

"Feasibility Survey and Pilot Project for  
Disseminating SME's Technologies to  
Developing Countries" under the Governmental  
Commission on the Projects for  
ODA Overseas Economic Cooperation  
in FY2012

Summary Report

Republic of the Sudan

(Pilot Project on Mobile Car Clinic(Dr.Car))

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Technology Seed Incubation Co., Ltd  
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joint venture

**This report is a summary of a feasibility survey and pilot project disseminating SME's technologies to developing countries conducted by the contractor, under the Governmental Commission on the Project for ODA Overseas Economic Cooperation, commissioned by the Ministry of Foreign Affairs of Japan in Fiscal Year 2012. It does not necessarily represent the official views of the Ministry of Foreign Affairs of Japan.**

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## PART 1 Confirmation of issues and the social needs in Medical and Health fields in Sudan

The Republic of Sudan ( Sudan thereafter) is located in North East region of Africa with neighboring countries such as Chad, Ethiopia, the Republic of Central Africa, Egypt, Lybia, Ethoria, and South Sudan. Sudan occupies 1,880,000 km<sup>2</sup> with population of 30.89 million people among 17 provinces.

Sudan used to be the nation of highly economic potential having the largest area of Africa and blessed with the fertile cultivated area as well as the abundant mineral resources and aquatic resources. Despite having such potential, Sudan's economy has become impoverished by the suspended economic support from the Western nations and accumulated government debts through the civil war for over 20 years; which has lead Sudan to accept economic restoration package from International Monetary Fund (IMF hereafter) in 1996. Sudan has since tried rebuilding its economy. However, a sharp drop of oil price due to the worldwide recession in 2008 has caused Sudan's economy to slow down to recover. Moreover, South Sudan, which produces 75% of the total oil in Sudan, became independent in July 2011. This has made a significant negative impact in Sudan's economy.

Although the health and medical administrative system is being developed in Sudan, the organization of the medical agencies covering vast country has not yet been established. Therefore, the government has stressed the importance on the agenda of the development of social infrastructure and personnel training as one of the highest priority issues especially a need of improvement in a community health care, i.e., an intensive support to the rural areas including the poor regions and trouble spots.

Moreover, though there have been some progress in the development and training of talents in the health and medical field, there are 8,642 physicians working in the public sector which represents only 2.8 persons per 10,000 populations according to the survey in 2008. Although this figure is an average level among African countries (2.9 physicians/10,000 in average), it is extremely low compared with neighboring Egypt being 16.9 persons and Libya being 19.0 persons. Specifically, a lack of doctor is most crucial in rural areas, and the demonstration test conducted in the province of Gezira has indicated that there is only 0.3 to 0.6 doctor per population of 10,000.

## PART 2 Utilization potential of technologies and a potential future business development

Generally, a “Doctor car” refers to a medical visitation vehicle which is dispatched with a doctor for visiting the patients, however, it often functions as an ambulance in the case of emergency. On the other hand, as shown in the demonstration test, the proposed Doctor car functions as a mobile clinic with a doctor and a nurse, who are stationed in a base hospital, that is to be dispatched to rural and remote locations where no resident physicians are stationed. By sharing diagnosis data between Doctor car and the base hospital through internet, also functions as a large medical treatment terminal unit that makes up a system capable of providing various post-visit, continuous treatments and diagnosis from the base hospital after a doctor left the location. Furthermore, in the area suffering from a water shortage, it can also provide clean potable water with its water treatment system on board. Specification of the Doctor car used for the demonstration is as follows;

Vehicle model : Toyota 2WD Hi-Ace Super High roof with special installation

Retrofitted equipment: Autoclave, sterilized shelves, Stand light, Side tent, Refrigerator, 2.5kW generator, Solar panel, Medical bed/chair, Pulse Oximeter, Electrocardiograph, USB Diagnostic Ultrasound Imaging System , Water treatment system.

Axiohelix Inc, the leading partner of this Joint Venture, is a venture company that develops custom software as well as original products ( including hardware ) and operates in various regions in Japan and overseas. It is assumed that Axiohelix will take the following roles in the proposed project;

1. Permeating the medical device and related (supporting) instruments as an integrated unit of a vehicle,
2. Developing medical service infrastructure in Sudan
3. Development and training of necessary talent resources

The proposed project, when it is successfully implemented, is expected to make positive contributions to the Sudan’s economy in the following area;

1. Creation of new business opportunities in the area of logistics support and its operation for medical services.
2. Creation of new employment in the scale of several 100’s (when implemented throughout

Sudan ) to sustain the operation in the future.

3. Creation of new services in the field of medical, health and relevant education.

4. Future development of talents in the fields of medical and health.

The following business issues have been examined in this research for the successful implementation of Doctor car operation in Sudan.

- Sales and maintenance of Doctor cars (Unit)
- Sales and maintenance of relative medical instruments
- Sales and maintenance of relative communication instruments
- Development and the sales of data base software, such as electronic clinical records
- Sales of other related products
- Support services for Japanese companies entering into Sudan market
- Promotion and intermediation of investments by Japanese companies to Sudan

Further, Gezira Family Medicine Project (GFMP hereafter), which is the project under the Gezira Ministry of Health as the counter partner of Sudan, and ROCINANTES with a help of Khartoum Ministry of Health are to be the first recipients beneficial and counterpart of the services by the project.

GFMP covers 128 Health Centers (HCs hereafter) in the province of Gezira, and we have found through the local hearings that 10 Doctor cars are needed to cover the local HCs in the area. The finding indicates that there is a need for 10 Doctor cars per province and over 100 Doctor cars when disseminated to the entire country.

In this research, having done an assessment of business plan based on the case when 3 Doctor cars are sold locally in a year and provided maintenance service for 10 Doctor cars, we estimated the annual sales to be 98 million yen in the 5<sup>th</sup> year based on the sales and the maintenance service for a Doctor cars and its accompanying medical instruments. In this case, the return of the initial investment could be paid back in 7 years. Moreover, this estimation is based on the case when no preferential tax treatments nor subsidies cannot be obtained. Therefore, the possibility of obtaining any preferential tax treatments or subsidies are yet to be considered in a future.

On the other hand, following risk factors must be taken into consideration for the successful implementation of the project.

- Risk of a delay in starting the business due to potentially lengthy process of acquiring

necessary permits and authorization.:

Uncertainty in necessary process of obtaining permits and authorization for medical instruments.( A need of permits and authorization, Time required, complexity of application processes )

- On road accident risk :

As a Doctor car travel a long distance covering the vast territories including the area with poorly maintained roads, efforts must be given to prevent potential traffic accidents.

- Risk of medical insurance uncoverage:

Medical insurance will cover mobile medical services through the hearing conducted.

- Risk of import duties :

Importing Doctor cars into Sudan, high import duties (54%) could potentially demotivate an implementation of Doctor cars.

- Risk of theft :

Certain measures against potential theft must be taken as the vehicle is equipped with expensive instruments.

### PART 3 Validation of local suitability of product and technology

As for the scheme of the demonstration test, it is to demonstrate that a Doctor car will make round of visits to HCs owned by GFMP as well as the under populated area with no HCs, and that the smooth communication between the doctor on board of a Doctor car, GFMP central operation base in Gezira and Okinawa Health and Longevity Research and Development Center can be made by connecting them online with an internet connection. In addition, it will also verify that such large data volume as those from ultrasound diagnostic system, image data of electrocardiogram and input data of PHR system; all of which are generated on board of a Doctor car; can be transmitted smoothly through internet connection. Furthermore, the vehicle's basic performance ( Solar system, battery system, air conditioning system, roadabilities, etc ) will be evaluated at on-site test, and sterilization capability of the water treatment system will be tested at Khartoum municipal water department.

Sudan's Ministry of Health was initiated the demonstration test of remote medical service project with the assistance of FMUG ( Faculty of Medicine, University of Gezira) in the province of Gezira in 2010. In the remote medical service project, experimental remote medical treatments have been provided by 207 young doctors stationed in HCs, and the project

is being yet continued as experimental treatment has been quite favorable to have achieved positive results. Because of the positive and high compatibility between the Doctor car used in the project and the remote medical service project, we expect an effective cooperation in the operational phase in the future.

The demonstration test have been conducted in the research with the following details.

Item	Contents
Equipment	Doctor car ×1
Duration of the test	Feb 4, 2013～April 30 (scheduled)
Number of villages visited	30 villages with no resident doctors in the province of Gezira
Total population of the villages visited	104,355 people (tentative figure for the 54 days from February 4 until April 9)
Treated patients	10,688 people (tentative figure for the 54 days from February 4 until April 9)
Average number of patients treated per day	236 people (average figure for the 54 days between February 4 and April 9)
Outline of Demonstration	<p>1) Verification of the suitability and suggested improvements from the following tests.</p> <ul style="list-style-type: none"> <li>▪ Demonstration test for the suitability of remote communication system</li> <li>▪ Demonstration test for the suitability of medical instruments</li> <li>▪ Demonstration test for the suitability of the water treatment system</li> <li>▪ Demonstration test for the suitability of basic equipment of Doctor car (vehicle)</li> </ul> <p>2) Confirmation of a need for Doctor cars in the subject area</p>

Through the demonstration test we have found the following 9 points to be improved according to the results of the demonstration test.

1) Utility equipment

- Install the ladder on the back door to make it accessible to the roof top to wash the solar panel.



- 2) Vehicle's drivability
  - Employ 4WD system and add 10cm or more to the vehicle's height to improve drivability in a rainy season.
- 3) Other equipment
  - Adopt a left sided steering wheel to meet the local traffic regulation.
  - Interior and the floor of the car should be harder and strong (material used in the demonstration car is too fragile)
  - Make it easier to set up a side awing tent.
  - Modify the air conditioning system to function even when the engine is off.
  - Improve the quality of rubber packing (as they deteriorate with the heat from the sun)
  - As it is assumed to have a maximum of 6 passengers in a vehicle, front row seat (the seat for a driver and an assistant ) is to accommodate 3 passengers, and in the rear of a vehicle to have a set of portable and foldable riding device for 3 passengers.
  - Carry 3 sets of portable and foldable beds in a vehicle in case of lodging for medical staffs

On the business of sales and maintenance of Doctor car, medical instruments and communication equipment, the estimated sales on the 5<sup>th</sup> year of operation is 98 million in Japanese yen. Since the initial investment for a package of Doctor car and the accompanying equipment is estimated to be 20 million yen, total sales of 100 Doctor cars alone will be over 2 billion yen with an assumption of expanding the operation of Doctor cars across Sudan. And, if the annual profit for the hospital out of the operation of one doctor car will be assumed to be 3 million yen, and if the subsidiary of Axiohelix, a Japanese SME, were to get the contract to provide the maintenance and management service of all doctor cars operation service annual income for the 5<sup>th</sup> year will be 10 million yen.

Price of doctor care with full equipment is about JPY20million which is fairly expensive, and the retail price of Doctor care in Sudan will be much more expensive considering 54% import duty. In addition, the operational cost (including labor cost) and the maintenance cost should be more costly than the stationary hospital operation.

On the other hand, since it is not practical to charge patients for such expensive medical treatment cost to cover the initial investment and the maintenance cost, preferential treatment and/or subsidies such as import duties for a Doctor car, or financial assistance from Sudan government, ODA and such, is among the issues to be considered further in future to make it

profitable for the local medical institutions.

## PART 4 Effects of the development from ODA program and effects of the project development by the joint venture

- 1) Following technologies are to be installed in a Doctor car.
  - Communication system for remote medical service
  - Medical instruments
  - Water treatment system
  - Power generator
- 2) The following domestic impacts are expected in Sudan when the project is certified as ODA project.
  - The impacts on medical service  
Establishment of the medical service infrastructure to provide independent and continuous medical services (including school health check-up) to an under populated area and/or villages with no resident doctors, it will bring positive impacts on the better health and medical system in other African developing countries than Sudan with vast territory suffering an acute shortage of human resources in health and medical field.
  - The impacts in technical aspect  
It is possible to change the priority of transmission in audio, visual and data to put priority on the medical communication system. There are very few portable Electrocardiograph nor Diagnostic Ultrasound Imaging System currently available at the level of medical facilities such as HC. However, it will make it possible to diagnose diseases that could not be diagnosed otherwise by installing those systems on a Doctor car as standard equipment. The water treatment system that is installed to a Doctor can instantly sterilize water without a need of neither any special maintenance nor the use of chemical agents. Such product is suitable for the rural area of Africa where no water supply is available.
- 3) Following development effects of Doctor car are expected by obtaining assistance of ODA program.
  - Provide medical services in isolated and under populated area
  - Lower the rate of mortality in the isolated and under populated area

- Allocation of doctors to the rural and isolated area to provide medical services
- Mitigation of the unrest in isolated and under populated area
- Improvement in quality of medical service by use of biometric PHR registration.

In addition, the following effects on the project development by the joint venture are expected.

- Establishment of the new company
- Development of B2B / B2G businesses in Sudan
- Development of one stop service for the business between Sudan and Japan.

## PART 5 Concrete proposal of obtaining assistance of ODA

The demonstration test has proved that it will be possible to improve primary Health Care ( PHC hereafter) more effectively by travelling villages with no resident doctors in the under-populated area rather than building HCs. Based on this finding, we plan to make an effort to obtain assistance of ODA program in order to mainly provide enough Doctor cars to expand the operation to the province of Gezira and Khartoum.

We propose, in the fiscal year of 2013, to provide Doctor cars themselves to the organization with an operational capability, using the scheme of JICA’s “Dissemination/demonstration Project Proposed by Private Sector”. Specifically, we propose to the province of Gezira to provide 4Doctor cars which will be operated by GFMP. The organization with an operational capability can expand the coverage area of doctor cars to the under populated area. In addition, we plan to perform the similar experimental project in the under populated area of Khartoum, and also plan to help achieve the goal of improving PHC of the youth by through school health check-up. Specifically, we propose to provide 3 Doctor cars to ROCINANTES for providing medical services in the under populated area as well as for a school health check-up service. Description of the project is as follows;

Project name	Dissemination by commercial proposition / demonstration (Operational support project for Doctor car: mobile clinic )
Subject field	Health and medical service
Development issues	Improvement of health and medical service
Operating agencies	1. Ministry of Health, Gezira Province (GFMP) 2. Ministry of Health, Khartoum Province (ROCINANTES)
Project sites	Province of Gezira and Khartoum
Recipients of service	Residents ( around 190,000) and school children (around 50,000) in

	HC sites and surrounding area with no resident doctor
Primary goal	To provide independent and sustainable medical service (including school health check-up) in all the area of Sudan including the under populated area / villages with no resident doctor.
Goal of the project	Operate 4 Doctor cars to cover 160,000 residents in the under populated area of the province of Gezira. In addition, operate 3 Doctor cars to cover 50,000 residents in the under populated area of Khartoum by doctor's round of visits, and also conduct mass health examination of 50,000 residents per year, including those in the urban area, on infectious disease by doctor's round visits. Through these activities, Provincial governments as well as Sudan government will recognize effectiveness of a mobile medical service and a school health check-up service, and the key issues for the continuous operation are to be identified at the same time.
Results	<ol style="list-style-type: none"> <li>1. The service coverage area in the province of Gezira and Khartoum will be expanded to the more villages with no resident doctors, and the mobile remote medical service will be socially accepted.</li> <li>2. Make contribution to the prevention of infectious disease from spreading at school by screening infectious disease among students at a school health check-up in Khartoum, and a school health check-up service is socially accepted.</li> </ol>

Furthermore, discussion with the counterpart agencies in Sudan have progressed, and GFMP who has conducted the demonstration test, have agreed to provide all necessary resources than hardware itself (ie; doctor care itself as well as installed equipments), such as payment of import duties and a doctor's operational round of visits, except Doctor car and its on-board equipment. And, ROCINANTES, with a help of Khartoum ministry of Health, plans to effectively raise the standard of community health care service by combining doctor's round visits using a Doctor car with school health check-up, and a maternal and child health operation (vaccination, medical check-up for nursing mothers and an education for midwives) in Sharuganiru district located in the outskirts of Khartoum. Both ROCINANTES and Khartoum ministry of Health have agreed to take care of an import duties and the running cost of Doctor car.

We have also received a letter from the federal ministry of health who will assume all the relevant legal requirement in connection with the operation of Doctor car.

Dissemination Project for a government of developing nations  
Republic of Sudan : Doctor car ( Mobil clinic ) Pilot project

**Company / Site Information**

- Name of SME: AXIOHELIX, Co.,Ltd. Technology Seed Incubation, Co.,Ltd. Smart Energy, Co.,Ltd. NPO Rocinantes Consortium
- Address of proposing company: Nishi, Naha-c Okinawa
- Survey Site • C/P Organization: Gezira Family Project Federal Ministry of Health

**Development issues of Sudan**

- Lack of access to a primary health services
- Out flowing of human resource in medical services to overseas and training of talents in medical field
- Lack of technology in providing medical service to remote and under populated area
- Lack of technology in water treatment and the storage of electricity

**Products and Technologies of SMEs**

- Remote communication technology using mobile communication system
- Technology in securely transmitting large data
- Water sterilization technology

**Proposed ODA Projects and Expected Impact**

- Proposed ODA scheme: Dissemination by proposal\* pilot project, Collaboration by Non-government volunteers, Grass root technical support and, voluntary and not-for-profit technical support by SMEs
- Provide Doctor car across the country (17 provinces) and manage the system. In addition, provide remote communication system
- Reduce the waste of building a medical facilities in the non profitable area and realize the nation wide health service by combining doctor's visitation and a remote diagnosis

**Future Business Development of Japanese SMEs**

- Sales and maintenance of Doctor car and its accompanying equipment
- Sales and maintenance of software for remote medical diagnosis