commitments outlined in the 2030 Agenda for Sustainable Development and addressed in a separate thematic report covering 22 countries throughout Asia and the Pacific.[i]

ESCAP first discussed inequality of opportunity in its 2015 report *Time for Equality*,[ii] establishing the distinction between inequality of outcome and inequality of opportunity. While the former depicts the consequences of unequally distributed income and wealth, the latter is concerned with access to key dimensions necessary for fulfilling one's potential.

The papers build on the work of many scholars and the findings from *Time for Equality*. They apply a novel approach to analysing household surveys with the aim of identifying the groups of individuals with the lowest access to the above-referenced opportunities. These groups are defined by common circumstances over which the individual has no direct control.

In addition to identifying the furthest behind, the Inequality of Opportunity papers also explore the gaps between in-country groups in accessing the key opportunities, as well as the extent to which these have narrowed or widened over time. These inequalities are then analysed to identify the impact and importance each key circumstance plays.

Ultimately, these findings are of direct use for generating discussion on transformations needed to reach the "furthest behind first" as pledged in the 2030 Agenda.

i All policy papers follow the same methodology using the latest publicly available DHS and MICS data, except for decent work, where slight modifications are due to the use of a different dataset.

ii Time for Equality: The Role of Social Protection in Reducing Inequalities in Asia and the Pacific (UNESCAP) (2015). Available from: https://www.unescap.org/sites/default/files/SDD%20Time%20for%20Equality%20report_final.pdf (accessed on 27/06/18).

1. Introduction and scope

Access to clean water and basic sanitation is a human right deemed essential to live a healthy life, be engaged in productive activities, and fulfil one's potential. Several Goals of the 2030 Agenda for Sustainable Development refer to the importance of water, including for achieving education, health and environmental objectives. Most significantly, through Sustainable Development Goal (SDG) 6 UN Member States have pledged to "ensure availability and sustainable management of water and sanitation for all".[1]

Apart from the evident gains of leading a healthy life, proper access to clean water and basic sanitation has profound social and economic impacts. Many of these impacts are captured in the sustainable development agenda, such as poverty reduction (Targets 1.1 and 1.4), ending malnutrition (2.2), ensuring healthy lives (3.2, 3.3, and 3.9), achieving gender equality (5.2 and 5.4), productive work (8.5), and safe and affordable housing for all (11.1 and 11.5), as well as environmental objectives outlined in SDGs 12, 13, 14 and 15. From an aggregate perspective, it also has positive externalities by protecting environmental resources and enabling sustained economic growth.

The Asia-Pacific region has made great progress in reducing poverty and raising the well-being of millions through economic growth. However, these gains have not been equally distributed. Many people have been "left behind" and continue to live in vulnerable situations, without adequate access to basic services, including both access to basic water and sanitation.[2] It is estimated that 260 million people in the ESCAP region had an unimproved water service and over 1.5 billion people lacked a basic improved sanitation facility in 2015.[3] It is also estimated that 630 million people practiced open defecation.[4] Open defecation threatens human dignity and also constitutes a major economic and health burden.

"Open defecation threatens human dignity and also constitutes a major economic and health burden."

This report measures inequality in access to water and basic sanitation among diverse population groups in 22 countries in the Asia-Pacific region (Box 1). Aligned with targets 6.1 and 6.2 of the SDGs, the indicators used in this report are defined as: (1) access to clean water; and (2) access to basic sanitation, using publicly available *Demographic and Health Surveys* (DHS) and *Multiple Indicator Cluster Surveys* (MICS).[iii]

Overall, the aim of this report is: i) to outline why it is important to reduce inequalities in access to clean water and basic sanitation; ii) to introduce a new way of analysing survey data by identifying the shared circumstances of those "furthest behind"; and iii) to analyse observed inequality by the relative contribution of each circumstance.

iii This policy paper calculates access to water and basic sanitation rates by country directly from the countries' DHS and MICS datasets, so as to allow further statistical analysis and exploration of the groups that are furthest behind within these datasets. (See section 3 for details of the statistical analysis.) For that reason, the average access rates per country may not exactly match the official WHO-UNICEF Joint Monitoring Programme (JMP) 2017 country access rates.

BOX 1

What does clean water and basic sanitation mean?

According to the World Health Organization (WHO) and the United Nations International Children's Emergency Fund (UNICEF), safely managed drinking refers to "water that is located on premises, available when needed, and free from faecal and priority chemical contamination", and safely managed sanitation refers to "the use of improved facilities that are not shared with other households and where excreta are safely disposed of in situ or transported and treated offsite". These definitions, developed to assist measurement of the relevant indicators in the 2030 Agenda (6.1.1 and 6.2.1), set the bar higher in terms of access compared to the Millennium Development Goals (MDG) framework that covered only basic or "improved" access.

In this paper, the indicators are defined following the "basic" service definition, also described in the water and sanitation ladder below, as was also reported in the MDGs. Basic drinking water sources include piped water, boreholes or tube wells, protected dug wells, protected springs, and packaged or delivered water. In the case of sanitation, the basic facilities include flush/pour flush to piped sewer systems, septic tanks or pit latrines; ventilated improved pit latrines, composing toilets or pit latrines with slabs. The decision to use the less strict definition of "basic" access allows wider country coverage, given the questions asked in the available surveys.

Water and sanitation ladder

SERVICE LEVEL	DEFINITION
Safely managed	Drinking water from an improved water source that is located on premises, available when needed and free from faecal and priority chemical contamination
Basic	Drinking water from an improved source, provided collection time is not more than 30 minutes for a round trip, including queuing
Limited	Drinking water from an improved source for which collection time exceeds 30 minutes for a round trip, including queuing Drinking water from an unprotected dug well or unprotected spring
Unimproved	Drinking water from an unprotected dug well or unprotected spring
Surface water	Drinking water directly from a river, dam, lake, pond, stream, canal or irrigation canal
	DEFINITION
Safely managed	Use of improved facilities that are not shared with other households and where excreta are safely disposed of in situ or transported and treated offsite
Basic	Use of improved facilities that are not shared with other households
Limited	Use of improved facilities shared between two or more households
Unimproved	Use of pit latrines without a slab or platform, hanging latrines or bucket latrines
Open defecation	Disposal of human faeces in fields, forests, bushes, open bodies of water, beaches or other open spaces, or with solid waste

Source: *Progress on Drinking Water, Sanitation and Hygiene: 2017 Update and SDG Baselines*. Geneva: World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) (2017). Licence: CC BY-NC-SA 3.0 IGO; p. 8.

2. Why does inequality in access to water and sanitation matter?

Clean water is not only vital for survival, but also for supporting a healthy and productive population. Inadequate access to clean water and basic sanitation reinforces the cycle of poverty. Not having access to water and sanitation is also an indisputable sign of inequity and a cause of disparities in other development areas.

"...there are still marginalized groups relying on unprotected dug wells or surface water as their main water source, and practicing unsafe sanitation"

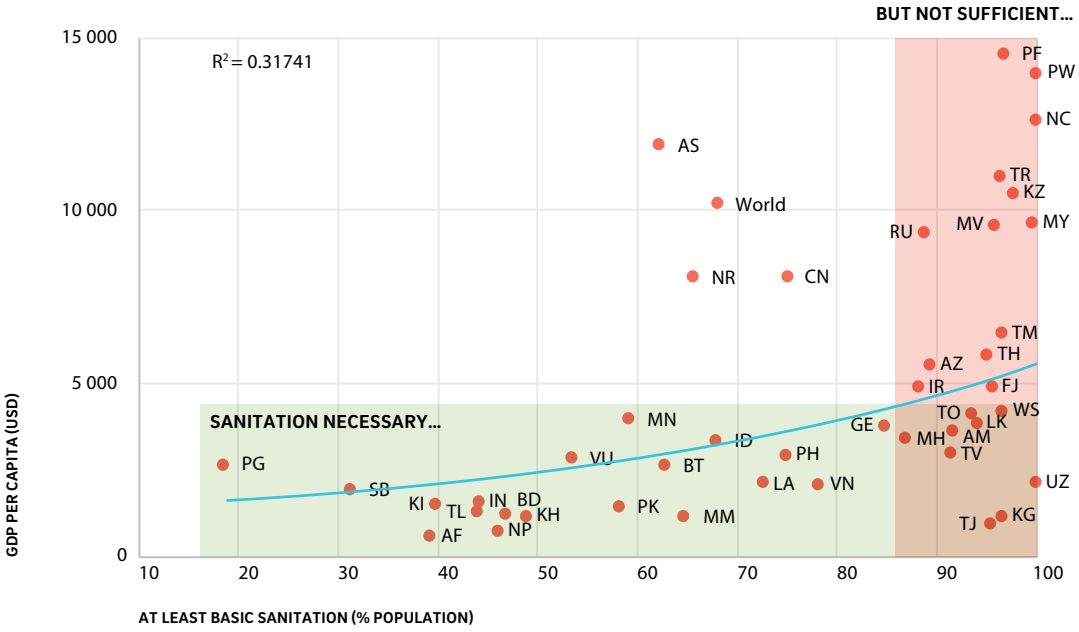
2.1 A necessary condition for development

Large gaps persist in the Asia-Pacific region both between countries and subregions, and between groups within countries.[5] Even though most individuals have access to a reliable drinking source and an improved sanitation facility, there are still marginalized groups relying on unprotected dug wells or surface water as their main water source, and practicing unsafe sanitation.

Figure 1 displays between-country variations in access to basic sanitation in the Asia-Pacific region. It highlights that no country with basic sanitation coverage of less than 60 per cent has achieved a per capita income of more than USD 5,000. Whether countries boost sanitation investment as they become richer, or achieving sanitation goals creates the conditions for growth, the relationship shows that critical mass in sanitation is a necessary, but not sufficient condition for economic development.

FIGURE 1

GDP per capita and access to basic sanitation in the Asia-Pacific region, 2015



Source: ESCAP calculation based on World Bank (2018), World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) (2017).

Water-related diseases are easily preventable, and, in most cases, interventions addressing water-supply and sanitation are cost-effective. Research shows that for every USD 1 spent on access to clean water and basic sanitation in the Asia-Pacific region, the return is USD 3.6 on average.[6] This impact embodies economic gains from time spent in productive activities, social benefits in the form of reduced deaths and premature mortality, as well as monetary savings from improved health.

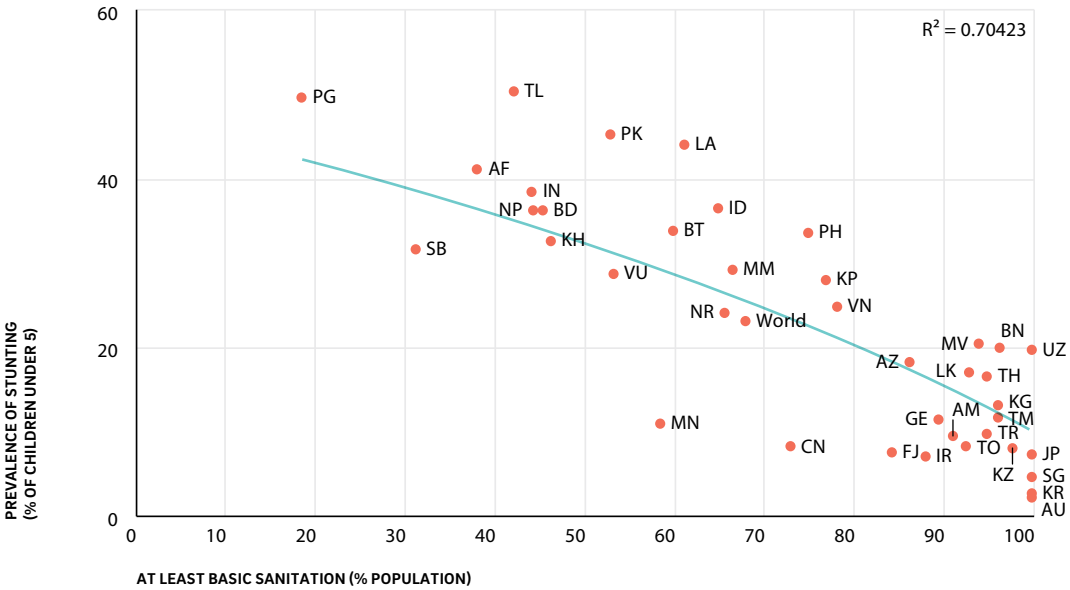
"Access to water and sanitation is not only a matter of healthy early childhood development years, but is a matter of survival"

2.2 Early childhood development

Access is not only a matter of healthy early childhood development years and positive long-term outcomes, but is a matter of survival.[7] An unimproved water source can be dangerous. Water-related diseases and those derived from poor sanitation are among the main causes of mortality in children under 5 years of age. It is estimated that more than 1,800 children die daily around the world due to diarrhoea or other preventable illnesses related to contaminated water, lack of sanitation, or inadequate hygiene.[8] For those who survive, basic sanitation provides the ground for healthy early childhood development years. Stunting, a condition characterized by low height for age among children under 5 years of age, is partly caused by loss of nutrition during bouts of disease, particularly diarrhoea.[9] In the Asia-Pacific region, countries with higher access to basic sanitation are also those with lower prevalence of stunting among children under 5 years of age (Figure 2).

FIGURE 2

Prevalence of stunting (% of children under 5) and access to basic sanitation in the Asia-Pacific region, latest year available



Source: ESCAP calculation based on World Bank (2018), World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) (2017).

Further research of WHO's Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (JMP) also shows that inequalities in access disproportionally affect the poorest segments of the population and, within these households, children under 5 years old.[10] Investing in sustainable and socially efficient structures can therefore help households alleviate childhood poverty, malnutrition, and set the stage to escape intergenerational poverty.

2.3 Clean water – a driver of gender equality

Access to clean water is critical for achieving gender equality and enhancing women's empowerment (SDG 5). Women often bear the brunt of a household's domestic work. They are responsible for supplying water for child care, house maintenance, and food preparation. When water is not available in the premises, collecting it is often an arduous task. Worldwide, it is estimated that those without access to clean water spend over 30 minutes per round trip to collect it.[11] More than time-consuming and dangerous, this activity restricts women from engaging in income-generating work or educational activities.

Water collection responsibilities also place women at higher risk of suffering health injuries and of sexual violence. For example, in rural areas in India, women can take up to six trips a day to gather water and carry up to 15 litres of water per trip.[12] The physical strain on the neck, shoulders, and posture is often coupled with fear of harassment, psychosocial stress, and risk of violence when travelling to and from water facilities.[13] Although gender equality is complex, universal access to clean water and basic sanitation constitutes a key step towards a level playing field.

2.4 Basic sanitation – a contributor to security and dignity

Without safe access to basic sanitation facilities and understanding of associated benefits, 630 million people practiced open defecation in 2015 in the Asia-Pacific region.[14] This practice spreads disease and contributes to environmental degradation. Open defecation highly increases the exposure level to water-borne diseases given most individuals practice it close to water ways and rivers. As a result, faecal material ends up contaminating sources used for human consumption. Open defecation is also particularly harmful for women, who are often obliged to defecate alone at night, exposing themselves to risks of violence.

"Countries with higher percentages of individuals living in extreme poverty have also higher percentages of people practicing open defecation."

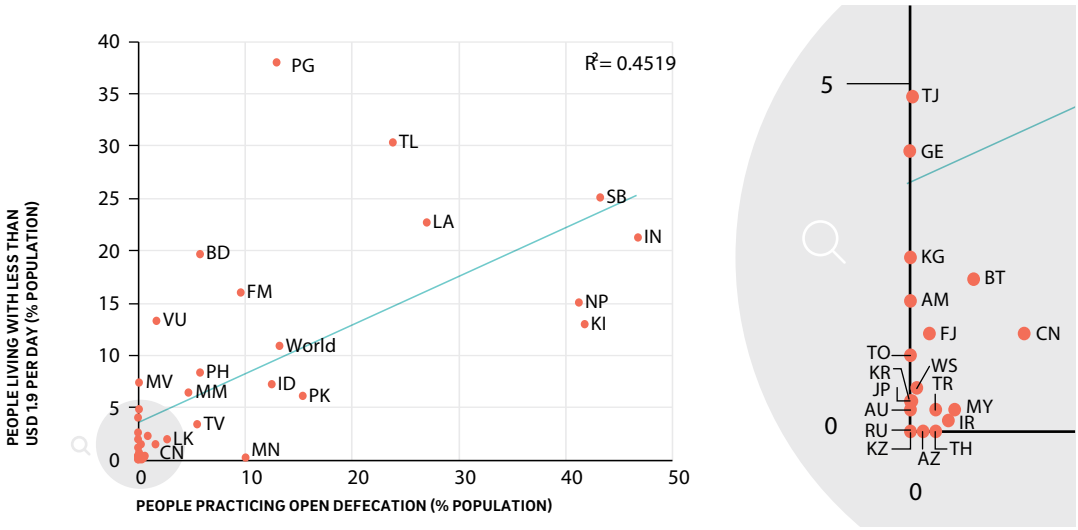
Figure 3 shows that open defecation is positively correlated with extreme poverty. Countries with higher percentages of individuals living in extreme poverty have also higher percentages of people practicing open defecation. To provide latrines and invest in proper waste disposal infrastructure may not be enough, when the demand for basic sanitation facilities is low. Policies also need to target behavioural changes in the use of these facilities.

"Policies also need to target behavioural changes in the use of these facilities."

In addition, when individuals defecate in the open, they expose themselves to harassment, violence, and physical abuse. Without proper infrastructure or support from local governments in providing basic facilities, this practice not only constitutes a major public health problem but a threat to human security and dignity.

FIGURE 3

Percentage of people living on less than USD 1.9 per day and percentage of population practicing open defecation in the Asia-Pacific region, latest year available



Source: ESCAP calculation based on World Bank (2018), World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) (2017).

2.5
Shaping urban space

There is persisting inequality in access to improved sanitation between urban and rural areas and within urban areas. While substantial progress has been made across the Asia-Pacific region in the past two decades, access to improved sanitation facilities remains low in rural areas of several countries. Fewer than 40 per cent of Cambodia's rural residents, for example, have access to improved sanitation facilities, compared to more than 80 per cent in urban areas.[15]

Yet, since 2000, the proportion of people in rural areas with access to sanitation has increased by 0.8 per cent per year, compared with 0.5 per cent per year in urban areas, because poor urban populations tend to be left behind.16 Given that the region's urban population has more than doubled between 1950, numerous cities are facing issues developing the adequate infrastructure to keep up with the quick expansion of urban populations and their and associated water and sanitation needs.

3. A new approach to identifying the furthest behind

A new methodological approach to ascertain the gaps in access to clean water and basic sanitation is needed to meet the 2030 agenda. This policy paper identifies the most excluded groups and analyses household level data from both the Demographic and Health Surveys (DHS) and Multiple Indicator Cluster Surveys (MICS) for 22 countries in the Asia-Pacific region.

Using the classification tree approach, an algorithm splits the value of the target indicators into groups, based on predetermined circumstances, namely: household wealth (bottom 40 and top 60); place of residence (urban and rural); and highest level of educational attainment for any member in the household (no education, primary, secondary, or higher education).[iv]

In each iteration, the classification tree ascertains significantly different groups with common circumstances and identifies those most and least advantaged in terms of access to clean water and basic sanitation. These groups consist of households sharing common circumstances. Section 6 describes the additional impact of belonging to a minority or culturally marginalized group and repeats the analysis using religion, ethnicity and caste as a shared circumstance for the few countries where data are available.

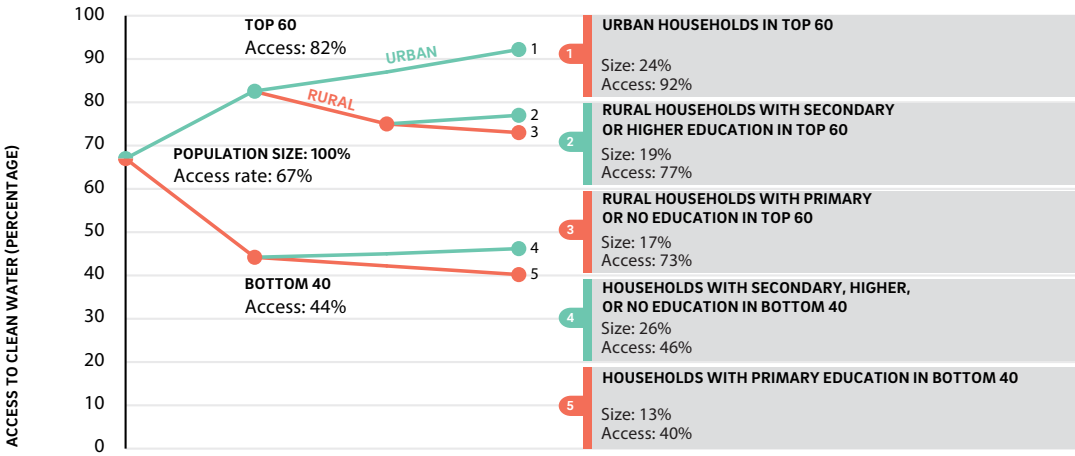
Measuring access to clean water and basic sanitation through household surveys requires using the household, rather than the individual, as the unit of analysis. Therefore, this policy paper does not lend itself to age and sex-disaggregation, nor does it consider within-household inequalities.

To illustrate how different household circumstances interact to produce a disadvantage (or advantage) in accessing clean water and basic sanitation, Afghanistan and Lao People's Democratic Republic are used as examples.

In Afghanistan, 67 per cent of all households have access to clean water (Figure 4). The first level of partition (split) is wealth (bottom 40 and top 60). Households belonging to the bottom 40 per cent of the wealth distribution have an access rate to clean water of 44 per cent, as compared to households belonging to the top 60 per cent that have an

FIGURE 4

Classification tree highlighting differences in access to clean water in Afghanistan, 2015



Source: ESCAP calculations, using data from the latest DHS and MICS surveys.

iv Please see Annex for a more detailed description of the methodology, as well as the selection of indicators and circumstances.

access rate of 82 per cent. The second split comes from residence for households belonging to the top 60 per cent, and educational attainment for households at the bottom 40 per cent. The third split comes from educational attainment; but it is only significant when analysing rural households at the top 60 per cent. Notably, in the group with lowest access, residence (urban or rural) does not matter since it is not identified as a significant factor.

Overall, the group with the highest access rate are urban households in the top 60 of the wealth distribution (upper green box) which accounts for 24 per cent of all households in Afghanistan. In this group, 9 out of 10 households have access to clean water. Households with the lowest overall access (40 per cent) belong to the bottom 40 of the wealth distribution with only primary education as the highest attainment (lower red box). This group accounts for 13 per cent of all households.

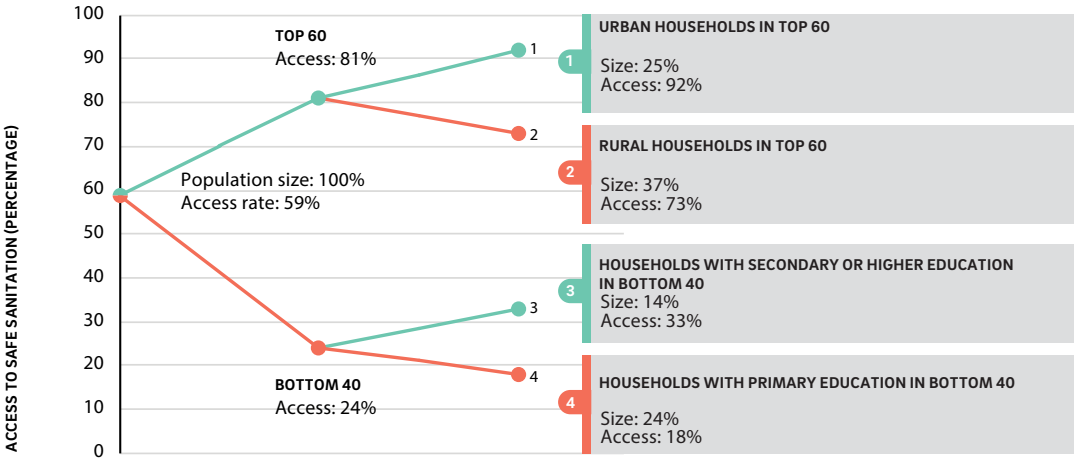
For access to basic sanitation, Lao People's Democratic Republic is used as an example (Figure 5). With an overall access of 60 per cent, the first split is again driven by wealth (bottom 40 and top 60), and the difference in access between bottom 40 and top 60 households is 57 percentage points. The second split differs for both groups. While residence (urban and rural) is more important in explaining access to basic sanitation for those households belonging to the top 60; educational attainment is more important when considering households at the bottom 40 per cent. There is no third separation because no other factor was significant enough to generate an additional split into further subgroups.

Urban households in top 60 have the highest access rate of 92 per cent (upper green box). This group accounts for one quarter of all households in Lao People's Democratic Republic. On the contrary, less than 2 out of 10 households with only primary education in the bottom 40 of the wealth distribution have access to basic sanitation. This most disadvantaged group accounts for the same share of households (24 per cent) in the country as the most privileged group.

The classification tree analysis is repeated for all 22 countries. This exercise, when repeated for the two indicators (water and sanitation) and for two points in time, produces 88 classification trees (for the list of all surveys used for this analysis, see Annex Table A1).[v] The trees hide in them stories of progress but also of stagnation. These more nuanced stories need to be explored further by policymakers and researchers working at the national level on water and sanitation programmes, using more detailed national datasets. The following section presents key findings from publicly available DHS and MICS at the time of writing.

FIGURE 5

Classification tree highlighting differences in access to basic sanitation in Lao People's Democratic Republic, 2011



Source: ESCAP calculations, using data from the latest DHS and MICS surveys.

v Classification trees for all countries are available upon request.

4. Who are those furthest behind?

Ample evidence demonstrates that many people in the Asia-Pacific region are left behind. With 260 million people relying on unimproved water sources and over 1.1 billion people lacking access to a basic improved sanitation facility, progress in achieving SDG 6 has been slow and has left many people vulnerable with stagnant standards of living. This situation undermines the principle of universalism permeating the 2030 Agenda, and reinforces the cycle of poverty.

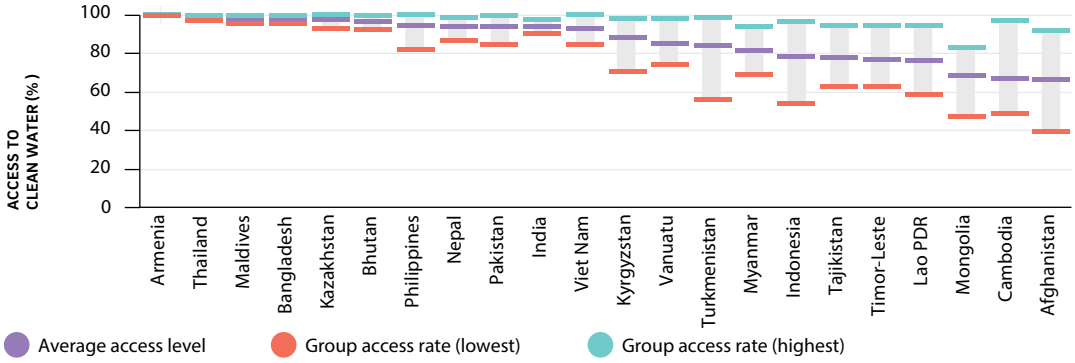
To support sustained and inclusive economic growth that leaves no one behind requires policymakers to identify which groups are marginalized and focus efforts on improving their access. Only then prosperity can be shared, and future socioeconomic stability be protected.

4.1 How large are the gaps?

The tree analysis described above allows for comparison across countries. This analysis was undertaken for 22 countries and the results are summarized in Figures 6 and 8 for clean water and basic sanitation respectively. Both figures show the gaps between the better-off groups and those furthest behind. The upper lines of each bar represent the average access of the most advantaged groups (those with highest access) for each country. The lower lines represent the average access of the most disadvantaged groups (those with lowest access). The middle line is the average access rate by which countries are sorted.[vi]

FIGURE 6

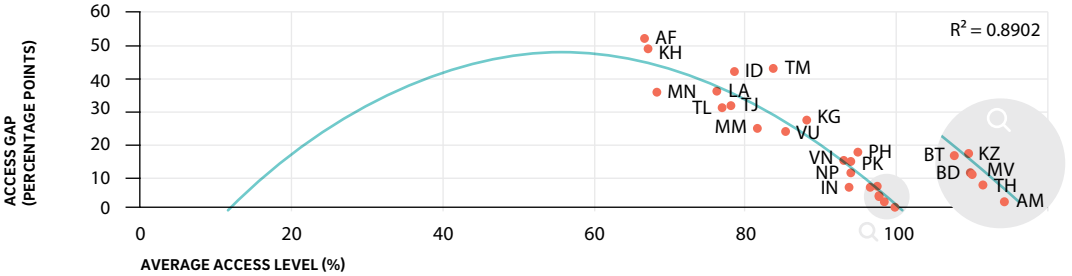
Gaps in access to clean water in the Asia-Pacific region, latest year available



Source: ESCAP calculations based on latest DHS and MICS surveys.

FIGURE 7

Average access level and access gap to clean water in the Asia-Pacific region, latest year available



Source: ESCAP calculations based on latest DHS and MICS surveys.

vi The actual composition of the most advantage or disadvantage groups is discussed later in this section.

According to their latest DHS and MICS, Armenia, Bangladesh, Kazakhstan, Maldives and Thailand all have average access to an improved water source of over 95 per cent and no substantial gaps between groups. On the contrary, Afghanistan, Cambodia and Mongolia have both the lowest average access and the lowest access rate among the left behind groups. Afghanistan also stands out as having the highest inequality between groups, with a difference in access of 52 percentage points.

The relationship between average access and access gap can be further illustrated by using a binomial equation (Figure 7). Countries with the highest average access rate also have the smallest gaps between groups. As countries edge towards universal access, the gap between population groups falls. It is worth noting that the expected inverted U-shaped curve is not clearly observed since all countries are pooled to the right, with

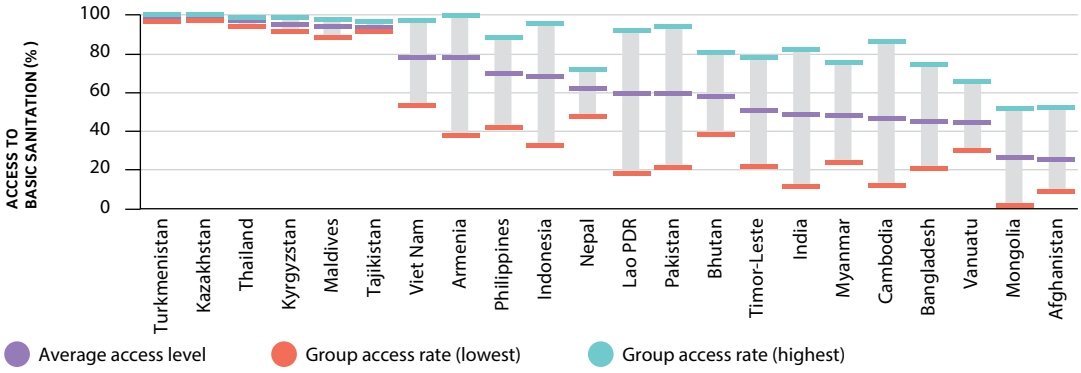
"most countries in the Asia-Pacific region have made significant progress towards universal access to basic drinking water"

average access rates higher than 60 per cent. In other words, most countries in the Asia-Pacific region have made significant progress towards universal access to basic drinking water. However, Afghanistan, Cambodia and Mongolia remain at the top of the curve.

Access to basic sanitation shows higher variation when compared with access to clean water (Figure 8). The figure illustrates that 16 out of the 22 countries have more than 50 percentage points

FIGURE 8

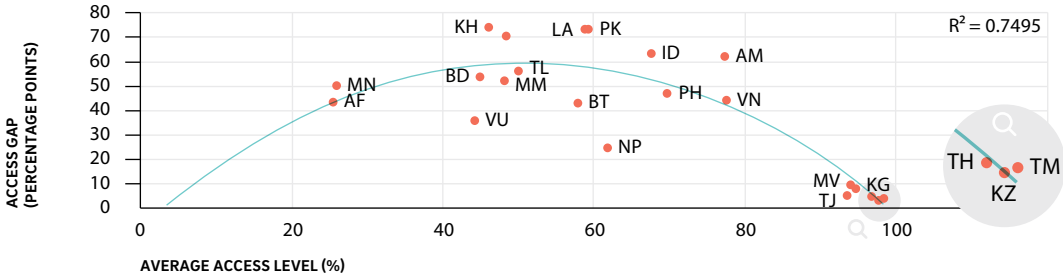
Gaps in access to basic sanitation in the Asia-Pacific region, latest year available



Source: ESCAP calculations based on latest DHS and MICS surveys.

FIGURE 9

Average access level and access gap to basic sanitation in the Asia-Pacific region, latest year available



Source: ESCAP calculations based on latest DHS and MICS surveys.

difference in access between groups with highest and lowest access. Only Kazakhstan, Tajikistan, Thailand and Turkmenistan stand out as positive examples with between-group inequalities of less than 5 percentage points and almost universal access. Although Afghanistan is the country with lowest average access (only 25 per cent), Mongolia is the country with lowest access rate for the most disadvantaged group. Lao People's Democratic Republic has the highest between-group gap, with a difference of 73 percentage points between the most advantaged and disadvantaged groups.

With a wider range of average access rates across countries, the relationship between average access and access gap is again illustrated through a binomial equation (Figure 9). The gap between groups can be as high as 70 per cent, as is the case of Lao People's Democratic Republic and Pakistan, or as low as 24 per cent as is the case of Nepal. Countries with similar gaps between groups also present differing patterns in average access to basic sanitation as is the case of Afghanistan (25 per cent) and Viet Nam (78 per cent). Nevertheless, as countries progress towards universal access, the gaps move towards zero.

4.2 Identifying those left behind

Addressing gaps in access to clean water and basic sanitation requires identifying the shared circumstances of the groups with the lowest access rates. This section narrows the focus onto these groups. Although the circumstances of those left behind are not the same across the 22 countries analysed, some commonalities are found.

Table 1 and 2 list the shared circumstances of groups with the lowest access rate (column 1-3), and provide information on the groups access level (column 4), the size of the population represented (column 5), and the gap between the groups with the highest and lowest access (column 6).

"belonging to the bottom 40 per cent of the wealth distribution is the main circumstance shared across groups with inadequate access to clean water in the Asia-Pacific region"

Table 1 shows that belonging to the bottom 40 per cent of the wealth distribution is the main circumstance shared across groups with inadequate access to clean water in the Asia-Pacific region. Lower educational levels (no education or primary education) also plays an important role.

For example, in Tajikistan, poorer households living in rural areas and with lower or secondary education (22 per cent of the population), are the most disadvantaged groups with an access of 63 per cent. This sharply contrasts with the most advantaged group, where urban households have an access rate close to 95 per cent.

Table 2 shows that households with low education that also belong to the bottom 40 per cent face higher restrictions in access to basic sanitation. Although similar patterns are found across countries, access rates vary drastically. For example, poorer households with low education can have an access rate as low as 11 per cent as is the case of India, or as high as 88 per cent as in the Maldives. Groups similar in nature face distinct limitations depending on the country context.

In the case of Mongolia, belonging to the bottom 40 per cent of households is the only circumstance found significant in determining access to basic sanitation. With only 1 per cent access, this group accounts for 40 per cent of the population. The gap between this group and the most advantaged is 50 percentage points, implying that even those better-off households also face substantial gaps in accessing basic sanitation.

TABLE 1

The impact of various circumstances on access to clean water in the Asia-Pacific region, latest year available

COUNTRY	WEALTH	EDUCATION	RESIDENCE	ACCESS LEVEL OF THE MOST DISADVANTAGE GROUP	SIZE OF THE MOST DISADVANTAGE GROUP	ACCESS GAP FROM MOST ADVANTAGE GROUP (PERCENTAGE POINTS)
Afghanistan	B40	Primary		40%	13%	52 pp
Armenia		Higher	Rural	100%	18%	0 pp
Bangladesh	B40	Primary		95%	15%	5 pp
Bhutan	B40	Primary		93%	28%	7 pp
Cambodia	B40	Primary or Higher		49%	22%	49 pp
India	B40			90%	40%	7 pp
Indonesia	B40	Primary or Higher	Rural	54%	13%	42 pp
Kazakhstan	B40	Secondary		93%	11%	7 pp
Kyrgyzstan	B40	No education or Secondary		71%	14%	27 pp
Lao PDR	B40	Primary		59%	24%	36 pp
Maldives	B40	Lower or Higher		95%	14%	4 pp
Mongolia	B40	Secondary	Rural	48%	22%	36 pp
Myanmar	B40	Lower or Higher		69%	22%	25 pp
Nepal	B40		Urban	87%	19%	11 pp
Pakistan	B40	No education		84%	10%	15 pp
Philippines	B40	Lower		82%	11%	18 pp
Tajikistan	B40	Lower or Secondary	Rural	63%	22%	32 pp
Thailand	B40	Primary or Higher		97%	24%	3 pp
Timor-Leste	B40	Lower		63%	23%	31 pp
Turkmenistan	T60		Rural	56%	19%	43 pp
Vanuatu	B40			74%	41%	24 pp
Viet Nam	B40	Secondary		85%	31%	15 pp

TABLE 2

The impact of various circumstances on access to basic sanitation in the Asia-Pacific region, latest year available

COUNTRY	WEALTH	EDUCATION	RESIDENCE	ACCESS LEVEL OF THE MOST DISADVANTAGE GROUP	SIZE OF THE MOST DISADVANTAGE GROUP	ACCESS GAP FROM MOST ADVANTAGE GROUP (PERCENTAGE POINTS)
Afghanistan	B40	Lower	Rural	9%	22%	43 pp
Armenia		Lower and Secondary	Rural	37%	19%	62 pp
Bangladesh	B40	Lower		20%	19%	54 pp
Bhutan	B40	Primary		38%	28%	43 pp
Cambodia	B40	Lower		12%	24%	74 pp
India	B40	Lower		11%	13%	71 pp
Indonesia	B40	Lower		32%	18%	63 pp
Kazakhstan			Urban	97%	60%	3 pp
Kyrgyzstan	T60		Urban	91%	36%	8 pp
Lao PDR	B40	Primary		18%	24%	73 pp
Maldives	B40	Lower		88%	13%	9 pp
Mongolia	B40			1%	40%	50 pp
Myanmar	B40	Lower		23%	22%	52 pp
Nepal		Lower		47%	27%	24 pp
Pakistan	B40	Lower		21%	23%	73 pp
Philippines	B40	Lower		41%	11%	47 pp
Tajikistan		Primary or Secondary	Urban	91%	11%	5 pp
Thailand	B40		Urban	94%	11%	5 pp
Timor-Leste	B40	Lower		22%	23%	56 pp
Turkmenistan		Primary or Secondary	Urban	96%	31%	4 pp
Vanuatu	B40			30%	41%	36 pp
Viet Nam	B40			53%	42%	44 pp

Source for Table 1 and Table 2: ESCAP estimations based on latest DHS and MICS surveys.
Note: T60=top 60 per cent of household in wealth distribution; B40=bottom 40 per cent of households in wealth distribution; pp=percentage point.

4.3
Are the gaps in access to clean water and basic sanitation falling over time?

"Gaps in access to clean water and basic sanitation remain despite an increase in overall prosperity in almost all countries"

Gaps in access to clean water and basic sanitation remain despite an increase in overall prosperity in almost all countries. This section reviews whether average gains made over time in countries for which two different surveys were available also translated into progress for the most disadvantaged groups.

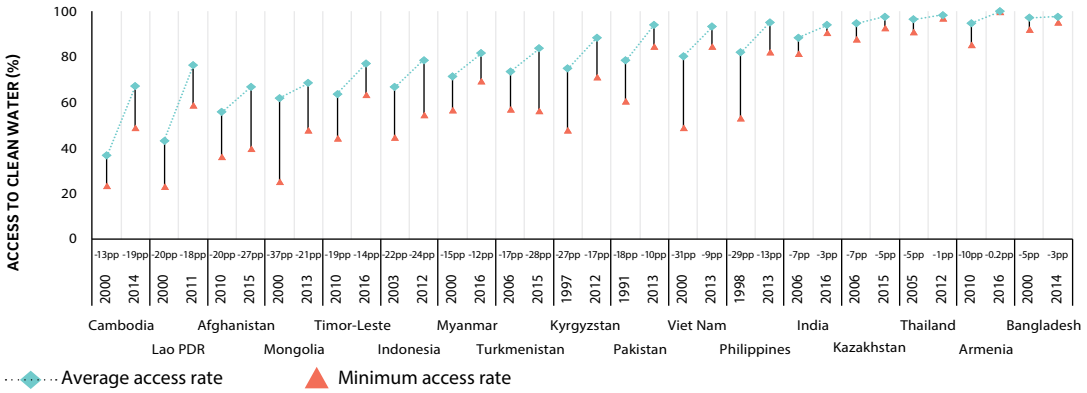
Progress across countries in this analysis is not fully comparable due to the time lag between the two surveys; Afghanistan having a span of 5 years, while Pakistan a span of 22 years. Results therefore should be viewed with this in mind. Furthermore, the composition of the most disadvantaged groups may vary between the two surveys.[vii]

That being said, if growth had benefited everyone equally, two achievements should be expected. First, average attainment should increase over time and second, the distance of the most marginalized group from the average access rate should have fallen.[viii]

All countries have experienced improvement in average access to clean water (Figure 10). The same is true for marginalized segments of the population (except Turkmenistan). However, in several countries, such as Afghanistan, Cambodia, Indonesia and Turkmenistan, the furthest behind groups saw access rates growing at a slower pace when compared to the rest of population. This is indicated by the growing percentage points difference from the mean between the later and earlier survey.

FIGURE 10

Distance of the worst-off group from the average in access to clean water in the Asia-Pacific region, earliest and 2010s



Source: ESCAP calculations based on latest DHS and MICS surveys.
Note: Average means the average rate in access to clean water in a respective year. With respect to the access rate to the worst-off or most disadvantaged group, the size and composition of that group may vary from year to year. "pp" stands for percentage point.

vii A full list of the classification trees that reveals the composition of all groups is available upon request and will be posted on ESCAP website soon.

viii It is important to note that the most disadvantage group, which has the lowest access rate, always represents at least 10 per cent of the sample population since this is a requirement in the classification tree analysis (see Annex).

Countries whose marginalized groups had an average access rate of over 80 per cent have consolidated these achievements and made sustained progress towards guaranteeing universal access to clean water. This is seen in countries such as Armenia, Bangladesh, India, Kazakhstan, and Thailand, where not only the average access of the marginalized groups increased, but the gaps to the most advantaged groups also fell.

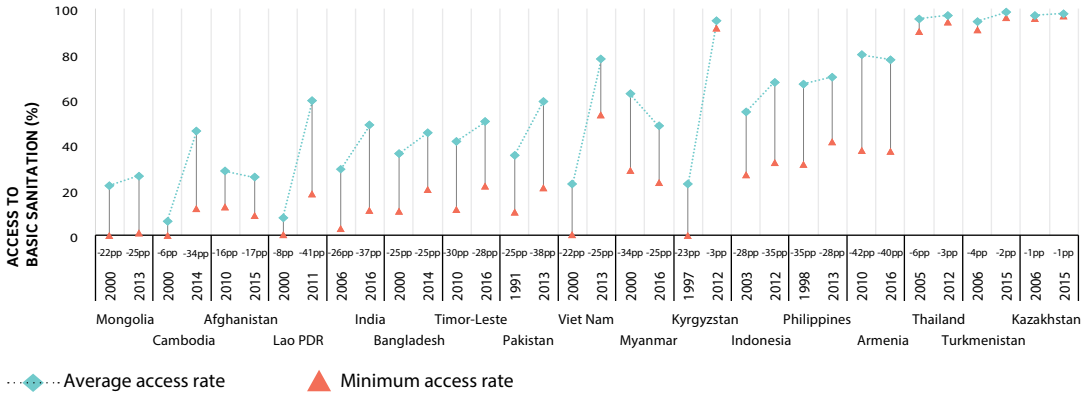
With respect to access to basic sanitation, all countries made substantial gains, except Afghanistan and Myanmar (Figure 11). Improvements have been greatest in Cambodia, Kyrgyzstan, Lao People's Democratic Republic and Viet Nam, where marginalized groups have seen gains of at least 18 percentage points between surveys. Kyrgyzstan is a positive outlier, with tremendous progress that benefited the entire population. In a 15-year span, it almost reached universal access.

"Countries whose marginalized groups had an average access rate of over 80 per cent have consolidated these achievements and made sustained progress towards guaranteeing universal access to clean water"

Neither the strategies that led to these improvements nor the reasons for delays in progress are the subject of this report. Noting the trend of marginalization in a few countries, however, proves that policy and institutions matter, and that development alone does not suffice to benefit everyone.

FIGURE 11

Distance of the worst-off group from the average in access to basic sanitation in the Asia-Pacific region, earliest and 2010s



Source: ESCAP calculations based on latest DHS and MICS surveys.

Note: Average means the average rate in access to basic sanitation in a respective year. With respect to the access rate to the worst-off or most disadvantaged group, the size and composition of that group may vary from year to year. "pp" stands for percentage point.

5. Understanding overall inequality in access to clean water and basic sanitation

Beyond identifying the most disadvantaged groups, this section calculates overall levels of inequality in accessing clean water and basic sanitation as experienced by all groups in each country. The calculated inequality can then be decomposed, thereby capturing the individual impact of different circumstances on inequality of opportunity. Policymakers can likewise follow this analysis to identify factors aggravating inequality in their country.

5.1
Calculating overall inequality

The first step to measuring overall inequality is identifying all possible groups and their access levels. The dissimilarity index (D-index) is then determined by taking the access distances each of these groups and comparing the sum of these to the average access rate for each country (see Box 2). The calculated D-index represents the overall inequality in access to clean water and basic sanitation.

5.2
Where is overall inequality highest?

Results show that overall inequality in access to clean water and basic sanitation is highest in countries with low average access. For example, with a D-index over 0.1 (or 10 per cent); Afghanistan, Cambodia and Mongolia have the highest inequality in access to clean water; whereas Armenia, Maldives and Thailand have almost universal access and therefore close to zero inequality (Figure 12).

Inequality in basic sanitation is higher than for clean water with D-indices reaching 0.42 in Mongolia, and almost 0.3 in Afghanistan, Cambodia and India (Figure 13).

BOX 2
Calculating the Dissimilarity Index

The dissimilarity index, or D-index, measures how all different groups fare in terms of accessing clean water and basic sanitation. For example, two countries with identical average access may have a very different D-index if the distribution of access in one country excludes certain groups (such as poorer groups, or ethnic minorities). To obtain the D-index, inequalities in access among all possible population groups are calculated using the following equation:

$$D = \frac{1}{2\bar{p}} \sum_{i=1}^{n} \beta_i \left| p_i - \bar{p} \right|$$

where β_i is the weighted sampling proportion of group i, (sum of β_i equals 1), $\bar{p}$ is the average access rate in the country and p_i is the level of access of population group i, and takes values from 0 to 1. There are n number of groups defined by using the interactions of the circumstances selected for the analysis.

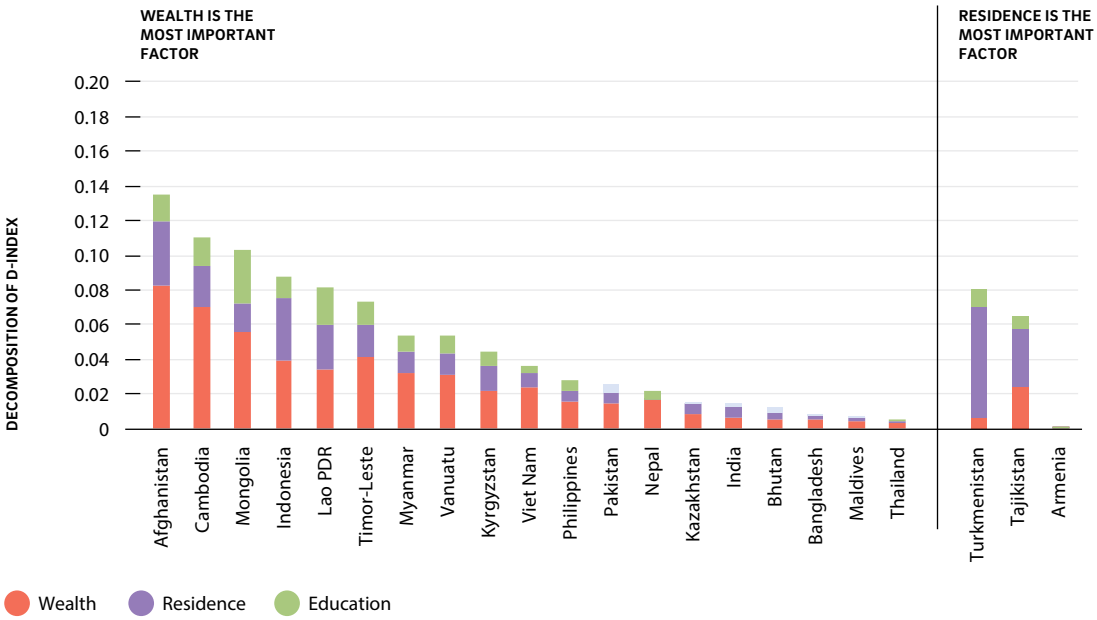
Three circumstances are used to determine the number and composition of the population groups: wealth (2 groups); residence (2 groups); and education (4 groups). This produces n=16 groups (2×2×4), covering the entire sample population.

5.3
What circumstances matter more in accessing clean water and basic sanitation?

Building on the D-index calculation, the contribution of each circumstance is estimated, using the Shapley decomposition methodology (Box 3). From a policymaking perspective, understanding these patterns is useful for informing water and sanitation priorities, particularly if the goal is to "leave no one behind".

FIGURE 12

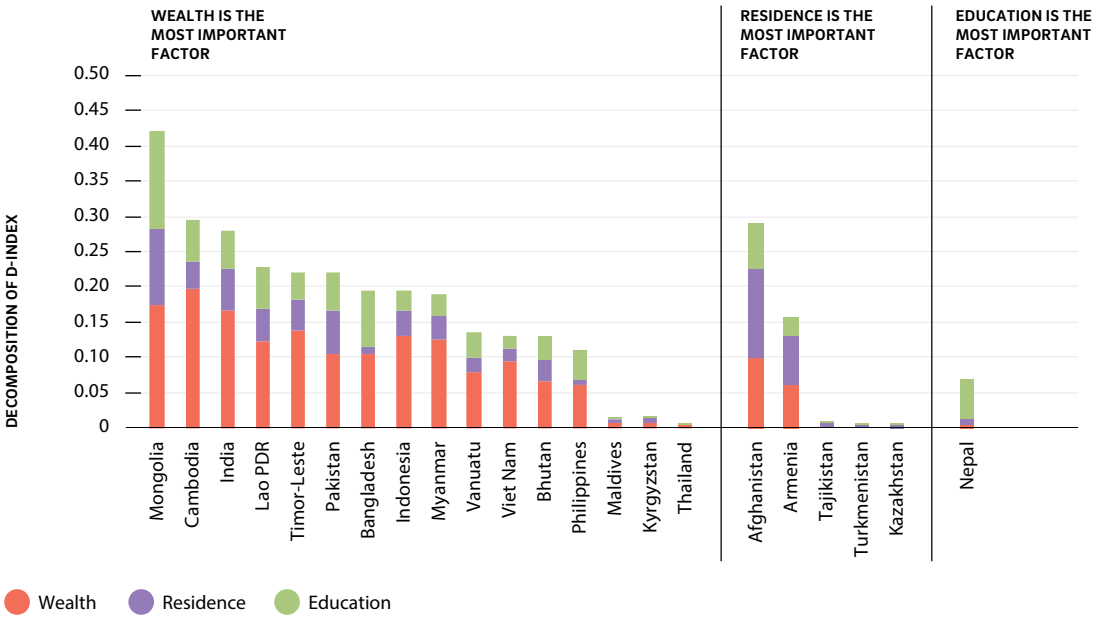
Inequality in access to clean water and its decomposition in the Asia-Pacific region, latest year available



Source: ESCAP calculations using data from the latest DHS and MICS surveys.

FIGURE 13

Inequality in access to basic sanitation and its decomposition in the Asia-Pacific region, latest year available



Source: ESCAP calculations using data from the latest DHS and MICS surveys.

BOX 3

Shapley decomposition

The Shapley decomposition method estimates the marginal contribution of each circumstance to inequality in educational attainment. The basic idea behind this decomposition, taken from cooperative game theory, is measuring how much the estimated D-index would change when a circumstance is added to the pre-existing set of circumstances. The change in inequality caused by the addition of a new circumstance would be a reasonable indicator of its contribution to inequality.[17]

The impact of adding a circumstance A (e.g. wealth) is given by the following formula:

$$D_A = \sum_{S \subseteq N\{A\}} \frac{|S|!(n-|S|-1)!}{n!} [D(S \cup \{A\}) - D(S)]$$

Where N is the set of all n circumstances; and S is the subset of N circumstances obtained after omitting the circumstance A. D(S) is the D-index estimated with the sub set of circumstances S. D(SU{A}) is the D-index calculated with set of circumstances S and the circumstance A.

The contribution of characteristic A to the D-index is then formula:

$$M_A = \frac{D_A}{D(N)}$$

The critical property satisfied by the Shapley decomposition is that the sum of contributions of all characteristics adds up to 1 (100 per cent).

As measured by the D-index, the relative contribution of each specific circumstance to overall inequality in access to water and sanitation does not vary much across the region. In the case of access to clean water, wealth is the most important circumstance in 19 out of 22 countries, and determines more than half of the inequality in several of countries (Figure 12). Living in a rural area is the main explanation in only 2 countries, Tajikistan and Turkmenistan.

In terms of access to basic sanitation, wealth is again the key factor in determining access and explains more than half of the observed inequality in 13 out of 16 countries. However, a lower education level and living in a rural area are also important factors in many countries. Knowing which circumstance contributes more towards inequality can guide policymakers toward the most effective areas of intervention.

5.4 How does each circumstance contribute in determining access?

To bolster the analytical findings, logistic regressions were conducted to observe the effects of circumstance variables (household wealth, residence, and highest educational level in the household) on access to clean water and basic sanitation.

The logistic regression model for each country is given by:

$$logit(p_i) = \log\left(\frac{p_i}{1-p_i}\right) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5$$

Where is a binary variable and assumes the value:

$$p_i = \begin{cases} 1, \ if\ the\ household\ has\ access \\ \quad to\ clean\ water\ (basic\ sanitation) \\ 0, \ if\ the\ household\ has\ no\ access \\ \quad to\ clean\ water\ (basic\ sanitation) \end{cases}$$

And

where β_0 ,..., n are logit model coefficients and X_1 ,..., n *are circumstance variables, i.e.* X_1 is household wealth, X_2 is household residence, and X_3-X_5 are the highest educational levels in the household, and represent primary, secondary, or higher education respectively.

The base references used in the model are households belonging to the bottom 40 per cent in terms of wealth, rural households, and households with no education.[ix]

ix A total of 44 logistic regressions (22 for access to clean water and 22 for basic sanitation) are summarized in Table A3 and A4.

Results show that households living in urban areas and belonging to the top 60 per cent of the population have higher odds of having access to clean water (Table A3). For instance, in Pakistan, richer households have four times greater odds compared to poorer households. The same is true for households in urban areas with twice the odds compared to their rural counterparts.

Educational attainment has a mixed impact on access to clean water in the region, often not significant. In the case of Pakistan, the odds ratios of 1.55 for primary education and 1.94 for higher education respectively, indicate increased chances of access to clean water with a higher level of education. Households with higher education have almost twice the odds of having access compared to those with no education.

Results are similar for access to basic sanitation (Table A4). In all countries (except Kyrgyzstan and Nepal where the coefficients were not significant), households belonging to the top 60 have greater odds of having access than those belonging to the bottom 40. For example, in Cambodia, the odds of richer households having access to basic sanitation are 10 times higher than poorer households.

The effect of residence on access to basic sanitation is mixed. Generally, households residing in rural areas have lower odds of having access. However, in Bangladesh, Kazakhstan, Nepal, Philippines, Thailand and Turkmenistan, urban households have fewer odds. Higher levels of education increase the odds of households having access to basic sanitation. This is most evident in Cambodia as households with secondary and higher education have two and five times higher odds of having access compared to those with no education.

6. Does ethnicity matter for determining the furthest behind?

In many countries, marginalized groups are also defined by a non-dominant, common ethnic or religious identity. However, there is a general lack of survey data detailing how ethnicity and religious characteristics shape inequality and create marginalized pockets within countries.

In nine countries, surveys include questions on ethnicity, caste, or religion in their MICS, thereby opening a small, but unique window to understanding these interactions. Repeating the classification tree analysis to include ethnicity, religion, and caste as circumstance variables alters the composition of the furthest behind groups in four countries.

"...ethnicity only matters in determining access among poorer households"

For example, in Afghanistan, the 2010 survey reveals that poorer Daris, Uzbeks, and Turkmens were the most disadvantaged groups both in access to clean water and basic sanitation.[x] In the case of clean water, their access rate of 32 per cent was lower than the access of those belonging to the country's largest ethnic group, Pashtun (column 2-3, Table 3). The 13-percentage point difference indicates that the former group faces discrimination in access derived from their ethnicity. Moreover, the significant gap in access between these marginalized groups and the most advantaged group (urban richer household with secondary or higher education), points to the fact that ethnicity only matters in determining access among poorer households.

In India, scheduled tribes, schedules castes, or those belonging to other backward classes are the most disadvantaged segments across the population. For example, in access to basic sanitation, these groups have an access of only 11 per cent, compared to 24 per cent for similar poorer households not belonging to a caste (columns 2 and 3, Table 4).

TABLE 3

Access to clean water for different groups in the Asia-Pacific region, latest year available

COUNTRY AND SURVEY YEAR (1)	CIRCUMSTANCES AND ACCESS RATE OF THE MOST MARGINALIZED ETHNIC/CASTE/RELIGIOUS MINORITY (2)	CIRCUMSTANCES AND ACCESS RATE OF THE COMPARABLE ETHNIC/CASTE/ RELIGIOUS MINORITY (3)	CIRCUMSTANCES AND ACCESS RATE OF THE LEAST MARGINALIZED GROUP (4)
Afghanistan (2010)	Dari, Uzbek/Turkmen or belonging to a minor ethnicity poor household: 32%	Pashtun poor household: 45%	Richer and urban household with secondary or higher education: 90%
India (2016)	Household belonging to a Scheduled Tribe: 83%	Household belonging to a Scheduled Caste, other backward class or without caste: 95%	Urban household not belonging to any caste: 98%
Mongolia (2013)	Poor household with lower education and no religion: 46%	Buddhist or belonging to a minor religion poor household with lower education: 48%	Richer and rural household with higher education: 86%
Viet Nam (2013)	Belonging to a minor ethnicity poor household: 72%	Kinh poor household: 90%	Richer and urban household: 100%

Note: When shaded in pink, this group is also the most marginalized overall, as determined by the classification tree. When shaded in green, this group is the least marginalized overall.

x In this section, Afghanistan's MICS survey is used because the latest DHS does not include questions on ethnicity, religion, and caste.

TABLE 4

Access to basic sanitation for different groups in the Asia-Pacific region, latest year available

COUNTRY AND SURVEY YEAR (1)	CIRCUMSTANCES AND ACCESS RATE OF THE MOST MARGINALIZED ETHNIC/CASTE/RELIGIOUS MINORITY (2)	CIRCUMSTANCES AND ACCESS RATE OF THE COMPARABLE ETHNIC/ CASTE/RELIGIOUS MINORITY (3)	CIRCUMSTANCES AND ACCESS RATE OF THE LEAST MARGINALIZED GROUP (4)
Afghanistan (2010)	Dari, Uzbek/Turkmen poor household: 11%	Pashtun or belonging to a minor ethnicity poor household: 17%	Urban and rich household with secondary or higher education: 60%
India (2016)	Scheduled Caste, Scheduled Tribe or belonging to any other backward class, Hindu poor household : 11%	Poor household with no caste: 24%	Urban and rich household with higher education: 87%
Viet Nam (2013)	Poor household with lower education belonging to a minor ethnicity: 37%	Kinh poor household with lower education: 53%	Christian or without religion rich household with higher education: 97%

Note: When pink, this group is also the most marginalized overall, as determined by the classification tree. When green, this group is the least marginalized overall.

In Mongolia, the 2013 survey shows that religion plays a marginal role only in access to clean water as poorer, non-religious households with low education have an access rate of 46 per cent compared to 48 per cent among similar profile Buddhist households. The 40-percentage points gap with the most advantaged group, on the other hand, shows that lack of access in Mongolia is more related to wealth and educational attainment.

"...in the four countries where ethnicity, religion and caste played a role, wealth, residence and education remained the main circumstances in determining access"

In Viet Nam, ethnicity severely restricts access to both water and sanitation. Poorer Kinh (major ethnic group) with low education, have greater access to both clean water and basic sanitation than their minor ethnicity counterpart with similar characteristics.

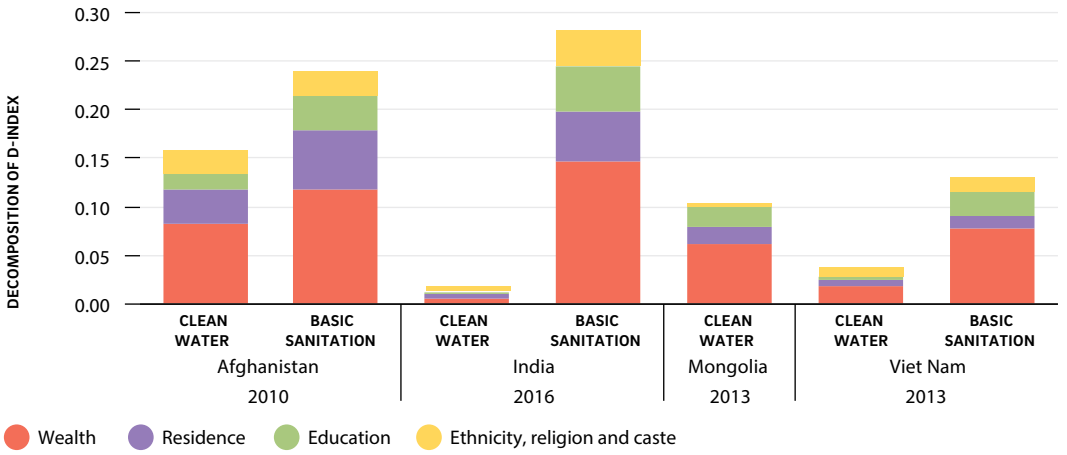
To conclude, in the four countries where ethnicity, religion and caste played a role, wealth, residence and education remained the main circumstances in determining access. Those with higher access were usually households in the top 60 of the wealth distribution with highly educated household members, living in urban areas. Ethnicity, religion and caste mattered most among the most vulnerable segments of the population.

6.1 So what's the impact on overall inequality?

The analysis in this section shows that ethnic marginalization can be both partly concealed and partly compounded by economic, social, or geographical circumstances. Recalculating the decomposition of inequality to include ethnicity, religion, and caste, confirm these findings. Although household wealth still matters the most in shaping inequality, marginalization derived by these last circumstances plays a small but significant role when focusing in the most deprived segments of the population.

FIGURE 14

The role of ethnicity, religion and caste in shaping inequality in access to clean water and basic sanitation, latest year available



Source: ESCAP calculations using data from the latest DHS and MICS surveys.
Note: Countries in which ethnicity, religion and caste contribute over 5 per cent to overall inequality.

"...the relationship between ethnicity and access to clean water and basic sanitation often intersects with other circumstances that aggravate inequalities"

While this analysis is not exhaustive and relies on a limited set of household surveys, the results cannot be ignored. Ethnic minorities and indigenous groups are generally less educated, have poorer health, and are less capable to break intergenerational poverty due to structural deprivations as in India, or geographical remoteness as in the case of Mongolia. Accordingly, the relationship between ethnicity and access to clean water and basic sanitation often intersects with other circumstances that aggravate inequalities.

In Afghanistan, for example, ethnicity accounts for 10 per cent in shaping overall inequality in access to clean water and to basic sanitation. Most ethnic Uzbeks, Turkmens, and those belonging to minor ethnicities in Afghanistan are farmers whose main source of income derives from arable lands and the production of crafts. Apart from being concentrated in rural areas, inadequate access to basic services as well as lack of social protection from the central government has enhanced discontent among these minorities.[18] Marginalization and discontent are breeding grounds for social instability.

Having the highest D-index for basic sanitation, India also faces several challenges in reducing the gaps between the most advantaged groups and those further behind. What this analysis does not show is that deeply rooted cultural beliefs may also pose additional challenges in the use of basic sanitation as many Indians still see indoor latrines as polluting, socially unacceptable, and a practice that clashes with the ancestral way of life.[19]

This brief assessment indicates the negative impact belonging to a minority may have on access to clean water and basic sanitation in the Asia-Pacific region. Nevertheless, it also reveals the general lack of comparable, reliable, and consistently collected data on more marginalized population groups, as well as the need to include them to a much larger degree in future data collection efforts. There are many other excluded groups, such as migrants and persons with disabilities who are also not included in the surveys, and whose needs remain invisible.

7. Recommendations for closing the gaps

Although the Asia-Pacific region has made great progress in improving access to clean water and basic sanitation, several countries face a range of challenges in reaching universal access as substantial gaps persist between groups.

With more than 260 million people relying on an unimproved water sources, and over 1.1 billion lacking basic improved sanitation facilities, living standards in many parts of the region are eroded. To assure a level playing field and guarantee sustained and inclusive growth, policymakers need to focus their efforts on those facing higher restrictions in access to these critical opportunities.

This policy paper has showed that poorer households with lower education living in rural areas are the most affected by the lack of clean water and basic sanitation. To meet SDG 6, policymakers should seek to extend access by prioritizing these disadvantaged groups. Although most countries are in a path to achieving universal access to clean drinking water, multiple challenges still exist in the provision of basic sanitation.

The following are put forward as key considerations for policymakers when designing regulatory and other applicable policies aimed to decrease inequality in access to clean water and basic sanitation:

1 **Identify the shared common circumstances shaping household inequalities.** Unequal access is strongly linked to education and unequal long-term outcomes in other development objectives. Understanding the factors limiting households' access is paramount to addressing water and sanitation inequalities, as well as providing the ground for breaking intergenerational poverty.

2 **Engage in partnership with stakeholders at different administrative levels to strengthen households' incentives to use basic sanitation facilities.** In many countries, cultural practices and the lack of awareness of health and environmental benefits of proper waste disposal are major obstacles. Policies targeted at increasing access should therefore go hand in hand with those targeted at shifting individual incentives and seek to induce long-run behavioural changes.

3 **Explore the social, economic, and cultural reasons for localized disparities in access.** Tailor-made policies need to guarantee reliable and sustainable access to clean water and basic sanitation so those left behind groups gain and maintain access. Affordability is of great importance, but accessibility and sustainability lay the foundation of further opportunities for successive generations.

4 **Promote access to clean water and basic sanitation as an investment in long-term human capital accumulation.** The investment in quality infrastructure and services can play a pivotal role during the early childhood development years which will translate in productive individuals entering the labour market. A country can only achieve sustained growth and shared prosperity when all its citizens are able to engage in productive activities and fulfil their potential.

5 **Support initiatives aimed at changing the hygiene culture and proper waste disposal across different societal agents.** With a special emphasis on girls, women, and their sanitation needs, increased awareness of good practices can widely reduce health disparities between groups. Sanitation policies also need to be gender-sensitive, ensuring that women and girls have good and safe access to basic sanitation facilities dedicated to them, particularly in schools.

6 **Strengthen data collection efforts to understand how water and sanitation deficits impact individual household members.** Existing data do not allow for a full understanding of household choices, behaviours or subsequent inequalities arising among and within households. Granular data are therefore necessary for dissecting how different members of a household cover their clean water and sanitation needs, as well as the consequences for failing to do so. Data on marginalized groups, such as migrants, persons with disabilities and minorities are also urgently needed.

Annex: Methodology for identifying gaps in access to opportunities

Inequality of Opportunity

To measure inequality of opportunity, the ESCAP policy papers on Inequality of Opportunity identify a set of opportunities and measure the gaps among different population groups in access to these opportunities. To do so, a set of circumstances is selected from available variables in the DHS and MICS datasets to define the groups. The circumstances are conditions over which the individuals or households have no control.

Those circumstances are used in the classification tree analysis to identify the groups that are most disadvantaged in each country; in this case, meaning those who have the least access to clean water and basic sanitation. The composition of those groups varies from country to country, as does the size of the sample population they represent.

This approach differs from the use of "inequality of opportunity" in other recent literature, which instead uses regression analysis to explain the share of inequality of outcome (income inequality or consumption inequality) that can be attributed to circumstances over which individuals have no control, such as ethnicity and sex.

Given that the DHS and MICS datasets do not include information on income or consumption (both classified as outcomes), these thematic policy papers do not include such regressions. However, future analysis might explore using the wealth index of the DHS and MICS as a proxy 'outcome' and regress it against the set of circumstances used in this analysis.

The data sources

This analysis uses the *Demographic and Health Surveys* (DHS) and the *Multiple Indicator Cluster Surveys* (MICS). DHS and MICS are publicly available for 22 Asian-Pacific countries as shown in Table 1.[xi] The DHS and MICS datasets are selected because of: a) the comparability across countries; b) the accessibility of the data; and c) the extensive questions on health, demographic and basic socioeconomic data referencing both the household (e.g., water and sanitation, financial inclusion, electricity and clean fuels) and individuals (e.g., level of education, nutrition status).

The countries

Based on available surveys, all 22 countries are included in this policy paper on clean water and basic sanitation. Seventeen countries have surveys representing two different points in time, all of which include questions on clean water and basic sanitation. Table A1 provides the full list of 22 countries and their survey years (latest and earliest).

The indicators and circumstances

The indicators depicting inequality in water and sanitation opportunities are access to clean water and access to basic sanitation. Their connection to both the Millennium Development Goals (MDGs) and the Sustainable Development Goals (SDGs) was the main criterion for selecting these indicators.[xii] However, as Box 1 explains, less strict definitions of access to clean water and basic sanitation, as used by the MDG framework, was used for this policy paper. The circumstances used are wealth (belonging to the bottom 40 or top 60), residence (rural or urban), and highest education level in the household (no education, primary, secondary or higher education) (Table A2).

xi Access to the DHS datasets for three additional Pacific countries has been requested and the requests are under consideration.

xii Resolution A/RES/71/313.

TABLE A1
List of countries and survey years

COUNTRY	EARLIEST YEAR	EARLIEST SURVEY	LATEST YEAR	LATEST SURVEY
Afghanistan	2010	MICS	2015	DHS
Armenia	2010	DHS	2016	DHS
Bangladesh	2000	DHS	2014	DHS
Cambodia	2000	DHS	2014	DHS
India	2006	DHS	2016	DHS
Indonesia	2003	DHS	2012	DHS
Kazakhstan	2006	MICS	2015	MICS
Kyrgyzstan	1997	DHS	2012	DHS
Lao People's Democratic Republic	2000	MICS	2011	MICS
Mongolia	2000	MICS	2013	MICS
Myanmar	2000	MICS	2016	DHS
Pakistan	1991	DHS	2013	DHS
Philippines	1998	DHS	2013	DHS
Thailand	2005	MICS	2012	MICS
Timor-Leste	2010	DHS	2016	DHS
Turkmenistan	2006	MICS	2015	MICS
Viet Nam	2000	MICS	2013	MICS
Bhutan	n/a	n/a	2010	MICS
Maldives	n/a	n/a	2009	DHS
Nepal	n/a	n/a	2016	DHS
Tajikistan	n/a	n/a	2012	DHS
Vanuatu	n/a	n/a	2007	MICS

The classification tree analysis

The primary goal of the household survey analysis is identifying the groups with the lowest and highest access to clean water and basic sanitation by using the two selected indicators. The indicators can be seen as "response variables", while the factors characterizing the groups are defined as "circumstances".

The analysis then uses a classification tree model to identify the groups with highest or lowest access. A classification tree is an analytical structure representing groups of the sample population with different response values, or different levels of access to a certain opportunity.

Consider the following example:

Opportunity: Clean water

Indicator ('response variable'): "Access to clean water".

Factors ('circumstances): The circumstances being considered are the following:

1. Household wealth (bottom 40 or top 60),
2. Residence (urban vs. rural),
3. Highest education level in the household (no education, primary, secondary, higher).

To identify the groups with the highest or lowest access to clean water, a classification tree is

constructed for each country, using R, an open source statistical software. The root node of the tree is the entire population sample. The tree method algorithm starts by searching for the first split (or branch) of the tree. It does so by looking at each circumstance and separating the sample in two groups, so that it achieves the most "information reduction". This information metric can be defined in a few ways, while the most common one – and the one used in this analysis is the "entropy".[20]

The tree representation

In the classification tree method, an algorithm estimates the access to clean water and basic sanitation by partitioning the household into different groups based on the household circumstances chosen:

$$p(Y_i = 1 || X_{1i}, X_{2i}, ..., X_{li}) = \sum_{j=1}^{m} p_j \times I((X_{1i}, X_{i2}, ...X_{li}) \in A_j)$$

Where Y_i is the observed opportunity for the i-th household in the sample, X_{1i}, ..., X_{li} are the household's circumstances. In the example of clean water, Y is the access to clean water, X_1, X_2, X_3 (where l = 3) household wealth level, residence, and highest education level of household members, three circumstances of the household from the surveys. A_1, A_2, ..., A_m are the different partitions of the sample, also called end nodes, where:

$$A_i \cap A_j = \emptyset$$

and

$$\cup_{i=1}^{m} A_i = \Omega.$$

This means the end nodes are mutually exclusive and complementary, and every household belongs to one and only one of the end nodes. I () only takes value 1 when the i-th household belongs to j-th end node, otherwise, I () takes value 0. The tree algorithm generates the end nodes, according to metrics that measure the effectiveness of the partition that leads to different levels of access to clean water.

Information theory and entropy is a very common choice for the metrics. Entropy for j-th end node can be calculated according to the definition:

$$I_E(p_j) = -(p_j \times log_2 p_j + (1 - p_j) \times log_2(1 - p_j))$$

The aggregated entropy for the tree is calculated by:

$$H(T) = \sum_{j=1}^{m} q_j \times I_E(p_j)$$

Where q_j is the sample proportion of A_j. The actual algorithm that generates the end-nodes works step-by-step, starting from the entire sample. Each time the sample is partitioned, new end-nodes are generated, and the entropy is calculated and compared to the entropy before the new partition. Each partition (and hence the new end nodes) is kept when the increment of entropy is bigger than a pre-set threshold. The algorithm stops when no more decrease of entropy can be made through a new partition, or a set of present conditions can't be satisfied.

In addition to finding groups that have significant differences in their access to clean water and basic sanitation, the classification tree algorithm also operates under the limitation that each group should have enough group members. To avoid a too small sub-sample size, the analysis has set the tree nodes to have a minimum size of at least 10 per cent of the total population and, as explained earlier, the split of the tree is only made when the "information reduction" criterion is satisfied.

In section 6, which introduces ethnicity, caste, and religion as a circumstance, the minimum size of the population group criterion is reduced to 5 per cent of the population to fully capture minority religions and ethnicities.

Choice of circumstances

Out of the many variables available in the DHS and MICS surveys, several determinant factors are considered to help identify the most excluded groups. The selection of variables is consistent across all surveys to maintain comparability across countries.

The classification tree includes these factors in the tree as branches only if they are found to reduce entropy. Ultimately, these circumstances (determinant factors) define the composition of the groups. However, circumstances should not be interpreted as 'causes' of inequality. The association found does not imply causality. Furthermore, there are many other factors that these models cannot consider, because of the limitations of the datasets.

Ideally, it would have been preferred to include only circumstances over which a household member has very little control, such as the dominant religion in a household, ethnicity, existence of a disability, or the education of the mother or father of the respondent. The majority of the DHS did not ask these questions. Some MICS, however, did ask questions related to ethnicity, caste, and religion and the results are presented in section 6.

Additional factors of interest for study are geographical variables, such as province or city in each country, but inclusion would have affected comparability across countries. Geographic variables can be analysed in future work focusing on one country only.

Gaps and limitations

The available datasets limit the scope of this analysis somewhat. First, several relevant circumstances cannot be captured. For example, the quality and reliability of a water connection is an important circumstance that might shape a household's use of water.

Furthermore, and consistent with similar studies on inequalities among groups, this analysis does not consider inequality within groups.[21] Even within homogenous groups, additional unobserved circumstances may affect outcomes. This analysis only calculates observable average access to opportunity for each group, and thus draws conclusions on gaps and inequality based on these average observations.

Finally, recent literature on inequality of opportunity also links inequality of outcome with inequality of opportunity, by calculating the share of income inequality (inequality of outcome) that can be explained by the circumstances of each group.[22] The analysis in this series of policy papers does not follow the same approach because the datasets do not include an income proxy besides the wealth index.

The wealth index and the bottom 40 – top 60 wealth split

Wealth, as used in this policy paper, is a composite index reflecting a household's cumulative living standard that is developed by the DHS and MICS researchers and combines a range of household circumstances including: a) ownership of household assets, such as TVs, radios and bicycles; b) materials used for housing; and c) type of water and sanitation facilities.

The wealth index is calculated using the Principal Component Analysis and thus allows a relative ranking of households based on their assets.[23] The wealth index is not comparable across countries, however, as it consists of different assets in each country. Cross-country comparison of household access based on "wealth" should be understood with that caveat.

In this series of policy papers, the wealth index is employed as a circumstance to distinguish between different types of households. Although technically not a circumstance over which households have no control, wealth is still a proxy for many hidden conditions that may limit access to a certain opportunity, especially considering the lack of other determinant factors to explore, such as education of mother or father, ethnicity, prevalence of a disability or migrant status.

In this policy paper, households can belong to one of two possible groups based on the wealth index: the bottom 40 per cent (sometimes labelled as "bottom 40") and the top 60 per cent (or "top 60").

Several other possible cuts of the wealth index were considered, including by quintile, top 40 – bottom 40, and top 10 – bottom 40. These options were not selected however, because generally they produce more homogenous groups, thus overshadowing other circumstances (e.g. education levels, rural – urban distinctions). The top 40 – bottom 40 approach (and its variation of top 10 – bottom 40) were also rejected because they eliminate 20 to 50 per cent of the sample population from the analysis, with a risk of missing some 'middle class' groups with common characteristics (e.g. secondary education).

Narrowing the sample population to only half (top 10–bottom 40) also runs the risk of not allowing for making statistically significant inferences. Moreover, neither the top node, or root, of the tree, nor the size of the groups of the rest of the nodes would be representative of the population.

Finally, the wealth index in the DHS and MICS produces a distribution of households by wealth, without any monetary values assigned to the distribution. Therefore, the comparisons of top 1 – top 10 – top 40 per cent do not have the same explanatory value as they would if the wealth index had taken continuous monetary values.

TABLE A2

Selected indicators and factors

	OPPORTUNITY STUDIED			FACTORS USED TO DETERMINE EXCLUDED GROUPS			SDG REFERENCE	SURVEY REFERENCE		
	OPPORTUNITY COMPONENT	INDICATOR	REFERENCE (TARGET) GROUP IN SURVEY	FACTOR 1	FACTOR 2	FACTOR 3	RELATED SDG INDICATOR	SURVEY QUESTION IN DHS/MICS	DESCRIPTION	SURVEY RECODE
1	Water and Sanitation	Clean water	All households	Wealth	Residence	Highest Education	6.1.1 Proportion of population using safely managed drinking water services	What is the main source of drinking water for members of your household?	Population using improved drinking water sources such as piped household water connection, public standpipe, borehole, protected dug well, protected spring, rainwater collection. (*instead of "safely managed", this paper is using the "basic services" definition so as to cover more countries)	HH*
2	Water and Sanitation	Basic sanitation	All households	Wealth	Residence	Highest Education	6.2.1 Proportion of population using safely managed sanitation services, including a hand-washing facility with soap and water	What kind of toilet facility do members of your household usually use?	Population using improved, non-shared sanitation facilities such as those with: sewer connections, septic system connections, pour-flush latrines, ventilated improved pit latrines, pit latrines with a slab or covered pit (*instead of «safely managed», this paper is using the "basic services" definition so as to cover more countries)	HH*

Note: *household.

TABLE A3

Logit model results: Access to clean water

MICS	BHUTAN (1)			KAZAKHSTAN (2)			LAO PDR (3)			MONGOLIA (4)		
	Coeff	SE	OR	Coeff	SE	OR	Coeff	SE	OR	Coeff	SE	OR
(Intercept)	3.01 ***	0		2.32 ***	0		0.52 ***	0		0.25 ***	0	
RicherHousehold	0.95 ***	0	3	3.14 ***	0	23	0.56 ***	0	2	1.22 ***	0	3
ResidenceUrban	1.69 ***	0	5	2.09 ***	0	8	1.82 ***	0	6	-0	0	
HighestEducationPrimary	-0	0		0.57 *	0	2	-0.64 ***	0	1	-0.29 ***	0	1
HighestEducationSecondary	-0	0		0	0		-0.25 **	0	1	-0.2 **	0	1
HighestEducationHigher	1	0		0	0		0.51 ***	0	2	0	0	

MICS	THAILAND (5)			TURKMENISTAN (6)			VANUATU (7)			VIET NAM (8)		
	Coeff	SE	OR	Coeff	SE	OR	Coeff	SE	OR	Coeff	SE	OR
(Intercept)	2.98 ***	0		1.43 ***	0		1.06 ***	0		1.62 ***	0	
RicherHousehold	1.19 ***	0	3	-0.95 ***	0	0	1.17 ***	0	3	2.53 ***	0	13
ResidenceUrban	0.65 ***	0	2	2.86 ***	0	17	1.46 ***	0	4	0.9 ***	0	2
HighestEducationPrimary	-0	0		-0	0		0	0		-0	0	
HighestEducationSecondary	0	0		-0.48 **	0	1	0.37 *	0	1	-0	0	
HighestEducationHigher	0.36 **	0	1	0	0		0	0		0	0	

DHS	AFGHANISTAN (1)			ARMENIA (2)			BANGLADESH (3)			CAMBODIA (4)		
	Coeff	SE	OR	Coeff	SE	OR	Coeff	SE	OR	Coeff	SE	OR
(Intercept)	1.44 ***	0		19	3275		5.18 ***	0		2.45 ***	0	
RicherHousehold	-1.06 ***	0	3	-0	0		-1.21 ***	0	3	-1.26 ***	0	4
ResidenceUrban	-1.01 ***	0	3	1.9 *	0	7	-0.63 ***	0	2	-1.54 ***	0	5
HighestEducationPrimary	0.15 ***	0	1	0	3597		-0	0		0	0	
HighestEducationSecondary	0.37 ***	0	1	-13	3275		-0	0		0	0	
HighestEducationHigher	0.38 ***	0	1	-13	3275		-0	0		0.6 ***	0	2

DHS	INDIA (5)			INDONESIA (6)			KYRGYZSTAN (7)			MALDIVES (8)		
	Coeff	SE	OR	Coeff	SE	OR	Coeff	SE	OR	Coeff	SE	OR
(Intercept)	2.94 ***	0		2.62 ***	0		3.45 ***	1		4.51 ***	0	
RicherHousehold	-0.53 ***	0	2	-1.23 ***	0	3	-0.58 ***	0	2	-0.93 ***	0	3
ResidenceUrban	-1.2 ***	0	3	-1.39 ***	0	4	-1.44 ***	0	4	-0	0	
HighestEducationPrimary	-0.15 ***	0	1	-0	0		-0	1		0	0	
HighestEducationSecondary	-0.16 ***	0	1	0.21 ***	0	1	-0	1		0.65 **	0	2
HighestEducationHigher	0.15 ***	0	1	0.51 ***	0	2	-0	1		0	0	

DHS	MYANMAR (9)			NEPAL (10)			PAKISTAN (11)			PHILIPPINES (12)		
	Coeff	SE	OR	Coeff	SE	OR	Coeff	SE	OR	Coeff	SE	OR
(Intercept)	0.72 ***	0		2.27 ***	0		3.53 ***	0		3.93 ***	0	
RicherHousehold	0.94 ***	0	3	1.55 ***	0	5	-1.55 ***	0	5	-2.29 ***	0	10
ResidenceUrban	0.81 ***	0	2	-0.46 ***	0	1	-0.85 ***	0	2	-0.85 ***	0	2
HighestEducationPrimary	0	0		-0.27 **	0	1	0.44 ***	0	2	0.49 *	0	2
HighestEducationSecondary	0.23 **	0	1	-0	0		0.43 ***	0	2	1.13 ***	0	3
HighestEducationHigher	0.33 **	0	1	0.31 **	0	1	0.66 ***	0	2	1.22 ***	0	3

DHS	TAJIKISTAN (13)			TIMOR-LESTE (14)		
	Coeff	SE	OR	Coeff	SE	OR
(Intercept)	2.84 ***	0		0.54 ***	0	
RicherHousehold	-0.66 ***	0	2	0.92 ***	0	3
ResidenceUrban	-2.07 ***	0	8	0.64 ***	0	2
HighestEducationPrimary	-0	0		0	0	
HighestEducationSecondary	0	0		0.16 **	0	1
HighestEducationHigher	0	0		0.43 ***	0	2

Source: UNESCAP elaboration based on DHS and MICS household surveys.

Notes: 1. Latest year available for each country. 2. Base references are poorer household, rural household, and no education.

Coeff. = Coefficient, SE = Standard Error, OR = Odds Ratio. *** 1% level of significance, ** 5% level of significance, * 10% level of significance.

TABLE A4

Logit model results: Access to basic sanitation

MICS	BHUTAN (1)			KAZAKHSTAN (2)			LAO PDR (3)			MONGOLIA (4)		
	Coeff	SE	OR	Coeff	SE	OR	Coeff	SE	OR	Coeff	SE	OR
(Intercept)	-0	0		4 ***	0		-1.26 ***	0		-4.6 ***	0	
RicherHousehold	1.05 ***	0	3	0.71 ***	0	2	2.09 ***	0	8	3.33 ***	0	28
ResidenceUrban	0.4 ***	0	1	-1.13 ***	0	0	1.52 ***	0	5	1.16 ***	0	3
HighestEducationPrimary	-0	0		0	0		-0.47 ***	0	1	-1.16 ***	0	0
HighestEducationSecondary	0	0		-0	0		0	0		-0.78 ***	0	0
HighestEducationHigher	0.57 **	0	2	0.59 ***	0	2	0.67 ***	0	2	0	0	

MICS	THAILAND (5)			TURKMENISTAN (6)			VANUATU (7)			VIET NAM (8)		
	Coeff	SE	OR	Coeff	SE	OR	Coeff	SE	OR	Coeff	SE	OR
(Intercept)	3.04 ***	0		5.49 ***	0		-0.6 ***	0		-0.22 **	0	
RicherHousehold	1.05 ***	0	3	0.96 ***	0	3	0.77 ***	0	2	2.79 ***	0	16
ResidenceUrban	-0.31 ***	0	1	-2.35 ***	0	0	0	0		0.12 *	0	1
HighestEducationPrimary	-0	0		-0	0		-0.2 *	0	1	0	0	
HighestEducationSecondary	0	0		-0	0		0	0		0.77 ***	0	2
HighestEducationHigher	0.37 **	0	1	0	0		0.66 ***	0	2	0.78 ***	0	2

DHS	AFGHANISTAN (1)			ARMENIA (2)			BANGLADESH (3)			CAMBODIA (4)		
	Coeff	SE	OR	Coeff	SE	OR	Coeff	SE	OR	Coeff	SE	OR
(Intercept)	-0.69 ***	0		-2.5 ***	0		-0.94 ***	0		0.76 ***	0	
RicherHousehold	-0.94 ***	0	3	1.74 ***	0	6	-0.99 ***	0	3	-2.37 ***	0	11
ResidenceUrban	-1.21 ***	0	3	1.94 ***	0	7	0.28 ***	0	1	-0.74 ***	0	2
HighestEducationPrimary	0.3 ***	0	1	1	0		0.31 ***	0	1	0	0	
HighestEducationSecondary	0.55 ***	0	2	1.9 **	0	7	0.96 ***	0	3	0.68 ***	0	2
HighestEducationHigher	0.94 ***	0	3	2.56 ***	0	13	1.88 ***	0	7	1.79 ***	0	6

DHS	INDIA (5)			INDONESIA (6)			KYRGYZSTAN (7)			MALDIVES (8)		
	Coeff	SE	OR	Coeff	SE	OR	Coeff	SE	OR	Coeff	SE	OR
(Intercept)	-0.96 ***	0		2.15 ***	0		14	272		2.88 ***	0	
RicherHousehold	-2.12 ***	0	8	-2.83 ***	0	17	1.68 ***	0	0	-0.68 ***	0	2
ResidenceUrban	-0.43 ***	0	2	-0.26 ***	0	1	0	0		-0.48 **	0	2
HighestEducationPrimary	0.33 ***	0	1	0	0		-12	272		0.43 **	0	2
HighestEducationSecondary	0.89 ***	0	2	0.42 ***	0	2	-12	272		0.57 ***	0	2
HighestEducationHigher	2.1 ***	0	8	0.96 ***	0	3	-12	272		0.8 ***	0	2

DHS	MYANMAR (9)			NEPAL (10)			PAKISTAN (11)			PHILIPPINES (12)		
	COEFF	SE	OR	COEFF	SE	OR	COEFF	SE	OR	COEFF	SE	OR
(Intercept)	-1.01 ***	0		0.24 ***	0		1.15 ***	0		0	0	
RicherHousehold	1.36 ***	0	4	-0.29 ***	0	1	-1.23 ***	0	3	-1.36 ***	0	4
ResidenceUrban	0.17 ***	0	1	-0.23 ***	0	1	-1.12 ***	0	3	0.33 ***	0	1
HighestEducationPrimary	-0	0		0	0		0.25 ***	0	1	0.67 **	0	2
HighestEducationSecondary	0.17 *	0	1	0.78 ***	0	2	0.89 ***	0	2	0.98 ***	0	3
HighestEducationHigher	0.74 ***	0	2	1.23 ***	0	3	1.56 ***	0	5	1.61 ***	0	5

DHS	TAJIKISTAN (13)			TIMOR-LESTE (14)		
	Coeff	SE	OR	Coeff	SE	OR
(Intercept)	0	0		-1.21 ***	0	
RicherHousehold	-0.22 **	0	1	1.51 ***	0	5
ResidenceUrban	0	0		0.46 ***	0	2
HighestEducationPrimary	0	0		0	0	
HighestEducationSecondary	1.44 **	0	4	0.34 ***	0	1
HighestEducationHigher	1.42 **	0	4	0.74 ***	0	2

Source: UNESCAP elaboration based on DHS and MICS household surveys.

Notes: 1. Latest year available for each country. 2. Base references are poorer household, rural household, and no education.

Coeff. = Coefficient, SE = Standard Error, OR = Odds Ratio. *** 1% level of significance, ** 5% level of significance, * 10% level of significance.

References

1 'Sustainable Development Goals: 17 Goals to Transform the World' (2018). Available from: https://www.un.org/sustainabledevelopment/water-and-sanitation/ (accessed on 10/05/18).

2 ESCAP, 2018. Inequality in Asia and the Pacific in the Era of the 2030 Agenda for Sustainable Development. Bangkok. Available from: https://www.unescap.org/sites/default/files/publications/ThemeStudyOnInequality.pdf

3 ESCAP (2016). Statistical Yearbook for Asia and the Pacific 2016: SDG Baseline Report. Available online at: https://www.unescap.org/sites/default/files/ESCAP_SYB2016_SDG_baseline_report.pdf

4 World Health Organization (WHO), 2017. Progress on Drinking Water, Sanitation and Hygiene: 2017 Update and SDG Baselines. Geneva, and the United Nations Children's Fund (UNICEF), 2017. Licence: CC BY-NC-SA 3.0 IGO; p. 8). Available from: http://www.who.int/water_sanitation_health/publications/jmp-2017/en/ (accessed on 14/05/18).

5 WHO, ibid.

6 'Global costs and benefits of drinking-water supply and sanitation interventions to reach the MDG target and universal coverage' WHO/HSE/WSH/12.01. Available from: http://www.who.int/water_sanitation_health/publications/2012/globalcosts.pdf (accessed on 06/06/18).

7 Gertler, P., Heckman, J., Pinto, R., Zanolini, A., Vermeersch, C., Walker, S., ... & Grantham-McGregor, S. (2013). Labor market returns to early childhood stimulation: A 20-year follow-up to an experimental intervention in Jamaica (No. w19185). National Bureau of Economic Research.

8 'Children dying daily because of unsafe water supplies and poor sanitation and hygiene, UNICEF says' (2013, March 21). Available from: https://www.unicef.org/media/media_68359.html (accessed on 11/05/18).

9 Source: UNICEF (2013). Improving Child Nutrition: The achievable imperative for global progress. United Nations Children's Fund.

10 *Progress on Drinking Water, Sanitation and Hygiene: 2017 Update and SDG Baselines*. Geneva: World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) (2017). Licence: CC BY-NC-SA 3.0 IGO.

11 Ibid.

12 Barton, A. 'Water in Crisis - Women in India'. Available from: https://thewaterproject.org/water-crisis/water-in-crisis-india-women (accessed on 15/05/18).

13 Lennon, S., 2011. "Fear and Anger: Perceptions of Risks Related to Sexual Violence against Women Linked to Water and Sanitation in Delhi, India". LSHTM.

14 Progress on Drinking Water, Sanitation and Hygiene: 2017 Update and SDG Baselines. Geneva: World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) (2017). Licence: CC BY-NC-SA 3.0 IGO. Statistical annex.

15 ESCAP, 2018. Inequality in Asia and the Pacific in the Era of the 2030 Agenda for Sustainable Development. Bangkok. Available from: https://www.unescap.org/sites/default/files/publications/ThemeStudyOnInequality.pdf

16 ESCAP, Asian Development Bank, UN Development Programme (2017) *Asia-Pacific Sustainable Development Goals Outlook*. Bangkok. Available online at: http://www.unescap.org/sites/default/files/publications/ap-susdevoutlook-full.pdf

17 Shorrocks, Anthony F. Decomposition procedures for distributional analysis: a unified framework based on the Shapley value. *Journal of Economic Inequality*, Vol. 11, No. 1 (December 2013).

18 'Afghanistan – Uzbeks and Turkmens'. Available from: http://minorityrights.org/minorities/uzbeks-and-turkmens/ (accessed on 31/05/18) and Bezhan, F. (2016, June 15). 'Ethnic Minorities are Fueling the Taliban's Expansion in Afghanistan'. Available from: http://foreignpolicy.com/2016/06/15/ethnic-minorities-are-fueling-the-talibans-expansion-in-afghanistan/ (accessed on 31/05/18).

19 Alexander, K; et al. (2016, January). 'Ending Open Defecation in India: Insights on Implementation and Behavior Change from Swachh Bharat Abhiyan' Graduate Policy Workshop Report, Woodrow Wilson School of Public & International Affairs, Princeton University. Available from: https://wws.princeton.edu/sites/default/files/content/India%20Workshop%20Report_FINAL_2.25.2016.pdf (accessed on 31/05/18).

20 Kelleher, John D., Brian Mac Namee, Aoife D'Arcy. Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, and Case Studies, The MIT Press Cambridge, Massachusetts.

21 Ferreira, F and Gignoux, J. (2011). The Measurement of Inequality of Opportunity: Theory and Application to Latin America. Review of Income and Wealth. International Association for Research in Income and Wealth.

22 European Bank for Reconstruction and Development. Transition Report 2016-17: Transition for All: Equal Opportunities in an Unequal World. London, 2017.

23 For more information see Demographic and Health Surveys (DHS), available from: http://www.dhsprogram.com/programming/wealth%20index/DHS_Wealth_Index_Files.pdf

Inequality of Opportunity in Asia and the Pacific: Water and Sanitation

Reducing inequality in all its forms is at the heart of the 2030 Agenda for Sustainable Development. It is emphasized in the stand-alone Goal 10 "Reduce inequality within and among countries" and in other Goals that call for universality and for 'leaving no one behind'. Reducing inequality advances human rights and social justice and is fundamental for all three dimensions of sustainable development.

The ESCAP *Inequality of Opportunity* papers identify seven areas of basic opportunities where inequality jeopardizes a person's life prospects, namely: education; women's access to health care; children's nutrition; decent employment; basic water and sanitation; access to clean energy; financial inclusion; and political participation. Each of these opportunities are covered by specific commitments outlined in the 2030 Agenda for Sustainable Development and addressed in a separate thematic paper covering 22 countries throughout Asia and the Pacific.

Visit our webpage at:

www.unescap.org/our-work/social-development