

# Discovering Appropriate Indicators In The Field Of Public Administration For Achieving Sustainable Development Goals In Developing Countries: Utilizing The Decision Tree Analysis Method

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## Summary

This study is based on the assumption that development, in the field of public administration, is important in terms of the sustainable development of developing countries. This is a prescriptive study, that seeks to discover which indicators are appropriate for measuring the levels of public administration in developing countries, and then applying them to these countries by using the actual values of the indicators thus discovered. Thereby, it should be possible to identify which specific projects, among public administration fields, should be implemented in the future to aid the sustainable development of developing countries. As an analysis method, decision tree analysis was applied. As a result, all developing countries were divided into eleven nodes, making it possible to identify the specific characteristics of the countries belonging to each node (group) and to discover projects beneficial for the future development of public administration.

**Keywords:** sustainable development goals, SDGs, ODA, public admimistration, decision tree analysis.

## I Introduction

The concept of public administration is multifaceted, but it can be generally defined as the act of the government in establishing policies, and executing and managing these established policies, to serve the public interest. It is a common problem in social science to find a unified view of concepts, and public administration is no exception. To date, developed countries have provided a large amount of aid to developing countries under the name of official development assistance. If such aid is classified by business type, it can be divided into public administration, health, education, agriculture, energy and technology, and the like.

Aid in all fields is important, but public administration is especially important because it establishes the appropriate institutions in underdeveloped countries and strengthens the capacity necessary to manage these systems (Alesina, 2000; Adedokun, 2017; Arndt and Jones, 2015). For example, no matter how expensive the equipment and facilities are that may be used to establish a school, if the ability to operate and manage these schools is lacking the schools may turn into old buildings only a few years after having been established (Burnside and Dollar, 2000; Knack, 2001; Riddell, 2007; Stephen and Swiss, 2013; Wotipka and Tsutsui, 2008; Pokorna and

Smutka, 2009). The same is true in the health sector. Even if state-of-the-art medical facilities are provided to underdeveloped countries, if there are not enough medical personnel to use them these facilities will function just like scrap metal. In this case, it is necessary to train medical professionals who can utilize these facilities. This training function can be directly performed in the public administration field. For this reason, it may be said that the public administration sector plays the most important role in implementing Official Development Assistance (ODA) (Tsikata, 1998; Durbarry et al., 2008).

In spite of this, however, aid has not been provided systematically to the public administration fields of underdeveloped countries. The reason for this is that the public administration levels of the developing countries that need to receive aid is not accurately understood, and even when policy decisions are made from the donor's point of view, it is not possible to classify aid-recipient countries by objective indicators. From the standpoint of donor countries including Korea, in order to provide systematic and sustainable aid to the public administration fields of underdeveloped countries, the first requirement is an index that can objectively classify the public administration levels of these countries. Next, it is necessary to measure the public administration levels of the underdeveloped countries in terms of specific areas of public administration, using these indicators. The domain of public administration is a comprehensive one, and so it is necessary to subdivide it. Using this subdivided index system to classify underdeveloped countries, identify their characteristics and prioritize aid according to their specific needs is a much more effective system than merely providing

blanket aid (Choi, 2022a).

Recognizing this problem, this study seeks to derive priorities for international development co-operation in the public administration field of underdeveloped countries, and to suggest future directions from a macroscopic point of view. In particular, the concept of sustainable development goals is used as an important dependent variable in this process. Sustainable development goals (SDGs) represent an already internationally recognized aim, and international organizations provide scores regarding different countries' SDGs. In this study, first, the level of aid recipient countries in the public administration field is identified: thereby, it is possible to identify which developing countries need aid in which areas of public administration. Next, examining the SDG scores of developing countries, we analyse which detailed indicators in the public administration sector affect these scores. This should make it possible in the future for aid-providing countries to identify preferential support projects in the public administration field for developing countries.

## **2 Theoretical Discussion and Key Indicators of Public Administration**

### **2.1 Relationships between key concepts**

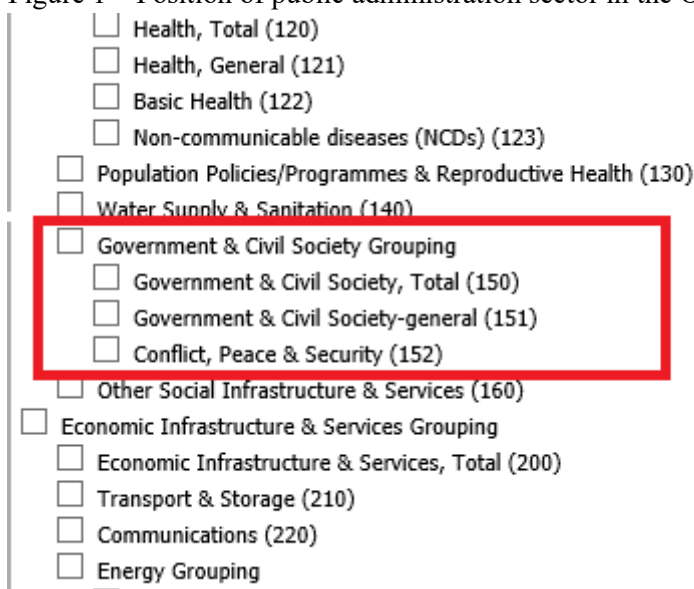
The concept of public administration is defined in multiple ways. The concept as defined in the field of public administration itself is different from the concept as defined in the field of international development co-operation (Choi, 2022d; KOICA, 2018). In terms of the former, the concept can be broadly defined in two ways. The first definition is a broad one. Here, 'public administration' refers to the overall action of a government in determining, executing and

managing policies to benefit the public interest. By contrast, the narrow concept of public administration refers to the act of executing and managing policies established by policymaking institutions such as the National Assembly (Choi, 2022a).

On the other hand, in the field of international development co-operation ‘public administration’ seems to carry a wider sense than the concept in its administrative meaning. In the OECD

Development Assistance Committee (DAC), the detailed areas included in the category of public administration are shown in the reporting system called the Creditor Report System (CRS) (Table 1). Here, public administration is included in the realm of government: in other words, public administration is included in the category Government & Civil Society. The red-boxed area in Figure 1 shows the Government & Civil Society category of the reporting system operated by the OECD DAC.

Figure 1 Position of public administration sector in the OECD DAC



Source: OECD DAC database.

Meanwhile, under Government and Civil Society in Figure 2, the followings are included: public sector policy and administrative management, public finance management, decentralization and support to sub-national government, anti-corruption organizations and institutions, domestic revenue mobilization, public procurement, legal and judicial development, macro-economic policy, democratic participation and civil society, elections, legislatures and

political parties, media and the free flow of information, human rights. As can be seen from these detailed areas, the realm of public administration here is much wider than in public administration regarded from an administrative point of view. This suggests that these detailed areas should be considered when deriving public administration indicators in the field of international development co-operation.

Figure 2 Detailed public administration areas of the OECD DAC

- Government and Civil Society - general, Total
- Public sector policy and administrative management (15110)
- Public finance management (PFM) (15111)
- Decentralisation and support to subnational government
  
- Anti-corruption organisations and institutions (15113)
- Domestic revenue mobilisation (15114)
- Public Procurement (15125)
- Legal and judicial development (15130)
- Macroeconomic policy (15142)
- Democratic participation and civil society (15150)
- Elections (15151)
- Legislatures and political parties (15152)
- Media and free flow of information (15153)
- Human rights (15160)

Source: OECD DAC.database

In Korea, the size in financial terms of free ODA projects included in the public administration category was \$109,355,656

as of 2019, accounting for around 17 per cent of the total sum for ODA projects, as shown in Table 1 (KOICA homepage).

Table 1 KOICA’s ODA business size by area (as of 2019)

사업분야별

· 기준년도 | 2019 ~ 2019 · 국가 |

· 사업분야별

사업분야	구분	연도별합계	2019
합계	금액(원)	755,996,063,399	755,996,063,399
	금액(달러)	648,759,858	648,759,858
보건의료	금액(원)	110,756,175,354	110,756,175,354
	금액(달러)	95,045,717	95,045,717
교육	금액(원)	186,330,974,351	186,330,974,351
	금액(달러)	159,900,407	159,900,407
공공행정	금액(원)	127,431,541,647	127,431,541,647
	금액(달러)	109,355,656	109,355,656
기술환경에너지	금액(원)	81,962,610,252	81,962,610,252
	금액(달러)	70,336,373	70,336,373
농림수산	금액(원)	88,381,932,283	88,381,932,283
	금액(달러)	75,845,137	75,845,137
긴급구호	금액(원)	7,944,800,670	7,944,800,670
	금액(달러)	6,817,852	6,817,852
기타	금액(원)	153,188,028,842	153,188,028,842
	금액(달러)	131,458,716	131,458,716

Source: KOICA.

Examples of projects included in the category of public administration are shown in Table 4. It can be seen that women’s

empowerment projects are included, and even peace-building projects are included in the public administration category.

Table 2 Examples of projects included in the category of public administration

Area	Project Title	Recipient country	Project period
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PA	Sustainable peace-building project through implementation of DR Congo New Deal and Humanitarian Aid-Development-Peace Nexus	DR Congo	2019–2021
PA	UNODC Gambia criminal procedure and law enforcement reinforcement project through prison facility reform	Gambia	2018–2021
PA	DR Congo’s human resources system re-organization and governance reinforcement project to promote the implementation of the UNDP New Deal	DR Congo	2017–2020
PA	Peace settlement project through prevention of gender-based violence and integrated support in DR Congo conflict-prone areas	DR Congo	2020–2024
PA	Uganda UNDP refugee and regional women’s empowerment project	Uganda	2019–2022
PA	Rwanda industrial R&D capacity reinforcement project	Rwanda	2014–2019
PA	Guinea border and immigration-related law enforcement capacity building project (IOM)	Guinea	2019–2021
PA	Tunisia UNDP democratic governance and public responsibility reinforcement project	Tunisia	2016–2019
PA	Sudan Blue Nile state community resilience promotion project	Sudan	2019–2021

Note. PA = public administration.

Source: KOICA.

As Table 2 shows, the scope of public administration is very wide, including as it does restoration projects for local communities in public administration ODA. In addition, it is necessary to determine the conceptual relationship between public administration and governance. The concept of governance is also defined in many different ways. Some scholars define governance simply as a decision-making structure, while others define it as a governance structure within an organization. Despite the difficulty of reaching an academic definition of the concept, many scholars it as ‘the institutional means to achieve a certain purpose and the management of these institutional means’. It may be said that governance as defined in the field of international development co-operation is also broadly consistent with this definition (Asongu, 2014; Busse and Groning, 2009; Cai et al., 2018).

In considering this definition, the conceptual difference between the concepts of public administration and governance should be considered. In the field of international development co-operation, some scholars regard public administration and governance as the same thing (Arvin, 1998; Bassam, 2008; Ekanayake and Chatrna, 2010; Herzer and Morrissey, 2013). However, these two concepts need to be distinguished. If public administration is defined in a broad sense, it can, as we have seen, be defined as the administrative act of determining, executing, and managing policies necessary to benefit the public interest. However, it can be said that the core of governance is ‘designing and managing institutions to achieve certain goals in the public domain’ (Choi, 2022d; KOICA, 2018). When defined in this way, it can be mainly seen as ‘the act of designing and managing the designed systems necessary to achieve national goals’.

In reality, for example in governance-related projects, all the following need to be included: the formation of new institutions in developing countries, that is, the establishment of new universities; the establishment and operational support for public officials training centres; the enactment of new laws; and the strengthening of the capacity of public officials necessary for law enforcement and organizational management. If governance is strengthened, the budget required for organization or systems operation will be reduced, the operation process will become transparent and transaction costs will be reduced (KOICA, 2018; Choi, 2022d). Therefore, when looking at the relationship between public administration and governance, governance should be seen as a sub-domain of public administration, and at its core is reducing transaction costs in public project management. Realistically speaking, then, governance may be said to be the core of public organizations and systems design, and therefore, the capacity-building projects of public officials are necessary to operate such organizations.

## 2.2 Sustainable Development Goals (SDGs)

Sustainable Development Goals (SDGs) are goals that were officially adopted by the UN General Assembly in September 2015 to address the problem of global poverty. The SDGs implemented or due to be implemented between 2016 and 2030 focus on reducing poverty and improving primary school enrolment. SDGs are the successors to the Millennium Development Goals (MDGs) which culminated in 2015. Under the slogan 'Leave No One Behind', the five goals representing Human, Earth, Prosperity, Peace and Partnership are classified into seventeen main goals and 169 detailed goals (Choi, 2022d).

SDGs include a broader range of development goals than did MDGs. As regards the MDGs, one for economic development, one for environmental sustainability and five for social development accounted for most of them. By contrast, the SDGs have been developed with a broader range of goals in mind, covering economic development, environmental sustainability and peace and security, in addition to social development. Separating the hunger problem from the poverty problem served to link it with food security; and in recent years efforts have been made by the international community to address new issues, such as alleviating inequality, separately (Choi, 2022c).

In addition, the SDGs addressed a limitation of the then-existing MDGs which were concentrated in developing countries, which placed a burden on those countries (Choi, 2022b). They set global goals in the true sense of that word by promoting various tasks related to climate change, youth job creation, alleviation of poverty and urbanization, which are goals that are also applicable to advanced countries.

## 2.3 Major public administration indicators

Indicators are needed to measure the level of public administration in developing countries by applying the mechanisms defined above to developing countries. Many studies have been conducted on these indicators. In particular, international organizations and international research institutes are providing specific indicators. In this study, we propose a particular set of indicators arrived at by synthesizing the research results of previous studies. These include: rule of law; government effectiveness; control of corruption; regulatory quality; voices and accountability; political stability; corruption

perception index; political right index; civil liberty; proportion of female members of parliament; refugee index. These indicators are not based on the concept of public administration in a narrow sense, but rather on the basis of the concept seen in a much broader sense (Buirnsice and Dollar, 2000; Kaufmann et al., 2009; Knack, 2001; Moolio and Kong, 2016).

### 3 Survey Design

As stated above, the primary purpose of this study is to derive indicators that can measure public administration in international development co-operation projects, and to properly classify developing countries by applying these indicators. The secondary purpose is to establish ODA policy directions that can in the future improve the

public administration levels of developing countries, on the basis of classifying developing countries by type. The research procedures and analysis methods used are as follows.

#### 3.1 Subject of analysis

The subjects of this study are 142 countries classified as receiving aid provided by the OECD DAC as of 2020. To these countries, the main indicators of public administration are applied, and the countries classified into certain types.

#### 3.2 Analysis indicators

General statistical data for eleven indicators theoretically derived to measure the levels of public administration in developing countries are shown in Table 3.

Table 3 Key indicators of public administration: general statistics

Indicator name (abbreviation)	Definition	Scale	Number of countries to be compared	Mini mum	Maxi mum	Mean	SD
rule of law (Ruleoflaw)	Degree of trust and compliance with various regulations in social life	-2.5 weak, 2.5 strong	118	-1.85	1.08	- 0.485 4	0.6094 6
government effectiveness (Goveffective)	Level of public service, level of civil service system, level of policymaking and policy execution	-2.5 weak, 2.5 strong	118	-2.28	1.00	- 0.496 6	0.6384 2
control of corruption (Controlofcorruptio n)	The extent to which public power is exercised for private purposes	-2.5 weak, 2.5 strong	118	-1.72	1.62	- 0.488 7	0.6286 2
quality of regulation (Regulatory)	The ability of governments to formulate and enforce regulations or policies for private sector development	-2.5 weak, 2.5 strong	118	-2.35	1.12	- 0.438 8	0.5769 7

voices and accountability (Voices)	The degree to which citizens participate in government choice, freedom of expression, and freedom of association	-2.5 weak, 2.5 strong	118	-1.86	1.13	-0.2928	0.77378
political stability (Polistability)	Potential for government to be destabilized by unconstitutional or violent means	-2.5 weak, 2.5 strong	118	-2.77	1.20	-0.3842	0.88541
corruption perception index (Cpi)	Degree of corruption in the public sector	100=no corruption	108	15.00	68.00	34.3981	10.45322
political right index (Poliright1)	The electoral process, political pluralism and participation, and the relevance of government functions	7(weak) – 1(strong)	118	1.00	7.00	4.0085	1.91037
civil liberty (Civilliberty1)	Individual autonomy and degree of protection of individual rights	7(weak) – 1(strong)	118	1.00	7.00	4.1356	1.54652
proportion of women in parliament (Women)	Proportion of women members in the parliament	%	115	0.00	61.25	22.1833	12.17846
refugee index (Refugee1)	Forced migration to foreign countries due to social and political unrest	0(low) – 10(high)	109	0.00	8.00	4.3000	2.17792
GDP per capita	GDP per capita		118	261.25	17112.82	4373.1866	3681.93391
SDG score	sustainability development goals score of each country						

Source: <https://www.theglobaleconomy.com/>

Note. Here, refugee index (refugee1), political right (poliright1) and civil liberty

(civilliberty1) converted their original numbers to inverse numbers to unify the



positive and negative directions with other variables.

### 3.3 Analysis method

In this study, all indicators' original scores were converted to z scores to standardize the values of the eleven indicators for the 142 developing countries. This is a process of unifying the units, because variables with different units cannot be used in that form. In this process, since the three variables have a negative character as the value increases, they were processed by taking the reciprocal number in order to have a direction with other variables.

Next, the z score values of the eleven variables were summed up and averaged to obtain the final average value, so as to give a comprehensive ranking. Such information will be important in providing ODA to developing countries in the future. Next, decision tree analysis is performed, with per capita GDP as the dependent variable and the eleven variables as independent variables. Via this analysis, we will try to

understand the conditional combination of the various variables that affect per capita GDP in developing countries. This analysis method has the effect of classifying the 142 countries using the characteristics of the variables. In other words, the fact that countries included in the same type have similar conditions has important implications, in that they can be classified as the same recipient country.

## 4 Analysis Result

### 4.1 Basic statistical values of variables

Looking at the basic statistical values for the eleven variables of the 142 countries receiving aid, we can see that Table 6 shows basic statistics for the variables employed in this study. As Table 4 shows, the average of the countries to be analysed is 62.90, the minimum 40.90 and the maximum 78.80. Meanwhile, the average per capita GDP is 4,373 dollars, the minimum value is 261 dollars and the maximum value 17,112 dollars.

Table 4 Basic statistics for variables (based on 2020 data)

	N	Minimum	Maximum	Mean	SD
SDG	103	40.90	78.80	62.9019	8.56
GDPcapita	118	261.25	17112.82	4373.18	3681.93
Ruleoflaw	118	-1.85	1.08	-.48	.60
Goveffective	118	-2.28	1.00	-.49	.63
Controlofcorruption	118	-1.72	1.62	-.48	.62
Regulatory	118	-2.35	1.12	-.43	.57
Voice	118	-1.86	1.13	-.29	.77
Politstability	118	-2.77	1.20	-.38	.88

CPI	108	15.00	68.00	34.39	10.45
Poliright1	118	1.00	7.00	4.00	1.91
Civilliberty1	118	1.00	7.00	4.13	1.54
Refugee1	109	.00	8.00	4.30	2.17

Note. Some of the 142 countries were excluded from the analysis due to lack of data.

#### 4.2 Standardized score values for each public administration area

Table 7 presents the values obtained by standardizing the values of the eleven variables. The letter z, meaning 'standardized', is automatically added in front of the original name of all the variables. Instead of presenting the z values of all 142

countries, below we present information on only 27 countries which Korea places a great deal of importance on in promoting ODA projects. In Table 5, standardized values for the rule of law, government effectiveness, control of corruption, and regulatory quality variables of these 27 countries are presented.

Table 5 Values of standardized variables (1)

	ZRuleoflaw	ZGoveffectiveness	ZControlofcorruption	ZRegulatory
Bolivia	-1.56924	-0.69917	-0.3413	-1.38108
Colombia	0.28442	1.19105	3.08631	1.85437
Paraguay	-0.08631	-0.28185	-0.50988	0.45777
Peru	0.09906	0.84737	0.20187	2.2268
Egypt	0.28442	-0.01182	-0.21019	-1.00865
Ethiopia	0.15202	-0.52734	0.27679	-1.14831
Ghana	1.52903	0.5037	0.89488	0.66726
Rwanda	1.60847	1.48563	2.09361	1.10952
Senegal	0.89349	0.87192	1.13837	0.66726
Tanzania	-0.13927	-1.14104	0.31425	-0.5664
Uganda	0.57572	-0.42914	-1.1467	0.06207
Bangladesh	-0.29816	-0.79737	-0.80956	-1.24142
Myanmar	-1.41035	-1.80385	-0.13527	-0.84572
Cambodia	-1.09258	-0.40459	-1.39019	-0.40346
India	1.31718	1.43653	0.61393	0.55088

Indonesia	0.49627	1.46108	0.25806	0.71382
Kyrgyzstan	-0.96018	-0.65008	-0.73464	0.10862
Laos	-1.09258	-0.89556	-0.94067	-0.72933
Mongolia	0.68164	0.55279	0.2206	0.90003
Nepal	-0.03335	-1.55837	-0.21019	-0.70606
Pakistan	-0.3776	-0.65008	-0.54734	-0.5664
Philippines	0.12554	1.14195	-0.02289	0.94658
Sri Lanka	1.37014	0.74918	0.44536	0.50433
Tajikistan	-1.86053	-1.55837	-1.42765	-1.42763
Uzbekistan	-1.38387	-0.23275	-0.92194	-1.38108
Vietnam	1.34366	1.11741	0.08949	0.31811

Table 6 shows the values of standardized variables voices, political stability, CPI and women.

Table 6 Values of standardized variables (2)

	ZVoices	ZPolistability	ZCPI	ZWomen
Bolivia	0.55042	-0.1876	-0.40401	2.12274
Colombia	0.98833	-0.62398	0.45717	-0.56454
Paraguay	0.78306	0.77868	-0.8346	-0.85461
Peru	1.07044	0.56049	0.31364	0.31819
Egypt	-1.28331	-0.88893	0.17011	-0.84679
Ethiopia	-0.7633	-1.21622	0.45717	1.0031
Ghana	1.46729	0.93453	1.03129	-1.00394
Rwanda	-0.80435	0.9657	2.75366	2.76152
Senegal	1.02938	0.87219	1.60542	1.33696
Tanzania	-0.01064	0.21762	0.45717	0.85768
Uganda	-0.17486	-0.23435	-0.8346	0.69818
Bangladesh	-0.3117	-0.65515	-1.12166	-0.39174
Myanmar	-0.47592	-1.18505	-0.69107	-1.15875
Cambodia	-0.96856	0.654	-1.98285	-0.46368
India	1.07044	-0.31228	1.03129	-0.90465
Indonesia	0.89254	0.03059	0.88776	-0.43631

Kyrgyzstan	0.04409	0.13969	-0.54754	-0.52857
Laos	-1.78964	1.6047	-0.69107	0.12429
Mongolia	1.15255	1.77613	0.17011	-0.67243
Nepal	0.49569	0.04618	0.02658	0.53164
Pakistan	-0.47592	-2.72798	-0.26048	-0.4496
Philippines	0.71464	-0.59281	0.02658	0.15869
Sri Lanka	0.61885	0.42022	0.6007	-1.60676
Tajikistan	-1.83069	-0.12526	-1.26519	-0.16578
Uzbekistan	-1.52963	0.35788	-1.26519	0.47456
Vietnam	-1.21489	0.98129	0.45717	0.06174
Ukraine	0.75569	-1.59027	-0.54754	-0.40113

Table 7 shows the values of standardized variables refugee, civil liberty and political rights.

Table 7 Values of standardized variables (3)

	ZRefugees1	ZCivilliberty1	ZPoliright1	z score total
Bolivia	1.2532	1.00241	0.71958	0.1
Colombia	-1.09089	1.00241	0.71958	0.66
Paraguay	1.40607	1.00241	0.71958	0.23
Peru	0.99841	1.00241	1.24467	0.81
Egypt	-0.32651	-1.25302	-0.85571	-0.57
Ethiopia	-1.54951	-1.25302	-0.85571	-0.49
Ghana	0.74361	1.75422	1.24467	0.89
Rwanda	-1.03993	-1.25302	-0.85571	0.8
Senegal	-0.32651	1.00241	0.71958	0.89
Tanzania	-0.02076	-0.50121	-0.33062	-0.08
Uganda	-1.54951	-0.50121	-0.85571	-0.4
Bangladesh	-0.93801	-0.50121	-0.33062	-0.67
Myanmar	-1.70238	-1.25302	-0.33062	-1
Cambodia	0.48882	-0.50121	-1.38081	-0.68
India	0.69266	1.00241	1.24467	0.7
Indonesia	0.6417	0.2506	1.24467	0.59
Kyrgyzstan	0.69266	0.2506	-0.33062	-0.23
Laos	0.18307	-1.25302	-1.38081	-0.62

Mongolia	1.76278	1.75422	1.76977	0.92
Nepal	-0.88705	0.2506	0.71958	-0.12
Pakistan	-1.03993	-0.50121	-0.33062	-0.72
Philippines	-0.42843	0.2506	0.71958	0.28
Sri Lanka	-0.88705	0.2506	0.19448	0.24
Tajikistan	0.99841	-1.25302	-1.38081	-1.03
Uzbekistan	0.53978	-1.25302	-1.38081	-0.73
Vietnam	0.69266	-0.50121	-1.38081	0.18
Ukraine	0.69266	1.00241	0.71958	0.04

Looking at Table 8, we see that among the 27 important developing countries receiving support from Korea, Mongolia is shown to be the best in terms of public administration and Tajikistan the worst.

Table 8 Comprehensive scores and rankings of 27 countries

Rank	Country	z score total
1	Mongolia	0.92
2	Senegal	0.89
3	Ghana	0.89
4	Peru	0.81
5	Rwanda	0.8
6	India	0.7
7	Colombia	0.66
8	Indonesia	0.59
9	Philippines	0.28
10	Sri Lanka	0.24
11	Paraguay	0.23
12	Vietnam	0.18
13	Bolivia	0.1
14	Ukraine	0.04
15	Tanzania	-0.08
16	Nepal	-0.12
17	Kyrgyzstan	-0.23
18	Uganda	-0.4
19	Ethiopia	-0.49
20	Egypt	-0.57
21	Laos	-0.62

22	Bangladesh	-0.67
23	Cambodia	-0.68
24	Pakistan	-0.72
25	Uzbekistan	-0.73
26	Myanmar	-1
27	Tajikistan	-1.03

### 4.3 Decision tree analysis result

Decision tree analysis was performed using the SDG score of developing countries as a dependent variable and eleven public administration variables as independent variables. The decision tree analysis method is a useful method that reduces the number of independent variables by selecting a small number of useful variables from among the many explanatory variables (Nuruddin et al., 2014; Venkata and Kiruthika, 2015; Freund

and Schapire, 1997;Chelghoum and Zeitouni, 2002). In addition, this analysis method identifies the effect of a specific combination of independent variables, and provides guidelines on which variables to consider in the parametric model (Esposito et al., 1997; Fan et al., 2006; Combes et al., 2012). Figure 3 shows the tree model obtained as a result of decision tree analysis for the 142 developing countries.

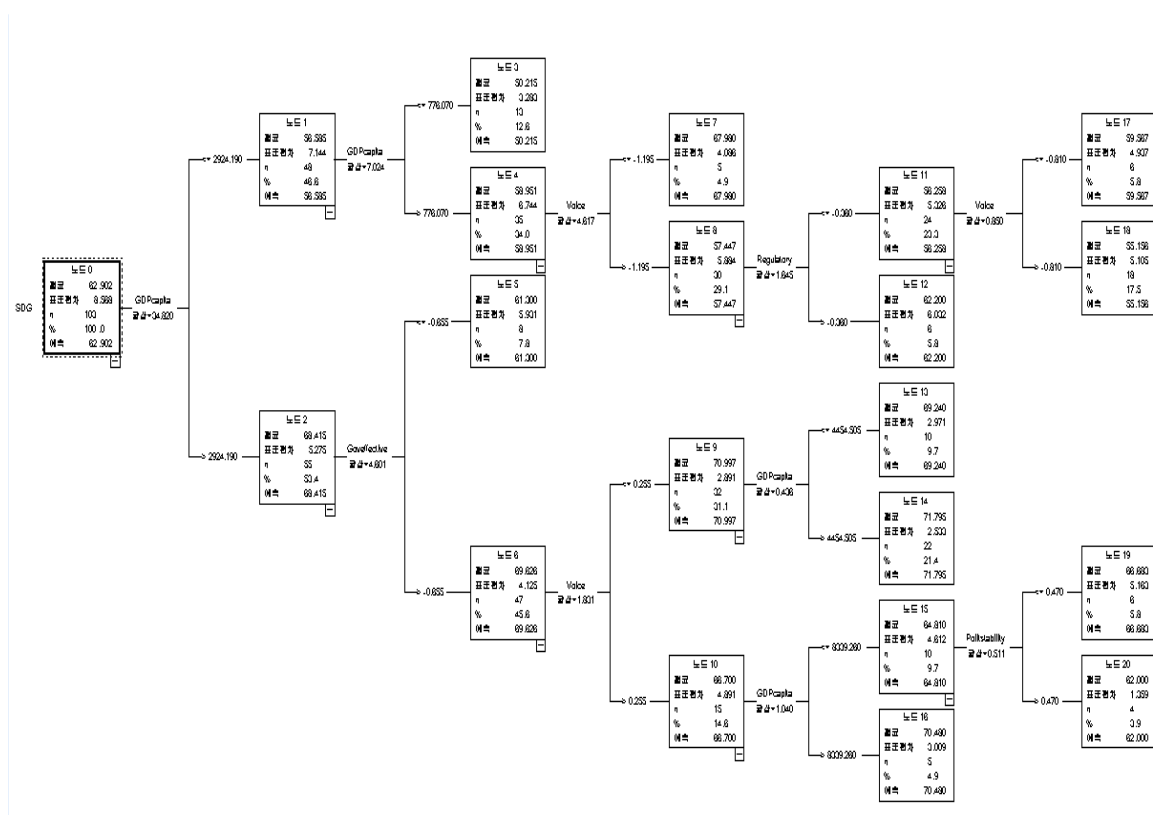


Figure 3 Tree model derived from decision tree analysis results

Looking at Figure 1, we can see that all eleven final nodes are generated. Table 11 shows the gain results for the final nodes. Node 14 includes 22 of the 142 analysed countries, the average SDG score of these countries being 71.79. This node occupies 21.4 per cent of the total nodes shown in Table 9.

Table 9 Gain by node

Node	N	Per cent	Mean
14	22	21.4%	71.7955
16	5	4.9%	70.4800
13	10	9.7%	69.2400
7	5	4.9%	67.9800
19	6	5.8%	66.6833
12	6	5.8%	62.2000
20	4	3.9%	62.0000
5	8	7.8%	61.3000
17	6	5.8%	59.5667
18	18	17.5%	55.1556

3	13	12.6%	50.2154
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Table 10 shows the importance of each node. It can be seen that per capita GDP is the variable that has the greatest influence on countries' SDG scores. When the importance value of per capita GDP on the SDG score is 100, this shows the relative importance values of other variables.

Table 10 Importance of independent variables

Independent variable	Weight	Normalized weight
GDPcapita	43.334	100.0%
Goveffective	38.757	89.4%
Regulatory	28.373	65.5%
Ruleoflaw	22.611	52.2%
Controlofcorruption	20.669	47.7%
Voice	18.841	43.5%
CPI	18.631	43.0%
Politstability	17.056	39.4%

Figure 4 shows the relative degree of each independent variable on the SDG score as a graph.

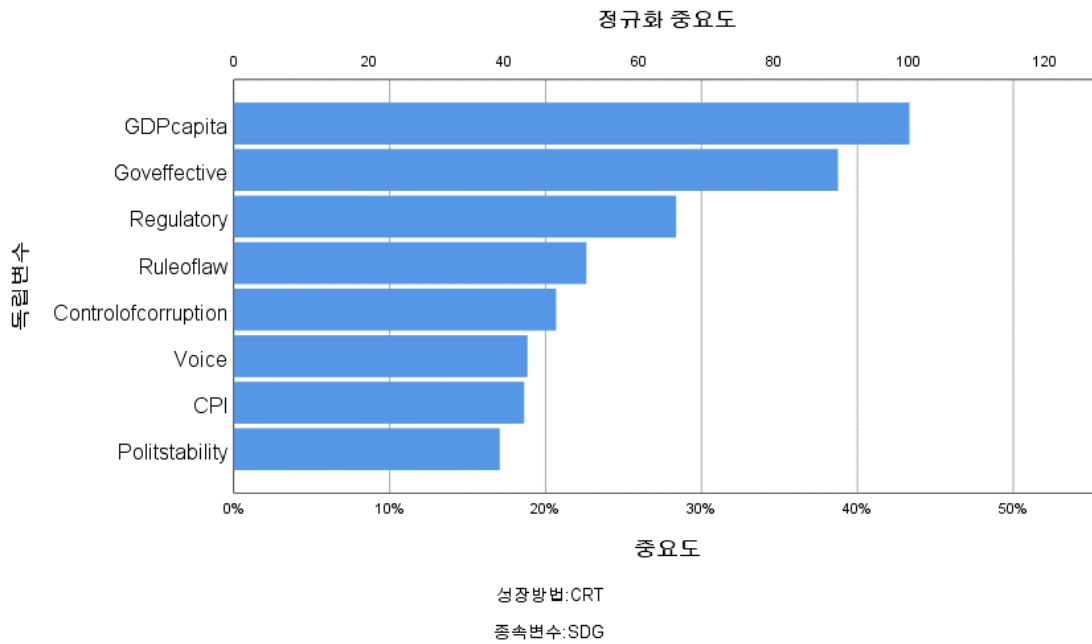


Figure 4 Normalized importance of variables

Figure 5 graphs the degree to which per capita GDP affects the SDG score. R2, which represents this, is 0.380, indicating that the SDG score increases as per capita GDP increases.

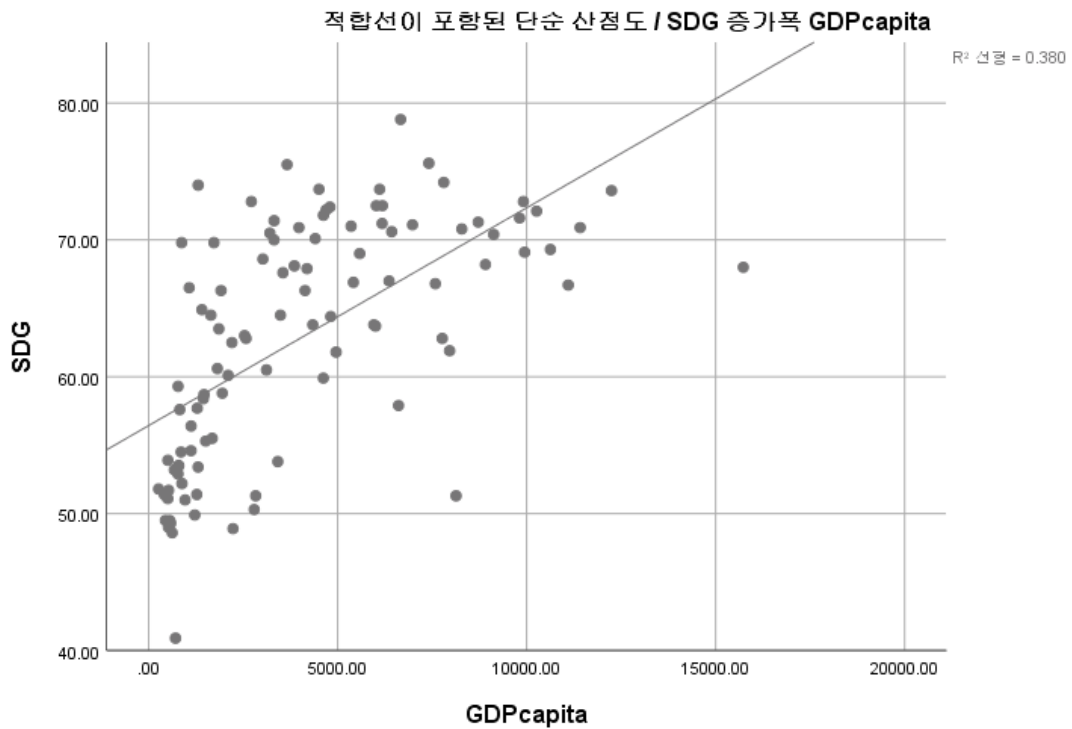


Figure 5 Relationship between per capita GDP and SDGs score

Table 11 presents the countries included in each node and the characteristics of these nodes.



Table 11 Characteristics of nodes

Node	Countries	Node characteristics
14	Colombia, Dominican Republic, Ecuador, Mexico, Paraguay, Armenia, Azerbaijan, China, Georgia, Kazakhstan, Malaysia, Maldives, Thailand, Fiji, Albania, Belarus, Bosnia & Herzegovina, Moldova, Montenegro, North Macedonia, Serbia, Turkey	<p>1. The average value of SDGs for countries in this group is 71.795.</p> <p>2. Countries in this group have per capita GDP higher than \$2,924, standardized value of government effectiveness indicator higher than -0.655, and standardized value of voice indicator lower than 0.255 but per capita GDP higher than US \$4,454.</p>
16	Antilles & Barbados, Argentina, Brazil, Costa Rica, Grenada, Jamaica, Panama, Saint Lucia, Mauritius, Palau	<p>1. The average value of SDGs for countries in this group is 70.480.</p> <p>2. Countries in this group have per capita GDP higher than \$2,924, standardized value of government effectiveness indicator higher than -0.655, and standardized value of voice indicator higher than 0.255 but per capita GDP lower than US \$8,339.</p>
13	El Salvador, Algeria, Egypt, Morocco, Bhutan, Indonesia, Jordan, Philippines, Sri Lanka, Ukraine	<p>1. The average value of SDGs for countries in this group is 69.240.</p> <p>2. Countries in this group have per capita GDP higher than \$2,924 and standardized value of government effectiveness indicator higher than -0.655, but standardized value of voice indicator lower than 0.255 and per capita GDP lower than \$4,454.</p>
7	Cambodia, Laos, Tajikistan, Uzbekistan, Vietnam	<p>1. The average value of SDGs for countries in this group is 67.980.</p> <p>2. Countries in this category have per capita GDP lower than US \$2,924 but higher than US \$776, and the standardized value of voice indicator is lower than -1.195.</p>

19	Guyana, Peru, Surinam, South Africa, Tunisia,	<p>1. The average value of SDGs for countries in this group is 66.683.</p> <p>2. Countries in this group have per capita GDP higher than \$2,924, standardized value of government effectiveness indicator higher than -0.655, and standardized value of voice indicator higher than 0.255, but per capita GDP is lower than \$8,339, and the political instability indicator lower than 0.470.</p>
12	Ghana, Kenya, Rwanda, Senegal, India, Kyrgyzstan	<p>1. The average value of SDGs for countries in this group is 62.200.</p> <p>2. Countries that belong to this category have per capita GDP lower than \$2,924 but higher than \$776, standardized value of voice index higher than -1.195, and standardized value of regulatory quality index higher than -0.360.</p>
20	Dominica, St Vincent, Botswana, Namibia, Mongolia, Samoa, Tonga, Tuvalu, Vanuatu	<p>1. The average value of SDGs for countries in this group is 62.000.</p> <p>2. Countries in this group have per capita GDP higher than \$2,924, standardized value of government effectiveness indicator higher than -0.655, standardized value of voice indicator higher than 0.255, but per capita GDP lower than US \$8,339, and the political instability index higher than 0.470.</p>
5	Belize, Bolivia, Guatemala, Djibouti, Equatorial Guinea, Gabon, Libya, Iraq, Lebanon	<p>1. The average value of SDGs for countries in this group is 61.300.</p> <p>2. Countries belonging to this group have per capita GDP higher than \$2,924 and a standardized value of government effectiveness index lower than -0.655.</p>
17	Nicaragua, Cameroon, Ethiopia, Zimbabwe, Myanmar, Pakistan	<p>1. The average SDGs of countries in this group is 59.567.</p>

		2. Countries in this category have per capita GDP lower than \$2,924 but higher than \$776, standardized value of voice index higher than -1.195, regulatory quality lower than -0.360, and voice index standardized value.
18	Haiti, Honduras, Angola, Benin, Burkina Faso, Comoros, Gambia, Guinea, Lesotho, Mali, Mauritania, Nigeria, S.T. & Principe, Tanzania, Uganda, Zambia, Bangladesh, Nepal, Kiribati, Papua New Guinea, Solomon Islands	1. The average value of SDGs for countries in this group is 55.156. 2. Countries in this category have per capita GDP lower than \$2,924 but higher than \$776, standardized value of voice index higher than -1.195, regulatory quality lower than -0.360, and voice index standardized value.
3	Burundi, CA Republic, Chad, DR Congo, Guinea-Bissau, Liberia, Madagascar, Malawi, Mozambique, Niger, Sierra Leone, Sudan, Togo, Afghanistan, Yemen	1. The average value of SDGs for countries in this group is 50.215. 2. Countries in this group have GDP per capita below US \$2,924 and below US \$776.

## 5 Conclusion

Since Korea joined the OECD DAC in 2010 it has significantly increased aid to developing countries. However, it is also true that the effectiveness of the ODA project has consistently been evaluated negatively (Coller and Dollar, 2002; Kargbo and Sen, 2014). Numerous ODA-related studies conducted to date have suggested that public administration is very important for developing countries' national development (Lancaster, 2007; Lopez et al., 2006; Mishra and Newhouse, 2009; Sachs, 2005). However, few studies have been conducted on the detailed indicators constituting the public administration domain. As a result, we can say that aid projects for public administration in developing countries have not been carried

out effectively. This study was conducted against this background. The implication of this study is that, above all, it is necessary to derive the major indicators constituting the public administration domain of developing countries, and to use these indicators as tools for classifying these countries. In doing this it is necessary, finally, to set new priorities for international development co-operation by country type and to implement aid strategies on this basis.

In conclusion, it may be said that the eleven international indicators for public administration ODA projects selected in this study are consistent with the contents of international development co-operation projects. There should be no problem in applying these indicators to the selection and

evaluation of public administration ODA projects in the future. As a result of conducting a causal map analysis used in the system dynamics method to understand how major public administration indicators are related to national development, it was found that the eleven public administration ODA indicators are important in enhancing the economic development and national competitiveness of aid-recipient countries. However, among the eleven public administration indicators, ratio of female members of parliament showed a low correlation with other variables. This suggests that it is necessary to re-examine whether this variable can become a public administration variable in the future. In other words, a feasibility issue is raised as to whether it is appropriate to consider ratio of female parliamentarians in order to measure the gender equality problem, and as to whether ratio of female parliamentarians is an indicator of public administration.

Meanwhile, the decision tree analysis shows that the most important indicator to consider when selecting a public administration ODA project is the per capita GDP variable. In other words, SDG score increases only when the income level of the country receiving aid increases. The next most important variable is the government effectiveness indicator. These findings indicate which projects should be considered important in the public administration sector from the point of view of raising the SDG score of developing countries in carrying out ODA projects in the future. They suggest that raising per capita GDP is an urgent priority, and that measures that can increase the effectiveness of government in this process should be closely considered.

**Acknowledgements:** This paper was written with support from Chungbuk

National University BK (Brain Korea) 21 FOUR (2021).

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