

Evaluation Summary

1. Outline of the Project	
Country: The Republic of Zambia	Project Title: The Project for Surveillance of Viral Zoonoses in Africa
Issue/Sector: Healthcare and medical treatment	Cooperation Scheme: Technical Cooperation Project (Science and Technology Research Partnership for Sustainable Development: SATREPS)
Division in charge: Health Team 2, Health Group 1, Human Development Department	Total Cost: 410 million JPY
Period of Cooperation	(R/D): 1/Jan/2013 – 31/May/2018
	Partner Country's Implementing Organization: University of Zambia School of Veterinary Medicine (UNZA-SVM); School of Medicine (UNZA-SOM); Ministry of Higher Education (MOHE); Ministry of Health (MOH); Zambia National Public Health Institute (ZNPFI); University Teaching Hospital (UTH); Ministry of Fisheries and Livestock (MFL); Central Veterinary Research Institute (CVRI); and the Department of National Parks and Wildlife (DNPW) of the Ministry of Tourism and Art
	Supporting Organization in Japan: Hokkaido University Research Center for Zoonosis Control
	Other Related Projects: Japan Agency for Medical Research and Development (AMED)
1-1 Background of the Project	
<p>In recent years, emerging and reemerging infectious diseases such as high pathogenic influenza and Ebola Virus Disease (hereinafter referred to as 'EVD') are becoming global agenda for public health concern. The Republic of Zambia (hereinafter referred to as 'Zambia') is inland state, sharing borders with eight countries; therefore, Zambia is under the constant thread of the said infectious diseases. Nevertheless, the foundation of research and education for proper control of infectious disease control remains insufficient in terms of the capacity of surveillance including testing and diagnosis for it.</p> <p>Under the circumstances, the Government of Zambia requested the Government of Japan to conduct a technical cooperation project, in parallel, the Hokkaido University (hereinafter referred to as 'HU') applied research proposal to the Japan Science and Technology Agency¹, to conduct collaborative research and technical assistance in the area of viral zoonosis. "<i>The Project for Surveillance of Viral Zoonoses in Africa</i>" (hereinafter referred to as '<i>the Project</i>') was launched from the 1st of June 2013 for 5 years under the scheme of the Science and Technology Research Partnership for Sustainable Development (SATREPS).</p>	
1-2 Project Overview	
(1) Project Purpose	
<p>Encompassing research and surveillance capacity for viral zoonoses is strengthened in Zambia, through collaborative researches between Zambian and Japanese research Institutes.</p>	
(2) Outputs	
<ol style="list-style-type: none"> 1) Research and education systems for viral zoonoses is established in UNZA-SVM. 2) Diagnostic methods (detection of viral genome, viral-specific antibody and viral antigen) are established/improved for known viral zoonoses such as influenza and viral 	

¹ Affairs under the jurisdiction and authorities of the projects in the field of infectious disease control was transferred to the Japan Agency for Medical Research and Development (hereinafter referred to as "AMED"). The transfer took place on the 1st of April 2015.

hemorrhagic fevers.

- 3) Risks of known and/or unknown (or uncharacterized) viruses as pathogens are assessed on the basis of information on genetic analyses, natural reservoirs, transmission pathways, host ranges and pathogenicity.

(3) Inputs

The Japanese side:

- **Dispatch of JICA experts:** a total of 2 short-term experts (28 M/M) and a total of 63 short-term experts (55.6 M/M);
- **Training in Japan:** A total of 5 counterpart personnel (Estimation by the time of the end of the project period in May 2018);
- **Provision of Equipment:** deep freezer (-80°C), high-speed multifunction centrifuge, high-speed micro centrifuge, protein electrophoresis and western blotting system, CO₂ incubator, microscope, genetic analyzer, Light Cycler, large generator (33kva), uninterruptible power-supply system (UPS), equipment for rearing experimental animals, vehicle for project activities, etc.; and
- **Overseas Activities Costs:** procurement of fertilized eggs, reagents and consumables, miscellaneous expenses and honorarium for sampling activities.

The Zambian side:

- **Allocation of Counterpart Personnel:** A total of 21 counterparts such as Project Director, Project Manager, lecturers and technicians;
- **Facilities, Equipment and Materials:** Facilities such as project office, laboratories and existing research instruments and related equipment; and
- **Local Costs:** personnel costs of researchers, research activity costs including consumables and supplies, facility usage charges, utility costs such as water and electricity, etc.

2. Terminal Evaluation Team

Members	Dr. Kaname KANAI	Leader	Executive Technical Advisor to the Director General, Human Development Department, JICA
	Ms. Kyoko YAMADA	Cooperation Planning	Associate Expert, Health Team 2, Health Group 1, Human Development Department, JICA
	Dr. Yoichi INOUE	Evaluation Analysis	Senior Consultant, Consulting Division, Japan Development Service Co., Ltd.
	Prof. Dr. Kiyoshi KITA	Infectious Disease Control	Program Officer of AMED - SATREPS Dean, Nagasaki University School of Tropical Medicine & Global Health (Observing member)
	Dr. Yasushi SHINTANI	Planning and Evaluation	Deputy Manager, Division of International Collaboration, Department of International Affairs, AMED (Observing member)
	Dr. George DAUTU		
Period of Evaluation	26/Nov/2017 – 13/Dec/2017		Study Type: Terminal Evaluation

3. Summary of Evaluation Results

3-1 Achievements

(1) Output 1

The Project had completed setting up the virology laboratory and animal rearing facility as of March 2014, and experimental animals are being bred. As the necessary research instruments and other items were installed, the project research activities such as the isolation of viruses and the

recombinant DNA experiments were accelerated, as described in the Activities under the Output 2 and 3 above. The Project also established the sample library to preserve specimens from various animals and arthropods systematically. Further, UNZA-SVM and UNZA-SOM had exchanged the Memorandum of Understandings for collaborative research in November 2016; accordingly, the sera samples obtained from the unidentified febrile patients were added to the said library, and were subject to screening for various viruses at UNZA-SVM.

Under such research environment, many experiments, investigation activities, and even facility management had been standardized in the forms of Standard Operating Procedures (SOPs), protocols, etc. through the research activities under the Outputs 2 & 3; at the time of the Terminal Evaluation, the Project is working on preparing a manual by compiling the SOPs, protocols, etc. and the preparation work is supposed to be completed by the end of the project period. Meanwhile, some pieces of equipment were provided in student training room of UNZA-SVM and effectively used for trainings geared toward students as well as health officers and professionals. Knowledge, findings and experiences gained through various project research activities have also been utilized the education and training of undergraduate and graduate students in UNZA.

For these reasons, the implementation system for research and education are established as expected in UNZA-SVM; therefore, it is deemed that the Output 1 has generally been achieved as of the time of the Terminal Evaluation.

(2) Output 2

As of the time of the Terminal Evaluation, the Project has established many diagnostic methods that detect viral genes and virus-specific antibodies targeting various viruses; therefore, it is deemed that the diagnosis capacity of UNZA-SVM for viral infectious diseases has been significantly improved. Concerning to the development of viral antigen detection method, the EVD diagnostic test kit for Zaire, Bundibugyo and Tai Forest ebolavirus, developed at the initiative of HU and a Japanese private enterprise, is reached at a sufficient level for clinical use; practically, the kit was used for EVD control in the Democratic Republic of the Congo (hereinafter referred to as '*DR Congo*'). Meanwhile, the Project had succeeded in producing hybridomas yielding a total of 67 lines of monoclonal antibodies at the laboratories in UNZA-SVM. The Project is supposed to work on the development of Marburg virus detection kit using the said monoclonal antibodies hereafter.

As just described above, various detection methods targeting various viruses that cause viral infectious diseases including zoonoses have been developed or modified at UNZA-SVM owing to the implementation of the Project. The Project has revealed epidemiological background of those various viral diseases using the various detection methods, some of which are being used for diagnostic services in clinical practices; therefore, it is deemed that the achievement level of the Output 2 exceeded our expectation.

(3) Output 3

The Project had gained many research findings and outcomes regarding not only to viral zoonoses but also to viral diseases in animals as of the time of the Terminal Evaluation. Major research outcomes of the Project are summarized as follows: the lineage analyses of various viruses detected in Zambia; the detection of virus-specific antibody against filovirus as well as Marburg virus from fruit bats; the prevalence of virus-specific antibodies against Rift Valley Fever (RVF) virus and Crimean-Congo Hemorrhagic Fever (CCHF) virus from bovines; the detection of novel phleboviruses from ixodid ticks; the analyses of transmission pathways of CCHF virus detected in Zambia; the isolation and risk assessment of Mumps-like paramyxovirus as well as novel adenovirus from fruit bats; the isolation of various subtypes of influenza virus from feces of wild aquatic birds; and molecular epidemiological analyses of African swine fever virus. In addition, the Project found, as other remarkable research outcomes, that the viruses with the potential to directly infect mammals are maintained in wild aquatic birds suggested from the characterization of isolated avian influenza viruses, and that that tick-borne phlebovirus is passaged by transovarian infection. As aforementioned, the Project had obtained various research outcomes that are expected to contribute to elucidate natural hosts, transmission pathways, host ranges and pathogenicity further.

As aforementioned, the Project had accumulated the epidemiological information on viral zoonoses in Zambia, and obtained many novel findings even at the time of the Terminal Evaluation. In parallel, the Project has successfully been completed the arrangement of research environment for the risk analyses of existing and novel viruses. For these reasons, it is deemed that the achievements of the Output 3 also exceeded our expectation.

(4) Project Purpose

With the support from the Project, the research environment for the implementation of virology research is deemed to properly be established; simultaneously with that, various virus detection methods for various viral zoonoses of public health concern in Zambia and its neighboring countries. Through the collaborative research with Japanese researchers, Zambian researchers have enhanced their capacity for diagnosis of viral zoonoses. Moreover, the project research activities such as risk analyses based on the characterization of existing and novel viruses using the detection methods developed as well as other fundamental studies such as natural hosts, host ranges and transmission pathways have been progressed. The Project, as of the time of the Terminal Evaluation, has published a total of 15 scientific articles based on the findings and achievements of the research activities regarding viral zoonoses and animal infectious diseases in international scientific journals. The publication of research findings and outcomes can be regarded not only as the scientific attainments of the collaborative research but also as an indirect indicator for the reinforcement of capacity development of researchers and institutions.

On the other hand, during the outbreak of African swine fever in Zambia and the outbreak of EVD in western African countries in 2014, the Project had contributed administration officers as well as medical professionals at central and local levels to take countermeasures in light of “*preparedness*” for the said diseases by providing diagnostic services and technical assistances. Furthermore, the Government of Zambia has been strengthening the efforts for addressing the “*Preparedness*” for the “*Public Health Emergency of International Concern (PHEIC)*” in recent years at the initiative of the Zambia National Public Health Institute (hereinafter referred to as ‘ZNPHI’, established in 2015. In this context, UNZA-SVM has been contributing ZNPHI to implement the “*Preparedness*” through the establishment of various diagnostic methods for various viral diseases including EVD as well as the epidemiological investigation (monitoring) of avian influenza, rift valley fever, CCHF, and so on.

As aforementioned, the Project achieved not only the research outcomes but also the functional enhancement of UNZA-SVM and human resource development for the implementation of research activities and the surveillance of infectious diseases as expected or more. For this reason, it is deemed that the achievement of the Project Purpose exceeded our expectation as of the time of the Terminal Evaluation.

3-2 Summary of Evaluation Results

(1) Relevance

The relevance of the Project is highly maintained throughout the project period.

The Ministry of Health gives priority to “*Disease outbreaks and Epidemic Control, Public Health Surveillance*” among the related policies under its “*National Health Strategic Plan 2017–2021*”. The Ministry of Fisheries and Livestock stresses the importance of viral zoonosis control in its “*National Agriculture Policy 2012*” from the perspective of the livestock productivity and states in its “*Livestock Development Policy 2012*” to strengthen surveillance function to control viral zoonosis outbreaks. While with these emphases at the national policy levels, the outbreaks of African Swine Fever and EVD occurred in Zambia in 2013 and in the Western Africa in 2014 respectively, which came to raise the necessity to promote preparedness to these pandemic outbreaks. Furthermore, in the international tide for the promotion of the “*Preparedness*” against PHEIC, the Government of Zambia established ZNPHI under MOH in 2015, and commenced the concerted efforts to promote the “*One Health*” approach at the initiative of ZNPHI with the national authorities such as the Headquarters of MOH, MFL, and academic institutions such as UNZA.

The Government of Japan has been promoting aid activities for infectious disease control. In

recent years, particularly, the *G7 Ise-Shima* Summit for Global Health in May 2016 came out to strengthen the preparedness and the response for communicable disease outbreaks and public health emergencies, and to promote the “One Health” approach. Furthermore, The Nairobi Declaration of the 6th Tokyo International Conference on African Development (TICAD VI) held in August 2016 in Nairobi, the Republic of Kenya, stated to strengthen the health system through the research and development for tropical diseases and other communicable diseases and the response to public health crises.

Therefore, there wasn't any alteration in the Zambian policies as well as the Japan's aid policies so as to undermine the relevance of the Project with regard to the consistency of the Project Purpose with the said Policies, thus, the consistency is rather enhanced at the time of the Terminal evaluation.

(2) Effectiveness

The effectiveness of the Project is high in general.

Owing to the implementation of the Project, the research environment for viral zoonosis at UNZA-SVM was established, and a lot of and various research findings and outcomes regarding the development of various virus detection methods, the epidemiological findings of viral infectious diseases including zoonotic diseases in Zambia and the risk assessment of novel and known viruses have been obtained. In parallel, both research and institutional and human capacity buildings have made expected progress or more. Through the said joint research between Zambia and Japan as well as the collaboration with the Zambian authorities engaged in the Preparedness against PHEIC, the research and surveillance capabilities in viral infectious diseases including zoonotic diseases have significantly been advanced in Zambia; therefore, it is deemed that the Project achieved the Project Purpose at a more-than-expected level.

It is worth noting that the Zambian researchers had succeeded in producing the hybridomas and obtained a total of 67 lines of monoclonal antibodies against Marburg virus in the laboratories in UNZA-SVM. In order to produce monoclonal antibodies, it is necessary for the Zambian researchers to acquire the techniques, experiences and even basic principles with its utilization for life scientific research, such as the purification of proteins, cell culture, the screening of antibodies using antigen-antibody reaction, cell cloning, characteristics analysis of antibodies, and various animal experiments; therefore, it is considered that the success of the production of monoclonal antibody against Marburg virus explains the significant reinforcement of research capacity of UNZA-SVM.

Furthermore, a number of findings were obtained through the abovementioned research activities, and a total of 15 research articles have been published in international journals as of the time of the Terminal Evaluation. There are some research findings and outcomes which are yet to be published, and more research articles are expected to be published onwards. In addition, the researchers have attended a number of invited lectures (17 in Japan and 14 in international conferences), oral presentations at academic conferences (20 in Japan and 6 international conferences) and poster presentations at academic conferences (15 in Japan and 19 international conferences) by the time of the Terminal Evaluation.

(3) Efficiency

The efficiency of the Project is high in general.

Though the Project started in June 2013, the setup of project virology laboratory was fully commenced following the arrival of the Project Coordinator (JICA expert) in Zambia in September 2013. However, the project research activities in HU had fully been commenced, right after the commencement of the Project in June 2013, and also, the sampling and other basic research activities were commenced by JICA short-term experts in Zambia. Following the dispatch of two (2) Japanese researchers stationed in UNZA-SVM for a certain period (dispatched as short-term JICA experts) in October 2014, whole project research activities had become full-scale operation. It is deemed that the overall progress of the Project is appropriate in general.

A set-up of essential research equipment was completed within first 2 years of the Project period

and the research activities have been actively processed by utilizing the set-up equipment. The Project also provided some equipment for students' laboratories and they are utilized to educate students on practices of microbiology. The laboratories of the Project are often used for students as well to learn viral diagnostic methods. In addition to that, some researches of UNZA-SOM, CVRI, etc. utilized the laboratories in UNZA-SVM which the Project supported to set up that resulting in collaborative research activities with UNZA-SVM researchers. The provision of research equipment by the Project benefitted not only research activities themselves but also student education and intellectual exchange among researchers in UNZA-SVM

A total of four (4) Zambian counterparts participated in short-term training in Japan hosted by HU and they utilized knowledge and skills they acquired through the training to the research activities in the Project. One (1) Zambian researcher is supposed to be dispatched to HU for a short-term training in the preparation of monoclonal antibodies; the techniques for the preparation of monoclonal antibodies will further be consolidated in UNZA-SVM.

(4) Impact

The following positive impacts are confirmed and/or expected by the implementation of the Project.

Through the collaborative research for the development of various virus detection methods targeting various viruses hand-in-hand, Zambian researchers of UNZA has acquired the basic and even advanced technologies for the detection of viruses. Those technologies can be utilized for the development of detection methods targeting other viruses. Actually, a Zambian researcher had developed a PCR-based virus detection method for the diagnosis of rabies independently, and the method is practically used for diagnostic services for canine rabies; for this reason, it is anticipated that the knowledge and technologies are utilized for other virology research at the time of the Terminal Evaluation.

The epidemiological studies for avian influenza as well as the EVD diagnostic services of the Project have substantively regarded as a part of the surveillance system for viral infectious diseases in Zambia; that is, a direct contribution of the Project toward the implementation of "Preparedness" against PHEIC in Zambia. Therefore, it is strongly desired that the said monitoring activities and diagnostic services will be continued following the end of the project period by any means in order to maintain the "Preparedness" against PHEIC in Zambia. At the interviewing opportunity with ZNPFI, an officer in charge of "Preparedness" in Zambia, showed an acknowledgement that the said monitoring and diagnostic function are irreplaceable and the necessity to maintain them even following the end of the project period, and stated an intention to provide political and financial supports to UNZA-SVM under the coordination of governmental authorities concerned such as MON and MFL.

On top of that, several positive impacts of the Project are observed or expected as follows: 1) Detection of antibodies specific for filoviruses and Marburg virus; 2) Contribution to the preparedness in Zambia against the EVD outbreak in the western African Countries; 3) Contribution to the preparedness in neighboring countries against the EVD outbreak; 4) Diagnostic support for African swine fever at the time of its outbreak in Zambia and technical transfer of the virus detection method for the relevant agencies; 5) Fostering Zambian and Japanese young researchers; 6) Contribution of the research outcomes to neighboring countries and 7) Awareness raising effects for the preparedness against viral zoonoses including EVD.

(5) Sustainability

The self-sustainability as well as the self-deployment of the benefits provided by the Project can be expected to a certain extent as of the time of the Terminal Evaluation.

From the political and institutional aspects, political importance of infectious disease control, animal health and the promotion of science and technology in Zambia are maintained, and it is assumed to be continued even after the end of the Project. ZNPFI indicates the plan to establish the National Public Health Laboratory under the Institute. While the assessment in testing and diagnosis functions of existing research organizations is carried out by ZNPFI for assigning domestic cooperating laboratories, UNZA-SVM, with high testing/diagnosing as well as research

capability for virus infectious diseases including EVD, is recognized as one of the most reliable partners. Now that the preparedness to infectious disease outbreak has been remarkably embodied not only in Zambia but also in the southern Africa region, UNZA-SVM is highly expected to play an important role of providing technical inputs. Therefore, political importance for maintaining and improving research capacities of UNZA-SVM is to be more increased.

Concerning the financial sustainability, UNZA-SVM was selected by the World Bank's "Eastern and Southern Africa Higher Education Centers of Excellence Project (ACE II)" for the "Center of Excellence for Infectious Diseases of Humans and Animals" in December 2015. The commencement the said COE project was behind schedule approx. for 2 years due to the procedural grounds; eventually, the practical activities under the project had just commenced in December 2017. For this reason, it can be said that the financial base for UNZA-SVM's research for viral zoonoses are secured to a certain degree. Meanwhile, it is desired that the UNZA-SVM's research activities, which directly contribute to the "Preparedness" against PHEIC, will be financially assisted by the governmental authorities such as ZNPHI under the pretext of "the assistance for research activities" ideally.

As for the technical aspect, the Project has established detection methods for viral genome virus-specific antibodies and targeting various viruses as of the time of the Terminal Evaluation. The detection methods for viral antigen for Ebola virus was established in the form the rapid test kit which was jointly developed with the Japanese company and the kit already reached the level of practical use. In addition to that, the skills of Zambian researchers generally reached the level where they are able to utilize the basic techniques of risk assessment and identification of the natural reservoirs and host ranges based on characterization of viruses through research collaboration with Japanese researchers and short-term trainings in Japan. The Project is working on preparing the SOPs of established and/or standardized experimental protocols and testing/diagnostic methods, as well as the regulations and/or rules for the operational management of the laboratories engaged in the Project. The Project is supposed to develop a manual by compiling the SOPs and regulations/rules by the end of the project period. For these reasons, the sustainability of the Project from the technical point of view is anticipated to a certain extent.

3-3 Factors that promoted the attainment of the Project

(1) Concerning the project design

None in particular.

(2) Concerning the implementation process of the Project

In order to respond the EVD outbreak in the Western Africa, the project researchers confirmed the clinical performance of the EVD rapid diagnosis test kit to be reached at the level of practical use in laboratory diagnosis, with the support from UNZA-SVM, JICA and the National Institute of Biomedical Research of the DR Congo. The EVD outbreak was declared as PHEIC; however, it turned out to promote the development of the kit by the Project in the end. The Project, thereafter, provided approx. 400 kits to the Institute and the kits were distributed to each health zone with the support of a JICA expert, stationed in the DR Congo. The kits were practically used for the primary diagnoses of EVD at the time of the incidence of EVD in May 2017 in the DR Congo, and detected the positive samples correctly (the test results were identical with that of the PCR method); implying that the kits can be used for primary diagnosis of EVD in the clinical practice. For these reasons, it can be considered that these things had enhanced the effectiveness of the Project.

3-4 Factors that impeded the attainment of the Project

(1) Concerning the project design

As mentioned above, since the arrival of the JICA long-term expert (Project Coordinator) was delayed, the Project activities in the field of Zambia were limited during a several-months interval until the Project Coordinator was posted in his position. The delay for the commencement of full-scale research activities hindered the efficiency of the Project to some extent from the aspect

of the effective utilization of time resource.

(2) Concerning the implementation process of the Project

During the presidential election in the year of 2015 and 2016, the sampling activities for wild animals were restricted due to the safety reasons for a certain period. In addition, it was announced that Zambia Wildlife Authority (ZAWA) would be abolished with its functions returning to the Ministry of Tourism and Arts as the DNPW in 2015. During the transitional period of its functions from ZAWA to DNPW, it took more than 6 months to obtain the permission for the Project to perform the sampling activities. These are regarded as hindering factors against the efficiency of the Project.

3-5 Conclusions

The Project provided the research instruments and related equipment, which are necessary for the virology research, and has established the virology laboratory. The Project afterward, has developed or improved virus detection methods, followed by their establishment in the University of Zambia, UNZA-SVM. The Project has generated various epidemiological findings and related research outcomes, and published them in a total of 15 research articles as at the time of the Terminal Evaluation. Furthermore, some of the detection methods were applied for laboratory diagnosis for viral infectious diseases; it is notable that the laboratory diagnostic system for EVD has been established in UNZA-SVM, and the system is being used for the practical EVD diagnostic service in the clinical practice. Through the collaborative research between Zambia and Japan, the research capacity of UNZA-SVM as well as each researcher has been enhanced significantly. As aforementioned, the surveillance function of viral zoonoses has been strengthened through the collaborative research, resulting in significant contribution to the “*Preparedness*” against the PHEIC in Zambia.

As the evaluation results of the Project, the relevance, the effectiveness, and the efficiency of the Project are all high, and various positive impacts are confirmed as of the time of the Terminal Evaluation. The sustainability is also expected to a certain extent.

3-6 Recommendations

- (1) ZNPHI and UNZA should clarify the role of UNZA-SVM in the infectious disease surveillance system as well as the “*Preparedness*” against PHEIC by the end of the project period.
- (2) The regular monitoring activities for avian influenza as well as the diagnostic service for EVD, which are implemented as a part of the project research, are utilized as means for implementing “*Preparedness*” against PHEIC in Zambia in a substantial way; it is desired that those activities will be continued even following the termination of project’s financial and technical assistance to UNZA-SVM. Therefore, ZNPHI and the MFL, in consultation with other stakeholders such as the MOH, need to provide UNZA-SVM with the political and financial support for the continuation of the said activities. Especially, it is desired that the budget allocation for those activities be decided prior to the termination of the Project in May 2018.
- (3) The collaborative alliance between UNZA-SVM and ZNPHI, as partners for the implementation of “*Preparedness*” against PHEIC in Zambia, will further be enhanced hereafter. As has been described, UNZA-SVM had advanced the capabilities of research and surveillance of viral zoonoses owing to the support of the Project; however, it is required for UNZA-SVM to acquire more advanced research techniques as well as to expand the scope of the research subject hereafter, in order to consolidate the function of “*Preparedness*” in Zambia through the cooperation with ZNPHI. To this end, HU with a high research capability should continue the technical assistance to UNZA-SVM. HU and UNZA-SVM had already commenced the preparation of continuous collaborative research; however, HU should make efforts for the continuation of the assistance by any means following the termination of the Project.

- (4) The Project should perform the cost analysis, in consideration of human resources, necessary for the continuation of the current regular monitoring activities as well as the EVD diagnostic service, and share the analysis results with the authorities concerned, such as ZNPFI, as soon as possible.
- (5) UNZA-SVM is an educational and research institute. Therefore, when UNZA-SVM is placed as a part of the infectious disease surveillance system and/or “*Preparedness*”, ZNPFI should make consideration to avoid diminishing UNZA’s original functions of education and research.
- (6) Currently, individual joint research collaborations between researchers of external institutions and UNZA-SVM are being developed. They are expected to exchange the official agreement such as Memorandum of Understanding to promote more effective and efficient joint research as necessary.
- (7) The Project should complete the developing a manual by compiling the SOPs and other protocols for standardized experimental manipulations and surveillance activities as well as the regulations and/or rules for the operational management of the laboratories by the end of the project period.
- (8) Some reagents and chemicals as well as spare parts and other materials for maintaining instruments and devices for virology research are supposed to be procured from abroad such as Japan. The Project should list them up and determine the route and/or procedures for procurement by the end of the project period.

3-7 Lessons Learnt

The principle of SATREPS is the practical application of research outcomes to society; therefore, projects are required to promote the information sharing and collaboration with future users (e.g. governmental authorities) of the research outcomes even within the project period as well as to provide necessary assistances in a timely manner, in order to fulfill the said principle.

Particularly, in response to the massive EVD outbreak in the west African countries, the Project established a PCR-based EVD diagnostic system in the BSL-3 laboratory in UNZA-SVM, and has been providing the diagnostic service to date. Besides, the principal researcher of UNZA-SVM was assigned a member of the National Ebola Virus Disease Preparedness Committee, which was established under the Government of Zambia, and Japanese researchers (JICA experts) have been providing technical advises to the Committee via the said Zambian principal researcher. Furthermore, the Project held two (2) training sessions entitled “*Training Course for Preparedness of Ebola Virus Disease: Diagnosis and Biosafety*” in February 2015 and March 2016 using the virology laboratory of the Project, and not only researchers in UNZA-SVM but also many health officers and professionals at central and even local levels had participated.

The development of diagnostic methods for viral zoonoses including EVD is one of the major achievements in the framework of the Project, it might be beyond the scope of the Output, the Project had comprehensively assisted the Government of Zambia in addressing the preparedness against the possible outbreak of EVD in Zambia in a timely manner. Accordingly, the Project had provided a benefit to society through the practical utilization of a part of research outcomes; simultaneously, strengthened a collaborative alliance with envisaged users of the research outcomes, such as governmental authorities concerned.