Chapter 7:
Policy Challenges for Infrastructure Development in Africa - The way forward for Japan's Official Development Assistance (ODA)

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This chapter examines how Japan's ODA can more effectively assist Africa's infrastructure development in consideration of a comprehensive study by the donor consortium. It recommends that Japan should consider, as short-term measures, sectoral reallocation of its assistance, financial assistance for maintenance, and management reform of public utilities, while supporting various reforms from a long-term perspective.

1. Introduction

Infrastructure[1] development in Africa is generally lagging behind other parts of the world, though there are variations between countries and sectors (see Section 2), hampering economic growth[2] and poverty reduction (for example, Calderón and Servén 2010). One of the serious problems was that the real picture of infrastructure in African countries could not be seen due to lack of data, preventing policy interventions and investment.

The Infrastructure Consortium for Africa (ICA)[3] conducted Africa infrastructure country diagnostic studies and published a flagship report titled *Africa's Infrastructure: A Time for Transformation* in late 2009

1. In this chapter, infrastructure includes: power; transport (roads, seaports, airports, and railways; water supply and sanitation; information and communication technology (ICT); and irrigation.

2. As pointed out in Chapter 6, infrastructure development would promote economic growth through industrial development while removing the cost penalties of economic activities.

3. ICA was established in 2005, following the G8 Gleneagles summit at which assistance for Africa was one of the main agenda topics. For details of ICA, see http://www.icafrica.org/en/

(hereinafter referred to as AFD-WB 2009). The values of this report include that current status and problems are analyzed through quantitative data; that infrastructure needs and funding gaps are estimated by sector and country type; and that policy interventions are prioritized through cost-benefit analyses. At the same time, however, it reveals that Africa's infrastructure challenges are overwhelming and complex, and require sustained and concerted efforts by African countries, regional organizations, and development partners.[4]

This chapter aims to discuss what Japan's ODA should place its emphasis among recommendations of AFD-WB 2009 in donor community's concerted efforts, in order to effectively contribute to address Africa's infrastructure challenges.[5] This exercise is useful because infrastructure has always been one of the priority areas for Japan's assistance for Africa to boost the region's economic growth as in the TICAD IV Yokohama Action Plan 2008, and Japan has provided financial resources and technical assistance.

This chapter is organized as follows: Section 2 summarizes the current status of infrastructure development through available statistics; Section 3 reviews Japan's recent ODA for infrastructure in Africa; Section 4 discusses the future direction of Japan's ODA; and Section 5 is the conclusion.

2. Overview of Infrastructure Development in Africa

2.1 Current infrastructure in Africa

Table 1 shows the current status of infrastructure development in Africa based on available statistics such as World Development Indicators (WDI) of the World Bank, and the Global Competitive Index (GCI) of the World Economic Forum (WEF). The countries are categorized into five groups[6] – North Africa, middle income countries, oil exporting

4. Development partners here include non-traditional funders such as China, Korea. Figure 2 shows their great contribution to infrastructure development.

5. Therefore, this chapter focuses only on how Japan's ODA can better meet Africa's infrastructure development needs; and does not directly consider the interests of Japanese industries in infrastructure business in Africa.

6. This chapter adopts the categorization of countries of IMF 2011, 80, which is a little different from AFD-WB 2009, 51. Fragile countries are low-income countries that face particularly severe development challenges, such as weak governance, limited administrative capacity, violence, or the legacy of conflict (AFD-WB 2009, 51).

countries, low-income nonfragile countries, and low-income fragile countries[7] - because they are different in infrastructure development and challenges. This section basically focuses on sub-Saharan African (SSA) countries because the quality and quantity of infrastructure in North Africa and small, middle-income island countries, including Mauritius and Seychelles, are relatively higher in almost all the sectors. As shown in Figures A1 to A6, there is generally a positive correlation between infrastructure development and GDP per capita, but, the degree of correlations is different across infrastructure sectors.[8] This suggests that the countries can improve some infrastructure regardless their income levels. The current situation of Africa's infrastructure by sector is as follows:

Power: Power is by far Africa's largest infrastructure challenge, with 30 countries facing regular power shortages (AFD-WB 2009, 5) and more than half of the population having no access to electricity except in North Africa, Mauritius and South Africa. SSA countries have low rates of electrification – the average rate for SSA countries is only 32%, compared to the average of low and middle income countries (LMIC) throughout the world, which is 74%. As for electricity consumption per capita, the average of SSA countries is only 517kWh, which is substantially lower than the world LMIC average (1,527kWh), with the exception of South Africa (4,532kWh) and Libya (4,170kWh). Furthermore, SSA countries' rate of electric power transmission and distribution loss[9] (11.2%) is almost the same as the world LMIC average (11.1%). The loss is higher in the whole of the African region particularly in middle-income (35%) and oil-exporting countries (24%), indicating operating inefficiency of power utilities.

Transport: The average roads pavement ratio in SSA countries is only 19% compared with the world LMIC average of 45%. The road pavement ratio in oil-exporting countries is very low. In addition, regarding road density (total road length per land area), the figures in many African countries are lower than the world LIMC average (21.5 km/100km2). It is urgent that African governments should address the poor condition

7. Sub-Saharan African (SSA) countries are subdivided to the latter four groups.

8. The road pavement ratio and the electricity power consumption per capita are more correlated with per capita income. The electricity power consumption and distribution losses, improved access to water sources, agriculture irrigation land, and mobile subscription per 100 are less correlated with per capita income. (Figures A1 to A6)

9. Measured in percentage of electricity power output (World Bank.2012a)

and low density of their road networks. In addition, to keep the road network in good condition, maintenance is another challenging task in Africa since it requires huge investment. Infrastructure development of other transport modes such as airports, seaports and railways in Africa face same challenges and ineffective linkage between different transport modes, declining air connectivity, poorly equipped ports and aging rail networks are key problems facing Africa's transport system (AFD-WB 2009, 233).

Water supply and sanitation (WSS): Only 61% of SSA countries' population has access to safe drinking water, which is below the world LMIC average of 86% and MDG's target rate of 75% by 2015. The rates are below 50% in Somalia, Ethiopia, the Democratic Republic of the Congo, Madagascar, Mozambique and Niger. Urban and rural disparities are also prominent – more than half of the rural population has no access to safe water in SSA countries. Access to adequate sanitation is even worse. Only 30% of the population in SSA countries lives in households with access to adequate sanitation and the rate is lower in rural areas. There are 12 low-income countries where more than 90% of the population has no access to adequate sanitation in rural areas.
Irrigation: While more than two-thirds of Africans rely on agriculture for a living, the average amount of arable land developed for irrigation is only 6% for a selected 28 African countries, compared with 39% in Asia and nearly 30% in Latin American countries (Bluffstone and Kohlin 2011, 6). Low levels of irrigation mean that few SSA countries can sustain yield increases, even with abundant rainfall (UNDP 2012). The amount in Egypt is exceptionally high (99.7%) since Egypt's agriculture depends entirely on irrigation. Further improvement is an urgent requirement for sustainable food production in Africa.

Information and communication technology (ICT): Approximately three-quarters of the world's inhabitants have access to mobile phones (World Bank 2012b, 23). The number of mobile subscriptions in use worldwide has grown from 1 billion in 2000 to over 6 billion in 2012, of which nearly 5 billion are in developing countries (ibid.). This trend is also true for some African countries. The number of mobile subscriptions per 100 people has increased dramatically since 2000; in 2010, North Africa (111 subscriptions) and some middle-income countries exceeded the world average (78 subscriptions). As for the penetration of telephone lines and the Internet, Africa still has low rates

especially in oil-exporting countries and low-income countries, suggesting the digital divide is a critical issue. It is still essential for African governments to develop the telecommunications sector.

2.2 Infrastructure by country groups

The infrastructure challenge differs among country type (Table 1). North Africa showed the highest level of infrastructure in quality and quantity in all the sectors. However, its electricity consumption per capita is still insufficient (average 1,751kWh per capita) compared with the world average (2,807kWh), though it exceeds the world LMIC average (1,527 kWh). As for the middle income countries in Africa, further improvement in both quality and quantity in the energy sector is necessary; and particularly, the rate of electric power transmission and loss is the highest among all the country groups (35%), due to the high figure for Botswana (79%).

Recent economic growth in Africa is attributed to price hike in energy and mineral resources[10] and oil exporting countries play a great role in economic growth of Africa. However, infrastructure development in oil exporting countries is stagnant, despite their higher GDP per capita and abundant natural resources revenue.[11] In particular, the level of infrastructure stock and quality in the transport sector are lower than low income countries. In addition, oil-exporting countries significantly lag in terms of quantity and quality in electricity services. Therefore, considering how to allocate additional fiscal resources from natural resources to infrastructure effectively (particularly in transport and energy sector) is urgent.

The low income African countries are facing a severe situation in all the sectors of infrastructure. The available data shows that there is no significant difference in infrastructure between fragile and non-fragile countries. In particular, power is the largest infrastructure challenge, especially in non-fragile countries (average rate of access to electricity is only 23% and electricity consumption per capita is the lowest, 240kWh), and both quantity expansion and quality improvement are urgent requirements.

10. Refer to Introduction of this report.

11. This is because they used most of their revenue from oil exports for debt repayment (AFD-WB 2009, 76).

Table 1. Infrastructure in African countries

	Transport				Energy			Water & Sanitation						Agriculture	Information & Communication technology			GDP
	Roads paved (% of total)		Road density		Access to electricity (%)	Electricity consumption (kWh per capita)	Electric power transmission and distribution losses (% of	Improved water source (% of population with access)			Improved sanitation facilities (% of population with access)			Irrigated Area to Arable area (%)	Telephone line per 100 people	Mobile subscription per 100 people	Internet users per 100 people	GDP per capita PPP
								Total	Urban	Rural	Total	Urban	Rural					
	2001-2009		2001-2009		2009	2009	2009	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010
Sub-Saharan Africa	18.8	-	-	-	32.4	517	11.2	61.1	82.7	48.6	30.6	42.4	23.4	-	1.4	44.9	11.3	-
Low & Middle income (World)	44.8	-	21.5	(2008)	73.7	1,527	11.1	86.4	95.0	79.6	56.2	72.5	43.0	-	11.9	71.8	21.5	-
World	64.9	-	30.2	(2008)	74.1	2,807	8.4	88.4	96.2	80.8	62.5	79.1	46.6	-	17.2	78.2	30.2	-
North Africa					*99.0*	*1,751*	*14.0*	*82.6*	*87.2*	*75.6*	*88.4*	*94.2*	*78.6*	-	*12.7*	*111.4*	*27.8*	-
Algeria (DZA)	74.0	-	5.0	-	99.3	971	20.6	83.0	85.0	79.0	95.0	98.0	88.0	6.8	8.2	92.4	12.5	7,564
Egypt (EGY)	89.4	-	10.0	-	99.6	1,549	10.5	99.0	100.0	99.0	95.0	97.0	93.0	99.7	11.9	87.1	26.7	5,544
Libya (LBY)	57.2	(2001)	5.0	(2001)	99.8	4,170	14.0	54.0	54.0	55.0	97.0	97.0	96.0	22.9	19.3	171.5	14.0	15,361
Morocco (MAR)	70.3	-	13.0	-	97.0	756	11.7	83.0	98.0	61.0	70.0	83.0	52.0	16.2	11.7	100.1	49.0	4,227
Tunisia (TUN)	75.2	-	12.0	-	99.5	1,311	13.0	94.0	99.0	84.0	85.0	96.0	64.0	8.9	12.3	106.0	36.6	8,566
Middle income countries					*54.0*	*2,537*	*34.8*	*83.8*	*92.0*	*76.1*	*53.6*	*69.0*	*39.3*	-	*10.1*	*79.3*	*14.7*	-
Botswana (BWA)	32.6	(2005)	4.0	(2005)	45.4	1,503	79.3	96.0	99.0	92.0	62.0	75.0	41.0	-	6.8	117.8	6.0	12,462
Cape Verde (CPV)	69.0	(2001)	33.0	(2001)	-	-	-	88.0	90.0	85.0	61.0	73.0	43.0	-	14.5	75.0	30.0	3,476
Djibouti (DJI)	45.0	(2001)	14.0	(2001)	-	-	-	88.0	99.0	54.0	50.0	63.0	10.0	-	2.1	18.6	6.5	2,087
Lesotho (LSO)	18.3	(2001)	20.0	(2001)	16.0	-	-	78.0	91.0	73.0	26.0	32.0	24.0	-	1.8	45.5	3.9	1,437
Mauritania (MRT)	26.8	(2007)	1.0	(2007)	-	-	-	50.0	52.0	48.0	26.0	51.0	9.0	-	2.1	79.3	3.0	2,203
Mauritius (MUS)	98.0	-	101.0	-	99.4	-	-	99.0	100.0	99.0	89.0	91.0	88.0	49.5	29.8	91.7	28.7	12,286
Namibia (NAM)	14.7	-	5.0	-	34.0	1,576	15.3	93.0	99.0	90.0	32.0	57.0	17.0	-	6.7	67.2	6.5	5,808
Seychelles (SYC)	96.5	-	110.0	-	-	-	-	-	100.0	-	-	98.0	-	-	25.5	135.9	41.0	20,734
South Africa (ZAF)	17.3	(2001)	30.0	(2001)	75.0	4,532	9.8	91.0	99.0	79.0	79.0	86.0	67.0	8.3	8.4	100.5	12.3	9,477
Swaziland (SWZ)	30.0	(2002)	21.0	(2002)	-	-	-	71.0	91.0	65.0	57.0	64.0	55.0	-	3.7	61.8	9.0	5,339
Oil exporting countries					*39.2*	*296*	*24.2*	*64.7*	*79.4*	*43.1*	*39.6*	*49.6*	*29.3*	-	*1.3*	*58.5*	*9.1*	
Angola (AGO)	10.4	(2001)	4.0	(2001)	26.2	202	10.1	51.0	60.0	*38.0*	58.0	85.0	19.0	2.17	1.6	46.7	10.0	5,549
Cameroon (CMR)	17.0	(2008)	6.0	(2008)	48.7	271	9.4	77.0	95.0	52.0	49.0	58.0	36.0	-	2.8	44.1	4.0	2,058
Chad (TCD)	0.8	(2000)	3.0	(2006)	-	-	-	51.0	70.0	44.0	13.0	30.0	6.0	0.69	0.5	23.8	1.7	1,229
Congo, Rep (COG)	7.1	(2006)	5.0	(2004)	37.1	146	73.4	71.0	95.0	32.0	18.0	20.0	15.0	-	0.2	94.0	5.0	3,808
Equatorial Guinea (GNQ)	-	-	10.0	(2001)	-	-	-	-	-	-	89.0	92.0	87.0	-	1.9	57.0	6.0	31,174
Gabon (GAB)	12.0	(2007)	3.0	(2007)	36.7	922	18.2	87.0	95.0	41.0	33.0	33.0	30.0	-	2.0	106.9	7.2	13,504
Nigeria (NGA)	15.0	(2004)	21.0	(2004)	50.6	121	5.9	58.0	74.0	43.0	31.0	35.0	27.0	0.7	0.7	55.1	28.4	2,152
South Sudan (SSD)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sudan (SDN)	36.3	(2001)	1.0	(2001)	35.9	114	28.1	58.0	67.0	52.0	26.0	44.0	14.0	8.9	0.9	40.5	10.2	2,023

	Transport				Energy			Water & Sanitation						Agriculture	Information & Communication technology			GDP
	Roads paved (% of total)		Road density		Access to electricity (%)	Electricity consumption (kWh per capita)	Electric power transmission and distribution losses (% of	Improved water source (% of population with access)			Improved sanitation facilities (% of population with access)			Irrigated Area to Arable area (%)	Telephone line per 100 people	Mobile subscription per 100 people	Internet users per 100 people	GDP per capita PPP
								Total	Urban	Rural	Total	Urban	Rural					
	2001-2009		2001-2009		2009	2009	2009	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010
Low-income nonfragile countries					*22.5*	*240*	*16.7*	*63.7*	*87.5*	*54.5*	*27.4*	*37.7*	*22.3*	-	*0.9*	*43.0*	*7.7*	
Benin (BEN)	9.5	(2004)	17.0	(2004)	24.8	91	-	75.0	84.0	68.0	13.0	25.0	5.0	-	1.5	79.9	3.1	1,424
Burkina Faso (BFA)	4.2	(2004)	34.0	(2004)	14.6	-	-	79.0	95.0	73.0	17.0	50.0	6.0	0.4	0.9	34.7	1.4	1,127
Ethiopia (ETH)	13.7	(2007)	4.0	(2007)	17.0	46	9.5	44.0	97.0	34.0	21.0	29.0	19.0	3.7	1.1	8.3	0.8	934
Ghana (GHA)	12.6	-	46.0	-	60.5	265	23.3	86.0	91.0	80.0	14.0	19.0	8.0	0.4	1.1	71.5	9.6	1,475
Kenya (KEN)	14.3	-	11.0	-	16.1	147	15.5	59.0	82.0	52.0	32.0	32.0	32.0	1.8	0.9	61.6	25.9	1,481
Madagascar (MDG)	11.6	(2001)	8.0	(2001)	19.0	-	-	46.0	74.0	34.0	15.0	21.0	12.0	30.6	0.7	37.2	1.7	869
Malawi (MWI)	45.0	(2003)	13.0	(2003)	9.0	-	-	83.0	95.0	80.0	51.0	49.0	51.0	1.6	1.1	20.4	2.3	791
Mali (MLI)	24.6	-	2.0	-	-	-	-	64.0	87.0	51.0	22.0	35.0	14.0	4.7	0.7	48.4	2.7	955
Mozambique (MOZ)	20.8	-	4.0	-	11.7	453	9.0	47.0	77.0	29.0	18.0	38.0	5.0	2.5	0.4	30.9	4.2	845
Niger (NER)	20.7	(2008)	1.0	(2008)	-	-	-	49.0	100.0	39.0	9.0	34.0	4.0	0.5	0.5	24.5	0.8	653
Rwanda (RWA)	19.0	-	53.0	(2004)	-	-	-	65.0	76.0	63.0	55.0	52.0	56.0	-	0.4	33.4	12.5	1,044
Senegal (SEN)	32.0	-	8.0	-	42.0	196	17.0	72.0	93.0	56.0	52.0	70.0	39.0	3.4	2.7	67.1	16.0	1,736
Tanzania (TZA)	6.7	-	11.0	-	13.9	86	19.4	53.0	79.0	44.0	10.0	20.0	7.0	1.7	0.4	46.8	11.0	1,286
Uganda (UGA)	23.0	(2003)	29.0	(2003)	-	-	-	72.0	95.0	68.0	34.0	34.0	34.0	0.1	1.0	38.4	13.0	1,141
Zambia (ZMB)	22.0	(2001)	12.0	(2001)	18.8	635	23.4	61.0	87.0	46.0	48.0	57.0	43.0	6.55	0.7	41.6	10.1	1,401
Low-income fragile countries					*30.4*	*299*	*20.3*	*69.5*	*87.6*	*58.3*	*27.8*	*40.8*	*20.1*	-	*1.5*	*37.7*	*5.0*	
Burundi (BDI)	10.4	(2004)	44.0	(2004)	-	-	-	72.0	83.0	71.0	46.0	49.0	46.0	-	0.4	13.7	2.1	366
Central African Republic (CAF)	-	-	4.0	(2001)	-	-	-	67.0	92.0	51.0	34.0	43.0	28.0	-	0.1	22.2	2.3	708
Comoros (COM)	76.5	(2001)	39.0	(2001)	-	-	-	95.0	91.0	97.0	36.0	50.0	30.0	-	2.9	22.5	5.1	983
Congo, Dem. Rep (COD)	1.8	(2004)	7.0	(2004)	11.1	104	4.9	45.0	79.0	27.0	24.0	24.0	24.0	-	0.1	17.9	0.7	311
Cote d' Ivoire (CIV)	7.9	(2007)	25.0	(2007)	47.3	203	25.0	80.0	91.0	68.0	24.0	36.0	11.0	1.0	1.4	76.1	2.6	1,704
Eritrea (ERI)	21.8	(2001)	3.0	(2001)	32.0	51	11.9	-	-	-	14.0	52.0	4.0	-	1.0	3.5	5.4	490
Gambia, The (GMB)	19.3	(2004)	33.0	(2004)	-	-	-	89.0	92.0	85.0	68.0	70.0	65.0	-	2.8	85.5	9.2	1,265
Guinea (GIN)	9.8	(2007)	18.0	(2003)	-	-	-	74.0	90.0	65.0	18.0	32.0	11.0	-	0.2	40.1	1.0	978
Guinea-Bissau (GNB)	27.9	(2002)	12.0	(2002)	-	-	-	64.0	91.0	53.0	20.0	44.0	9.0	-	0.3	39.2	2.5	1,064
Liberia (LBR)	6.2	(2001)	10.0	(2001)	-	-	-	73.0	88.0	60.0	18.0	29.0	7.0	-	0.1	39.3	7.0	376
Sao Tome and Principe (STP)	68.1	(2001)	33.0	(2001)	-	-	-	89.0	89.0	88.0	26.0	30.0	19.0	18.5	4.6	62.0	18.8	1,704
Sierra Leone (SLE)	8.0	(2002)	-	-	-	-	-	55.0	87.0	35.0	13.0	23.0	6.0	-	0.2	34.1	0.3	742
Somalia (SOM)	11.8	(2001)	3.0	(2001)	-	-	-	29.0	66.0	7.0	23.0	52.0	6.0	-	1.1	6.9	1.2	-
Togo (TGO)	21.0	(2007)	21.0	(2007)	20.0	111	53.1	61.0	89.0	40.0	13.0	26.0	3.0	-	3.5	40.7	5.4	895
Zimbabwe (ZWE)	19.0	(2002)	25.0	(2002)	41.5	1026	6.6	80.0	98.0	69.0	40.0	52.0	32.0	4.5	3.0	61.2	11.5	-

Source:World Bank 2012a and ICID 2010

Note: The majority of the data is as of year stated. However, if the data are not available, they are taken from the most recent year.

The figures in *Italics* represent the average value of respective country groups which are calculated by a simple arithmetic average using available data.

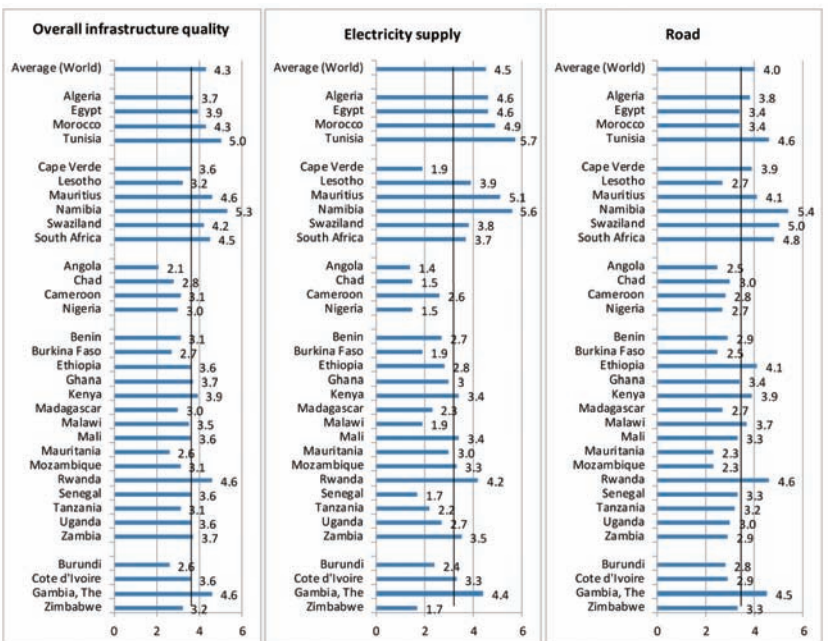
The aggregated figures of Sub-Saharan Africa, Low and Middle income (World) and World are taken from the World Bank 2012a.

These aggregated figures are not consistent with the average figures mentioned above due to a different computation method.

2.3 Infrastructure and a country's competitiveness

It is useful to see the perception of private businesses regarding infrastructure as one of the key components to a country's competitiveness. WEF 2011[12] shows that almost all African countries are assessed as inferior to the world average in terms of quality except Tunisia, Mauritius, Namibia, South Africa, Gambia and Rwanda (Figure 1). Poor infrastructure quality in oil-exporting countries is noticeable mainly due to the poor reliability of the electricity supply. The infrastructure index ranking shows 24 out of 33 African countries are ranked below 100 out of 142 surveyed countries. It is obvious that the poor infrastructure quality of SSA countries negatively affects a country's global competitiveness.

Figure 1. Infrastructure quality of selected African countries



Notes: The vertical line (bold) is the average of scores for 33 African countries.
Aveage (world) is the average of scores for all the 142 surveyed countries for each item.
Scores given by respondents range from 1(= extremely underdeveloped) to 7(= extensive and efficient by international standards).
Source: WEF 2011

12. WEF 2011 covers 33 African countries.

2.4 Infrastructure spending needs and funding and efficiency gaps

Infrastructure of all sectors is substantially underdeveloped in Africa, though variations exist between countries and sectors. Special attention should be paid to the power sector (by sector), and to the low income countries (by country groups). According to AFD-WB 2009, the cost of addressing Africa's infrastructure needs for 2006 through 2015 amounts to US$93 billion a year, about one third of which is for maintenance (Table 2).

Africa's annual infrastructure spending (2001 to 2006)[13] is estimated at US$45.3 billion. 66% of the overall spending is financed by the domestic public sector, and the rest, 34%, (US$15.5 billion) is from external sources, where the share of ODA is 7.9%, non-OECD financiers 5.5% and private sector 20.7% (AFD-WB 2009, 8-9).

Given infrastructure annual spending needs (US$93.3 billion) and the annual existing spending (US$45.3 billion), the annual financial gap is estimated at US$48 billion, comprising of an efficiency gap (US$17 billion) and funding gap (US$31 billion). Electricity is the sector most in need of additional funding, followed by WSS and irrigation. These have an aggregate need of US$23 billion while ICT and transport receive more than their needs (Table 2).

Table 2. Africa's infrastructure spending needs, and funding and efficiency gaps, 2006-15[14]

Item ($billions annually)	Electricity	ICT	Irrigation	Transport	WSS	Cross-Sector Gain	Total
Infrastructure spending needs	-40.8	-9.0	-3.4	-18.2	-21.9	n/a	-93.3
Existing spending	11.6	9.0	0.9	16.2	7.6	n/a	45.3
Efficiency gap	6.0	1.3	0.1	3.8	2.9	3.3	17.4
Gain from raising capital execution	0.2	0.0	0.1	1.3	0.2	n/a	1.9
Gain from eliminating operational inefficiencies	3.4	1.2	-	1.9	1.0	n/a	7.5
Gain from tariff cost recovery	2.3	-	-	0.6	1.8	n/a	4.7
Potential for reallocation	n/a	n/a	n/a	n/a	n/a	3.3	3.3
Funding gap	-23.2	1.3	-2.4	1.9	-11.4	3.3	-30.6

Source: AFD-WB 2009

Note: n/a = not applicable; - = not available

13. The study identifies four major financial sources including: domestic public sector, ODA from OECD member countries, non-OECD countries like China, India and the Arab states, and private sector; and sum up their spending on the capital investment and O&M in electricity, ICT, irrigation, transport, water supply and sanitation and cross-sector projects (AFD-WB 2009, 66-67).

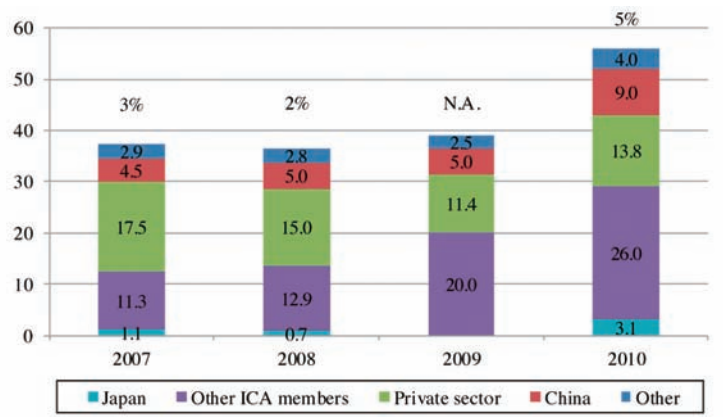
14. AFD-WB 2009 (66-67) identifies four major financial sources including: domestic public sector, ODA from OECD member countries, non-OECD countries like China, India and the Arab states, and private sector; and sum up their spending on the capital investment and O&M in electricity, ICT, irrigation, transport, water supply and sanitation and cross-sector projects.

3. Trend of Financial Resources for Infrastructure and Japan's Aid

3.1 Infrastructure financing source and gap

In response to financial needs, the financial commitment of external sources rapidly increased from 2005 to 2010 (ICA 2011, 20). In addition, the share of the power sector, whose financial gap is the largest among the sectors (Table 2), accounted for 44% in 2010 (ICA2011, 22). The share of Japan's ODA in 2010 was 5% of total commitments by external sources, or 10% of commitments by ICA members (Figure 2). This increasing trend regarding Japan's commitment is a recent phenomenon because the high indebtedness of African countries prevented loan assistance until 2005, and political instability and conflicts hampered new infrastructure investment. Japan has waived debt repayments for African countries under the international debt relieve initiatives,[15] and commenced the Enhanced Private Sector Assistance for Africa (EPSA) initiative in 2005, pledging US$1 billion in ODA loans to Africa for five years. TICAD IV in 2008 has also contributed to speed up infrastructure assistance.

Figure 2. ICA Members Financial Support for African Infrastructure



Source: ICA 2008, 2009, 2010, 2011
Note: ICA Total Commitments 2007-2010; Billions of Dollars;
Data of Japan's commitment in 2009 is not available.; Percentage shows a share of Japan's commitments.

3.2 Japan's infrastructure assistance

A more detailed picture of Japan's ODA for Africa's infrastructure is reviewed through the original database of yen loans and grants for 2005

15. For Africa, Japan waived debt repayments amounting to JPY 765.3 billion (ODA debt JPY 440.2 billion and non-ODA JPY 325.1 billion) from 2003 to 2011 (MOFAJ 2011).

to 2011, and technical cooperation (TC) for 2005 to 2010 constructed from the JICA project database.[16] The data for grants or loans is based on commitments in the period (as of the signing of the Exchange of Notes), while that of TC is on an actual disbursement basis.[17] The loans and grants assistance is usually provided for new capital investment or rehabilitation projects; in addition, the loan projects often include the capacity building components of executing agencies. Japan's TC is provided as grants, and includes project formulation studies, the dispatch of experts, training of recipient government officials, and provision of equipment.

3.2.1 Japan's loans and grants assistance

Japan's ODA loans/grants average annual commitment (2005-2011) for Africa's infrastructure amounts to Yen 77.8 billion (65%) out of the total annual commitment of Yen 119.0 billion[18] (Table 3). Out of this annual average commitment for infrastructure, North Africa receives Yen 30.2 billion (39%) and SSA countries receive Yen 47.5 billion (61%). As for the proportion between loans and grants, while loans accounts for 96% in North Africa, in SSA countries the loan/grant proportion is almost equal (loans 52% and grants 48%), reflecting the different income levels and borrowing capacity of the two groups (Table A2, Figure 3).

Regarding the sectoral breakdown (Africa total), transport has the largest share (38%), followed by power (32%) and WSS (23%). In North Africa, power is the largest (37%), followed by WSS (31%) and transport (24%). In SSA countries, transport represents a much higher share (46%), followed by power (29%) and WSS (19%) (Table A2, Figure 4).

16. Although the JICA project database covers all ODA loan projects, it does not cover all grants and TC projects. Nevertheless, it is sufficient to review the overall picture of Japan's grants and TC assistance because of the substantial coverage of the JICA database.

17. The data is on a calendar year basis. The sectoral category is in accordance with that of OECD-DAC. Since TC projects are basically on a shorter implementation period, the time lag of commitment and disbursement is generally small.

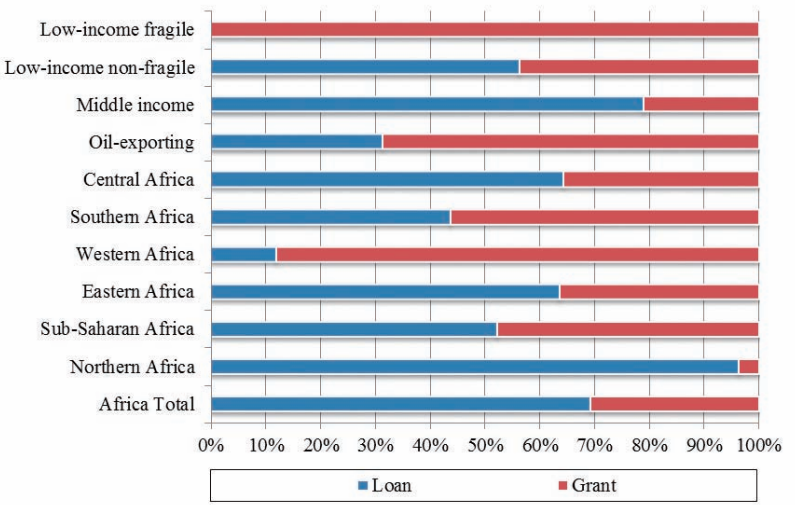
18. The total commitments include ODA loans amounting to JPY 7.4 billion (annual average 2005-2011) to African Development Bank (AfDB) for private sector -lending programs, which cannot be broken down to individual infrastructure sectors.

Table 3. Japan's Financial Commitment Regarding Africa's Infrastructure

	JPY millions			Share	
Total Commitment, 05-11 (Annual Ave.)	Total	Infrastructure	Non-Infrastructure	Infrastructure	Non-Infrastructure
Africa Total	118,964	77,757	41,207	65%	35%
AfDB	7,434	0	7,434	0%	100%
Northern Africa	41,223	30,210	11,014	73%	27%
Sub-Saharan Africa	70,306	47,547	22,759	68%	32%

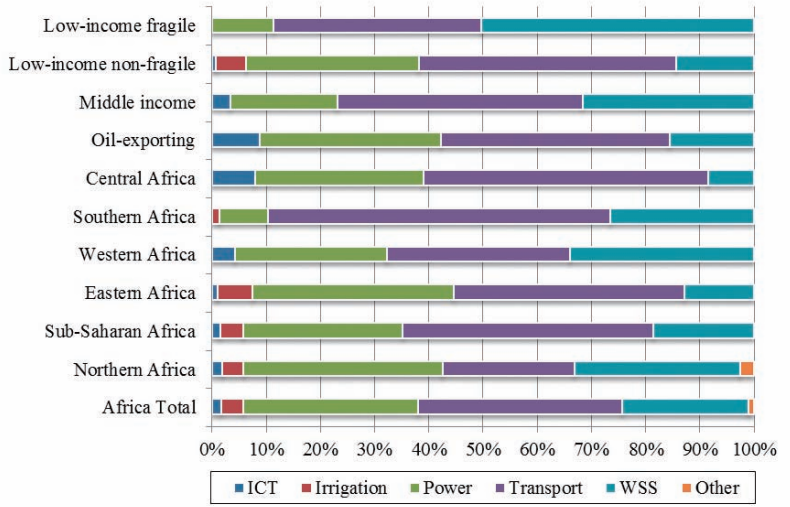
Source: Compiled by author from JICA project database

Figure 3. Modality Share of Japan's Financial Commitment Regarding Africa's Infrastructure



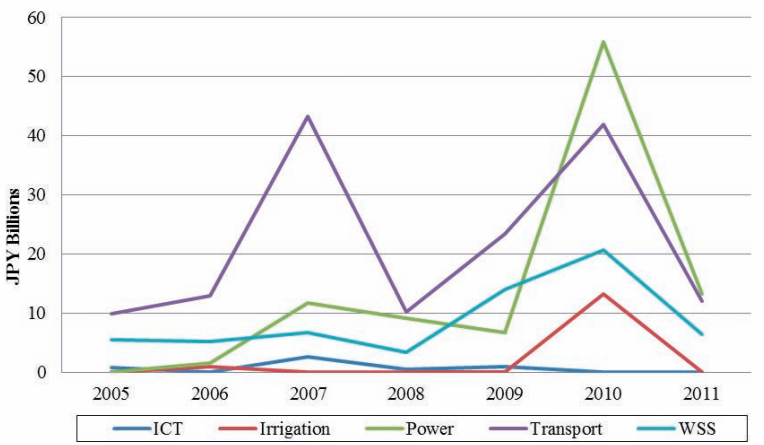
Source: Compiled by author from JICA project database

Figure 4. Sectoral Share of Japan's Financial Commitment Regarding Africa's Infrastructure



Source: Compiled by author from JICA project database

Figure 5. Sectoral Trend of Japan's Financial Commitment Regarding Infrastructure in Sub-Saharan Africa



Source: Compiled by author from JICA project database

We will review Japan's ODA loans/grants regarding infrastructure in SSA countries in more detail. While the annual commitments of loans/grants noticeably fluctuate, the commitment to the power sector in 2010 was quite high (Figure 5). This increase was because several project loans, which had been under preparation, were provided in this single year. Within the transport sector, road and bridge projects account for 75%, while seaports receive 25%. As for the proportion of loans and grants, it is almost equal in transport; 77% of the commitment in power is by loans; and WSS is mostly funded by grants (89%). This difference of loan/grant proportion by sector is mainly due to the different economic and financial returns of these sectors because both African countries and Japan prefer using grants to lower return projects.

Within SSA countries, the eastern Africa region (11 countries) accounts for 61%, followed by the southern African region comprising 15 countries (22%). This is because the western and central African countries include more fragile states and oil producing countries. As to the country's income categories, the low-income non-fragile countries (15 countries) received 77%, and the shares of the other three categories are between 7% and 8%. The low income non-fragile states are the main target of infrastructure assistance because of their income levels and absorption capacity. Low-income fragile states received a small share of infrastructure assistance (7%), which is for transport and WSS funded only by grants, because of serious constraints owing to peace and order issues, debt sustainability, and aid absorption capacity.

3.2.2 Japan's technical cooperation (TC)

The annual average disbursement of TC (2005-2010) amounts to Yen 30.4 billion, of which 20% is for infrastructure, and 80% is for non-infrastructure (Table 4). This is in sharp contrast to the loan/grant assistance which is used for upfront infrastructure investment. The sectoral breakdown of TC for infrastructure shows another contrast with the loan/grant assistance. WSS has the largest share (36%), followed by transport (27%) and irrigation (18%); and far less input into power (9%). Geographically, 84% of TC goes to SSA countries, so, the sectoral breakdown of SSA countries is almost the same as that of the African total as mentioned above. Within SSA countries, the share for western Africa is higher in TC (21%) than in loans/grants (14%) (Table A3). Distribution among the income groups is dominated by the low income non-fragile states (75%), and the other groups' shares are between 6 and

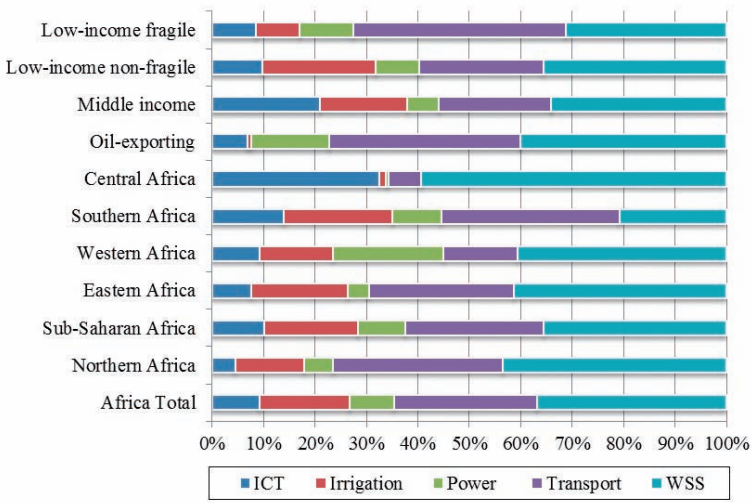
10%, which is almost the same pattern as that for loan/grant assistance.

Table 4. Japan's Technical Cooperation Regarding Africa's Infrastructure

	JPY millions			Share	
Total Disbursement, 05-10 (Annual Ave.)	Total	Infrastructure	Non-Infrastructure	Infrastructure	Non-Infrastructure
Africa Total	30,390	6,018	24,372	20%	80%
Northern Africa	3,578	968	2,610	27%	73%
Sub-Saharan Africa	26,811	5,050	21,762	19%	81%

Source: Compiled by author from JICA project database

Figure 6. Sectoral Share of Japan's Technical Cooperation Regarding Africa's Infrastructure



Source: Compiled by author from JICA project database

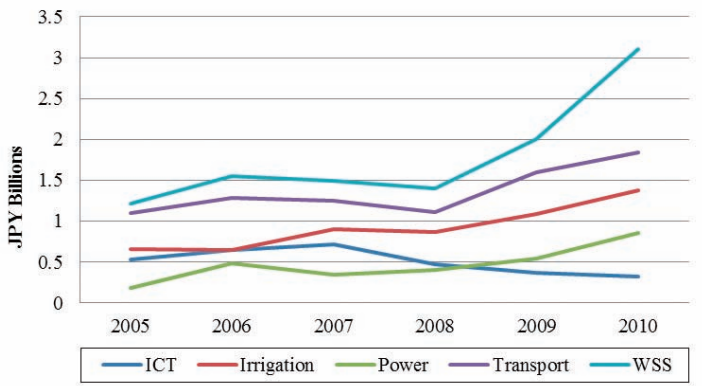
It is natural that the sectoral breakdown of TC does not coincide with that of loan/grant assistance, because there are TC projects which are closely related to investment projects and those which are not, as follows:

- ➢ TC is closely related to capital investment supported by loans/grants: pre-investment studies, capacity building of executing agencies, dispatch of experts, etc.
- ➢ When it is premature or difficult to implement investment projects due to economic and/or capacity constraints of countries, TC is provided mainly for efficiency improvement, for training of government officials, project identification, master planning,

provision of equipment, etc.

However, it may be reasonable to reallocate the TC resources to fulfill the efficiency gaps of Africa, which is one of the targets of assistance through TC, since the efficiency gaps of infrastructure is clearly estimated by AFD-WB 2009. As Table 2 shows, the efficiency gap is the largest in the power sector (US$6 billion annually), followed by transport and WSS, while the allocation of Japan's TC is weighted on WSS, transport and irrigation in order.

Figure 7. Sectoral Trend of Japan's Technical Cooperation Regarding Infrastructure in Sub-Saharan Africa



Source: Compiled by author from JICA project database

3.3 Policy implications

Japan's recent allocation of loan/grant assistance does not appear to match the spending needs or funding gap across the infrastructure sectors as in Table 2. Japan's loan and grant assistance for investment purposes is dominated by the transport sector, which is estimated to have a financial surplus by the AFD-WB 2009. Japan's TC, which can improve efficiency and facilitate infrastructure investment through capacity development and project preparation, is provided for the WSS (36%) and transport (27%) sectors in SSA countries. As seen in Table 2, the power sector in Africa has the largest funding and efficiency gaps among the sectors. Since private investment is playing a major role in the power sector (ICA2011), it does not necessarily mean that public funds, including Japan's ODA, should be used for capital investment in power projects. In addition, Japan's ODA has strengths and emphasis in certain sectors, including WSS (particularly in TC) and transport (both in loans/

grants and TC). However, it would be appropriate to consider how Japan's ODA – loans, grants, and TC – can better contribute to improve infrastructure investment in needy sectors such as power, and to more effectively remove infrastructure inefficiencies.

4. Policy Challenges Regarding Infrastructure Development in Africa and Future Direction of Japan's ODA

It appears that there is room for Japan's ODA to take more into account the recommendations of the AFD-WB 2009 (Box) for promoting infrastructure development in Africa. The most important characteristic of the recommendations of AFD-WB 2009 is the emphasis on closing efficiency gaps in Africa's infrastructure, though most of the recommendations are common to other parts of the world.[19] All of these recommendations are essential for infrastructure development in Africa, and should be pursued in the long term. This section discusses three key issues that Japan should urgently consider based on the analysis of Section 3 in relation to the recommendations (Box). The three issues are selected according to the following general criteria: they are areas where (i) African countries' needs are unmet; (ii) higher development impact is expected; and (iii) development impact is realized relatively in a short period of time, though we do not underestimate the importance of long-term interventions.

Box: 10 recommendations by AFD-WB 2009
1. Address Africa's infrastructure efficiency gap as a pressing policy priority
2. Make greater efforts to safeguard maintenance-related spending
3. Tackle inefficiency through institutional reform
4. Include line ministries and budgetary processes in the institutional reform agenda
5. Use administrative and regulatory reforms to get full value from existing infrastructure
6. Pursue regional integration to reduce infrastructure costs
7. Take a spatial view of infrastructure development priorities
8. Rethink infrastructure social policy
9. Find practical ways to broaden access to infrastructure services
10. Close the infrastructure funding gap

Source: AFD-WB 2009

19. For example, see twelve recommendations of ADB-JBIC-WB 2005 (xlvi – lvi) for East Asia.

4.1 Rethinking of sectoral allocation of Japan's ODA

The transport sector, especially roads, has received the largest share of Japan's ODA. While Japan's country assistance strategies for African countries give emphasis on infrastructure development, there is no clear policy on the allocation of funds between the sectors. Since Africa's infrastructure needs and funding gaps are estimated, it is time to rethink the allocation of Japan's ODA so that needy sectors can receive more support for more investment and efficiency improvement. In fact, JICA has recently been increasing loan/grant assistance to the power sector, and project preparation in Africa's power sector has been strengthened as shown in the increase of TC in the power sector (Figures 5 and 7).

Nevertheless, we do not mean that Japan's grant/loan assistance should immediately and directly go to financing power sector investment projects. It should be noted that the power sector (particularly power generation) is one of the few sectors which can expect capital investment by the private sector even in low-income countries (Leigland 2010). Japan's ODA to the power sector needs to be more carefully examined by sub-sector, as follows:

- Power generation: The possibility of private sector capital investment should always be explored in power generation projects. For this purpose, JICA should assist with the preparation of bankable projects through TC, regardless of whether they will be financed by the private or public sectors. When private capital investment is not possible, JICA should provide loans/grants for capital investment. Areas for Japan's ODA financing for investment would include: thermal plants in which private investors are not interested, renewable energy projects (e.g., geothermal and wind-power) whose investment risk is usually higher than conventional thermal plants; and hydropower projects which require social and environmental considerations. Some recent project examples include a geothermal project in Kenya and a wind power project in Egypt.
- Transmission, distribution and rural electrification: These sub-sectors would qualify for public sector funding because the private sector is less interested due to generally low commercial viability. Assistance both for project preparation and investment would be necessary.

In a hydropower project in Uganda, while the power station is invested

in by the private sector, the associated transmission lines are funded by JICA and AfDB through concessional loans. This sort of division of labor between private and public funds is common in power projects in Asia.
On the other hand, it is difficult to expect private sector capital investment in the WSS and irrigation sectors due to low commercial viability; and, therefore, public financing is expected to close the funding gap. In WSS, while Japan's ODA appears to place emphasis on efficiency improvement through TC, the low access rate to WSS is a serious problem (Section 2), suggesting room for Japan's assistance for WSS investment. Likewise, raising productivity in agriculture is essential for Africa's food security and economic transformation. Irrigation facilities are a vital component, together with improved inputs including fertilizers as shown in the green revolution in Asia. JICA should consider the possibilities of supporting new investment through loan/grant assistance in these two sectors.

Lastly, there is an important caution to be placed on the reallocation of Japan's assistance among the sectors. The estimation of the funding gaps is made on the assumption that current spending continues (Table 2). If all development partners shift from the transport to other sectors at once, there is the risk that the transport sector would be in deficit. In addition, as in Section 2, there are variations in infrastructure between sectors and countries and the infrastructure deficits of sub-sectors (particularly, roads, ports and railways) within the transport sector vary. Therefore, sectoral reallocation needs coordination with recipient countries and other development partners, and a careful review of infrastructure needs and gaps in each country should be undertaken. (If the current resource allocation to the transport sector is reconsidered, the prioritization of spending is necessary within the transport sector, including emphasis on regional connectivity discussed in Chapter 8, financial support for road maintenance in the next Sub-section 4.2, and reallocation between transport sub-sectors.)

4.2 Financial assistance for maintenance

Japan has always emphasized the importance of maintenance of infrastructure over the years through TC projects (e.g., road maintenance) and ex-post evaluation of projects. Japan's ODA, however, do not finance operation and maintenance expenditures, which shall be shouldered by recipient countries through their budget and user charges. Japan's assistance for strengthening infrastructure maintenance

has been through capacity building of maintenance techniques, financial management, etc., through technical assistance and overseas training. Japan only provides budget support, which possibly finances maintenance expenditures, on a limited basis in Africa, almost all in Tanzania.

JICA's ex-post evaluations found financial weaknesses in JICA-assisted infrastructure projects at the operation and maintenance stage in Africa.[20] JICA 2011 and 2012 include post-evaluations of fourteen (14) infrastructure projects funded by loans or grants in Africa. Out of 8 projects whose sustainability is rated "medium," six (6) projects (43%), which are rated "medium," have problems related to insufficient budget allocation or low cost recovery at the operation and maintenance stage.[21]

Ultimately, there are only two financing sources for infrastructure investment, operation and maintenance: tax and user charges.[22] Therefore, in order to have the financial resources for infrastructure, governments, developers and service providers need to adopt cost-reflective tariffs when service charges are collected, and exert tax collection efforts to cover the cost in the case of non-revenue generating projects. Careful attention should be paid to affordability by poorer sections of society, for example, through designing targeted subsidy schemes and adopting more cost effective technologies. In the long run, Japan's ODA should help developing countries in Africa take the self-help approach

In the short run, however, Japan should reconsider its approach to strengthening maintenance in Africa. The finding that insufficient budget and cost recovery caused insufficient maintenance in JICA-funded projects means that non-financial capacity building alone cannot address insufficient maintenance. Japan's financial assistance for maintenance, through (sector) budget support or sector program loans,

20. Insufficient maintenance due to insufficient budget and low cost-recovery is a problem common for most developing countries (JICA 2012).

21. In JICA post-evaluation, the rating of "sustainability" is in three grades: high, medium and low. Out of the 14 evaluated projects, 6 projects get high ratings and 8 projects get medium ratings regarding sustainability. There are no low-rated projects regarding sustainability in JICA 2011 and 2012.

22. "Financiers – whether the private sector, or official lenders and donors - can change the requisite time profile of taxes or user charges by providing financing in the form of loans or equity, but eventually those loans need to be repaid or remunerated." (ADB-JBIC-WB 2005, 30)

can play an important role in the sustainability of infrastructure.

In addition, the financing of maintenance would have some advantages over new investments given the current situation in Africa: higher return and quicker impact. While a new investment project takes time from project preparation to completion, maintenance investment generally requires a shorter time because of minimal environmental considerations, a shorter time for contractor selection, less technical complexities, etc. Particularly, the economic return for road maintenance in SSA countries is quite high (138.8%) according to AFD-WB 2009 (70-71). If this statement is combined with the argument in Sub-section 4.1 – sectoral reallocation of resources – the policy implication is that a portion of the funds for new road investment should be shifted to road maintenance.

Before embarking on financial assistance for maintenance in Africa, there are two important considerations. First, it can and should be selective in terms of recipient countries and sectors. As in JICA 2011 and 2012, it should be noted that 57% of projects still have no problem with budget allocation or cost recovery. In addition, capacity constraints on the Japan side and fiduciary risks of recipient countries should also be taken into account. Countries and sectors for financial assistance regarding maintenance should be carefully selected in consideration of capital investment projects in the past and if there are on-going projects. Second, Japan should have a phase-out policy from this type of assistance since maintenance cannot be supported forever. It has to be undertaken together with capacity development TC for budget management, infrastructure asset management, and maintenance techniques.

4.3 Assistance regarding management reform of public utilities

Three recommendations of AFD-WB 2009 (Nos. 3 to 5 of the Box) are regarding institutional and regulatory reforms. AFD-WB 2009 also finds that governance reform of public utilities is more successful in countries where broader governance reforms are in progress, and that some countries do well despite broader governance reform being delayed (106-108). The latter finding is consistent with the argument of pockets of effective agencies in weak governance states – "it is well established that even in countries that have poor governance and a weak public sector, exceptional well-functioning government and government supported agencies do exist"(Leonard 2010).

While there is no doubt that broader governance reform should be pursued, it would take time to produce results due to the political economy of African countries. Therefore, a realistic approach would be that while broader governance reform is executed, efforts should be made to create effective organizations which are expected to produce positive results through organizational reforms in the short run.[23] Japan should identify government agencies and public utilities of past, ongoing, and/or future Japan ODA projects, and should consider support for internal management and organizational reforms, and cost recovery mechanisms.

5. Conclusions

This chapter has reviewed the current status of infrastructure, and recent Japan ODA projects, and discussed three issues that Japan's infrastructure assistance should consider in light of the findings and recommendations of AFD-WB 2009. We have suggested rethinking resource allocation between sectors, financial assistance for infrastructure maintenance, and the organizational reform of executing agencies.

One of the strengths of Japan's ODA is that it can contribute both to address efficiency gaps and to close funding gaps through the three modalities: loans, grants and TC. These three modalities can be effectively used for various types of countries and sectors, depending on the stages of infrastructure development and the country's needs. One important note is that loan assistance is indispensable to increase Japan's financial support to Africa's infrastructure. In view of the fact that the high indebtedness of some African countries hampered Japan's infrastructure assistance, it is essential to pay careful attention to debt sustainability issues to sustain Japan's infrastructure assistance. In close coordination with other development partners, it would be more effective to reconsider Japan's infrastructure assistance strategy in Africa with new data and findings, and to take one step further by setting up an infrastructure assistance strategy for individual countries.

23. Some pockets of effective organizations in weak governance states were created through long-term management practices and strong organizational culture. This sort of effective organization cannot be created over a short period of time (Fujita 2011).

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Annex Tables and Figures

Table A1. Classification of countries

North Africa	Oil-exporting countries	Middle-income	Low-income non fragile	Low-income fragile countries
Algeria	Angola	Botsuwana	Benin	Burundi
Egypt	Cameroon	Cape Verde	Burkina Faso	Central African Republic
Libya	Chad	Djibouti	Ethiopia	Comoros
Morocco	Congo Rep	Lesotho	Ghana	Congo Demo Rep
Tunisia	Equatorial Guniea	Mauritania	Kenya	Cote d'Ivoire
	Gabon	Mauritius	Madagascar	Eritrea
	Nigeria	Namibia	Malawi	Gambia The
	South Sudan	Seychelles	Mali	Guinea
	Sudan	South Africa	Mozambique	Guinea-Bissau
		Swaziland	Niger	Liberia
			Rwanda	Sao Tome and Principe
			Senegal	Sierra Leone
			Tanzania	Somalia
			Uganda	Togo
			Zambia	Zimbabwe

Source: *World Bank (2010), IMF(2011)*

Table A2. Modality Share of Japan's Financial Commitment on Africa's Infrastructure by Sector

	JPY millions														
Total Commitment, 05-11 (Annual Ave.)	ICT		Irrigation		Power		Transport		WSS		Other		Total		Grand Total
	Loan	Grant	Loan	Grant	Loan	Grant	Loan	Grant	Loan	Grant	Loan	Grant	Loan	Grant	
Africa Total	582	693	2,634	570	21,732	3,382	18,437	10,864	9,746	8,326	791	0	53,923	23,834	77,757
Northern Africa	582	0	751	422	10,961	139	7,276	55	8,744	489	791	0	29,105	1,105	30,210
Sub-Saharan Africa	0	693	1,883	148	10,772	3,243	11,162	10,810	1,002	7,837	0	0	24,818	22,730	47,547
Eastern Africa	0	291	1,883	0	8,926	1,821	7,611	4,696	0	3,730	0	0	18,420	10,537	28,958
Western Africa	0	271	0	0	638	1,190	137	2,057	0	2,207	0	0	775	5,725	6,501
Southern Africa	0	0	0	148	787	137	2,764	3,833	1,002	1,758	0	0	4,553	5,876	10,429
Central Africa	0	131	0	0	420	96	649	223	0	142	0	0	1,068	592	1,660
Oil-exporting	0	298	0	0	420	724	649	792	0	533	0	0	1,068	2,347	3,415
Middle income	0	132	0	0	638	130	1,442	325	1,002	235	0	0	3,082	822	3,903
Low-income non-fragile	0	263	1,883	148	9,714	1,993	9,071	8,354	0	5,312	0	0	20,668	16,070	36,737
Low-income fragile	0	0	0	0	0	397	0	1,339	0	1,756	0	0	0	3,492	3,492
	Share														
Total Commitment, 05-11 (Annual Ave.)	ICT		Irrigation		Power		Transport		WSS		Other		Total		Grand Total
	Loan	Grant	Loan	Grant	Loan	Grant	Loan	Grant	Loan	Grant	Loan	Grant	Loan	Grant	
Africa Total	0.7%	0.9%	3.4%	0.7%	27.9%	4.3%	23.7%	14.0%	12.5%	10.7%	1.0%	0%	69.3%	30.7%	100%
Northern Africa	1.9%	0%	2.5%	1.4%	36.3%	0.5%	24.1%	0.2%	28.9%	1.6%	2.6%	0%	96.3%	3.7%	100%
Sub-Saharan Africa	0%	1.5%	4.0%	0.3%	22.7%	6.8%	23.5%	22.7%	2.1%	16.5%	0%	0%	52.2%	47.8%	100%
Eastern Africa	0%	1.0%	6.5%	0%	30.8%	6.3%	26.3%	16.2%	0%	12.9%	0%	0%	63.6%	36.4%	100%
Western Africa	0%	4.2%	0%	0%	9.8%	18.3%	2.1%	31.6%	0%	34.0%	0%	0%	11.9%	88.1%	100%
Southern Africa	0%	0%	0%	1.4%	7.5%	1.3%	26.5%	36.8%	9.6%	16.9%	0%	0%	43.7%	56.3%	100%
Central Africa	0%	7.9%	0%	0%	25.3%	5.8%	39.1%	13.4%	0%	8.5%	0%	0%	64.4%	35.6%	100%
Oil-exporting	0%	8.7%	0%	0%	12.3%	21.2%	19.0%	23.2%	0%	15.6%	0%	0%	31.3%	68.7%	100%
Middle income	0%	3.4%	0%	0%	16.4%	3.3%	36.9%	8.3%	25.7%	6.0%	0%	0%	78.9%	21.1%	100%
Low-income non-fragile	0%	0.7%	5.1%	0.4%	26.4%	5.4%	24.7%	22.7%	0%	14.5%	0%	0%	56.3%	43.7%	100%
Low-income fragile	0%	0%	0%	0%	0%	11.4%	0%	38.3%	0%	50.3%	0%	0%	0%	100%	100%

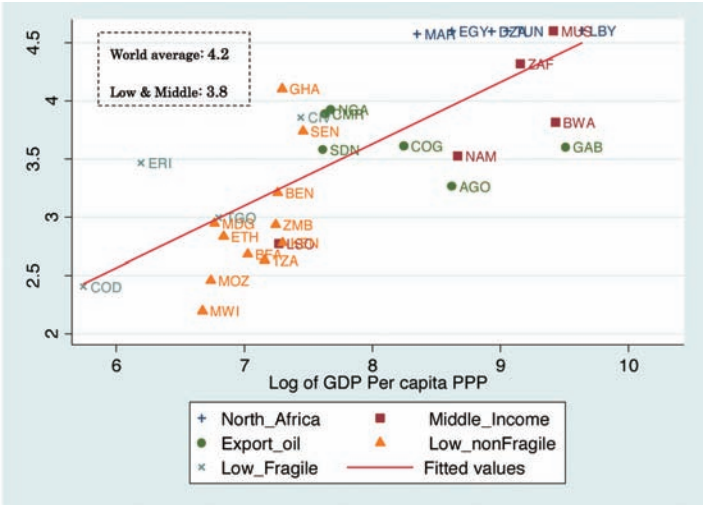
Source: Made by author from JICA project database

Table A3. Japan's Technical Cooperation on Africa's Infrastructure

Disbursement, Annual Average 05-10	JPY millions							Share						
	ICT	Irrigation	Power	Transport	WSS	Other	Total	ICT	Irrigation	Power	Transport	WSS	Other	Total
Africa Total	549	1,053	522	1,677	2,216	0	6,018	9%	18%	9%	28%	37%	0%	100%
Northern Africa	43	130	55	319	421	0	968	4%	13%	6%	33%	44%	0%	100%
Sub-Saharan Africa	506	923	468	1,359	1,794	0	5,050	10%	18%	9%	27%	36%	0%	100%
Eastern Africa	191	468	104	706	1,033	0	2,502	8%	19%	4%	28%	41%	0%	100%
Western Africa	97	150	228	151	429	0	1,056	9%	14%	22%	14%	41%	0%	100%
Southern Africa	200	304	136	498	300	0	1,439	14%	21%	9%	35%	21%	0%	100%
Central Africa	17	1	0	3	32	0	53	32%	1%	0%	6%	59%	0%	100%
Oil-exporting	34	3	75	182	196	0	490	7%	1%	15%	37%	40%	0%	100%
Middle income	59	48	18	62	97	0	283	21%	17%	6%	22%	34%	0%	100%
Low-income non-fragile	371	831	324	912	1,348	0	3,786	10%	22%	9%	24%	36%	0%	100%
Low-income fragile	42	41	51	203	153	0	490	9%	8%	10%	41%	31%	0%	100%

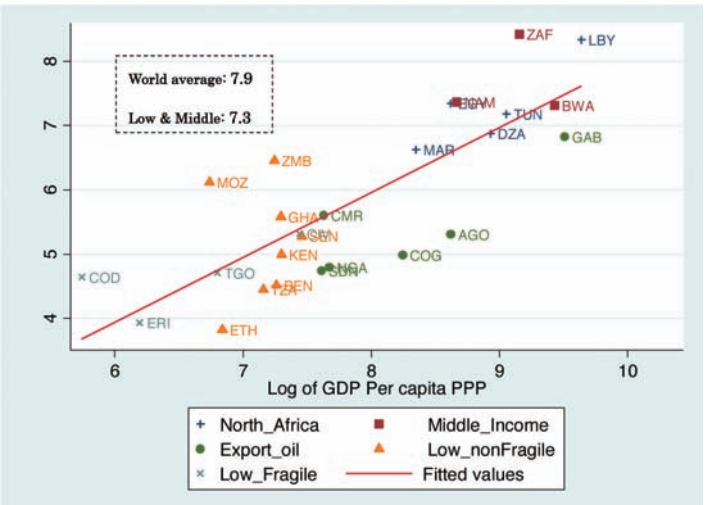
Source: Made by author from JICA project database

Figure A1. Log of roads, paved (% of total roads)



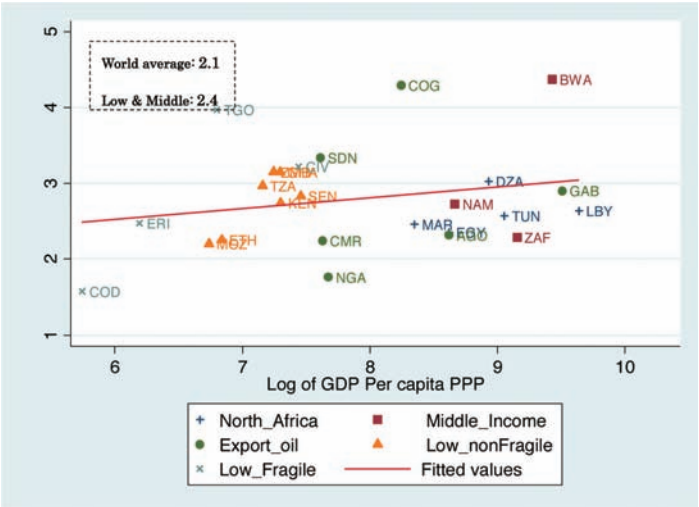
Source: World Bank 2012a

Figure A2. Log of Electricity power consumption (kWh per capita)



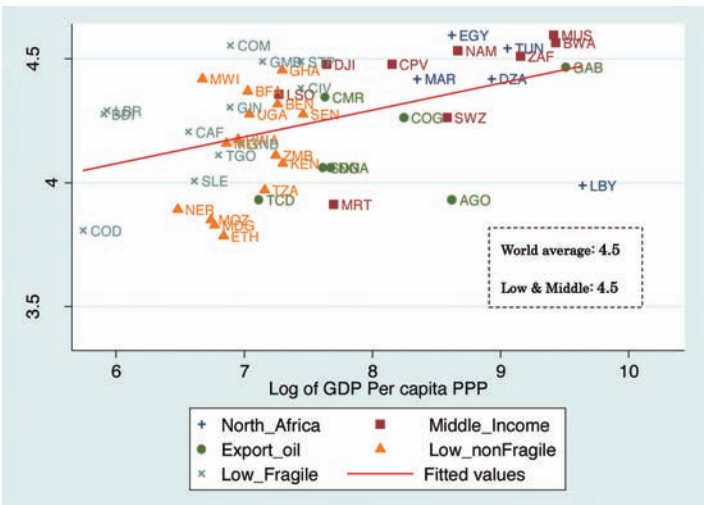
Source: World Bank 2012a

Figure A3. Log of electric power transmission and distribution losses (% of output)



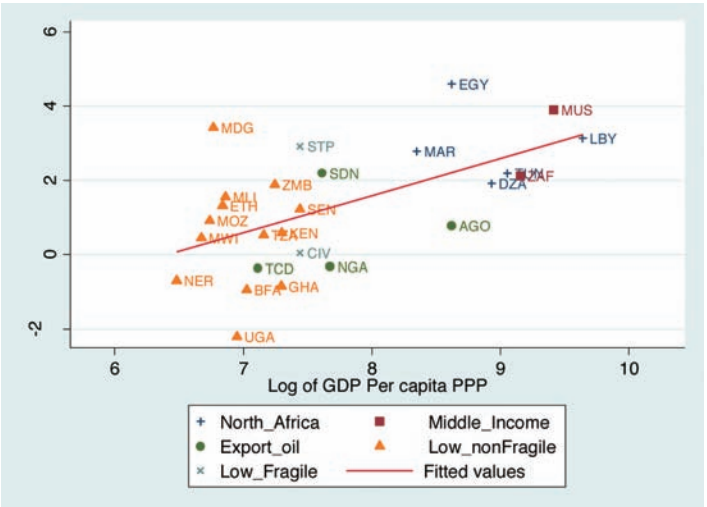
Source: World Bank 2012a

Figure A4. Log of Improved access to water sources (% of population with access)



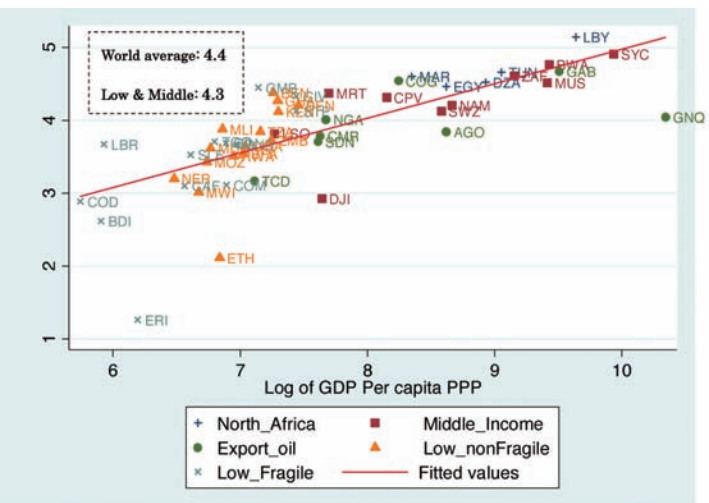
Source: World Bank 2012a

Figure A5. Log of Agriculture irrigated land (% of total arable land)



Source: ICID2010

Figure A6. Log of Mobile subscription per 100 people



Source: World Bank 2012a