STUDY REPORT
ON
THE PROJECT FOR
THE EXPANDED PROGRAMME ON IMMUNIZATION
(GRANT AID FOR CHILD WELFARE)
IN
THE REPUBLIC OF MALI

NOVEMBER 2000

JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)

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PREFACE

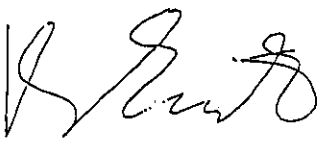
In response to a request from the Government of the Republic of Mali, the Government of Japan decided to conduct a study on the Grant Aid for Child Health, the Project for Expanded Program on Immunization and entrusted the Japan International Cooperation Agency (JICA) to conduct the study with the assistance of the Japan International Cooperation System (JICS).

JICA sent to the Republic of Mali a study team from July 9th to 31st , 2000.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Mali for their close cooperation extended to the team.

November 2000

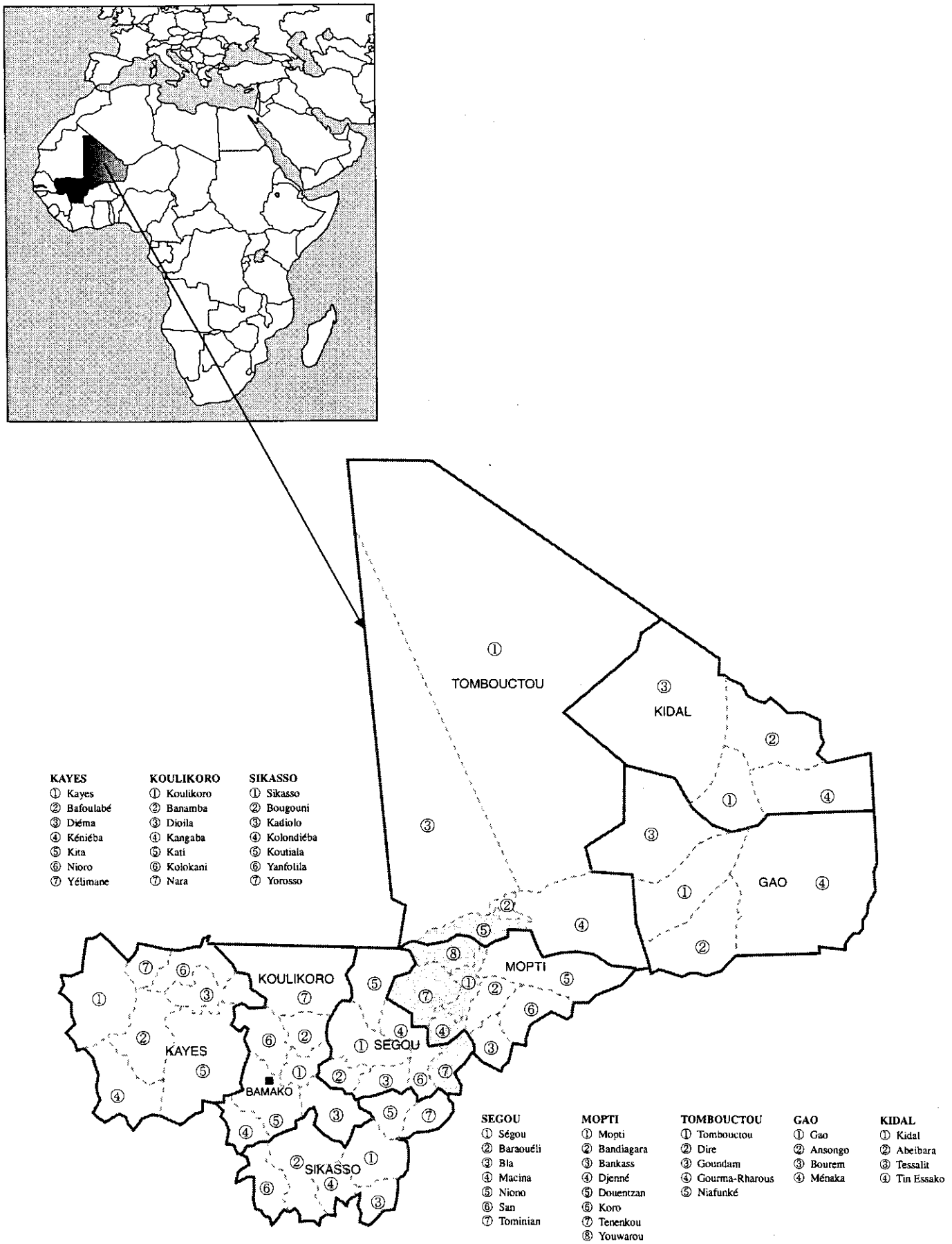


Kunihiko Saito

President

Japan International Cooperation Agency

Location map



(Shadow indicate the flood area in rainy season.)

Map-1 Republic of Mali

Abbreviations

AIDS	Acquied Immuno-deficiency Syndrom
AD syringe	Autodisable syringe
BCG	Bacillus Calmette-Guerin Vaccine
CNI	National Immunization Center
DPT	Diphteria, Pertussis, Tetanus Vaccine
EPI	Expanded Program on Immunization
GAVI	Global Alliance for Vaccines Immunization
HIV	Human Immuno-deficiency Virus
KVA	Kilovolt ampere
NID	National Immunization Days
PDDSS	10-Year National Plan for the Development of Health and Society
UNICEF	United Nations Children's Fund
WHO	World Health Organization

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Chapter 1 Background of the Project

The Republic of Mali (hereinafter referred as to "Mali") gained independence from France in 1960 and ruled by an autocratic one-party government for the following 21 years. During the 1990s, Mali was forced to undergo major political and economic transformations. A bloodless coup in 1992 led to the establishment of a transitional government, under which a democratization process began. In 1993 the CFA Franc was devaluated.

Under these circumstances, the Malian government endeavors to carry out various health Programmes to reform its rigid health policies, improve nation's access to basic health care services and medical supplies, and promote residents' participation in the health/medical Programmes under the Bamako Initiative. Despite these efforts, the country's morbidity and mortality rates have remained high. The mortality rates of infants, children under five, and pregnant women are worse than other sub-Saharan countries. In 1997, the under-5 mortality rate ranked fifth among 188 independent nations worldwide. Table-1 below shows the health indices of five sub-Saharan countries.

Table-1: Health Indicators of 5 Sub-Saharan Countries

	Infant mortality rate	Under-5 mortality rate	Maternal mortality	Average life expectancy at birth
Mali	145	239	580	48
Mauritania	120	183	550	53
Senegal	72	124	560	51
Kenya	157	87	370	54
Tanzania	92	143	530	51
Developing countries, average	65	96	-	63

Source: The State of the World's Children 1999, UNICEF

Major causes of infant death are malaria, cerebral meningitis, respiratory infection, diarrhea, tetanus, measles, and other infectious diseases, which could be prevented or mitigated by the use of immunization, oral re-hydration therapy, and antibiotics. Using a state budget and subsidies from UNICEF, the Malian Ministry of Health has been implementing the Expanded Programme on Immunization (hereinafter abbreviated to "EPI") since 1986 to promote BCG, polio, measles, and DTP (absorbed diphtheria-purified pertussis-tetanus combined vaccine) vaccination nationwide. However, as shown in Table-2 below, the routine immunization rates against all target diseases, except BCG, have remained low since the inauguration of the Programme more than ten years ago, registering 47% for the third shot of DTP and 46% for measles, which are far below WHO's recommended target rate of 80%. The Ministry of Health lists the following factors accountable for the low rates:

1) Aged and deteriorated cold chain equipment
2) Inadequate means of vaccine transportation (automobiles, boats, and motorcycles)
3) Difficult access to health centers
4) Shortage of health workers

Table-2: Routine Immunization Rates and Targets (%)

	1996	1997	1998	1999 (April)	2000 target	2001 target
BCG	79	76	75	82	80	97
DPT (1st)	79	74	74	61	60	65
DPT (3rd)	53	52	53	47	60	65
Measles	57	56	58	46	62	65
Tetanus (2nd)	51	57	32	19	30	54
Yellow fever	8	9	10	13	55	20
Hepatitis-B	-	-	-	-	55	65

(Source: CNI)

In addition to routine vaccination against the above-mentioned six diseases, the Malian government included in EPI the immunization against yellow fever in 1987, as the country was struck by the plague that year. It also added hepatitis B vaccination in April 2000. However, as both are rather expensive vaccines, the immunization rate of yellow fever remains around 10%, and the Ministry of Health has no prospect of purchasing hepatitis B vaccines on its own account, except for 600,000 doses that it procured in 1999, which were to be consumed during 2000.

Under these circumstances, the Malian government formulated a plan for procuring cold chain and other equipment for the Community Centers throughout the country, District Referral Health Centers, Regional Health Bureaus, and the National Immunization Center and requested the Japanese government for grant aid to implement the plan.

Chapter 2 Contents of the Project

2-1 Objective of the Project

The Malian government positioned the improvement of maternal and child health as its top priority under its "10-Year National Plan for the Development of Health and Society (PDDSS) (1998 – 2007)," which, among other things, aims to reduce the morbidity and mortality rates of EPI's target diseases. The government is carrying out specific programmes according to the "5-Year Immunization Plan (1998 –2002)," but is failing to meet the target immunization rates recommended by WHO against all subject diseases except tuberculosis(BCG). The Malian government attributes the low rates to the aging cold chain and logistics equipment and the reduction of financial aid from major donor organizations.

This Project aims to contribute to the nationwide improvement of immunization rates by upgrading the vaccine storage, control, and transportation systems by renewing aged or broken equipment, as well as by procuring a 1-year supply of Hepatitis B vaccine so that the supply may continue until the donation of the same from Global Alliance for Vaccines Immunization (GAVI) in 2002.

2-2 Basic Concept of the Project

The initial request of the Malian government consisted of the procurement of i) vaccines (polio, BCG, DTP, measles, Hepatitis B, and yellow fever) to cover routine immunization for the five-year period between 2000 and 2005, ii) vaccines (polio and measles), syringes, and safety boxes for the National Immunization Day (NID) activities, iii) cold chain equipment (cold/freezer rooms, refrigerators/freezers, power generators, voltage regulators, cold boxes, vaccine carriers, and computers), and iv) logistics equipment (automobiles and motorcycles). The above items were examined based on the survey findings as outlined below:

2-2-1 Items and Quantity of Equipment to Procure

(1) Vaccines, Syringes, and Safety Boxes

1) Vaccine (hepatitis B)

Nationwide EPI activities in Mali began in 1986. The initial request included the vaccines, syringes, and sterilization equipment for routine immunization for the next five years, as well as two kinds of vaccines (polio and measles) for NID as described above. However, BCG, DPT, measles and routine polio vaccines were excluded, as it was confirmed that the Malian government could procure them at its own account. Vaccines for NID were also excluded, as Mali was

receiving sufficient supplies of such vaccines through UNICEF and WHO.

In addition, the Malian government eagerly requested the Japanese government to procure vaccines against yellow fever and hepatitis B. 1,000 people were reported to have contracted yellow fever (20% of whom died) in 1987, since when concentrated immunization efforts against this disease have been made in three regions where the plague is most prevalent. The Ministry of Health later included yellow fever in its routine immunization program, but has so far done it twice in 1988 and 1999, covering only 10 – 13% of the target population, because the vaccine is too expensive. However, the request for yellow fever vaccine is not to be fulfilled, as there is a worldwide basic shortage of this vaccine, and UN-prequalified producers (manufacturers that have passed WHO's pre-qualification test with regard to the production of the vaccine) are unable to supply the vaccine.

As for hepatitis B vaccine, according to the survey results that were conducted on three occasions between 1980 and 1996, about 25% of pregnant women were reported to have been infected with hepatitis B virus, which could be passed to neonates through vertical infection. The Ministry of Health procured 600,000 doses of hepatitis B vaccine in 1999, but has since unable to procure additional doses and requested GAVI to extend financial assistance in July 2000 for the procurement of vaccine, etc. Our site survey confirmed that the Malian government had no prospect of procuring the vaccine for 2001, but might be able to do so after 2001 with the financial assistance from GAVI. Therefore, to avoid duplication, this Project will procure the vaccine only to cover the required amount for 2001. The required amount was calculated by multiplying the target population in 2001 (infants under one: 418,480) by the target immunization rate (65%), number of immunization rounds (three), and vaccine wastage rate[1] (coefficient: 1.33).

2) Syringes and Safety Boxes

Syringes for EPI in Mali has been reusable type, but are now being replaced with auto-disable (AD)type. This is because the Ministry of Health is trying to comply with WHO's recommendation to use AD syringes in routine immunization and mass campaigns with regard to the prevention of HIV/AIDS and hepatitis infection. At the time of site survey, UNICEF, based on the policy, was procuring AD–type syringes against measles for NID to be conducted in November and December 2000, while there is no prospect of procuring such syringes for routine immunization.

In view of the above, this Project will procure AD-type syringes for routine immunization instead of reusable type as requested originally. As for syringes for dissolving freeze-dried vaccines (BCG and measles vaccines), those of disposable type will be procured, as it will be only used for dilution and not for direct injection to the client

The initial request also included sterilization equipment and kits. However, they were for

(1) Vaccine wastage rate: the ratio of vaccine quantity that is disposed because of damage during transportation and storage, miss-shot, and remaining portion after use

disinfecting reusable syringes and therefore excluded from the Project. Safety boxes, although they were not part of the initial request, will be procured by the Project to ensure the safe disposal of AD syringes.

Required quantities of syringes and safety boxes were calculated as shown in Table-3 below:

Table-3: Quantities of Vaccines and Syringes to Procure

Name of equipment	Quantity	Parameters of calculating required quantity
Auto-disable syringe, 0.05ml	446,500	Target population in 2001 (418,480) for BCG vaccine × target immunization rate (97%) × 1 shot × syringe wastage rate (coefficient: 1.11).
Auto-disable syringe, 0.5ml	6,196,000	Target population in 2001 (418,480) for DPT, measles, Hepatitis B , and tetanus vaccines × respective target immunization rates × numbers of shots × syringe wastage rate (coefficient: 1.11).
Dissolving syringe, 5ml	76,800	Same quantity as the required number of vials (76,800) of freeze-dried BCG and measles vaccines in 2001.
Safety box	68,100	1 box per 100 AD syringes (total of 66,425 boxes) + 1 box for each Community Health Center (total of 943 boxes) for dissolving syringes (76,800)+732 boxes to be stocked at CNI.

(2) Cold chain Equipment

This Project will cover the following equipment:

1) Cold/Freezer Rooms

These are for storing vaccines at the central government level. The existing cold and freezer rooms ($5m^3$, 2 each) at Bamako Central Warehouse within National Immunization Center (CNI) are deteriorating, and their temperature recorders and alarm devices are broken and need to be renewed as soon as possible. Also, the storage capacity of the existing equipment is not large enough to store an increasing volume of vaccines for NID and routine immunization. Thus, the Project will procure two each of $8m^3$ cold rooms and freezer rooms for Bamako Central Warehouse, as well as one $8m^3$ cold room and one $8m^3$ freezer room for the Central Warehouse of the Mopti Region Health Bureau, which is the supply base of vaccines to three northern Regions, in order to ensure a stable supply of vaccines to target areas.

Parameters for calculating the capacities of cold and freezer rooms are shown in Table-4 below. The estimation was made by multiplying the number of required vials for the immunization activities scheduled by the Malian government in 2001 (B) by the size of package (C) to obtain the storage space required each year (D). As vaccines are delivered twice a year, half of D (=E) was multiplied by the amount that can be stored safely (F) and by 1.5 to allow extra space for efficient cooling. The Bamako/Mopti capacity ratio was derived based on the population ratio of 64/36%.

Table-4: Calculation of Storage Capacity of Cold/Freezer Room

Routine Immunization

Control temp.	Name of vaccine	2001 Plan (doses)	No. of doses per vial	No. of vials per package	Package size per vial (cm3)	Storage space needed	Storage qty. per delivery (2/year) (m3)	Safe storage qty. (m3) E x 0.25	Total vaccine qty. stored (m3) E + F	Storage capacity (m3) G x 1.5	Bamako storage qty. (64%)m3	Mopti storage qty. (36%)m3
		A		B	C	D	E	F	G	H	I	J
4℃	DPT	1,085,327	10	108,533	3.5	3.80	1.90	0.47	2.37	3.56	2.28	1.28
	Tetanus (VAT)	4,959,103	10	495,910	3	14.88	7.44	1.86	9.30	13.95	8.93	5.02
	B	1,085,327	10	108,533	2.5	2.71	1.36	0.34	1.70	2.54	1.63	0.92
	Required refrigerator capacity (m3)										12.83	7.22
-20℃	Oral polio	2,048,208	20	102,410	1.5	3.07	1.54	0.38	1.92	2.88	1.84	1.04
	BCG	811,851	20	40,593	1.5	1.22	0.61	0.15	0.76	1.14	0.73	0.41
	Measles (VAR)	361,775	10	36,178	3	1.09	0.54	0.14	0.68	1.02	0.65	0.37
	Yellow fever	278,289	20	13,914	3	0.83	0.42	0.10	0.52	0.78	0.50	0.28
	Required refrigerator capacity (m3)										3.73	2.10
NID												
-20℃	Oral polio	6,384,000	20	319,200	1.5	9.58	9.58	2.39	11.97	17.96	11.49	6.46
	Required refrigerator capacity (m3)										11.49	6.46

2) Refrigerators/Freezers

Initially, 1,035 units of iceline refrigerators, freezers, small refrigerators, and other equipment were requested, including those for the Community Health Centers to be newly constructed. However, as the construction of the new Health Centers is not finalized, this Project will focus on replacing the existing equipment.

Table-5 below shows the status of the existing cold chain equipment according to the CNI data with regard to the health facilities throughout Mali. This Project will make reference to the data in selecting the model type and quantity of each equipment item.

Table-5: Status of Existing Refrigerators and Freezers

Region	Qty. of existing equipment (qty. of equipment to be renewed)							
	Cold room	Freezer room	Electric freezer	Electric refrigerator	Electric refrigerator w/icepack freezer	Large freezer (electric/kerosene)	Small freezer (electric/kerosene)	Solar refrigerator
D. Bamako	2(2)	2(2)	1(0)	27(9)	-	0(0)	8(8)	8(8)
Kayes	-	-	1(1)	1(1)	1(1)	10(10)	62(56)	0(0)
Kurikoro	-	-	7(4)	10(0)	4(4)	12(8)	56(33)	1(1)
Sikasso	-	-	8(7)	2(2)	4(4)	6(6)	58(44)	3(0)
Segou	-	-	6(3)	6(4)	3(3)	9(8)	52(35)	0(0)
Mopti	-	-	4(4)	5(2)	0(0)	14(14)	59(44)	2(0)
Gao	-	-	3(1)	1(1)	0(0)	8(8)	22(22)	0(0)
Tombouctou	-	-	7(7)	0(0)	0(0)	11(11)	32(32)	0(0)
Kidal	-	-	0(0)	0(0)	0(0)	2(0)	5(0)	0(0)
Sub total	2(2)	2(2)	37(27)	52(19)	38(38)	72(65)	354(274)	14(9)
Total		4					553	14

Table-6 below shows the quantity of cold chain and peripheral equipment by Region to be installed under this Project. Only those facilities that installed the existing equipment before 1991 are subject to renewal

Table-6: Cold chain Equipment Distribution Plan by Region

	Cold/freezer room		Freezer/Refrigerator								
Region	Cold room	Freezer room	Iceline electric refrigerator w/ icepack freezer	Iceline electric refrigerator	Small icepack freezer (electric/kerosene)	Large electric freezer	Small refrigerator (electric/kerosene)	Solar refrigerator	Total qty. by district	Power generator	Computer
D. Bamako	2	2	26	9	0	0	8	8	51	-	1
Kayes	-	-	1	1	10	1	56	0	69	15KVA 1	-
Kurikoro	-	-	4	0	8	4	33	1	50	15KVA 1	-
Sikasso	-	-	4	2	6	7	44	0	63	15KVA 1	-
Segou	-	-	3	4	8	3	35	0	53	15KVA 1	-
Mopti	1	1	0	2	14	4	44	0	64	30KVA 1	1
Gao	-	-	0	1	8	1	22	0	32	-	-
Tombouctou	-	-	0	0	11	7	32	0	50	-	-
Kidal	-	-	0	0	0	0	0	0	0	-	-
Sub total	3	3	38	19	65	27	274	9	432	5	2
Total		6							432	5	2

Of 14 solar refrigerators in 13 facilities in four Regions, only those that were introduced 10 or more years ago will be replaced. Table-7 lists the facilities that have solar refrigerators subject to renewal.

Table-7: Distribution Plan of Solar Refrigerators

Region	District	Facility Name	Quantity to be installed
D. Bamako	Commune 1	CScom SIKORO	1
	Commune 3	CScom ASACODIA	1
	Commune 3	CScom ASACODIA	1
	Commune 3	CScom ASACODES	1
	Commune 4	CScom SEBENIKORO	1
	Commune 5	CScom BACODJICORONI	1
	Commune 5	CScom KALABANCORO	1
		National Immunization Center	1
Kurikoro	KATI	Cscom MORIBABOUGOU	1
		Total	9

3) Cold Boxes and Vaccine Carriers

According to the Malian standard for distributing these items (Table-8), a total of 1,348 cold boxes and 5,285 vaccine carriers will be needed to cover the entire country. As for cold boxes, this Project will focus on procuring 379 boxes that were requested finally by CNI, of which 50 will be kept at CNI (for delivering vaccines to nine Regions), 54 will be for the vaccine storage rooms of the nine Regions (for distributing vaccines to an average of 6 Districts per Region × 9 Regions), and 275 will be for District Referral Health Centers (for delivering vaccines to an average of 5 Community Health Centers × 55 Districts).

As for vaccine carriers, 1,500 were determined to be in urgent need and requested finally by CNI, which the Project is going to fulfill.

A set of spare icepacks for each cold box and vaccine carrier will be provided also.

Table-8: Standard Quantities of Cold Boxes and Vaccine Carriers

	National	Region	District	Community Health Center	Total
No. of facilities	1	9	55	969	1,034
Cold box	50	6	5	1	1,348
Vaccine carrier	0	0	8	5	5,285

4) Electric Power Generator

A power generator was requested for Bamako Central Warehouse within CNI, but a 70-KVA generator was later donated by WHO and therefore excluded from the Project. A 30-KVA generator, which is appropriate to the capacity of the cold/freezer rooms to be procured under this Project, will be procured for Mopti Central Warehouse, as it is essential to ensure an uninterrupted power supply to the equipment to maintain the proper temperature range during power outage. A 15-KVA generator will be procured for the vaccine storage rooms of each of four Regions, excluding the three northern Regions where public security is unstable.

5) Voltage Regulators

To cope with voltage fluctuation that causes equipment failure, each electrical appliance will be built-in or attached with a automatic voltage regulator(AVR). AVR for compression type refrigerator and icepack freezer will be procured for each unit (3 models, 84 units), and AVR for absorption type small icepack freezer (65 units) will also be procured for each unit.

6) Computers

In Mali, computers seem to be hardly used for managing vaccine-related information, statistical analysis for making EPI activity plans, and controlling equipment. However, CNI fully recognizes

the need for adopting computers and began conducting training seminars on the usage of computers for accounting procedures, etc. As computers are expected to facilitate information management, statistical analysis for EPI activity planning, and equipment control, thereby promoting systematic immunization activities, this Project will procure computers for CNI, conducting centralized control of vaccines in Mali, and the Central Warehouse of Mopti Regional Health Bureau.
15 computers were initially requested for CNI and all the Regions. However, the Project will provide computers only for selected locations, because the power distribution rate of many urban areas is only around 45% on the average, and an information control system has yet to be fully established in local districts before introducing computers.

(3) Logistics Equipment

1) Pickup Trucks

Initially, 75 4WD-vehicles for vaccine transportation and one subcompact car for supervisory activities were requested. The subcompact car was later excluded, as this Project should focus on the establishment of cold chain as its top priority. Equipping each District with at least one operating 4WD vehicle will ensure vaccine transportation, supervision and guidance of immunization activities, and maintenance/control of cold chain equipment. Therefore, this Project will procure a pickup truck for each of nine of eleven Districts that have no properly operating vehicles, excluding two northern Districts in Tombouctou Region where public security is unstable.

2) Boats

During the rainy season, transportation of vaccines by car is often hindered especially in the six central Districts (Mopti, Djenne, Teninkou, and Youwarou Districts in Mopti Region, Tomnian District in Segou Region, and Niafunke District in Tombouctou Region). Since this Project aims to increase immunization rates by providing vaccines, and facilitating systematic mobile immunization services and health activities regardless of seasons for the target population of about 260,000, it will be appropriate to procure five boats for five of the six Districts, excluding one northern District where public order is often disturbed.

3) Motorcycles

Initially, 580 motorcycles were requested for the Community Health Centers throughout the country. The site survey confirmed that the existing motorcycles were severely deteriorated and that renewing them would significantly enhance the vaccination and health education activities. However, as the status of motorcycles at all facilities has yet to be confirmed by CNI, this Project will concentrate on procuring motorcycles for the Referral Health Center of each District. Thus, a total of 36 motorcycles will be distributed to 36 of 55 Districts, excluding three northern Regions

(13 Districts) where public order is unstable and Bamako District where public transportation is available.

Distribution of logistics equipment by District is shown in Table-9 below:

Table-9: Distribution of Logistics Equipment by District

No.	Region	District	Pickup truck	Boat	Motorcycle
1	Kayes	Regional Central Warehouse			
	1	Bafoulabe	1		1
	2	Diema	1		1
	3	Kayes			1
	4	Kenieba			1
	5	Kita			1
	6	Nioro			1
	7	Yelimane			1
2	Kurikoro	Regional Central Warehouse			
	8	Banamba			1
	9	Dioilia			1
	10	Kangaba			1
	11	Kati			1
	12	Kolokani			1
	13	Koulikoro			1
	14	Nara			1
3	Sikasso	Regional Central Warehouse			
	15	Bougouni			1
	16	Kadiolo			1
	17	Kolondieba	1		1
	18	Koutiala			1
	19	Sikkaso			1
	20	Yanfoila	1		1
	21	Yarroso	1		1
4	Segou	Regional Central Warehouse			
	22	Baraoueli			1
	23	Bla			1
	24	Macina	1		1
	25	Niono			1
	26	San	1		1
	27	Segou			1
	28	Tominiam		1	1
5	Mopti	Regional Central Warehouse			
	29	Bandiaggara	1		1
	30	Bankass			1
	31	Djenne		1	1
	32	Douentza			1
	33	Koro			1
	34	Mopti		1	1
	35	Teninkou		1	1
	36	Youwarou	1	1	1
6	Tombouctou	Regional Central Warehouse	Excluded from the Project, as public order is unstable.		
	37	Dire			
	38	Goundam			
	39	Gourma Rharous			
	40	Niafunke			
	41	Tobouctou			
7	Gao	Regional Central Warehouse			
	42	Ansongo			
	43	Bourem			
	44	Gao			
	45	Menaka			
8	Kidal	Regional Central Warehouse			
	46	Abeibara			
	47	Kidal			
	48	Tin-Essaako			
	49	Boureissa			
9	D. Bamako	Special District Central Warehouse	Excluded from the Project, as public transportation is available in these districts.		
	50	Commune 1			
	51	Commune 2			
	52	Commune 3			
	53	Commune 4			
	54	Commune 5			
	55	Commune 6			
	Total		9	5	36

2-3 Basic Design

2-3-1 Design Policy

This Project is about donating funds for procuring vaccines and syringes and renewing cold chain and logistics equipment in order to support the health Programmes of the Malian government that aims to reduce the mortality and morbidity rates of preventable diseases.
The Project was designed based on the following policies:

1) Policy on Natural Environment

The cold room and freezer room shall be of those model types that can maintain the inside temperatures at 2℃～8℃ and -15℃～-25℃ respectively when the outside temperature is 35°C. The refrigerator shall be able to keep the inside temperature range between 0°C and 8℃ at the outside temperature of 43°C (see WHO quality standard in the following section).

2) Policy on Social Condition

①Equipment that requires motor power should be of those model types that can run on the power sources available at each installation site (electricity, kerosene, or solar).

②Electrical equipment should be attached (or built-in) with a voltage regulator to protect itself from voltage changes.

③Logistics equipment and power generators will not be distributed to three northern Districts (Tombouctou, Kidal, and Gao) where maintenance and control of such equipment may be difficult because of instability of public order.

3) Policy on Maintenance and Control

For the maintenance and control of the cold/freezer rooms to be installed at Mopti Region Health Bureau Central Warehouse, sufficient instructions and technical guidance will be given at the time of installation.

4) Policy on Selecting the Model Types and Grades

①Hepatitis B vaccine is produced either by concentrating/purifying the blood of Hepatitis B virus carriers and collecting antigens of Hepatitis B virus, or by genetically manipulating yeast or other microorganisms. For this Project, vaccines made with the latter method are chosen, as the former method does not ensure a stable supply or safety because it has certain limitations in terms of collecting a sufficient amount of blood samples and testing the presence of infectious viruses using animals etc. WHO has established a set of quality standards and selects for UNICEF projects such vaccine manufacturers that meet the

standards and can produce a large volume of vaccines at a reasonable cost. This Project will also procure vaccines from such manufacturers.

②As for cold chain and logistics equipment, only those items that were introduced in or before 1991 and are superannuated or broken beyond repair will be replaced.

③WHO has a set of quality standards for refrigerators and freezers to ensure that they operate stably for a long period of time under harsh tropical weather conditions and with fluctuating voltage. This Project will procure such model types that comply with these standards (see Table-10).

Table-10: List of Applicable WHO/UNICEF Quality Standards

Item No.	Name of Equipment	WHO/UNICEF Quality Standard Code No.
13	Ice-line refrigerator with icepack freezer	E3/RF.3
14	Ice-line refrigerator	E3/RF.3
15	Small icepack freezer	E3/RF.3
16	Large icepack freezer	E3/RF.2
17	Small refrigerator	E3/RF.6
18	Solar refrigerator	E3/RF.4
19	Cold box	E4/CB1or2
20	Vaccine carrier	E4/VC.1
21	Icepack (0.6L)	E5/1P.1 or E5/1P.2
22	Icepack (0.3L)	E5/IP.2 or passed the WHO/UNICEF test although the size does not comply with the standard.
23	Voltage regulator (for item nos.13, 14, 16)	E7/VR.1
24	Voltage regulator (for item no.15)	E7/VR.2

④Auto-disable syringes will be of those that meet WHO's standard specifications. Syringes for dissolving freeze-dried vaccines will be procured from the manufactures that have obtained ISO9001 or 9002 Certification.

⑤Pickup trucks will belong to the vaccine storehouses at District level and be used for transporting vaccines and cold chain equipment. As the pavement ratio of Malian roads is only about 16.5%, 4WD trucks will be selected that can travel unpaved and mountainous roads.

⑥Motorcycles will be used for mobile immunization and health education services and thus will run on farm roads and treacherous roads more often. Therefore, off-road-type motorcycles that are suitable for traveling on unpaved rough surfaces will be selected.

2-3-2 Basic Plan

(1) Overall Plan

Table-11 lists the installation site and purpose of each equipment item to be procured under this Project.

Installation work will be required for setting up cold/freezer rooms at Bamako Central Warehouse and Mopti Region Health Bureau Central Warehouse. Four new units will be installed at Bamako Central Warehouse, of which two will be used to replace existing units, which means that the facility already has the basic infrastructure. The remaining two will be set up in a separate building, in which electrical cables and sewage pipes need to be installed. The building already has a concrete floor, which is suitable for installing the equipment.

For the cold/freezer rooms at Mopti Central Warehouse, a special storehouse (70 m^2) will be constructed in the adjacent lot (approx. 60 m^2) of the current vaccine storehouse. As the Ministry of Health is projecting that the related construction work will be completed by the summer of 2001, delivery of equipment by the Project will probably be carried out without delay.

Table-11: Installation Site and Purpose of Each Equipment Item

Installation Site	Name of Equipment	Purpose
Vaccination sites throughout Mali	Hepatitis-B vaccine	Improvement of immunization rate
(including hospitals and health centers)	Syringe (AD, dissolving)	Improvement of immunization rate
	Safety box	Improvement of immunization rate
Community Health Centers	Small and solar refrigerators	Storage/control of vaccines
	Vaccine carrier	Storage/control/transport of vaccines
District Referral Health Centers	Truck, boat, motorcycle	Support of immunization activities
	Small icepack freezer	Storage/control of vaccines
	Iceline refrigerator	Storage/control of vaccines
	Large icepack freezer	Storage/control of vaccines
	Cold box	Storage/control/transport of vaccines
	Vaccine carrier	Storage/control/transport of vaccines
	Voltage regulator	Storage/control of vaccines
Regional Central Warehouses	Power generator (15KVA)	Storage/control of vaccines
	Iceline refrigerator	Storage/control of vaccines
	Large icepack freezer	Storage/control of vaccines
	Cold box	Storage/control/transport of vaccines
	Voltage regulator	Storage/control of vaccines
Mopti Central Warehouse	Cold/freezer room	Storage/control of vaccines
	Iceline refrigerator	Storage/control of vaccines
	Large icepack freezer	Storage/control of vaccines
	Cold box	Storage/control/transport of vaccines
	Power generator (30KVA)	Storage/control of vaccines
	Computer	Immunization activity planning
Bamako Central Warehouse	Cold/freezer room	Storage/control of vaccines
	Iceline refrigerator	Storage/control of vaccines
	Solar refrigerator	Storage/control of vaccines
	Voltage regulator	Storage/control of vaccines
	Cold box	Storage/control/transport of vaccines
	Computer	Immunization activity planning

(2) Equipment Plan

Table-12: List of Equipment to be Procured

Item No.	Name of equipment	Use	Quantity
1	Hepatitis-B vaccine	For preventing mother-to-child vertical infection of hepatitis-B virus	1,086,000
2	Auto-disable syringe (0.05ml)	For injecting BCG vaccine	446,500
3	Auto-disable syringe(0.5ml)	For injecting DPT/tetanus/hepatitis-B/measles vaccines	6,196,000
4	Syringe for dissolving (5ml)	For dissolving freeze-dried measles/BCG vaccines	768,000
5	Safety box	For safe disposal of syringes with needles	68,100
6	Pickup truck	For transporting vaccines and cold-chain equipment	9
7	Motorcycle	For vaccine transportation, mobile immunization services, and health guidance	36
8	Boat	For vaccine transportation and mobile immunization services	5
9	Power generator (30KVA)	For supplying electric power to the cold/freezer rooms at Mopti Central Warehouse during power outage.	1
10	Power generator (15KVA)	For supplying electric power to the refrigerators and freezers at Regional Central Warehouses during power outage.	4
11	Cold room	For central administration, and refrigeration/storage of 6-month requirement of DTP, tetanus, and hepatitis-B vaccines (Bamako and Mopti).	3
12	Freezer room	For central administration, and freezing/storage of 6-month requirement of polio, measles and BCG vaccines (Bamako and Mopti).	3
13	Iceline refrigerator w/icepack freezer	For storing vaccines at Regional and District levels and freezing icepacks for vaccine carriers.	38
14	Iceline refrigerator	For storing vaccines at Regional and District levels.	19
15	Small icepack freezer	For freezing icepacks for cold boxes and vaccine carriers to be distributed to District facilities.	65
16	Large icepack freezer	For freezing icepacks for cold boxes and vaccine carriers to be distributed to Regional and District facilities.	27
17	Small refrigerator	For storing vaccines mainly at Community Health Centres	274
18	Solar refrigerator	For storing vaccines at Community Health Centres with no electric power services.	9
19	Cold box	For transporting vaccines from Central to Region, and from Region to District.	379
20	Vaccine carrier	For mobile immunization services and transporting vaccines between facilities at Regional, District, and Community Health Centre levels.	1,500
21	Icepack (for item No.19)	For keeping vaccines cool	379
22	Icepack (for item No.20)	For keeping vaccines cool	1,500
23	Voltage regulator (for item No. 13, 14, 16)	For stabilizing the operation of electric iceline refrigerators, and large icepack freezers.	84
24	Voltage regulator (for item No. 15)	For stabilizing the operation of small icepack freezers.	65
25	Computer	For managing information on EPI projects and activities and controlling cold-chain equipment.	2

(3) Supply Sources of the Equipment

Table-13 below lists the name and supply source of each equipment item, and the reason for selecting the source. None of the equipment will be procured locally under this Project.

Table-13: Supply Sources of Equipment

No.	Name of Equipment	Japan	3rd country	Reason for selection
1	Hepatitis-B vaccine		○	No Japanese manufacturers of this vaccine hold the pre-qualified certificate by WHO/UNICEF.
2	Auto-disable syringe (0.05ml)		○	Syringes complying with the WHO/UNICEF standards are not produced in Japan.
3	Auto-disable syringe(0.5ml)		○	
4	Syringe for dissolving (5ml)		○	Japanese products are much more expensive.
5	Safety box		○	Safety boxes complying with the WHO/UNICEF standards are not produced in Japan.
6	Pickup truck	○		Products made by two or more Japanese manufactures are already being used, and the maintenance/control system is well established.
7	Motorcycle	○		
8	Boat	○		
9	Power generator (30KVA)	○		
10	Power generator (15KVA)	○		
11	Cold room	○		
12	Freezer room	○		
13	Iceline refrigerator w/icepack freezer		○	Equipment complying with the WHO/UNICEF standards is not produced in Japan.
14	Iceline refrigerator		○	
15	Small icepack freezer		○	
16	Large icepack freezer		○	
17	Small refrigerator		○	
18	Solar refrigerator		○	
19	Cold box		○	
20	Vaccine carrier		○	
21	Icepack (for item No. 19)		○	
22	Icepack (for item No. 20)		○	
23	Voltage regulator (for item No.13,14,16)		○	
24	Voltage regulator (for item No. 15)		○	
25	Computer		○	PCs in French language are not manufactured in Japan.

(4) Transportation

All equipment items will be transported by ocean freight, except for Hepatitis B vaccine, which will be shipped by air. The Japanese side is responsible for the inland transportation of the equipment from the port of discharge to the final handover points (Bamako Airport, Bamako Central Warehouse or Mopti Regional Health Bureau Central Warehouse). Table-14 below shows the means of transportation and final handover point of each equipment item,

Table-14: Final Handover Points and Transportation of Equipment

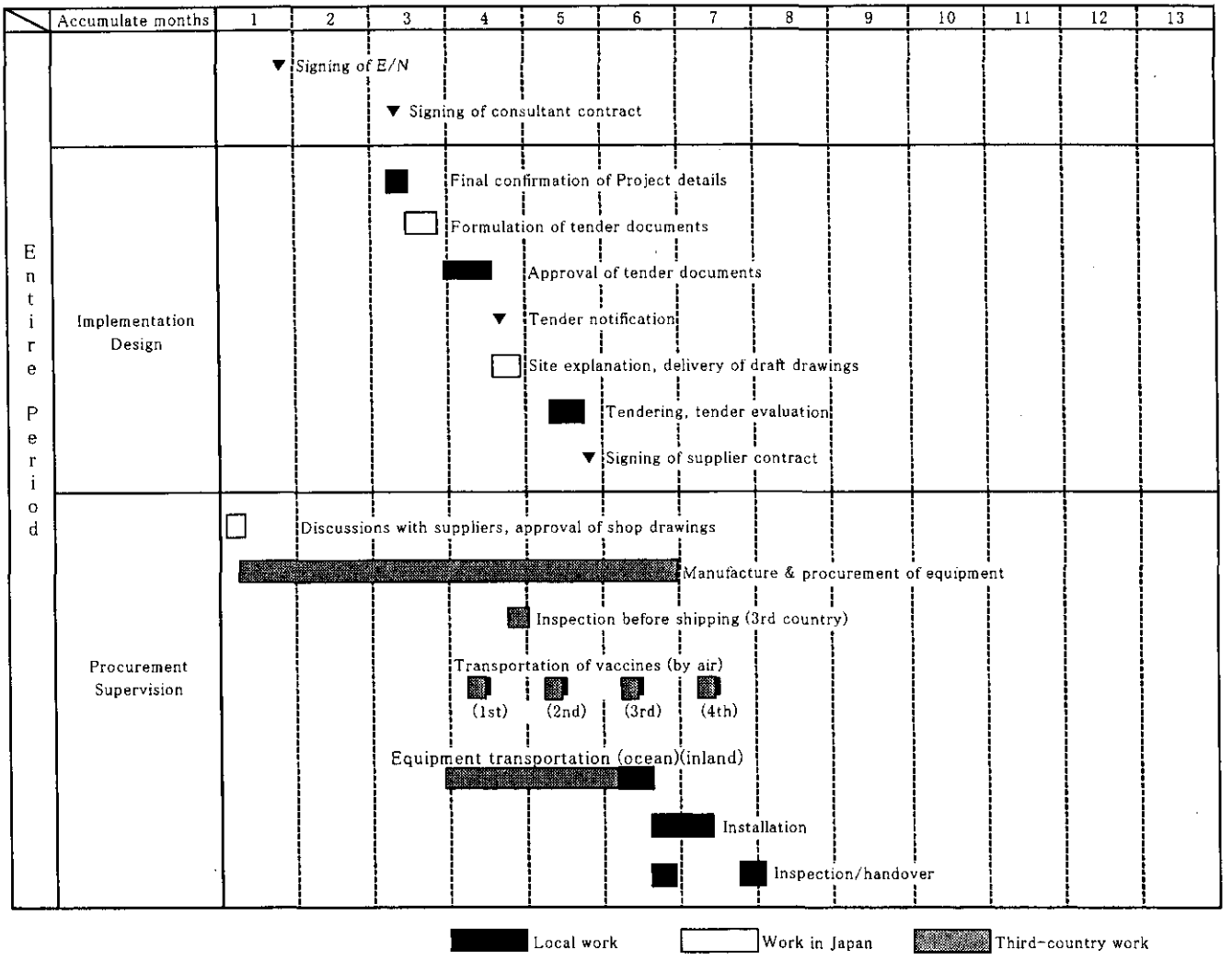
	Final handover point	Transportation	Equipment no.	Equipment name	Quantity
1	Bamako Airport	Air	1	Hepatitis B vaccine	108,600 vials
2	Mopti Regional Health Bureau Central Warehouse	Ocean Inland	8 9 11 12	Boat Power generator (30KVA) Cold room Freezer room	5 1 1* 1*
3	Ministry of Health Bamako Central Warehouse	Ocean Inland	Equipment other than the above		

* 1 of 3 units

Chapter 3 Implementation Plan

3- 1 Implementation Schedule

Entire work period (from E/N to delivery): 12.0 months
From E/N to contract with supplier: 3.5 months
Delivery period (from contract with supplier to deliver: 8.5 months



Budgetary year: single year (FY 2000)

In installing the cold-room equipment, guidance for the assembly, installation, renovation of incidental facilities, initial operation, and basic maintenance and control of the equipment will be needed. Therefore, two Japanese engineers will be dispatched to the project site when the installation work takes place. In addition, four local technicians will be employed to do the installation work.

Dispatch Plan of Local Procurement Supervisor and Installation Workers

Technical staff	No. of persons	Job description	No. of work days
Local procurement supervisor	1	Overall supervision/coordication of cold-room installation and equipment handover	27
Japanese engineer	2	Guidance on cold-room installation, maintenance, and control	20
Local technician A/B	2	Cold-room installation (assembly/pluming)	8
Local technician C/D	2	Cold-room installation (electrical work)	8

3-2 Obligations of the Recipient Country

The obligations of the recipient country in implementing the Project are as follows:

1) To secure spaces in which the equipment will be installed.
2) To bear the expenses necessary for transportation of the equipment procured by the Project from the final hand over points i) Bamako Airport, ii) Ministry of Health's Bamako Central Warehouse, and iii) Mopti Region Health Bureau Central Warehouse to the final destination sites in regions, districts and community health center.

3-3 Project Maintenance/Control Plan

Cold chain equipment operating throughout the country is maintained and controlled by three staff members (1 supervisor, 1 engineer, and 1 assistant) of CNI's Maintenance/Control Logistics Department, which receives support from the Equipment Infrastructure Department of the Ministry of Health's Public Health Bureau when necessary. On the Regional/District level, one medical-equipment engineer is deployed to take charge of the maintenance and control of the cold chain. In Community Health Centers, where no engineers in charge of equipment maintenance is placed, mid-wives or nurses, who have received pertinent training, are undertaking the job with the help of engineers from the Region or District. When the local staff cannot repair a certain equipment item, they request dispatch of CNI engineers or send the broken equipment to CNI or a local repair shop.

Broken equipment has been repaired adequately under this system, except for the items that were deteriorated beyond repair and needed to be scrapped.

All logistics equipment will be controlled by the District Referral Health Centers under their respective Directors who assume the final responsibility for the control of the equipment (see Table-15). However, as motorcycles will be rent out to Community Health Centers by their respective Districts, fuel costs will be born by the Health Centers as before while repair costs will be born by the District governments.

Table-15: Control of Logistics Equipment

	Administrator	User	Budget (maintenance/control)
Pickup truck	Head of District Referral Health Center	Drives of Health Center	District
Boat	Head of District Referral Health Center	Drives of Health Center	District
Motorcycle	Head of District Referral Health Center	Community Health Center staff	District (repair cost)
			Resident Health Fund (fuel cost)

The cold chain equipment to be procured by this Project will be adequately maintained and controlled under the above-mentioned system. UNICEF and WHO are offering assistance in monitoring the usage of the equipment. Working closely with these organizations will be important for the effective maintenance and control.

Chapter 4 Project Effect and Recommendations

4-1 Project Effect

The Malian Ministry of Health, under its "5-Year Immunization Project (1998 – 2000)," endeavors to enhance the state of children's health through the improvement of immunization rates by upgrading the cold chain system and strengthening immunization activities, including the dispatch of mobile immunization services. However, due to lack of funds, the Ministry has been struggling to upgrade the cold chain system in a significant way.

Under these circumstances, implementing this Project holds great significance. If the donated equipment is utilized fully, the following direct/indirect effects can be expected.

(1) Vaccination

According to the sampling surveys that have been conducted in Mali, about 25% of mothers are said to carry Hepatitis B virus. If immunization against this disease is promoted as scheduled under this Project, the number of new carriers through mother-to-child vertical infection will decrease.

(2) Injector Devices

To prevent HIV and Hepatitis B virus infection via injection devices, the Malian Ministry of Health has decided to switch to auto-disable-type injection devices starting in 2000. If this Project is implemented, infection via injection needles will be reduced substantially, thereby contributing to the health of infants and special childbearing age population subject to the immunization Programmes (2.7 million people). Also, the use of safety boxes will ensure the safe disposal of injection devices after use, which will protect the health/medical workers from infection by accidental stings.

(3) Cold chain Equipment

Setting up the second central warehouse with cold and freezer rooms in Mopti will ensure a stable supply of vaccines to the three northern Regions. Also, renewing the aged cold chain equipment throughout the country that is beyond repair will ensure the proper storage and control of vaccines, thereby reducing the scrap rate of deteriorated vaccines and suspension of immunization caused by failure of refrigerator and other equipment. In addition, securing a certain quantity of vaccines regularly at the Community Health Center level will give the residents access to vaccination whenever needed.

(4) Vehicles

By procuring automobiles, each District will have at least one operating vehicle to transport

vaccines. This will allow stocking of vaccines at the Regional level and delivery of vaccines to remote Community Health Centers in a systematic manner.
Providing motorcycles will strengthen the mobile immunization and health education services, thereby directly contributing to the immunization activities.
Provision of boats will enable the distribution of vaccines to Community Health Centers on schedule and rendering of mobile immunization services during the rainy season, when these activities tend to be delayed. This will also bring direct benefit to the immunization activities.

Upgrading of nationwide cold chain system and the smooth implementation of immunization Programmes as mentioned above will not only reduce the morbidity and mortality rates among the target population, but also lessen financial burdens on families, provide a sense of security for the residents that they could be immunized whenever necessary, promote trust in health facilities, and encourage the residents' involvement in local health activities.

4-2 Recommendations

As mentioned in the previous section, the implementation of this Project is expected to bring significant benefits and contribute to the overall enhancement of maternal-and-child health in Mali. The effects of the Project will be enhanced even further if the following problems are attended and resolved:

1) Promotion of Educational Activities

In order to maintain children's health by improving the immunization rates, education of health personnel and diffusion of proper knowledge among the general public will be essential. CNI is working on these points by making plans and giving guidance in conjunction with WHO and UNICEF. Uninterrupted implementation and diffusion of these educational activities throughout the country are desirable.

2) Storage and Transportation of Equipment Procured

Many items of the equipment to be procured under this Project will be handed over to the Malian side at Bamako Central Warehouse as requested by the Ministry of Health. This means that the Ministry of Health needs to make a sufficient appropriation for the transportation of the equipment from the warehouse to the final destinations. Also, in order to avoid the situation where procured equipment is stacked up in the warehouse until the existing equipment breaks beyond repair, it is recommended that the new equipment should be delivered to the facilities immediately, and all aged equipment should be collected or disposed.

3) Maintenance and Control of Procured Equipment

Equipment maintenance requires both preventative maintenance and repair work, and the former tends to be neglected. For cold chain equipment, daily inspection and servicing will be necessary, such as defrosting of cooling units, organizing of stored items to allow proper circulation of cold air, cleaning of heat-exchangers to maintain good heat-exchange efficiency, and, for kerosene-type refrigerators, inspection, cleaning, and adjustment of kerosene stoves and wicks.

Member List of the Survey Team

1 Mr. IWAMA Toshiyuki	Leader Deputy Director, Second Project Management Division, Grant Aid Management Department Japan International Cooperation Agency
2 Ms. TOYOSHIMA Etsuko	Equipment Planner Japan International Cooperation System
3 Mr. NYUI Isamu	Procurement Planner Japan International Cooperation System
4 Mr. SUZUKI Gentaro	Interpreter Japan International Cooperation Center

Survey schedule

Date			Activity		Place
			Officer	Survey Member	
Jul.9	(Sun)			Tokyo(Narita)11:207(JL405)→Paris16:35	
Jul.10	(Mon)			Paris16:30(AF718)→Dakar20:25	
Jul.11	(Tue)			Honorary visit to the Embassy of Japan, Senegal・Meeting with JICA	Embassy of Japan
				Dakar18:30(RK520)→Bamako20:10	
Jul.12	(Wed)	AM:		Honorary visit to the Ministry of Foreign Affairs, the Ministry of Health	Ministry of Foreign Affairs, Ministry of Health
		PM:		Meeting with the Ministry of Health representatives	Planning and Statistics Dept.
Jul.13	(Thu)	AM:		Meeting with the Ministry of Health representatives	Planning and Statistics Dept.
		PM:		Visit National Immunization Center	National Immunization Center
Jul.14	(Fri)	AM:		Visit and exchange opinions with the World Bank and UNDP	the World Bank, UNDP
		PM:		Visit and exchange opinions with WHO	WHO
Jul.15	(Sat)			Confirmation Survey ・ Meeting	
Jul.16	(Sun)			Site Visit	
Jul.17	(Mon)	AM:	Leader arrives at Bamako 9:25, Honorary visit to the Ministry of Health, the Ministry of Foreign Affairs		Ministry of Health, Ministry of Foreign Affairs
		PM:	Visit and exchange opinions with UNICEF and French organization		UNICEF, French organization
Jul.18	(Tue)		Honorary visit to Regional Health Bureau, visit District Health Center etc.		Koulikoro
Jul.19	(Wen)	AM:	Visit and exchange opinions with WHO, arrangement of the Minutes of discussion		WHO, National Immunization Center
		PM:	Arrangement of the Minutes of discussion, visit and exchange opinions with USAID		National Immunization Center, USAID
Jul.20	(Thu)	AM:	Arrangement of the Minutes of discussion		National Immunization Center
		PM:	Signing of the Minutes		Ministry of Health
		Evening	Bamako (RK741)→Dakar	Confirmation Survey	
Jul.21	(Fri)	AM:	Arrive Dakar, report to the Embassy of Japan, Senegal and JICA	Confirmation Survey	National Immunization Center
		Evening	Dakar (AF719)→Paris (on board)		
Jul.22	(Sat)	All day		Confirmation Survey	National Immunization Center
Jul.23	(Sun)			Confirmation Survey	
Jul.24	(Mon)	All day		Confirmation Survey	National Immunization Center
Jul.25	(Tue)	AM:		Bamako→Mopti, honorary visit to Regional Health Bureau, meeting, site survey, visit District Referral Health Center	Regional Health Bureau of Mopti etc.
		PM:		Visit Community Health Center	Mopti
Jul.26	(Wed)			Mopti→Bamako	
Jul.27	(Thu)	All day		Discussion on specifications	National Immunization Center
Jul.28	(Fri)	AM:		Discussion on specifications, report to the Ministry of Health, the Ministry of Foreign Affairs	Ministry of Health, Ministry of Foreign Affairs
		PM:		Final discussion with National Immunization Center	National Immunization Center
Jul.29	(Sat)	AM:		Internal Meeting	
				Bamako22:55 (AF731) →Paris (on board)	
Jul.30	(Sun)			Paris14:20 (AF276) →	
Jul.31	(Mon)			Tokyo(Narita)9:00	

The List of Parties Concerned in the Recipient Country

Ministry of Health, Republic of Mali (MINISTERE DE LA SANTE)

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MR.ABDOULAYA CHABA SANGARA	CHIEF DE CABINET
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MR. SDI YEYA CISSE	STAFF CPS
DR. YOUSSOUF KONATE	DIRECTOR DU C.N.I
DR. SIDY DIALLO	CHEF DE SECTION P.E.V.DU, C.N.I
DR. ZANKOURA KOULIBALY	CHEF DU SECTION MAINTENANCE ET RAVITAILLEMENT LOGISTIQUE DU C.N.I.
MR. MAMADOU TRAORE	CONSELLER TECHNIQUE, C.N.I
MR. ALIDJI CISSE	TECHNICIEN POUR LA CHAINE DE PROID DU C.N.I
MR. WAGOUSSEROU DOLO	INFIRMIER D' ETAT – SUPERVISEUR DU C.N.I

Ministry of Foreign Affairs, Republic of Mali (CONSEILLER DES AFFERIER ETRABGEROR)

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MR. GUIROU TIGUE	RESPONSABLE DOSSIER JAPON

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MR. AMADOU HAIDARA	CHARGE DU SYSTEME INFORMATIQUE DE SANTE DU C.S. DE REF. MOPTI

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