

SUSTAINED USE OF ULTRASOUND  
EQUIPMENT IN UGANDA:  
AN EVALUATION

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## **Sustained use of ultrasound equipment in Uganda: an evaluation**

A thesis submitted in partial fulfilment in the requirement for the degree of

Master in International Health

by

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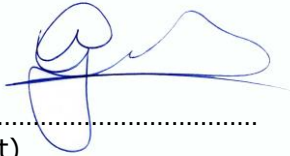
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Declaration:

Where other people's work has been used (either from a printed source, internet or any other source) this has been carefully acknowledged and referenced in accordance with departmental requirements.

The thesis "*Sustained use of ultrasound equipment in Uganda, an evaluation*" is my own work.

Signature



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## **Abbreviations**

AHSPR	Annual Health Sector Performance Report
DHO	District Health Officer
ECUREI	Ernest Cook Ultrasound and Research Institute
ENT	Ear Nose and Throat
FY	Financial Year
GRI	Global Reporting Initiative
HC	Health Centre
HF	Health Facility
HR	Human Resources
HSD	Health Sub District
HSSP	Health Sector Strategic Plan
IDA	International Development Agency
IFAD	International Fund for Agricultural Development
IFC	International Finance Corporation
IMR	Infant Mortality Rate
IOB	Inspectie Ontwikkelingssamenwerking en Beleidsevaluatie
IUCN	International Union for Conservation of Nature
IUFD	Intra Uterine Foetal Death
KIT	Koninklijk Instituut voor de Tropen
LCD	Liquid Crystal Display
MHRRC	Mengo Hospital Research Review Committee
MMR	Maternal Mortality Ratio
MoF	Ministry of Finance
MoH	Ministry of Health
MoLG	Ministry of Local Governments
MTR	Mid Term Review
NDP	National Development Plan
NGO	Non Governmental Organisation
NHS	National Health Sector
NHP	National Health Policy

NRH	National Referral Hospital
ODA	Official Development Assistance
OPD	Out Patient Department
ORET	Ontwikkelings Relevante Export Transacties
PHP	Private Health Provider
PNFP	Private Not For Profit
REC	Research Ethical Committee
RRH	Regional Referral Hospital
TA	Technical Assistance
TBE	Theory Based Evaluation
ToC	Theory of Change
TCMP	Traditional and Complementary Medicine Practitioners
UBOS	Uganda Bureau of Statistics
UDHS	Uganda Demographic and Health Survey
UNCSD	United Nations Center for Sustainable Development
UNDP	United Nations Development Program
UNMHCP	Uganda National Minimum Healthcare Package
US	Ultrasound
USAID	United States Agency for International Development
VHT	Village Health Team
VU	Vrije Universiteit
WCED	World Commission on Environment and Development
WRR	Wetenschappelijke Raad voor het Regeringsbeleid



## **Abstract**

### *Background*

Sustainability continues to be a major concern of many externally- and locally funded healthcare projects in developing countries. In literature on sustainability usually five dimensions are distinguished: economic, social, environmental, institutional and technical sustainability.

### *Main objectives and methods*

This thesis evaluates the technical sustainability of an externally funded health infrastructure development project in Uganda. Focus of the evaluation was on the continued use and maintenance of ultrasound equipment and on continued availability of competent staff. A 'Theory Based Evaluation' Weiss (1972) approach was used. To this end a Theory of Change for the technical sustainability of the project was constructed, consisting of 3 pillars: materials, maintenance and training. Information was gathered from 32 out of 52 facilities that had benefitted from the project through a paper-based questionnaire and interviews. In addition a number of key stakeholders were interviewed.

### *Findings*

The research found that only 60% of the equipment which had been delivered through the project was fully operational. Identified *direct* reasons for equipment not being used were: no maintenance done (56%), battery down (28%), high voltage malfunctioning (12%), and repairs too expensive for facility (4%). *Indirect* reasons contributing to equipment not being used were found in the health workforce: transfers of staff (74%), retirement (5%), gone for further studies (11%), not interested (5%) and staff passed away (5%). Poor local adherence to maintenance procedures and lack of trained engineers was found to hamper a good maintenance management structure. The project had a positive impact on the reputation of the local training institute in the country and the rest of East-Africa. The local training institute managed to continue good quality training in ultrasound after the end of the project.

### *Conclusions*

The fact that only 60% of the delivered equipment were found fully operational, suggests that the issue of sustainability in projects like these need more attention. The research found that the following are important conditions for technical sustainability: (1) establishment of local supportive systems (like health workforce management, budget allocation for districts, maintenance management structure, supply chain), and (2) institutionalisation of training. Research on factors influencing sustainability remains a challenge. The nature and set-up of projects vary tremendously, so generalization of findings is not always possible. Careful consideration must also be given to interactions among the five dimensions of sustainability.

### **Key words**

sustainability, theory based evaluation, theory of change, institutionalization, donor-funded programs, quantitative research, Africa, Uganda

**Word count: 13.197**

## Chapter 1; Introduction

As training coordinator and program manager I have been working in Uganda from 2005 till 2008. One of my responsibilities was to plan all training activities under an externally funded healthcare project whereby diagnostic equipment was delivered to 52 health facilities in Uganda. Some of the facilities received renovation and operating theatre equipment as well. Another responsibility I had was to monitor project progress and report about this to the local Ministry of Health (MOH) and the implementing Dutch company.

In December 2008 I had an interesting conversation with one of my local team members. The topic was "maintenance" and he stated that in the local language there is no word for "maintenance". Also "sustainability" is a word that is not known to the local language according to him. I asked why and he explained to me that it has never been necessary in Uganda to make or build things that last for a longer time. "The lifespan of a hut in rural areas is about 2 years, if the hut breaks down, you simply build a new one right next to it, so why plan for a hut that can sustain longer? Sustainability or maintenance is just "not in our systems here in Uganda", he said. Of course I could have challenged him by asking what people do to prevent that the roof of their hut starts leaking, and how they would call that, but in stead this small conversation triggered me to look critically to our project in Uganda. Sustainability is one of the key success factors of the project. I wondered how exactly that had been operationalized in this project and how the sustainability of this project could be evaluated.

The phenomenon of sustainability was first described between 1970 and 1980 (IUCN, 1980), but became truly important after the publication of the report of the World Commission on Environment and Development in 1987 (WCED, 1987). Like in many other sectors today, the healthcare sector is increasingly pushed to ensure that projects are sustainable in order to invest money efficiently while at the same time yielding lasting results (WRR, 2010). The topic of sustainability is increasingly important in global development efforts. Attention to the long-term viability of health intervention programs has even become a more explicit goal in the last decade, as policy makers and donors have to be more concerned with allocating scarce resources efficiently. This trend is also visible in the Dutch development cooperation sector. In the nineties, under Minister of Development Aid, Jan Pronk, the term sustainability was introduced into the policy of the Dutch development cooperation (IOB, 2002). The Dutch government would no longer subsidize projects that did not pay due attention to sustainability (IOB, 2002).

Reflecting on the importance of sustainability in health care projects and realising that sustainability has many facets, the next question to be addressed was how to evaluate project sustainability. I decided that the best way to explore this was to do an evaluation of the project I had been involved in, some years after the end of the project. In this way, I hoped to gain better understanding how sustainability issues in a project like this can be evaluated as well as come up with a number of concrete findings and lessons learned around the sustainability of this and similar projects.

The field-based evaluation was carried out in November 2012 in Uganda. The thesis describes the methodology and findings and is structured in 8 chapters:

- **Chapter one** introduction
- **Chapter two** describes the problem statement; research objectives and overall design of the study
- **Chapter three** gives background information of Uganda and its health system as well as background information of the project under study
- **Chapter four** describes what was found in the literature on sustainability. A description of which strategies were in place to enhance the sustainability of the project under study completes this chapter
- **Chapter five** describes the methodology used for the research, explaining how this is

based on the “theory of change” underlying the project

- **Chapter six** presents the findings of the research
- **Chapter seven** comprises the discussion of the findings
- **Chapter eight** concludes and provides recommendations

## **Chapter 2; Problem statement and objectives of the study**

This chapter presents the problem statement and objectives, followed by the overall study design for this thesis.

### **2.1 Problem statement**

The ORET program is a health infrastructure development program of the Ministry of Foreign Affairs in the Netherlands. Under this program, developing countries get the opportunity to buy investment goods like diagnostic equipment via a grant. A sustained use of the procured equipment is essential and one of the explicit objectives of these programs<sup>1</sup>. But what happens after these projects end and funding has expired? Do the project activities indeed continue? And if continued project activities are found, what are the conditions that have made it possible that they have been sustained? And what happens to sustainability over time?

### **2.2 Study objectives**

The main purpose of this research is to evaluate how much "change" has been sustained in 2012 after the implementation of a health infrastructure development project in Uganda between 2005 and 2008. The evaluation is focussing on studying how the change has most likely occurred, and to discuss which factors might be responsible for the project's success or failure. This led to the following general objective and specific objectives:

#### **2.2.1 General objective**

To evaluate the technical sustainability of an externally funded healthcare project in Uganda

#### **2.2.2 Specific objectives**

Based on the fact that the main components of the project consisted of provision of materials (equipment, spare parts, consumables), maintenance of imaging equipment and training of staff, the following specific objectives were derived from the general objective:

1. To explore to what extent provision of materials is sustained 4 years after the funding ended
2. To explore if and to what extent maintenance of equipment is sustained 4 years after the funding ended
3. To explore if and to what extent training is sustained 4 years after the funding ended

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<sup>1</sup> [www.oret.nl](http://www.oret.nl)

### **2.3 Overall study design**

To inform the study, three sets of literature were examined: (1) literature on sustainability in order to define and operationalize sustainability for the purpose of this research; (2) the background of the funding instrument that was used to subsidize the project, with a focus on how sustainability had been operationalized in the project; and (3) literature on the concept of a "Theory Based Evaluation" (TBE) approach was studied in order to construct a Theory of Change (ToC) needed to "frame" the research.

The next chapter gives background information on Uganda and its health system as well as general background information on the project under study and the funding instrument.

Findings from the literature search on sustainability are presented in chapter 4, together with information about how sustainability was operationalized in the funding instrument. Chapter 5 presents a background on TBE, as well as the reconstructed ToC and the actual research design.

## Chapter 3; Background information on Uganda and the project under study

### 3.1 General information

#### 3.1.1 Geography

Uganda is a land locked country located in East Africa, bordered by Sudan in the north, Kenya in the east, Tanzania and Rwanda in the south and Democratic Republic of Congo in the west (Encyclopedia of the Nations). The country is divided into 80 Districts all of which have a decentralized local governance system. The districts have various land sizes and populations. With its population growing at the rate of 3.2% per annum, Uganda has one of the highest growth rates in the world and higher than the Sub-Saharan Africa average of 2.4% (Uganda Demographic and Health Survey, UDHS 2011). Only 49% of households have access to health care facilities in Uganda. Access to health care facilities has been limited by poor infrastructure; especially in the rural areas where the majority of the population lives (Uganda Population and Household Census, 2002).

#### 3.1.2 Demographics

The Population Census conducted in 2002 puts the total population of Uganda at 24.7 million persons. The projected 2011 midyear population is 32.9 million with the following characteristics:

**Table 1: Demographic Information**

<b>Demographic Variables</b>	<b>Proportion</b>	<b>Population</b>
Total Population	100%	32,939,800
Children below 18 years	56%	18,446,288
Adolescents and youth (10 – 24 years)	34.7%	11,430,111
Orphans (for children below 18 years)	10.9%	3,590,438
Infants below one year	4.3%	1,416,411
Children below 5 years	19.5%	6,423,261
Women of reproductive age (15 – 49 years)	23%	7,576,154
Expected number of pregnancies	5%	1,646,990

*Source: Uganda Bureau Of Statistics, UBOS 2011*



### 3.3 Health sector organization, function and management<sup>2</sup>

The MoH provides leadership for the health sector: it takes a leading role and responsibility in the delivery of curative, preventive, promotive, palliative and rehabilitative services in accordance with the HSSP II. The provision of health services in Uganda has been decentralized with districts and health sub-districts (HSDs) playing a key role in the delivery and management of health services. Unlike in many other countries, in Uganda there is no 'intermediate administrative level' (province, region). The health services are structured into National Referral (NRHs) and Regional Referral Hospitals (RRHs), general hospitals, Health center IVs, HC III, II and HC I. The HC I has no physical structure but a team of people (the Village Health Team (VHT)) which works as a link between health facilities and the community.

#### 3.3.1 National, Regional and General Hospitals

The National Hospital Policy, adopted in 2005, lists the role and functions of hospitals at different levels in the NHS. Hospitals provide technical back up for referral and support functions to district health services. The public, PHPs and PNFPs, provides hospital services. The public hospitals are divided into three groups<sup>3</sup>:

(i) *General Hospitals* provide preventive, promotive, curative maternity, in-patient health services, surgery, blood transfusion, laboratory and medical imaging services. They also provide in-service training, consultation and operational research in support of the community-based health care programs.

(ii) *Regional Referral Hospitals (RRHs)* offer specialist clinical services such as psychiatry, Ear, Nose and Throat (ENT), ophthalmology, higher level surgical and medical services, and clinical support services (laboratory, medical imaging, pathology). They are also involved in teaching and research.

(iii) *National Referral Hospitals (NRHs)* provide comprehensive specialist services and are involved in health research and teaching in addition to providing services offered by general hospitals and RRHs. NRHs provide care for a population of 30 million people<sup>4</sup>, RRHs for 2 million people while general hospitals provide for 500,000 people. All hospitals are supposed to provide support supervision to lower levels and to maintain linkages with communities through Community Health Departments (CHDs). The operations of the hospitals at different levels are limited by lack of funding.

#### 3.3.2 District health systems

The 1995 Constitution and the 1997 Local Government Act mandates the District Local Government to plan, budget and implement health sector policies. The Local Governments are responsible for the delivery of health services, management of human resources (HR) for district health services and monitoring of overall health sector performance. These Local Governments manage public general hospitals and health centers and provide supervision and monitoring of all health activities (including those in the private sector) in their respective areas of responsibility.

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<sup>2</sup> This section is based on the HSSP II

<sup>3</sup> Ministry of Health(2005): *National Hospital Policy*. Kampala, Ministry of Health

<sup>4</sup> Ministry of Health (2009): *Annual Health Sector Performance Report 2008/2009*. Kampala, Ministry of Health



### 3.3.3 Health sub-district (HSD) system

The HSD is a lower level after the district in the hierarchy of district health services organization. The HSD is mandated with planning, organization, budgeting and management of the health services at this and lower health center levels. It carries an oversight function of overseeing all curative, preventive, promotive and rehabilitative health activities including those carried out by the PNFP, and PFP service providers in the sub district.

### 3.3.4 Health Centers III, II and I

HC IIIs provide basic preventive, promotive and curative care and provides support supervision of the community and HC II under its jurisdiction. There are provisions for laboratory services for diagnosis, Maternity care and first referral cover for the sub-county. The HC IIs provide the first level of interaction between the formal health sector and the communities. HC IIs only provide out patient care and community outreach services. An comprehensive nurse is key to the provision of comprehensive services and linkages with the village health team (VHT). A network of VHTs has been established in Uganda, which is facilitating health promotion, service delivery, community participation and empowerment in access to and utilization of health services.

While VHTs are playing an important role in health care promotion and provision, coverage of VHTs is however still limited: VHTs have been established in 75% of the districts in Uganda but only 31% of the districts have trained VHTs in all villages<sup>5</sup>.

### 3.3.5 Health Centre IV

The HC-IV is an innovation of the 1999 National Health Policy. HC-IVs provide basic promotive, preventive and curative services including emergency surgical and obstetric services, in order to address the poor health indicators such as infant mortality rate and maternal mortality ratio. Being a key strategy for the sector the functionality of HC-IVs is a key objective in providing special components of the UNMHCP.

## 3.4 General background of the project under study

### 3.4.1 Health situation in Uganda in 1999<sup>6</sup>

In 1995, life expectancy at birth in Uganda was approximately 47 years, one of the lowest levels in the world. The Maternal Mortality Ratio (MMR) was between 500 and 2000 maternal deaths per 100.000 live births. The Infant Mortality Rate (IMR) was 97 infant deaths per 1000 births. Only 13,7% of pregnant women received antenatal care in the first trimester, and only 35,4% of births occurred in a medical facility. Of all births, 65,9% was considered high risk.

According to the 1995 Burden of Disease analysis<sup>7</sup>, 75% of life years lost to premature deaths were due to 10 preventable diseases. With 20,4% perinatal and maternal conditions took the largest share of the Burden of Disease, followed by Malaria, Acute Lower Respiratory Infections, AIDS and diarrhoea. Women and children had a disproportionate share of the Burden of Disease.

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<sup>5</sup> Ministry of Health (2009): *Annual Health Sector Performance Report 2008/2009*. Kampala, Ministry of Health

<sup>6</sup> This section is based on the World Bank Discussion Paper No.404: *Health Care in Uganda, Selected Issues, 1999*

<sup>7</sup> Ministry of Health, Uganda; 1995

The central focal point of the HSSP 2001/02-2004/05 of the MoH was the reduction of infant mortality and maternal mortality, followed by the reduction of HIV and decreasing the fertility rate.

An essential policy change in Uganda at that time was the decentralisation of government to district level (see also 3.3). The creation of health sub-districts was expected to improve physical access to health care for the poor. Distance to health facilities had been a significant barrier. The national average of households within walking distance to a health facility was 49%. The poor infrastructure of facilities was another factor influencing low access to health care.

A main impediment towards further development of the health sector was the availability of (qualified) staff. It was estimated that qualified staff filled only 40% of the staff positions. Furthermore, the actual staff present in the hospitals was less than 50% of the needed staff establishment (Uganda National Health Policy, 1999).

#### 3.4.2 Diagnostic services and training situation

Uganda, with a population of 28 million (Uganda Bureau of Statistics [Uganda], 2002) had only 25 radiologists and 60 non-physician sonographers. There were about 150 ultrasound machines countrywide, most operated by non-trained or under trained personnel. Similar shortages of trained ultrasound personnel can be found throughout Africa (Vries de C *et al.*, 2003). In Uganda pregnancy related complications are the largest source of mortality for women of childbearing age<sup>8</sup>. Health care providers increasingly see the use of ultrasound in antenatal care for early detection of pregnancy related problems as a useful tool (Kongnyuy & van de Broek, 2007; Papp *et al.*, 2003). Also the government of Uganda acknowledged that the use of ultrasound can have a positive effect on pregnancy outcomes (Ministry of Health [Uganda], 2005).

In addition, Uganda had insufficient ultrasound training capacity and resources. Individuals from Uganda who wished to undertake formal courses in ultrasound had to travel to Europe or America, which proved too expensive and deterred many from training.

### 3.5 The project

#### 3.5.1 ORET instrument

Like other countries, the Netherlands is providing development assistance to the developing world. To this effect the Dutch government uses a range of instruments in the "development aid arena". One of these instruments is the ORET program. The program for development-relevant export transactions is known by its Dutch acronym ORET (ontwikkelings relevante export transacties). It is an instrument of the Ministry of Foreign Affairs that enables developing countries to buy investment goods or services in the Netherlands for commercially non-viable projects that will enhance employment. The Dutch government, i.e. the Ministry of Foreign Affairs, provides a grant to the government of the importing country to cover part of the transaction costs. By accepting the grant, the recipient has to guarantee funding for the remaining costs. These grants qualify as Official Development Assistance (ODA) according to international standards. Since January 2007 a consortium of PWC (previously known as PricewaterhouseCoopers) and Ecorys, has been authorized to administer the program in consultation with the Ministry of Economic Affairs<sup>9</sup>.

Sustainability is of particular importance to ORET programs. The general description of the

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<sup>8</sup> Uganda Demographic and Health Survey 2002

<sup>9</sup> See [www.ORET.nl](http://www.ORET.nl)

ORET program comprises a section titled "relevance to development policy". To achieve this relevance, the project is assessed on (1) financial and economic impact, (2) technical sustainability, (3) environmental impact and (4) social impact. Extra attention is given to Technical Assistance (training) to ensure that the project will be sustainable and yield long-term benefits<sup>10</sup>.

### 3.5.2 Project definition<sup>11</sup>

The Government of Uganda (GoU) attaches high priorities to its Primary Health Care and Health Care at district level<sup>12</sup>. Major bottlenecks at district level were the poor infrastructure of hospitals and health centres, the lack of operating theatres, the lack of diagnostic equipment and the lack of trained staff to operate equipment. In view of this the Government of Uganda embarked on the externally funded project "Countrywide Diagnostic Imaging & Surgical Services Rehabilitation". This included capacity building through training of technical and medical personnel.

Key objectives for the GoU were to:

- Rehabilitate and improve existing health facilities
- Increase access of households to healthcare from 49% to 100% in 2005
- Provide appropriate medical equipment for healthcare
- Provide a substantial maintenance program

### 3.5.3 Project objectives

The project aimed at improving the quality of Ugandan healthcare services. It was expected that rehabilitation and placement of diagnostic equipment and operating theatres in a geographically more widespread area would establish this. Purpose of the enlarged coverage of medical services was to improve the access for rural people to healthcare. Furthermore the introduction of equipment was aiming at improving the quality and quantity of necessary medical technical staff through training. In addition the project was expected to contribute to the expansion of medical services available at the lower levels (HC-IV)<sup>13</sup>.

### 3.5.4 Project impact

The project was expected to have a direct impact on the provision of medical services for the benefitting facilities. Equipping and staffing these hospitals would result in higher coverage and quality of medical services. The provision of medical equipment and medical and technical staff would result in improved access to diagnostic services, x-ray services and surgical services. It was assumed that the number of consultations and treatments would rise according to the increased number of staff and equipment.

The improved access to these medical services was expected to lead to more accurate and earlier diagnosis, thereby enlarging the efficiency and effectiveness of medical treatment. The ultimate, long-term impact of the project would be a reduced burden of disease in Uganda.

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<sup>10</sup> [http://www.oret.nl/docs/ORET\\_program\\_october\\_2006\\_englishv2.pdf](http://www.oret.nl/docs/ORET_program_october_2006_englishv2.pdf)

<sup>11</sup> All information in this chapter about the project is retrieved from the ORET 01/44 draft report, written by the applicant in 2002 for the Ministry of Foreign Affairs Directorate-General for International Cooperation (DGIS)

<sup>12</sup> Health Sector Strategic Plan I 2001/2004, Uganda

<sup>13</sup> The total project budget was around 11 million euro's, of which the budget for equipment and transport was around 6 million, for installations and maintenance training around 2,5 million and for staff training the budget was around 0,7 million

### 3.5.5 Author's presence during the project

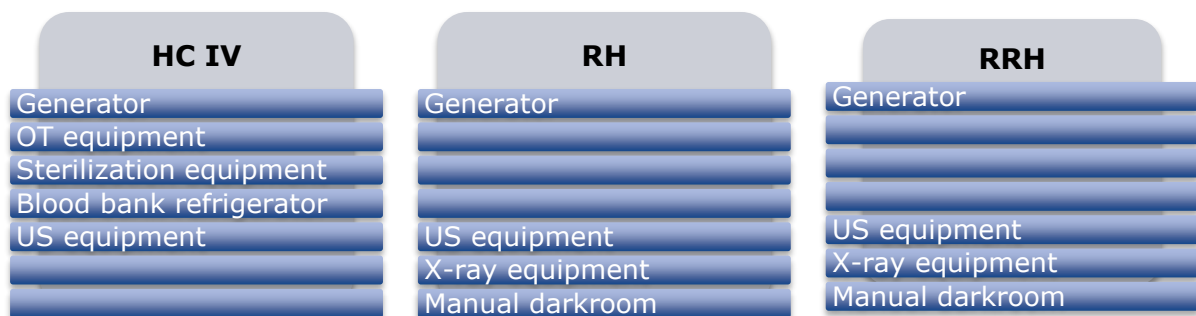
In 2004 I was working at Fontys University as International Project Manager and I was involved in this project as Manager of the TA (Technical Assistance). My responsibility was to manage ultrasound- and x-ray training activities, report on project progress to the MoH and the implementing Dutch company, be present at progress meetings and finally (because my professional background is in ultrasound), I was responsible for the ultrasound training part together with ECUREI. For ultrasound the set-up of the training was in a Train-the-Trainer model: 12 local sonographers and radiologists were selected to teach the various modules and develop teaching materials. Didactical skills and in-depth knowledge on ultrasound was part of their teacher training.

Since I have a degree in Medical Education, I conducted the Train the Trainers course myself. Radiologist Professor Kawooya, head of ECUREI, had been teaching ultrasound in Uganda. Together with him I developed the curriculum for the 6 modules of 2 weeks each that were to be taught under the project. We implemented the ultrasound training and developed a local team capable of teaching the six modules. The first year of the project I was present during all six modules for supervision and co-teaching, the second year during only three of the six modules and the 3<sup>rd</sup> and 4<sup>th</sup> year only 1 week during 2 of the six modules. This gave me the opportunity to travel to Uganda often, build a strong relationship with the professor and the local team, interact with participants and witness project progress in relation to training.

### 3.6 Project implementation

The implementation of the project started in 2004 and was done by a Dutch company that has extensive experience in turnkey health care projects. The project ended in 2008. After a needs assessment carried out by the MoH in 1999, the most needy facilities were identified: lack of any equipment, remoteness from the next service delivery point and the level of service that should be provided (interview MoH). The project targeted 52 health facilities in northwest, west, central, southwest and southeast Uganda, selected by the MoH. Benefitting facilities under this project were 30 Health Centres IV, 18 Regional hospitals and 4 Regional Referral hospitals. The 30 HC IV-s received Operating Theatre equipment, sterilization equipment and a blood bank refrigerator. All 52 facilities received ultrasound equipment and the 18 General hospitals and 4 Regional Referral hospitals received X-ray equipment and a manual darkroom processor as well. Besides equipment a generator was installed at the facilities that were not on the national grid (15 KVA at HC IV-s, 20 KVA at the GH-s, and 60 KVA at RRH-s). Facilities that lacked the proper infrastructure to place equipment, received some rehabilitation works as well.

In sum:



*Project equipment specifications*  
Source: author

### 3.6.1 Training program ultrasound

Because the project introduced ultrasound equipment nationwide at a large scale, an extensive ultrasound-training program for 104 health professionals (2 per facility) working at the health facilities under the project was implemented. Many health professionals had not been exposed to ultrasound before, so the training program consisted of 6 modules of 2 weeks to be taught over a period of 1 year. ECUREI (Ernest Cook Research and Education Institute), a local Non Governmental Organization (NGO), based in Kampala, was chosen as the partner to carry out the training together with Fontys University based in the Netherlands (Fontys was subcontracted by the implementing Dutch company, which did the overall management of the project). ECUREI was founded in 2002. The institute was at that time inadequately equipped, and received strengthening in the form of 3 ultrasound machines and teaching materials (LCD's, computers, small library). It was envisioned that ECUREI should become a key source for ultrasound education in the whole of east Africa.

### 3.6.2 Training program x-ray

For x-ray the training was not as extensive as for ultrasound; only 4 short courses of 2,5 day were scheduled for 22 radiographers working at the facilities that received x-ray equipment. The feasibility study that was done before the project revealed that radiography equipment was not new in Uganda, and that the level of college-trained radiographers was rather satisfactory.

### 3.6.3 Training program maintenance

Regarding maintenance training the project was aiming at training local technical staff in such a way that a gradual take over of the maintenance of equipment by the MoH would be possible at the end of the project. In that regard a total of 10 regional workshop engineers were trained in a 2-weeks course. Diagnostic equipment engineers (2) were trained at Philips Medical Systems in the Netherlands during 5 weeks and finally the 2 project managers at the MoH were trained in an equipment management course of 2 weeks during the first year of the project.

### 3.6.4 Summary of project specifications

In sum the ORET project in Uganda consisted of the following components:

- Installation of ultrasound equipment in all 52 facilities
- Installation of x-ray equipment in 22 facilities
- Rehabilitation of some facilities
- Operating Theatres for the 30 HC-IVs
- Sterilization equipment for the 30 HC-IVs
- Blood bank refrigerator for the 30 HC-IV-s
- Generator for facilities that were not on the national grid
- An ultrasound training program for 104 health professionals
- Train the Trainer program for 12 local ultrasound trainers
- Short courses for 22 radiographers
- Maintenance training program for 14 technical professionals
- Equipment maintenance for 7 years (4 years under the project, 3 years after the project)

## Chapter 4; Defining sustainability

This chapter first provides a definition of sustainability. Since sustainability is a complex concept, five underlying concepts are comprehensively discussed, followed by a description of how these five dimensions were operationalized in the project.

### 4.1 Defining sustainability in healthcare

Sustainability is the Holy Grail in most health intervention projects. However, the large variety of literature shows little consensus on how to define sustainability. One of the reasons is that sustainability covers a wide range of dimensions. Sustainability is used to describe institutions, communities, environments, policies and so on. All these different dimensions need different definitions of sustainability. The definition most often used to describe the broadest sense of sustainability is the definition used in the report "our common future" of the World Commission on Environment and Development, chaired by Gro Harlem Brundtland, also known as the Brundtland report:

*"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs"*

(WCED, 1987)

Literature on how to define sustainability in healthcare is much more uniform. Although still a wide variety of definitions were found, they all seem to include the aspect of maintaining project activities after the project ended (Pluye, Potvin & Denis, 2004; Shediak-Rizkallah & Bone, 1998; Bossert, 1990; European Commission, 2006; UNDP, 2000). Let us look a bit closer to what "maintaining project activities" and "after the project ended" exactly means. According to Shediak-Rizkallah & Bone (1998), Cassidy, Levinton & Hunter (2006) and the European Commission (2006), maintaining project activities is *maintaining those activities that were most successful in achieving the project objectives*. It seems that it is not always necessary or desirable that the project as a whole is sustained to achieve the objectives. Certain elements may appear less successful due to several reasons, e.g. flaws in project design, contextual changes, lack of sufficient resources or demand (Shediak-Rizkallah & Bone, 1998).

The second aspect that needs attention is the sentence *after the project ended*. What is meant with this phrase is the withdrawal of external support and funding. When a project is developed and implemented, there is often an international donor responsible for the financial viability of the project and an implementing organisation (international or locally) for the actual project implementation. When the official project period ends, the donor and the implementing organisation will withdraw and it becomes the responsibility of the local government to continue the activities (Bossert, 1990; European Commission, 2006).

For this thesis I adopted an operational definition of sustainability, i.e. *"continuation of program activities when financial, organizational, and technical support of external donors/organizations has ceased"* (Swiss Development Cooperation, 1991).

While project sustainability may not be that difficult to define, achieving project sustainability is far from easy. That is where the real complexity and challenge begins.

#### 4.1.1 Sustainability dimensions

Evaluating sustainability is a complex challenge. It is therefore important to first analyze the underlying dimensions of sustainability. Most of the general frameworks to analyze sustainability consist of 3 components: economic, social and environmental sustainability (IDA, 2009; IFC, 2006; GRI, 2011; Jacob, 1994; Dyllick & Hockerts, 2002). Traditionally, interventions mainly focused on financial viability only. Without sufficient funds, interventions will eventually collapse and thus not be sustainable. The introduction of *sustainable development* (UNCSD, 2007) brought the addition of the social and environmental dimensions. The social dimension focuses on the people influenced by a certain intervention (e.g. employees and consumers). The environmental dimension was added to ensure that natural resources are preserved for future generations. Various institutions and studies have underlined the importance of a fourth dimension: institutional sustainability (UNCSD, 2007; Spannenberg & Bonniot, 1998). Originally this fourth dimension was introduced by the United Nations Center for Sustainable Development (UNCSD, 2007) who realized that a wide range of institutions play a role in sustainable development, and the UNCSD realized that their capacity largely determines a sustainable outcome of projects.

When looking at *project* sustainability, a fifth dimension should be added: technical sustainability (Pluye, Potvin & Denis, 2004; Shediak-Rizkallah & Bone, 1998; IFAD 2009; Bossert, 1990; UNDP, 2000; Ramirez, Oetjen & Malvey, 2011). The technical dimension focuses on continued supply of necessary materials, maintenance of equipment and training.

In sum, the literature on project sustainability reveals 5 dimensions of sustainability:

1. Economic
2. Social
3. Environmental
4. Institutional
5. Technical

The next section describes how the five dimensions of sustainability were operationalized in this project.

## 4.2 Sustainability in ORET

Four of the five dimensions of sustainability are mentioned in the ORET guidelines. Institutional sustainability is lacking, but this dimension was added in the report for the Ministry of Foreign affairs Directorate General of International Cooperation, written by the applicant in May 2002 to justify the Uganda project (ORET 01/44, 2002). The following sections explain how the project was designed in order to achieve sustainability in the five dimensions.

#### 4.4.1 Economic sustainability

Economic or financial sustainability concerns the financial viability of a project. The recurrent costs of project activities need to be covered by either the user or the donor. After the project ends these costs need to be taken over by other financial support or cost recovery mechanisms, but these are highly dependent on local available financial resources (Bossert, 1990; European Commission 2006; Swerisson, 2007).

In this project<sup>14</sup> both the MoH and the Ministry of Finance (MoF) expressed their support for the project. In Uganda, healthcare is free of charge, so no direct financial revenues were generated by the project. Hence there were some doubts about the affordability of the project for the GoU. Recurrent costs seemed to be less demanding, but additional recurrent costs (wages, consumables, spare parts) could make the project's impact on the budgetary resources of the MoH substantial. It was concluded that because of this a more detailed analysis of recurrent costs were needed to improve the forecast. This was considered crucial for the MoH to weigh the impact of this project against other investments (ORET, 2002).

#### 4.4.2 Social sustainability

Social sustainability encompasses human rights, labour rights and corporate governance. Together with environmental sustainability, social sustainability is the idea that future generations should have the same or greater access to social resources as the current generation (European Commission, 2006; UNDP, 1997; IFAD, 2009). It includes ideas from "other cultures" to "basic human rights". Sustainable *Human Development* is a dimension added by Anand and Sen (1996). According to them it promotes the capabilities of present people without compromising the capabilities of future generations. It aims at achieving better standards of living.

This project was expected to have a positive impact on poverty alleviation in Uganda. Also the project was thought to be beneficial to pregnant women. The provision of basic surgery and ultrasound scans was expected to contribute to mother and child programs. Because a considerable number of staff was to be trained, the project was expected to make a contribution to human resources development in Uganda. Lastly the project was expected to have a positive effect on employment if funds would be available to pay the salaries, and qualified people could be attracted (ORET, 2002).

#### 4.4.3 Environmental sustainability

Environmental sustainability regards the impact a project has on the environment, both positive and negative (UNDP, 2000). Two aspects are important: the usage of natural resources and the management of emission, waste and effluent (project's outputs) (IFAD, 2009; UNCSD, 2007; GRI 2011; Spangenberg & Bonniot 1998). Natural resources usage refers to the extent and manner the project makes use of natural resources like land, water, minerals and energy. If projects deplete natural resources this may cause severe drawbacks for future generations to meet their needs (IFAD, 2009).

For this project the main impact on the environment was related to radiation and clinical waste. Hazardous emission of radiation or waste can affect public health and the environment (UNCSD, 2007). They need to be disposed safely to minimize harmful consequences. The possible harmful effects of ionising radiation of the x-ray equipment were tackled by provision of protection for staff, patients and members of the public (e.g. lead walls, lead aprons). Production of clinical waste (chemicals used in darkrooms) could be of potential risk to the public or environment. Appropriate disposal procedures were formulated in a policy document (ORET, 2002).

#### 4.4.4 Institutional sustainability

Institutional sustainability concerns the processes within and between the organizations involved in the project. It concerns the strength of the implementing organization (Bossert, 1990; Shediak-Rizkallah & Bone, 1998) and the extent to which activities are routinized within existing structures (Pluye, Potvin & Denis, 2004; Bossert, 1990; Yin, 1981). The

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<sup>14</sup> Information in this chapter about the project is retrieved from the ORET 01/44 draft report, written by the applicant in 2002 for the Ministry of Foreign Affairs Directorate-General for International Cooperation (DGIS), referred to as "ORET 2002"



strength of the implementing organization depends largely on the organization's economic, human and material resources (Shediac-Rizkallah & Bone, 1998). Integration of managing project activities into existing structures is another important determinant. Both aspects add to the institutional capacity to achieve the project objectives (Bossert, 1990; Shediac-Rizkallah & Bone, 1998).

In this project the implementing organizations were considered to be the management of the facilities under guidance of the MoH. During the development phase of the project hardly any information was available on the number of qualified people in the facilities or on the management of these facilities. The availability of qualified personnel and the competence and motivation of the management of the facilities were seen as important determinants to the successful implementation of the project. This could consequently undermine the efforts of the supplier and the MoH to maintain a good operating project. Taking the impact on management at the respective facilities in account, it was recommended to gather more information on this aspect before the start of the project (ORET, 2002).

#### 4.4.5 Technical sustainability

The fifth dimension is technical sustainability. It concerns the provision of materials, maintenance of the equipment, and capacity of staff (IFAD, 2009; CPHA, 1990). A "strong" project needs to be equipped with the necessary materials to achieve its objectives. Also it is important that spare parts are made available (IFAD, 2009). Especially in resource poor settings it may be difficult to purchase needed materials at a later stage, as local institutions are often not capable of bearing the high costs of spare parts or consumables (Bossert, 1990). The second concern is the maintenance of equipment that was delivered under a project. In resource poor settings the budget to pay for repair and service is not always available. In this regard long-term contracts for maintenance will favour the continuation of equipment use, and thus of project activities (Pluye, Potvin & Denis, 2004). The final aspect of technical sustainability is training. Research has learned that projects where training is included are more likely to be sustained than project where no training was done (Pluye, Potvin & Denis, 2004; Shediac-Rizkallah & Bone, 1998; Bossert, 1990).

In this project the equipment maintenance was addressed in the short-term and long-term. This was considered an important part of the project, given the poor state of the health service infrastructure in Uganda. The supplier provided maintenance for 4 years, during which a transfer of maintenance skills and maintenance management to the local health service staff was intended to take place. Tool kits were also provided and. After these 4 years the MoH was expected to be responsible for providing funds for maintenance.

To *manage* the maintenance part of the project under study, efforts were done to train Regional Workshop Engineers, Diagnostic Imaging Engineers, and project managers at the MoH in equipment management (see also 3.6.3). In the set-up of the project it was foreseen that the *management* of all maintenance would be gradually transferred to the MoH. This was done by giving the responsibility for some systems to the MoH under the supervision of the supplier and to pilot the responsibility of the MoH for corrective maintenance call handling under supervision of the supplier (ORET, 2002).

Training of staff on how to apply ultrasound in diagnosing pregnancy conditions was done in an extensive training program. See section 3.6.1 and 3.6.2.

#### 4.4.6 The research

The research focuses on evaluating the *technical sustainability* of the project: supply of materials, maintenance of delivered equipment and training.

## Chapter 5; Methodology

This chapter provides the theoretical framework on which the research is based. In searching for an appropriate evaluation strategy, the criteria developed by the Development Assistance Committee (DAC, Paris 1991) were considered. These criteria are: relevance, effectiveness, efficiency, impact and sustainability. Further reading revealed another interesting evaluation strategy: *theory based evaluation*. According to the author a "Theory Based Evaluation" (TBE) approach provides an evaluation strategy that corresponds to the intended goals of the research. Using a TBE approach necessitated the reconstruction of a Theory of Change (ToC) for the total project as well as a ToC for technical sustainability.

### 5.1 Theory Based Evaluation

First a brief word on what TBE is. According to Carol Weiss, the root idea of TBE is that the beliefs and assumptions underlying an intervention or project can be expressed in terms of a phased sequence of causes and effects, that is the "program theory" (Weiss, 1997). It is an approach to evaluation that requires surfacing the assumptions on which a project is based *in advance* and in considerable detail: what activities have been conducted, what effect did each particular activity have, what did the project do next and what were the expected outcomes (Weiss & and Birckmayer, 2000).

The word *theory* is described in dictionaries as "a set of beliefs or assumptions that underlie action"; this definition is what is meant by Weiss when she first published about TBE (Weiss, 1972). Projects are inevitably based on a theory - in fact often on several theories - about how activities are expected to bring about desired changes (Weiss, 1997). Theories do not have to be right, and they do not have to be uniformly accepted. They are the hypotheses on which people, consciously or unconsciously; build their project plans and actions (Weiss, 1997).

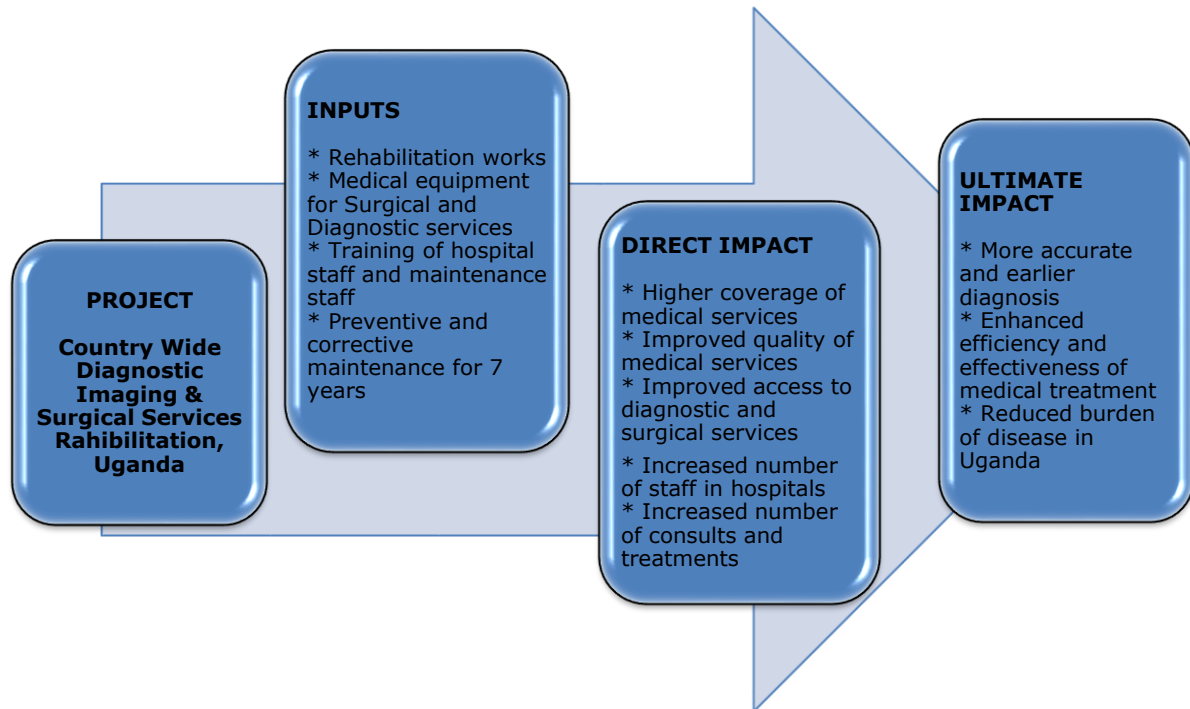
Weiss explains TBE, using the prototypical program theory in educational programs as an example: Knowledge → Attitude → Practice. A program increases *knowledge* (say, of nutrition); more knowledge leads to changed *attitudes* (regarding diet), and changed attitudes lead to changed *practice* (eating more healthy food). Many programs are based on these assumptions.

A TBE aims to describe the actual mechanisms that are related to good outcomes. The relation between these mechanisms and the good outcome may be complex. For instance, if contraceptive counselling is associated with a reduction in pregnancies, it seems clear that the counselling is the mechanism. But in fact, the mechanism might be the knowledge that the counselling provides. But it could also be that knowledge might not be the operative mechanism. It might be the overcoming of cultural taboos or a shift in power relations between men and women. Often the linkage between project activities and outcomes is not at all clear. What makes TBE distinct from routine evaluations is that it seeks to specify the mechanisms by which change is achieved, not just the activities or characteristics that are associated with change (Weiss, 1997).

### 5.1.1 Reconstructing a Theory of Change for the total project

The project under study did not have an explicit ToC, so it was necessary to first reconstruct a ToC. The project aimed at improving the efficiency and effectiveness of Ugandan healthcare services through rehabilitation of facilities, the placement of diagnostic equipment and operating theatres, training of staff and a maintenance package. The final aim was to reduce the burden of disease in Uganda.

The reconstructed ToC for this project can be visualized as follows:



*Theory of Change for total project*  
Source: author

So, for this project the underpinning theory is that: the provision of diagnostic and surgical equipment (together with training and maintenance) → would lead to a higher coverage of medical services → to an increased number of treatments → to enhanced efficiency and effectiveness of healthcare, and finally → to a reduced burden of disease in Uganda.

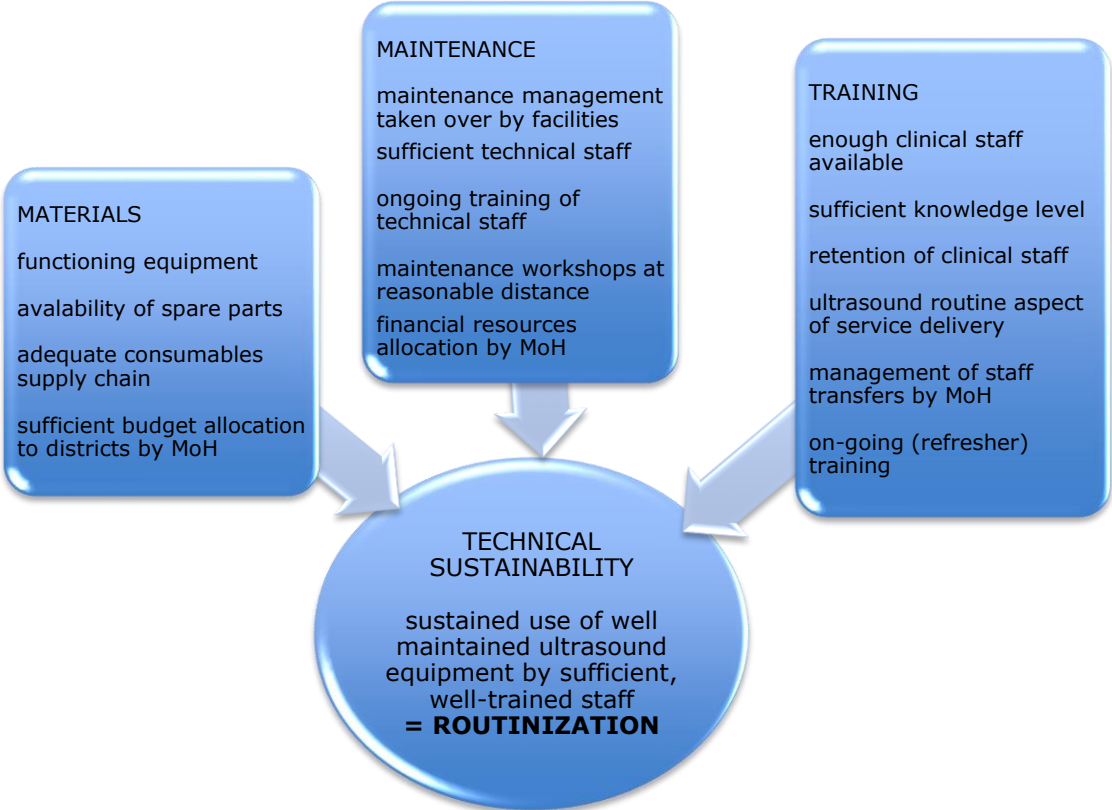
However, this ToC is for the project as a whole, and it does not directly focus on sustainability issues, therefore in the next section a ToC for sustainability is reconstructed.

### 5.1.2 Reconstructing a ToC for Technical Sustainability

The aim of this research is to evaluate the *sustainability* of the project under study. Given

the time and resources available for the field research it was not possible to study all 5 dimensions of sustainability, and therefore the evaluation is only looking at *technical sustainability*. Also, with large-scale introduction of ultrasound equipment, accompanied by extensive training being a key component of the project, the research was limited to look at continued use of the ultrasound equipment and continuation of training.

Technical sustainability concerns materials, maintenance and training (see also 4.4.5).



*Theory of Change for Technical Sustainability*  
Source: author

The hypothesis to be evaluated here is that if proof can be found of sustained use of equipment, a sustained maintenance structure and sustained training, this would mean that technical sustainability is achieved, ultimately contributing to *routinization*, a stable and regular service delivery at the level as initiated under the project (Pluye, Potvin & Denis, 2004; Bossert, 1990; Yin, 1981).

### 5.1.3 Objectives for the research

The specific objectives, as mentioned earlier, are:

1. To explore if and to what extent provision of MATERIALS is sustained
2. To explore if and to what extent MAINTENANCE of imaging services is sustained
3. To explore if and to what extent TRAINING is sustained

To answer the specific objectives a field-based study in Uganda was implemented. The study took place during 3 weeks in November 2012 by the author, with the assistance of 2 research assistants.

## 5.2 Overall research design

The research activities took place in the health facilities that had been targeted by the project. In this sample semi-structured questionnaires were administered. In some of the facilities additional information was collected through interviews. In the latter facilities the status of the equipment was also observed. In addition a number of in-depth interviews were conducted with key stakeholders in the project: MoH, ECUREI and the implementing company.

## 5.3 Site, setting and study population

The study sites were the *health facilities* in Uganda that received equipment under the project between 2005 and 2008. At the facilities *staff* was interviewed or received a questionnaire. In addition, *staff of ECUREI* was interviewed to evaluate ECUREI's training capacity. Information was also collected from the *Ministry of Health clinical services directorate*, since this unit was responsible for the project, and finally the *local management of the implementing company* was interviewed.

### 5.3.1 Sampling of health facilities

The initial aim was to include all 52 facilities in the study that had received ultrasound equipment. However, only 30 facilities could finally be included. We had to exclude 2 facilities that were high up in the Ruwenzori Mountains (travel would take too much time), and 8 facilities due to an outbreak of the Marburg virus in west and southwest Uganda, during the time of the research. All the remaining 42 facilities were included to receive questionnaires. Thirty-two facilities were to receive paper-based questionnaires, to be delivered by a research assistant. Ten facilities were to be visited to collect information through staff interviews. Unfortunately travel by the research assistant took longer than anticipated, and he could only visit 22 of the 32 facilities. In 2 of these facilities staff refused to fill out the questionnaires, because they said to be unsatisfied with the fact that no maintenance had been done for some time.

Therefore, the final sample consisted of 30 facilities out of 52 (62%). From 20 facilities information was obtained through a paper-based questionnaire and additional information was obtained from 10 other facilities through interviews. An overview of all health facilities under the project can be found in appendix 1.

### 5.3.2 Sampling of staff at facilities

Sampling of staff within the selected health facilities to be included in the research was done through *purposive sampling*. The aim was to include health staff, hospital management staff and maintenance engineers that perform preventive maintenance to imaging equipment. A training record at ECUREI was used to identify the staff that had been trained in ultrasound and to contact them (appendix 2). Permission to do interviews

or questionnaires was sought from the management or in-charge of each facility; an official letter introducing the research was used when necessary (appendix 3).

### 5.3.3 Sampling of ECUREI staff

Four staff members of ECUREI out of the 15 staff members (12 trainers and 3 administrative staff) involved in the project were randomly selected to be interviewed. The sample consisted of 3 trainers and 1 administrative staff member.

## 5.4 Methodology per specific objective

To investigate *materials* the following 3 operational indicators were used to study this:

- Number of distributed ultrasound equipment that is still in use (indicator 1)
- Common reasons *why* equipment is not being used (indicator 2)
- On-going supply of consumables and spare parts (indicator 3)
- Budget allocation for materials (indicator 4)

To investigate *maintenance* the following operational indicators were formulated:

- Number of times equipment broke down per year during the project and after the project ended (indicator 1)
- Maintenance structure after the project ended (indicator 2)
- On-going training of technical staff (indicator 3)
- Budget allocation for maintenance (indicator 4)

To investigate *training* the following 6 operational indicators were used to study this:

- Number of ORET trained staff that is still using the equipment in the facility (indicator 1)
- Number of non-ORET trained staff that is using the equipment (indicator 2)
- Reasons *why* staff is still present at the facilities (indicator 3)
- Number of ultrasound exams per year (after installation of the equipment) during the project and after the project ended (indicator 4)
- Common indications for ultrasound examinations (indicator 4)
- Training activities at ECUREI in 2012 (indicator 6)

### 5.4.1 Data collection

To collect the data in a sample as large as possible, two complementary approaches were used. Twenty of the health facilities received 3 questionnaires<sup>15</sup> to be completed by 3 staff members per facility: 1 hospital administration (or management) staff member, 1 staff member using ORET ultrasound equipment and 1 maintenance staff (60 questionnaires in total). In ten other facilities the same information was obtained using interviews by asking the same questions to the same type of staff (30 interviews in total). The questionnaires A (for hospital administration staff) and B (for staff using ORET equipment or maintenance staff) are reproduced in appendices 4 and 5.

The investigation into the "mechanisms why" was done through the interviews with staff at the HFs by asking for clarifications and probing. The interviews focused on the *reasons why* staff is still working at the facilities and on the *reasons why equipment is still in use or why not*. The aim was to interview 3 staff members per facility: 1 hospital administration staff, 1 staff using ORET equipment and 1 maintenance staff. The interview guide for these

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<sup>15</sup> The questionnaires were delivered to the health facilities by a research assistant, who would wait for them to be completed by staff before taking them back again

interviews is reproduced in appendix 6. Furthermore direct observations on the status of equipment in these facilities were done.

To study the sustained training capacity, interviews at ECUREI were held. The interview guide that was used during the research is reproduced in appendix 8.

To collect data about the supportive activities of the MoH regarding the project an interview with the project manager was held. This interview guide is reproduced in appendix 7.

Finally an interview with the local implementing company was done to collect data on their opinion on the implementation process and thereafter (appendix 9).

## **5.5 Governance**

The research proposal was submitted to the Research Ethical Committee (REC) at KIT/ VU, where ethical approval was granted. The proposal was also submitted to the Mengo Hospital Research Review Committee (MHRRC) in Kampala, where it was approved.

## **5.6 Data analysis**

At 20 facilities a paper-based questionnaire survey was done. Staff that filled out the questionnaires were medical doctors, radiographers, midwives and administration staff. The response rate was 65% (n= 39). The questionnaires were taken back to Kampala to be analysed.

The response rate for the questionnaire survey done via interviews was 60% (n= 18). The designations of staff interviewed at the 10 facilities were radiographers, nurses, midwives, medical doctors and administration staff. They all had been involved in the project, either in undergoing training or in management of the facility during or after the project. To avoid researcher bias the interviews were done by my assistant if the respondent knew me, otherwise the interviews were done by me. Interviews were conducted at participant's own office or at a convenient location in the hospital. Written consent was taken from each respondent before the interviews were done. The interviews were electronically recorded. The contact list of staff that had been trained at ECUREI between 2005 and 2008 was used to announce our coming.

Compilation of data collected through the questionnaires was done using excel master sheets. The questionnaires consisted of 5 sections; these sections formed the base for the master sheets. The occurrence of the described indicators was counted and percentages were calculated. Remarks in the section for additional comments were noted.

Transcripts of the interviews were written each day after the interviews were held. This was reviewed and checked for consistency, summarized, coded and tabulated. The themes for coding were based on the indicators formulated per specific objective. After coding the data was entered in excel master sheets. The 5 sections from the questionnaires formed the base for the master sheet used for the interviews.

The interviews with ECUREI staff (n=4), the project management at the ministry of health (n=1) and the company project management (n=1) were conducted at their respective offices. Written consent was taken and the interviews were electronically recorded.

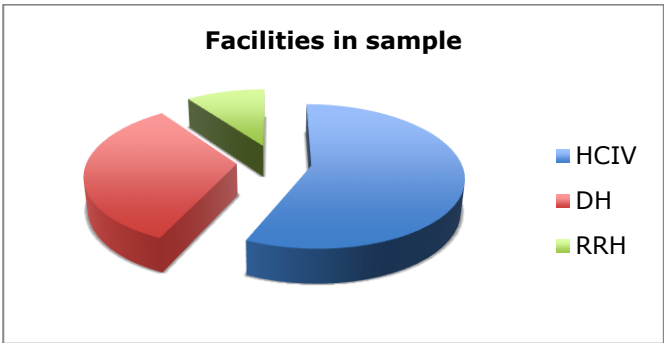
# Chapter 6; Findings

This chapter presents the findings of the research. The findings are presented per specific objective, describing *if* and *why* aspects were sustained. In chapter 7 the interpretation of these findings will be discussed.

## 6.1 Sample characteristics

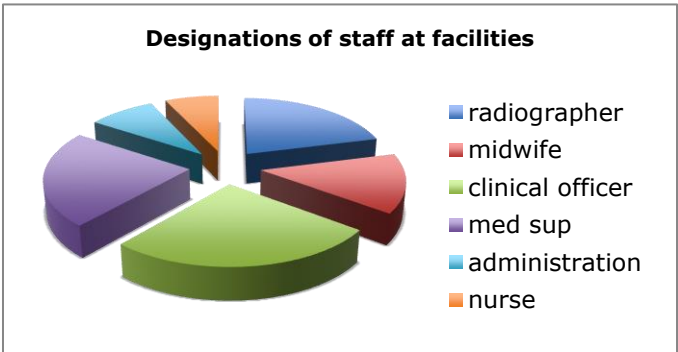
The sample (n= 30) consisted of 17 HC-IVs (56%), 10 District hospitals (33%) and 3 Regional Referral hospitals (10%). Table 1 shows the proportion of facilities in the sample. The majority of facilities were HC-IVs, followed by DHs; this is in line with the proportion of benefitting facilities under the project (30 HC-IVs and 18 DHs out of the total of 52).

**Table 1 Proportion of facilities in sample**



The designations of staff members in these facilities that were interviewed or filled out a questionnaire are listed in table 2.

**Table 2 Designations of staff that was interviewed or filled out questionnaires**



Clinical officers (26%), medical superintendents (23%) and radiographers (21%) were most represented in the sample. Midwives (14%), hospital administration (9 %) and nurses (7%) were less present in the sample. In none of the facilities a person responsible for maintenance was found, therefore this category is absent in the sample.



**6.2 Evaluation of sustained MATERIALS**

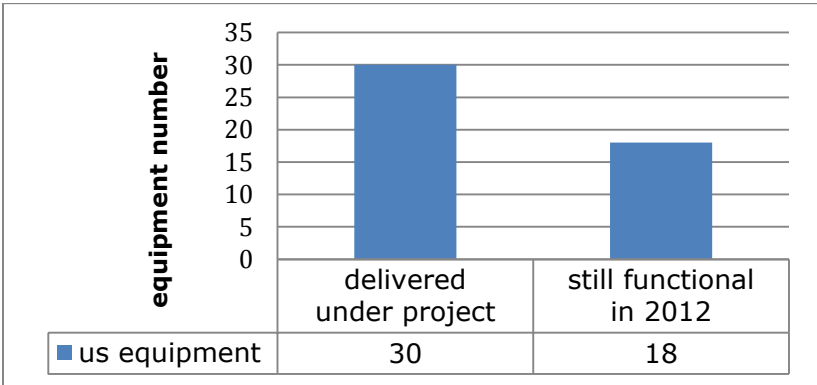
To evaluate whether materials were sustained, 4 operational indicators were formulated:

- Number of distributed ultrasound equipment that is still in use (indicator 1)
- Common reasons for equipment not being used (indicator 2)
- On-going supply of consumables (indicator 3)
- Budget allocation for materials (indicator 4)

**6.2.1 Equipment distributed and still in use**

For the outcome of this assessment the findings of the status of ultrasound equipment as seen during the research is used. Under the project all 52 facilities received ultrasound equipment, so we found ultrasound equipment in all 30 facilities of the sample. Of the 30 present ultrasound machines, only 18 were found operational (e.g. functioning without any or minor technical problems).

**Table 3 Equipment functioning in 2012**

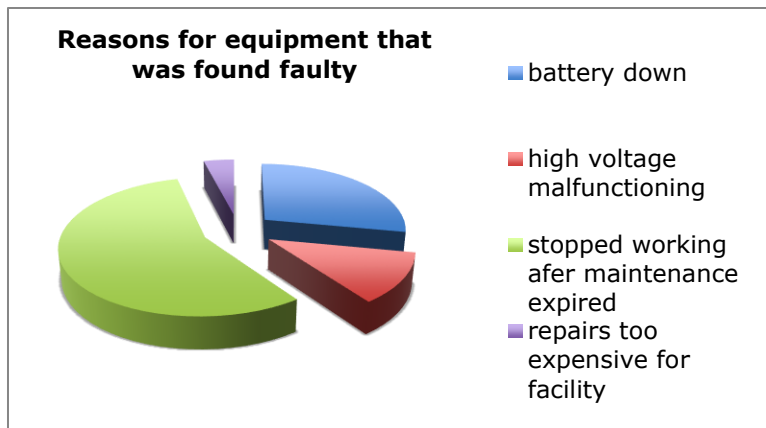


**6.2.2 Reasons for equipment not being used**

Participants indicated that all equipment worked well during the project due to *good maintenance and replacements of transducers, spare parts, or even the complete machine* when needed. Respondents indicated that no maintenance was done since 1,5 years and that this was the main reason that equipment went faulty or had major breakdowns.

The research found that reasons for equipment being faulty were: no maintenance done (56%), battery down (28%), high voltage malfunctioning (12%), and repairs too expensive for facility (4%).

**Table 4 Main reasons equipment failure**



### 6.3.3 Supply chain of consumables

However, not only working equipment, but also adequate resources (consumables like gel and sonopaper) are required to be able to perform scans. Absence of consumables was mentioned in 11 facilities (36%) and lack of power in 13 (43%) as the main reasons for equipment not being used. Main reason was that the medical stores do not always have a sufficient stock of consumables available, according to the respondents.

Hampering resources supply and equipment failure can be seen as *direct reasons* for equipment not being used.

### 6.2.4 Budget allocation for materials

The interviewee at the MOH stated that financial support to the facilities is done via the districts. The districts are autonomous in allocating funds to the facilities. Budget allocation to the districts has increased, according to him. Health care is free of charge in Uganda, so facilities cannot rely on user fees for their running costs. From the project the MoH has learned that new supplies to the Medical Stores were needed (ultrasound gel, sonopaper, films, chemicals etc.). According to the interviewee this is currently in the strategic vision of the MoH.

#### **Box 1. Coping mechanisms of staff**

In facilities where we found equipment in use, not all equipment worked properly, but staff was using it and coping with the challenges.

*Nurse at RRH:*

*"The machine switches itself on and off all the time, so now we use it every other day and hope it will last for a few more months, until the District Health Officer (DHO) gives us a new machine"*

*Radiographer at DH:*

*"It has decreased performance because of the age. This started 2 years back. Immediately after the contract expired, that is the time it started to deteriorate. As long as it had been serviced on, the performance was okay, after expiry of maintenance the performance went down. The probe has an artefact, but still good enough to do the scans"*

A nurse at another DH indicated how the patients suffer due to the breakdown of the ultrasound machine:

*"Patients are suffering so much. Like the other time I got a patient whom they were suspecting to have ectopic pregnancy. I had nothing of assisting her. There is another machine in some private hospital, so they told the patient to go there. Can you imagine with all that pain, and the rough road, so patients are suffering, cause of the breakdown of the machine. And I am feeling so bad about that"*

### **6.3 Evaluation of sustained MAINTENANCE**

To evaluate whether the capacity to maintain imaging services is sustained, the following indicators were used:

- Number of times the equipment broke down per year during the project and after the project ended (indicator 1)
- Maintenance structure after the project ended (indicator 2)
- On-going training of technical staff (indicator 3)
- Budget allocation for maintenance (indicator 4)

#### 6.3.1 Number of times equipment broke down

During the research it appeared that once equipment is broken down, the machines are not used anymore, so to assess the number of times that the equipment broke down after the maintenance contract expired, appeared not to be a useful indicator.

#### 6.3.2 Current maintenance structure

However, information on maintenance *during* the project was collected through the questionnaires and interviews and via the interview with the project manager of the implementing company. Like a car, medical equipment can only work properly when maintenance is done on a regular basis. When well maintained, equipment has a lifespan of 10 years (*interview implementing company*).

During the 4 years of the project, local engineers of the implementing company carried out preventive or corrective maintenance twice a year. The researcher was allowed to study the maintenance records at the offices of the company. The record showed a well-structured maintenance scheme, with records of equipment failures and what was done in each facility.

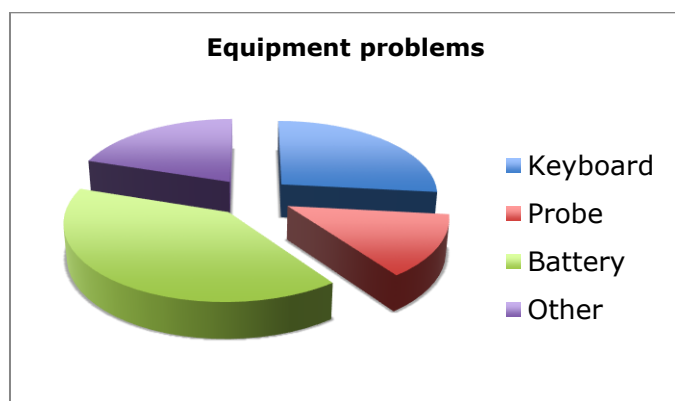
From the questionnaires it was interesting to find that indeed 95% of the participants were very satisfied with the maintenance done during the project, and that they indicated that maintenance in case of repairs almost always resulted in restoring the functionality of the equipment.

This project did have a mechanism in place to include officials from the MoH on maintenance trips and other trips to the field, in order to make them aware of what was needed to manage the maintenance under the project. However, on many occasions ministry people never joined during these trips due to absence of transport or "no time" to make the trip (*interview implementing company*).

After the expiry of the maintenance contract, no new contract has been initiated, and the local maintenance structure is not adequate. This results in a long response time to

equipment problems. Also the number of maintenance engineers is said not to be adequate (*interview implementing company*).

**Table 9 common equipment problems**



**Box 2. Explanation battery problem**

A brief explanation on the “battery” problem: power in Uganda is unstable, and to prevent damage to equipment a UPS (uninterruptable power source) was provided together with the equipment. The UPS acts as back up when the input power source fails. However, the UPS needs to be charged in order to function properly. This was not done systematically, resulting in staff unplugging the UPS, and putting the equipment directly on the grid, leading to equipment damage due to “fluctuating” power (*interview implementing company*).

**6.3.3 On-going training of technical staff**

Training of 14 technical staff was done during the project, but due to “brain drain” (trained staff leaving for jobs with better remuneration) only 3 of these remained (*interview implementing company*). Unfortunately the project did not have a provision for on-going training of technical staff <sup>16</sup>.

**6.3.4 Budget allocation for maintenance**

Equipment replacement and maintenance was an aspect discussed during the interview at the MoH. The respondent said to be aware of the current status of the equipment. Replacements of equipment when broken down are included in the strategic vision, according to him. Budget allocation for maintenance has to be done by the districts, and is not done by he MoH. Unfortunately the researcher did not include interviews with the Health Sub District officers in the methodology, so it was not possible to collect data from the districts about allocation of funds for maintenance. However, from the analysis of the questionnaires, one gets the impression that the budget at facilities earmarked for maintenance was poor.

<sup>16</sup> Note from the author: after finishing this project in 2008, an extension of the project was initiated under ORET funding (called Phase II), apart from equipment delivery in 55 other facilities, an extensive Training Program for technical engineers was established together with Kyambogo University in Kampala. At the time of the research in 2012 the first Batch of 12 technical engineers had graduated in September 2012.

**6.4 Evaluation of sustained TRAINING**

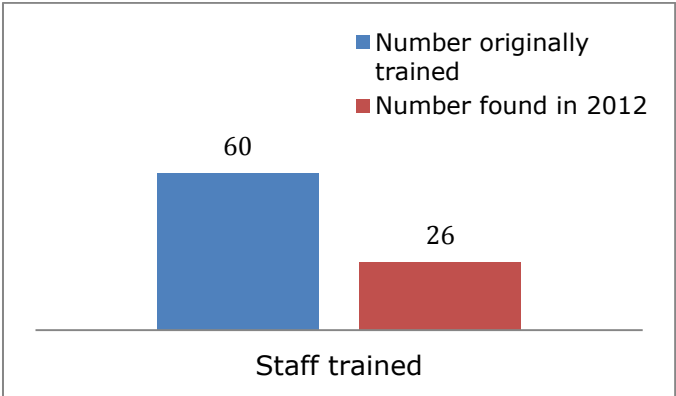
To evaluate if and to what extent the equipment has indeed resulted in sustained use by trained staff the following indicators were used:

- Number of ORET trained staff that is still using the equipment in the facility (indicator 1)
- Number of non-ORET trained staff that is using the equipment (indicator 2)
- Reasons why the staff is still present at the facilities (indicator 3)
- Number of ultrasound exams per year (after installation of the equipment) during the project and after the project ended (indicator 4)
- Common indications for ultrasound examinations during the project and after the project (indicator 5)
- Training activities at ECUREI in 2012 (indicator 6)

**6.4.1 ORET trained staff using equipment**

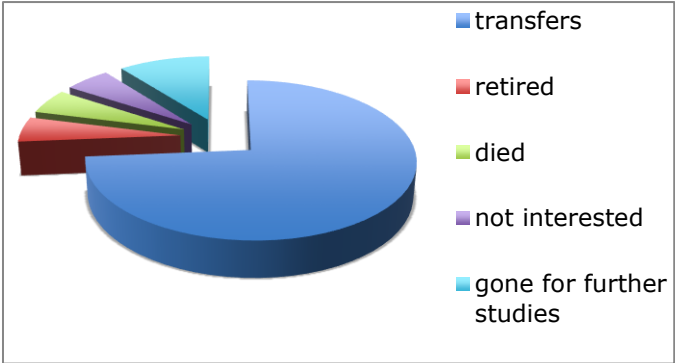
During the project per facility 2 staff members were trained. In all facilities assessed there was staff operating the equipment (that is if the equipment was still functioning properly). Table 5 shows that in the sample of 30 facilities, where it was expected to find 60 ORET trained staff, only 26 were present in the facilities during the research.

**Table 5 Number of trained staff found in facilities**



An interesting finding is that *transfers* (to another facility or *within the same facility*) are the main reason for absence of ORET trained staff (74%). Other reasons found were: retirement (5%), gone for further studies (11%), not interested (5%) and 1 had passed away (5%). It should be noted that transfers were not always done to another facility, in 4 cases (3 doctors and 1 nurse) we found that staff was transferred within the facility; they indicated this was due to a higher need of their skills in another department.

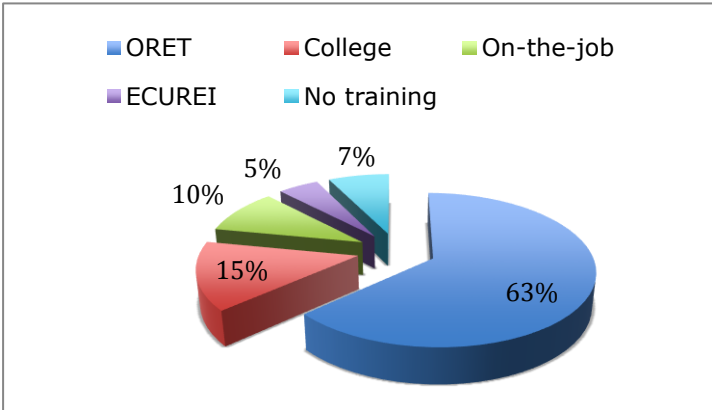
**Table 6 Reasons for absence of ORET trained staff**



6.4.2 Non-ORET trained staff using equipment

Not all staff we found to be using the equipment were trained under ORET, if trained at all. Some staffs were trained in college or others mentioned they were trained "on the job". Only 26 of the expected 60 ORET trained staff were found in the facilities during the research. However, this does not mean that equipment was not used if no ORET trained staff was present. In 6 cases the operator of the machine had been trained in college, 4 mentioned to be trained "on the job", 3 had no training at all and 2 took a course at ECUREI.

**Table 7 training of staff using equipment**



Training was seen of utmost importance and a key factor in their ability to perform reliable scans by 66% of the respondents. Interesting question to ask is if sustained capacity is achieved when people that did not have proper training are using the equipment. What about possible misdiagnosis? Unfortunately the research has not investigated that aspect.

During the interview at the MoH, the deployment policy of the MoH was one of the issues discussed. From the ORET program the MoH learned that staff should not be transferred after training. So they instructed the districts to implement that policy. However, during the ORET project this policy was not yet implemented.

### 6.4.3 Why staff is still present at the facilities

The majority of staff indicated that the government based them there. Reasons like better remuneration, housing options or exposure to further studies was mentioned by 3 participants only. Interesting finding was that 90% of the respondents answered that they were happy with the equipment because it enhanced their diagnostic capacity. Higher motivation due to the delivered equipment was mentioned by 70%.

#### **Box 3. Staff confidence**

*Nurse at HC-IV:*

*"In the past we used to manage patients clinically, so someone could come with an acute abdomen, they just go for an operation. But now, if there is a patient with acute abdomen, we have to scan first and be sure of what is taking place, if it needs surgery, then they go in it, if it does not need surgery they treat clinically. But then you are sure there is no problem. And I am so happy, actually I have been diagnosing perforated uteruses, yeah I am so very happy"*

#### *Motivation*

The ORET intervention required a relatively high level of skills to produce the intended service delivery with respect to ultrasound. During the project, staffs were trained and had the opportunity to consult their peers or teachers when they were exposed to difficult cases. By using interviews this research tried to investigate how staffs cope with difficult cases 4 years after the project ended, and how they view their current skills. An interesting finding was that all staffs that had expressed that their motivation has increased due to the equipment usage, mentioned that they take measures to keep their skills "up to date" like: reading text books, searching the internet, consulting peers by phone, asking for feedback from the clinician after theatre to confirm the diagnosis.

#### **Box 4. Staff motivation**

*Midwife at DH:*

*"Whenever I get a challenge like on a patient, then I must go and look for that condition to know exactly. I read about it. Sometimes I even consult my fellow students, the ones I completed with. I sometimes give them calls and ask if this was like this what do you think is this... then they tell me"*

*Nurse at HC-IV:*

*"I got enough experience to diagnose even complicated cases. I got that just from here. Rubbing the books and treating on the patients. Yeah, I have some textbooks. So whenever I could diagnose a case, I would follow up in theatre. I look at the case and they even give me a report, then I conform what I saw is right!"*

Staffs that seemed to be less motivated or not ORET trained, did not take any measures to keep their skills "up to date", they mainly expressed the need for more training. The latter suggests that intrinsic motivation is enhanced by proper training, and that this then leads to confidence in equipment use and diagnostic capacity.

#### *Mentoring*

During the interviews, participants (n=4) mentioned that on-going mentoring would have been helpful to assess whether their skills are still at a sufficient level and as a feedback moment for complicated cases. Mainly participants in HC-IVs, which are located more rural, expressed this.

### Workload

Also, an interesting outcome of this research is that in 7 facilities (23%) participants complained of an increased workload due to the presence of equipment. Especially when someone was the only one trained, this was mentioned as a drawback.

#### Box 5. Staff workload

*Nurse at HC-IV:*

*"The challenge I am facing is work overload. Because the scan is added to my other duties. Cause I already have my duties, but these ones are added. Then whenever there is a case, like at night, when I had a busy day, I have to come and scan the patient. Cause I am the only one doing scans"*

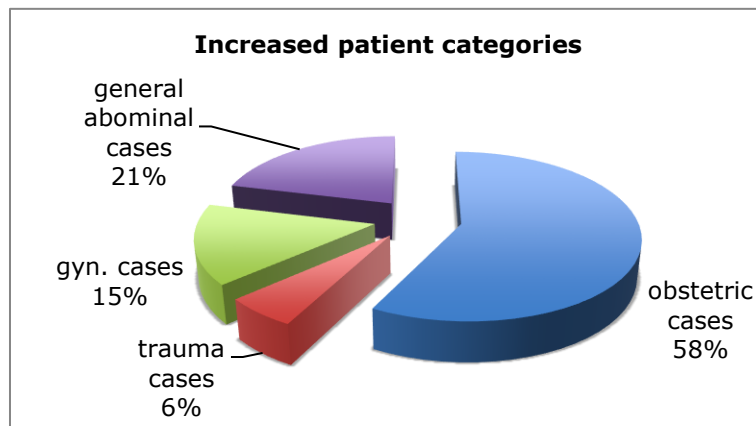
This suggests that staff characteristics can be seen as *indirect reasons* for equipment being used (or not).

#### 6.4.4 Number of ultrasound exams per year

Unfortunately it appeared to be almost impossible to collect these data since record keeping was not adequately (manually) done in most HFs to provide reliable numbers over a longer period of time. Therefore the evaluation focused on which patient categories are currently visiting the HFs. The research assessed this aspect in the questionnaires as well as the interviews (see appendix 4,5 and 6). It should be noted however that this outcome is predominantly based on self-assessment.

In all facilities participants indicated that they perceived that the number of patients has increased (mainly obstetric cases; 58%).

**Table 8 Perceived patient categories that increased after equipment delivery**



#### 6.4.5 Common indications for ultrasound

Also for this indicator it was not possible to collect adequate data, because the manual records in hospitals (if any) contained only patient numbers and not the indications for their scans. However, during the interviews some respondents gave information on indications for a scan. It should be noted that this outcome is based on self-assessment only.



## Box 6. Indications for ultrasound

Intra Uterine Foetal Death

Complete and Threatening abortions

Rule out ectopic pregnancy

Placenta Praevia

Gestational Age

Diagnosing twins

Foetal malformations

Growth retardation

### 6.4.6 Training activities at ECUREI in 2012

The interviews with ECUREI staff members focussed on on-going training activities. The research indeed identified on-going training activities. Also the research found that the reputation of ECUREI in the country, the modular set-up of training programs, the organisation structure at ECUREI and enhancement of teaching skills were thought to be attributing to ECUREI'S success.

#### *Reputation of ECUREI*

Four (4) staff members at ECUREI were interviewed to assess the project's impact on ECUREI's training capacity. All interviewees (n=4) mentioned that the project has had a positive impact on ECUREI in terms of it's reputation in the country and the rest of East-Africa. Since then the number of students has gone up, and also other programs, besides ultrasound training, have been initiated (e.g. biomedical engineering, master in radiology, master in ultrasound, training of midwives for USAID). Students from all over Africa are now taking courses and programs at ECUREI. They pay a student fee from which ECUREI pays the running costs.

#### *Modular set-up of programs*

However, according to the interviewees, an even greater impact the project has had on ECUREI was the modular set-up of programs. Before the ORET project, courses were only taught full-time. After ORET it became clear that a modular set-up of programs for health professionals that are already working in a facility, is much more convenient. This prevents an abruption of health service delivery due to long absence of staff. Modular set-up has now been implemented to all courses and programs running at ECUREI.

#### *Organisation at ECUREI*

Three of the interviewees mentioned that another positive effect of the project is that ECUREI now has a better organisational structure, in terms of good administration of activities and student records.

#### *Enhancement of teaching capacity*

All mentioned that their personal skills have grown due to the project. The only drawback of the enhancement of skills and knowledge of ECUREI staff is brain drain (n=3). From the 12 originally trained staff, 3 have left during the past years to England to work as sonographers. Better remuneration and enhanced career perspectives were mentioned as reasons for their colleagues to live abroad.

## **Chapter 7; Discussion**

This study sought to evaluate the factors leading to sustained use of ultrasound equipment in Uganda. To that end a ToC for technical sustainability was reconstructed.

### **7.1 Factors influencing availability of materials**

#### *Funding*

Health facilities need sufficient funding to deliver care. If a project, like the one under study, brings in equipment whereby also consumables or fuel for the generator are needed, this implies that the expenditure for HFs increases. After expiry of the project, the budget allocation of governments to districts needs to be reviewed, in order to allow facilities to spend money on spare parts, consumables and fuel for the generator. Budgetary constraints were an impediment for facilities to buy consumables.

#### *Supply of consumables*

To be able to produce ultrasound scans, consumables like gel and sonopaper are needed. Unavailability of consumables influences the capacity to deliver health services at the level as initiated under the project. Availability of these goods in the Medical Stores is therefore another important factor. Stock-outs were common, so it is important that expected input and output volumes of the project (e.g. number of ultrasound scans per year, resulting in amount of consumables needed) be analysed and calculated beforehand in order to be able to estimate the project's impact on the available goods at Medical Stores and the budgetary resources of the MoH.

#### *Spare parts*

Like a car, ultrasound equipment needs regular corrective maintenance. For corrective maintenance spare parts need to be at hand. Adequate supply of spare parts within the country is needed to foster optimal equipment use. In projects where equipment is delivered, spare parts necessary for equipment repairs should become a standard item in the supply chain of the country. It is cheaper to repair equipment, than buying new.

### **7.2 Factors influencing good maintenance**

#### *Management*

Key influencing factor to service delivery is equipment that runs properly. When equipment is involved in a project, regular maintenance after the project expires is essential to keep equipment up and running. This study found that the main reason for equipment not being used was the lack of maintenance. That is were "the chain broke". Although a mechanism was in place to promote gradual take over of responsibilities for maintenance management by the MoH, this did not result in a good maintenance arrangement. Commitment of the local government to adhere to maintenance management is therefore important in making projects where equipment is involved a success.

#### *Staff*

An important factor in the provision of maintenance is a sufficient number of maintenance engineers. In this project the low number of technical staff, resulted in poor adherence to maintenance of equipment. Motivating technical staff to adhere to maintenance should already commence during the project, to create better ownership of the delivered goods. Continuous training of maintenance staff is essential to be able to solve the unavoidable loss of technical staff due to brain drain. Institutionalisation of training (like what happened to ultrasound training) is the best option to achieve this goal.

#### *Funding*

Adequate operational funds are needed to deliver quality healthcare. In this project it was

unclear to what extent the GoU would be able to fund the recurrent costs after the project ended. Good maintenance cannot be implemented without sufficient funding, as well as continuous training of new technicians. Furthermore funding is needed to buy spare parts.

### **7.3 Factors influencing training**

#### *Availability of sufficient number of health workforce*

Important factor in achieving a sustained service delivery is the continuous availability of adequate numbers of staff. Also the knowledge of staff need to be sufficient in order to receive training. The shortage of staff (as in Uganda at the start of the project) was seen as the main risk in achieving project goals. Key aspect then is to establish a structure that motivates staff to stay in facilities, or move to facilities in rural areas. Health workforce shortages are found throughout Africa (WHO, 2006), this stresses the importance to manage the available health workforce efficiently. In projects like the one under study, well-trained staff to operate equipment is needed. Therefore the commitment of the MoH to properly manage the relocation of trained staff is a must.

#### *Characteristics*

For interventions that require a reasonable level of skills, adequate workforce, both in number and level of training, is needed. It seems that especially the *characteristics* of the workforce plays a key role. In selecting staff to be trained the following should be considered: age (no retirement within 5 years?), designation (doctors tend to be relocated frequently), motivation to study (however this is not easy to assess) and attitude. This study found that motivated staff is more likely to retain and willing to keep their skills up to date. Better salaries do not necessarily influence motivation, but job satisfaction is an important factor according to the findings.

#### *Mentoring*

In this project, in order to be able to use the equipment in a reliable way, staff needed a reasonable level of ultrasound skills. As suggested by Woolf SH *et al.* (2007), mentoring is essential in interventions that require a high degree of skills to produce the intended improved service delivery. This project did not have a mentoring structure in place. The findings suggest that regular supervision visits would have enhanced the confidence of staff. This could also have been used to discuss difficult cases and to assess the skills of the trainees.

#### *Institutionalisation*

Activities that are embedded in an organizational structure are more likely to continue after funding has ended (Shediak-Rizkallah and Bone, 1998). This study identified on-going training activities at ECUREI; that is running quality programs till today. As was envisioned at the start of the project, ECUREI was to become a key source in ultrasound education in East-Africa. The project created a *good reputation* of ECUREI in and outside Uganda. Training capabilities were improved by adapting the training programs into a *modular set-up*, by enhancing the *teaching skills* of ECUREI's trainers and by improving the *management structure*. This has resulted in student applications not only from Uganda, but also Kenya, Tanzania, Zambia and Botswana. The ambition of ECUREI has grown, and the institute currently offers not only ultrasound education, but also masters programs in ultrasound and medical imaging, and radiology training at various levels.

## 7.4 Limitations of the study

I now want to reflect on some methodological issues regarding this study.

It should be noted that from the 52 facilities not all were in the sample. But since the sample represented facilities that were equally geographically located in Uganda, it is expected that the findings in the remaining facilities would not have been very different from the 30 facilities in the sample. From the 30 facilities that were in the sample, the response rate within the facilities was lower than anticipated. This was especially the case for the questionnaires. It was expected that 3 different respondents per facility would fill out a questionnaire, but often only 1 questionnaire was completed.

A second limitation concerns the fact that no observations were done to assess *how* staff uses the equipment and *how competent* they still are in performing ultrasound examinations.

A third issue is that the research was done at one moment in time. It would have been interesting to collect data over a longer period of time, in order to be able to observe some of the mentioned outcomes (e.g. increased patient numbers, use of equipment to diagnose pathology).

Fourth, in this study, the analysis of the paper-based questionnaires revealed some answers that were written in the "additional section for comments". These highlighted some different aspects from those that emerged from the interviews and it would have been interesting to have been able to further explore by interview, which was unfortunately not possible.

Fifth, part of the research was qualitative, and it should be acknowledged that in qualitative research the outcome could be susceptible to researcher bias due to the background of the person who conducts the interviews. The author, who is a European lady and a former training coordinator of the project, did part of the interviews. This may have created a rosier picture of the outcomes, because some respondents could have expected benefits when answering positively. However, my impression was that respondents seemed to be very honest regarding their motivation and reasons for equipment malfunctioning (so not much bias here).

A sixth limitation concerns the fact that no data could be collected on numbers of ultrasound examinations to see the trends over time. This would have given better insight in the actual sustained service production of the project.

A final limitation is the limited generalizability of the research. For this study the context was very specific (an ORET funded project in Uganda), so generalizability to other externally funded projects is limited. However, some of the findings related to achieving technical sustainability are quite general, and may be taken in consideration when designing similar projects.

## Chapter 8; Conclusions and recommendations

### 8.1 Conclusions

Technical sustainability has 3 pillars: materials, maintenance and training. These pillars cannot be viewed as “stand alone” pillars. Between these are horizontal connections. The findings in this study suggest that the actual mechanisms that are related to good outcomes are likely to be found in the connections between the 3 pillars.

#### 8.1.1 Technical sustainability

For projects that aim at large-scale introduction of ultrasound equipment, accompanied by extensive training, a continued use of the ultrasound equipment and on-going training of staff are desired achievements. Local contextual factors are important determinants in achieving these goals.

In this project, the lack of sufficient funding resulted in the fact that the “chain broke”. Due to insufficient funding consumables or fuel for the generator could not be purchased. Already in 2002 it was advised that a more detailed analysis of recurrent costs (wages, consumables, spare parts) was needed to improve the financial forecast of the project. This was considered crucial for the MoH to weigh the impact of this project against other investments (ORET, 2002). The findings in this study underline the importance of such an analysis.

Next to availability of sufficient materials a good maintenance management structure is a key factor in achieving technical sustainability. In the design of the project it was foreseen that the *management* of all maintenance would be gradually transferred to the MoH. This was done by giving the responsibility for some systems to the MoH under the supervision of the supplier and to pilot the responsibility of the MoH for corrective maintenance call handling under supervision of the supplier (ORET report, 2002). However, the findings suggest that this transfer to the local government did not result in a functional maintenance structure. Adherence to responsibilities of managing project activities is important to create ownership of the project.

Training is a separate pillar, but also important in the pillar “maintenance”. It should not be limited to clinical staff only, but also include technical staff. This study suggests that on-going training can be achieved when it is embedded in a strong organizational structure, e.g. when it is institutionalized. The findings suggest that for ultrasound on-going training was achieved in Uganda, but not for technical training. To achieve the desired continued production of health services not only a sufficient number trained ultrasound staff is needed, but also a sufficient number of trained technical staff, in order to keep the equipment “up and running”. To that end management of health workforce (e.g. transfers) plays an important role. This study suggests that better management of the health workforce could influence not only retention of staff, but also motivation of staff.

This study found that adequate “funding” is a contextual factor that is the connecting factor in all 3 pillars. Funding is needed to retain staff in facilities, to allow them to go for further training, to buy consumables and to pay for timely maintenance. In sum, establishment of strong local supportive systems (budget allocation for districts, workforce management, maintenance management, supply chain management) and institutionalization of training are important mechanisms in achieving technical sustainability.

#### 8.1.2 The reconstructed ToC

This study used a ToC for technical sustainability that was reconstructed *before* the research took place. Reflecting on the ToC *after* analysing the data, interesting question to ask is if the ToC would look the same as before the research. Based on the findings, the author suggests that the ToC would still be made up of 3 pillars, but the last pillar should be renamed to “staff capacity”. The word “training” is too limited, because this

pillar comprises broader human resource issues. Also, the findings suggest that horizontal lines between the pillars should be added, indicating that the pillars should not be viewed separately. There are connections between the pillars that are important determinants for successful achievements of technical sustainability in projects like these. The horizontal connections need to be addressed in the project design (funding, training for technical and clinical staff, establishment of supportive systems).

### 8.1.3 The 5 dimensions of sustainability

Although this study focussed on technical sustainability only, some of the findings are connected to other dimensions than just technical sustainability. Institutionalization of training can be connected to *institutional sustainability*, job satisfaction of staff and retention of staff can be connected to *social sustainability* as well; an adequate funding structure can be connected to *economic sustainability* as well. This suggests that the 5 dimensions of sustainability are much more interrelated than expected.

## 8.2 Recommendations

This study focussed on the sustainability of an ORET funded project. The author believes that ORET deserves credits for trying to address sustainability from the start by including continued maintenance for 3 years after formal closure of the project. Nevertheless, this research has shown that this provision is not enough. Similar projects would have to take the following recommendations into account:

- Analyze and calculate beforehand the financial impact that projects like these will have on the budget available at the MoH
- Include a solid transition strategy. Local governments (especially at district level) need time to adapt and manage the new situation
- Include explicit attention to health workforce management

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## Appendices

### Appendix 1. Health facilities under ORET project

#### COUNTRYWIDE REHABILITATION OF HEALTH CARE FACILITIES IN UGANDA (ORET)

Batch	Regional Hospitals	District Hospital	Health center IV
1	<ol style="list-style-type: none"> <li>1. Masaka</li> <li>2. Kabale</li> </ol>	<ol style="list-style-type: none"> <li>1. Entebbe</li> <li>2. Nakaseke</li> <li>3. Kawolo</li> <li>4. Mubende</li> <li>5. Virika</li> </ol>	<ol style="list-style-type: none"> <li>1. Kiyumba</li> <li>2. Kiwangala</li> <li>3. Namayumba</li> <li>4. Nyimbwa</li> <li>5. Ngoma</li> <li>6. Mpigi</li> <li>7. Bbaale</li> <li>8. Buvuma</li> <li>9. Kibaale</li> <li>10. Kikuube</li> </ol>
2	<ol style="list-style-type: none"> <li>1. Fort portal</li> <li>2. Jinja</li> </ol>	<ol style="list-style-type: none"> <li>1. Bundibugyo</li> <li>2. Itojo</li> <li>3. Kambuga</li> <li>4. Kitagata</li> <li>5. Kagadi</li> <li>6. Kayunga</li> </ol>	<ol style="list-style-type: none"> <li>1. Bulisa</li> <li>2. Bwijanga</li> <li>3. Ishongororo</li> <li>4. Kikyo</li> <li>5. Kyarusoji</li> <li>6. Maziba</li> <li>7. Kinoni</li> <li>8. Kiganda</li> <li>9. Bukasa</li> <li>10. Wakiso</li> </ol>
3	<ol style="list-style-type: none"> <li>1. Arua</li> <li>2. Lira</li> </ol>	<ol style="list-style-type: none"> <li>1. Abim</li> <li>2. Kiryandongo</li> <li>3. Kitgum</li> <li>4. Moroto</li> <li>5. Nebbi</li> <li>6. Iganga</li> </ol>	<ol style="list-style-type: none"> <li>1. Aduku</li> <li>2. Amac</li> <li>3. Kotido</li> <li>4. Nabiratuk</li> <li>5. Tokora</li> <li>6. Busesa</li> <li>7. Bugobero</li> <li>8. Busia</li> <li>9. Kibuku</li> </ol>

## Appendix 2. Example ORET staff contact list

2 <sup>nd</sup> ORET DIPLOMA COURSE June 2006							
Index No		Name	Hospital	Profession	Telephone	Address	Email/Emergency Telephone contact
1	PASSED	MR. HIRE N. MARTIN	KAGADI HOSPITAL	CLINICAL OFFICER	077-2950698	P.O. BOX 4 KAGADI	078-2307510 or 077-2950942
2	PASSED	DR. MUKWAYA JOHN BAPTIST	KITAGATA HOSPITAL	MEDICAL OFFICER	078-2620826	P.O. BOX 92 MAREMBO - BUSHENYI	077-2467515 071-2620826
3	FAILED	KAHUNGU BEN	KIRYO H/C IV	CLINICAL OFFICER	078-2581310	P.O. BOX 1183 BUNDIBUGYO	077-2387138 kahughen@yahoo.com
4	PASSED	BWAMBALLE KIRWANA SOLOMON	KIRYO H/C IV	NURSING OFFICER	077-2612752	P.O. BOX 1183 BUNDIBUGYO	077-2528707
5	PASSED	DR. TINKASON AHMAD	BWJANNGA H/C IV	MEDICAL OFFICER	077-2588470	P.O. BOX 40 MASINDI	077-2333996 tinkason@yahoo.com
6	PASSED	KATARYEBWA ROSE	KITAGATA HOSPITAL	SENIOR NURSING OFFICER	078-2856362	P.O. BOX 92 MAREMBO, BUSHENYI	077-2823457
7	PASSED	MUTABAZI STANISLUS	BUNDIBUGYO HOSPITAL	CLINICAL OFFICER	077-2880593	P.O. BOX 1167 BUNDIBUGYO	077-2487505
8	FAILED	OWANI DENIS	APAC HOSPITAL	CLINICAL OFFICER	077-2888978	P.O. BOX 11 APAC	077-2660699 owanidenis@yahoo.co.uk
9	FAILED	ATIM CECILIA	APAC HOSPITAL	NURSING OFFICER	078-2528253	P.O. BOX 11 APAC	
10	PASSED	BUSINGE MARY GRACE PULIKERIA	KAGADI HOSPITAL	NURSING OFFICER	077-2389077	P.O. BOX 4 KAGADI	071-2534214
11	PASSED	NAMATOYU MARIAM	KALANGALA H/C IV	CLINICAL OFFICER	077-2607789	P.O. BOX 2 KALANGALA	077-2540420
12	PASSED	BATUUSA FLORENCE	KALANGALA H/C IV	CLINICAL OFFICER	078-2310893	P.O. BOX 2 KALANGALA	077-2590851
13	PASSED	OKUNI JOHN WILSON	KAMBUGA HOSPITAL	RADIOGRAPHER	075-2578353	P.O. BOX 23 KANUNGU	077-2302797
14	PASSED	MUKASA PHOEBE JUSTINE	KIGANDA H/C IV MUBENDE	NURSING OFFICER	077-2512313	P.O. BOX 19 MUBENDE	077-2410746
15	PASSED	DR. KASOZI FRANCIS. M.	WAKISO H/C IV	MEDICAL DOCTOR	077-2361629	P.O. BOX 7218 KAMPALA	077-2605732
16	PASSED	NAMPEWO SARAH SSENKUNGU	WAKISO H/C IV	NURSING OFFICER	077-2880040	P.O. BOX 7218 KAMPALA	077-2361629
17	PASSED	BARUNGI ALFRED	KINONI H/C IV (MHR)	MCO	075-2614473	P.O. BOX 9260	075-2548494

### **Appendix 3. Letter used to get permission for participation**

Letterhead ECUREI

Attn. Medical Director/ Superintendent/ In Charge

31 October 2012

Health facilities ORET Phase I

UGANDA

Dear Sir, Madam

**RE: COUNTRYWIDE REHABILITATION OF HEALTHCARE FACILITIES**

**(ORET PROJECT, UGANDA)**

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The purpose of this letter is to introduce Mrs. Wilma de Groot, who is currently undertaking a research study on the *continued use of equipment* that was delivered to health facilities that participated in an ORET project that took place between 2005 and 2009. The Ministry of Health (MOH) was responsible for this project.

Your health facility was one of the facilities that received a physical upgrade and equipment between 2005 and 2009.

This is to request your facility to furnish her with any requested information she may require which is related to ORET Phase I by filling out the questionnaire / allowing her to interview your staff.

Your cooperation will be highly appreciated.

Thank you,

Prof. Michael Kawooya

Director ECUREI

Mengo Hospital

## Appendix 4. Questionnaire A to be filled by hospital administration

### A SURVEY TO DETERMINE FACTORS AFFECTING THE SUSTAINED USE OF DIAGNOSTIC EQUIPMENT DELIVERED UNDER AN ORET PROJECT IN UGANDA

Your health facility has been selected for the study, because your facility has received equipment between 2005 and 2008 under an ORET project.

In order to help us improve healthcare delivery standards in Uganda, could you please take a few minutes to fill in this form?

#### INSTRUCTIONS

- Please do not write your name on this questionnaire
- Respond to each question as freely and honestly as possible
- All information will be treated with strict confidentiality

#### GENERAL

Date .....

Health facility .....

#### TO BE FILLED BY HOSPITAL ADMINISTRATION

##### Your Position

Med Sup

Other

Specify .....

For how long have you worked in this position? ..... years

**Section A: Equipment**

1. What kind of diagnostic equipment is available in your facility that has been delivered under the ORET project?

Ultrasound	Duo-Diagnost	MRS
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2. Is the equipment still working properly?

Ultrasound	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Duo-Diagnost	Yes <input type="checkbox"/>	No <input type="checkbox"/>
MRS	Yes <input type="checkbox"/>	No <input type="checkbox"/>

3. In which year was the equipment installed?

2005	2006	2007	2008
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4. Have you noticed any change in performance of the equipment?

Same performance	<input type="checkbox"/>
Increased performance	<input type="checkbox"/>
Decreased performance	<input type="checkbox"/>

5. How many times did the equipment break down in the last year?

Ultrasound	Never <input type="checkbox"/>	between 1 and 3 <input type="checkbox"/>	>3 <input type="checkbox"/>
Duo-Diagnost	Never <input type="checkbox"/>	between 1 and 3 <input type="checkbox"/>	>3 <input type="checkbox"/>
MRS	Never <input type="checkbox"/>	between 1 and 3 <input type="checkbox"/>	>3 <input type="checkbox"/>

6. How long did it take for the engineer to repair the equipment?

Ultrasound	< 1 week <input type="checkbox"/>	< 2 weeks <input type="checkbox"/>	>3 weeks <input type="checkbox"/>
Duo-Diagnost	< 1 week <input type="checkbox"/>	< 2 weeks <input type="checkbox"/>	>3 weeks <input type="checkbox"/>
MRS	< 1 week <input type="checkbox"/>	< 2 weeks <input type="checkbox"/>	>3 weeks <input type="checkbox"/>

7. How satisfied are you with the repairs?

Excellent	Very good	Good	Fair	Poor
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

• If NOT satisfied, can you explain why?

.....

.....

.

.....

.

- If satisfied, can you explain why?

.....

.....

8. What was the commonest cause for the equipment not to be used? (More than 1 answer is possible)

Breakdown	Absence of staff	No consumables	No Power	Workload
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

9. In general, how satisfied are you with the delivered equipment?

Very satisfied	Satisfied	Not satisfied
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Section B: Costs**

1. Did the expenditure of your facility increase after you received the ORET equipment?  
 Yes  No

2. If you answered Yes, what was the reason for this? (if you answered No, you can skip this question)

- Fuel for generator
- Buying consumables (gel, sono paper, x-ray films, chemicals)
- Higher remuneration for staff working with equipment
- Other, please specify.....

3. How does your facility take care of the running costs of the equipment?

.....

.....

.....

**Section C: Patients**

1. Did you see any change in the number of patients attending your clinic after the delivery of the equipment?

Increase	Decrease	No change at all
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2. If you saw an increase in the number of patients attending your clinic, what kind of patients was that about? (if you saw no change or decrease, you can skip this question)

- obstetric cases
- trauma cases
- paediatric cases

other, please specify .....

**Section D: Staff**

1. How satisfied are you with the performance of your staff operating the equipment?

Very satisfied                      Satisfied                      Not satisfied

Please explain your answer?

.....  
.....  
.....

2. Does your facility take any measures to reward staff that is operating the equipment?

Yes                                       No

3. If yes, what measures? (if No, you can skip this question)

- better remuneration
- housing possibilities
- continued exposure to training
- other, please specify .....

4. How do you think your staff feels about using the equipment?

- they are happy, because diagnostic options have increased
- they complain about the extra workload
- they do not care
- other, please specify .....

**ADDITIONAL COMMENTS**

**Thank you so much for your time!**



## Appendix 5. Questionnaire B to be filled by staff using the ORET equipment

### A SURVEY TO DETERMINE FACTORS AFFECTING THE SUSTAINED USE OF DIAGNOSTIC EQUIPMENT DELIVERED UNDER AN ORET PROJECT IN UGANDA

Your health facility has been selected for the study, because your facility has received equipment between 2005 and 2008 under an ORET project.

In order to help us improve healthcare delivery standards in Uganda, could you please take a few minutes to fill in this form?

#### INSTRUCTIONS

- Please do not write your name on this questionnaire
- Respond to each question as freely and honestly as possible
- All information will be treated with strict confidentiality

#### GENERAL

Date .....

Health facility .....

#### TO BE FILLED BY HEALTH STAFF USING THE ORET EQUIPMENT

##### Your Position

Radiographer	Nurse	Midwife	Doctor	Other
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Specify .....

For how long have you worked at this facility? ..... years

**Section A: Equipment**

1. What kind of diagnostic equipment is available in your facility that has been delivered under the ORET project?

- |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|
| Ultrasound               | Duo-Diagnost             | MRS                      |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

2. Which of this equipment do you use in your daily work?

- |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|
| Ultrasound               | Duo-Diagnost             | MRS                      |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

3. Is the equipment still working properly?

- Yes  No

4. In which year was the equipment installed?

- |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|
| 2005                     | 2006                     | 2007                     | 2008                     |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

5. Have you noticed any change in performance of the equipment?

- Same performance   
Increased performance   
Decreased performance

6. How many times did the equipment break down in the last year?

- Never  between 1 and 3  >3

7. How long did it take for the engineer to repair the equipment?

- < 1 week  < 2 weeks  >3 weeks

8. How satisfied are you with the repairs?

- |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Excellent                | Very good                | Good                     | Fair                     | Poor                     |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

If NOT satisfied, can you explain why?

.....  
.....

If satisfied, can you explain why?

.....  
.....

9. What was the commonest cause for the equipment not to be used? (More than 1 answer is possible)

- |                          |                          |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Breakdown                | Absence of staff         | No consumables           | No Power                 | Workload                 |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

10. In general, how satisfied are you with the delivered equipment?

- |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|
| Very satisfied           | Satisfied                | Not satisfied            |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**Section B: Costs**

1. How does your facility take care of the running costs for the equipment?

.....  
.....

**Section C: Patients**

1. Did you see any change in the number of patients attending your clinic after the delivery of the equipment?

- |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|
| Increase                 | Decrease                 | No change at all         |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

2. If you saw an increase in the number of patients attending your clinic, what kind of patients was that about? (if you saw no change or decrease, you can skip this question)

- obstetric cases
- trauma cases
- pediatric cases
- other, please specify .....

**Section D: Satisfaction with equipment use**

1. How satisfied are you with your own performance in using the equipment?

- |                          |                          |                          |
|--------------------------|--------------------------|--------------------------|
| Very satisfied           | Satisfied                | Not satisfied            |
| <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |



## Appendix 6. Interview guide for staff at selected health facilities

### Introduction

May I talk with you for a few minutes? I am a student at the Royal Tropical Institute in the Netherlands, and as part of my master course I am doing a study about the current status and use of equipment delivered under an ORET project in Uganda between 2005 and 2008. I am also interested to hear about the training you had under the ORET project.

### The consent form will be read here, before the start of the interview

After the informant has agreed:

Everything we discuss will be treated confidentially. Please feel free to remain silent if you hesitate to answer a particular question. And if you have any question for me, please feel free to ask.

---

Date ..... Questionnaire number .....

Health facility .....

---

1. Sex:                      male                      0

                                    female                      0

2. Age:                      .....

3. Designation

Radiographer	Nurse	Midwife	Doctor	Engineer	Other
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

For how long have you worked in this position? ..... years

## 1. Equipment

- What kind of diagnostic equipment is available in your facility that has been delivered under the ORET project?

Ultrasound	Duo-Diagnost	MRS
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- Which of this equipment do you use in your daily work?

Ultrasound	Duo-Diagnost	MRS
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- Is the equipment still working properly?

Yes  No

- In which year was the equipment installed?

2005	2006	2007	2008
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- Have you noticed any change in performance of the equipment?

Same performance	<input type="checkbox"/>
Increased performance	<input type="checkbox"/>
Decreased performance	<input type="checkbox"/>

- How many times did the equipment break down in the last year?

Never  between 1 and 3  >3

- How long did it take for the engineer to repair the equipment?

< 1 week  < 2 weeks  >3 weeks

- How satisfied are you with the repairs?

Excellent	Very good	Good	Fair	Poor
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- If NOT satisfied, can you explain why?

.....  
.....

- If satisfied, can you explain why?  
.....  
.....

- What was the commonest cause for the equipment not to be used? (More than 1 answer is possible)

Breakdown	Absence of staff	No consumables	No Power	Workload
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- In general, how satisfied are you with the delivered equipment?

Very satisfied	Satisfied	Not satisfied
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**2. Costs**

- How does your facility take care of the running costs for the equipment?  
.....  
.....  
.....
- Has the facility changed anything in the user fees after equipment was received?  
.....  
.....  
.....

**3. Patients**

- Did you see any change in the number of patients attending your clinic after the delivery of the equipment?

Increase	Decrease	No change at all
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- If you saw an increase in the number of patients attending your clinic, what kind of patients was that about? (if you saw no change or decrease, you can skip this question)
  - obstetric cases
  - trauma cases
  - paediatric cases
  - other, please specify .....

#### 4. Training and performance

- How satisfied are you with your own performance in using the equipment?

Very satisfied                      Satisfied                      Not satisfied

- Please explain your answer?

.....

.....

- Have you had any formal training how to use the equipment and diagnose diseases?

- No Training at all
- Trained under the ORET project
- Trained on the job
- Other, please specify .....

- If Yes, how do you rate this training?

Excellent                      Good                      Fair                      Poor

- Can you explain how the training has helped you in the equipment use?

.....

.....

.....

- Does your facility take any measures to reward you for operating the equipment?

Yes     No

- If yes, what measures?

- better remuneration
- housing possibilities
- continued exposure to training
- other, please specify .....

- How do you feel about this?

.....

- Which sentence best expresses your opinion regarding the use of the equipment?

- I am happy, because diagnostic options have increased
- I have too much extra workload
- I do not care, there is no difference if I use it or not
- other, please specify .....

Explain please?.....

.....



- What is the *main* reason you are still working at this facility?
  - I was born here and my family lives here
  - Government located me here
  - My motivation increased because I can easier diagnose patients with the ORET equipment
  - The neighbouring health facility has no diagnostic equipment, so I want to stay here
  - I earn more money if I stay in this facility
  - other, please specify.....

**5. Questions for staff performing Ultrasound**

- Does the facility take any measures to make sure you have enough time to do ultrasound in addition to your other duties in the facility?  
.....  
.....
- What measures are you taking to ensure that your ultrasound skills stay up to date or even improve following your return to your facility?  
.....  
.....
- What challenges do you face during your ultrasound practice in the health facility?  
.....  
.....
- How have you been solving these challenges?  
.....  
.....  
.....
- Do you usually get feedback on what you wrote in your report?  
Yes  No
- If Yes, are the ultrasound findings usually consistent with the clinicians' opinion?  
.....  
.....
- What are the clinician's opinion about your ultrasound REPORTS?  
.....  
.....
- Do you have any suggestion how to support your performance level?  
.....  
.....

**6. Question for staff performing x-ray examinations**

- What measures are you taking to ensure that your x-ray skills stay up to date or even improve?

.....  
.....

- What challenges do you face during your x-ray practice in the health facility?

.....  
.....

- How have you been solving these challenges?

.....  
.....

- Do you have any suggestion how to support your performance level?

.....  
.....

**7. Questions for maintenance staff**

- Did you receive any training on equipment maintenance?  
.....  
.....
- What measures are you taking to ensure that your maintenance skills stay up to date or even improve?  
.....  
.....
- What challenges do you face during your practice in the health facility?  
.....  
.....
- How have you been solving these challenges?  
.....  
.....  
.....
- Do you have any suggestion how to support your performance level?  
.....  
.....  
.....

## **Appendix 7. Interview guide Ministry of Health**

### **Introduction**

Thank you so much for allowing me to interview you. I am a student at the Royal Tropical Institute in the Netherlands, and as part of my master course I am doing a study about the current status and use of equipment delivered under ORET I in Uganda between 2005 and 2008.

Date:

---

### **ORET project General**

1. Why did the MOH embark on the first ORET program that started in 2005?  
Probe: what did the MOH wanted to achieve by embarking on this ORET project?
2. How was the selection of the benefitting health facilities done?  
Probe: which criteria were used for selection?
3. How does the ORET project fit into the MOH strategic plan?
4. Are there similar projects that ran parallel with the ORET project? If yes, which projects?  
Probe: how does the MOH ensure that related projects synergize each other?

### **Equipment**

5. What criteria did the MOH use in selecting equipment to be delivered under the ORET project?

### **Training**

6. What is your opinion about the fact that health staffs were trained under the project?
7. What challenges did the MOH encounter regarding the training under ORET I?
8. What did MOH do to tackle these challenges?
9. What steps did the MOH take in selecting the staff to be trained?  
Probe: was there enough staff available in the health facilities to be trained?  
Probe: if no, what did the MOH do to overcome this problem?
10. Were there any actions needed by the MOH to enable the training to take place?  
Probe: if so, did this involve resources (funding, change in management structures)
11. Was there a change in remuneration package following graduation?
12. Did the HF receive any support from the MOH to fully utilize the skills and infrastructure required?
13. Does the MOH have a deployment policy? If yes, has this had any effect on the ORET project?

## **Monitoring and Evaluation**

14. How does the MOH monitor the progress of the ORET project?

15. What are the positive impacts of the project according to you (if any)?

16. What are the negative impacts of the project according to you (if any)?

17. How satisfied are you with the results of the ORET project?

Probe: if satisfied, why do you think this ORET project has been so successful?

18. Do you think the ORET project is sustainable?

Probe: which aspects are sustainable according to you?

Probe: what do you think has led to this sustainability?

Probe: what aspects are not sustainable

Probe: why do you think they are not sustainable?

19. Would you change anything in the set-up of an ORET project? If yes, why

## **Appendix 8. Interview guide ECUREI staff members**

### **Introduction**

Thank you so much for allowing me to interview you. I am a student at the Royal Tropical Institute in the Netherlands, and as part of my master course I am doing a study about the current status and use of equipment delivered under ORET I in Uganda between 2005 and 2009.

### **ORET project General**

1. Can you tell what the ORET project is about?  
Probe: what do you think the MOH wanted to achieve by embarking on the ORET project?
2. How was the selection of the candidates to be trained in ultrasound done?  
Probe: which criteria were used for selection?
3. What is your opinion in general about the set-up of this ORET project?

### **Equipment**

4. What do you think about the imaging equipment that is delivered under this project?
5. Has ECUREI encountered any challenges regarding the equipment?

### **Training and ECUREI**

6. What is your opinion about the fact that health staffs were trained under the project?
7. How is the ORET training organized at ECUREI?  
Probe: are you pleased with this arrangement?
8. Did the ORET training change anything at ECUREI?  
Probe: how did that influence you as a teacher?
9. Have you learned anything from ORET? What?  
Probe: are you still using that today?  
Probe: why do you like this, or why do you not like this?
10. Did the trainees receive any support from ECUREI during the ORET project to fully utilize the equipment?  
Probe: and after the training was finished?  
Probe: does ECUREI follow the graduates in any way?
11. What are the most frequent challenges you experienced during the training of the different Batches?
12. On which aspects are you most proud?

### **Monitoring and Evaluation**

13. How does ECUREI monitor the progress of the training under the ORET project?
14. What are the positive impacts on ECUREI of the project according to you (if any)?
15. What are the negative impacts on ECUREI of the project according to you (if any)?
16. How satisfied are you with the results of the ultrasound training under the ORET project?  
Probe: if satisfied, why do you think this ORET project has been so successful?  
Probe: if not satisfied, why do you think this ORET project is not so successful?

17. Do you think the ORET project is sustainable?  
Probe: which aspects are sustainable according to you?

Probe: what do you think has led to this sustainability?

Probe: what aspects are not sustainable

Probe: why do you think they are not sustainable?



## **Appendix 9. Interview guide local implementing company**

### **Introduction**

Thank you so much for allowing me to interview you. I am a student at the Royal Tropical Institute in the Netherlands, and as part of my master course I am doing a study about the current status and use of equipment delivered under ORET I in Uganda between 2005 and 2009.

### **ORET project General**

1. Why, according to you did the MOH embark on the first ORET program that started in 2005?  
Probe: what do you think the MOH wanted to achieve by embarking on this ORET project?
2. How was the selection of the benefitting 54 health facilities done?  
Probe: which criteria were used for selection?
3. Do you have any experience in other ORET projects? If yes, which projects?
4. What is your opinion in general about the set-up of this ORET project?

### **Equipment**

5. What do you think about the imaging equipment that is delivered under this project?
6. Were there any challenges encountered during the installation of the equipment?
7. Were there any challenges regarding the physical upgrade of the health facilities?

### **Training**

8. What is your opinion about the fact that health staffs were trained under the project?
9. What is your opinion about the fact that maintenance engineers were trained under the project?
10. Did you encounter any challenges regarding the training under ORET?
11. What did you do to tackle these challenges?
12. Did the HF receive any support from your company to fully utilize the equipment and infrastructure?
13. Do the HF still receive any support from your company to date?
14. What are the most frequent challenges you had during the implementation of the project?
15. On which aspects are you most proud?

### **Monitoring and Evaluation**

16. How does the company monitor the progress of the ORET project?
17. What are the positive impacts of the project according to you (if any)?
18. What are the negative impacts of the project according to you (if any)?
19. How satisfied are you with the results of the ORET project?  
Probe: if satisfied, why do you think this ORET project has been so successful?

20. Do you think the ORET project is sustainable?

Probe: which aspects are sustainable according to you?

Probe: what do you think has led to this sustainability?

Probe: what aspects are not sustainable

Probe: why do you think they are not sustainable?

21. Would you change anything in the set-up of an ORET project? If yes, why

## **Appendix 10. Consent form approved by MHRRC**

### **TO PARTICIPATE IN A RESEARCH STUDY**

#### **“WHAT ARE THE FACTORS THAT INFLUENCE THE SUSTAINABILITY OF EXTERNALLY FUNDED HEALTH RELATED PROJECTS IN DEVELOPING COUNTRIES”**

##### **1. Introduction**

You are being asked to volunteer for a research study.

This study is being conducted at: *your health facility*

The Investigator in charge of this study is: *Mrs. Wilma de Groot*

##### **2. Purpose of This Research Study**

The purpose of this research study is: to identify the factors that influenced the sustainability of an ORET project

##### **3. Length of Your Participation**

Your participation in the study will last 1- 1,5 hour. You will be interviewed by Mrs. Wilma de Groot, and she will ask questions about your opinion on the equipment delivered under the project and she will also ask about your own performance.

##### **4. Where the Study is Being Done and Number of People Participating**

This study is taking place in the 52 health facilities that have received equipment under an ORET project between 2005 and 2008, and about 48 people are expected to take part.

##### **5. Study Procedures**

Before you take part in this research study, the study must be explained to you and you must be given the chance to ask questions. You must read and sign this informed consent form. You will be given a copy of this consent form to take home with you.

If you agree to take part in this study, the following will happen

There will be 1 visit in your health facility executed by Mrs. Wilma de Groot. During this visit you will be interviewed and she will do some observations at your department.

##### **6. Possible Benefits to You for Taking Part in the Study**

There are no direct benefits to you for participating in this study. However, your participation in this study may add to the medical knowledge about the factors influencing sustainability of ORET programs.

## 7. About Participating in this Study

Your participation in this study is voluntary. You may stop participating in this interview at any time. Your decision not to take part in this study or to stop your participation will not affect your medical care or any benefits to which you are entitled. If you decide to stop taking part in this study, you should tell the Investigator.

## 8. Confidentiality of Study Records and Medical Records

Information collected for this study is strictly confidential.

## 9. Participant Consent Page

I certify that I have read or have had read to me the above document describing the benefits, risks and procedures for the study titled "what are the factors that influence the sustainability of externally funded health related projects in developing countries", or that it has been read and explained to me, and that I understand it. I have been given an opportunity to have any questions about the study answered to my satisfaction. I agree to participate voluntarily.

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature or mark of participant

\_\_\_\_\_  
Name of participant (print)

### **If participant cannot read the form herself (illiterate participant), a witness must sign here:**

I was present while the informed consent form detailing the benefits, risks, and procedures were read to the participant. All questions by the participant were answered and the participant has agreed to take part in the study.

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature of witness

\_\_\_\_\_  
Name of witness (print)

I certify that the nature and purpose, the potential benefits, and possible risks associated with participating in this study have been explained to the above individual.

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature of person who obtained consent

\_\_\_\_\_  
Name of person who obtained consent (print)

## Appendix 11. Consent form approved by REC

### Informed consent form for interview with staff involved in the use or maintenance of Ultrasound or X-ray equipment

#### *Explanation of the study and purpose of observation*

My name is Wilma de Groot. I am asking if you are willing to participate in a study that we are doing to find out about the current situation of the use of equipment delivered between 2005 and 2008 under an ORET project.

I am a student at the Royal Tropical Institute in Amsterdam, the Netherlands. The results of the interview will be used to complete a thesis, which is part of my training in International Health.

The results will also be made available to MeduProf-S, a Dutch training company, that is interested to better understand why health workers perform ultrasound or x-ray exams the way they do, and how they feel about this technique. The company hopes that this information will help improving services and training of health workers on diagnostic imaging techniques.

Also the results will be made available to the Ministry of Health in Kampala, which is interested to hear how the program has been received in the country.

#### *Procedures including confidentiality*

If you agree, I will ask you to participate in an interview with me. I will ask you questions and write notes. During this interview I will ask questions about how satisfied you are with the equipment, to what extend you are using it, and about your perception regarding ultrasound or x-ray in your daily practice. If you are a health worker I will also ask some questions related to your employment in this health facility. Finally I will ask some questions about your opinion what should be done to make the equipment last as long as possible.

In addition to making notes, I would like to electronically-record the discussion to make sure I do not miss anything you will say. The tapes will not have your names and we will keep everything you say confidential. When I have written down what was on the tape, the tape will be destroyed. The notes will be kept in a locked space, so nobody other than the researcher will be able to look at the notes. The discussion will take about 1 to 1,5 hour.

#### *Risk, discomforts and right to withdraw*

If you feel uncomfortable at any stage of the discussion, you are free to withdraw from the discussion without giving any reason.

#### *Benefits*

This study will not help you at this very moment, but the results will give us better understanding of the achievements of the ORET project, and that will help us to advise on improving the services delivered and improve on training aspects

#### *Consent and contact*

Is there anything not clear to you, or anything you would like to ask? Are there areas that need more clarification? Please feel free to discuss this now.

Your participation to the interview will be totally voluntary as well as your consent. There will be no personal consequences if you do not wish to give your consent.

If you have any question about the study later on, you can always contact the researcher at:  
077556688

I agree to be interviewed YES / NO

Signature: Date:

I agree that the interview will be electronically-recorded YES/ NO

Signature: Date: