

Water Security and Sustainability  
Thailand's Water Security Situation  
in the context of world  
and ASEAN

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## Water Security and Sustainability

### Thailand's Water Security Situation in the context of world and ASEAN

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#### Abstract

Worlds nowadays focus on SDG goals to be set as country benchmark for socio-economic environmental development. The successful countries for sustainable water security depend on efficiency of integrated water management, water productivity and provision of water supply and sanitary services. Water security index was another issue that had been proposed to monitor the national socio-economic development which comprised of household, urban water, economic water (including irrigation water), river health and resilience. The study proposed the water security definition and assessed the water security status of Thailand by using water use status and correlated with gross domestic product per capita, water productivity, Government effectiveness (Governance), political stabilities in various countries of the world, Asia and ASEAN which helped to understand the competitiveness and the strength, weakness and potential of water resources development of Thailand compared with the rest of the world and ASEAN countries and their initiatives needed.

**Keywords:** water security, sustainability, water resources, Thailand, world, ASEAN.

#### 1. Introduction

Worlds nowadays focus on SDG goals to be set as country benchmark for socio-economic environmental development. The successful countries for sustainable water security depend on efficiency of integrated water management, water productivity and provision of water supply and sanitary services. Water security index was another issue that had been proposed to monitor the national socio-economic development which comprised of household, urban water, economic water (including irrigation water), river health and resilience. The study proposed the water security definition and assessed the water security status of Thailand by using water use

status and correlated with gross domestic product per capita, water productivity, Government effectiveness (Governance), political stabilities in various countries of the world, Asia and ASEAN which helped to understand the competitiveness and the strength, weakness and potential of water resources development of Thailand compared with the rest of the world and ASEAN countries and their initiatives needed.

This study determined the water security status from five dimensions, i.e., WS1: basic water (renewable, supply, hygiene), WS2: sufficient water (water supply, consumption, agricultural water), WS3: development water (irrigation area, industrial water use, water for energy, water for aquaculture), WS4: water disaster (loss from floods and drought), WS5: water for future (population growth, urban population growth, water footprint) (Sucharit et. al., 2014). The index status analyzed were correlated with water use unit (cubic meter per capita), water productivity (US \$ per cubic meter of water use), government effectiveness, political stability and grouped into four groups of country classified by income per capita of the country. Based on the available data from various sources of the world (World Bank, 2016; ADB, 2016), the index of each country was determined comparatively by weighting equally from each dimensions and ranked by marking equally (1-5 points) of each elements from the average and standard deviation values while the security status in ASIA is based on ADB study (ADB, 2016, 2019; Piyatida et.al., 2019).

## **2. Water security index concept**

Up to now, water resources development process started with project development, implementation, monitoring and system improvement which aimed to facilitate basic needs to people and society. The other portion of water was used for economic development. In recent years, environmental issues were raised and had to be simultaneously considered during water resources planning too. The index described sufficiency, risk and was later developed to water security. The index helped to monitor the development of water management clearer and determined from various aspects, e.g., water sufficiency of both quantitative and qualitative

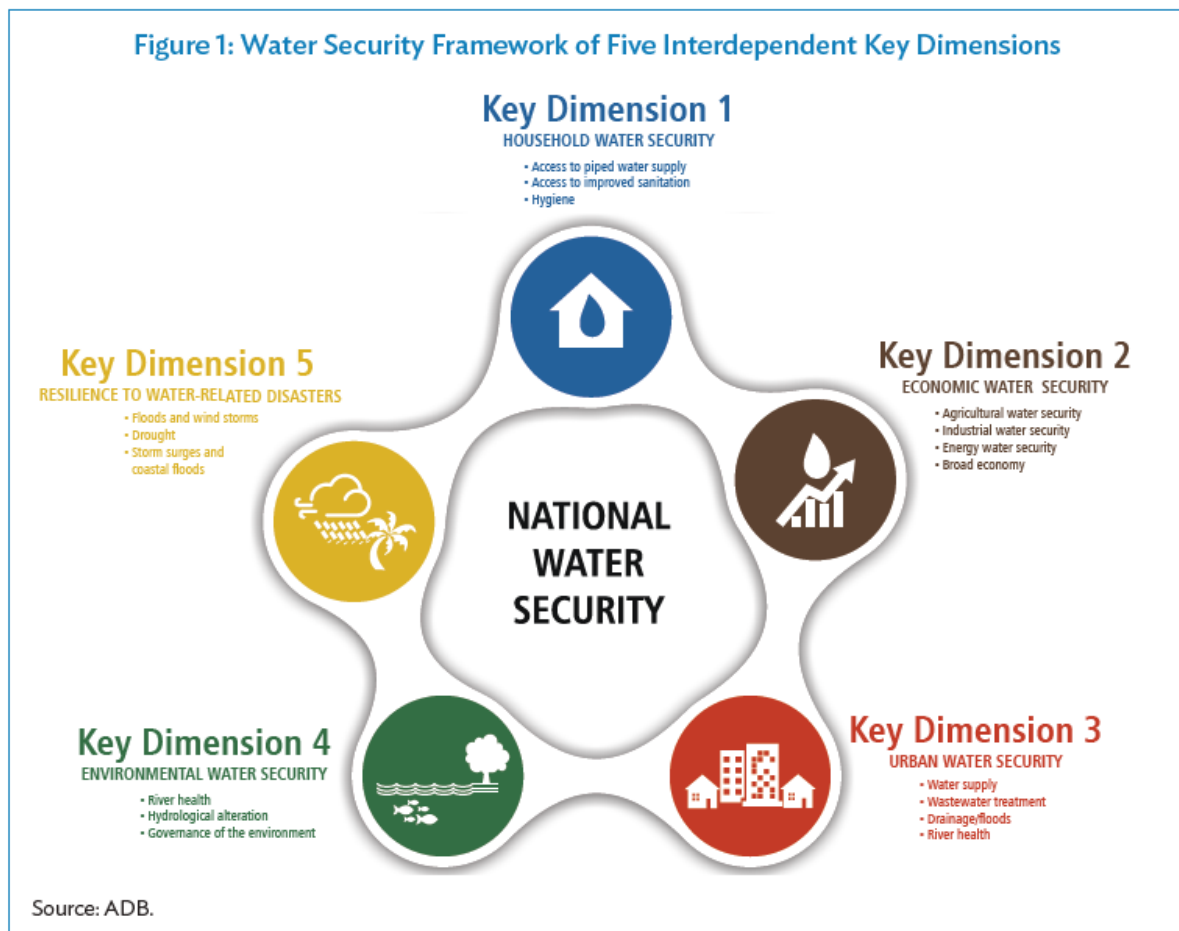
aspects for health, life, ecology preservation, production, disaster relief (Grey and Sadoff, 2007) or the accessibility to clean and safe water with sufficient amount and payable cost for hygiene and good quality life with environment protection (Global Water Partnership, 2010).

The planning of each country normally concerned with the development of economics, society and environment. However the important element for sustainable development is still engaged with water resources. The concept of water security was developed to investigate the actual situations of these basic water developments with socio-economical and environmental development. The security dimensions proposed by ADB comprised of water security of house hold, economics, urban, river health and resilience to disaster (see Fig. 1). The water security status also linked to water governance level, political stability and SDGs at the end.

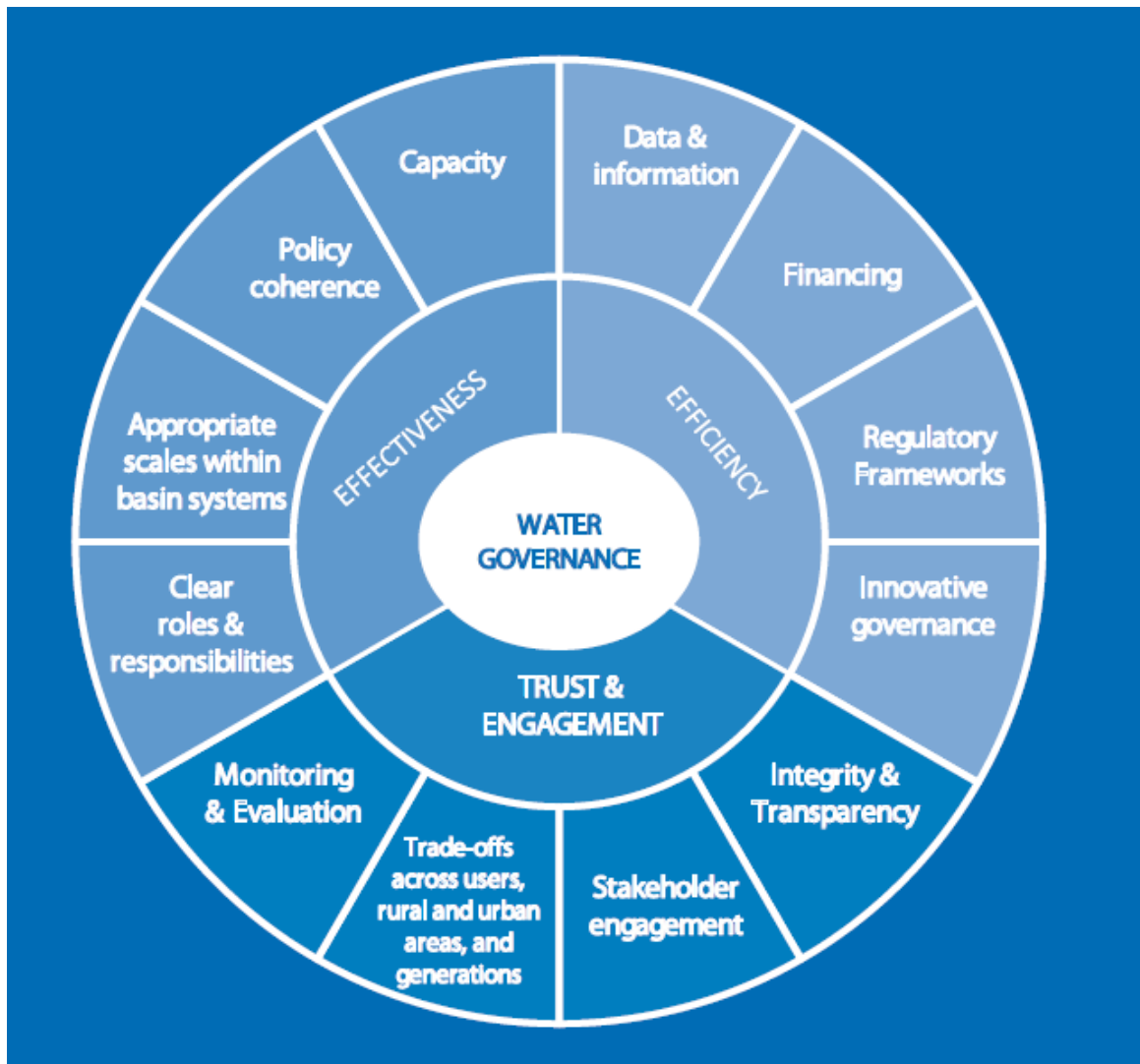
In the world scale, this study determined the water security status from five dimensions, i.e., WSI1: basic water (renewable, supply, sanitation), WSI2: sufficient water (water supply, consumption, agricultural water), WSI3: development water (irrigation area, industrial water use, water for energy, water for aquaculture), WSI4: water disaster (loss from floods and drought), WSI5: water for future (population growth, urban population growth, water footprint). The index status analyzed were correlated with water productivity (US\$ per cubic meter of water) with the four groups of country classified by GDP per capita of the country. Based on the available data from various sources of the world (World Bank, 2014; Mackie Black et. al, 2009), the index of each country was determined comparatively by weighting equally from each dimensions and marking equally (1-5 points) of each elements with ranking from the average and standard deviation values.

In the Asian scale, ADB (AWDO2013, 2016) reported the assessment results of Asian Water Development Outlook which comprised of water security indexes of KD1 Rural Household Water Security, KD2 Economic Water Security, KD3 Urban Water Security, KD4 Environmental Water Security and KD5 – Resilience against disasters and analyzed the linkage to Governance and Finance (GDP). This study used the AWDO assessment results and compared with Governance (Government Effectiveness index from World Bank), Finance (GDP from World Bank) and Political stability

(Political Stability Index from World Bank), SDGs (SDG 6, 8, 9, 11, 13, 16) to see their relationships and analyzed the SWOT of Thailand's Water Development status for future recommendations.



(a) Water Security Index



(b) Water Governance Index



(c) SDG Index

Fig.1 Water security index and linkage to Water Governance and SDG

### 3. Study procedure

The study collected the related information for estimate the level of water security and sustainability, i.e., Gross domestic product: Population, Water productivity, Government Effectiveness (represented governance), Political stability index and National Water Security Index by Economy as follows.

1) Collected data of Gross Domestic Product: Population (year2016) to compute GNP per capita from data of GDP (at average annual % growth) divided by population based on data from WORLD BANK (2016), Gross domestic product and Population.

2) Collected data of water productivity (from Annual Water Use 2010/2005 GDP/cubic meter) and classified by each country's average GDP (source: THE WORLD BANK (2015), Sucharit (2014))

3) Collected data of Government Effectiveness (year2016) by ranking and average of each country data (source: THE WORLD BANK (2016), Government Effectiveness)

4) Collected data of Political stability index (year2017) by ranking and average of each country data (source: THE WORLD BANK (2017), Political stability)

5) for world scale evaluation , collected data from the National Water Security Index by Economy (NWS Score) (full score: 25) and used assessment data of basic water, development data, data for disaster, future water during the year of 2003-2007 for ranking and average calculation (marking each water dimension of 5 points in total of 25 points). The grouping and ranking of country revenue used the data in July 2018 of World Bank (source: THE WORLD BANK, ADB 2016, and Sucharit2014)

6) for Asia evaluation, NWS fromADB2016were used for ranking and averaging and grouping by country revenue based on the data in July 2018 of World Bank (source: THE WORLD BANK, ADB 2016)

7) The country revenue of each country used the data and criteria of World Bank in July 2018 as follows. Threshold GNI/Capita (current US\$) Low-income(< 995) Lower-middle income (996 - 3,895) Upper-middle income (3,896 - 12,055) High-income (> 12,055)

#### 4. World water use, water security and sustainability

The data of water use for domestic, industry and agriculture of each country were gathered and grouped up by country income (GDP per capita) into four groups, i.e., high(> 12,055 US\$), upper middle (3,896 - 12,055 US\$), lower middle (996 - 3,895 US\$), low income (< 995 US\$) group of countries with the rate of water use in each categories, i.e., agriculture, households, industry and showed in Fig. 2. It can be seen that average water use rate grows up with the GDP per capita growth up to the moderate level but becomes lower at the very high income group. The water use structure changes with the GDP per capita growth with the increase of industrial water use (as shown in Fig 3 for each dimension) except in the dimension of water disaster which decrease in the high income country group due to the loss from water disaster (which may reflect from the data availability).

Based on the water security index proposed by the study and data in 2007 (since there is no world water security assessment results), the distribution of water security status of each country (146 countries shown in Appendix Table 6) in the world scale can be shown in Fig. 4. The water productivity, measured by the income per capita per water use unit, was assessed (shown in Fig 5) and compares with the water security index obtained and governance, political stability indexes as shown in Fig 6, 7.

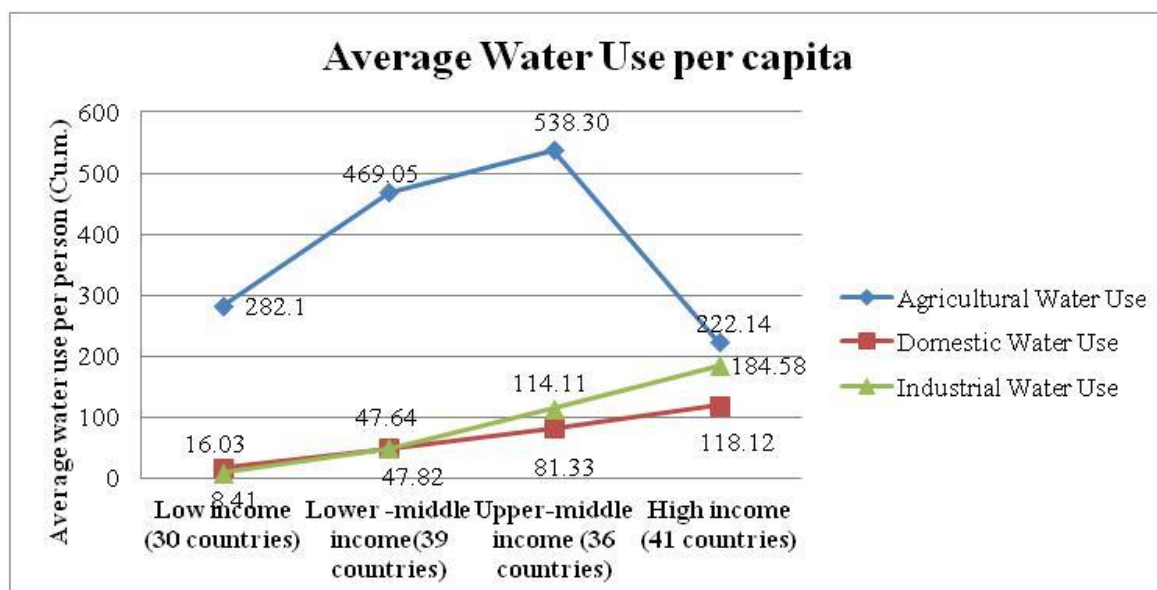


Fig.2 Water use per capita of each income country group



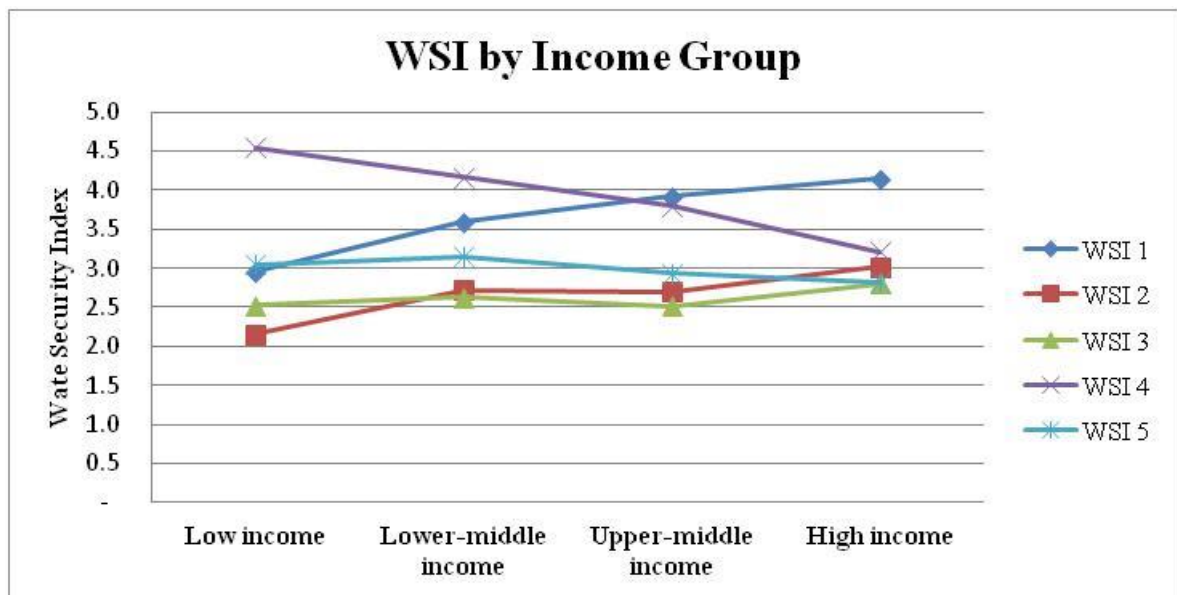


Fig.3 Water security index of the world in each dimension

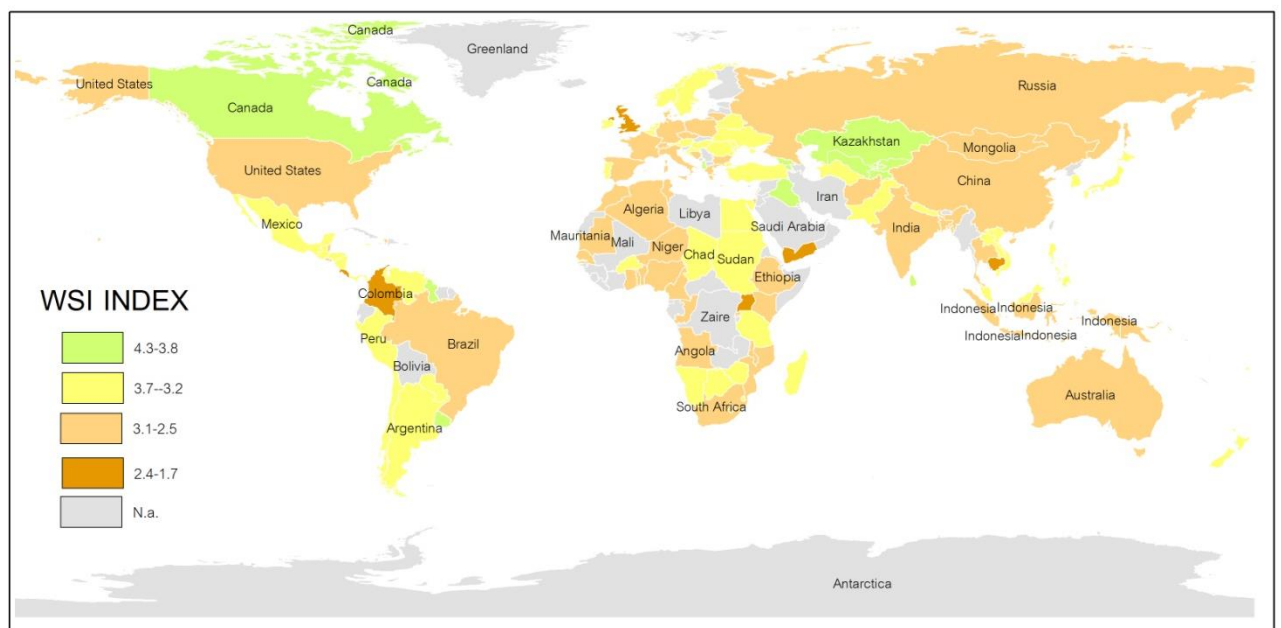


Fig.4 Distribution of water security index of each country in the world

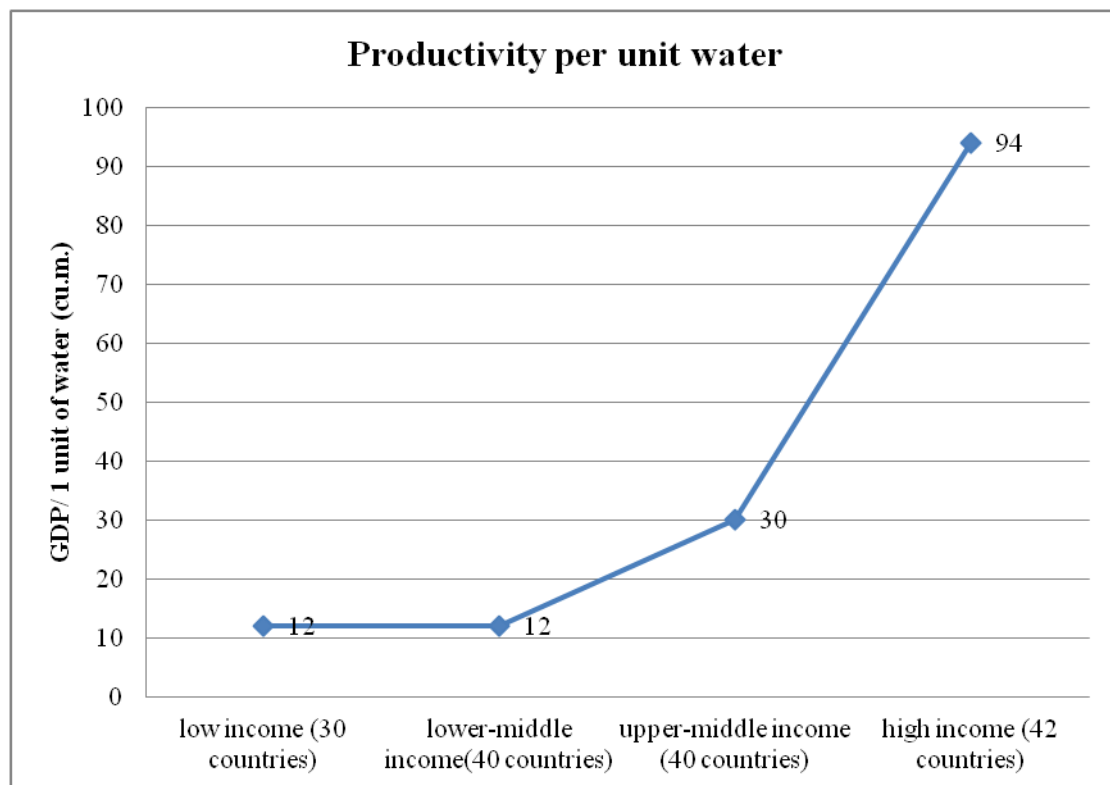


Fig.5 Water productivity of each income country group

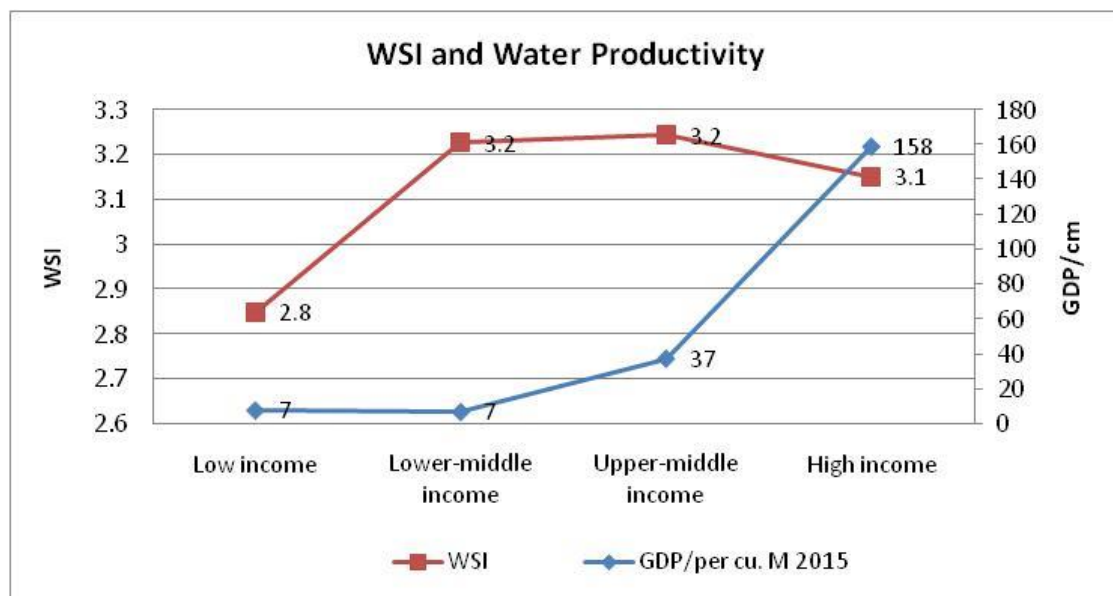


Fig.6 Water security index and water productivity

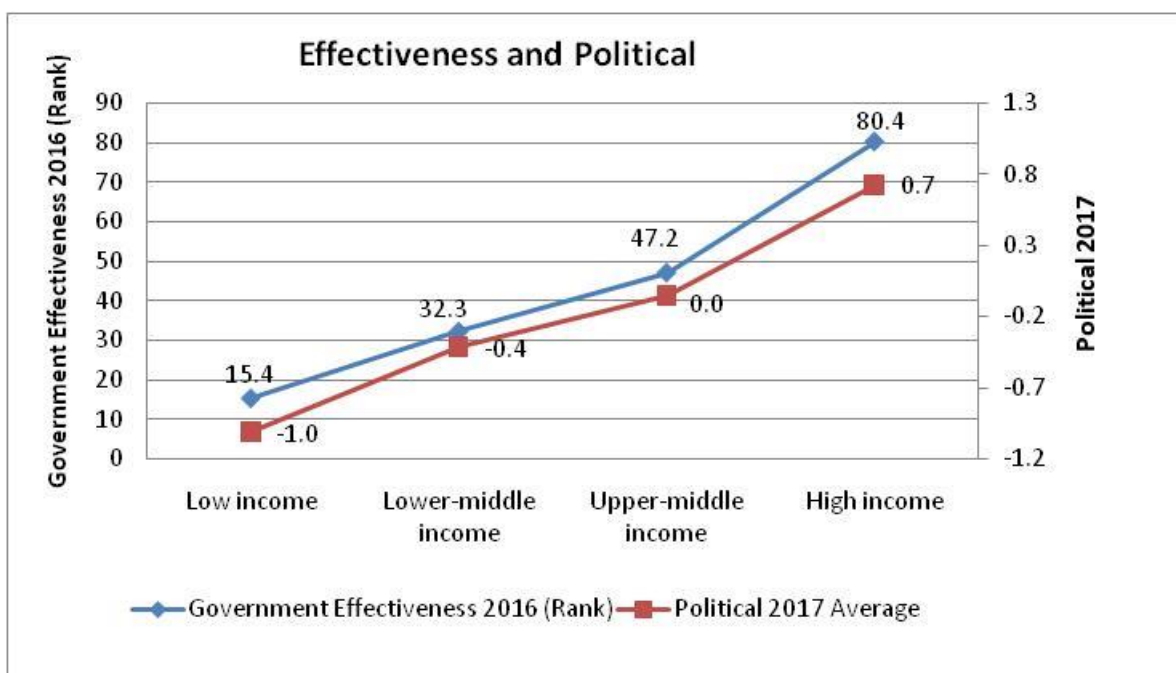


Fig.7 Governance and political stability

From the analysis, the average water use unit, water productivity grows up with the GDP per capita growth though the agricultural water use in the high income group decreased due to the change of water use structure. In general, more water productivity induced better water security status. Water security index increased from the less income group to lower middle income group and became stable in the upper middle and high income group due to the loss of water disaster (which may reflect from the data availability). The water productivity, measured by the income per capita and per water use unit, was assessed and compared with the water security index obtained and it showed that more water productivity, governance and political stability induced better water security status

##### 5. Thailand's water security and sustainability compared with the rest of the world

Based on 2007 data, the water security status of Thailand, compared with the world, Asia and ASEAN regions were assessed and shown in Table 1 and the ranking of each dimensions are shown in Table 2 and Fig 8. Within ASEAN countries, the water use, water productivity and water security status of each country were assessed comparatively and shown

in Fig. 9 in the sequence of GDP per capita which showed that Thailand has the highest water use unit, lower water productivity and moderate in water security ranking. From these figures and tables, the strength and weakness of water security status and development potential of Thailand can be analyzed and discussed (as Table 3) as follows.

#### **Strength**

- High clean water accessibility (98 %) compared with the rest of the world
- High accessible population to improved sanitation facility (96%)
- Moderate irrigation area (25 % of agricultural area) compared with world average of 19%) and ASEAN average of 18%
- High water use for fresh water aquaculture (1.3 M cu m per capita) with fresh water aquacultural area of 3,750 sq. km.

#### **Weakness**

- Low runoff amount (6,382 cu m per capita per year) compared with world, Asia, ASEAN countries.
- High portion of agricultural water use
- High water footprint in agricultural sector (rank 3 of the world) stated the low water use productivity (which may induce low competitiveness of the country).

#### **Development potential**

- Still low industrial water use (34 cum/year compared with world (97 cum), Asia (60 cum) and ASEAN (49 cum)
- Still low water use for energy (4%) compared with world (31%), Asia (20%) and ASEAN (14%)

The strength, weakness and potential of water resources status in Thailand compared with the rest of the world were summarized in Table 3.

Based on the analysis, it was clear that Thailand had developed and utilized moderate fresh water renewable and used in the higher rate comparatively, looking from available water

and high water use per capita especially in the agricultural sector. But when looking at GDP per water use unit, the water use efficiency is low compared with Indonesia, Malaysia and Vietnam. To increase the potential, Thailand needs to have more water storage, improve water use efficiency. Water use for irrigation should be improved in efficiency and used in the selected crops and potential area. The cultivation diversification to higher potential neighboring area should be considered together with higher technology transfer schemes.

**Table 1** The average world, Asia and ASEAN water use status and the ranking of Thailand's

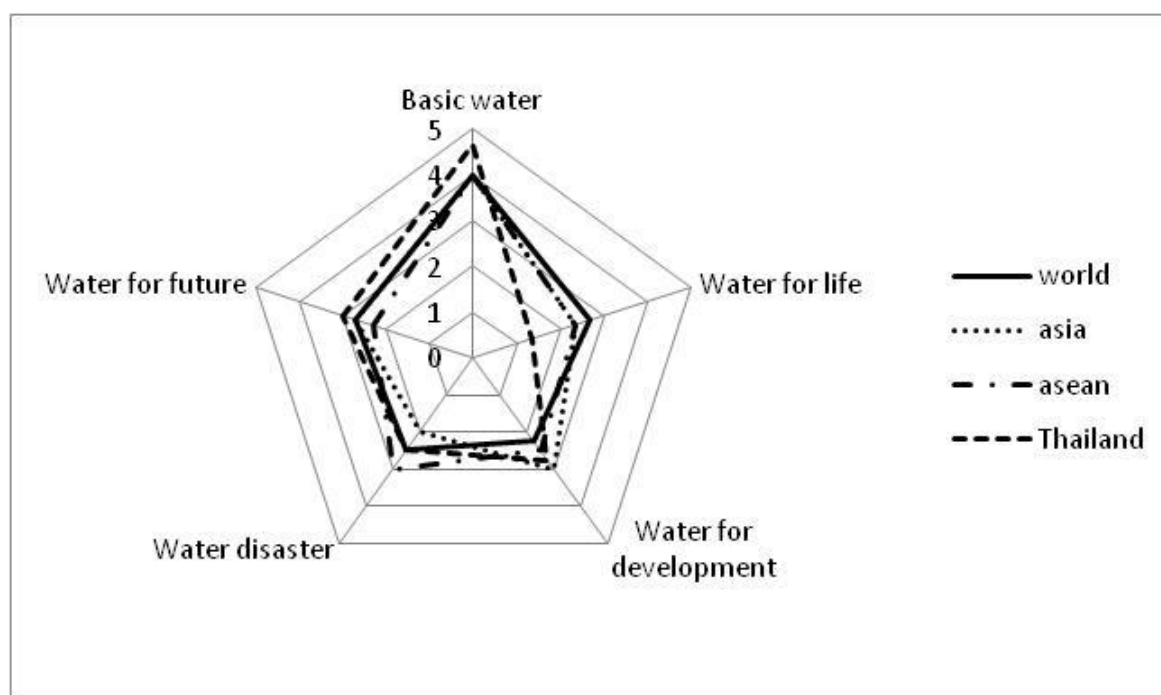
Items	Elements	Year	World		Asia		ASEAN		Thailand
			average	ranking	average	ranking	average	ranking	
Basic water	1.fresh water renewable (cu.m. per capita)	2003-07	22,167	79	10,854	15	19,205	8	6,382
	2.water supply (cu.m. per capita)	2004-06	84	46	84	9	85	3	98
	3.sanitation water (cu.m. per capita)	2004-06	67	15	70	6	71	2	96
Sufficient water	1. water use per capita (cu.m./capita)	2000-05	511	12	842	9	531	7	1,391
	2.house holds (cu.m./capita)	2000-05	84	46	84	9	85	3	98
	3.agricultural water	2000-05	354	159	712	7	424	1	1,322
Water for development	1.Irrigation area (%)	2008	19	49	41	30	18	3	25
	2. industrial water (cu.m./capita)	2000-05	97	68	60	18	49	4	34
	3. Water for energy (%)	2005	31	89	20	23	14	6	4
	4. water for fresh water aquaculture (cu.m./capita)	2006	346,734	4	1,241,323	4	582,458	2	1,385,801
Water disaster	1. flood damage (US\$)	2009	3,543,108	3	8,670,092	2	6,002,888	1	41,051,592
	2. drought damage (US\$)	2009	1,261,531	22	1,896,770	5	239,512	2	424,300
Water for future	1. Population growth (%)	2007	1.3	137	1.43	38	1.31	10	0.43
	2. Urban population growth (%)	2025	63	147	59	30	59	7	42
	3. water footprint (cu.m./capita)	2001	1,338	7	1,304	2	1,697	2	2,223
Water productivity	1.GDP (million US\$)	2010	343,530	29	445,799	7	151,224	2	318,907
	2. Productivity (US\$/ cu.m. water)	2007-1)	81	132	41.3	132	117.3	6	3.6
	3. agricultural productivity (US\$/cu.m. water) )	2007-11	392	124	33.8	18	162.5	7	0.32
	4. industrial productivity (US\$/ cu.m. water)	2007-11	169.1	63	69.5	8	121.6	4	51.2

**Table 2** Water security status of Thailand in each dimension compared with the rest

Item	weight	world	Asia	ASEAN	Thailand
Basic water	5	4.0	4.0	4.0	4.7
Sufficient water	5	2.7	2.3	2.3	1.3
Water for development	5	2.3	3.0	2.5	2.8
Water disaster	5	2.5	2.0	3.0	2.5
Water for future	5	3.7	3.7	3.3	2.0
Total	5	3.04	3	3.02	2.66

**Table 3** Strength, weakness and water development potential of Thailand's water status

Strength weakness and potential of Thailand water status		
Strength	weakness	potential
<ul style="list-style-type: none"> <li>• access to clean water</li> <li>• access to well sanitary</li> <li>• irrigation area</li> <li>• aquacultural water</li> </ul>	<ul style="list-style-type: none"> <li>• average runoff</li> <li>• agricultural water</li> <li>• water footprint</li> </ul>	<ul style="list-style-type: none"> <li>• industrial water</li> <li>• water for energy</li> </ul>



**Fig.8** Thailand's water security status compared with the rest of the world

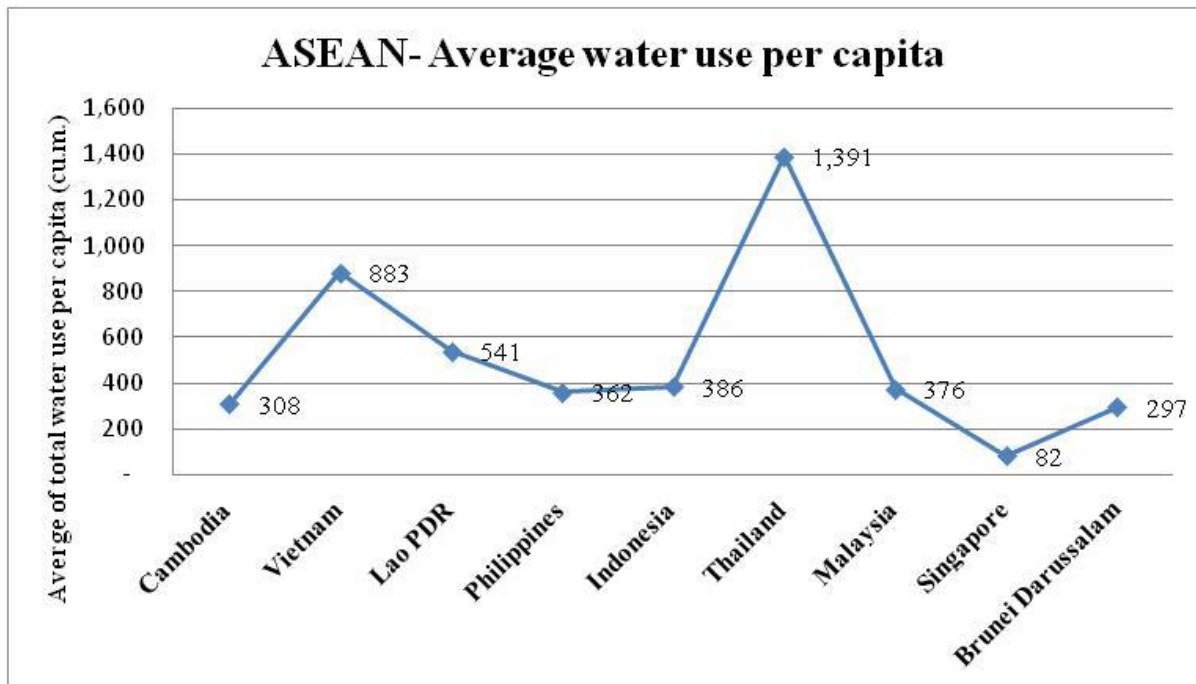


Fig.9 Water use per capita in ASEAN countries

However, based on ADB assessment results in 2016, the water security status of Thailand, compared with the world, Asia and ASEAN regions (Fig. 10, 11) were investigated with the ranking in each dimension as shown in Table 1. Within ASEAN countries, the water use, water productivity (Suthidhummajitet.al., 2019) and water security status of each country VS country GDP per capita were assessed comparatively and it showed that Thailand has the highest water use unit, moderate lower water productivity and moderate in water security ranking (Table 4). The water productivity in ASEAN, measured by the income per capita and per water use unit, was assessed and compared with the water security index obtained and it showed that more water productivity, governance and political stability induced better water security status (Fig. 12, 13).

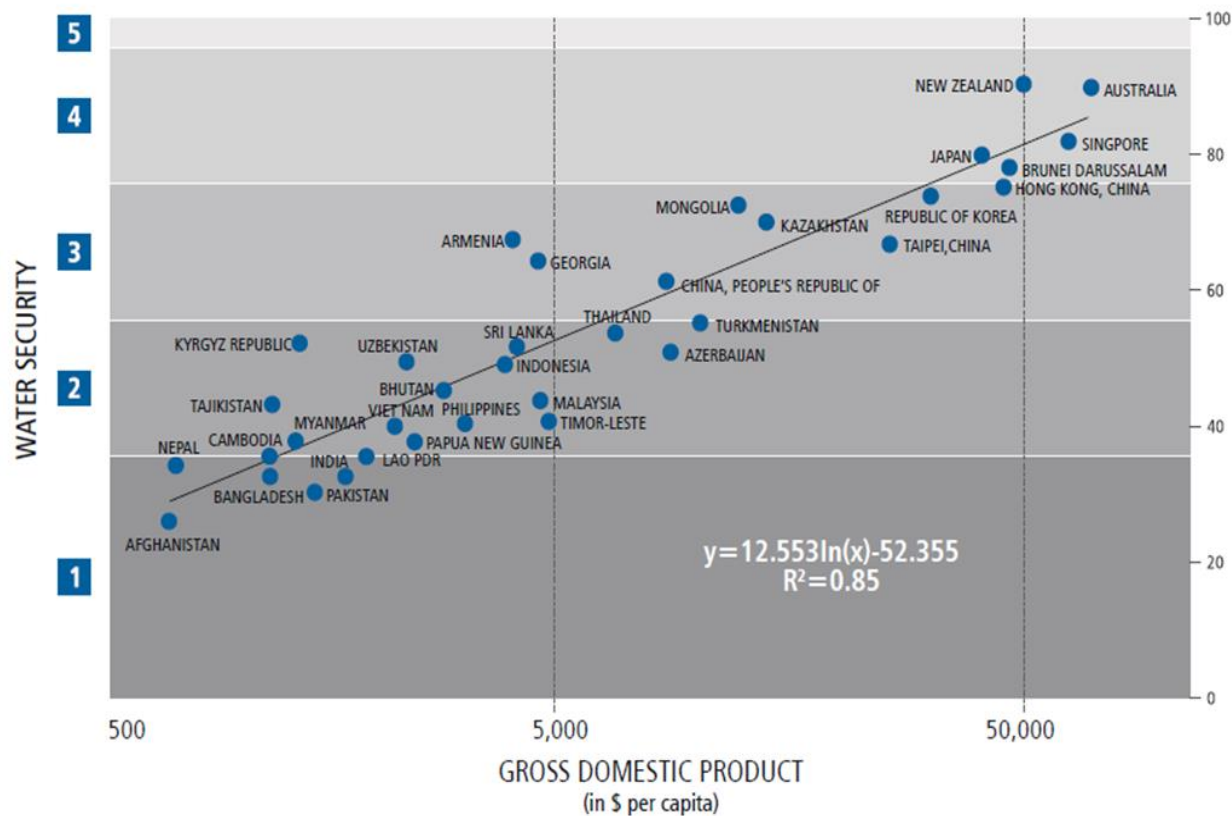


Fig.10 ASEAN Water Security Status with GDP (ADB 2016)

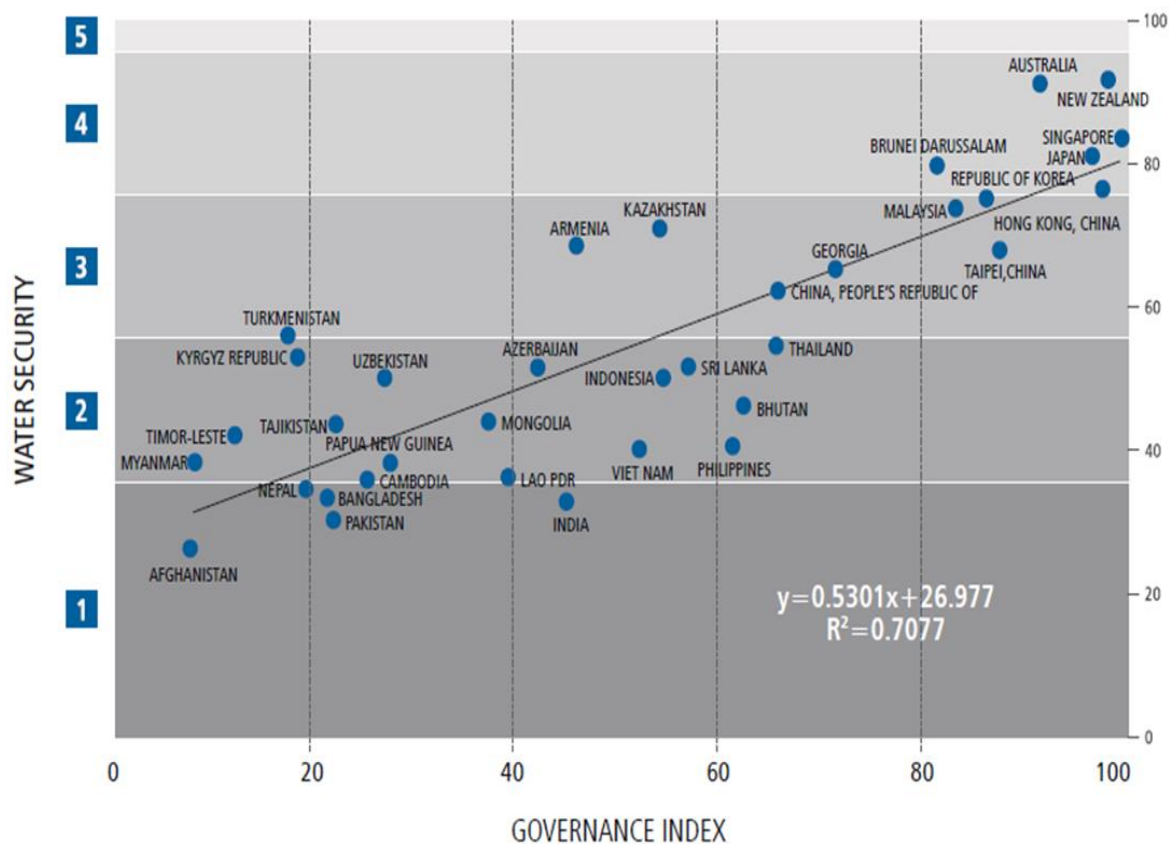


Fig.11 Water Security with Governance Index (ADB 2016)



Table 4 Water Security Index of Thailand compared with other ASEAN countries

Table A1.7: Southeast Asia

	Population (million)	NWS Score	
		2013	2016
Cambodia	15.4	31.6	37.5
Indonesia	252.8	40.9	49.8
Lao People's Democratic Republic	6.9	35.0	38.0
Malaysia	30.2	60.6	73.4
Myanmar	53.7	35.0	40.8
Philippines	100.1	35.0	40.4
Thailand	67.2	47.9	54.4
Viet Nam	92.5	33.9	40.2
Average (population weighted)		39.9	47.3

NWS = National Water Security.

Source: ADB.

Table 5 The average world, Asia and ASEAN water security, water productivity and Sustainability status and the ranking of Thailand's

Elements	World		Asia		ASEAN		Thailand
	average	ranking	average	ranking	average	ranking	
Gross domestic product : Population	14,260	88	9,546	14	11,117	4	5,980
Water productivity (GDP/cm)	81	132	49	20	82	6	4
Government Effectiveness	48.70	59	46.34	13	56.30	2	66.3
Political stability index	-0.05	118	0.14	32	0.03	8	-0.76
National Water Security Index by Economy (NWS Score) (full score: 25)	15.8	23	16.7	12	17	5	17.3

Remarks 1) Gross domestic product Population: World Bank (2016), 2) Water productivity (GDP/cm): World Bank (2015), 3) Government Effectiveness: World Bank (2016), 4) Political stability index: World Bank (2017), 5) National Water Security Index by Economy: ADB 2016, \* Sucharit 2014.

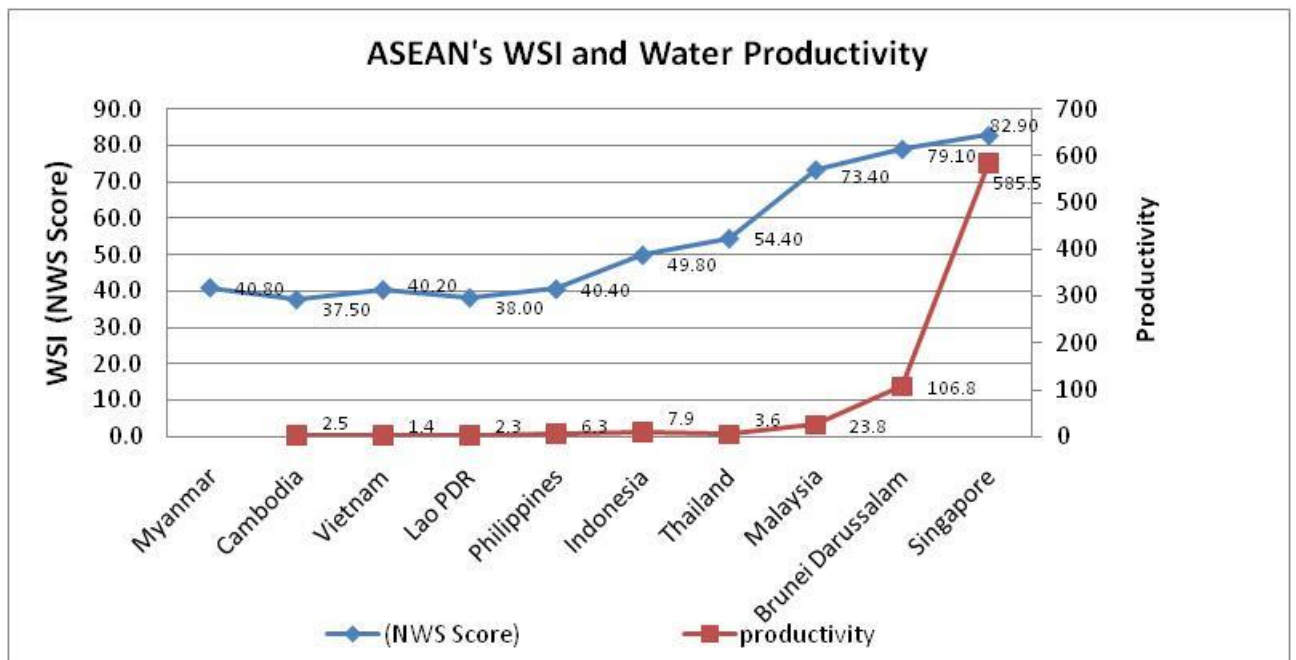


Fig.12 ASEAN's WSI and Water Productivity

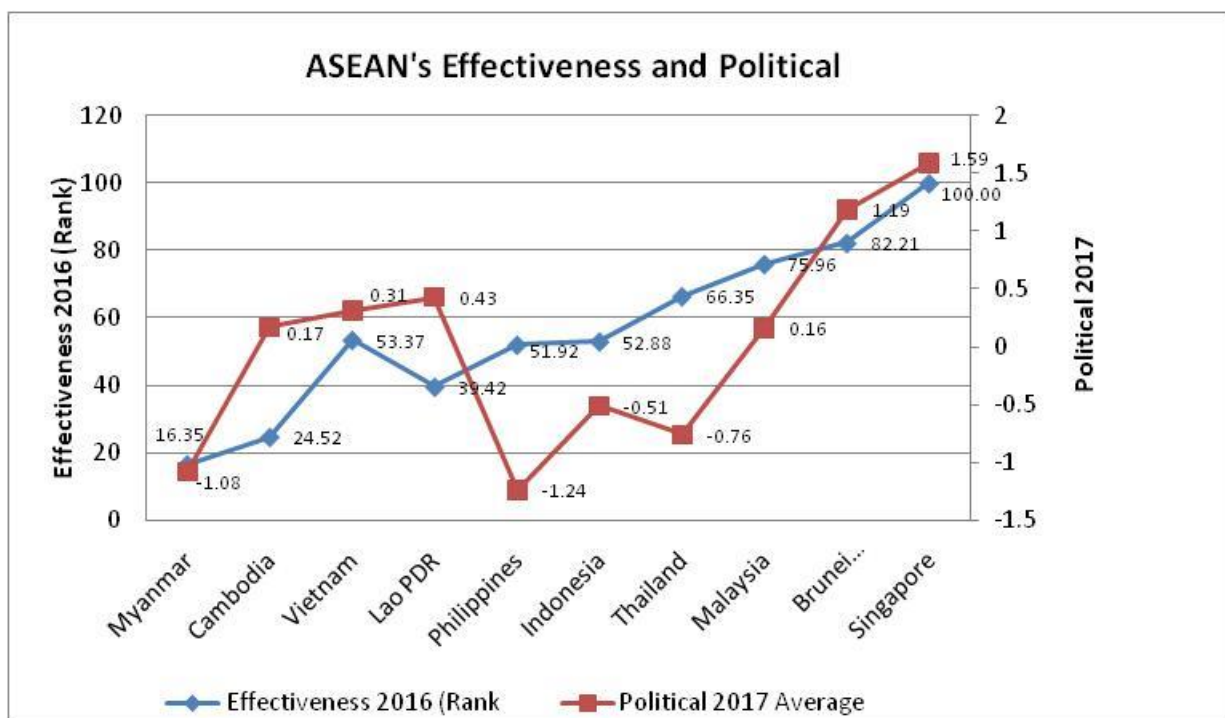


Fig.13 ASEAN's Government Effectiveness and Political stability

## 6. National Water Management Strategies

From the recent water security assessment results (Table 6), Thailand improved the security in the dimensions of KD1 (household) and KD2 (economic water) while the dimensions of Urban water (mostly about water pollution), Environmental water (water quality) and Water related disaster (flood and drought) still need improvement in the future.

**Table 6** Water Security Level in each dimension of Thailand (ADB, 2016)

Economy	KD1 Household	KD2 Economic	KD3 Urban	KD4 Environment	KD5 Water- related Disasters	NWS Score	NWS Index
Scale	1-20	1-20	1-20	1-20	1-20	1-100	1-5
Thailand	13.3	15.7	6.8	8.0	10.6	54.5	2

Thailand had set up long term National Strategic Plan and water resources management is an important issue out of 23 issues (NESDB, 2019). The concept of water security was then used as a framework and target setup on water security, water productivity, water governance with counter initiatives in lined with SDGs under country development goals (SDG8) which can be grouped up into three groups based on their urgency and impacts, i.e.,

- Group 1     to reduce loss via issues of flood and drought (SDG 13), urban water (SDG 11),
- Group 2     to induce more value added and participation via issues of water Productivity (SDG 9) and water governance (SDG 16),
- Group 3     to upgrade quality of life via issues of environmental water (SDG 6), Water sanitary (especially in the rural areas) (SDG 6).

## 7. Conclusions and recommendations

This study introduced the concept of water security to analyze, evaluate the strength and weakness for future planning. If the socio-economic development increases rapidly, the restructure of water use will be needed. When compared with other ASEAN countries (or ASEAN Economical Community, AEC), Thailand may have constraints in water resources (limited fresh water renewable, high water use rate, low productivity). More development in water storage capacity, water use efficiency and productivity should be considered.

In the Asian scale, ADB (AWDO 2013, 2016) reported the assessment results of Asian Water Development Outlook which comprised of water security indexes of KD1 Rural Household Water Security, KD2 Economic Water Security, KD3 Urban Water Security, KD4 Environmental Water Security and KD5 – Resilience against disasters and analyzed the linkage to Governance and Finance (GDP). This study used the AWDO assessment results and compared with Governance (Government Effectiveness index from World Bank), Finance (GDP from World Bank) and Political stability (Political Stability Index from World Bank), and SDGs (SDG 6, 8, 9, 11, 13, 16) to see their relationships and analyzed the SWOT of Thailand's Water Development status for future recommendations. The water productivity general, measured by the income per capita and per water use unit, was assessed and compared with the water security index obtained and it showed that more water productivity, governance and political stability induced better water security status.

The study also showed the status of water security of Thailand compared with the rest of the world. Thailand has strengths on clean water and sanitation water accessibility and water for development due to the investment in the past. However, water use status in fresh water renewable, agricultural sector, i.e., low efficiency, high water footprint, low productivity, water resilient, urban water seemed to be a weakness compared with other countries. Water governance is comparatively in good handlings. Based on the National Master Plan on water resources management, the urgent issues are to reduce loss, to enhance more value added and to improve quality of life to comply with SDG 6.

In near future, the introduction of secured and green economy concepts into water resources management and disaster resilience with climate change will also improve water security index, though there is a need for tool development (to coupling physical aspect with socio economical aspect) to link measures and outputs closely which will induce clearer policy with higher confidence and enable sustainable development environments among stakeholders

## **8. Acknowledgement**

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## Appendix

Water Security, Water Productivity, Governance Effectiveness, Political Stability

Indexes of each country and Poster



Table 1 Water Security Index

Water Security Index of each country								
No.	Country	1.Basic water	2.Sufficient water	3.Water for development	4.Water disaster	5.Water for future	Total	Average
	Weight	5	5	5	5	5	25	5
1	Afghanistan	2	3	4	4	3	16	3
2	Albania	5	3	2	5	3	19	4
3	Algeria	3	3	4	2	3	15	3
4	Antigua and Barbuda	4	3	5	-	3	15	4
5	Argentina	5	3	3	3	3	17	3
6	Armenia	5	2	3	3	4	17	3
7	Australia	5	4	3	1	3	15	3
8	Austria	4	3	2	3	3	15	3
9	Azerbaijan	4	-	1	4	3	12	3
10	Bahrain	3	3	4	-	3	14	3
11	Bangladesh	4	3	3	2	4	16	3
12	Barbados	5	4	4	-	3	15	4
13	Belarus	3	4	3	5	3	18	4
14	Belgium	4	4	3	5	2	17	3
15	Belize	3	4	4	5	2	17	3
16	Benin	4	3	5	5	3	20	4
17	Bhutan	4	3	3	-	3	13	3
18	Bolivia	5	-	3	2	4	13	3
19	Botswana	5	3	3	5	3	19	4
20	Brazil	5	4	3	3	2	17	3
21	Bulgaria	2	4	4	5	2	16	3
22	Burkina Faso	4	4	4	5	3	20	4
23	Burundi	3	4	4	-	3	14	4
24	Cameroon	4	3	3	4	3	17	3
25	Canada	5	3	3	5	2	18	4
26	Cambodia	2	4	5	2	1	14	3
27	Cape Verde	3	4	5	-	3	15	4
28	Chad	5	3	3	4	2	17	3
29	Chile	3	3	4	4	4	18	4
30	China	5	3	3	1	3	14	3
31	Colombia	3	4	5	3	3	17	3
32	Comoros	3	4	3	-	2	11	3
33	Congo, Dem. Rep.	5	-	-	-	5	10	5
34	Costa Rica	3	3	4	5	2	11	2
35	Cote d' Ivoire	5	-	3	-	3	11	4

Table 1 Water Security Index (continued)

Water Security Index of each country								
No.	Country	1.Basic water	2.Sufficient water	3.Water for development	4.Water disaster	5.Water for future	Total	Average
	Weight	5	5	5	5	5	25	5
36	Cyprus	4	3	4	-	2	13	3
37	Czech Republic	4	3	4	3	3	16	3
38	Denmark	3	3	1	3	2	12	2
39	Dominican Republic	3	-	-	5	3	11	4
40	Ecuador	5	3	4	-	3	14	4
41	Egypt	3	3	3	5	3	17	3
42	El Salvador	4	3	3	3	3	16	3
43	Equatorial Guinea	3	3	4	-	2	12	3
44	Estonia	5	3	4	-	4	16	4
45	Ethiopia	2	4	4	5	3	17	3
46	Fiji	3	3	3	5	4	19	4
47	Finland	5	4	3	-	3	15	4
48	France	5	4	4	2	2	16	3
49	Gabon	4	3	3	-	2	12	3
50	Gambia	4	4	5	5	2	19	4
51	Georgia	5	3	2	4	4	19	4
52	Germany	4	4	4	2	3	16	3
53	Ghana	3	3	3	5	2	16	3
54	Greece	5	3	4	2	3	16	3
55	Guatemala	4	3	4	5	3	19	4
56	Guinea	3	3	5	-	2	14	3
57	Guinea-Bissau	3	4	5	-	2	14	4
58	Guyana	5	3	3	5	3	19	4
59	Haiti	2	4	4	5	3	18	4
60	Honduras	4	3	4	5	3	19	4
61	Hungary	5	4	4	4	4	20	4
62	Iceland	5	3	1	-	3	12	3
63	India	3	3	4	2	4	15	3
64	Indonesia	4	3	5	3	3	18	4
65	Iraq	4	2	3	5	2	16	3
66	Ireland	5	4	4	5	3	20	4
67	Israel	3	3	3	4	2	16	3
68	Italy	4	3	3	2	3	15	3
69	Jamaica	4	3	4	5	4	20	4
70	Japan	5	3	4	2	4	17	3

Table 1 Water Security Index (continued)

Water Security Index of each country								
No.	Country	1.Basic water	2.Sufficient water	3.Water for development	4.Water disaster	5.Water for future	Total	Average
	Weight	5	5	5	5	5	25	5
71	Jordan	3	3	4	-	2	12	3
72	Kazakhstan	5	3	3	5	2	18	4
73	Kenya	2	3	3	5	3	17	3
74	Korea, South	4	3	4	5	3	19	4
75	Kuwait	1	3	4	-	2	9	2
76	Kyrgyzstan	4	3	2	5	3	17	3
77	Laos	3	4	3	5	3	18	4
78	Latvia	5	3	3	-	4	12	3
79	Lebanon	4	3	3	-	3	10	2
80	Lesotho	3	3	3	5	4	18	4
81	Liberia	3	4	5	-	2	14	4
82	Lithuania	4	3	4	3	4	17	3
83	Madagascar	3	3	3	5	2	16	3
84	Malawi	3	3	4	5	2	17	3
85	Malaysia	5	3	4	5	1	19	4
86	Mali	3	4	4	-	2	12	3
87	Malta	3	3	4	-	2	15	4
88	Mauritania	3	3	5	4	2	17	3
89	Mauritius	4	3	3	3	3	16	3
90	Mexico	4	3	4	3	3	16	3
91	Moldova	4	4	3	4	3	18	4
92	Mongolia	4	4	5	5	3	19	4
93	Morocco	3	3	4	4	2	16	3
94	Mozambique	3	4	3	5	3	17	3
95	Namibia	4	3	3	5	4	18	4
96	Nepal	3	3	3	5	3	17	3
97	Netherlands	5	4	3	5	3	20	4
98	New Zealand	5	3	4	4	3	18	4
99	Nicaragua	4	4	4	5	3	20	4
100	Niger	2	4	4	5	3	17	3
101	Nigeria	2	3	4	5	1	15	3
102	Norway	5	3	3	5	3	19	4
103	Oman	1	3	3	-	1	8	2
104	Pakistan	3	3	3	3	3	15	3
105	Panama	4	3	3	5	3	18	4
106	Paraguay	4	3	3	5	3	18	4
107	Peru	4	3	3	4	3	17	3
108	Philippines	4	3	4	5	2	18	4

Table 1 Water Security Index (continued)

Water Security Index of each country								
No.	Country	1.Basic water	2.Sufficient water	3.Water for development	4.Water disaster	5.Water for future	Total	Average
	Weight	5	5	5	5	5	25	5
109	Poland	2	4	4	2	4	15	3
110	Portugal	5	3	3	2	3	15	3
111	Qatar	4	3	3	0	2	12	2
112	Romania	4	3	3	3	3	15	3
113	Russia	5	4	4	2	3	17	3
114	Rwanda	2	4	4	5	3	17	3
115	Saudi Arabia	1	3	4	2	2	11	2
116	Senegal	3	4	4	4	1	16	3
117	Seychelles	4	3	3 -		4	14	4
118	Sierra Leone	3	4	5 -		3	14	4
119	South Africa	3	3	4	2	4	16	3
120	Spain	4	3	4	2	2	15	3
121	Sri Lanka	4	3	3	5	4	19	4
122	Sudan	3	3	3	5	1	16	3
123	Suriname	5	3	2 -		3	13	3
124	Swaziland	3	4	4	5	4	20	4
125	Sweden	5	3	3	5	3	19	4
126	Switzerland	5	4	3	2	3	16	3
127	Syria	4	3	3 -		1	11	3
128	Tajikistan	4	3	2	5	3	17	3
129	Tanzania	3	3	3	5	3	17	3
130	Thailand	5	3	4	2	3	17	3
131	Togo	2	3	4	5	2	16	3
132	Trinidad and Tobago	4	3	5 -		4	13	3
133	Tunisia	3	4	4	5	3	18	4
134	Turkey	4	3	4	5	2	18	4
135	Turkmenistan	3	3	3	5	2	16	3
136	Uganda	3	4	4	5 -		15	4
137	Ukraine	5	3	3	2	3	17	3
138	United Arab Emirates	4	3	3 -		1	10	3
139	United Kingdom	3	4	4	1	3	15	3
140	Uruguay	5	3	3	4	3	17	3
141	Uzbekistan	4	3	3	4	4	17	3
142	Venezuela	4	3	3	5	3	17	3
143	Vietnam	4	3	4	3	3	16	3
144	Yemen	2	3	4	2	3	15	3
145	Zambia	3	3	3 -		3	12	3
146	Zimbabwe	3	3	3	5	4	17	3
Remarks: - means not available.								

Table 2 World, Gross Domestic Product

No	Country	\$ billions	average annual % growth	income	population 2016	GNP	Ranking
		2016	2000-2016	2016	per capita		
1	Burundi	3	3.4	3,000,000,000	10,524,117	285	185
2	Malawi	5.4	5.3	5,400,000,000	18,091,575	298	184
3	Niger	7.6	5.1	7,600,000,000	20,672,987	368	183
4	Mozambique	11	7.5	11,000,000,000	28,829,476	382	182
5	Central African Republic	1.8	-0.3	1,800,000,000	4,594,621	392	181
6	Madagascar	10	2.8	10,000,000,000	24,894,551	402	180
7	Congo, Dem. Rep.	35	6.0	35,000,000,000	78,736,153	445	179
8	Liberia	2.1	3.7	2,100,000,000	4,613,823	455	178
9	Somalia	6.8	..	6,800,000,000	14,317,996	475	177
10	Sierra Leone	3.6	6.5	3,600,000,000	7,396,190	487	176
11	Gambia, The	1	3.3	1,000,000,000	2,038,501	491	175
12	Afghanistan	19.5	8.3	19,500,000,000	34,656,032	563	174
13	Togo	4.4	3.4	4,400,000,000	7,606,374	578	173
14	Uganda	24.1	6.9	24,100,000,000	41,487,965	581	172
15	Burkina Faso	11.4	5.8	11,400,000,000	18,646,433	611	171
16	Chad	9.4	7.9	9,400,000,000	14,452,543	650	170
17	Yemen, Rep.	18.2	-0.3	18,200,000,000	27,584,213	660	169
18	Guinea-Bissau	1.2	3.1	1,200,000,000	1,815,698	661	168
19	Ethiopia	73	9.7	73,000,000,000	102,403,196	713	167
20	Rwanda	8.5	7.9	8,500,000,000	11,917,508	713	166
21	Nepal	21.1	4.1	21,100,000,000	28,982,771	728	165
22	Haiti	8	1.3	8,000,000,000	10,847,334	738	164
23	Guinea	9.3	3.7	9,300,000,000	12,395,924	750	163
24	Comoros	0.6	2.1	600,000,000	795,601	754	162
25	Mali	14	4.4	14,000,000,000	17,994,837	778	161
26	Benin	8.6	4.0	8,600,000,000	10,872,298	791	160
27	Tajikistan	7	7.4	7,000,000,000	8,734,951	801	159
28	Tanzania	47.4	6.7	47,400,000,000	55,572,201	853	158
29	Senegal	14.7	4.0	14,700,000,000	15,411,614	954	157
30	Zimbabwe	16.6	0.3	16,600,000,000	16,150,362	1,028	156
31	Lesotho	2.3	4.2	2,300,000,000	2,203,821	1,044	155
32	Mauritania	4.7	5.0	4,700,000,000	4,301,018	1,093	154
33	Kyrgyz Republic	6.8	4.4	6,800,000,000	6,079,500	1,119	153
34	Myanmar	63.2	10.3	63,200,000,000	52,885,223	1,195	152
35	Zambia	21	7.1	21,000,000,000	16,591,390	1,266	151
36	Cambodia	20	7.6	20,000,000,000	15,762,370	1,269	150
37	Bangladesh	221.4	6.0	221,400,000,000	162,951,560	1,359	149
38	Cameroon	32.2	4.2	32,200,000,000	23,439,189	1,374	148
39	Pakistan	278.7	4.2	278,700,000,000	193,203,476	1,443	147
40	Kenya	70.9	4.9	70,900,000,000	48,461,567	1,463	146

Table 2 World, Gross domestic product(continued)

No	Country	\$ billions	average annual % growth	income	population 2016	GNP	Ranking
		2016	2000-2016	2016	per capita		
41	Ghana	42.8	6.8	42,800,000,000	28,206,728	1,517	145
42	Congo, Rep.	7.8	4.5	7,800,000,000	5,125,821	1,522	144
43	India	2,274.20	7.5	2,274,200,000,000	1,324,171,354	1,717	143
44	Kiribati	0.2	1.4	200,000,000	114,395	1,748	142
45	Djibouti	1.8	..	1,800,000,000	942,333	1,910	141
46	Moldova	6.8	4.5	6,800,000,000	3,551,954	1,914	140
47	Timor-Leste	2.5	8.7	2,500,000,000	1,268,671	1,971	139
48	Sao Tome and Principe	0.4	5.3	400,000,000	199,910	2,001	138
49	Solomon Islands	1.2	4.5	1,200,000,000	599,419	2,002	137
50	Ukraine	93.3	1.9	93,300,000,000	45,004,645	2,073	136
51	Uzbekistan	67.1	7.8	67,100,000,000	31,847,900	2,107	135
52	Nicaragua	13.2	3.8	13,200,000,000	6,149,928	2,146	134
53	Vietnam	205.3	6.4	205,300,000,000	94,569,072	2,171	133
54	Nigeria	404.7	7.5	404,700,000,000	185,989,640	2,176	132
55	Lao PDR	15.8	7.5	15,800,000,000	6,758,353	2,338	131
56	Honduras	21.6	3.9	21,600,000,000	9,112,867	2,370	130
57	Sudan	95.6	5.1	95,600,000,000	39,578,828	2,415	129
58	Papua New Guinea	19.9	4.9	19,900,000,000	8,084,991	2,461	128
59	Bhutan	2.2	7.7	2,200,000,000	797,765	2,758	127
60	Micronesia, Fed. Sts.	0.3	-0.1	300,000,000	104,937	2,859	126
61	Morocco	103.6	4.5	103,600,000,000	35,276,786	2,937	125
62	Philippines	304.9	5.2	304,900,000,000	103,320,222	2,951	124
63	Vanuatu	0.8	3.2	800,000,000	270,402	2,959	123
64	Bolivia	33.9	4.6	33,900,000,000	10,887,882	3,114	122
65	Angola	95.3	9.5	95,300,000,000	28,813,463	3,307	121
66	Egypt, Arab Rep.	332.9	4.4	332,900,000,000	95,688,681	3,479	120
67	Indonesia	932.3	5.5	932,300,000,000	261,115,456	3,570	119
68	Armenia	10.5	6.0	10,500,000,000	2,924,816	3,590	118
69	Tunisia	42.1	3.5	42,100,000,000	11,403,248	3,692	117
70	Mongolia	11.2	8.1	11,200,000,000	3,027,398	3,700	116
71	Tonga	0.4	1.1	400,000,000	107,122	3,734	115
72	El Salvador	23.9	2.0	23,900,000,000	6,344,722	3,767	114
73	Marshall Islands	0.2	1.6	200,000,000	53,066	3,769	113
74	Sri Lanka	81.8	6.0	81,800,000,000	21,203,000	3,858	112
75	Georgia	14.4	5.8	14,400,000,000	3,719,300	3,872	111
76	Azerbaijan	37.9	11.0	37,900,000,000	9,757,812	3,884	110
77	Algeria	159	3.5	159,000,000,000	40,606,052	3,916	109
78	Paraguay	27.4	4.3	27,400,000,000	6,725,308	4,074	108
79	Jordan	38.7	5.2	38,700,000,000	9,455,802	4,093	107
80	Samoa	0.8	2.1	800,000,000	195,125	4,100	106

Table 2 World, Gross domestic product(continued)

No	Country	\$ billions	average annual % growth	income	population 2016	GNP	Ranking
		2016	2000-2016	2016	per capita		
81	Albania	11.9	3.9	11,900,000,000	2,876,101	4,138	105
82	Guatemala	68.7	3.5	68,700,000,000	16,582,469	4,143	104
83	Guyana	3.5	3.4	3,500,000,000	773,303	4,526	103
84	Namibia	11.3	5.0	11,300,000,000	2,479,713	4,557	102
85	Iraq	171.5	5.8	171,500,000,000	37,202,572	4,610	101
86	Bosnia and Herzegovina	16.9	3.1	16,900,000,000	3,516,816	4,805	100
87	Jamaica	14.1	0.4	14,100,000,000	2,881,355	4,894	99
88	Belize	1.8	3.2	1,800,000,000	366,954	4,905	98
89	Belarus	47.7	5.6	47,700,000,000	9,501,534	5,020	97
90	Libya	32.3	-1.4	32,300,000,000	6,293,253	5,132	96
91	Macedonia, FYR	10.7	3.2	10,700,000,000	2,081,206	5,141	95
92	Iran, Islamic Rep.	419	3.0	419,000,000,000	80,277,428	5,219	94
93	Fiji	4.7	1.9	4,700,000,000	898,760	5,229	93
94	South Africa	295.8	3.1	295,800,000,000	56,015,473	5,281	92
95	Serbia	38.3	2.9	38,300,000,000	7,058,322	5,426	91
96	Colombia	280.1	4.5	280,100,000,000	48,653,419	5,757	90
97	Suriname	3.3	3.9	3,300,000,000	558,368	5,910	89
98	Thailand	411.8	3.9	411,800,000,000	68,863,514	5,980	88
99	Ecuador	98.6	4.2	98,600,000,000	16,385,068	6,018	87
100	Peru	191.6	5.8	191,600,000,000	31,773,839	6,030	86
101	Turkmenistan	36.2	9.5	36,200,000,000	5,662,544	6,393	85
102	Dominican Republic	72.3	5.0	72,300,000,000	10,648,791	6,790	84
103	Botswana	15.6	4.6	15,600,000,000	2,250,260	6,933	83
104	Montenegro	4.4	2.9	4,400,000,000	622,303	7,071	82
105	Gabon	14	2.7	14,000,000,000	1,979,786	7,071	81
106	Panama	57.8	7.1	57,800,000,000	8,084,991	7,149	80
107	St. Vincent and the Grenadines	0.8	2.0	800,000,000	109,643	7,296	79
108	Bulgaria	53.2	3.4	53,200,000,000	7,127,822	7,464	78
109	Cuba	87.1	4.8	87,100,000,000	11,475,982	7,590	77
110	Kazakhstan	137.3	6.6	137,300,000,000	17,794,055	7,716	76
111	China	11,191.00	9.9	11,191,000,000,000	1,378,665,000	8,117	75
112	Dominica	0.6	1.9	600,000,000	73,543	8,158	74
113	Lebanon	49.6	4.9	49,600,000,000	6,006,668	8,257	73
114	Mexico	1,076.90	2.1	1,076,900,000,000	127,540,423	8,444	72
115	Brazil	1,794.00	3.2	1,794,000,000,000	207,652,865	8,639	71
116	Russian Federation	1,284.70	3.8	1,284,700,000,000	144,342,396	8,900	70
117	Equatorial Guinea	11.3	8.7	11,300,000,000	1,221,490	9,251	69
118	Malaysia	296.5	4.9	296,500,000,000	31,187,265	9,507	68
119	Romania	187.8	3.4	187,800,000,000	19,702,332	9,532	67
120	St. Lucia	1.7	2.0	1,700,000,000	178,015	9,550	66

Table 2 World, Gross domestic product(continued)

No	Country	\$ billions	average annual % growth	income	population 2016	GNP	Ranking
		2016	2000-2016	2016	per capita		
121	Mauritius	12.2	4.3	12,200,000,000	1,263,473	9,656	65
122	Maldives	4.2	5.4	4,200,000,000	427,756	9,819	64
123	Grenada	1.1	1.8	1,100,000,000	107,317	10,250	63
124	Turkey	863.7	5.3	863,700,000,000	79,512,426	10,862	62
125	Costa Rica	57	4.2	57,000,000,000	4,857,274	11,735	61
126	Croatia	51.3	1.2	51,300,000,000	4,174,349	12,289	60
127	Poland	471.4	3.9	471,400,000,000	37,970,087	12,415	59
128	Argentina	554.9	3.6	554,900,000,000	43,847,430	12,655	58
129	Hungary	125.8	1.5	125,800,000,000	9,814,023	12,818	57
130	Palau	0.3	0.7	300,000,000	21,503	13,952	56
131	Chile	250	4.2	250,000,000,000	17,909,754	13,959	55
132	Latvia	27.6	3.0	27,600,000,000	1,959,537	14,085	54
133	Seychelles	1.4	3.6	1,400,000,000	94,677	14,787	53
134	Antigua and Barbuda	1.5	1.6	1,500,000,000	100,963	14,857	52
135	Lithuania	42.8	3.6	42,800,000,000	2,868,231	14,922	51
136	Oman	66.8	3.9	66,800,000,000	4,424,762	15,097	50
137	Venezuela, RB	482.4	3.9	482,400,000,000	31,568,179	15,281	49
138	Uruguay	52.7	4.3	52,700,000,000	3,444,006	15,302	48
139	Barbados	4.5	0.9	4,500,000,000	284,996	15,790	47
140	Trinidad and Tobago	22.3	3.7	22,300,000,000	1,364,962	16,337	46
141	Slovak Republic	89.8	4.1	89,800,000,000	5,430,798	16,535	45
142	Cyprus	20.2	1.4	20,200,000,000	1,170,125	17,263	44
143	Estonia	23.3	2.8	23,300,000,000	1,315,790	17,708	43
144	Greece	192.7	-0.8	192,700,000,000	10,775,971	17,882	42
145	Czech Republic	195.3	2.5	195,300,000,000	10,566,332	18,483	41
146	Portugal	205.2	0.1	205,200,000,000	10,325,452	19,873	40
147	Saudi Arabia	644.9	4.2	644,900,000,000	32,275,687	19,981	39
148	Slovenia	44.7	1.7	44,700,000,000	2,065,042	21,646	38
149	Bahrain	32.2	5.0	32,200,000,000	1,425,171	22,594	37
150	Malta	11.3	2.9	11,300,000,000	455,356	24,816	36
151	Spain	1,237.30	1.1	1,237,300,000,000	46,484,062	26,618	35
152	Brunei Darussalam	11.4	0.7	11,400,000,000	423,196	26,938	34
153	Kuwait	110.9	4.2	110,900,000,000	4,052,584	27,365	33
154	Korea, Rep.	1,414.80	3.8	1,414,800,000,000	51,245,707	27,608	32
155	Bahamas, The	11.8	0.5	11,800,000,000	391,232	30,161	31
156	Italy	1,859.40	-0.2	1,859,400,000,000	60,627,498	30,669	30
157	Puerto Rico	105	-0.2	105,000,000,000	3,406,520	30,823	29
158	France	2,465.10	1.1	2,465,100,000,000	66,859,768	36,870	28
159	Israel	317.7	3.5	317,700,000,000	8,546,000	37,175	27
160	Andorra	2.9	0.4	2,900,000,000	77,281	37,525	26



Table 2 World, Gross domestic product(continued)

No	Country	\$ billions	average annual % growth	income	population 2016	GNP	Ranking
		2016	2000-2016	2016	per capita		
161	United Arab Emirates	357	4.2	357,000,000,000	9,269,612	38,513	25
162	Japan	4,949.30	0.7	4,949,300,000,000	126,994,511	38,973	24
163	New Zealand	189.3	2.5	189,300,000,000	4,693,200	40,335	23
164	United Kingdom	2,650.90	1.4	2,650,900,000,000	65,595,565	40,413	22
165	Belgium	467.5	1.4	467,500,000,000	11,331,422	41,257	21
166	Germany	3,477.80	1.2	3,477,800,000,000	82,348,669	42,233	20
167	Canada	1,535.80	1.9	1,535,800,000,000	36,264,604	42,350	19
168	Finland	238.7	1.0	238,700,000,000	5,495,303	43,437	18
169	Hong Kong SAR, China	320.9	3.9	320,900,000,000	7,336,600	43,740	17
170	Austria	390.8	1.4	390,800,000,000	8,736,668	44,731	16
171	Netherlands	777.2	1.1	777,200,000,000	17,030,314	45,636	15
172	San Marino	1.6	-1.4	1,600,000,000	33,203	48,188	14
173	Australia	1,208.00	3.0	1,208,000,000,000	24,210,809	49,895	13
174	Sweden	514.5	2.0	514,500,000,000	9,923,085	51,849	12
175	Denmark	306.9	0.8	306,900,000,000	5,728,010	53,579	11
176	Singapore	309.8	5.8	309,800,000,000	5,607,283	55,250	10
177	United States	18,624.50	1.7	18,624,500,000,000	323,405,935	57,589	9
178	Qatar	152.5	12.1	152,500,000,000	2,569,804	59,343	8
179	Iceland	20.3	2.5	20,300,000,000	335,439	60,518	7
180	Ireland	304.8	3.3	304,800,000,000	4,755,335	64,096	6
181	Norway	371.1	1.5	371,100,000,000	5,234,519	70,895	5
182	Macao SAR, China	45.3	9.9	45,300,000,000	612,167	73,999	4
183	Switzerland	668.7	1.9	668,700,000,000	8,373,338	79,861	3
184	Luxembourg	58.6	2.6	58,600,000,000	582,014	100,685	2
185	Liechtenstein	6.3	..	6,300,000,000	37,666	167,260	1

Table 2.1 Asia, Gross Domestic Product

No	Country	\$ billions	average annual % growth	income	population 2016	GNP	Ranking
		2016	2000-2016	2016	per capita		
1	Afghanistan	19.5	8.3	19,500,000,000	34,656,032	563	44
2	Nepal	21.1	4.1	21,100,000,000	28,982,771	728	43
3	Tajikistan	7	7.4	7,000,000,000	8,734,951	801	42
4	Kyrgyz Republic	6.8	4.4	6,800,000,000	6,079,500	1,119	41
5	Myanmar	63.2	10.3	63,200,000,000	52,885,223	1,195	40
6	Cambodia	20	7.6	20,000,000,000	15,762,370	1,269	39
7	Bangladesh	221.4	6	221,400,000,000	162,951,560	1,359	38
8	Pakistan	278.7	4.2	278,700,000,000	193,203,476	1,443	37
9	India	2,274.20	7.5	2,274,200,000,000	1,324,171,354	1,717	36
10	Kiribati	0.2	1.4	200,000,000	114,395	1,748	35
11	Timor-Leste	2.5	8.7	2,500,000,000	1,268,671	1,971	34
12	Solomon Islands	1.2	4.5	1,200,000,000	599,419	2,002	33
13	Uzbekistan	67.1	7.8	67,100,000,000	31,847,900	2,107	32
14	Vietnam	205.3	6.4	205,300,000,000	94,569,072	2,171	31
15	Lao People's Democratic Republic	15.8	7.5	15,800,000,000	6,758,353	2,338	30
16	Papua New Guinea	19.9	4.9	19,900,000,000	8,084,991	2,461	29
17	Bhutan	2.2	7.7	2,200,000,000	797,765	2,758	28
18	Micronesia, Federated States of	0.3	-0.1	300,000,000	104,937	2,859	27
19	Philippines	304.9	5.2	304,900,000,000	103,320,222	2,951	26
20	Vanuatu	0.8	3.2	800,000,000	270,402	2,959	25
21	Indonesia	932.3	5.5	932,300,000,000	261,115,456	3,570	24
22	Armenia	10.5	6	10,500,000,000	2,924,816	3,590	23
23	Mongolia	11.2	8.1	11,200,000,000	3,027,398	3,700	22
24	Tonga	0.4	1.1	400,000,000	107,122	3,734	21
25	Marshall Islands	0.2	1.6	200,000,000	53,066	3,769	20
26	Sri Lanka	81.8	6	81,800,000,000	21,203,000	3,858	19
27	Georgia	14.4	5.8	14,400,000,000	3,719,300	3,872	18
28	Azerbaijan	37.9	11	37,900,000,000	9,757,812	3,884	17
29	Samoa	0.8	2.1	800,000,000	195,125	4,100	16
30	Fiji	4.7	1.9	4,700,000,000	898,760	5,229	15
31	Thailand	411.8	3.9	411,800,000,000	68,863,514	5,980	14
32	Turkmenistan	36.2	9.5	36,200,000,000	5,662,544	6,393	13
33	Kazakhstan	137.3	6.6	137,300,000,000	17,794,055	7,716	12
34	China, People's Republic of	11,191.00	9.9	11,191,000,000,000	1,378,665,000	8,117	11
35	Malaysia	296.5	4.9	296,500,000,000	31,187,265	9,507	10
36	Maldives	4.2	5.4	4,200,000,000	427,756	9,819	9
37	Palau	0.3	0.7	300,000,000	21,503	13,952	8
38	Brunei Darussalam	11.4	0.7	11,400,000,000	423,196	26,938	7
39	Korea, Repblic of	1,414.80	3.8	1,414,800,000,000	51,245,707	27,608	6
40	Japan	4,949.30	0.7	4,949,300,000,000	126,994,511	38,973	5
41	New Zealand	189.3	2.5	189,300,000,000	4,693,200	40,335	4
42	Hong kong, China	320.9	3.9	320,900,000,000	7,336,600	43,740	3
43	Australia	1,208.00	3	1,208,000,000,000	24,210,809	49,895	2
44	Singapore	309.8	5.8	309,800,000,000	5,607,283	55,250	1

Table 2.2 ASEAN, Gross Domestic Product

No	Country	\$ billions	average annual % growth	income	population 2016	GNP	Ranking
		2016	2000-2016	2016	per capita		
1	Myanmar	63.2	10.3	63,200,000,000	52,885,223	1,195	10
2	Cambodia	20	7.6	20,000,000,000	15,762,370	1,269	9
3	Vietnam	205.3	6.4	205,300,000,000	94,569,072	2,171	8
4	Lao People's Democratic Republic	15.8	7.5	15,800,000,000	6,758,353	2,338	7
5	Philippines	304.9	5.2	304,900,000,000	103,320,222	2,951	6
6	Indonesia	932.3	5.5	932,300,000,000	261,115,456	3,570	5
7	Thailand	411.8	3.9	411,800,000,000	68,863,514	5,980	4
8	Malaysia	296.5	4.9	296,500,000,000	31,187,265	9,507	3
9	Brunei Darussalam	11.4	0.7	11,400,000,000	423,196	26,938	2
10	Singapore	309.8	5.8	309,800,000,000	5,607,283	55,250	1

Table 3 World, Government Effectiveness 2016

No	Country/Territory	2016	2016	Ranking
		NumSrc	Rank	
1	Somalia	9.00	0.48	188
2	Haiti	8.00	0.96	187
3	Libya	8.00	1.44	186
4	Syrian Arab Republic	6.00	1.92	185
5	Yemen, Rep.	8.00	2.40	184
6	Central African Republic	9.00	2.88	183
7	Eritrea	8.00	3.37	182
8	Korea, Dem. Rep.	5.00	3.85	181
9	Guinea-Bissau	6.00	4.33	180
10	Marshall Islands	2.00	4.81	179
11	Comoros	6.00	5.29	178
12	Sudan	11.00	6.25	177
13	Chad	10.00	6.73	176
14	Burundi	11.00	7.21	175
15	Equatorial Guinea	5.00	7.69	174
16	Liberia	11.00	8.17	173
17	Venezuela, RB	11.00	8.65	172
18	Iraq	8.00	9.13	171
19	Afghanistan	8.00	9.62	170
20	Sierra Leone	11.00	10.10	169
21	Madagascar	12.00	10.58	168
22	Zimbabwe	12.00	11.06	167
23	Turkmenistan	5.00	11.54	166
24	Nigeria	12.00	12.02	165
25	Congo, Rep.	10.00	12.50	164
26	Togo	11.00	12.98	163
27	Tajikistan	9.00	13.94	162
28	Timor-Leste	5.00	14.42	161
29	Guinea	11.00	14.90	160
30	Mali	12.00	15.38	159
31	Solomon Islands	4.00	15.87	158
32	Myanmar	9.00	16.35	157
33	Djibouti	6.00	16.83	156
34	Tuvalu	3.00	17.31	155
35	Kyrgyz Republic	8.00	17.79	154

Table 3 World, Government Effectiveness 2016(continued)

No	Country/Territory	2016	2016	Ranking
		NumSrc	Rank	
36	Vanuatu	4.00	18.27	153
37	Mozambique	11.00	18.75	152
38	Gambia, The	8.00	19.23	151
39	Nepal	9.00	19.71	150
40	Lesotho	10.00	20.19	149
41	Gabon	10.00	20.67	148
42	Paraguay	10.00	21.15	147
43	Mauritania	10.00	21.63	146
44	Cameroon	12.00	22.12	145
45	Malawi	11.00	22.60	144
46	Papua New Guinea	7.00	23.08	143
47	Honduras	10.00	23.56	142
48	Nicaragua	9.00	24.04	141
49	Cambodia	9.00	24.52	140
50	Nauru	1.00	25.00	139
51	Bangladesh	10.00	25.48	138
52	Belize	5.00	25.96	137
53	São Tomé and Príncipe	6.00	26.44	136
54	Zambia	11.00	27.40	135
55	Egypt, Arab Rep.	11.00	27.88	134
56	Pakistan	10.00	28.37	133
57	Ethiopia	11.00	28.85	132
58	Moldova	8.00	29.81	131
59	Guatemala	10.00	30.29	130
60	Niger	11.00	30.77	129
61	Uzbekistan	8.00	31.25	128
62	Ukraine	9.00	31.73	127
63	Uganda	12.00	32.21	126
64	Bolivia	10.00	32.69	125
65	Benin	11.00	33.17	124
66	Swaziland	7.00	33.65	123
67	Tanzania	12.00	34.13	122
68	Burkina Faso	11.00	34.62	121
69	Lebanon	9.00	35.10	120
70	Algeria	11.00	35.58	119

**Table 3** World, Government Effectiveness 2016(continued)

No	Country/Territory	2016	2016	Ranking
		NumSrc	Rank	
71	Belarus	7.00	36.06	118
72	Senegal	12.00	36.54	117
73	Kiribati	4.00	37.02	116
74	Ecuador	10.00	37.98	115
75	Palau	1.00	38.46	114
76	Bosnia and Herzegovina	8.00	38.94	113
77	Lao PDR	8.00	39.42	112
78	Suriname	3.00	39.90	111
79	Micronesia, Fed. Sts.	3.00	40.38	110
80	Maldives	4.00	40.87	109
81	Kenya	12.00	41.35	108
82	Guyana	5.00	41.83	107
83	El Salvador	10.00	42.31	106
84	Tonga	4.00	42.79	105
85	Fiji	3.00	43.27	104
86	Dominican Republic	10.00	43.75	103
87	Tunisia	12.00	44.23	102
88	Russian Federation	9.00	44.71	101
89	Ghana	12.00	45.19	100
90	Iran, Islamic Rep.	8.00	45.67	99
91	Peru	11.00	46.15	98
92	Grenada	3.00	46.63	97
93	Brazil	11.00	47.12	96
94	Romania	9.00	47.60	95
95	Azerbaijan	9.00	48.08	94
96	Kuwait	7.00	48.56	93
97	Armenia	9.00	49.04	92
98	Cuba	6.00	49.52	91
99	Morocco	11.00	50.00	90
100	Mongolia	11.00	50.48	89
101	Kazakhstan	9.00	50.96	88
102	Sri Lanka	10.00	51.44	87
103	Philippines	10.00	51.92	86
104	Albania	8.00	52.40	85
105	Indonesia	10.00	52.88	84

**Table 3** World, Government Effectiveness 2016(continued)

No	Country/Territory	2016	2016	Ranking
		NumSrc	Rank	
106	Vietnam	10.00	53.37	83
107	Colombia	11.00	53.85	82
108	St. Lucia	3.00	54.33	81
109	Turkey	10.00	54.81	80
110	Dominica	2.00	55.29	79
111	India	10.00	55.77	78
112	Serbia	8.00	56.25	77
113	Rwanda	10.00	56.73	76
114	Macedonia, FYR	7.00	57.21	75
115	Cape Verde	8.00	57.69	74
116	Montenegro	7.00	58.17	73
117	Mexico	11.00	58.65	72
118	Jordan	10.00	59.13	71
119	Panama	9.00	60.10	70
120	Argentina	11.00	60.58	69
121	Namibia	12.00	61.06	68
122	Oman	6.00	61.54	67
123	Greece	7.00	62.50	66
124	Trinidad and Tobago	6.00	62.98	65
125	Saudi Arabia	8.00	63.46	64
126	Antigua and Barbuda	1.00	64.42	63
127	South Africa	13.00	64.90	62
128	Bulgaria	9.00	65.38	61
129	Bahrain	7.00	65.87	60
130	Thailand	10.00	66.35	59
131	Costa Rica	9.00	66.83	58
132	China	9.00	67.31	57
133	Seychelles	6.00	67.79	56
134	Puerto Rico	3.00	68.27	55
135	Jamaica	9.00	68.75	54
136	Hungary	8.00	69.23	53
137	Bhutan	8.00	69.71	52
138	Croatia	9.00	70.19	51
139	Georgia	8.00	70.67	50
140	Botswana	11.00	71.15	49

Table 3 World, Government Effectiveness 2016(continued)

No	Country/Territory	2016	2016	Ranking
		NumSrc	Rank	
141	Italy	7.00	72.12	48
142	Samoa	3.00	72.60	47
143	Uruguay	10.00	73.08	46
144	Poland	9.00	73.56	45
145	Bahamas, The	3.00	74.04	44
146	Qatar	7.00	74.52	43
147	Malaysia	10.00	75.96	42
148	Slovak Republic	8.00	76.92	41
149	Malta	6.00	77.40	40
150	Cyprus	6.00	77.88	39
151	Mauritius	11.00	78.37	38
152	Latvia	8.00	78.85	37
153	Chile	10.00	79.33	36
154	Czech Republic	8.00	79.81	35
155	Korea, Rep.	8.00	80.77	34
156	Lithuania	8.00	81.25	33
157	Barbados	3.00	81.73	32
158	Brunei Darussalam	5.00	82.21	31
159	Estonia	8.00	82.69	30
160	Spain	7.00	83.17	29
161	Slovenia	8.00	83.65	28
162	Macao SAR, China	2.00	85.10	27
163	Portugal	7.00	85.58	26
164	Belgium	7.00	86.54	25
165	Bermuda	1.00	87.98	24
166	Ireland	7.00	88.46	23
167	Israel	7.00	88.94	22
168	Taiwan, China	8.00	89.42	21
169	Iceland	7.00	89.90	20
170	France	7.00	90.87	19
171	United States	7.00	91.35	18
172	Austria	7.00	91.83	17
173	Australia	7.00	92.31	16
174	United Kingdom	7.00	92.79	15
175	Luxembourg	7.00	93.27	14



**Table 3** World, Government Effectiveness 2016(continued)

No	Country/Territory	2016	2016	Ranking
		NumSrc	Rank	
176	Liechtenstein	2.00	93.75	13
177	Germany	7.00	94.23	12
178	Sweden	7.00	94.71	11
179	Canada	7.00	95.19	10
180	Japan	7.00	95.67	9
181	Finland	7.00	96.15	8
182	Netherlands	7.00	96.63	7
183	Hong Kong SAR, China	6.00	97.12	6
184	New Zealand	7.00	97.60	5
185	Norway	7.00	98.56	4
186	Denmark	7.00	99.04	3
187	Switzerland	7.00	99.52	2
188	Singapore	8.00	100.00	1

Table 3.1 Asia, Government Effectiveness 2016

No	Country/Territory	NumSrc	Rank	Ranking
1	Marshall Islands	2.00	4.81	46
2	Afghanistan	8.00	9.62	45
3	Turkmenistan	5.00	11.54	44
4	Tajikistan	9.00	13.94	43
5	Timor-Leste	5.00	14.42	42
6	Solomon Islands	4.00	15.87	41
7	Myanmar	9.00	16.35	40
8	Tuvalu	3.00	17.31	39
9	Kyrgyz Republic	8.00	17.79	38
10	Vanuatu	4.00	18.27	37
11	Nepal	9.00	19.71	36
12	Papua New Guinea	7.00	23.08	35
13	Cambodia	9.00	24.52	34
14	Nauru	1.00	25.00	33
15	Bangladesh	10.00	25.48	32
16	Pakistan	10.00	28.37	31
17	Uzbekistan	8.00	31.25	30
18	Kiribati	4.00	37.02	29
19	Palau	1.00	38.46	28
20	Lao People's Democratic Republic	8.00	39.42	27
21	Micronesia, Federated States of	3.00	40.38	26
22	Maldives	4.00	40.87	25
23	Tonga	4.00	42.79	24
24	Fiji	3.00	43.27	23
25	Azerbaijan	9.00	48.08	22
26	Armenia	9.00	49.04	21
27	Mongolia	11.00	50.48	20
28	Kazakhstan	9.00	50.96	19
29	Sri Lanka	10.00	51.44	18
30	Philippines	10.00	51.92	17
31	Indonesia	10.00	52.88	16
32	Vietnam	10.00	53.37	15
33	India	10.00	55.77	14
34	Thailand	10.00	66.35	13
35	China, People's Republic of	9.00	67.31	12

Table 3.1 Asia, Government Effectiveness 2016(continued)

No	Country/Territory	NumSrc	Rank	Ranking
36	Bhutan	8.00	69.71	11
37	Georgia	8.00	70.67	10
38	Samoa	3.00	72.60	9
39	Malaysia	10.00	75.96	8
40	Korea, Repblic of	8.00	80.77	7
41	Brunei Darussalam	5.00	82.21	6
42	Australia	7.00	92.31	5
43	Japan	7.00	95.67	4
44	Hong kong, China	6.00	97.12	3
45	New Zealand	7.00	97.60	2
46	Singapore	8.00	100.00	1

Table 3.2 ASEAN, Government Effectiveness 2016

No	Country/Territory	NumSrc	Rank	Ranking
1	Myanmar	9.00	16.3	10
2	Cambodia	9.00	24.5	9
3	Lao People's Democratic Republic	8.00	39.4	8
4	Philippines	10.00	51.9	7
5	Indonesia	10.00	52.9	6
6	Vietnam	10.00	53.4	5
7	Thailand	10.00	66.3	4
8	Malaysia	10.00	76.0	3
9	Brunei Darussalam	5.00	82.2	2
10	Singapore	8.00	100.0	1

**Table 4** World, Political Stability Index 2017

No	Country	Average	Ranking
1	Yemen	-2.96	151
2	Afghanistan	-2.78	150
3	Syria	-2.63	149
4	Pakistan	-2.40	148
5	Iraq	-2.33	147
6	Libya	-2.33	147
7	Somalia	-2.33	147
8	DR Congo	-2.30	146
9	Sudan	-2.01	145
10	Burundi	-1.97	144
11	C.A. Republic	-1.94	143
12	Nigeria	-1.94	143
13	Mali	-1.91	142
14	Ukraine	-1.89	141
15	Turkey	-1.80	140
16	Ethiopia	-1.69	139
17	Palestine	-1.64	138
18	Lebanon	-1.59	137
19	Egypt	-1.42	136
20	Chad	-1.34	135
21	Niger	-1.30	134
22	Bangladesh	-1.25	133
23	Philippines	-1.24	132
24	Venezuela	-1.18	131
25	Ivory Coast	-1.09	130
27	Cameroon	-1.08	129
28	Kenya	-1.08	129
26	Myanmar	-1.08	129
29	Tunisia	-1.05	128
30	Mozambique	-0.98	127
31	Algeria	-0.96	126
32	Bahrain	-0.95	125
33	Iran	-0.93	124
34	Burkina Faso	-0.92	123
35	Israel	-0.88	122

**Table 4** World, Political Stability Index 2017(continued)

No	Country	Average	Ranking
36	India	-0.83	121
37	Colombia	-0.79	120
38	Zimbabwe	-0.77	119
39	Azerbaijan	-0.76	118
40	Thailand	-0.76	118
41	Togo	-0.74	117
42	Armenia	-0.71	116
43	Djibouti	-0.71	116
44	Haiti	-0.70	115
45	Russia	-0.67	114
46	Tajikistan	-0.67	114
47	Eritrea	-0.66	113
48	Nepal	-0.66	113
49	Mexico	-0.65	112
50	Mauritania	-0.62	111
51	Saudi Arabia	-0.62	111
52	Guinea	-0.61	110
53	G.-Bissau	-0.60	109
54	Papua N.G.	-0.58	108
55	Tanzania	-0.58	108
56	Guatemala	-0.57	107
57	Uganda	-0.56	106
58	Honduras	-0.55	105
59	Jordan	-0.53	104
60	R. of Congo	-0.53	104
61	Indonesia	-0.51	103
62	North Korea	-0.48	102
63	Kyrgyzstan	-0.43	101
64	Brazil	-0.41	100
65	Liberia	-0.41	100
66	Morocco	-0.41	100
67	Bosnia & Herz.	-0.38	99
68	Georgia	-0.37	98
69	Madagascar	-0.33	97
70	Bolivia	-0.30	96

**Table 4** World, Political Stability Index 2017(continued)

No	Country	Average	Ranking
71	Swaziland	-0.30	96
72	Angola	-0.29	95
73	Uzbekistan	-0.28	94
74	Malawi	-0.27	93
75	South Africa	-0.27	93
76	Peru	-0.26	92
77	China	-0.25	91
78	El Salvador	-0.25	91
79	Lesotho	-0.25	91
80	Macedonia	-0.25	91
81	Moldova	-0.24	90
82	Gambia	-0.21	89
83	Eq. Guinea	-0.15	88
84	Turkmenistan	-0.15	88
85	Greece	-0.13	87
86	Ecuador	-0.10	86
87	Gabon	-0.09	85
88	Sri Lanka	-0.06	84
89	Nicaragua	-0.05	83
90	Guyana	-0.04	82
91	Kuwait	-0.04	82
92	Senegal	-0.04	82
93	Montenegro	0.01	81
94	Kazakhstan	0.02	80
95	Belarus	0.03	79
96	Comoros	0.03	79
97	Sierra Leone	0.03	79
98	Rwanda	0.04	78
99	Belize	0.05	77
100	Benin	0.05	77
101	Romania	0.06	76
102	Ghana	0.09	75
103	Serbia	0.10	74
104	Zambia	0.11	73
105	Paraguay	0.12	72

**Table 4** World, Political Stability Index 2017(continued)

No	Country	Average	Ranking
106	Suriname	0.14	71
107	Domin. Rep.	0.16	70
108	Malaysia	0.16	70
109	Cambodia	0.17	69
110	Argentina	0.18	68
111	France	0.21	67
112	Solomon Isl.	0.21	67
113	S.T.&Principe	0.22	66
114	Italy	0.24	65
115	Jamaica	0.25	64
116	Maldives	0.26	63
117	UK	0.26	63
118	Spain	0.27	62
119	South Korea	0.29	61
120	Tr.&Tobago	0.29	61
121	USA	0.30	60
122	Vietnam	0.31	59
123	Bulgaria	0.37	58
124	Chile	0.38	57
125	Panama	0.39	56
126	Albania	0.40	55
127	Puerto Rico	0.40	55
128	Belgium	0.42	54
129	Laos	0.43	53
130	Latvia	0.46	52
131	Costa Rica	0.51	51
132	Poland	0.52	50
133	Qatar	0.55	49
134	Germany	0.58	48
135	Cyprus	0.60	47
136	UA Emirates	0.63	46
137	Namibia	0.65	45
138	Estonia	0.66	44
139	Seychelles	0.68	43
140	Cuba	0.69	42



**Table 4** World, Political Stability Index 2017(continued)

No	Country	Average	Ranking
141	Vanuatu	0.71	41
142	Oman	0.74	40
143	Croatia	0.75	39
144	Ant.& Barb.	0.76	38
145	Lithuania	0.78	37
146	Fiji	0.79	36
147	Tonga	0.79	36
148	Hungary	0.81	35
149	Mongolia	0.82	34
150	Hong Kong	0.85	33
151	Denmark	0.87	32
152	Slovakia	0.88	31
153	Slovenia	0.89	30
154	Taiwan	0.89	30
155	Australia	0.90	29
156	Cape Verde	0.90	29
157	Kiribati	0.90	29
158	St. Vincent & ...	0.90	29
159	Netherlands	0.92	28
160	Palau	0.94	27
161	San Marino	0.94	27
162	Barbados	0.98	26
163	Sweden	0.98	26
164	Mauritius	0.99	25
165	Bahamas	1.00	24
166	Bermuda	1.01	23
167	Czech Rep.	1.02	22
168	Ireland	1.02	22
169	Botswana	1.03	21
170	Grenada	1.03	21

**Table 4** World, Political Stability Index 2017(continued)

No	Country	Average	Ranking
171	Austria	1.04	20
172	Dominica	1.04	20
173	Uruguay	1.06	19
174	Finland	1.07	18
175	Portugal	1.08	17
176	Canada	1.11	16
177	Japan	1.12	15
178	Bhutan	1.13	14
179	Norway	1.15	13
180	Saint Lucia	1.15	13
181	Brunei	1.19	12
182	Micronesia	1.20	11
183	Samoa	1.20	11
184	Switzerland	1.21	10
185	Malta	1.27	9
186	Tuvalu	1.27	9
187	Aruba	1.32	8
188	Luxembourg	1.34	7
189	Iceland	1.37	6
190	Macao	1.44	5
191	Andorra	1.45	4
192	Liechtenstein	1.50	3
193	New Zealand	1.59	2
194	Singapore	1.59	2
195	Monaco	1.65	1

Table 4.1 Asia, Political Stability Index 2017

No	Country	Average	Ranking
1	Afghanistan	-2.78	38
2	Pakistan	-2.40	37
3	Bangladesh	-1.25	36
4	Philippines	-1.24	35
5	Myanmar	-1.08	34
6	India	-0.83	33
7	Azerbaijan	-0.76	32
8	Thailand	-0.76	32
9	Armenia	-0.71	31
10	Tajikistan	-0.67	30
11	Nepal	-0.66	29
12	Papua New Guinea	-0.58	28
13	Indonesia	-0.51	27
14	Kyrgyz Republic	-0.43	26
15	Georgia	-0.37	25
16	Uzbekistan	-0.28	24
17	China, People's Republic of	-0.25	23
18	Turkmenistan	-0.15	22
19	Sri Lanka	-0.06	21
20	Kazakhstan	0.02	20
21	Malaysia	0.16	19
22	Cambodia	0.17	18
23	Solomon Islands	0.21	17
24	Maldives	0.26	16
25	Korea, Repblic of	0.29	15
26	Vietnam	0.31	14
27	Lao People's Democratic Republic	0.43	13
28	Vanuatu	0.71	12
29	Fiji	0.79	11
30	Tonga	0.79	11
31	Mongolia	0.82	10
32	Hong kong, China	0.85	9
33	Australia	0.90	8
34	Kiribati	0.90	8
35	Palau	0.94	7

**Table 4.1** Asia, Political Stability Index 2017(continued)

No	Country	Average	Ranking
36	Japan	1.12	6
37	Bhutan	1.13	5
38	Brunei Darussalam	1.19	4
39	Micronesia, Federated States of	1.20	3
40	Samoa	1.20	3
41	Tuvalu	1.27	2
42	New Zealand	1.59	1
43	Singapore	1.59	1

Table 4.2 ASEAN, Political Stability Index 2017

No	Country	Average	Ranking
1	Philippines	-1.24	10
2	Myanmar	-1.08	9
3	Thailand	-0.76	8
4	Indonesia	-0.51	7
5	Malaysia	0.16	6
6	Cambodia	0.17	5
7	Vietnam	0.31	4
8	Lao People's Democratic Republic	0.43	3
9	Brunei Darussalam	1.19	2
10	Singapore	1.59	1

Table 5 World, Water Productivity, 2015

No	Country	Water productivity GDP/water use 2010 \$ per cu. M 2015	Ranking
1	Kyrgyz Republic	1	62
2	Madagascar	1	62
3	Nepal	1	62
4	Pakistan	1	62
5	Guyana	2	61
6	Mali	2	61
7	Philippines	2	61
8	Sudan	2	61
9	Bangladesh	3	60
10	Egypt, Arab Rep.	3	60
11	India	3	60
12	Zimbabwe	3	60
13	Armenia	4	59
14	Bhutan	4	59
15	Cambodia	4	59
16	Azerbaijan	5	58
17	Chile	5	58
18	Ethiopia	5	58
19	Haiti	5	58
20	Moldova	5	58
21	Thailand	5	58
22	Georgia	6	57
23	Nicaragua	6	57
24	Suriname	6	57
25	Albania	7	56
26	Kazakhstan	7	56
27	Dominican Republic	8	55
28	Bolivia	9	54
29	Morocco	9	54
30	Ukraine	9	54
31	Bulgaria	10	53
32	Cuba	10	53
33	Mozambique	10	53
34	Peru	10	53
35	Serbia	10	53

Table 5 World, Water Productivity, 2015(continued)

No	Country	Water productivity GDP/water use 2010 \$ per cu. M 2015	Ranking
36	Guatemala	11	52
37	Libya	11	52
38	Argentina	12	51
39	Kenya	12	51
40	Mongolia	12	51
41	Paraguay	12	51
42	Estonia	13	50
43	Tunisia	13	50
44	Mexico	14	49
45	China	15	48
46	Macedonia, FYR	16	47
47	Jamaica	17	46
48	Venezuela, RB	17	46
49	Costa Rica	18	45
50	Turkey	18	45
51	Saudi Arabia	21	44
52	Algeria	22	43
53	Colombia	23	42
54	Dominica	25	41
55	Hungary	26	40
56	Montenegro	26	40
57	Portugal	26	40
58	South Africa	26	40
59	Jordan	27	39
60	New Zealand	28	38
61	Panama	28	38
62	Romania	28	38
63	Russian Federation	28	38
64	Uganda	28	38
65	Nigeria	29	37
66	Brazil	30	36
67	Greece	35	35
68	United States	36	34
69	Spain	37	33
70	Finland	38	32

Table 5 World, Water Productivity, 2015(continued)

No	Country	Water productivity GDP/water use 2010 \$ per cu. M 2015	Ranking
71	Canada	40	31
72	Slovenia	40	31
73	Italy	41	30
74	Belarus	42	29
75	Poland	45	28
76	Bosnia and Herzegovina	54	27
77	Iceland	55	26
78	Grenada	60	25
79	Lithuania	63	24
80	Trinidad and Tobago	66	23
81	Japan	67	22
82	Australia	78	21
83	Belgium	78	21
84	Netherlands	78	21
85	St. Vincent & ...	89	20
86	Croatia	91	19
87	France	91	19
88	Puerto Rico	97	18
89	Germany	104	17
90	Cyprus	106	16
91	Austria	112	15
92	Latvia	114	14
93	Czech Republic	126	13
94	Norway	143	12
95	Slovak Republic	174	11
96	Sweden	182	10
97	Antigua and Barbuda	265	9
98	Ireland	288	8
99	Swaziland	299	7
100	UK	313	6
101	Malta	425	5
102	Denmark	513	4
103	Maldives	553	3
104	Monaco	1,051	2
105	Luxembourg	1,308	1



Table 5.1 Asia, Water Productivity, 2015

No	Country	Water productivity GDP/water use 2010 \$ per cu. M 2015	Ranking
1	Kyrgyz Republic	1	13
2	Nepal	1	13
3	Pakistan	1	13
4	Philippines	2	12
5	Bangladesh	3	11
6	India	3	11
7	Bhutan	4	10
8	Cambodia	4	10
9	Azerbaijan	5	9
10	Thailand	5	9
11	Georgia	6	8
12	Kazakhstan	7	7
13	Mongolia	12	6
14	China, People's Republic of	15	5
15	New Zealand	28	4
16	Japan	67	3
17	Australia	78	2
18	Maldives	553	1

Table 5.2 ASEAN, Water Productivity, 2015

No	Country	Water productivity GDP/water use 2010 \$ per cu. M 2015	Ranking
1	Philippines	2	3
2	Cambodia	4	2
3	Thailand	5	1

Table 6 World, National Water Security Index by Economy(2003-2007)

No.	Country	1.Basic water	2.Sufficient water	3.Water for development	4.Water disaster	5.Water for future	Total	Average	Score	Ranking
1	Oman	1	3	3	-	1	7.9	2	31.7	72
2	Kuwait	1	3	4	-	2	9.2	2	36.7	71
3	Lebanon	4	3	3	-	3	9.7	2	38.7	70
4	Congo, Dem. Rep.	5	-	-	-	5	10.0	5	40.0	69
5	United Arab Emirates	4	3	3	-	1	10.1	3	40.3	68
6	Dominican Republic	3	-	-	5	3	10.5	4	42.0	67
7	Costa Rica	3	3	4	5	2	10.7	2	42.7	66
8	Cote d' Ivoire	5	-	3	-	3	10.7	4	42.7	66
9	Syria	4	3	3	-	1	11.0	3	44.0	65
10	Comoros	3	4	3	-	2	11.2	3	44.7	64
11	Saudi Arabia	1	3	4	2	2	11.2	2	44.7	64
12	Azerbaijan	4	-	1	4	3	11.7	3	46.7	65
13	Qatar	4	3	3	0	2	11.7	2	46.7	65
14	Latvia	5	3	3	-	4	11.7	3	46.7	65
15	Jordan	3	3	4	-	2	11.8	3	47.3	64
16	Mali	3	4	4	-	2	12.0	3	48.0	63
17	Equatorial Guinea	3	3	4	-	2	12.2	3	48.9	62
18	Gabon	4	3	3	-	2	12.3	3	49.0	61
19	Denmark	3	3	1	3	2	12.3	2	49.3	61
20	Iceland	5	3	1	-	3	12.3	3	49.3	61
21	Zambia	3	3	3	-	3	12.4	3	49.7	60
22	Bhutan	4	3	3	-	3	12.9	3	51.7	59
23	Suriname	5	3	2	-	3	13.0	3	52.0	58
24	Trinidad and Tobago	4	3	5	-	4	13.3	3	53.3	57
25	Bolivia	5	-	3	2	4	13.3	3	53.3	57
26	Cyprus	4	3	4	-	2	13.4	3	53.7	56
27	Guinea	3	3	5	-	2	13.6	3	54.2	55
28	Bahrain	3	3	4	-	3	13.9	3	55.7	54
29	Liberia	3	4	5	-	2	14.0	4	56.0	53
30	Seychelles	4	3	3	-	4	14.2	4	56.7	52
31	Guinea-Bissau	3	4	5	-	2	14.2	4	56.7	52
32	Burundi	3	4	4	-	3	14.3	4	57.0	51
33	Sierra Leone	3	4	5	-	3	14.3	4	57.3	51
34	Cambodia	2	4	5	2	1	14.3	3	57.3	51
35	China	5	3	3	1	3	14.3	3	57.3	51
36	Ecuador	5	3	4	-	3	14.4	4	57.7	50
37	Antigua and Barbuda	4	3	5	-	3	14.5	4	58.0	49
38	Spain	4	3	4	2	2	14.6	3	58.3	48
39	Italy	4	3	3	2	3	14.7	3	58.7	47
40	Yemen	2	3	4	2	3	14.7	3	58.7	47
41	Poland	2	4	4	2	4	14.8	3	59.3	46
42	Barbados	5	4	4	-	3	14.8	4	59.3	46
43	Malta	3	3	4	-	2	14.8	4	59.3	46
44	Austria	4	3	2	3	3	14.9	3	59.7	45
45	Finland	5	4	3	-	3	14.9	4	59.7	45

Table 6 World, National Water Security Index by Economy2003-2007(continued)

No.	Country	1.Basic water	2.Sufficient water	3.Water for development	4.Water disaster	5.Water for future	Total	Average	Score	Ranking
46	United Kingdom	3	4	4	1	3	15.0	3	60.0	44
47	Pakistan	3	3	3	3	3	15.1	3	60.3	43
48	Portugal	5	3	3	2	3	15.1	3	60.3	43
49	India	3	3	4	2	4	15.2	3	60.7	42
50	Romania	4	3	3	3	3	15.3	3	61.0	41
51	Nigeria	2	3	4	5	1	15.3	3	61.0	41
52	Uganda	3	4	4	5	-	15.3	4	61.3	41
53	Cape Verde	3	4	5	-	3	15.3	4	61.3	41
54	Algeria	3	3	4	2	3	15.4	3	61.7	40
55	Australia	5	4	3	1	3	15.4	3	61.7	40
56	Switzerland	5	4	3	2	3	15.5	3	62.0	39
57	Israel	3	3	3	4	2	15.6	3	62.3	38
58	Sudan	3	3	3	5	1	15.6	3	62.3	38
59	Estonia	5	3	4	-	4	15.6	4	62.5	38
60	Greece	5	3	4	2	3	15.8	3	63.0	37
61	Iraq	4	2	3	5	2	15.8	3	63.0	37
62	Morocco	3	3	4	4	2	15.8	3	63.3	37
63	Mexico	4	3	4	3	3	15.9	3	63.7	36
64	Bangladesh	4	3	3	2	4	16.0	3	64.0	35
65	France	5	4	4	2	2	16.0	3	64.0	35
66	Ghana	3	3	3	5	2	16.0	3	64.0	35
67	Senegal	3	4	4	4	1	16.1	3	64.3	34
68	Turkmenistan	3	3	3	5	2	16.1	3	64.3	34
69	Germany	4	4	4	2	3	16.2	3	64.7	33
70	South Africa	3	3	4	2	4	16.2	3	64.7	33
71	Togo	2	3	4	5	2	16.2	3	64.7	33
72	Bulgaria	2	4	4	5	2	16.3	3	65.3	32
73	Madagascar	3	3	3	5	2	16.3	3	65.3	32
74	Mauritius	4	3	3	3	3	16.3	3	65.3	32
75	Vietnam	4	3	4	3	3	16.3	3	65.3	32
76	Afghanistan	2	3	4	4	3	16.3	3	65.3	32
77	Czech Republic	4	3	4	3	3	16.4	3	65.7	31
78	El Salvador	4	3	3	3	3	16.4	3	65.7	31
79	Armenia	5	2	3	3	4	16.5	3	66.0	30
80	Mauritania	3	3	5	4	2	16.5	3	66.0	30
81	Peru	4	3	3	4	3	16.5	3	66.0	30
82	Tajikistan	4	3	2	5	3	16.5	3	66.0	30
83	Argentina	5	3	3	3	3	16.6	3	66.3	29
84	Ukraine	5	3	3	2	3	16.6	3	66.3	29
85	Kenya	2	3	3	5	3	16.6	3	66.3	29
86	Cameroon	4	3	3	4	3	16.7	3	66.7	28
87	Chad	5	3	3	4	2	16.8	3	67.0	27
88	Ethiopia	2	4	4	5	3	16.8	3	67.3	27
89	Mozambique	3	4	3	5	3	16.8	3	67.3	27
90	Niger	2	4	4	5	3	16.8	3	67.3	27

**Table 6** World, National Water Security Index by Economy2003-2007(continued)

No.	Country	1.Basic water	2.Sufficient water	3.Water for development	4.Water disaster	5.Water for future	Total	Average	Score	Ranking
91	Uzbekistan	4	3	3	4	4	16.8	3	67.3	27
92	Brazil	5	4	3	3	2	16.8	3	67.3	27
93	Japan	5	3	4	2	4	16.8	3	67.3	27
94	Russia	5	4	4	2	3	16.8	3	67.3	27
95	Egypt	3	3	3	5	3	16.9	3	67.7	26
96	Tanzania	3	3	3	5	3	16.9	3	67.7	26
97	Belgium	4	4	3	5	2	17.0	3	68.0	25
98	Colombia	3	4	5	3	3	17.0	3	68.0	25
99	Rwanda	2	4	4	5	3	17.0	3	68.0	25
100	Zimbabwe	3	3	3	5	4	17.2	3	68.7	24
101	Thailand	5	3	4	2	3	17.3	3	69.0	23
102	Belize	3	4	4	5	2	17.3	3	69.3	23
103	Malawi	3	3	4	5	2	17.3	3	69.3	23
104	Uruguay	5	3	3	4	3	17.3	3	69.3	23
105	Venezuela	4	3	3	5	3	17.3	3	69.3	23
106	Kyrgyzstan	4	3	2	5	3	17.4	3	69.7	22
107	Lithuania	4	3	4	3	4	17.4	3	69.7	22
108	Nepal	3	3	3	5	3	17.4	3	69.7	22
109	Philippines	4	3	4	5	2	17.5	4	70.0	21
110	Indonesia	4	3	5	3	3	17.6	4	70.3	20
111	Belarus	3	4	3	5	3	17.7	4	70.7	19
112	Laos	3	4	3	5	3	17.7	4	70.7	19
113	Lesotho	3	3	3	5	4	17.8	4	71.3	18
114	Haiti	2	4	4	5	3	18.0	4	72.0	17
115	Moldova	4	4	3	4	3	18.0	4	72.0	17
116	New Zealand	5	3	4	4	3	18.0	4	72.0	17
117	Panama	4	3	3	5	3	18.0	4	72.0	17
118	Paraguay	4	3	3	5	3	18.0	4	72.0	17
119	Kazakhstan	5	3	3	5	2	18.1	4	72.3	16
120	Canada	5	3	3	5	2	18.1	4	72.3	16
121	Turkey	4	3	4	5	2	18.1	4	72.3	16
122	Namibia	4	3	3	5	4	18.2	4	72.7	15
123	Chile	3	3	4	4	4	18.4	4	73.7	14
124	Tunisia	3	4	4	5	3	18.4	4	73.7	14
125	Honduras	4	3	4	5	3	18.5	4	74.0	13
126	Albania	5	3	2	5	3	18.6	4	74.3	12
127	Georgia	5	3	2	4	4	18.6	4	74.3	12
128	Guyana	5	3	3	5	3	18.7	4	74.7	11
129	Fiji	3	3	3	5	4	18.7	4	74.7	11
130	Sri Lanka	4	3	3	5	4	18.8	4	75.0	10
131	Norway	5	3	3	5	3	18.8	4	75.0	10
132	Guatemala	4	3	4	5	3	18.8	4	75.3	10
133	Korea, South	4	3	4	5	3	18.8	4	75.3	10
134	Malaysia	5	3	4	5	1	18.9	4	75.7	9
135	Sweden	5	3	3	5	3	19.0	4	76.0	8

**Table 6** World, National Water Security Index by Economy2003-2007(continued)

No.	Country	1.Basic water	2.Sufficient water	3.Water for development	4.Water disaster	5.Water for future	Total	Average	Score	Ranking
136	Botswana	5	3	3	5	3	19.3	4	77.0	7
137	Gambia	4	4	5	5	2	19.3	4	77.3	7
138	Mongolia	4	4	5	5	3	19.3	4	77.3	7
139	Swaziland	3	4	4	5	4	19.5	4	78.0	6
140	Benin	4	3	5	5	3	19.5	4	78.0	6
141	Nicaragua	4	4	4	5	3	19.7	4	78.7	5
142	Netherlands	5	4	3	5	3	19.7	4	78.7	5
143	Burkina Faso	4	4	4	5	3	19.8	4	79.0	4
144	Jamaica	4	3	4	5	4	20.1	4	80.3	3
145	Hungary	5	4	4	4	4	20.2	4	80.7	2
146	Ireland	5	4	4	5	3	20.3	4	81.0	1

**Table 6.1 Asia, National Water Security Index by Economy (ADB, 2016)**

No	Country	NWS Score	Ranking NWS Score	NWS Index
1	Afghanistan	27.5	48	1
2	Kiribati	30.7	47	1
3	Pakistan	32.7	46	1
4	India	33.1	45	1
5	Bangladesh	35.3	44	1
6	Nepal	37.3	43	2
7	Cambodia	37.5	42	2
8	Lao People's Democratic Republic	38.0	41	2
9	Papua New Guinea	39.5	40	2
10	Vietnam	40.2	39	2
11	Philippines	40.4	38	2
12	Myanmar	40.8	37	2
13	Timor-Leste	41.8	36	2
14	Vanuatu	42.0	35	2
15	Marshall Islands	42.6	34	2
16	Tonga	42.9	33	2
17	Tajikistan	43.8	32	2
18	Mongolia	43.9	31	2
19	Bhutan	48.5	30	2
20	Uzbekistan	48.8	29	2
21	Solomon Islands	49.7	28	2
22	Indonesia	49.8	27	2
23	Azerbaijan	50.8	26	2
24	Sri Lanka	51.4	25	2
25	Kyrgyz Republic	51.9	24	2
26	Micronesia, Federated States of	53.1	23	2
27	Samoa	54.0	22	2
28	Turkmenistan	54.1	21	2
29	Thailand	54.4	20	2
30	Maldives	58.7	19	3
31	Tuvalu	60.3	18	3
32	China, People's Republic of	61.8	17	3
33	Nauru	62.5	16	3
34	Georgia	64.9	15	3
35	Cook Islands	65.8	14	3

**Table 6.1** Asia, National Water Security Index by Economy (ADB, 2016)(continued)

No	Country	NWS Score	Ranking NWS Score	NWS Index
36	Fiji	66.3	13	3
37	Taipei, China	67.6	12	3
38	Armenia	68.1	11	3
39	Kazakhstan	70.2	10	3
40	Palau	71.8	9	3
41	Malaysia	73.4	8	3
42	Korea, Repblic of	74.4	7	3
43	Hong kong, China	76.0	6	3
44	Brunei Darussalam	79.1	5	4
45	Japan	80.7	4	4
46	Singapore	82.9	3	4
47	Australia	90.8	2	4
48	New Zealand	91.3	1	4

**Table 6.1** ASEAN, National Water Security Index by Economy(ADB, 2016)

No	Economy	NWS Score	Ranking NWS Score	NWS Index
1	Cambodia	37.5	10	2
2	Lao People's Democratic Republic	38.0	9	2
3	Vietnam	40.2	8	2
4	Philippines	40.4	7	2
5	Myanmar	40.8	6	2
6	Indonesia	49.8	5	2
7	Thailand	54.4	4	2
8	Malaysia	73.4	3	3
9	Brunei Darussalam	79.1	2	4
10	Singapore	82.9	1	4



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## Water Security and Sustainability Thailand's Water Security Situation in the context of world and ASEAN

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### Abstract

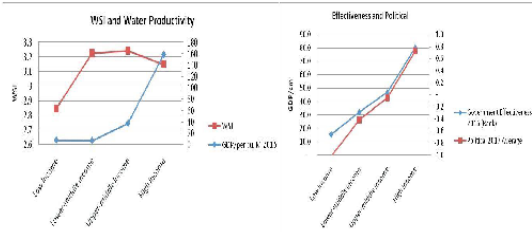
Worlds nowadays focus on SDG goals to be set as country benchmark for socio-econ-environmental development. The successful countries for sustainable water security depend on efficiency of integrated water management, water productivity and provision of water supply and sanitary services. Water security index was another issue that had been proposed to monitor the national socio-economical development which comprised of household, urban water, economic water (including irrigation water), river health and resilience. The study proposed the water security definition and assessed the water security status of Thailand by using water use status and correlated with gross domestic product per capita, water productivity, Government effectiveness (as governance), political stabilities in various countries of the world, Asia and ASEAN which helped to understand the competitiveness and the strength, weakness and potential of water resources development of Thailand compared with the rest of the world and ASEAN countries and their initiatives needed.

### Definition and methodologies

This study determined the water security status from five dimensions, i.e., WS1: basic water (renewable, supply, hygiene), WS2: sufficient water (water supply, consumption, agricultural water), WS3: development water (irrigation area, industrial water use, water for energy, water for aquaculture), WS4: water disaster (loss from floods and drought), WS5: water for future (population growth, urban population growth, water footprint) (Sucharit et. al., 2014). The index status analysed were correlated with water use unit (cubic meter per capita), water productivity (US \$ per cubic meter of water use), government effectiveness, political stabilities and grouped into four groups of country classified by income per capita of the country. Based on the available data from various sources of the world (World Bank, 2016; ADB, 2016), the index of each country was determined comparatively by weighting equally from each dimensions and ranked by marking equally (1-5 points) of each elements from the average and standard deviation values while the security status in ASIA is based on ADB study (ADB, 2016; Piyatida et. al., 2019).

### Water security status in the world scale

The water productivity, measured by the income per capita and per water use unit, was assessed and compared with the water security index obtained and it showed that more water productivity induced better water security status in the upper middle and high income group due to the loss of water disaster. The government effectiveness and political stability also grows with income per capita stage which reflects the influenced factors of governance and politic to water security.



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### Thailand and ASEAN

The water security status of Thailand, compared with the world, Asia and ASEAN regions were investigated with the ranking in each dimension as shown in table 1. Within ASEAN countries, the water use, water productivity (Suthidhumajit et. al., 2019) and water security status of each country VS country GDP per capita were assessed comparatively and it showed that Thailand has the highest water use unit, moderate lower water productivity and moderate in water security ranking.

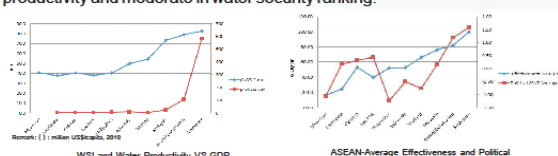


Table 1 Water Security of Thailand compared with the rest of the world

Elements	World		Asia		ASEAN		Thailand
	average	ranking	average	ranking	average	ranking	
Gross domestic product: Population	14,260	58	9,545	14	11,117	4	5,980
Water productivity (GDP/cm <sup>3</sup> )	81	122	45	20	82	6	4
Government Effectiveness	68.70	59	46.34	13	56.30	2	56.3
Political stability index	-0.05	118	0.14	37	0.03	8	-0.06
National Water Security Index by Economy (NWS Score) (full scores: 75)	15.8	23	15.7	12	17	5	17.3

Remark: 1) Gross domestic product: Population: World Bank (2016), 2) Water productivity (GDP/cm<sup>3</sup>): World Bank (2015), 3) Government Effectiveness: World Bank (2016), 4) Political stability index: World Bank (2017), 5) National Water Security Index by Economy: ADB 2016, \* Sucharit 2014.

### National Water Management Strategies

Thailand had set up long term National Strategic Plan and water resources management is an important issue out of 23 issues (NESDB, 2019). The concept of water security was used of the framework and target setup on water security, water productivity, water governance with counter initiatives in lined with SDGs, i.e.,  
Group 1 to reduce loss via issues of flood and drought (SDG 13), urban water (SDG 11),  
Group 2 to induce more value added and participation via issues of water productivity (SDG 9) and water governance (SDG 16),  
Group 3 to upgrade quality of life via issues of environmental water (SDG 6), watersanitary (especially in the rural areas) (SDG 6).

### Conclusions

This study showed the status of water security of Thailand compared with the rest of the world. Thailand has strengths on clean water and sanitation water accessibility and water for development due to the investment in the past. However, water use status in fresh water renewable, agricultural sector, i.e., low efficiency, high water footprint, low productivity, water resilient, urban water seemed to be a weakness compared with other countries. Water governance is comparatively in good handled. Based on the National Master Plan on water resources management, the urgent issues are to reduce loss, to enhance more value added and to improve quality of life to comply with SDG 6.

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