ECONOMIC ANALYSIS OF
KOICA MATERNAL AND CHILD HEALTH PROJECT IN PARAGUAY

By

Jae-Hwi Kim

THESIS

Submitted to

KDI School of Public Policy and Management

in partial fulfillment of the requirements

for the degree of

MASTER OF PUBLIC POLICY IN ECONOMIC DEVELOPMENT

2012

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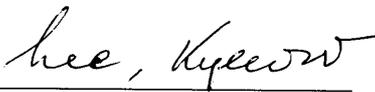
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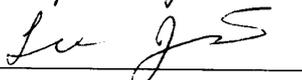
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ABSTRACT

ECONOMIC ANALYSIS OF
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High maternal and infant mortality have been one of the most pressing issues in development of Paraguay. To tackle this problem, KOICA maternal and child health project started in 2008 and completed in 2010. The purpose of this paper is to conduct economic analysis of the project and to examine the hypothesis that cost-effectiveness of this project in Paraguay is high in comparison to without the project case. Main motivation of this study comes from absence of rigorous economic evaluation of this project. To test the hypothesis, CEA (Cost-Effectiveness Analysis) method is adopted. In the analysis, cost-effectiveness of with the project case and without the project case is compared.

Major finding of the analysis is that without the project case is calculated to be more cost-effective than with the project case. This result contradicts the findings of an end-of-project evaluation report where the project is highly assessed by five DAC criteria. There are two reasons for this analysis result: First, high recurrent cost for doctors as a result of adoption of KOICA system leads to lower cost-effectiveness in with the project case; second, the output indicators derived from the stated project objective do not reflect actual outcome or health effects of the project given that three hospitals are functioning as a general hospital not maternal and child health specialized one.

For the first reason, in spite of advantages of KOICA system, budgetary sustainability of MSPBS and exacerbation of urban-rural gap come to the limelight and, in turn, should be taken into consideration in any health reform measures in Paraguay. Moreover, as the primary reason that output indicators cannot capture the actual health impact comes from insufficient project appraisal in the project cycle, it is advised that KOICA considers project appraisal as an essential part of project cycle.

ACKNOWLEDGEMENTS

Acknowledgement seems to be not enough to express gratitude for everyone and everything. In completing the thesis, Professor Kye-Woo Lee's disciplined guidance throughout the entire research helped me greatly and I could not have completed it without Professor Lee. For valuable research experience in Paraguay health evaluation project, I highly appreciate Ms Myung-Ok Kang's having given me an opportunity. Last but not least, my beloved family has always been the biggest motivation for me to further my study. Very special thank-you is given to Ms Park, my mother.

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Chapter 1: Introduction

1.1. Purpose of Study

This paper intends to examine the cost-effectiveness of the KOICA health project in Paraguay which was started in 2008 and completed in 2010. While a goal of economic analysis is to assess what would happen with and without the project, which would establish a firm rationale for the public involvement in the sector and the provision of project outputs at the planning stage, this paper will further look into the cost-effectiveness of the project at the actual outcome and health effects level after its completion in comparison with without the project case (i.e. do-nothing option).

This thesis focuses on the examination of cost-effectiveness of KOICA's maternal and child health project in Paraguay in comparison to without the project case. Therefore, there are lessons learned and policy implications from this health project.

1.2. Statement of the Problem

In the Republic of Paraguay full recognition of social problems derived from high maternal and infant mortality exists, as well as the high percentage of excluded population with lesser accessibility to health care services. According to the World Health Organization (WHO), 39% of the total population does not have access to health care services, especially in rural areas where the poor and the excluded class constitute a majority. In response to this issue, Paraguay adopted a Health Law which assured health care to "all people, in an equitable, timely and efficient manner-without discrimination of any kind" in 1996.[1]

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[1] World Bank, *Health Service Delivery in Paraguay: A Review of Quality of Care and Policies on Human Resources and User Fees* (Document of World Bank: 2006), n.p.,

However, there has consistently been concern about the quality of health care accessible for the poor. Paraguay had, in the mid 1990s, the second highest estimated maternal mortality in the region, (350 to 386/100,000 live births).[2] Wide disparities in the availability of maternal and child health care is found in the latest census of the country. International comparisons note that "Paraguay's health outcomes are worse than average in the case of maternal mortality and slightly better than average in infant mortality but show slow progress over time."[3] World Bank also pointed out that: "(i) Paraguay has been the country in Latin America with the slowest progress in reducing infant mortality in the last 50 years; (ii) maternal mortality has shown no progress in the last 15 years; (iii) the percentage of spending devoted to health is among the lowest in Latin America; (iv) there is large variation in outcomes by region and socioeconomic groups, with poor regions and quintiles doing significantly worse than rich regions and quintiles."[4] "Institutional data from the Ministry of Public Health and Social Welfare (*Ministerio de Salud Pública y Bienestar Social*, MSPBS) indicated that infant mortality was around the Regional average (40.8 per 100,000 live births), and concentrated around the neonatal period."[5]

This concern has been explicit in government policies. Compared to President Nicanor Duarte's government, in power from 2003 to 2008, whose policy focus was on "restoring

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http://www.cird.org.py/salud/docs/Paraguay_Health_Service_Delivery.pdf.

[2] World Bank, *Implementation Completion Report on a Loan to the Republic of Paraguay for a Maternal and Child Development Project* (Document of World Bank: 2005), 2, http://www-wds.worldbank.org/servlet/WDSContentServer/WDSP/IB/2005/06/30/000012009_20050630110326/Rendered/PDF/304010rev.pdf.

[3] World Bank, *Health Service Delivery in Paraguay: A Review of Quality of Care and Policies on Human Resources and User Fees*, n.p.

[4] World Bank, *Health Service Delivery in Paraguay: A Review of Quality of Care and Policies on Human Resources and User Fees*, 2.
http://www.cird.org.py/salud/docs/Paraguay_Health_Service_Delivery.pdf.

[5] World Bank, *Implementation Completion Report on a Loan to the Republic of Paraguay for a Maternal and Child Development Project*, 2.

faith in the institutions and sustainable economic growth,"[6] an incumbent Fernando Lugo's government, in power since 2008, "managed to advance elements of his social agenda, including increasing access to public health services."[7] The government established the strategies to contribute to fulfilling Millennium Development Goals, in which child and maternal health issues are primarily focused.

1.3. Significance of Study

KOICA published the end-of-project evaluation report of this health project in Paraguay. However, it has not been assessed whether financial and technical support in the KOICA health project is cost-effective. Without a rigorous economic analysis of the project, one is not able to check the cost-effectiveness. It is especially important to monitor the Korean government ODA budget to Paraguay is spent effectively. In addition, the analysis results and findings of this paper would have important policy implications not only for KOICA but for other international cooperation agencies working with Paraguayan government in the health sector. From the broader perspective, the paper will have implications to improve the quality of health services in Paraguay and potentially in other Latin American countries where similar conditions prevail.

1.4. Structure of the Thesis

Chapter 1 provides the introduction of this thesis. This chapter is followed by Chapter 2 which reviews literature on KOICA maternal and child hospital project and on maternal and

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[6] European Commission, *Paraguay Country Strategy Paper 2007-2013* (2007), 5, http://eeas.europa.eu/paraguay/csp/07_13_en.pdf.

[7] Freedom House, "Freedom in the World 2011: Paraguay", accessed June 7, 2012, http://www.freedomhouse.org/report/freedom-world/2011/paraguay.

child health system in Paraguay. Review goes on to existing economic analyses of health project tools, which leads to the research methodology of this thesis.

Chapter 3 describes the overview of the project and analyzes the cases with and without the project based on projection of health impacts and identification of project cost. The main health indicators and cost-effectiveness indicators in with and without the project cases are calculated and analyzed in comparison.

Chapter 4 discusses the result from the previous chapter and draws implications. Given the KOICA health project in Paraguay is analyzed to be inefficient in achieving the stated project objective, two reasons are examined, which are Higher recurrent cost for doctors as a result of adoption of KOICA system and three hospitals' functioning as a general hospital in practice.

The final chapter summarizes the result of the analysis and concludes the thesis with relevant implications that are drawn from the previous chapter.

Chapter 2: Literature Review and Methodology

The aim of literature review is threefold. First, KOICA maternal and child hospital project and the result of end-of-project evaluation of the identical project will be reviewed. This is to identify the objective and core components of the project and to examine the output or outcome at the completion. Second, health system in Paraguay is to be reviewed. Essential characteristics of the health system will be described along with major factors which could affect implementation of health project in Paraguay. Lastly, the economic analysis of health project has required intensive research into quantitative data and analysis framework. The review will mainly focus on general discussion regarding economic analysis of health project which is narrowed down to methodology of this paper.

2.1. Review on KOICA maternal and child hospital project

In response to the Paraguayan government initiative, the three-year project was supported by the Korea International Cooperation Agency (KOICA) from 2008 to 2010 with a total budget of 3.27 million US dollars. The project objective is to improve maternal and child health care services in Paraguay in order to improve quality of life. Project purposes include: increase in accessibility to maternal and child health care service; improvement in a quality of maternal and child health care service; capacity building of medical personnel.

The project is divided into two components. The first component is construction of maternal and child hospital in Limpio, Capiata and Villa Elisa (neighboring cities of Asuncion). At the three project sites, there used to be a basic health unit, and KOICA assisted project intended to expand and upgrade from the previous unit. Necessary medical equipment and start-up

supplies were provided to each hospital. This component is implemented by KOICA and local Construction Management company.

The other component comprises of an invitational training to Korea and dispatch of medical experts. It is designed to increase awareness of hygiene within the health facility and build capacity by providing opportunity to benchmark advanced medical system in Korea. This component is implemented by Hanlim University Medical Centre. The administrative process (i.e. provision of a building site and customs clearance) is supported by the MSPBS.

As KOICA completed an end-of-project evaluation, the result of it is worth reviewing. The main focus of the evaluation report is to assess the comprehensive outputs of the project. Five evaluation criteria of the OECD Development Assistant Committee were applied throughout the evaluation process: relevance, effectiveness, efficiency, impact and sustainability. Main Findings of the Report includes:

- Relevance: The project is highly related to the needs and policy of Paraguay, the Korean ODA policy and MDGs; it is assessed to have high relevance in the selection of project sites.
- Effectiveness: It is proved that the project achieved project purposes. The most surprising achievement is an adoption of 'KOICA system'. It is a newly adopted medical personnel management system where doctors work full-time in one hospital with the trebled salary. Doctors in Paraguay generally rotate two or three hospitals a day mainly because of low salary. However, three maternal and child hospitals which adopt KOICA system upgraded working environment of the hospitals, job satisfaction of doctors and consistency in patient treatment.

- Efficiency: It is assessed that the project budget was efficiently distributed to each project activity. However, there were difficulties in balancing accounts because of external factors. Project outputs are achieved in an efficient manner; it is also noted that KOICA worked with a Paraguay local construction company in an efficient manner and installed medical equipments very efficiently by dispatching relevant Korean experts. However, these outputs are not compared with the costs involved, and therefore the economic efficiency of the project investment was not assessed. This thesis is to fill this gap in assessment.

- Impact (Prospect): The prospect of mid and long term impact is very positive mainly because of introduction of KOICA system and highly passionate medical personnel in the three hospitals. It is expected that institutional strengthening of Paraguay medical system will be achieved by spreading KOICA system in the country.

- Sustainability (Prospect): The project is assessed to be sustainable, because the three hospitals function as general hospital, not exclusively for children and women, with the full support of the Ministry of Health of Paraguay.

2.2. Review on Maternal and Child Health System in Paraguay

Health system of Paraguay "is regulated by Law No 1032/96, Article 4 of which states that the [health system] should provide health services through the public, private, and mixed subsectors, health insurance programs, and universities."[8] The health system is highly fragmented and uncoordinated among service providers. "There is overlapping of actions between the [MSPBS] and the Social Welfare Institute (IPS), and between the IPS and the

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[8] PAHO, "Health Systems Profile Paraguay," PAHO Publication, 2008, 11.

private sector."[9] There appears a demographical segmentation according to health institutions. Minority upper-income class and participants of IPS are the customers of private health institutions whereas majority of population (estimated to be 70% of entire population) use public health institutions. Private institutions are, in general, more expensive but staffed with skilled employees whereas public institutions are crowded primarily because of zero user fees, which leads to low quality health services. Especially, USAID notes that "health posts and health centers are primarily staffed by nurses and nursing auxiliaries who have very little training."[10]

Londoño and Frenk identify the health system of Paraguay as "the atomized private model with a free market modality." It is characterized with two components: "the enormous differences in financial accessibility [which] generate an extremely segmented private market, which excludes the majority of the population from its upper end"; overwhelming private expenditure which "takes place in a highly unregulated service delivery environment (…)"[11] First one pinpoints the demographical segmentation in health care services. In the system, majority of people in need are excluded and fragmented health services generate inefficiencies.

Among a few health project evaluations in Paraguay, the World Bank's completion report of a loan to Paraguay for a maternal health and child development project is worth attention for this paper. While concluding that the overall outcome and sustainability of the project are

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[9] Ibid., 27.
[10] Ibid., 36.
[11] Juan-Luis Londoño and Julio Frenk, "Structured pluralism: towards an innovative model for health system reform in Latin America," *Health Policy* 41 (1997): 12.

unsatisfactory, the report identifies "major factors affecting implementation and outcome"[12] of the health project in Paraguay. Factors are categorized into three which include: (i) "Factors outside the control of government or implementing agency" such as financial collapse and social unrest of neighboring countries; (ii) "Factors generally subject to government control" such as domestic political instability and depreciation of local currency (Guaraní); (iii) "Factors generally subject to implementing agency control."[13] Since this paper focuses on cost-effectiveness of the project and its implications for health sector in Paraguay, a variety of factors mentioned in the World Bank report should be considered in the economic analysis and drawing implications.

2.3. Review on Economic Analysis of Health Project

As the awareness of the importance of cost-effectiveness in health care has increased, the number of published economic evaluations has been growing for the past several years. This reflects the increased recognition of the significance of economic evaluation in the policy area. In 1998, the World Health Organization (WHO) established the Global Program on Evidence for Health Policy (GPE), "which reflects the recognition that a provision of an objective assessment of the various kinds of evidence is one of core functions of WHO." [14] This trend of focusing on an objective analysis of health care programs and projects starts to influence not only conventional (i.e. Western and Japanese agencies) development

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[12] World Bank, "Implementation Completion Report on a Loan in the Amount of US$ 21.8 million to the Republic of Paraguay for a Maternal Health and Child Development Project", Document of World Bank, June 2005, 23, http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2005/06/30/000012009_20050630110326/Rendered/PDF/304010rev.pdf.

[13] Ibid., 23.

[14] Damian Walker, "Cost and cost-effectiveness guidelines: which ones to use?," *Health Policy and Planning* 16, no. 1 (2001), 113-21, http://heapol.oxfordjournals.org/content/16/1/113.full.pdf.

cooperation organizations but also newly emerging agencies such as KOICA. In this respect, KOICA's health project in Paraguay is to be analyzed from the perspective of an objective economic evaluation. Moreover, some findings and implications to the health sector in Paraguay will be examined.

Economic analyses of a health project can be categorized depending on the type of comparison of the costs and consequences. The range of studies goes under a multiple set of labels, such as [cost-minimization analysis (CMA),] cost-effectiveness analysis (CEA), cost-benefit analysis (CBA), and cost-utility analysis (CUA). [15] Walter and Zeheymayr provide a classification of the types of economic analyses as follows[16]:

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[15] Michael F. Drummond et al., *Methods for the Economic Evaluation of Health Care Programmes*, 3rd ed. (New York: Oxford University Press, 2005), 1.
[16] Evelyn Walter and Susanne Zehetmayr, "Guidelines on Health Economic Evaluation: Consensus Paper", A document of Institute for Pharmaeconomic Research, April 2006, 4, http://www.ispor.org/peguidelines/source/Guidelines_Austria.pdf.

Table 1 The Types of Economic Analysis

Method of analysis	Measurement/ assessment of costs	Measurement/ assessment of outcome	Cost-outcome comparison
Cost-minimization analysis(CMA)	Monetary	None	None
Cost-effectiveness analysis(CEA)	Monetary	Natural units	Costs per outcome unit
Cost-utility analysis(CUA)	Monetary	Utility values	Costs per QALY
Cost-benefit analysis(CBA)	Monetary	Monetary	Net costs

Since outputs and outcomes of health projects are generally difficult to quantify in monetary terms, CEA and CUA appear to be appropriate for the purpose of this paper. Damian Walker provides an objective of each analysis method, which guides the data analysis method of this paper. "While [cost-effectiveness] approach can answer questions regarding technical efficiency, which aims to maximize the achievement of a given objective within a specific budget, it fails to address allocative efficiency"[17] on which cost-utility analysis focuses.

One of the greatest challenges in economic evaluation of health projects is associated with deriving the quantitative value from health benefits.[18] Pedro Belli et al. provide, in chapter 10 of their book, health-project-specific techniques to assess projects. They include cost-effectiveness analysis, weighted cost-effectiveness analysis, and cost-benefit analysis. Detailed steps of economic analysis primarily focusing on cost-effectiveness and weighted cost-effectiveness analysis are discussed since cost-benefit analysis "involves a great increase in complexity […] and there are also added dangers of unwittingly double-counting effects or including false benefits."[19] The book is of great help to this paper in that it elaborates the specific method to identify the costs and effects, to justify discounting of premature averted

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[17] Damian Walker, "Cost and cost-effectiveness guidelines: which ones to use?," 114.

[18] Pedro Belli et al*., Economic Analysis of Investment Operations: Analytical Tools and Practical Applications* (Washington DC: World Bank Institute, 2001), 77.

[19] Belli et al., *Economic Analysis of Investment Operations: Analytical Tools and Practical Applications*, 88.

deaths, to calculate the related benefits, and to measure effectiveness and cost-effectiveness.

In a similar context, it provides a firm rationale to identify effects with an output indicator (not process indicator that implicitly assumes "the causal link between effective [process] and improvement in health status) and to measure cost-effectiveness with Years of Potential Life Gained (YLGs) since YLGs can be easily calculated and "they can be useful tool in countries where data are scarce and the primary objective is to reduce mortality."[20]

In conclusion, the specific method for the economic analysis (cost-effectiveness analysis) in this paper is examined with the review of different types of economic analysis of health project and identification of factors affecting the project analysis in Paraguay. The maternal and child health project by KOICA in Paraguay is subject to economic analysis with the methods and findings examined in the sources noted in the literature review.

2.4. Methodology

Since it is well known that quantifying benefits in monetary value from health projects, ADB notes that "quantitative economic analysis should normally concentrate on comparing costs in relation to health impacts from different project alternatives."[21] Given the health project to be analyzed in this paper is completed one, the procedure would specify project impact and compare this with project cost in two cases: 'With the project' and 'without the project'. Like project evaluation conducted in other sectors, both impacts and costs would be discounted to present value. Therefore, a cost-effectiveness indicator (CEI) is presented as

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[20] Ibid., 83.
[21] ADB, "Handbook for the Economic Analysis of Health Sector Project," ADB Publication, August 2000, 41. http://www.adb.org/documents/handbook-economic-analysis-health-sector-projects.

$$\text{CEI } w = \text{PV}(C\ w)/\text{PV}(\text{HI } w)$$

$$\text{CEI } w\hat{\imath} = \text{PV}(C\ w\hat{\imath})/\text{PV}(\text{HI } w\hat{\imath})$$

where   C is project costs;

HI is health impact;

PV is the annual figures over the project life discounted to the present;

w and wî refer to with and without a project respectively.

Chapter 3: Data Analysis and Results

3.1. Analysis

3.1.1. Description of the project

This chapter intends to examine the cost-effectiveness of the KOICA health project in Paraguay which was started in 2008 and completed in 2010. Since there was no standardized hospital for maternal and child health (MCH) despite of less-than-regional-average MCH outcomes in Paraguay, KOICA health project aimed at modeling a MCH services upon the request from government of Paraguay.

The overall goal is to enhance MCH status and to improve the quality of health care services. Project activities include: construction of maternal and child health hospitals in Capiata, Limpio and Villa Elisa; provision of medical equipment; technical support such as local workshops and training. In the three project sites near Asuncion, new hospitals were constructed in connection with the existing old hospital.

3.1.2. With and Without the Project

Identifying and Quantifying the Effects

Identifying the benefits of the project is the beginning of the analysis. "The objective of health sector activities [is to] increase individual and social welfare by improving health status."[22] In general, there are three types of indicators: an input indicator (disbursement of

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[22] Belli et al., *Economic Analysis of Investment Operations: Analytical Tools and Practical*

project funds for project activities), a process indicator (improvement in hospital records), and an output indicator (deaths prevented or Years of potential Life Gained). Since input indicators are not directly related to the final outcome of health status improvement and process indicators are typically used as the "practical available measure of project achievement," output indicators are to be used in the analysis. The number of deaths prevented and Years of potential Life Gained are to be used as an output indicator since "outcome measures have the advantage that they focus more directly on the objective and allow a wider scope of comparisons."[23]

In order to derive the number of deaths prevented after the project, a past trend of maternal mortality ratio and infant mortality rate is used for extrapolation. Effects will be derived from maternal mortality ratio and infant mortality rate respectively and calculated into output indicators (i.e. the number of deaths prevented and YLGs).

- Maternal Mortality Ratio

Table 2 Maternal Mortality Ratio in Paraguay

	1990	1995	2000	2005	2008	2009	2010	2011
Maternal Mortality Ratio*	120	120	110	110	95	...	99	...

*Maternal mortality ratio - Annual number of deaths of women from pregnancy-related causes per 100,000 live births.

(Source: WHO, UNICEF, UNFPA and the World Bank, Trends in Maternal Mortality from 1990 to 2010)

Applications, 79.

[23] Ibid., 79.

"The estimates [for maternal mortaliy ratios are] (…) derived from multilevel (or hierarchical) linear regression model(….)"[24] According to the estimation data, annual percentage change in the ratio has been -0.5 from 1990 to 2000; -1.2 from 2000 to 2010; -0.9 from 1990 to 2010. Based on the estimates and annual percentage change, a trend in maternal mortality ratio is extrapolated in the figure 1 below.An annual percentage change of -0.9% is used for without the project case as the consistent trend from 1990-2010 period into the future is assumed. For with the project case, an annual percentage change of -1.2% is assumed to extrapolate the future trend, which is to capture the trend in more recent years (i.e. from 2000 to 2010) when interventions to health sector increased.

Figure 1 Extrapolation of the Effects (MMR)

(Unit: Maternal deaths)
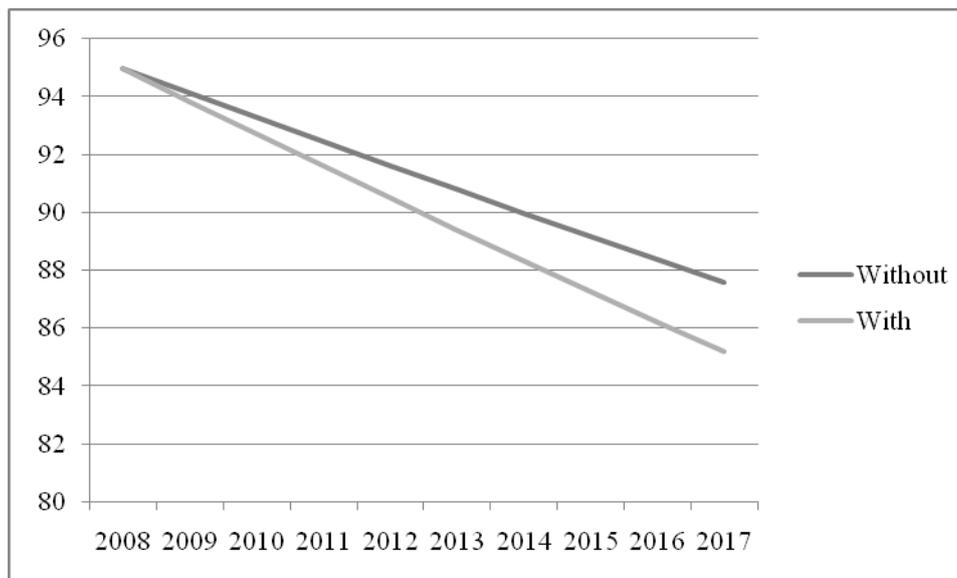
Deaths prevented is calculated based on the UN population data: Annual number of births in Paraguay is 722,000 in 1990-1995; 742,000 in 1995-2000; 757,000 in 2000-2005; 767,000 in

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[24] WHO, UNICEF, UNFPA and the World Bank, *Trends in Maternal Mortality from 1990 to 2010* (World Health Organization: 2010), n.p.

2005-2010.[25] The number of deaths prevented is calculated by mulpliying the difference

between death projected with and without the project case with annual number of births in

2005-2010 period. Since the projection is based on MMR which is defined as annual number

of deaths of women from pregnancy-related causes per 100,000 live births, annual number of

births is multiplied in a proportionate manner.

For another measure of effectiveness, one can use Years of Potential Life Gained(YLGs). It is

"calculated as the difference between the expected durations of life with and without the

[project.]"[26] YLGs are calculated based on the UN Population data. According to World

Population Prospect by UN Department of Economic and Social Affairs, Paraguay's life

expectancy at birth is estimated to be 71.73; female life expectancy at birth to be 73.90 in

2005-2010.

Table 3 Number of Births by Age Groups of Mother in 2005-2010

(Unite: Thousand births)

	15-19	20-24	25-29	30-34	35-39	40-44
Number of Births	125	221	179	125	75	28

As one can see in the table 3, the fact that the most births are given in an age group of 20-24

leads to the assumption that an average age of mother who gives birth is 22.5. In order to

calculate YLGs, one infant death prevented is presumed to have 71.73 additional years of life

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[25] United Nations, *World Population Prospects: The 2010 Revision* (Department of Economic and Social Affairs, Population Division: 2011), n. p.

[26] Belli et al., *Economic Analysis of Investment Operations: Analytical Tools and Practical Applications*, 83.

gained; one maternal death prevented is assumed to have 51.4 (i.e. a femaile life expectancy at birth minus an average age of pregnancy) more years of life gained.

Table 4 Effects (MMR) Breakdown by Year and Deaths Prevented from the Project

(Unit: Deaths, Years)

Year from start of the project	MMR with the project	MMR without the project	Deaths projected with the project	Deaths projected without the project	Deaths prevented (With-without)	YLG
Year 1 (2008)	95	95	729	729	0	0
Year 2 (2009)	94	94	721	721	0	0
Year 3 (2010)	93	93	713	713	0	0
Year 4 (2011)	92	92	706	706	0	0
Year 5 (2012)	91	92	698	706	-8	411.2
Year 6 (2013)	89	91	683	698	-15	771
Year 7 (2014)	88	90	675	690	-15	771
Year 8 (2015)	87	89	667	683	-15	771
Year 9 (2016)	86	88	660	675	-15	771
Year 10 (2017)	85	88	652	675	-23	1182.2
Discounted* Total			4,205	4,244	-39	1978.04
Adjusted for net gains			3,680	3,714	-34	1730.78

* Discounted at 12% per annum

Table 4 presents effects breakdown by year based on projection and calculation method discussed above. It is constructed "under the assumption that death prevented today is more valuable than a death prevented tomorrow."[27] One reason follows the standard economic theory that enjoyment of life today is more valuable than that of tomorrow; "what is being

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[27] Ibid., 80.

discounted is not the health effect itself, but the benefits that the health effects generates."[28] Another reason is to avoid the absurd conclusion that we should never save lives when one values continuation of future equivalent to that of life today. Therefore, avoided deaths is discounted like any other good.

In addition, there is need to adjust for net gains of the effects. According to Pan-American Health Organization (WHO/PAHO), 15 percent of the population purchases health services from private health institutions in Paraguay. Without the project, 15 percent of the population is covered by private hospitals. It is estimated that, after the project, almost 90 percent of pregnant women who would have purchased private health services used the private hospital. The net coverage of the population by the public hospital will not be 100 percent, but 100 percent less 13.5 (15*0.9) percent. Thus, the actual effects would be 0.875(87.5/100) of the effects calculated in the table 4. The totals at the bottom present the adjustment that reflects net gains.

- Infant Mortality Rate

Table 5 Infant Mortality Rate in Paraguay

	1990-1995	1995-2000	2000-2005	2005-2010	2010-2015	2015-2020
Infant Mortality Rate*	43	39	36	32	27**	24**

*Infant mortality rate – infant deaths per 1,000 live births

** Medium-fertility variant, 2010-2020

(Source: UN Population Division, World Population Prospects: The 2010 Revision[29])

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[28] Ibid., 80

[29] United Nations, *World Population Prospects: The 2010 Revision*, n. p.

Infant mortality rate in Paraguay from 1990 to 2020 is estimated by the population division of

UN Department of Economic and Social Affairs. According to the data, annual percentage

change in the ratio has been -2.0 from 1990 to 2000; -2.8 from 2000 to 2010; -2.2 from 1990

to 2010. Based on the estimates and annual percentage change, a trend in infant mortality rate

is extrapolated in the figure 2.An annual percentage change of -2.2% is used for without the

project case as the consistent trend from 1990-2010 period into the future is assumed. For

with the project case, an annual percentage change of -2.8% is used since the trend in more

recent years (i.e. from 2000 to 2010) is assumed to extrapolate the future trend.

Figure 2 Extrapolation of the Effects

(Unit: Infant deaths)
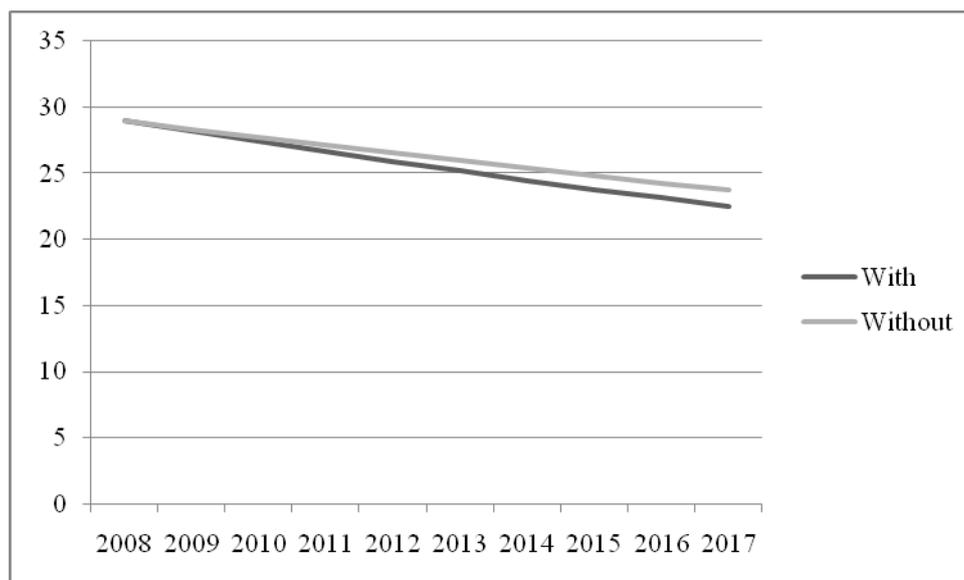
Deaths prevented is calculated based on the UN population data as it is done in maternal

mortality in the previous section. The number of deaths prevented is calculated by mulpliying

the difference between death projected with and without the project case with annual number

of births in 2005-2010 period (i.e. 767,000). As the projection is based on IMR which is

defined as – annual infant deaths per 1,000 live births, annual number of births is multiplied

in a proportionate manner. YLSs are derived from multiplying the number of deaths

provented with a life expectancy at birth in Paraguay (i.e. 71.73).

Table 6 Effects (IMR) Breakdown by Year and Deaths Prevented from the Project

(Unit: Deaths, Years)

Year from start of the project	IMR with the project	IMR without the project	Deaths projected with the project	Deaths projected without the project	Deaths prevented (With-without)	YLGs
Year 1 (2008)	29	29	222,430	222,430	0	0
Year 2 (2009)	28	28	214,760	214,760	0	0
Year 3 (2010)	27	28	207,090	214,760	-7,670	426,050.95
Year 4 (2011)	27	27	207,090	207,090	0	0
Year 5 (2012)	26	27	199,420	207,090	-7,670	329,933.86
Year 6 (2013)	25	26	191,750	199,420	-7,670	290,341.79
Year 7 (2014)	24	25	184,080	191,750	-7,670	255,500.78
Year 8 (2015)	24	25	184,080	191,750	-7,670	224,840.69
Year 9 (2016)	23	24	176,410	184,080	-7,670	197,859.80
Year 10 (2017)	22	24	168,740	184,080	-15,340	348,233.25
Discounted Total			989,560	1,018,458	-28,898	2,072,761.12
Adjusted for net gains			865,865	891,151	-25,285	1,813,665.98

Identifying Costs

In the project analysis, "costs should include capital costs, such as expenditures for plant, equipment, and training; recurrent expenditures, including the incremental costs of administrators, doctors, nurses, laboratory technicians, unskilled support, and other staff; and indirect costs such as patients' time and travel."[30] One can note that recurrent cost is more than four times as large as capital cost where about 83% of total recurrent cost comes from expenditure on medical personnel. It is due to the project planning which convert part-time doctors to full-time with a trebled wage level.

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[30] Ibid., 78.

Table 7 Costs in KOICA health project

(Present Value, Unit: thousands of USD)

	Total Cost	KOICA grants	Transfer from central government
Capital costs			
- Facilities	2038.3	2,004	34.3
- Equipment	1124.3	926	198.3
- Training	145	145	
- Other	195	195	
Total capital costs	3502.6	3,270	232.6
Recurrent costs			
- Personnel	12518		12518
- Supplies	1818.6		1818.6
- Maintenance	254.4		254.4
- Other	168.8		168.8
- Client time, travel	183		
Total recurrent costs			14942.8

Table 7 summarizes the 2008 value of the incremental costs of the project. Cost flow charts from Limpio hospital is not acquired. Considering the similarities between three hospitals in terms of the size, location and characteristics, the equivalent cost flow is assumed. Column 2 shows the total cost for each cost category; column 3 and 4 present the costs borne by KOICA and central government of Paraguay respectively.

Table 8 Total Costs Breakdown by Year

(Unit: Thousands of USD)

Year from start of the project	Cost of the project
Year 1 (2008)	800
Year 2 (2009)	1360
Year 3 (2010)	16052.8
Discounted Total (12% disc. rate)	14428.09
Value of capital remaining at end of 3 years	567.67
Total costs less value of capital at end of project	13860.42

Asian Development Bank notes that "any residual values such as hospital buildings or equipment must be entered as negative costs at the end of project life."[31] The future value of hospital buildings and equipment at the end of project life is calculated in terms of depreciation of their initial value. Given that the project life is long, the future value of equipments is negligible; that of hospital facilities are calculated.

As for projecting for cost in without the project case, recurrent cost of original health unit is calculated. Personnel cost (doctors' wage) is one third of that in with the project case where KOICA system applies; the other costs (medical supplies, maintenance and others) is estimated to half of that in with the project case given the project provides almost double size of an original health unit facility.

3.2. Analysis Results

Cost-Effectiveness

Cost-effectiveness with and without the project case is calculated based on cost and effect identified in the previous section. Total deaths prevented and YLGs are output indicators, which are derived from maternal mortality ratio and infant mortality rate projection. Each indicator is divided by total cost borne out of project for three years.

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[31] ADB, "Handbook for the Economic Analysis of Health Sector Project," 41.

Table 9 Cost-Effectiveness with the Project

(Unit: Deaths Prevented, YLGs)

Years from start of the project	Output indicators	
	Total deaths prevented	YLGs
Year 1	7,678	550,580.3
Year 2	7,678	550,580.3
Year 3	7,678	550,580.3
Year 4	7,678	550,580.3
Year 5	7,686	550,580.3
Year 6	7,700	550,940.1
Year 7	7,693	550,580.3
Year 8	7,693	550,580.3
Year 9	7,693	550,580.3
Year 10	15,371	1,100,749.4
Discounted total	45,871	3,485,353.62
Adjusted net gains	40,137	3,049,684.41
Cost-effectiveness ($/Death prevented, YLGs)	345	4.54

Table 9 presents the analysis result at the last row. With KOICA health project, it costs US$ 345 to prevent one death; US$ 4.54 to save one year of life. In order for this result to be compared with the without the project case, cost-effectiveness without the project is calculated based on the projection and cost data obtained from three hospitals.

Table 10 Cost-Effectiveness without the Project

(Unit: Deaths, Years)

Years from start of the project	Output indicators	
	Total deaths prevented	YLGs
Year 1	7,678	550,580.3
Year 2	7,678	550,580.3
Year 3	7,678	550,580.3
Year 4	7,678	550,580.3
Year 5	7,678	550,580.3
Year 6	7,685	550,940.1
Year 7	7,678	550,580.3
Year 8	7,678	550,580.3
Year 9	7,678	550,580.3
Year 10	7,678	550,580.3
Discounted total	46,164	3,310,359.60
Adjusted net gains	40,393	2,896,564.60
Cost-effectiveness ($/Death prevented, YLGs)	185	2.58

One can note the result at the last row of the table 10. In without the project case, it is estimated that prevention of one death would have cost US$ 185; one more year of life saved would have been valued at US$ 2.58.

The following table presents a summary of the analysis result where detailed figures are presented and compared. In comparison between with and without the project cases, without the project case is calculated to be more cost-effective than with the project case in two output indicators (i.e. total deaths prevented and YLGs). Therefore, it is concluded that the project failed to achieve its initial project objective in a cost-effective manner.

Table 11 Cost-effectiveness with and without the project

(Unit: Deaths, Years)

		Effects	
		Total deaths prevented	YLGs
With the Project	Cost-effectiveness ($/Death prevented, YLGs)	345	4.54
Without the Project	Cost-effectiveness ($/Death prevented, YLGs)	185	2.58

This result appears to contradict the findings of an end-of-project evaluation of the identical project since the latter found that the project is highly assessed in DAC criteria for evaluating development assistance (i.e. relevance, efficiency, effectiveness, impact and sustainability). However, this analysis shows that although the project may be effective, it is not cost-effective or efficient.

Given the adoption of KOICA system raises the doctors' wage level by three times, one can argue that the reason for low cost-effectiveness in with the project case comes from high recurrent cost primarily due to high expenditure on doctors' wage. In order to check this, cost effectiveness of with the project case is calculated with one third of doctors' wage level. The following table presents a recalculation and its comparison with without the project case. Unlike the previous finding, with the project case is calculated to be slightly more cost-effective compared to without the project case.

Table 12 Cost-effectiveness with (one third of doctors' wage) and without the project

(Unit: Deaths, Years)

		Effects	
		Total deaths prevented	YLGs
With the Project	Cost-effectiveness ($/Death prevented, YLGs)	184	2.43
Without the Project	Cost-effectiveness ($/Death prevented, YLGs)	185	2.58

Therefore, the project failed to achieve its initial project objective in a cost-effective manner and it is mainly because of high recurrent cost primarily due to high expenditure on doctors' wage under the KOICA system.

Chapter 4: Discussion

Given the analysis result in the chapter 3, the KOICA health project in Paraguay is analyzed to be inefficient in achieving the stated project objective. This chapter examines the reason for this result. As it is mentioned in Chapter 1 of this paper, significance of the study primarily comes from the insufficient economic analysis in the end-of-project evaluation. Interestingly, this thesis analysis result is at variance with the end-of-project evaluation which argues the project is evaluated to be highly efficient. These seemingly contradictory results are to be examined in comparison between the analysis result of this paper and that of the end-of-project evaluation report.

4.1. Reasons for Unsuccessful Result

Higher recurrent cost for doctors as a result of adoption of KOICA system

According to the analysis of the end-of-project report[32], the adoption of KOICA system is one of the main success factors of the project. WHO/PAHO jointly with USAID (United States Agency for International Development) notes that "[i]n Paraguay, many health establishments are not staffed with permanent full-time doctors and instead recruit part-time physicians."[33] So a lot of doctors commonly have more than one job, which gives them a dishonorable name of 'taxi doctor'. It was estimated in 2008 that "nearly 38% of establishments do not have full-time physicians."[34] In this context, conversion of part-time doctors to full-time with a threefold wage of other doctors in three hospitals would provide incentives for capable doctors to apply and work hard.

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[32] Refer to the Chapter 2 of this paper for detailed content of the report.
[33] PAHO, "Health Systems Profile Paraguay", Washington, D.C.: PAHO, 2009. 35.
[34] Ibid., 35.

However, this trebled wage level for doctors in three hospitals leads to lower cost-effectiveness in with the project case than that in without the project case. To be more precise, it was more costly to prevent one death or to save one year of life with the presence of KOICA health project than it would have been no project at all mainly because of high recurrent cost in health personnel. Therefore, the adoption of KOICA system is a critical factor explaining two diverging results of the end-of-project evaluation report and the economic analysis of this paper.

Three Hospitals' Functioning as a General Hospital in Practice

Examining the results closely, there is a reasonable factor which can fill in the diverging gap as well as project's failure to meet the objective. The three hospitals, in practice, are serving a role as a general hospital rather than a specialized maternal and child hospital. This is especially significant point since economic analysis of the project only identifies health benefits with maternal and child health indicators according to project objective. The fact that the stated objective is primarily the improvement of indicators related to maternal and child health, non-MCH improvement outcome cannot be reflected in the analysis.

A number of hospital records are presented below where one can find a dramatic improvement in non-MCH practices, which indicates the actual functioning of the three hospitals as a general hospital. The time range and a category of hospital records vary among three hospitals since availability of hospital data differs.

Table 13 Hospital Records in Capiata Hospital

(Unit: persons)

	2010	2011	Average annual growth rate (%)
Total number of patients	109035	181795	67
Emergency consultations	27706	58371	111
Pediatric consultations	48300	67300	39
Clinical consultations	48063	92355	92
Total hospitalizations	1166	5434	366
Number of beds	33	64	94
Caesarean sections	285	873	206
Major surgery	201	772	284
Minor surgery	1516	1670	10

Table 14 Hospital Records in Limpio Hospital

(Unit: persons)

	2008	2011	Average annual growth rate (%)
Total number of patients	66107	177764	56
Pediatric consultations	13011	28934	41
Clinical consultations	5576	28165	135
Gynecological consultations	5448	22275	103
Anesthesia for surgery	392	2957	218
Caesarean sections	224	799	86
Laboratory services	16,348	159,243	291

Table 15 Hospital Records in Villa Elisa Hospital

(Unit: persons)

	2008	2011	Average annual growth rate (%)
Total number of patients	24870	165326	188
Pediatric consultations	10270	48750	125
Clinical consultations	7055	34540	130
Prenatal consultations	1918	9478	131
Gynecological consultations	9517	37111	97
Emergency consultations	1672	19546	356
Caesarean sections	0	432	257

* A percentage change is calculated based on the fact that there were 121 caesarean sections in 2010.

(Source: MSPBS Workshop Presentation)

Records indicate that three hospitals function as a general hospital where services include general surgery, pediatrics, internal medicine, emergency operations as well as obstetrics and gynecology. Some records exhibit rapid increase and they are not translated into output indicators of the economic analysis in this paper since the stated objective of the project requires MCH improvement as an outcome.

4.2. Implications

Rigorous Appraisal in KOICA Project Cycle

The primary reason that the output indicators are not successful at capturing the actual outcome of the project comes from absence of rigorous project appraisal in this KOICA project cycle. Each stage of the project cycle is shown in the figure 3.

Figure 3 The Project Cycle
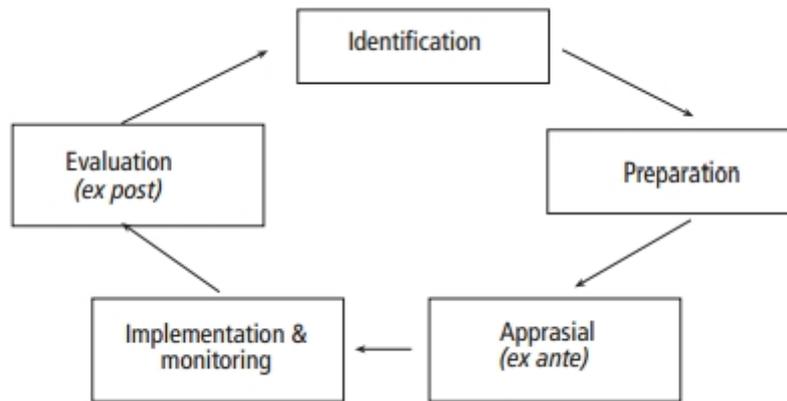
(Source: Centre for Financial and Management Studies, Project Appraisal and Impact Analysis)

In recent years, early stages until a project starts to be implemented have gained considerable highlights from major donor agencies (such as World Bank) as an important factor in overall success of project. Especially, project appraisal examines "whether a project is worthwhile in the light of its costs in terms of resource commitments and the project's expected benefits."[35] In other words, appraisal is an *ex ante assessment* of a project that decides the proceeding of a project to next stage. It generally involves consideration of alternative projects and comparison with the status quo (i.e. do-nothing option).

Examining the documents in the early stages of the project, it is found that project is identified upon an official request from MSPBS and is prepared with detailed project design taking account of technical, institutional and social aspect of the project through feasibility studies. However, absence of project appraisal is seen in the cycle. In particular, lack of an economic appraisal in this KOICA health project brings about underachievement of the

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[35] Centre for Financial and Management Studies, Project Appraisal and Impact Analysis, SOAS, University of London (2004), 5.

objective. There is, in turn, corresponding absence of an economic evaluation in mid-term evaluation and end-of-project evaluation.

Ideally, examination of technical, financial and economic viability of the project would be fed back to initial project design. "Appraisal covers four major aspects of the project: technical, institutional, financial and economic."[36] Given the significant role of project appraisal in effectiveness and sustainability of the project, rigorous appraisal should be conducted before project implementation in KOICA project.

Sustainability of KOICA system in Paraguay

Much of improvement can be explained by an introduction of KOICA system in a sense that it ensures consistency of medical services and enhanced working environment for doctors. Based upon the discussion, it is evident that sustainability of KOICA system is an essential part in the project analysis. Outstripping benefits of the KOICA system appear to be a significant factor for MSPBS to improve quality of public health in Paraguay. The Ministry adopts KOICA system for incoming doctors in all public hospitals.

There are two problems in applying a full-time work scheme to a national level. First, budgetary sustainability is called into question since MSPBS does not have sufficient budget and user fee collection is almost zero. For instance, only newly recruited doctors (50% of total number of doctors in each hospital) work under the full-time scheme due to a budgetary constraint of MSPBS. It is found in an interview record with hospital staffs that there were sometimes delay in wage payment. Second, full-time scheme would generate urban-rural gap in health services since most of national health institutions are concentrated in Asuncion and other urban centers. Given that higher salary would attract capable doctors from non-urban

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[36] Ibid, 5.

areas, existing demographical polarization in healthcare services can be exacerbated by accelerating urban-rural gap in healthcare availability and quality.

Therefore, in order to mitigate the first problem, MSPBS needs to balance between its budgetary affordability and the incentive level (i.e. salary) for full-time doctors and budgetary support should not be subject to political pressure. The second problem as well as the first one is, in fact, related to a broader scope of health sector issue in Paraguay: public health sector reform. Government has been committed to health sector reform measures. Among those include progressive development of National Health Law; decentralization of health services; establishment of basic health insurance.

The reform measures primarily aim at "increasing access to services for all segments of the population [and] optimizing the use of available resources."[37] In this sense, adoption of KOICA system is a part of comprehensive framework of health sector reform in Paraguay. In parallel with on-going effort to reform health sector, what the discussion above implies would be that MSPBS should consider not only socio-economic segmentation but also potential urban-rural gap widening in healthcare services as a result of introduction of KOICA system at the national level.

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[37] Tisna Veldhuyzen van Zanten and Cristina Semidei, *Assessment of Health Sector Decentralization in Paraguay*. USAID Technical Report No. 1., 1996, 12. http://pdf.usaid.gov/pdf_docs/Pnach238.pdf.

Chapter 5: Conclusion

Responding to Paraguay's government initiative to tackle high maternal and infant mortality, KOICA maternal and child health project started in 2008 and completed in 2010. This paper tries to conduct economic evaluation of the project. Specifically, this paper intends to examine the hypothesis that cost-effectiveness of KOICA's maternal and child health project in Paraguay is high in comparison to without the project case. Main motivation of this study comes from absence of rigorous economic evaluation in an end-of-project evaluation report. Given the importance of an economic analysis in assessing efficiency or cost-effectiveness of international development assistance, the significance of this study is highlighted.

To test the hypothesis, this paper adopts cost-effective analysis (CEA) method. As the paper tries to analyze the completed project, the procedure specifies project impact and compares this with project cost in two cases: 'With the project' and 'without the project (do-nothing option)'. Total cost (both capital and recurrent) is identified; health impacts are measured by two output indicators which are the number of deaths prevented and Years of potential Life Gained (YLGs).

The result of the analysis is summarized as follows. In comparison between with and without the project cases, without the project case is calculated to be more cost-effective than with the project case in two output indicators. Therefore, it is concluded that KOICA maternal and child health project is inefficient in achieving its initial project objective. This result contradicts the findings of an end-of-project evaluation report where the project is highly assessed by five DAC criteria.

There are two reasons for the analysis result. First, high recurrent cost for doctors as a result of adoption of KOICA system (i.e. a full time work scheme with trebled wage) leads to lower cost-effectiveness in with the project case. Thus, the adoption of KOICA system is identified as a critical factor in explaining the diverging analysis result. Second, given that three hospitals are functioning as a general hospital not maternal and child health specialized one, output indicators derived from the stated project objective do not reflect actual outcome or health effects of the project.

The principal reason that the output indicators cannot capture the actual health impact of the project is originated from absence of project appraisal in the project cycle. Particularly, lack of economic appraisal in this KOICA health project brings about underachievement of the objective stated in the initial project design. To be ideal, there should be positive feedback of examination of technical, financial and economic viability of the project before an implementation stage. Therefore, it is advised to KOICA to consider project appraisal be essential part of project cycle.

Another issue coming to the limelight is sustainability of KOICA system in Paraguay. In spite of advantages of the system (i.e. consistency of medical services and enhanced working environment for medical staffs), there appear two critical issues in applying it to a national level. First, budgetary affordability of MSPBS to sustain provision of higher wages is called into question; second, it may exacerbate urban-rural gap in health services.

Therefore, it is essential for MSPBS to balance between its budgetary constraint and the incentive level for full time workers. Moreover, considering the fact that adoption of KOICA system is a part of comprehensive health sector reform, the discussion above implies that reform measure should consider both socio-economic division and urban-rural gap in

availability and quality of health services.

APPENDICES

APPENDIX A Project Design Matrix (PDM)

- Target Area: 1. Villa Elisa 2. Limpio 3. Capiata
- Target Group: Women of childbearing age, pregnant women and local medical staffs

Narrative Summary	Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal Improvement in maternal and child healthcare services and quality of life in beneficiary areas	Decrease in maternal and infant mortality rate	MSPBS Statistics	Health policy does not change Medical facility with the same target group is not constructed around the target areas
Project Purpose 1. Increase accessibility to maternal and child health care service 2. Improvement in a quality of maternal and child health care service 3. Capacity building of medical personnel	1. Increased accessibility to maternal and child health care services 2. Better use of medical equipment 3. Better use of facilities and increase in satisfaction of users	MSPBS Statistics Mid-term evaluation report and checklist End-of-project evaluation report and checklist	No natural disaster breaks out in the target areas There is no drastic decrease in income level in the target areas

Outputs	1. Completion of hospital construction	Construction completion report	Contractors (Project
1. Three maternal and child hospitals	2. Provision and installation of medical equipment	Medical equipment checklist	management company and
2. Provision of medical equipment	3. The number of participants to workshops	Workshop evaluation report	construction management company) are capable and responsible
3. Workshops and training			

Activities	Input		Trained staffs work for the
1. Construction of maternal and child hospitals	- Korea		constructed hospitals for certain period of time
2. Provision of medical equipment	USD 3,270 thousand for hospital construction; provision of medical equipment; operation training and dispatch of experts; invitational training.		There are sufficient medical staffs, medicine supply and
- Procure and install equipment			equipment to operate the
- Training for operation	- Paraguay		hospitals
3. Invitational training and dispatch of medical experts	Land for hospital construction, administrative support and provision of information		Pre-Condition
- Operation and management of maternal and child hospitals			No natural disaster breaks out in the target areas
- Workshops for basic sanitation			Government of Paraguay is cooperative in securing administrative and financial budget

APPENDIX B Projection with Maternal Mortality Ratio (MMR)

Projection of MMR with and without the project

<div align="right">(Unit: Deaths)</div>

	1990	1995	2000	2005	2008*	2009	2010	2011	2012	2013	2014	2015	2016	2017
With	120	120	110	110	95	94	93	92	91	89	88	87	86	85
Without	120	120	110	110	95	94	93	92	92	91	90	89	88	88

<div align="right">* Start of the project</div>

Deaths projected and prevented from the MMR Projection

<div align="right">(Unit: Deaths, Deaths projected)</div>

Year from start of the project	MMR*		Deaths projected*	
	with the project	without the project	with the project	without the project
Year 1 (2008)	95	95	729	729
Year 2 (2009)	94	94	721	721
Year 3 (2010)	93	93	713	713
Year 4 (2011)	92	92	706	706
Year 5 (2012)	91	92	698	706
Year 6 (2013)	89	91	683	698
Year 7 (2014)	88	90	675	690
Year 8 (2015)	87	89	667	683
Year 9 (2016)	86	88	660	675
Year 10 (2017)	85	88	652	675

* Maternal mortality ratio: Annual number of deaths of women from pregnancy-related causes per 100,000 live births
** It is calculated based on MMR projection and the number of annual births (767,000) in Paraguay

Present Value of death projected

<div style="text-align: right;">(Unit: Deaths)</div>

	PV* of Deaths projected	
	with the project	without the project
Year 1 (2008)	729	729
Year 2 (2009)	634	634
Year 3 (2010)	552	552
Year 4 (2011)	481	481
Year 5 (2012)	419	423
Year 6 (2013)	360	368
Year 7 (2014)	313	321
Year 8 (2015)	273	279
Year 9 (2016)	237	243
Year 10 (2017)	206	214
Total	4205	4244
Adjusted total	3680	3714

*Discount rate of 12%

APPENDIX C Project with infant mortality rate (IMR)

Projection of IMR with and without the project

	1990	1995	2000	2005	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
With	43	39	36	32	29	28	27	27	26	25	24	24	23	22
Without	43	39	36	32	29	28	28	27	27	26	25	25	24	24

Deaths projected and prevented from the IMR Projection

(Unit: Deaths, Deaths projected)

Year from start of the project	IMR		Deaths projected	
	with the project	without the project	with the project	without the project
Year 1 (2008)	29	29	222430	222430
Year 2 (2009)	28	28	214760	214760
Year 3 (2010)	27	28	207090	214760
Year 4 (2011)	27	27	207090	207090
Year 5 (2012)	26	27	199420	207090
Year 6 (2013)	25	26	191750	199420
Year 7 (2014)	24	25	184080	191750
Year 8 (2015)	24	25	184080	191750
Year 9 (2016)	23	24	176410	184080
Year 10 (2017)	22	24	168740	184080

Present Value of death projected

(Unit: Deaths)

	PV of deaths projected	
	With the project	**Without the project**
Year 1 (2008)	729	730
Year 2 (2009)	188989	188989
Year 3 (2010)	160370	166310
Year 4 (2011)	141126	141126
Year 5 (2012)	119591	124191
Year 6 (2013)	101193	105240
Year 7 (2014)	85488	89049
Year 8 (2015)	75229	78364
Year 9 (2016)	63443	66202
Year 10 (2017)	53403	58257
Total	**989560**	**1018458**
Adjusted total	**865865**	**891151**

APPENDIX D Identifying Effects With and With the Project Cases

Deaths Prevented and YLGs **with the project case**

<div align="right">(Unit: Deaths, Years)</div>

	Infant deaths prevented	Maternal deaths prevented	Deaths prevented(I+M)	YLGs of death prevented infants	YLGs of death prevented mothers	YLGs (I+M)
Year 1 (2008)	7670	8	7678	500169.10	411.20	550580.30
Year 2 (2009)	7670	8	7678	500169.10	411.20	550580.30
Year 3 (2010)	7670	8	7678	500169.10	411.20	550580.30
Year 4 (2011)	7670	8	7678	500169.10	411.20	550580.30
Year 5 (2012)	7678	8	7686	500169.10	411.20	550580.30
Year 6 (2013)	7685	15	7700	500169.10	771	550940.10
Year 7 (2014)	7685	8	7693	500169.10	411.20	550580.30
Year 8 (2015)	7685	8	7693	500169.10	411.20	550580.30
Year 9 (2016)	7685	8	7693	500169.10	411.20	550580.30
Year 10 (2017)	15363	8	15371	1100338	411.20	1100749.40
Total			84548			6056331.90
Discounted Total			45871			3485353.62
Adjusted Total			40137			3049684.41

Deaths Prevented and YLGs **without the project case**

	Infant deaths prevented	Maternal deaths prevented	Deaths prevented(I+M)	YLGs of death prevented infants	YLGs of death prevented mothers	YLGs (I+M)
Year 1 (2008)	7670	8	7678	550169.10	411.20	550580.30
Year 2 (2009)	7670	8	7678	550169.10	411.20	550580.30
Year 3 (2010)	7670	8	7678	550169.10	411.20	550580.30
Year 4 (2011)	7670	8	7678	550169.10	411.20	550580.30
Year 5 (2012)	7670	8	7678	550169.10	411.20	550580.30
Year 6 (2013)	7670	8	7678	550169.10	771.00	550940.10
Year 7 (2014)	7670	8	7678	550169.10	411.20	550580.30
Year 8 (2015)	7670	8	7678	550169.10	411.20	550580.30
Year 9 (2016)	7670	8	7678	550169.10	411.20	550580.30
Year 10 (2017)	7670	8	7678	550169.10	411.20	550580.30
Total			76780			5506162.80
Discounted Total			46164			3310359.60
Adjusted Total			40393			2896564.60

APPENDIX E Identification of Cost

Cost Chart (with the Project)

(Unit: Thousand USD, Present Value)

		Transfer from MSPBS			KOICA grant	Total
		Capitata	Limpio	Villa Elisa		
Capital	Facilities			34.3	2004	2038.3
	Equipment			198.2	926	1124.3
	Training				145	145
	Others				195	195
	Total			232.6	3270	3502.6
Recurrent	Personnel	4118	4200	4200		12518
	Supplies	1779.3		39.3		1818.6
	Maintenance	237.1		17.3		254.4
	Other	168.8				168.8
	Client Time	61	61	61		183
	Total	6364.2	4261	4317.6		14942.8

Costs Breakdown by Year

(Unit: Thousands of USD)

Year from start of the project	Cost of the Project
Year 1 (2008)	800
Year 2 (2009)	1360
Year 3 (2010)	16052.8
Discounted Total (12% disc. rate)	14428.09
Value of capital remaining at end of 3 years	567.67
Total costs less value of capital at end of project	13850.42

Cost Chart (without the Project)

(Thousand USD. Present Value)

		Transfer from MSPBS			Total
		Capitata	Limpio	Villa Elisa	
Recurrent	Personnel	2059.0	2100	2100	6259.0
	Supplies	889.7		19.7	909.3
	Maintenance	118.6		8.7	127.2
	Other	84.4			84.4
	Client Time	30.5	30.5	30.5	91.5
	Total	3182.1	2130.5	2158.8	7471.4

APPENDIX F Cost-Effectiveness Indicators

Cost Effectiveness with **the Project**

(Unit: Deaths, Years)

	Deaths prevented	**YLGs**
Year 1 (2008)	7678	550580.30
Year 2 (2009)	7678	550580.30
Year 3 (2010)	7678	550580.30
Year 4 (2011)	7678	550580.30
Year 5 (2012)	7686	550580.30
Year 6 (2013)	7700	550940.10
Year 7 (2014)	7693	550580.30
Year 8 (2015)	7693	550580.30
Year 9 (2016)	7693	550580.30
Year 10 (2017)	15371	1100749.40
Total	84548	6056331.90
Discounted Total	45871	3485353.62
Adjusted Total	40137	3049684.41
CEI	11263080 USD/40137 = 281	11263080 USD/3049684 =3.96

Cost Effectiveness **without the Project**

(Unit: Deaths, Years)

	Deaths prevented	**YLGs**
Year 1 (2008)	7678	550580.30
Year 2 (2009)	7678	550580.30
Year 3 (2010)	7678	550580.30
Year 4 (2011)	7678	550580.30
Year 5 (2012)	7678	550580.30
Year 6 (2013)	7678	550940.10
Year 7 (2014)	7678	550580.30
Year 8 (2015)	7678	550580.30
Year 9 (2016)	7678	550580.30
Year 10 (2017)	7678	550580.30
Total	76780	5506162.80
Discounted Total	46164	3310359.60
Adjusted Total	40393	2896564.60
CEI	5385100 USD/40393 =133	5385100 USD/2896564.60 = 1.86

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