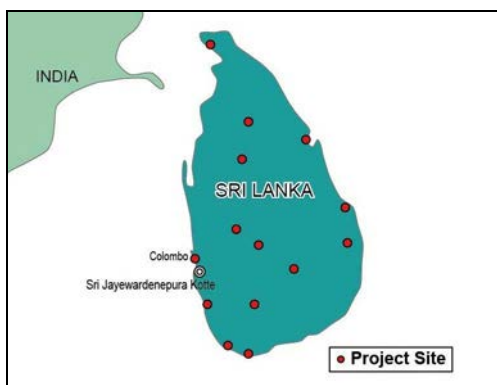


## 0. Summary

This project sufficiently matches Sri Lanka’s development policy, development needs and Japan’s aid policy, hence its relevance is high. Although the project cost was within its plan, the project period was significantly exceeded; therefore efficiency of the project is fair. By implementing the project, various project effects were seen as planned such as an increased number of blood donations, an increased voluntary blood donation rate, increased blood product supplies of red blood cells, platelet and fresh frozen plasma, decreased blood discards, improved safety of the blood transfusion service, improved blood testing and screening capacity. Therefore the effectiveness of the project is high. Furthermore, the project has contributed to better medical treatment in hospitals and clinics through the increase of blood supply, which has been a positive impact. Lastly, the operation and maintenance of the project in terms of system, skills and finances is good and the project’s sustainability is high.

In light of the above, this project is evaluated to be highly satisfactory.

## 1. Project Description



Project Locations



The National Blood Center (NBC), Colombo

### 1.1 Background

After gaining its independence, the Government of Sri Lanka made social sector development, including healthcare sector development, a priority. Following this, the child mortality rate was 16.5 per 1,000 (1998), the maternal mortality rate was 24 per 100,000 birth (1998) and the average life expectancy was 72.9 (1995). Therefore, the basic health indicators of Sri Lanka were good compared to other developing countries in the same income level group. The healthcare system of the country has been maintained by the public hospitals network which includes teaching hospitals across the country, provincial general hospitals, and regional hospitals, as well as a community-based healthcare service network for which public health inspectors and family health workers are responsible.

On the other hand, a transition to advanced medical systems has been in demand in order to correspond to phenomena such as aging as the result of the decreased birth and death rates, and main constituents shifting from contagious diseases to chronic diseases such as cardiac disease, high blood pressure, and cerebrovascular disease. In 2000, the blood transfusion service of Sri

Lanka was operated by the Central Blood Bank (CBB) and 56 Regional Blood Banks (RBB) under the control of the Ministry of Health, however, the CBB was facing difficulties in responding to the increasing demand for blood and within their existing facilities there were problems such as the deterioration of the building, shortages in facilities for blood collecting, blood testing, screening and blood storage, insufficient educational and training facilities. The CBB building was built before the 1960s.

## 1.2 Project Outline

The objective of this project was to ensure safety, adequacy, and easy accessibility of blood products for the public by the construction of a new National Blood Transfusion Center (NBTC), the upgrading the operation equipment of the National Blood Transfusion Services (NBTS), and through technical transfer to staff in charge of NBTS, thereby contributing to the improvement of the public health sector in Sri Lanka.

Loan Approved Amount/ Disbursed Amount	1,508 million yen / 1,332 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	November 2000 / January 2001
Terms and Conditions	Interest Rate: 2.2% (Interest rate for consulting service: 0.75%) Repayment Period: 30 years (Grace Period: 10 years) Conditions for Procurement: Partial Tied
Borrower / Executing Agency	Government of the Democratic Socialist Republic of Sri Lanka / Ministry of Health
Final Disbursement Date	May 2008
Main Contractor (Over 1 billion yen)	Not applicable
Main Consultant (Over 100 million yen)	YAMASHITA SEKKEI (Japan)
Feasibility Studies, etc.	Master Plan Study for Strengthening the Health System in the Democratic Socialist Republic of Sri Lanka, JICA, 2002-2003
Related Projects	County-Focus Training “Laboratory Methodology and the Management System for Blood Banks”, JICA, 2005-2007

## 2. Outline of the Evaluation Study

### 2.1 External Evaluator

Keishi Miyazaki, OPMAC Corporation

### 2.2 Duration of Evaluation Study

Duration of the Study: November 2010 – October 2011

Duration of the Field Study: April 24 – May 7, 2011, July 30 – August 6, 2011

### 2.3 Constraints during the Evaluation Study

None

### 3. Results of the Evaluation (Overall Rating: A<sup>1</sup>)

#### 3.1 Relevance (Rating: ③<sup>2</sup>)

##### 3.1.1 Relevance with the Development Plan of Sri Lanka

At the appraisal, in the health sector action plan (1998), human resource development in the public and private health sector, the improvement of health and medical care services, the decentralization of health and medical care services, and the mitigation of the regional gap in health and medical care services were set as development objectives. In order to respond to the above objectives, improvement in the quantity of the blood supply, improvement in the quality and efficiency of blood transfusion services and human resource development were emphasized.

At the time of ex-post evaluation, the Health Master Plan (2007-2016)<sup>3</sup> of the Government of Sri Lanka stated the following five strategic objectives; (1) To ensure the delivery of comprehensive health services, which reduce the disease, burden and promote health; (2) To empower communities (including households) towards more active participation in maintaining their health; (3) To improve the management of human resources for health; (4) To improve health financing, resource allocation and utilization; and (5) To strengthen stewardship and management functions of the health system. In order to achieve the above strategic objectives, twenty priority programs and projects were specified, including blood safety.

##### 3.1.2 Relevance with the Development Needs of Sri Lanka

At the time of appraisal, the blood transfusion services in Sri Lanka were operated by the National Blood Transfusion Center (NBTC) together with 56 Regional Blood Banks (RBB) under the control of the Ministry of Health. Since the NBTC building was built before the 1960s, it faced recognised constraints such as its aged facilities, lack of facilities for blood collection, blood screening, and blood preservation, and lack of space for training and education. On the other hand, as the blood supply in Sri Lanka had increased by 10% every year since 1993 due to increase of diseases associated with adult lifestyle habits and development of advanced medical technology, the existing NBTC and RBB could not meet requirements due to their capacity limitation. Therefore, the upgrading of NBTC and the modernization of the blood transfusion system in Sri Lanka was necessary.

At the time of ex-post evaluation, the blood transfusion service in Sri Lanka was operated by the National Blood Center (NBC) and 16 Cluster Centers (CC) nationwide as well as 64 Hospital Blood Banks (HBB) under control of the National Blood Transfusion Service (NBTS), Ministry of Health<sup>4</sup>. Through this project, modernization of the National Blood Center (NBC) and 5 Cluster Centers was conducted, and remarkable improvements were seen in both the quality and the quantity of the blood transfusion services in Sri Lanka. On the other hand, the demand for blood transportation and blood products has been continuously increasing, and there is now a high demand for the new construction of blood banks in the northern region, which had been left behind after the end of the civil war in 2009, as well as for modernization of the facilities of small scale HBBs. The needs for the modernization of the blood transfusion services in Sri Lanka and the expansion of its service coverage areas are thus still recognized.

##### 3.1.3 Relevance with Japan's ODA Policy

At the appraisal, the Country Assistance Program for Sri Lanka of the Ministry of Foreign Affairs, Japan, gave the following as priority areas: (1) development and improvement of the

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<sup>1</sup> A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory.

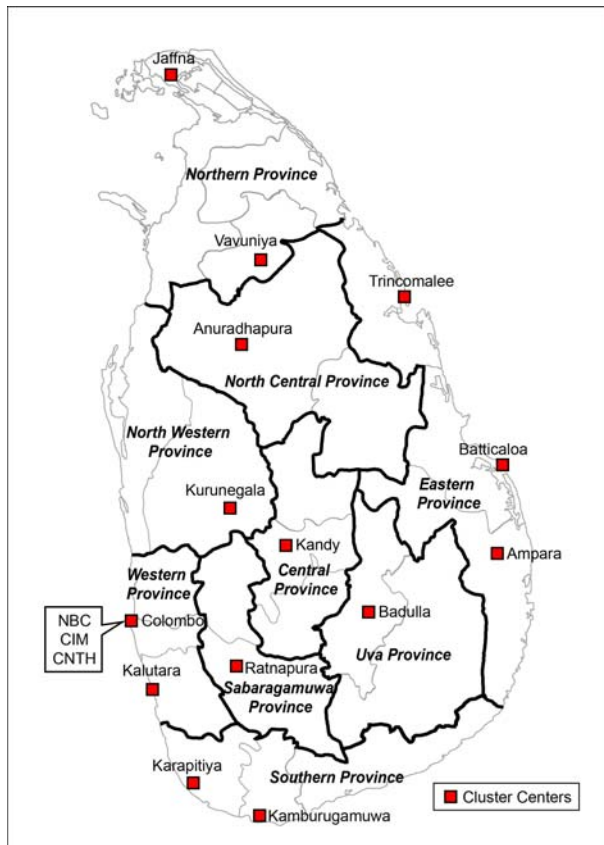
<sup>2</sup> ③: High, ②: Fair, ①: Low.

<sup>3</sup> The Health Master Plan (2007-2016) was prepared by the "Master Plan Study for Strengthening the Health System in the Democratic Socialist Republic of Sri Lanka (2002-2003)" by JICA and it was officially approved by the Government of Sri Lanka in February 2007 as the 10-year Health Sector Plan of the country.

<sup>4</sup> The National Blood Transfusion Service (NBTS) underwent a structural reform in 2009, and the former Central Blood Bank (CBB), Provincial Blood Bank (PBB), Regional Blood Bank (RBB) changed names to National Blood Center (NBC), Cluster Center (CC) and Hospital Blood Bank (HBB), respectively.

economic infrastructure, (2) development of the mining and manufacturing industries, (3) development of the agriculture, forestry and fishery industries, (4) human resource development, and (5) improvement of the health and medical systems. JICA's Assistance Strategy for Japanese ODA loan to Sri Lanka (1992-2002)<sup>5</sup> emphasized support for improvement of the social infrastructure and human resource development in order to sustain continuous economic development. Hence, collaboration with the World Health Organization (WHO), which supports Sri Lanka in the field of infection control measures and primary health care, was also in line with this policy (See **3.2.1 Project Outputs** for more information on the collaboration between JICA and WHO for this project). Furthermore, this project meets the G8 Communiqué Okinawa 2000 declared by the Kyushu-Okinawa Summit stating the need to "Implement an ambitious plan on infectious diseases, notably HIV/AIDS, malaria and tuberculosis".

This project has been highly relevant with Sri Lanka's development plan, development needs, as well as Japan's ODA policy, therefore its relevance is high.



Note: Three Cluster Centers are located in Colombo.

Figure 1 : Location of Cluster Centers

### 3.2 Efficiency (Rating: ②)

#### 3.2.1 Project Outputs

Planned outputs of this project were (1) Construction of the National Blood Center (NBC) (3 story building, 5,010 square meters), (2) Procurement and installation of equipment for the NBC (apheresis system, testing and screening equipment, storage facilities, etc.) as well as for 8 Provincial Blood Banks (PBB) and 48 Regional Blood Banks (RBB) (storage facilities, ambulances, etc.), and (3) Procurement of training materials and blood transfusion manuals (for all blood banks). As for items (1) and (3), the actual outputs were as planned. As for (2) the actual output was almost as planned except for a change in the quantity of equipment procured, and a decrease in the target blood banks from 8 PBB to 5 Cluster Centers. The 5 Cluster Centers were: Kandy (Central Province), Jaffna (Northern Province), Anuradhapura (North Central Province), Ampara (Eastern Province) and Kamburugamuwa (Southern Province). At the time of appraisal, it was envisaged that the project would cover 8 PBBs in all 8 provinces of Sri Lanka, however, the target PBBs were narrowed down to the above 5 PBBs (or current Cluster Centers) due to a policy change of the Ministry of Health that prioritized 5 PBBs out of 8 PBBs to strengthen capacity in the course of project implementation.

In the original plan, the consulting services consisted of two packages, 'Engineering Services' and "Education and Training Services". The 'Engineering Services' involved detailed

<sup>5</sup> It was the Medium-term Strategy for Overseas Economic Cooperation Operation (December 1992-March 2002) originally established by the former Japan Bank for International Cooperation (JBIC).

design and assistance for tender that considered environmentally friendly aspects, environmental monitoring during the construction stage, and technical advice for counter measures for medical wastes. ‘Education and Training Services’ was to provide education and training for all NBTS employees including medical doctors, nurses and laboratory technicians on how to manage blood transfusion services according to the global standards with the introduction of modern equipment and advanced testing methods. The ‘Education and Training Services’ package, was carried out by consultants from WHO and its cost was covered by the consultant fee of this project based on a Letter of Agreement between the Ministry of Health and WHO. The above two consulting service packages were implemented as planned (See **Comparison of the Original and Actual Scope of the Project** in the last page of this report for more information on the planned and actual project outputs).

In addition to these outputs, JICA’s Country-Focus Training, “Laboratory Methodology and the Management System for Blood Banks<sup>6</sup>” was conducted in coordination with the education and training of this project, in which approximately forty NBTS employees (medical doctors, nurses, medical laboratory technologists and public health inspectors) received technical training in Japan for four years between 2005 and 2008. According to the JICA training evaluation report, the levels of achievement of the trainees were substantial.

The NBTS, the executing agency of this project, underwent structural reform in 2009, which saw a shift from the conventional system of the “Central Blood Bank (CBB) - Provincial Blood Bank (PBB) - Regional Blood Bank (RBB)” to the “National Blood Center (NBC) – Cluster Center (CC) – Hospital Blood Bank (HBB)”. In comparison to the old system, the new system focused on the enhancement of Cluster Centers (CC) so that at least one was set up in each province. Each Cluster Center received substantial empowerment from the NBC in every area regarding the management and operation of the blood transfusion service except finance, and thus each Cluster Center has more responsibility for operational control of the Hospital Blood Banks (HBB) in its respective area. Currently there are 16 Cluster Centers and 64 HBBs nationwide (See **3.5.1 Structural Aspects of Operation and Maintenance** for more details).

### 3.2.2 Project Inputs

#### 3.2.2.1 Project Cost

The actual project cost amounted to 1,908 million yen (including the 1,508 million yen of the Japanese ODA loan), resulting in a reduction from the planned cost of 2,010 million yen (including the 1,332 million yen of the Japanese ODA loan). This is 95% of the planned cost, which means that the project cost was lower than planned. As mentioned above, although there was a change in the number of target blood banks from eight to five locations, the cost saving through this change was off set by an increase in the amount of expensive equipment such as refrigerated centrifuges and ambulances. As a result, the actual project cost was within the planned project cost.

Table 1: Planned and Actual Project Cost

Items	Plan			Actual		
	ODA Loan Portion (Mill. JPY)	Sri Lankan Gov. Portion (Mill. LKR)	Total (Mill. JPY)	ODA Loan Portion (Mill. JPY)	Sri Lankan Gov. Portion (Mill. LKR)	Total (Mill. JPY)
1. Civil Work	532	157	758	532	371	929
2. Procurement of Equipment & Materials	573	0	573	603	154	768

<sup>6</sup> The contents of training were quality assurance and clinical blood transfusion work focusing on work implementation, standards, document storage and record keeping, human error prevention and quality control based on GMP (Good Manufacturing Practice). Training was conducted by the Japanese Red Cross Fukuoka Blood Center. \*GMP (Good Manufacturing Practice) is a system that those who are engaged in pharmaceutical and biotech production must follow to ensure that products are consistently produced and controlled according to quality standards appropriate to their intended use and as required by the product specification.

Items	Plan			Actual		
	ODA Loan Portion (Mill. JPY)	Sri Lankan Gov. Portion (Mill. LKR)	Total (Mill. JPY)	ODA Loan Portion (Mill. JPY)	Sri Lankan Gov. Portion (Mill. LKR)	Total (Mill. JPY)
3. Technical Transfer	24	0	24	3	0	3
4. Training & Education	64	0	64	57	2	59
5. Engineering Services	81	0	81	100	11	112
6. Interest During Construction	96	0	96	37	0	37
7. Physical Contingency	138	0	138	0	0	0
8. Tax & Duties	0	192	276	0	0	0
Total	1,508	349	2,010	1,332	538	1,908

Source: JICA appraisal documents and Project Completion Report (PCR) of this project.

Note: Exchange rate used: (Planned cost) LKR1=JPY1.44 (February 2000), (Actual cost) LKR1=JPY1.07 (year and month is unknown).

### 3.2.2.2 Project Period

The planned project period was a total of 57 months from January 2001 (the signing of the loan agreement) until September 2005 (the end of the educational and training consulting services). However, the actual project period was significantly longer than planned, from January 2001 (the signing of the loan agreement) until May 2008 (the end of procurement of equipment and materials), a total of 89 months and 156% longer (a delay of 27 months). The main factors for the delay were, (1) delays in the administrative procedures within Sri Lanka due to a lack of experience of the executing agency in Japanese ODA loan procedures including an unfamiliarity towards JICA's procurement guidelines, (2) changes in the number of target blood banks and the amount of procured equipment, and (3) the Sri Lankan civil war<sup>7</sup> between the government and an anti-government armed organization called the "Liberation Tigers of Tamil Eelam (LTTE)"; there was a delay in the installation of equipment of blood banks in the Northern Province of Sri Lanka which was under the control of LTTE. Of these three factors, (3) is an external factor, which made correspondence more difficult for the project. Nevertheless, the actual project period was longer than planned even ignoring the above external factor.

The opening ceremony of the National Blood Center (NBC) took place on November 2, 2006.

Table 2: Planned and Actual Project Period

Activities	Plan	Actual
1. Signing of Loan Agreement	January 2001	January 2001
2. Civil Work	1 <sup>st</sup> Quarter 2001 – 4 <sup>th</sup> Quarter 2003	3 <sup>rd</sup> Quarter 2002 – 2 <sup>nd</sup> Quarter 2007
3. Procurement of Equipment & Materials	2 <sup>nd</sup> Quarter 2001 – 4 <sup>th</sup> Quarter 2003	3 <sup>rd</sup> Quarter 2002 – 2 <sup>nd</sup> Quarter 2008
4. Engineering Services	2 <sup>nd</sup> Quarter 2001 – 1 <sup>st</sup> Quarter 2004	2 <sup>nd</sup> Quarter 2002 – 2 <sup>nd</sup> Quarter 2007
5. Training and Education Services	4 <sup>th</sup> Quarter 2002 – 3 <sup>rd</sup> Quarter 2005	3 <sup>rd</sup> Quarter 2001 – 4 <sup>th</sup> Quarter 2007
6. Project Completion	September 2005	May 2008
7. Entire Project Period	January 2001 – September 2005 (57 months)	January 2001 – May 2008 (89 months)

Source: Questionnaire survey results to the National Blood Transfusion Service (NBTS).

Although the project cost was within the plan, the project period was significantly exceeded, therefore efficiency of the project is fair.

<sup>7</sup> The end of the civil war between government troops and the anti-government armed organization, "Liberation Tigers of Tamil Eelam (LTTE)" was officially announced by President Rajapaksa at the National Assembly of Sri Lanka on May 19, 2009.



## Equipment and Facilities provided by the Project at the National Blood Center (NBC)



Microbiology Laboratory



Blood Group Serology Laboratory



Reference Immunohematology Lab.



Blood Component Laboratory



Refrigerator Room for Blood Storage



Training for Medical Students

### 3.3 Effectiveness (Rating: ③)

This project not only modernized the facilities and equipment of the NBC and five Cluster Centers, but training for medical doctors, nurses and other NBTS employees was also conducted in order to improve their skills and knowledge. In addition, proposals were made to reform the organization and systems for the improvement of quality control and the management capacity of NBTS for consulting services. The beneficiaries of the training and education extended to all blood bank staff nationwide. This means that the outcome of training and education was not limited to the strengthening of NBC capacity for management, testing, research, training and education as the hub of the Sri Lankan blood transfusion service, but also included capacity development of individual blood banks as well as the entire blood transfusion service system in Sri Lanka.

Based upon the above understanding, in addition to analysis of the project effects regarding NBC and the five Cluster Centers mainly targeted by this project, this ex-post evaluation concludes that changes in the performance of the entire blood transfusion service system in Sri Lanka before and after the project should be also analyzed as an effect of this project.

#### 3.3.1 Quantitative Effects

##### 3.3.1.1 Results from Operation and Effect Indicators

###### a) Number of Blood Donations

The number of blood donations in Sri Lanka increased 1.9 times; from 158,541 before the project (2002) to 302,883 after the project (2010). In 2010, the proportion of blood donations by province was: Western Province (where Colombo is located), 41.2%, followed by Central Province (12.5%), Southern Province (12.2%), North Central Province (10.1%), North Western Province (10.1%), Uva Province (5.5%), Eastern Province (4.8%), Sabaragamuwa Province (3.1%), and Northern Province (3.1%) (See Table 3).

The NBC and Cluster Centers in five locations (Kandy, Jaffna, Anuradhapura, Ampara and Kamburugamuwa), all main target blood banks of this project, also observed increases in blood donations by 1.4 to 3 times between 2002 (2003 for the NBC) and 2010 (See Table 4). The reasons why the number of blood donations at NBC decreased after 2008 to 78,684 in 2009 and 63,569 in 2010 having hit a peak of 96,388, are: (i) the number of blood donations in the entire

Western Province tended to decline after 2008, and (ii) there was an increase in the number of blood donations at other blood banks in Western Province as the result of capacity improvement of the Cluster Centers and Hospital Blood Banks after the introduction of the Cluster System through the structural reform of 2009. Consequently, there was a relative decline in the number of blood donations in the NBC. In fact, the total number of blood donations in Western Province, excluding those at the NBC, increased little by little from 53,238 in 2008 to 58,073 in 2009 and 61,092 in 2010. Regarding the Kamburugamuwa Cluster Center, this was newly established during the project implementation period and commenced operations in 2006.

Table 3: Number of Blood Donations in Sri Lanka (2002-2010)

Unit: Number of Blood Donations

Province	2002	2003	2004	2005	2006	2007	2008	2009	2010
Western	73,651	78,079	90,250	93,302	115,539	120,008	149,626	136,757	124,661
	46.5%	46.6%	49.6%	45.6%	46.8%	46.2%	46.9%	44.2%	41.2%
Central	22,613	24,696	27,522	28,096	31,852	32,466	36,430	38,433	37,979
	14.3%	14.7%	15.1%	13.7%	12.9%	12.5%	11.4%	12.4%	12.5%
North Western	10,894	10,881	12,075	15,012	17,644	21,238	25,785	25,239	22,780
	6.9%	6.5%	6.6%	7.3%	7.2%	8.2%	8.1%	8.1%	7.5%
North Central	13,740	14,894	15,246	17,274	20,133	20,538	28,697	28,670	30,587
	8.7%	8.9%	8.4%	8.5%	8.2%	7.9%	9.0%	9.3%	10.1%
Uva	8,156	9,711	10,494	10,751	12,525	14,870	16,525	15,358	16,657
	5.1%	5.8%	5.8%	5.3%	5.1%	5.7%	5.2%	5.0%	5.5%
Southern	16,369	15,283	7,952	21,697	26,768	28,315	36,298	38,159	36,801
	10.3%	9.1%	4.4%	10.6%	10.8%	10.9%	11.4%	12.3%	12.2%
Sabaragamuwa	4,689	3,794	6,215	6,436	8,274	8,253	9,657	8,698	9,397
	3.0%	2.3%	3.4%	3.1%	3.4%	3.2%	3.0%	2.8%	3.1%
Northern	3,753	4,773	6,108	6,997	6,084	5,350	4,892	5,762	9,485
	2.4%	2.8%	3.4%	3.4%	2.5%	2.1%	1.5%	1.9%	3.1%
Eastern	4,676	5,422	6,140	4,847	7,933	8,915	10,953	12,679	14,536
	2.9%	3.2%	3.4%	2.4%	3.2%	3.4%	3.4%	4.1%	4.8%
<b>Total</b>	<b>158,541</b>	<b>167,533</b>	<b>182,002</b>	<b>204,412</b>	<b>246,752</b>	<b>259,953</b>	<b>318,863</b>	<b>309,755</b>	<b>302,883</b>

Source: National Blood Transfusion Service (NBTS).

Note: The volume of blood per one blood donation is 450cc.

Table 4: Number of Blood Donations in Six Blood Banks (2002-2010)

Unit: Number of Blood Donations

Blood Bank	Province	2002	2003	2004	2005	2006	2007	2008	2009	2010
NBC	Western	-	46,204	53,145	52,651	67,687	75,666	96,388	78,684	63,569
Kandy	Central	11,003	11,519	13,732	13,722	17,162	17,009	18,963	19,209	20,016
Jaffna	Northern	2,513	3,597	4,689	5,643	5,268	4,975	4,517	4,427	5,584
Anuradhapura	N. Central	10,216	11,543	10,945	12,386	15,132	15,300	22,463	21,099	22,495
Ampara	Eastern	1,607	1,831	2,237	3,122	3,488	4,513	5,133	5,715	4,957
Kamburugamuwa	Southern	-	-	-	-	8,259	13,291	17,992	18,076	16,975
<b>Total</b>		<b>25,339</b>	<b>74,694</b>	<b>84,748</b>	<b>87,524</b>	<b>116,996</b>	<b>130,754</b>	<b>165,456</b>	<b>147,210</b>	<b>133,596</b>

Source: National Blood Transfusion Service (NBTS).

Note 1: The volume of blood per one blood donation is 450cc.

Note 2: Since Kamburugamuwa is a newly established blood bank which commenced operations in 2006, there is no actual number of blood donations from 2002 to 2005.

#### b) Voluntary Blood Donation Rate<sup>8</sup>

The rate of voluntary blood donations improved from a national average of 55% in 2004 to 89% in 2010 (See Table 5). Before the completion of this project, 45% of blood donations relied

<sup>8</sup> The voluntary blood donation rate is the ratio of volunteers and non-remunerated blood donations among all blood donations.



on replacement donations<sup>9</sup> and the selling of blood, however, the fact that this rate decreased to 10% post-project while voluntary donations increased to 90% contributes to improved blood safety. The main target blood banks of the project, the NBC and the Cluster Centers in five locations, have seen a significant improvement in the voluntary blood donation rate, especially the NBC and the blood banks at Jaffna, Anuradhapura and Kamburugamuwa, which have achieved almost a 100% voluntary blood donation rate (See Table 6).

Table 5: Voluntary Blood Donation Rate in Sri Lanka (2004-2010)

	Unit: %						
	2004	2005	2006	2007	2008	2009	2010
Voluntary Blood Donation Ratio in Sri Lanka	55.0	62.9	75.0	81.0	88.0	84.0	89.0

Source: National Blood Transfusion Service (NBTS).

Table 6: Voluntary and Replacement Blood Donation Rate in Six Blood Banks (2006-2010)

		Unit: %				
		2006	2007	2008	2009	2010
NBC (Western Province)	Voluntary	96.2	94.7	97.4	98.6	97.7
	Replacement	3.8	5.3	2.6	1.4	2.3
Kandy (Central Province)	Voluntary	81.8	81.4	86.4	86.8	87.5
	Replacement	18.2	18.6	13.6	13.2	12.5
Jaffna (Northern Province)	Voluntary	73.5	81.9	96.4	100.0	99.9
	Replacement	26.5	18.1	3.6	0.0	0.1
Anuradhapura (N. Central Province)	Voluntary	86.1	92.4	97.6	99.2	99.6
	Replacement	13.9	7.6	2.4	0.8	0.4
Ampara (Eastern Province)	Voluntary	75.1	78.8	83.6	90.5	89.6
	Replacement	24.9	21.2	16.4	9.5	10.4
Kamburgamuwa (Southern Province)	Voluntary	99.9	98.5	98.4	98.5	99.3
	Replacement	0.1	1.5	1.6	1.5	0.7

Source: National Blood Transfusion Service (NBTS).

Note: Currently remunerated blood donations are forbidden by law in Sri Lanka. Therefore the replacement blood donations in Table 6 do not include remunerated blood donations.

Currently, on national average, 80% of blood donations are conducted outside of the blood banks (off-site), while the remaining 20% are conducted within the blood banks (on-site). Each blood bank actively participates in blood collection, in collaboration with its local community, by dispatching mobile units with blood bank employees such as medical doctors and nurses and ambulances to public facilities such as community centers, Buddhist temples, schools and offices. Such efforts have resulted in an increase in the number of blood donations nationwide. In the case of Sri Lanka, the level of service standards in education and healthcare is relatively high compared to other developing countries of the same income level group. Public health inspectors and health workers are assigned in each local community and they often assist in blood donation campaigns. The fact that this public health inspector system in Sri Lanka is well utilized is one of the reasons why blood donations using mobile units are successful there. The

<sup>9</sup> A replacement blood donation is when a patient who is in need of a blood transfusion receives blood from his/her family and relatives. If the blood type of the family member does not match, blood in stock is used, but if there is a match, the blood is used as it is after being tested. However, if the blood testing capacity in the hospital is not sufficient, a replacement blood donation can have a high risk of transmitting disease. Also, since the blood must be checked by required tests, including the screening test for transmittable infectious viruses before transfusion, cases where the blood collected from replacement donors is directly used for transfusion take longer than using stocked blood which is already examined through proper tests and screening.

project provided 19 ambulances equipped with refrigerators (5 for the NBC, 14 for the Cluster Centers and 2 for the Hospital Blood Banks) and this is another factor that has contributed to the expansion of off-site blood collection.

The main factors for the increase in the voluntary blood donation rate are (1) successful blood collection activities through the use of mobile units, and (2) the positive attitude of Sri Lankan people towards voluntary blood donations based on their Buddhist spirit, i.e., they are enthusiastic to “do good for others” through donating blood.

The project’s main target blood banks, the NBC and Cluster Centers in five other locations, have observed an increase in off-site blood donations using mobile units (see Table 7). However, decreases in off-site blood donations have been observed at Jaffna (Northern Province) and Ampara (Eastern Province). These were 59.3% and 67.9% respectively in 2010, in comparison to the national average of 80%. According to the Jaffna and Ampara blood banks, the reason is assumed to be unique ethnic and religious backgrounds in those regions<sup>10</sup>.

Table 7: Off-Site and On-Site Blood Collection Ratio in Six Blood Banks (2006-2010)

			2006	2007	2008	2009	2010
NBC (Western Province)	Off-Site	No. Blood Donations	63,264	68,930	88,284	75,963	57,272
		Ratio (%)	93.5%	91.1%	91.6%	96.5%	90.1%
	On-Site	No. Blood Donations	4,423	6,730	8,104	2,721	6,297
		Ratio (%)	6.5%	8.9%	8.4%	3.5%	9.9%
Kandy (Central Province)	Off-Site	No. Blood Donations	13,111	12,693	15,187	15,448	16,248
		Ratio (%)	76.4%	74.6%	80.1%	80.4%	81.2%
	On-Site	No. Blood Donations	4,051	4,316	3,776	3,761	3,768
		Ratio (%)	23.6%	25.4%	19.9%	19.6%	18.8%
Jaffna (North Province)	Off-Site	No. Blood Donations	2,153	2,472	2,164	2,501	3,309
		Ratio (%)	40.9%	49.7%	47.9%	56.5%	59.3%
	On-Site	No. Blood Donations	3,115	2,503	2,353	1,925	2,275
		Ratio (%)	59.1%	50.3%	52.1%	43.5%	40.7%
Anuradhapura (N. Central Province)	Off-Site	No. Blood Donations	11,595	13,053	19,598	18,933	20,351
		Ratio (%)	76.6%	81.5%	87.2%	89.7%	90.5%
	On-Site	No. Blood Donations	3,537	2,967	2,865	2,166	2,144
		Ratio (%)	23.4%	18.5%	12.8%	10.3%	9.5%
Ampara (Eastern Province)	Off-Site	No. Blood Donations	1,584	2,335	3,410	3,781	3,365
		Ratio (%)	45.4%	51.7%	66.4%	66.2%	67.9%
	On-Site	No. Blood Donations	1,904	2,178	1,723	1,933	1,592
		Ratio (%)	54.6%	48.3%	33.6%	33.8%	32.1%
Kamburgamuwa (Southern Province)	Off-Site	No. Blood Donations	8,198	12,865	17,360	17,351	16,437
		Ratio (%)	99.3%	96.8%	96.5%	96.0%	96.8%
	On Site	No. Blood Donations	61	426	632	725	538
		Ratio (%)	0.7%	3.2%	3.5%	4.0%	3.2%

Source: National Blood Transfusion Service (NBTS).

<sup>10</sup> In the Northern Province and Eastern Province where Jaffna and Ampara are located, the population is largely Tamil. According to the interview with the blood banks in Jaffna and Ampara, the Tamils are not as proactive as Sinhalese in blood donation. Sri Lanka’s ethnic makeup is as follows: Sinhalese 72.9% (mostly Buddhists), Tamils 18.0% (mostly Hindus), Moors 8% (mostly Muslims) and others 1.1% (from the Japanese Ministry of Foreign Affairs website).

On the other hand, off-site blood collection by mobile units is influenced by seasonal changes which cause the number of donors to decrease in number during festivals or farming/harvest seasons. Also off-site blood collection by mobile units requires a higher cost, more time and labor than the on-site blood collection. Since the amount of on-site blood collection has not increased at many blood banks in the same way as off-site blood collection has, it is necessary to promote on-site blood collection within blood banks in order to secure a stable volume of blood. The NBTS recognizes this issue, and plans for enhancing on-site blood collection such as promotion of awareness campaigns though the mass-media have been discussed in the NBTS.

#### Blood Donation at the National Blood Center (NBC)



#### Off-Site Blood Donation Campaign using a Mobil Unit at the Buddhist Temple in Kandy



#### c) Blood Supply Red Blood Cells

Sri Lanka's red blood cell supply doubled from 156,147 bags in 2002, pre-project, to 320,966 bags in 2010, post project. By Province, Eastern Province, Sabaragamuwa Province, Northern Province and North Central Province have marked increases of five times, four times, 3,8 times and three times, respectively.

The Cluster Centers in five locations, the main target blood banks of this project (except Kamburugamuwa), have increased their red blood cell supply by 2-4 times, but this is not the case for the NBC. The NBC red blood cell supply decreased by approximately 20%, from 20,672 bags in 2003, pre-project, to 4,278 bags in 2010, post project<sup>11</sup>. This is because, pre-project, the NBC was responsible for the blood demand not only of Western Province but also other neighboring provinces as the functions of each provincial and regional blood bank were rather limited. However, the blood donation and blood product supply capacity improved at the blood banks outside of the NBC post project, causing the NBC supply of blood products to decrease. In addition, the Cluster Center at Kamburugamuwa is a newly built blood bank in the course of the project, and it is an independent facility which is not attached to an existing

<sup>11</sup> As reference, 80% of red blood cells provided by the Kandy Cluster Center in 2010 were for the Kandy Teaching Hospital to which the Cluster Center is attached (39.3% for medical wards, 26.5% for surgical wards, 9.7% for pediatric wards, 5.2% for obstetrics and gynecology wards). The remaining 20% was provided to other public hospitals (13.5%) and private hospitals (5.8%).

public hospital. The functions of the Kamburugamuwa Cluster Center are blood collection, blood testing and screening, the production of blood products, and the distribution of blood products to the other Hospital Blood Banks (HBB) in Southern Province<sup>12</sup>. Therefore, Kamburugamuwa Cluster Center does not directly supply blood products to the medical institutions which need blood for transfusions. For this reason, there is no supply of red blood cells in Kamburugamuwa indicated in Table 9.

Table 8: Supply of Red Blood Cells in Sri Lanka (2002-2010)

Province	Unit: Bag									
	2002	2003	2004	2005	2006	2007	2008	2009	2010	
Western	79,290 50.8%	66,418 44.2%	5,195 5.6%	75,879 43.7%	86,999 44.3%	88,992 41.6%	104,492 43.7%	110,141 37.7%	119,405 37.2%	
Central	21,329 13.7%	23,195 15.4%	22,331 24.2%	23,831 13.7%	24,601 12.5%	28,332 13.2%	30,757 12.9%	40,489 13.9%	42,748 13.3%	
North Western	10,851 6.9%	11,412 7.6%	11,994 13.0%	13,957 8.0%	16,987 8.6%	18,552 8.7%	18,996 7.9%	26,059 8.9%	24,894 7.8%	
North Central	10,322 6.6%	11,894 7.9%	12,298 13.3%	14,911 8.6%	18,221 9.3%	18,588 8.7%	23,329 9.8%	34,577 11.8%	31,819 9.9%	
Uva	7,653 4.9%	10,305 6.9%	8,926 9.7%	9,476 5.5%	10,591 5.4%	12,732 6.0%	12,570 5.3%	15,422 5.3%	16,784 5.2%	
Southern	14,533 9.3%	13,334 8.9%	16,299 17.6%	16,769 9.6%	16,589 8.4%	20,964 9.8%	23,817 10.0%	31,959 10.9%	32,552 10.1%	
Sabaragamuwa	4,337 2.8%	3,674 2.4%	4,015 4.3%	3,862 2.2%	6,575 3.3%	9,276 4.3%	7,207 3.0%	9,482 3.2%	17,577 5.5%	
Northern	3,509 2.2%	4,423 2.9%	4,841 5.2%	6,605 3.8%	6,880 3.5%	6,240 2.9%	6,307 2.6%	9,685 3.3%	13,341 4.2%	
Eastern	4,323 2.8%	5,570 3.7%	6,544 7.1%	8,529 4.9%	9,080 4.6%	10,152 4.7%	11,740 4.9%	14,170 4.9%	21,846 6.8%	
<b>Total</b>	<b>156,147</b>	<b>150,225</b>	<b>92,443</b>	<b>173,819</b>	<b>196,523</b>	<b>213,828</b>	<b>239,215</b>	<b>291,984</b>	<b>320,966</b>	

Source: National Blood Transfusion Service (NBTS).

Note 1: The volume of red blood cells contained in one bag is 275-300cc.

Note 2: The shelf-life of red blood cells is 35-42 days.

Table 9: Supply of Red Blood Cells in Six Blood Banks (2002-2010)

Blood Bank	Province	Unit: Bag								
		2002	2003	2004	2005	2006	2007	2008	2009	2010
NBC	Western	-	20,672	3,276	8,140	9,639	5,232	5,202	4,296	4,287
Kandy	Central	11,300	11,701	11,710	11,833	12,295	14,616	15,921	20,532	22,063
Jaffna	Northern	2,070	3,394	4,075	5,341	5,917	4,824	4,338	5,171	6,992
Anuradhapura	N. Central	7,774	9,246	8,678	11,134	14,003	14,916	19,259	27,890	25,274
Ampara	Eastern	1,447	1,886	2,374	3,057	3,112	3,564	3,881	5,548	6,191
Kamburugamuwa	Southern	-	-	-	-	0	0	0	0	0
<b>Total</b>		<b>22,591</b>	<b>46,899</b>	<b>30,113</b>	<b>39,505</b>	<b>44,966</b>	<b>43,152</b>	<b>48,601</b>	<b>63,437</b>	<b>64,807</b>

Source: National Blood Transfusion Service (NBTS).

Note 1: The volume of red blood cells contained in one bag is 275-300cc.

Note 2: The shelf-life of red blood cells is 35-42 days.

Note 3: Since Kamburugamuwa is a newly established blood bank which commenced operations in 2006. There is no actual number of blood donations from 2002 to 2005.

### Platelet

Sri Lanka's platelet supply increased 1.5 times from 74,259 bags in 2006, pre-project, to 109,498 bags in 2010, post project (See Table 10). Because platelet can be preserved for a shorter period of time, only for five days, compared to red blood cells, it is produced and supplied as needed, and thus its amount may vary depending on the province and year. About 60% of the country's overall platelet supply is concentrated in Western Province which has the

<sup>12</sup> The Kamburugamuwa Cluster Center is called the Kamburugamuwa Collection and Distribution Center.

largest population among nine provinces. The NBC and the Cluster Centers in five locations that are the main target blood banks of the project (except Kamburugamuwa) showed a marked expansion in their capacity for platelet supply although there were some inconsistencies seen annually. For the same reason as that given for the red blood cell supply, there is no supply of platelet in Kamburugamuwa indicated in Table 11.

Table 10: Supply of Platelet in Sri Lanka (2006-2010)

Province	Unit: Bag				
	2006	2007	2008	2009	2010
Western	48,692 (65.6%)	50,457 (67.1%)	60,474 (67.1%)	65,443 (53.5%)	66,410 (60.7%)
Central	6,585 (8.9%)	6,671 (8.9%)	7,515 (8.3%)	11,192 (9.1%)	12,341 (11.3%)
North Western	3,654 (4.9%)	2,877 (3.8%)	2,566 (2.8%)	6,069 (5.0%)	1,861 (1.7%)
North Central	6,383 (8.6%)	5,336 (7.1%)	5,205 (5.8%)	7,419 (6.1%)	6,977 (6.4%)
Uva	864 (1.2%)	2,180 (2.9%)	2,570 (2.9%)	3,165 (2.6%)	3,700 (3.4%)
Southern	6,044 (8.1%)	5,631 (7.5%)	8,880 (9.9%)	23,471 (19.2%)	11,160 (10.2%)
Sabaragamuwa	883 (1.2%)	985 (1.3%)	1,517 (1.7%)	2,668 (2.2%)	3,469 (3.2%)
Northern	955 (1.3%)	762 (1.0%)	807 (0.9%)	1,528 (1.2%)	1,636 (1.5%)
Eastern	199 (0.3%)	321 (0.4%)	566 (0.6%)	1,383 (1.1%)	1,935 (1.8%)
<b>Total</b>	<b>74,259</b>	<b>75,220</b>	<b>90,100</b>	<b>122,337</b>	<b>109,489</b>

Source: National Blood Transfusion Service (NBTS).

Note 1: The volume of platelet contained in a one bag is 50cc.

Note 2: The shelf-life of platelet is 5 days.

Table 11: Supply of Platelet in Six Blood Banks (2006-2010)

Blood Bank	Province	Unit: Bag				
		2006	2007	2008	2009	2010
NBC	Western	4,860	4,258	3,537	3,913	6,466
Kandy	Central	5,321	5,121	472	7,600	9,277
Jaffna	Northern	871	550	637	78	1,017
Anuradhapura	N. Central	6,202	5,009	4,882	6,968	6,544
Ampara	Eastern	63	115	313	977	93
Kamburugamuwa	Southern	0	0	0	0	0
<b>Total</b>		<b>17,317</b>	<b>15,053</b>	<b>9,841</b>	<b>20,245</b>	<b>24,243</b>

Source: National Blood Transfusion Service (NBTS).

Note 1: The volume of platelet contained in a one bag is 50cc.

Note 2: The shelf-life of platelet is 5 days.

#### Fresh Frozen Plasma (FFP)

Sri Lanka's fresh frozen plasma supply increased 1.4 times from 132,970 bags in 2006, pre-project, to 180,340 bags in 2010, post project (See Table 12). Like platelet, Western Province took about 50% of the country's overall fresh frozen plasma supply. In addition, the fresh frozen plasma supply was 215,583 bags in 2009 which was higher compared to other years. This was because there was a dengue fever outbreak in Sri Lanka, and there was a higher demand for fresh frozen plasma according to the NBTS. The NBC and the Cluster Centers in five locations that are the main target blood banks of the project (except Kamburugamuwa) have shown a marked expansion in their capacity for fresh frozen plasma supply although there were some inconsistencies seen annually. For the same reason as that for red blood cells and platelet supply, there is no supply of fresh frozen plasma in Kamburugamuwa indicated in Table 13.

Table 12: Supply of Fresh Frozen Plasma (FFP) in Sri Lanka (2006-2010)

Province	2006	2007	2008	2009	2010
Western	69,439 (52.2%)	72,552 (50.5%)	82,470 (52.3%)	96,382 (44.7%)	95,527 (53.0%)
Central	14,730 (11.1%)	15,780 (11.0%)	17,879 (11.3%)	21,438 (9.9%)	21,595 (12.0%)
North Western	11,301 (8.5%)	13,860 (9.6%)	11,361 (7.2%)	15,485 (7.2%)	7,899 (4.4%)
North Central	4,602 (3.5%)	6,777 (4.7%)	6,705 (4.3%)	14,079 (6.5%)	13,143 (7.3%)
Uva	6,322 (4.8%)	6,562 (4.6%)	7,144 (4.5%)	10,636 (4.9%)	4,893 (2.7%)
Southern	11,606 (8.7%)	13,034 (9.1%)	15,674 (9.9%)	35,378 (16.4%)	17,953 (10.0%)
Sabaragamuwa	6,283 (4.7%)	6,301 (4.4%)	7,220 (4.6%)	7,426 (3.4%)	6,876 (3.8%)
Northern	3,662 (2.8%)	3,752 (2.6%)	4,276 (2.7%)	6,489 (3.0%)	5,744 (3.2%)
Eastern	5,025 (3.8%)	5,017 (3.5%)	4,813 (3.1%)	8,273 (3.8%)	6,710 (3.7%)
Total	<b>132,970</b>	<b>143,635</b>	<b>157,542</b>	<b>215,583</b>	<b>180,340</b>

Source: National Blood Transfusion Service (NBTS).

Note 1: The volume of fresh frozen plasma contained in one bag is 150cc.

Note 2: The shelf-life of fresh frozen plasma is one year.

Table 13: Supply of Fresh Frozen Plasma (FFP) in Six Blood Banks (2006-2010)

Blood Bank	Province	2006	2007	2008	2009	2010
NBC	Western	4,046	4,218	2,405	4,499	7,104
Kandy	Central	5,706	7,230	607	9,269	8,997
Jaffna	Northern	2,971	2,901	3,408	4,208	4,878
Anuradhapura	N. Central	3,151	5,522	5,692	10,914	10,940
Ampara	Eastern	1,142	934	1,277	4,075	1,495
Kamburugamuwa	Southern	0	0	0	0	0
Total		17,061	20,805	13,389	32,965	33,414

Source: National Blood Transfusion Service (NBTS).

Note 1: The volume of fresh frozen plasma contained in one bag is 150cc.

Note 2: The shelf-life of fresh frozen plasma is one year.

It should be noted that currently, component blood products such as red blood cells, platelet, and fresh frozen plasma are mainly used, and whole blood transportations are rare except in special circumstances.

#### d) Blood Discard Amount and Rate

The blood discard rate in Sri Lanka has significantly improved from 20% in 2008, pre-project, to 8.47% in 2010, post project (See Table 14). Primarily, this is due to the effects of an improved preservation capacity of blood products and a cold chain system resulting from the provision by the project of cooling facilities and ambulances equipped with refrigerators. Secondary reasons are improved systems, such as the functional enhancement of the Cluster Centers, business management based on 5S<sup>13</sup>, and the introduction of a quality control policy in the field of blood transfusion services as the result of the structural reform of 2009 mentioned earlier. In the old blood transfusion service system, regional coordination between the Provincial Blood Banks (PBB) and the Regional Blood Banks (RBB), as well as quality control functions, were pointed out as being weak, however, in the new system, each Cluster Center has responsibility for its own Hospital Blood Bank (HBB) inventory control, and quality control of blood products under its respective area (See **3.5.1 Structural Aspects of Operation and**

<sup>13</sup> 5S stands for the slogan, Seiri (Sorting/Putting things in order), Seiton (Orderliness/Proper arrangement), Seisou (Clean/Cleanliness), Seiketsu (Standardization/Purity), and Shitsuke (Sustaining/Discipline/Commitment) that is used in maintaining and improving the work environment in production and service industries.

**Maintenance** for more details).

The NBC and the Cluster Centers in five locations that are the main target blood banks of the project were below the national average of 5.3-7.4% for the blood discard rate in 2010.

Table 14: Blood Discard Rate

						Unit: %
Blood Bank	Province	2007	2008	2009	2010	
NBC	Western	7.4	6.2	3.0	5.3	
Kandy	Central	N.A.	N.A.	11.2	7.4	
Jaffna	Northern	N.A.	N.A.	7.2	5.7	
Anuradhapura	N. Central	N.A.	N.A.	6.4	2.4	
Ampara	Eastern	N.A.	N.A.	14.5	7.3	
Kamburugamuwa	Southern	N.A.	N.A.	3.0	5.6	

Source: National Blood Transfusion Service (NBTS).

e) Coverage of Blood Screening Tests for Blood Transmittable Infectious Viruses and Bacillus (HIV, hepatitis B and C, syphilis)

Sri Lanka attained a 100% screening ratio for reactions to all the above viruses and bacillus (HIV, hepatitis B and syphilis) except for hepatitis C before the project started. In 2004, during the conduction of this project, pilot screening tests for hepatitis C by ELSIA<sup>14</sup> started, and 100% screening ratio nationwide had been attained by 2009 (See Table 15).

Table 15: Coverage of Blood Screening Tests for Hepatitis C

									Unit: %
	2003	2004	2005	2006	2007	2008	2009	2010	
Coverage of the Blood Screening Test for Hepatitis C	0	*	*	92	95	100	100	100	

Source: National Blood Transfusion Service (NBTS).

Note: The period between 2004 and 2005 was for pilot screening tests

f) Virus Infection Rate of Patients Resulting from Blood Transportation

According to the NBTS, in Sri Lanka, there was only one case of HIV infection by blood transportation reported in 2000. From 2001 to the present, there have been no reports of virus infection of patients resulting from blood transportation<sup>15</sup>.

g) Reduction in Time to Prepare Transfusions of Blood

There is no statistical data on the reduction of time to prepare transfusions of blood, however, the key informant interview<sup>16</sup> conducted during the field survey of this ex-project evaluation revealed that blood supply services and the systems at blood banks have improved, and that necessary blood products can be provided at any time 24 hours, as needed. It can thus be assumed that there has been some reduction in time.

h) Numbers for Blood Supply Areas and Medical Institutes

Regarding blood supply areas, since the end of the civil war in 2009, the NBTS has expanded the existing service area of blood banks in the northern regions left behind in

<sup>14</sup> An abbreviation for Enzyme-linked Immunosorbent Assay (ELISA), which is a popular antibody screening method used worldwide.

<sup>15</sup> The current blood transfusion service system in Sri Lanka has established a tracing system for donors whose blood caused any side effects. Also the Ministry of Health collects and archives infection disease data nationwide.

<sup>16</sup> Details of the key informant interview are show in **3.3.2 Qualitative Effects**.



development by upgrading existing blood banks as well as constructing new blood banks based in the Jaffna Cluster Center which was improved and modernized by this project. On the other hand, what increase there has been in the number of medical institutes is not known since the NBTS does not keep track of this.

### 3.3.1.2 Results of Calculations of Internal Rates of Return (IRR)

The IRR of the ex-post evaluation will not be calculated for the following reasons: (1) no IRR was calculated at the appraisal, (2) if the IRR were to be calculated at the time of the ex-post evaluation, special knowledge of the health sector would be necessary in order to set preconditions for the costs and economic benefit effects, and (3) additional time and cost would be required to collect information.

### 3.3.2 Qualitative Effects

Before the project, the National Blood Transfusion Center (NBTC) building was old, there was a lack of facilities for blood collection, blood screening, and blood preservation, and the space for training and education was insufficient. After the project, these were remarkably improved. Firstly, there had been a quantitative expansion in and modernization of blood collection, testing devices and blood keeping facilities. The introduction of blood tests and screening by ELISA enabled more accurate and a larger number of blood tests than before. It is now possible to screen for hepatitis C in addition to the conventional screenings (serodiagnosis of HIV, hepatitis B, syphilis, malaria) upon blood transfusion. The capacity and accuracy of histocompatibility tests (tissue typing) were enhanced. The above mentioned improvements were seen not only in the NBC but also in the five Cluster Centers mainly targeted by this project. In addition, an apheresis machine, which is a blood component separator, was newly installed in the NBC.

Furthermore, the training and educational capacity of the NBC was strengthened by the expansion of training and of laboratory space, equipment and facilities. A voluntary blood donor registration system was established of in all the blood banks.

At the time of ex-post evaluation, a key informant interview was conducted using questionnaires at blood banks and private hospitals in 14 locations in order to grasp the quantitative effects and impact. The numerical breakdown<sup>17</sup> of these hospitals was: 7 Cluster Centers, 5 Hospital Blood Banks and 2 private hospitals<sup>18</sup>.

#### (1) Improved Safety of the Blood Supply and Transfusion System

The results of the key informant interview revealed that eleven hospitals considered that the safety of their blood supply system had improved post project. Areas mentioned in particular were: (i) improved blood collection safety (11 responses), (ii) improved hygiene conditions / work place environment (9 responses), (iii) well-functioning referral system<sup>19</sup> of the NBC (10 responses), (iv) sufficient blood management and conservation in the blood banks (11 responses), and (v) establishment of a committee for quality control and medical accident prevention (8 responses).

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<sup>17</sup> The breakdown of the key informant interview target facilities is as follows: 7 Cluster Centers (Kandy, Jaffna, Anuradhapura, Ampara, Kuliyaipitiya, Kurunegala, Kamburugamuwa), 5 Hospital Blood Banks (Sri Lanka National Hospital, Ragama North Colombo Teaching Hospital, Mahamodara Hospital, Ratnapura Hospital, Peradeniya Hospital) and 2 private hospitals (Lanka Hospital, Ninewells Hospital).

<sup>18</sup> Since Kamburugamuwa Cluster Center was a newly established blood bank in 2006, some questions that compared pre and post project were unanswered. For Peradeniya Hospital, because the respondent was a newly assigned person who was not familiar with the pre project status, some questions remained unanswered.

<sup>19</sup> The NBC is the headquarters for all blood banks in Sri Lanka and plays the role of reference center that has information on the supply and demand of blood, quality unification and blood management, conducts high level blood testing that cannot be handled in the Cluster Centers or at Hospital Blood Banks, and gives technical advice throughout the country.

### (2) Improvement of Testing and Screening of the Blood Transfusion Service

The results of the key informant interview revealed that 11 hospitals considered that there had been some improvements in blood testing and screening post project in comparison to pre project. Areas mentioned in particular were: (i) improved accuracy of blood matching tests (11 responses), (ii) decreased side effects associated with blood transfusions (11 responses), and (iii) establishment of blood donor tracing systems in the case of emerging side effects after blood transfusion (9 responses).

### (3) Improved Technical Capacity of NBTS Employees

The results of the key informant interview revealed that 13 hospitals considered that the technical capacity of the NBTS employees had improved post project in comparison to pre project. Areas mentioned in particular were: (i) improved accuracy and responses of blood testing and screening, (ii) decreased human errors during testing and screening, (iii) improved record management, and (iv) improved work efficiency as a result of the introduction of 5S.

In the consulting service of the project, training and education on international standardized blood management was given to NBTS employees. As shown in Table 16 below, various training programs were conducted during the project implementation period, and a total 675 employees participated in the programs during the period between 2002 and 2007. These included 326 medical officers/doctors, 77 nurse officers, 136 medical laboratory technologists, 90 public health inspectors and 46 other staff. In addition, about 40 NBTS staff including medical officers/doctors, nurse officers, medical laboratory technologists, and public health inspectors attended JICA's County-Focus Training "Laboratory Methodology and the Management System for Blood Banks" conducted by the Japanese Red Cross Fukuoka Blood Center in Japan from 2005 to 2008.

Table 16: Training Programs conducted during the Project Implementation Period

Training Program	Year	Participants
Workshop on Basic Computer Knowledge	2002-2003	SMO: 12, MO: 12, NO: 16, MLT: 10, PHI:80
Quality Management Training Workshop	2002	MO: 20, MLT: 5
Quality Assurance Training Workshop	2003	NO: 26, MLT: 17, PHI: 10, Office staff: 16
Seminar on Transfusion Transmitted Infections	2003	MO: 25, MLT: 13
Program for Tecan Machine Training	2003	MLT: 12
Workshop on HCV ELISA	2004	MO: 8, MLT: 12
Japanese 5S System Awareness Program	2004	MO: 24, NO: 20, MLT: 16, Minor staff: 30 (All NBC staff)
Blood Group Serology Workshop on Improving Immune Haematological Techniques	2004	MO: 18, MLT:12
GMP* Awareness Program	2004	MO: 24, NO: 15, MLT: 18
Technical Aspects of Blood Banking	2004	MO: 29
Workshop on Quality Assurance and Technical Training in the Blood Transfusion Service	2004	MO: 70, MLT: 21
Appropriate Clinical Use of Blood	2006	MO: 32
Bio Safety and Waste Management	2007	MO: 20
Donor Counselling and Management	2007	MO: 32

Source: National Blood Transfusion Service (NBTS).

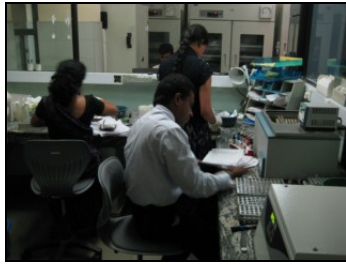
Note 1: SMO: Senior Medical Officer (Doctor); MO: Medical Officer (Doctor); NO: Nurse Officer; MLT: Medical Laboratory Technologist; PHI: Public Health Inspector.

Note 2: \*GMP (Good Manufacturing Practice) is a system that those who are engaged in pharmaceutical and biotech production must follow to ensure that products are consistently produced and controlled according to quality standards appropriate to their intended use and as required by the product specification.

Since this project supported the technical capacity development of NBTS employees together with the improvement and modernization of the facilities and equipment of the blood banks, it produced the outcome of “improved technical capacity of NBTS employees” which led to other outcomes such as “improved safety of the blood supply and transfusion system” “improvement of testing and screening of the blood transfusion service”

For these reasons, this project has largely achieved its objectives, therefore its effectiveness is high.

#### Five Cluster Centres mainly improved by the Project



Kandy (Central)



Jaffna (Northern)



Anuradhapura (North Central)



Ampara (Eastern)



Kamburugamuwa (Southern)



Mobile Unit

### 3.4 Impact

#### 3.4.1 Intended Impacts

##### (1) Contribution to Medical Treatment in Hospitals and Clinics by an Increase in the Blood Supply

The results of the key informant interview revealed that 12 hospitals had positive perceptions of the project’s contribution to medical treatment in hospitals and clinics. In particular, these included: (i) increase in the number/cases of surgical operations (11 responses), and (ii) increase in the number of cases of other medical treatments (8 responses). Regarding the increase in the number/cases of surgical operations, although this depended highly on the scale, level, number of specialists and technical skills of each medical institute, some improvements were observed where surgical procedures had been restricted due to an insufficient blood supply, except for some special cases.

In Kurunegala in North Western Province, the only domestic thalassemia center in Sri Lanka is found, the region having the most thalassemia patients in the country. In this region, there is a high demand for blood transfusion on a daily basis, and thalassemia treatment cases have increased through the project.

A safe blood supply service is an essential part of the medical infrastructure, and it can be seen that the project has played an important role in the increase of treatment cases where blood transfusion is required by establishing the preferable environment where safe blood can be obtained anytime.

### 3.4.2 Other Impacts

#### (1) Impacts on the natural environment

##### a) Disposal of Medical Waste

An incinerator was built by the project on the premises of the NBC for medical waste disposal. Upon completion of the project, the incinerator was used for the disposal of medical waste, but soon after it started to experience trouble. Currently the medical waste disposal of the NBC is outsourced to a private medical waste service provider. The reasons are as follows: (i) since the incinerator was manufactured overseas, the maintenance costs such as for repair or spare parts is high; (ii) when the project started, the NBC was supposed to take care of its own medical waste since there was no private medical waste service provider. Now, there are several private medical waste service providers authorized by the government, and it costs less to outsource the service than for the NBC to have its own incinerator and to conduct repair and maintenance on a regular basis.

Although the incinerator is no longer in use as planned at the beginning, the disposal of medical waste from the NBC is handled appropriately by the private medical waste service provider, and considering it is more efficient from the point of view of operating cost to outsource the service, the decision to outsource is considered to be appropriate.

Medical waste from the Cluster Centers and the Hospital Blood Banks (HBB) are handled by each hospital's own facility (incinerator). According to the NBTS, the treatment is carried out properly.

##### b) Environmental Impact Monitoring System of the National Blood Center

The NBC is required by law to undergo inspections for noise, water quality, air and waste, and to renew their environment protection license. However, the environmental authority inspections are mainly based on documentary examination of process and procedures, and on-site inspections of the NBC are conducted only irregularly. Other than the environmental authority inspections, the NBC takes its own measures, primarily treating drainage using chemicals, then allowing it to drain in to the sewage. The NBC is planning to strengthen their environmental monitoring system by having a water quality test carried out by an external inspection agency.

The NBC renews its environment protection license annually according to law, and the disposal of medical waste and drainage are appropriately carried out. Thus, there is no negative impact on the natural environment from the project.

#### (2) Social Impacts associated with Land Acquisition and Resettlement

Since the NBC was built in a compound owned by the Ministry of Health, there was no land acquisition and settlement for the project.

From the above, it can be seen that some positive impacts of the project were observed such as the contribution to medical treatment in hospitals and clinics as the result of increased transfusions of blood. Also, there were no negative impacts on the natural environment or on society due to land acquisition and resettlement.

## 3.5 Sustainability (Rating: ③)

### 3.5.1 Structural Aspects of Operation and Maintenance (O&M)

The O&M agency for the project facilities is the National Blood Transfusion Service (NBTS) under the Laboratory Service Department, Ministry of Health. The NBTS shares its function as the National Blood Center (NBC), and it has constructed the public blood transfusion system of Sri Lanka with its affiliated Cluster Centers in 16 locations and Hospital Blood Banks in 64 locations. The total number of NBTS employees at present is 1,037 including 355 medical doctors and 320 nurses. There are 191 staff working at the NBC in

Colombo. The NBTS conducted a structural reform in 2009, and its structure shifted from the conventional system of “Central Blood Bank (CBB) - Provincial Blood Bank (PBB) - Regional Blood Bank (RBB)” to the new system of “National Blood Center (NBC) – Cluster Center (CC) – Hospital Blood Bank (HBB)”. One or more Cluster Centers are situated in each of all nine provinces<sup>20</sup> and they have received a significant level of empowerment (other than over financing) from the NBC, in order that they can be responsible for the blood transfusion service in each region, including management of the HBBs in their respective areas. All Cluster Centers and Hospital Blood Banks except for the NBC and the Kamburugamuwa Cluster Center (Southern Province) are located within existing public hospitals. However, their budget, staff, authority and scope of works are solely independent from the public hospitals to which they are attached.

Upon structural reform in 2009, the concept of business administration and quality management policy based on 5S was introduced to Sri Lanka<sup>21</sup>. In 2010, The NBC was awarded the Taiki Akimoto 5S Award<sup>22</sup> which is given to a company/organization that has successfully introduced and diffused 5S by the Japan Sri Lanka Technical and Cultural Association (JASTECA)<sup>23</sup>. The NBC is the first organization to receive this award in the healthcare sector in Sri Lanka.

Currently, as of April 2011, there are 80 Cluster Centers and Hospital Blood Banks in Sri Lanka, and there is ongoing effort to establish new blood banks in Northern Province, North Central Province and Eastern Province where their development was delayed. The organization chart of the NBTS is shown in Figure 2.

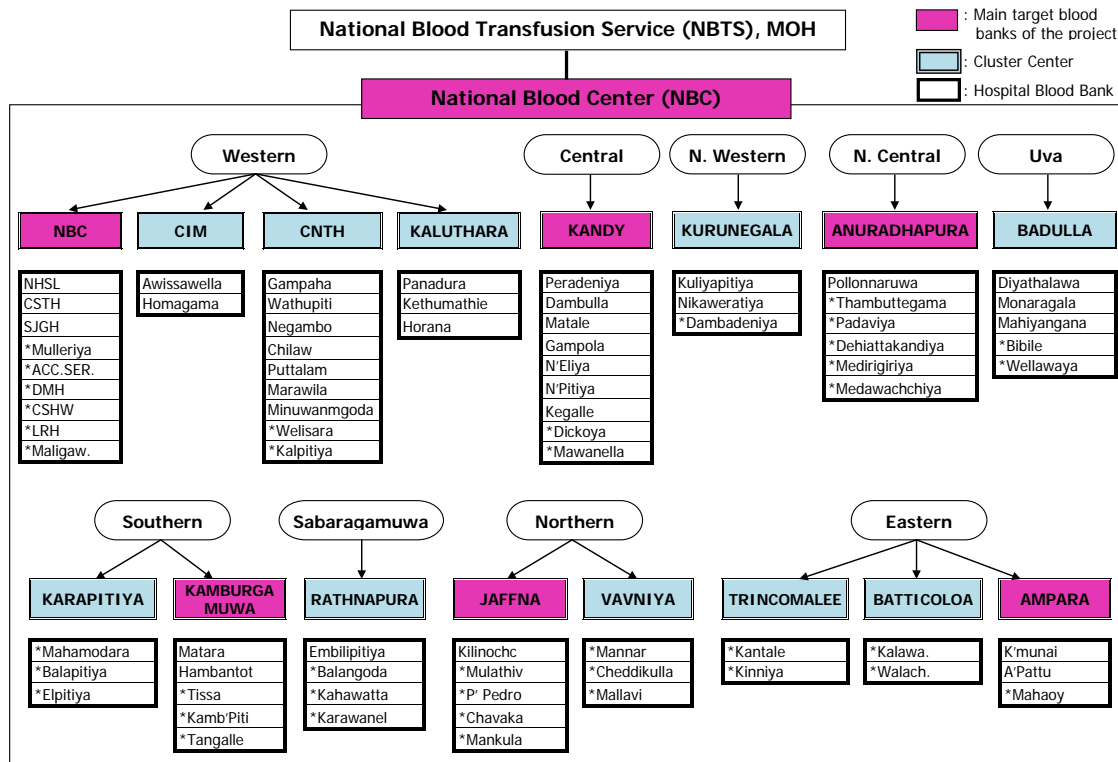
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<sup>20</sup> Although the old system set one blood bank in each province, the new system gave consideration to the population of each province, its geographical condition and regional healthcare service status, and established more than two Cluster Centers each in Western, Southern, Northern and Eastern Provinces.

<sup>21</sup> The main reason why the concept of 5S was introduced to the blood transfusion services is because when the current director of NBTS who was assigned the position in 2009 (he is also a director of the National Blood Center) was at the Kurunegala Public Hospital as a director, the hospital brought in the 5S practice with great success. For this reason, he took an active role in introducing the 5S into the blood transfusion services. During the implementation period of this project, a Japanese 5S System Awareness Program was conducted in 2004 for NBTS employees. Furthermore, since 2009 JICA has been conducting a technical cooperation project, “Improvement of the Quality of and Safety in Healthcare Institutions in Sri Lanka” (2009-2012) introducing the 5S, Kaizen, TQM approaches at seven pilot hospitals. One of the seven pilot hospitals is the Castle Street Hospital in Colombo to which a hospital blood bank is attached.

<sup>22</sup> Taiki Akimoto 5S Award is an award the 5S promotion named after the late Mr. Taiki Akimoto who used to give AOTS seminars as a lecturer in Sri Lanka. This award is given to applicants who made the most successful efforts to introduce and promote the 5S among all companies and organizations who apply.

<sup>23</sup> JASTICA (Japan Sri Lanka Technical and cultural Association) is a non-profit organization founded by the alumni of the Association for Overseas Technical Scholarship (AOTS) in 1984 in order to promote international exchange between Japan and Sri Lanka and to disseminate the 5S system in Sri Lanka.



Source: National Blood Transfusion Service (NBTS).

Note 1: Those marked with an asterisk (\*) are only storage blood banks and do not collect blood at the moment.

Note 2: National Blood Center (NBC) also functions as one of the four Cluster Centres in Western Province.

Note 3: CIM: Cancer Institute, Maharagama; CNTH: Colombo North Teaching Hospital; NHSL: National Hospital of Sri Lanka; CSTH: Castle Street Teaching Hospital; SJGH: Sri Jayawarananapura General Hospital; ACC.

SER: Accident Service Blood Bank; DMH: De Zoya Maternity Hospital; CSHW: Castle Street Hospital for Women; LRH: Lady Ridgeway Hospital.

Figure 2: Organizational Chart of NBTS (As of April 2011)

### 3.5.2 Technical Aspects of Operation and Maintenance

The NBTS established Sri Lanka's original blood transfusion service guidelines, which referred to the U.K. guidelines, with the support of the project. Also, as a part of quality management, it has set up a system to check the testing skills of each blood bank by sending a blind sample from the NBC once a year and getting feedback on the result. The NBTS also emphasizes employees' technical training, and there are many training courses available such as the orientation of new recruits for all employees, specialized training for doctors, nurses and laboratory technicians in their respective fields, and a diploma and doctoral degree in transfusion medicine.

The WHO has set the NBC as its Coordination Center in South Asia and conducts training there for government offices working for blood transfusion services in South Asian countries. After the completion of the project, the WHO has continuously provided support through consulting services, and domestic and overseas training for medical doctors, nurses and laboratory technicians as part of its technical cooperation for the NBTS.

### 3.5.3 Financial Aspects of Operation and Maintenance

The O&M budget of the NBTS increased from 422 million Rupees to 591 million Rupees in 2009, post project (See Table 16). The results of the key informant interview revealed that the blood banks are relatively satisfied with the O&M budget. All necessary testing reagents for a year are stocked and managed at the NBC, and the necessary budget allowances are provided for reagents and expendable supplies.

Table 16: O&M Budget of the NBTS

Unit: Sri Lankan Rupee: LKR

	2008	2009	2010
Allocated Budget	442,052,738	591,066,599	546,870,705
Actual Expenditure	385,981,000	591,066,589	547,039,022

Source: National Blood Transfusion Service (NBTS).

The Sri Lankan government maintains the principle of providing free medical care and education for its citizens, and as for the blood transfusion service, it provides free blood product supplies for public medical institutions, and collects minimum cost-recovering fees from private medical institutes. Therefore, the current revenue source for O&M of the NBTS largely relies on income from the national budget and not on the sales revenue from blood products.

### 3.5.4 Current Status of Operation and Maintenance

Project facilities, equipment and machinery are well utilized and maintained. There is an equipment workshop at the NBC and all damaged and malfunctioning equipment and machinery is sent to the workshop for repair. If the equipment workshop cannot handle the problem, an external service provider is asked to provide repair services instead.

Also, most reagents are imported from advanced countries such as Australia and U.K., although some reagents for antibody screening are produced within the NBC in order to reduce costs and improve research and technical skills.



Equipment Workshop (NBC)



Reagent Laboratory (NBC)



Reagent Store (NBC)

From above, no major problems have been observed in the operation and maintenance system, therefore sustainability of the project effect is high.

## 4. Conclusion, Lessons Learned and Recommendations

### 4.1 Conclusion

This project sufficiently matches Sri Lanka's development policy, development needs and Japan's aid policy, hence its relevance is high. Although the project cost was within its plan, the project period was significantly exceeded; therefore efficiency of the project is fair. By implementing the project, various project effects were seen as planned such as an increased number of blood donations, an increased voluntary blood donation rate, increased blood product supplies of red blood cells, platelet and fresh frozen plasma, decreased blood discards, improved safety of the blood transfusion service, improved blood testing and screening capacity. Therefore the effectiveness of the project is high. Furthermore, the project has contributed to better medical treatment in hospitals and clinics through the increase of blood supply, which has been a positive impact. Lastly, the operation and maintenance of the project in terms of system, skills and finances is good and the project's sustainability is high.



In light of the above, this project is evaluated to be highly satisfactory.

## **4.2 Recommendations**

### **4.2.1 Recommendations to the Executing Agency**

- While 80% of blood donations rely on off-site donations using mobile units, there are seasonal fluctuations and these require a higher cost and more labor for staffing and transportation. For this reason, in order to secure a more stable blood supply, the promotion of on-site blood donations at the blood banks is required. This may be achieved with methods such as through the promotion of public awareness campaigns using mass-media and through collaboration with local medical institutions. This should increase the number of on-site blood donations at the blood banks.
- Although the NBTS provides training opportunities for staff of cluster centers and blood banks at the NBC in Colombo, each cluster center and blood bank carry out their routine work with a limited number of staff, therefore opportunities for staff to participate in training are limited. On the other hand, staff are highly enthusiastic in learning new skills and gaining knowledge and their need for trainings is high. It is recommended that local training is organized at each province, especially in those provinces distant from Colombo.

### **4.2.2 Recommendations to JICA**

None

## **4.3 Lessons Learned**

The project was designed and implemented using the following approaches: (1) collaboration between different Japanese ODA schemes such as ODA loans and technical cooperation, (2) a combination of support for the “hardware” aspects that focused on the modernization of facilities and equipment and the “software” aspects that emphasized human resource development and organization and system improvement, (3) mobilization of the knowledge and expertise of the WHO which possesses abundant experience and achievements in this field. These approaches were the key to the success of the project. The project hired WHO consultants for its consulting service and they advised that facilities be designed to match their specialized needs. They also advised on the selection of procured equipment, conducted training for medical doctors, nurses and other NBTS employees to improve the skills and knowledge of those directly engaged in the operation of the modernized facilities, and proposed that organization and systems be reformed for the improvement of quality control and the management capacity of NBTS from the viewpoint of securing the effectiveness and sustainability of the project. It is notable that this technical assistance component was provided in parallel with the infrastructure development component and was given the same priority as the infrastructure development component as a main project component, not as a subordinate component in the project. This was a good project plan and design and can be used as a useful reference for health sector projects in other developing countries.

End

### Comparison of the Original and Actual Scope of the Project

Item	Original	Actual
<p>1. Project Outputs</p> <p>(1) Construction Work Construction of the National Blood Center (NBC)</p> <p>(2) Equipment Procurement</p> <p>(3) Consulting Service a) TOR</p> <p>b) Work Volumes</p>	<ul style="list-style-type: none"> <li>• Three story building, 5,010 m<sup>2</sup></li> <li>• Equipment to be installed at the NBC (Apheresis system, testing equipment, storage facilities, etc.)</li> <li>• Equipment to be installed at the blood banks in 8 provinces and 48 regions (storage facilities, ambulances, etc.)</li> <li>• Training materials and manuals</li> </ul> <p><u>Engineering Service</u></p> <ul style="list-style-type: none"> <li>• Detailed design and assistance in tender that considered the environmentally friendly aspects</li> <li>• Technical advice on environmental monitoring during the construction stage, and on counter measures for medical wastes treatment</li> </ul> <p><u>Education and Training Service</u></p> <ul style="list-style-type: none"> <li>• Technical training and education on the international standardized blood transfusion service for NBTS employees (by WHO consultants)</li> </ul> <p><u>Engineering Service</u></p> <ul style="list-style-type: none"> <li>• Foreign: 16.2 M/M</li> <li>• Local: 128.3 M/M</li> </ul> <p><u>Education and Training Service</u></p> <ul style="list-style-type: none"> <li>• Foreign 24 M/M</li> </ul>	<ul style="list-style-type: none"> <li>• Three story building, 5,367 m<sup>2</sup></li> <li>• There were some changes in numbers but the contents were as planned.</li> <li>• There were changes in the number of target blood banks.</li> <li>• As planned</li> <li>• As planned</li> <li>• As planned</li> <li>• As Planned (Conducted education/training at 5 Cluster Centers and 48 Hospital Blood Banks for their staff)</li> <li>• Almost as planned</li> <li>• Almost as planned</li> </ul>
2. Project Period	Jan. 2001 – Sep. 2005 (57 months)	Jan. 2001 – May 2008 (89 months)
3. Project Cost		
Amount paid in Foreign currency	(Unknown)	(Unknown)
Amount paid in Local currency	(Unknown)	(Unknown)
Total	2010 million yen	1908 million yen
Japanese ODA loan portion	1,508 million yen	1,332 million yen
Exchange rate	1 Rupee = 1.44 yen (As of Feb. 2000)	1 Rupee = 1.07 yen (Annual average but years are unknown)